BLM

Tillamook Resource Area, Oregon

ENVIRONMENTAL ASSESSMENT

The Moon Creek Projects

Density Management Thinning and Coarse Wood Development

November 2008

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering economic use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interest of all people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

Environmental Assessment Number OR-086-08-05

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United States Department of Interior
Bureau of Land Management
Oregon State Office
Salem District
Tillamook Resource Area
Tillamook County, Oregon

November 3, 2008

Responsible Agency:	Bureau of Land Management
Responsible Official:	Brad Keller Tillamook Field Manager Tillamook Resource Area 4610 Third Street Tillamook, OR 97141 (503) 815-1100

Abstract: The Bureau of Land Management proposes to conduct ***two*** different project types in the Late Successional Reserve portion of the Northern Coast Range Adaptive Management Area and the Riparian Reserve land use allocations. The first project is a density management thinning of approximately ***420*** acres. Thinning would occur on federal land in portions of Township 3 South, Range 8 West, Sections 3, 11, 13, 14, 15, and 24, Willamette Meridian. The second project involves coarse wood development treatments on approximately ***300*** acres. These actions would occur on federal land in portions of Township 3 South, Range 8 West, Sections 5, 7, 8, 9, 10, 11, 13, 15, and 18, Willamette Meridian.

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ENVIRONMENTAL ASSESSMENT

1 INTRODUCTION

Project Scope - The Moon Creek Projects Environmental Assessment (EA) covers a subwatershed-wide forest management and ecosystem function enhancement effort proposed by the Tillamook Resource Area of the Salem District Bureau of Land Management (BLM). The assessment area includes lands allocated as Late Successional Reserve (LSR) within the Northern Coast Range Adaptive Management Area (AMA) and Riparian Reserve (RR) where resource objectives include the development of and/or improvement of late successional forest conditions. The EA analyzes two distinct project types which together would help to move the subwatershed condition toward functional late-successional forest. These projects include a density management thinning project and a coarse wood development project, both occurring in RR and LSR stands. The coarse wood development project would create snags and large down wood, both important components of late successional forest, in forest stands over 80 years old where such components are deficient and would fall some trees into selected headwater streams to provide structure in areas with debris flow potential**.**

The projects presented in this EA are the products of the Tillamook Resource Area's integrated planning processes which were conducted at three scales and utilized an interdisciplinary planning approach. The largest scale of planning considered all BLM lands within the Tillamook Resource Area and applied eleven rating criteria which reflected various management directions, concerns, or objectives (e.g. Key Watershed Status, Clean Water Act, Land Use Allocations, Silvicultural Needs Assessment, and Transportation - including both access issues and restoration needs). This analysis resulted in the identification of the Nestucca Watershed as a high priority for management. The second scale of planning looked at eight Activity Planning Units (APUs) roughly correlated to 6th field watersheds within the Nestucca Watershed (aka Nestucca subwatersheds). Nine different Nestucca-specific rating criteria were applied to the APUs (e.g. Key Watershed Status, forest restoration potential and transportation system concerns) to help prioritize planning efforts within the watershed. This analysis resulted in the Moon Creek APU being identified as one of the top three planning priorities within the watershed. The final scale of planning considered all lands within the Moon Creek APU. With APU-specific planning issues in mind, the current resource conditions were compared to those conditions desired in the future based on the management criteria derived from the Salem District Resource Management Plan (RMP), the Late-Successional Reserve Assessment (LSRA) document, which covers the entire Northern Coast Range Adaptive Management Area, and the Nestucca Watershed Analysis. The projects included in this EA were identified during this Activity Planning Process.

1.1 Project Area Location and Characterization

The proposed project areas are in the Moon Creek subwatershed of the Nestucca River watershed in Tillamook County, Oregon, approximately 13 miles southwest of the city of Tillamook in portions of Township 3 South, Range 8 West, Sections 3, 5, 7-11, 13-15, 18 and 24, Willamette Meridian (Figure 1).

The project areas are located on Oregon and California Railroad Land (O & C Lands) and Public Domain land (PD) within the Northern Coast Range Adaptive Management Area (AMA), LSR and RR land-use allocations.

The Moon Creek subwatershed (which includes East Creek) is part of the Upper Nestucca Tier 1 Key watershed designated in the *Salem District Record of Decision and Resource Management Plan*, May 1995 (ROD/RMP). Tier 1 Key Watersheds are areas containing high quality habitat for at-risk aquatic species, and are believed to have high potential for restoration.

The High Peak/Moon Creek Area of Environmental Concern and Research Natural Area (ACEC/RNA) is also located within the Moon Creek subwatershed generally to the west of the proposed Moon Creek Projects. This ACEC/RNA is ~ 1,113 acres of mid seral and late successional forest managed for scientific and educational purposes and is a somewhat rare representative of northern coast range late-successional forest, and is not available for timber harvest or off-highway vehicle (ohv) use; consequently little human activity occurs there.

The proposed projects are also within the boundaries of designated critical habitat for the marbled murrelet, and within northern spotted owl and Oregon Coast (OC) coho salmon critical habitat (all three species are federally listed threatened species). The Moon Creek subwatershed contains Essential Fish Habitat for OC coho and chinook salmon (as defined by the Magnuson-Stevens Fishery Conservation and Management Act of 1996). A portion of the proposed density management treatment units and all of the coarse wood development units are also located within a Spotted Owl Reserve Pair Area as delineated within the document titled *Delineation and Management of Reserve Pair Areas within Oregon's Northern Coast Range Adaptive Management Area* (dated June 1, 2000).

Moon Creek Projects Location Map

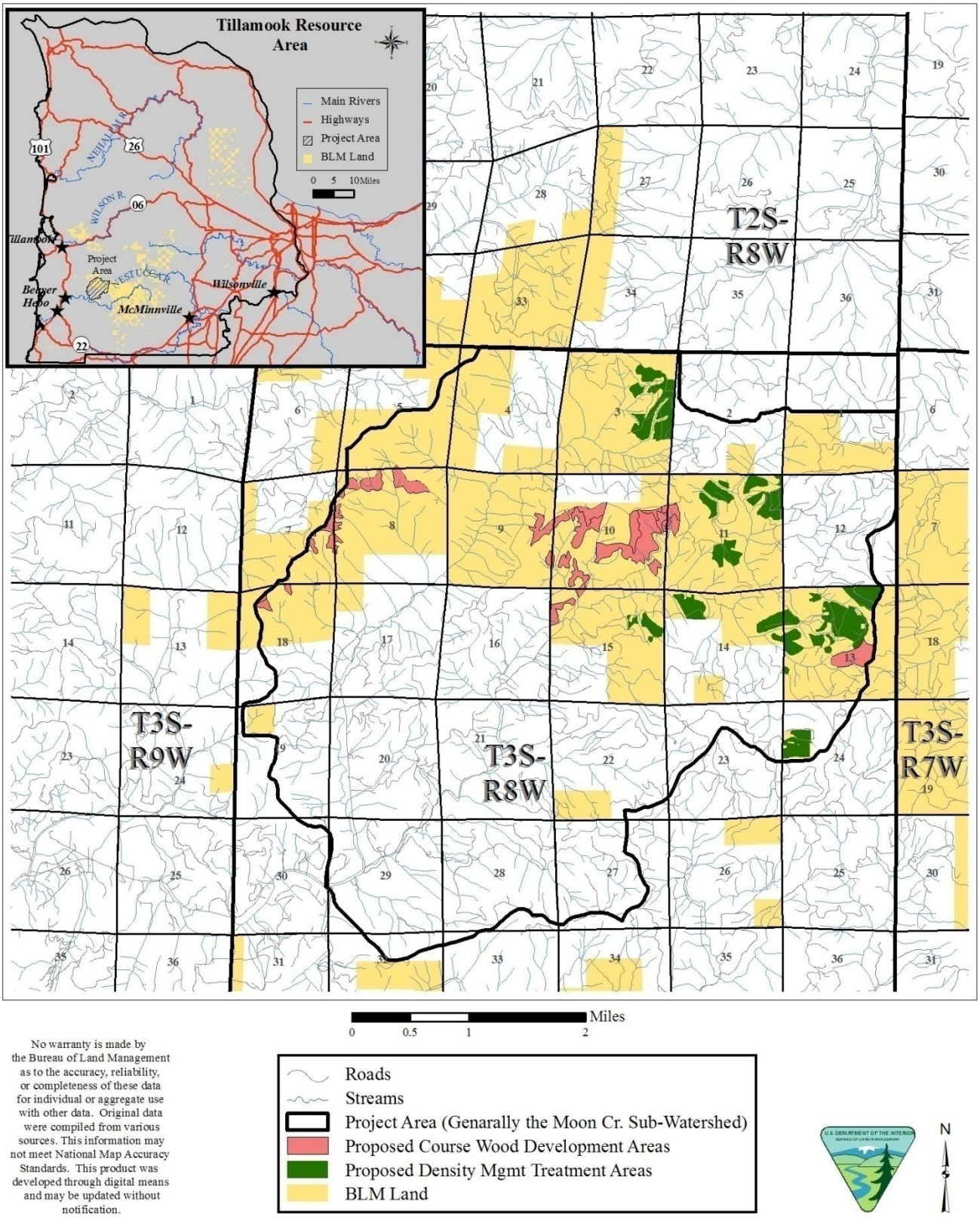

Figure 1

1.2 Conformance with Land Use Plans, Policies and Programs

The proposed projects would conform to the *Salem District Record of Decision and Resource Management Plan*, May 1995 (ROD/RMP) which tiers to the *Salem District Proposed Resource Management Plan/Final Environmental Impact Statement*, September 1994 (FEIS).

The proposed projects would also conform to the following NEPA decisions:

- *Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl*, April 1994 ("Northwest Forest Plan")

- *Record of Decision to Remove the Survey and Manage Mitigation Measure Standards and Guidelines from the Bureau of Land Management Plans within the Range of the Northern Spotted Owl,* July 2007

Additionally, the proposed projects would be consistent with the following planning analyses, assessments and guidance:

- *Nestucca Watershed Analysis*, October 1994
- *Northern Coast Range Adaptive Management Area Guide*, January 1997 (AMA Guide)
- *Late-Successional Reserve Assessment for Oregon's Northern Coast Range Adaptive Management Area*, January 1998

And the proposed projects would conform to the following laws:

- The *Coastal Zone Management Act* of 1974
- The *Endangered Species Act* of 1972, as amended (ESA).
- *Magnuson-Stevens Fishery Conservation and Management Act* of 1996, (P.L. 94-265) as amended and reauthorized by (P.L. 109-479), (2007)
- The *Migratory Bird Treaty Act*, *Executive Order 13186,* and *Migratory Bird Treaty Reform Act* of 2004.
- *Federal Land Policy and Management Act* of 1976
- *Federal Clean Water Act (as amended by the Water Quality Act of 1987)*
- *Clean air Act*
- *The O&C Act of 1937*

1.3 Permits and Approvals Required

- Proposed haul routes needed to implement the Density Management Project are covered by existing road use agreements or permits. New construction on private and/or Oregon Department of Forestry (ODF) land would require the approval of crossing plats. Preparation and approval of License Agreements would be needed for use of non-BLM controlled roads.

The following *Letters of Concurrence* may be required from the appropriate Regulatory Agency prior to implementation of these projects.

- Letter of Concurrence from the U.S. Fish and Wildlife Service for *Formal and Informal consultation on projects within the North Coast Province which may modify the habitat of northern spotted owls, and marbled murrelets* (Habitat Modification LOC) See Consultation section below.

- Letter of Concurrence from the U.S. Fish and Wildlife Service for *Formal and Informal consultation on projects within the North Coast Province which may disturb northern spotted owls, and marbled murrelets* (Disturbance LOC). See Consultation section below.

- Letter of Concurrence from NOAA – Fisheries. See Consultation section below.

1.4 Decisions to be Made

The Tillamook Field Manager is the official responsible for deciding whether or not to prepare an Environmental Impact Statement (EIS), and whether to approve the Moon Creek Density Management Thinning and Coarse Wood Development projects as proposed, not at all, or to some other extent.

1.5 Consultation

The proposed actions would be implemented consistent with the Terms and Conditions of the associated programmatic Letters of Concurrence from the appropriate regulatory agencies.

- Consultation under the Endangered Species Act (ESA) and Magnuson-Stevens Act (MSA) is required and is expected to be covered programmatically. A Programmatic Biological Assessment for "Low-Risk" NLAA timber sales has been completed and has a Letter of Concurrence From NOAA Fisheries (2007/00171) for the Willamette valley "*Biological Assessment for Fiscal Year 2007-2009 Low Risk Thinning Timber Sales on the Mt. Hood and Willamette National Forests, and portions of the Eugene and Salem Bureau of Land Management Districts"* and is expected to be extended to the coast range to cover the Oregon Coast coho ESU. The Environmental effects described in the Moon Creek Projects EA fall within the effects analyzed in the "Low-Risk Thinning" programmatic.

- Consultation under the ESA for the spotted owl and the marbled murrelet will be done programmatically within the appropriate years Biological Assessment for projects that would modify habitat for the spotted owl or marbled murrelet.

2 PROJECT 1 – Density Management Thinning

2.1 Purpose of and Need for Action

The purpose of the proposed action is to enhance conditions for the development of late-successional forest ecosystems, both in the uplands and the riparian areas, by managing young and mid seral conifer stands that resulted from harvests in the 1950's through the 1970's. Managing these younger stands for the development of late-successional features would augment the remaining old growth stands within the proposed project area and increase the overall late-successional characteristics of the watershed while protecting the late-successional habitat features, such as large down coarse woody debris, that still exist within the proposed project area.

Without density management thinning, development of many late-successional forest structural features would be expected to occur at a very slow rate because the overstory is generally becoming increasingly dense and uniform. Live crown ratios are declining and height:diameter ratios are increasing in many of these stands under the influence of tree-to-tree competition. Deferring treatment now would leave fewer management options in the future because of decreased windfirmness, less potential to build crown mass needed to accelerate diameter growth and less potential to develop trees with large limbs and deep crowns favored by marbled murrelets.

There is one exception to the above:

Unit 24-2 is a small 8-acre western hemlock progeny test site that was established in 1977 to evaluate western hemlock genetic families as part of the Tillamook Cooperative Tree Improvement Program. The LSRA provides the following direction: "Manage existing sites- thin progeny sites and treat seed orchards as per existing forest

genetics plans. Enhance late-successional characteristics as opportunity allows (p. 88)." The objective is to thin the site following the original design which called for the removal of every other diagonal row. This will result in maintaining representatives of each family at uniform spacing throughout the site. Heavier thinning at this time would not be recommended at any rate due to the very high density of 554 trees per acre (tpa) and it's location on a relatively flat ridge top that predisposes the trees to potential windthrow damage.

The proposed harvest units were initially identified as potential candidates for density management in the 2005 Moon Creek Activity Planning Report. The stands identified were all of relatively dense, single-storied, approximately 30- to 55-year-old Douglas-fir or mixed Douglas-fir/western hemlock plantations that were expected to respond favorably to treatment designed to increase the development of late-successional forest features. Stand exams were conducted in 2007 and the resulting data largely confirms the initial impression of these stands. Proposed harvest unit boundaries have been modified to delete areas with steep slopes, logging problems, streamside buffers, areas of low stocking, high likelihood of windthrow, etc.

By comparing existing resource conditions to desired resource conditions and the management objectives and opportunities contained in the Nestucca Watershed Analysis, Salem District Resource Management Plan (RMP), Late-Successional Reserve Assessment (LSRA) and the Northern Coast Range Adaptive Management Area guide (AMA Guide), the Interdisciplinary Team (IDT) identified the following management opportunities.

Salem District Record of Decision/Resource Management Plan (ROD/RMP) (USDI BLM 1995a):
Management direction for Late-Successional Reserve within the Northern Coast Range Adaptive Management Area includes:

- "If needed to create and maintain late-successional forest conditions, conduct thinning operations in forest stands up to the 110-year age class (106 to 115 years). This will be accomplished by precommercial or commercial thinning of stands regardless of origin." (p. 15).
- "If new roads are necessary to implement a practice that is otherwise in accordance with these guidelines, they will be kept to a minimum, be routed through unsuitable habitat where possible, and be designed to minimize adverse impacts." (p.17).

Management direction for Key Watersheds includes:

- "Reduce existing road mileage within Key Watersheds…" (p. 7)

Aspects of the Aquatic Conservation Strategy (ACS) most relevant to the Moon Creek Project under the *Watershed Restoration* section are:

- "Focus watershed restoration on removing some roads and, where needed, upgrading those that remain in the system"
- "Apply silvicultural treatments to restore large conifers in Riparian Reserves". (p. 7).

Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (ROD/FSEIS): The ROD/FSEIS (USDA Forest Service and USDI BLM, 1994) provides goals, standards and guidelines for management of the Northern Coast Range AMA, LSRs and RRs.

AMA Direction: Primary management emphasis of the Northern Coast Range AMA is restoration and maintenance of late-successional forest habitat. (p. D-15)

LSR Direction: The two principal objectives for silvicultural systems in Late-Successional Reserves (LSR's) are identified in the ROD/FSEIS (p. B-5):

- Development of old-growth forest characteristics including snags, logs on the forest floor, large trees, and canopy gaps that enable establishment of multiple tree layers and diverse species composition;
- Prevention of large-scale disturbances by fire, wind, insects and diseases that would destroy or limit the ability of the reserves to sustain viable forest species populations.

RR Direction:

- "Apply silvicultural practices for RR's to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives." (p. C-32)
- "Active silvicultural programs will be necessary to restore large conifers in RR's. Appropriate practices may include planting unstable areas such as landslides along streams and flood terraces, thinning densely-stocked young stands to encourage development of large conifers, releasing young conifers from overtopping hardwoods, and reforesting shrub and hardwood-dominated stands with conifers." (p. B-31)

Late Successional Reserve Assessment for Oregon's Northern Coast Range Adaptive Management Area (LSRA): The LSRA provides further guidance and details for treating timber stands to meet management goals for the AMA and LSR. The LSRA classifies the proposed harvest units as being within the **Upper Nestucca Mixed-Seral Cell in the Core Zone** i.e. between 20 and 35% of the area (cell) is currently in late-seral-stage forest occurring in patches 100 to 1,000 acres in size occurring within a larger block of contiguous land in federal ownership (core zone). It should be noted that the proposed density management project is immediately adjacent to a **Core – Late Seral** zone and cell, and that much of the Coarse Wood Development project occurs within the Core-Late Seral zone and cell. The management goals for the Mixed-Seral Landscape Cells are:

- "Grow out" from adjacent large blocks of late-seral forest,
- Create new and enlarge existing patches of late-seral forest within the zone
- Identify Key Watersheds [the project area is in the Nestucca Tier 1 watershed- "Key Watersheds are highest priority for watershed restoration" (C-7)] and anadromous fish "core areas" needing restoration and apply silvicultural treatments that have a high degree of certainty of success and will accelerate the development of late-successional habitat. (p. 49)

The Upper Nestucca Mixed-Seral Cell in the Core Zone is specifically recommended in the LSRA as an area where it would be appropriate to apply treatments which meet LSR standards and guidelines while providing sustainable commodities over time. (p. 51)

The LSRA also addresses genetics plantations (Unit 24-2): "Manage existing sites- thin progeny sites and treat seed orchards as per existing forest genetics plans. Enhance late-successional characteristics as opportunity allows." (p. 88)

2.2 Alternatives

2.2.1 Alternative Development

On November 7, 2007, a Scoping Letter was sent to 44 individuals, organizations and agencies (Project Record Document 6). As a result of this scoping effort, four letters providing comments were received (Project Record Documents 9-12). Comments were generally favorable. Concerns ranged from economical viability, impacts associated with road construction and improvement, and support for use of variable density thinning.

Pursuant to Section 102(2) (E) of NEPA (National Environmental Policy Act of 1969, as amended), Federal agencies shall "…study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources." No unresolved conflicts concerning alternative uses of available resources were identified. Consequently, no alternatives were identified that would both meet the purpose and need of the project and also have meaningful differences in environmental effects from the Proposed Action. Therefore, this EA will analyze the effects of the "Proposed Action" and the "No Action" alternatives only.

2.2.2 Alternative 1: The Proposed Action

Project 1 proposes to perform density management thinning harvest, on approximately 420 acres of relatively young (planted 1950- 1977) plantations. See Figure 2 for a map of the proposed action (Alternative 1). Generally, all trees larger than 20 inches diameter at breast height (dbh) would be reserved. Only Douglas-fir and western hemlock would be cut, all other species would be reserved except those in road rights-of-way, landings or

yarding corridors. Generally, thinning would be from below, selecting the largest, healthiest trees to leave. Stands would be marked to maintain the existing species mix of Douglas-fir and western hemlock as much as possible. Because land use allocation is LSR, in addition to leaving the healthiest trees, marking would not attempt to "simplify" the stand by removing all the damaged trees and shorter, less vigorous trees. To encourage a more variable spatial distribution of trees, stands would be altered from their current relatively uniform tree distribution spatial pattern to a more random spatial pattern, with interspersed "gaps". A combination of ground-based and cable yarding systems would be used. Approximately 39% of the area would be harvested using a ground system, and 61% would be harvested with a cable system (Table 1).

Approximately 46% (359 acres) of the stands that comprise the proposed harvest units would remain unthinned during this entry. These acres were dropped from the proposed treatment area because of logging difficulties, stocking, slope stability, disease pockets, stream buffers, high windthrow risk, etc. Not including these areas in the density management proposal serves a double purpose; beyond the reasons stated above, they would retain areas of natural suppression and mortality, natural size differentiation, and undisturbed ground.

Riparian Reserves

In general, the proposed treatments would be similar in both the Riparian Reserve and in the uplands outside of Riparian Reserves. Approximately 35% of the proposed density management (about 148 acres) would occur within the Riparian Reserve land use allocation. No-harvest buffers would be 60' in width along non-fish-bearing and 100' along fish-bearing streams. Riparian Reserve widths would range from 220 feet in unit 13-1 up to 520 feet (2 SPTH) along fish-bearing streams in units 11-1 and 14-1. See Table1 for site potential tree heights.

Table 1 Land Use Allocations and Logging Systems for Proposed Density Management Thinning Units (Acreages are GIS derived and therefore are estimates only. Actual on-the-ground acres would vary but would still be within the scope of the analysis).

Unit Number	LSR Acres	Riparian Reserve Acres	Site Potential Tree Heights	Total Acres	Logging Systems (acres)	
					Ground-based	Skyline
3-1	51.6	36.4	240	88.0	4.9	83.1
11-1	27.3	18.6	260	45.9	6.3	39.6
11-2	9.7	18.6	240	28.3	0.0	28.3
11-3	20.2	4.5	260	24.7	2.8	21.9
13-1	26.2	3.5	220	29.7	29.7	0.0
13-2	12.4	5.3	260	17.7	17.7	0.0
13-3	55.7	20.5	260	76.2	69.5	6.7
13-4	1.6	0.0	260	1.6	1.6	0.0
14-1	8.8	15.6	260	24.4	0.0	24.4
14-2	20.4	7.2	260	27.6	18.4	9.2
15-1	10.6	6.9	240	17.5	1.1	16.4
24-1	11.5	10.8	240	22.3	0.0	22.3
24-2	8.8	0.0	260	8.8	8.8	0.0
Totals	264.8	147.9		412.7*	160.8	251.9

***For analysis purposes the estimated total acres is rounded up to 420**.

Road Reduction in Tier 1 Key Watershed (Nestucca Watershed)

In addition to temporarily reopening some existing roads and constructing approximately one-half mile of new temporary road, the Proposed Action would require the renovation of approximately 2.5 miles of

existing road. Upon completion of the proposed timber harvest, approximately two miles of the renovated roads would be fully decommissioned by removing any culverts, subsoiling, and revegetating with native seed or plants if necessary thus returning the road area to a more natural hydrologic and vegetative condition and a net decrease of two miles of road in the watershed.

Proposed Density Management Treatment Areas

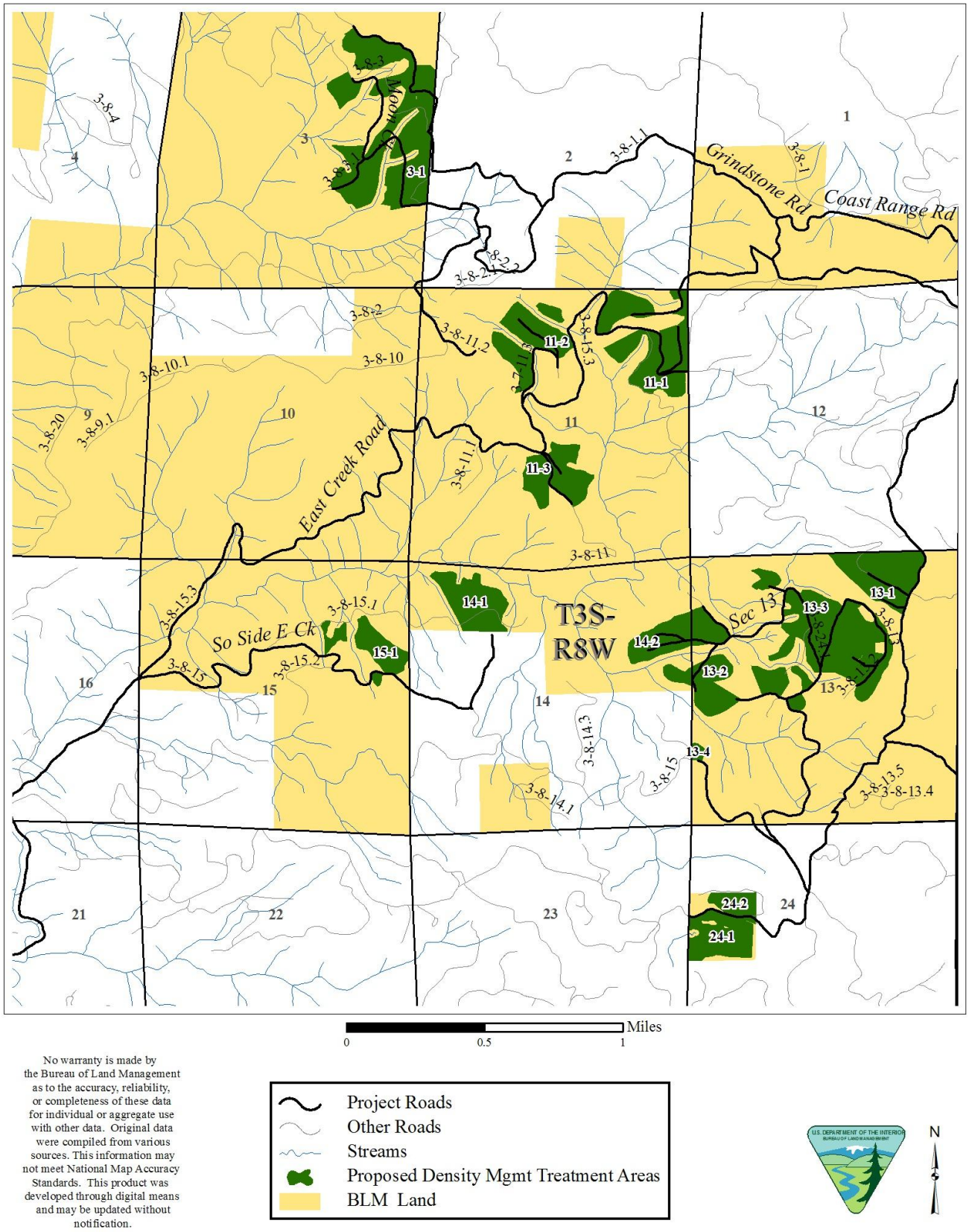

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Figure 2

2.2.2.1 Connected Actions

Road Work (See Figure 3 below)

Temporary Reopening of Previously Decommissioned[1] Roads: The proposed action would involve the temporary reopening of approximately 4.5 miles of existing rocked road that were previously decommissioned by closing, stabilizing, removing the culverts and putting into an "erosion-resistant" condition (upper portion of East Creek Road in Section 11 and the road system in Section 13). Reopening the roads would involve the reinstallation of culverts at approximately 13 stream crossings, placing rock over the fill material, grading of the rocked surface, spot rocking areas where the rock has deteriorated and minor roadside brushing. At the completion of the timber sale contract period these roads would again be decommissioned and left in a stabilized, "erosion-resistant" condition and would be blocked to vehicle traffic by either earthen barrier or gate, in the locations where they are currently blocked.

Culvert Work: Section 11- Three culverts along the upper portion of East Creek Road would be permanently reinstalled on 1st and 2nd order streams (#'s 2 – 4) A new culvert would be temporarily installed at a 2nd order stream crossing on the 3-7-11.3 road which would access unit 11-2 (#5). This installation location would be in an area where the stream has eroded through the road fill and established a new channel. The culvert would be placed in the new channel and removed at the end of the timber sale contract period. Finally, a one or two culvert system would be reinstalled temporarily at the East Creek crossing in the NE ¼ of Section 11 (#1). The East Creek crossing would allow access to approximately 30 acres of treatment units and be in place for only one Oregon Dept. of Fish and Wildlife (ODFW) defined in-stream work season (July 1 – September 15). Consequently, all operations that would need access across East Creek at that site would need to be completed within the one dry season constraint. The reason for this constraint is that the cost of installing a culvert that would accommodate 100 year flood events (required in order to be in place during the winter) at the East Creek crossing would be prohibitive for the access of only 30 acres and thus potentially cause the timber sale to be economically infeasible. With the exception of the East Creek crossing, all culverts, including the temporary pipes, would be sized to accommodate a 100 year flood event.

Section 13- A total of eight culverts would be reinstalled on 1st and 2nd order streams to facilitate harvest activities. Four culverts placed in the NW ¼ of Section 13 (#'s 6 - 9) would be temporary culverts that would be removed at the completion of the timber sale; the other four culverts would remain in place permanently (#'s 10 - 13). One small culvert that is currently in place (#14) would also be removed at the completion of the timber sale. All culverts would be sized to accommodate a 100 year flood event.

New Road Construction: Approximately 0.5 miles of new road construction would occur. All new roads would be natural-surface (no rock would be added) and would not involve stream crossing culvert installation. New roads and landings would be "fully decommissioned"[2] and blocked following timber harvest and site preparation activities. Full decommissioning would consist of removing any ditch relief culverts where applicable, subsoiling, water-barring, and seeding or planting with native species where appropriate.

Road Renovation: Approximately 2.5 miles of existing, currently undrivable, roads would be renovated as necessary to accommodate timber harvest and log-hauling activities. The work would include brushing, grading, drainage structure improvement or replacement, and spot rocking at deficient locations. Most of the roads to be renovated are natural-surface and they would be used as natural surface roads. Approximately 2 miles of the renovated road (the natural surfaced portion) would be fully decommissioned at the end of the timber sale contract period. Water barring and planting or seeding with native vegetation would be done where appropriate.

Definitions taken from Revised 2002 BLM Western Oregon Districts Transportation Management Plan:

[1] Decommission – Road closed to vehicles on a long term basis (>5 years) but may be used again. Left in an erosion resistant condition, no maintenance planned but could be placed back into use at a reasonable cost.

[2] Full Decommission – Road closed permanently to vehicles with a barrier, in a maintenance free condition. Generally have culverts removed and road bed prepared for reestablishment of vegetation. Road template remains on the landscape.

Culvert Replacement/Improvement And Road Construction/Renovation

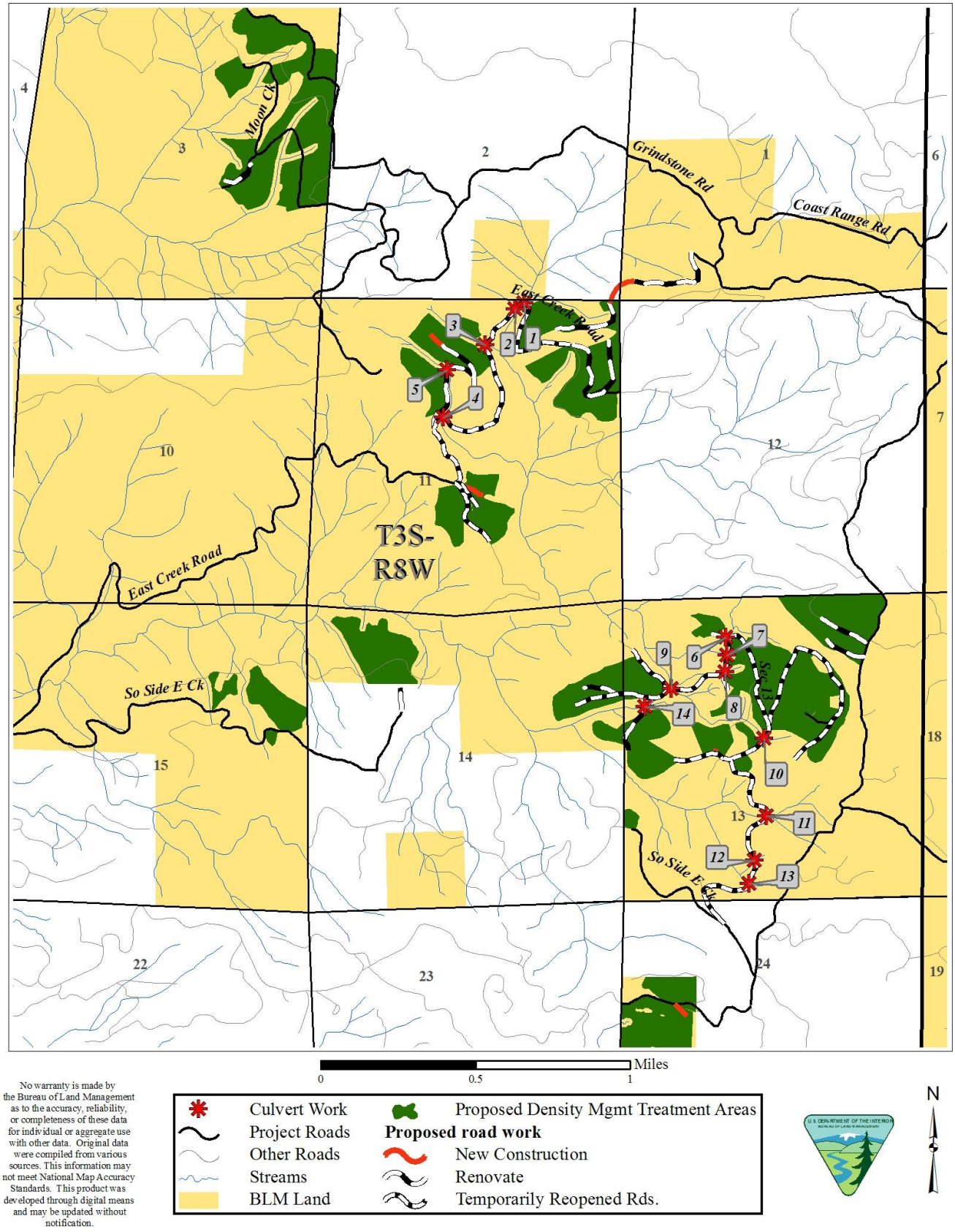

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Figure 3

Fuels Treatments

Fuel treatment strategies would be implemented on portions of the project areas to reduce both the intensity and severity of potential wildfires in the long term (after fuels reduction has occurred). Post-harvest fuels hazard surveys would be conducted and site-specific treatments would be recommended. A variety of fuels prescriptions may be employed including lopping and scattering of slash, pullback of slash, hand piling and burning, swamper burning, landing piling and burning, or selling the material as firewood. These treatments may occur along roads, landings, property lines, within *Phellinus weirii* pockets, or other areas within the harvest units such as heavily thinned "gap" areas or variable density thinning areas where fuel loadings are determined to be hazardous, or where underplanting of trees is recommended.

Post Treatment Reforestation

An area of approximately four acres within Unit 24-1, heavily impacted by *Phellinus weirii* (laminated root rot), would be planted following logging operations. The patch would be planted with a mixture of 50% red alder and 50% western redcedar at a rate of 100 trees per acre. This wide spacing should minimize cutting shrubs or other site preparation needed for tree planting. The idea is not to blanket the area with trees but to maintain, at least for a while, a young seral component within the stand. Large-sized planting stock would be used to minimize the need for brush release. Planted seedlings would be protected from animal browsing with Vexar^{tm} tubes. The western redcedar in particular would need several years of tube maintenance before the trees are out of browsing range. The need for follow-up brush release (salmonberry occurs in the planting area), cutting all vegetation within approximately 3 feet of the planted trees, would be expected to occur two or three times.

2.2.2.2 Project Design Features

The following is a summary of the design features intended to achieve treatment objectives or would reduce the risk of adverse effects to the affected elements of the environment due to project implementation. The proposed action would be implemented consistent with the Best Management Practices (BMPs) contained in Appendix C of the Salem ROD\RMP.

- Generally, trees larger than 20 inches dbh would be reserved.
- Only Douglas-fir and western hemlock would be cut, all other species will be reserved to preserve species diversity, unless in road rights-of-way, landings or yarding corridors.
- Unless stated otherwise in specific unit prescriptions, alder will be counted towards the recommended basal area and tree per acre target. This requirement would contribute to species diversity and stand variability both immediately and into the future. Because red alder is relatively short-lived compared to conifers, as it is over-topped or dies out it will create gaps that will fill in with brush or conifer regeneration.
- Generally thinning would be from below, selecting the largest, healthiest trees for retention. Although the prescribed trees per acre to be reserved can be converted to an average spacing, tree size and health would be the overriding consideration in selecting trees to leave since the best trees are not expected to occur at even spacing. This would result in retaining the trees that can best respond to thinning, shortening the time to develop large trees and to maintain stand vigor for optimum late-successional development.
- A mix of Douglas-fir and western hemlock would be retained as much as possible in order to maintain and enhance species diversity.
- Leave trees would include damaged trees and suppressed and intermediate crown class trees. The suppressed/intermediate trees would be left close to a dominant or codominant tree. The goal would be to leave a damaged, suppressed or intermediate crown class tree every 7th to 10th tree marked, this equates to 10% - 15% of leave trees per acre. While maintaining the same proportion per acre, occasionally a clump of two suppressed/intermediate trees with a codominant or dominant would be left. These trees would count towards the total prescribed trees per acre to leave; they're not "extra" trees. By doing so this will help create some "vertical structural complexity", vary spacing and retain a potential long-term source of coarse woody debris in the stand as trees die from suppression or succumb to injuries caused by damage.
- An exception to leaving damaged and lower crown class trees would be where stocking levels should be kept higher due to windthrow risk; in these areas mainly the suppressed and intermediate trees would be removed to maintain a relatively unbroken upper canopy. This would lessen the risk of large-scale windthrow.

- It is likely all Douglas-fir have the Swiss needle cast fungus present on their needles. Douglas-fir with the greenest, fullest crowns (both in overall size and in the amount of needles retained) would be favored to leave. These trees are probably the most tolerant of the disease. The seemingly healthiest trees would respond better to thinning and provide for the long-term health of the stand. There is some evidence that resistance to Swiss needle cast has a genetic component. Selecting the most resistant trees is the best insurance that the stand will eventually have a component of the very large, old Douglas-fir that characterizes old growth stands in the coast range.
- When marking units, areas of lower stocking may be encountered where most of the trees would need to be marked in order to meet the prescribed stocking level. In these areas more trees would be removed than the density prescribed for the rest of the unit since the trees should have correspondingly wider crowns and be more windfirm than the average for the unit.
- Average post-thinning relative densities for individual stands are expected to be generally below 35. An RD below 35 would emphasize individual tree growth over total volume growth of the stand. Areas prone to windthrow, including areas dominated by poorly rooted hemlock, would be maintained at higher relative densities. Proposing heavier thinning has been avoided due to:
    - the windthrow risk (the treatment area contains numerous ridges that run perpendicular to southwesterly storms winds),
    - simplifying the stands by creating an even understory layer of brush or saplings,
    - the need to retain trees that would provide a future source of large CWD.
- Although prescribed stocking would vary between units; with the exception of 24-1, canopy closures are expected to average between 40 and 60 percent following the proposed treatment. Keeping canopy closure above 40% would maintain dispersal habitat for northern spotted owls.
- Although an overall average number of trees per acre is specified for each unit (see Table 7), spacing would be varied by as much as 25% in order to promote variable density.
- Within specific units, the development of deeper crowns and larger limbs would be cultivated on selected dominant trees by cutting trees within 30 feet of the selected tree. Approximately 233 acres would receive this prescription.
- Within specific units, up to ten percent of the area within units would be treated to obtain heavily thinned "gaps" ranging from ¼ acre to 1 acre in size which would allow for greater growth potential of the retained trees thus establishing potential future marbled murrelet habitat. Gaps over ½ acre in size would not occupy more than five percent of the total stand area (LSRA p. 100). Stocking for gaps is proposed as follows:
    - ¼ acre gaps would contain 4 trees.
    - ½ acre gaps would contain 9 trees.
    - 1 acre gaps would contain 16 trees.

All trees reserved in the gaps would be left at least 30 ft in from the outer edge.

- Placement of gaps would be oriented towards areas with enough relatively large, healthy Douglas-fir with live crown ratios greater than 30%. These would naturally occur in areas where the trees are already more widely spaced. Scattered, very large Douglas-fir are characteristic of old growth stands in this area. Heavily thinned gaps would not be placed on slopes $\geq$70%. These gaps would help maximize individual tree development, encourage some understory vegetation development, and encourage the initiation of structural diversity.
- Within selected units, scattered ¼ acre to 1 acre unthinned patches would be left. These patches would retain areas for thermal and visual cover for wildlife as well as a source of natural suppression mortality.
- A 4 acre *Phellinus* pocket in Unit 24-1 would be heavily thinned to remove most Douglas-fir and then planted. Planting would speed up the natural process of disease-caused openings filling in with less susceptible conifers and hardwoods. Planting would be done at a wide spacing to preserve early successional characteristics and a vine maple understory.

<u>Within Riparian Reserves:</u>

- A relative density (RD) (Curtis, 1992) of 30 would be maintained between the no-harvest buffer and the one site potential tree height boundary from the stream when adjacent to listed fish habitat (LFH) or adjacent to tributary streams within one stream mile of LFH habitat **(this applies to all units except 24-1 and 24-2)**
- Maintain at least 50% canopy closure within the secondary shade zone on perennial streams.
- The distance separating "heavily thinned gaps" from LFH would be greater than the height of a site potential tree. The distance separating a patch cut from all other streams would be at least 100 feet.

Coarse Woody Debris (Snags and Down Wood)

- Existing coarse woody debris would be retained to the extent possible, and snags that are cut or knocked over during logging would remain on site.
- When cutting reserved trees for the development of skid trails or skyline yarding corridors, retain those trees on site in the following manner: for stands 40 years old and younger (Units 24-1 and 24-2), retain all trees larger than 16" dbh, for stands older than 40 years, retain all trees larger than 20" dbh. Retained trees may be bucked and/or moved aside in order to prevent undue yarding difficulties.
- If reserve trees must be topped for operational purposes (e.g. lift or tail trees), both portions of the reserve trees would remain on site to augment snag and down woody debris habitat.
- Existing snags that are greater than 18" dbh and 20' in height, or snags being actively used by wildlife would be surrounded with two or more leave trees to protect them from logging damage.

Water, Fisheries and Soil Resources

- A "no-harvest" buffer would be placed along both sides of streams. The minimum size of this buffer would be 60 feet for non-fish bearing streams and 100 feet for fish bearing streams or to the outer extent of any unstable areas, whichever is greater.
- No ground-based equipment would be permitted in no harvest buffers.
- Yarding corridors or skid trails where soil disturbance and compaction occurred that is capable of channeling water would be waterbarred.
- To protect water quality, trees would be felled away from all no-harvest buffers within the harvest area. If a cut tree falls into a no-harvest buffer, the portion of the tree within the buffer would remain in place.
- Refueling of all equipment and storage of all petroleum products would occur at least 150' from any stream or other water body.
- Woody material removed during culvert work, would be left in the stream network after work is completed, typically accomplished by replacing the wood downstream of the culvert in the stream channel.
- Stream flow would be diverted around culvert work occurring in live streams to maintain downstream flows and minimize turbidity. Culvert work on intermittent streams would occur when streams are dry.

Yarding

- Designated skid trails and landings would be used in order to limit the areal extent of skid trails and landings to less than 10% of each harvest unit. Skid trail and landing cutting limits would be kept to the narrowest width and size necessary to reasonably harvest the unit (for analysis purposes, a 12-foot-wide skid trail spaced on average 150 feet apart and a 50-foot diameter impact area for landings was used). Existing skid trails and landings would be used to the extent possible.
- In order to reduce the amount of soil disturbance and compaction, skid trails would be kept to the shortest practical length and, where possible, would intersect at the haul roads (landing points) rather than with other skid trails.
- Yarding logs or construction of skid trails through depressions with very moist, poorly drained sites would be avoided where practical.
- Ground-based logging areas may be harvested with mechanized, cut-to-length systems provided that the following measures are met:

    - Harvesters, feller-bunchers, and or log processors would be boom mounted with a minimum operating radius of 20 feet. The equipment would have a ground pressure rating of 8 psi (pounds per square inch) or less. Log harvesting equipment trails would be spaced 40 to 50 feet apart and be no more than 15 feet in width. No more than two passes over the same ground would be permitted. They may be used on slopes up to 45 percent, provided that no topsoil displacement or gouging is occurring.
    - Forwarding or skidding equipment would be restricted to designated trails approved by the

Authorized Officer prior to felling and yarding operations. Trails would average 12 feet or less in width and would be located, on average, 100 feet apart.

- The harvester would be required to place slash in front of the machine tracks or tires in order to reduce compaction. The forwarder or skidder would operate on a nearly continuous layer of slash that is at least 6 inches thick.

- Full log suspension would be employed on potentially erosive or unstable sites, e.g. generally on slopes exceeding 70 percent. At least one-end suspension of logs would be required in all other cable and ground-based logging areas.
- Skyline corridors would generally not exceed 12 feet in width and would be located at least 150 feet apart at one end.
- Riparian no-harvest buffers may have yarding corridors cut through them if necessary; however any trees cut in the no-harvest buffers would be left on site to augment CWD.
- Crawler tractor, skidders, and forwarders would not be allowed to operate within Riparian Reserves except where they are able to operate from existing, gently-sloping (<20%) roads or compacted skid trails that are upslope of topographic drainage breaks.
- If yarding logs across slopes (i.e. side slope), retain rub trees next to corridors or take other precautions to protect residual trees such as using plastic culverts around tree boles.
- Cable yarding corridors over perennial streams will be limited to no more than 5 per 1,000 lineal feet of stream, would be at least 100 feet apart, as close to perpendicular to the stream as possible and maintain full log suspension within 30ft for intermittent streams over 1 mile above Listed Fish Habitat (LFH), 50ft for perennial streams over a mile from LFH, and 50ft on all streams within a mile of LFH.
- Skylines that are strung across East Creek would be operated as "standing skylines" after the initial raising in order to protect mature riparian hardwood trees along East Creek.

Road, Skid Trail and Landing Construction, Reconstruction and Decommissioning

- New roads and skid trails would generally be located outside of Riparian Reserves. Rock would not be placed on new roads.
- Landings would not be located within 200 feet of any stream within ½ mile of Listed Fish Habitat (LFH), or within 100 feet of any other stream. The number of landings and their size would be kept to the minimum required to reasonably harvest the units. Landings would be located by the purchaser and approved by the BLM.
- All of the newly constructed and most renovated roads (two miles of natural surfaced road) would be fully decommissioned and blocked. Full decommissioning would consist of removing culverts, subsoiling, water barring, seeding or planting with native species, and restricting OHV use. Blocking to restrict OHV use may include the strategic placement of boulders, logs, root wads, or other types of earthen barriers. Skid trails that could also be easily accessed by OHVs would be blocked in the same manner.
- Where determined necessary and appropriate by the silviculturist and soil scientist, some of the primary skid trails may be decompacted by subsoiling. This determination would be made upon completion of timber harvest and would be expected to be approximately one acre or less in total. Subsoiled roads and landings would be planted with native plant species where appropriate.
- Geotextile fabric would be installed prior to placing gravel across sections of roads that have poorly drained, fine textured soils (e.g., silty clay). The geotextile fabric will provide additional support and keep fines (sand, silt and clay size particles) in the underlying soil from working its way up into the road surface.
- All culverts replaced or installed would be sized to accommodate 100 year flow events except for the temporary East Creek culvert, which would be sized to accommodate annual flow events. The temporary East Creek culvert would be installed and removed during the same summer dry season. In addition, fill material would be crushed rock for bedding instead of common soil, thus reducing the potential for sediment delivery downstream.
- All culvert work involving live water would be done during the ODFW in-stream work period (July 1 to September 15) unless a waiver can be obtained from ODFW.

Invasive / Non-Native Plants

- Prior to entering the sale contract area all heavy machinery (with the exception of log trucks, rock trucks and

vehicles that transport personnel to the site) would have all dirt and adhering vegetation removed by power-washing.
- All disturbed sites such as landings, subsoiled roads, skid trails etc., will be evaluated for reintroduction of native plant material to mitigate the spread of invasive non-native plant species.

Cultural Resources

- Survey techniques for cultural resources are based on those described in the *Protocol for Managing Cultural Resources of Lands Administered by the Bureau of Land Management in Oregon* (BLM, 1998). A post-project survey would be conducted according to standards based on slope defined in the Protocol appendix. If cultural material is discovered during project implementation, work would be suspended until an archaeologist can assess the significance of the discovery.

Fire Risk

- Lopping and scattering of fuels may be incorporated in areas where fuel loading is relatively heavy but not heavy enough to warrant hand piling or burning.
- Pullback of fuels may be incorporated in areas where fuel loading is relatively light (especially along roads) and not heavy enough to warrant hand piling or burning
- Burning would be conducted under good atmospheric mixing conditions to lessen the impact on air quality in designated areas.
- Landing piles should be located as far as possible from green trees to minimize damage.
- Hand piles should be located at least 10 feet from green trees, where possible, to minimize damage.
- Hand piles and landing piles would be covered to facilitate the consumption of fuels during the high moisture fall/winter burning periods.
- To further mitigate fire risk, specified logging roads in the project area would be posted 'closed' to all vehicle use when an Industrial Fire Precaution Level of II or greater is reached during the first year following harvest activities, while fuels are in the "red needle" stage. These designated areas should be monitored for the need of additional closures during subsequent years during periods of high fire danger.

Seasonal Restrictions (See Table 2 for a summary of seasonal restrictions)

- *Yarding and Hauling:* Yarding and hauling would be restricted to periods of low soil moisture, generally June 1 through October 15. This season could be adjusted if unseasonable conditions occur (e.g., an extended dry or wet season). Operations would be suspended during periods of heavy precipitation if resource damage would occur.
- *Road Work:* All road decommissioning, construction, renovation and maintenance would occur during the dry season (generally June 1 through October 15).
- *Culvert Work:* All work requiring in-stream work (culvert installation, replacement or removal) would be limited to the ODFW in-stream work period (July 1 to September 15).
- *Bark Slip Period:* If excessive leave tree damage is occurring during felling and yarding operations, operation would be halted until after the peak bark-slip period ends (generally about July 15). Western hemlock and true firs are particularly prone to damage.

Table 2* Seasonal Restrictions Incorporated into the Moon Creek Density Management Project. Shaded areas in the "1" cells indicate effective dates from the 1st to the 14th of each month. Shaded areas in the "15" cells indicate effective dates from the 15th to the end of each month.

	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
Activity	**1**	**15**	**1**	**15**	**1**	**15**	**1**	**15**	**1**	**15**	**1**	**15**	**1**	**15**	**1**	**15**	**1**	**15**	**1**	**15**	**1**	**15**	**1**	**15**
Yarding and Hauling																								
Road Construction, Renovation and Decommissioning																								
Culvert Work (live																								

streams)																							
Falling and Yarding (bark slip period)**									Conditional – Depending on Damage														

*Restricted dates are shaded. All dates are dependent on actual weather conditions.
**Bark slip restrictions may be conditionally waived.

- *Daily Time Restrictions:* All road maintenance and renovation work, including culvert installation, which would occur on the 3-8-24.1 road (see figure 2) in the south ½ of Section 13, T3S, R8W, WM., would be restricted to the daily time period of two hours after sunrise until two hours before sunset. This requirement would minimize the potential for disturbance to a patch of unsurveyed marbled murrelet habitat.

2.2.3 Alternative 2: No Action

The BLM would not implement the density management thinning project at this time. Existing roads would continue to age over time with little or no road surface or drainage structure maintenance. The plant and animal communities would continue to be dependent upon the current stand development trajectories and ecological processes. Management objectives for these areas would not be met.

2.3 Affected Environment and Environmental Effects

2.3.1 Forest Vegetation

2.3.1.1 Affected environment

The areas proposed for variable-density thinning treatment consist primarily of relatively dense, single-storied plantations planted between 1950 and 1977 (Table 3). Although originally planted with Douglas-fir, many of the plantations currently have a large component of western hemlock that seeded in. The exception is Unit 24-2 which was established as a western hemlock progeny test site. Areas dominated by red alder, primarily riparian areas, would be excluded from the harvest areas as much as possible. Red alder within the proposed harvest units is mainly restricted to old skid trails and landings.

Table 3. Current Unit Parameters.

Density Management Unit	Year of origin[1]	Trees/Ac.[5]	Basal Area (ft.[2])	QMD[2] (in.)	Curtis RD[3]	Ave. Ht (ft)	Ht./Diam. Ratio	Species composition[4]
3-1	1954	224	250	14.3	66	104	79	DF (40%), WH (59%)
11-1	1965	229	235	13.7	64	103	77	DF (71%), WH (21%)
11-2	1967	286	218	11.8	63	90	91	DF (75%), WH (9%)
11-3	1964	201	206	13.7	56	100	82	DF (91%), WH (8%)
13-1	1962	274	277	13.6	75	92	74	DF (60%), WH (32%)
13-3	1962	243	214	12.7	60	94	80	DF (43%), WH (34%)
13-2	Units 13-2 and 13-4 are too variable to neatly characterize on a table. See description below							
13-4								
14-1	1960	239	231	13.3	63	110	90	DF (73%), WH (13%)
14-2	1965	283	246	12.6	69	99	*	DF (28%) WH (55%)
15-1	1964	248	244	13.4	67	110	85	DF (67%), WH (21%)
24-1	1977	296	173	10.4	54	70	77	DF (93%), WH (1%)
24-2	1977	554	264	9.3	86	76	87	W H (100%)

[1]Weighted average, planted over several years

[2]Quadratic mean diameter (diameter of the tree of average basal area)

[3]Curtis Relative Density (Curtis 1982)
[4]DF= Douglas-fir, WH = western hemlock, remaining species predominantly red alder
[5] Trees per acre 6 inches and greater in diameter at 4.5 feet (dbh)

* Impractical to calculate due to mixed stand data.

Unit 13-2 is too variable to neatly characterize in a table. It is composed of portions of four separate stands including a portion of the stand that contains Unit 13-4. Approximately 25% of the unit is a relatively young (planted 1975) plantation that received a late precommercial thinning in 1996. Tree diameters (quadratic mean diameter - QMD) average about 10 inches. About 15% is composed of a portion of the same stand that makes up a portion of Unit 14-2. The quadratic mean diameter in this portion is about 17 inches; the stand originated in 1965. Another 25% is composed of a portion of the stand that includes all of Unit 13-4. The quadratic mean diameter in this portion is about 11 inches; the stand originated in 1966. The remaining 35% originated in 1960 and has a quadratic mean diameter is about 12 inches. Overall, there is more western hemlock than Douglas- fir in the unit.

Except where laminated root rot has created various-sized openings or areas of lower density, most of the proposed treatment areas have relatively dense overstory canopies, which limit the amount of light reaching the forest floor, and therefore, understory vegetation growth. The only consistently abundant understory species in all of the units are mosses and swordfern. Unit 24-1 is exceptional in that it also has a relatively large vine maple component in the understory. Unit 24-1 is a young stand (31 years old) which hasn't developed a uniformly closed canopy as well as having a relatively large opening (4 acres) caused by the *Phellinus weirii* root disease. Understory species that occur in very low densities throughout the proposed harvest units include salal, red huckleberry, Oregon grape (on rockier sites), salmonberry and oxalis. The stands are above the density level where mortality from tree-to-tree competition begins (RD $\geq$50).

Swiss needle cast disease, caused by the fungus *Phaeocryptopus gaeumannii*, occurs on Douglas-fir throughout the project area. Annual aerial surveys for this disease conducted by the Oregon Department of Forestry from 2003 through 2007 found symptomatic Douglas-fir trees somewhere within the project area in each year, although stands in Section 11 had symptomatic trees detected every year. Throughout western Oregon, within the time period of 2003 to 2007, the level of disease intensity was at its lowest in 2004 and has since begun to increase again (Oregon Dept of Forestry, 2007). In contrast, the number of sections within the project area that had symptoms of Swiss needle cast has fluctuated with a low in 2005 (only Section 11) and a high in 2006 (all sections). The 2007 flight detected Swiss needle cast infections in 3 sections; Section 3, 11 and 14. In all observations, the patches with symptoms were rated "Moderate" meaning they were predominantly yellow to yellow-brown in color and had slightly denser crowns than those classified a "Severe". A moderate level of Swiss needle cast infection probably corresponds to 1.6 to 2.5 years of foliage retained, according to the severity rating in Filip et al. 2000.

Laminated root rot, caused by the fungus *Phellinus weirii*, appears to occur in relatively low levels in the watershed. Douglas-fir is readily infected and killed by this disease. The disease was noted in Units 11-2, 11-3, 15-1 and 24-1.

Except for unit 24-2, the coarse wood volumes (includes down wood and snags) in all of the proposed treatment units are either at the moderate or high LSRA coarse wood level category as shown in Table 24 of the LSRA –see Table 4. As shown in Table 5, most of the total coarse wood volume is in the form of down wood and generally occurs in the more advanced decay classes, while the opposite is true for snags (Table 6). Virtually all of the snags are relatively small diameter trees in decay classes 1 and 2 that have died primarily as a result of inter-tree competition.

Table 4. Volume (cubic feet per acre) of conifer coarse wood (down wood and snags) in the units proposed for density management thinning (all decay classes combined). Minimum piece size for data collection was 8 feet in length and 5 inches in diameter at the transect intersection.

Unit	Down wood volume (ft^3/ac)	Snags/ Ac.	Snag QMD (in.)	Snag volume (ft^3/ac)	Total coarse wood volume (ft^3/ac)	LSRA coarse wood level category[1]	LSRA coarse wood level category range (ft^3/ac)
3-1	2,718	8	9	66	2,784	High	1980-4840
11-1	2,029	16	10	96	2,125	High	1,980-3,800
11-2	3,071	28	7.7	113	3,184	High	1,980-4,840
11-3	1,207	7	13.1	75	1,282	Moderate	1,100-1,980
13-1	1,586	10	12.1	61	1,647	Moderate	1,100-1,980
13-3							
13-2	2,664	15	14	121	2,785	High	1,980-3,800
13-4							
14-2							
14-1	2,097	7	12.6	90	2,187	High	1,980-3,800
15-1	1,621	22	10.6	305	1,926	Moderate	1,100-1,980
24-1	2,277	18	7.6	69	2,346	High	1,980-3,800
24-2	0	1	42.9	47	47	Below minimum	Minimum = 525-1,100

[1] Late-Successional Reserve Assessment for Oregon's Northern Coast Range Adaptive Management Area (USDA Forest Service and USDI Bureau of Land Management 1998).

2.3.1.2 Environmental Effects - Alternative 1: Proposed Action

The expected short-term effects (0-25 years) of the proposed density managements include:

- Increased diameter growth rates and crown development to lessen the time it takes to develop the large trees, snags and logs characteristic of late-successional forests. See Table 7 and Table 8 for a comparison of QMD's.
- Scattered areas of tree regeneration, particularly shade tolerant western hemlock and shrub growth, a beginning towards the development of multi-storied stands.
- Increased horizontal diversity by varying tree spacing, leaving unthinned areas and creating heavily thinned gaps.
- Greater wind-firmness (see ht/diam ratios, Table 8.) which would allow more flexibility during future entries and lessen the risk of large-scale windthrow.

Table 5. Estimated stand conditions immediately following harvest as projected by ORGANON (Hann et al. 2006). (Unit 13-2 is not included because data could not be combined and run in ORGANON.)

Unit	**Harvest Acres**	**Trees/Ac.**	**BA (sq. ft.)**	**QMD (in.)**	**Curtis RD**	**%BA Removed**	**%TPA Removed**
3-1	88	81	147	18.2	34	41%	64%
11-1	46	70	127	18.3	30	46%	69%
11-2	28	99	115	14.6	30	47%	65%
11-3	25	76	108	16.1	27	48%	62%
13-1	30	87	151	17.9	36	45%	68%
13-3	76	85	125	16.5	31	42%	65%
13-2	18						
14-1	24	89	118	15.6	30	49%	63%
14-2	28	126	144	14.4	38	49%	57%
15-1	18	78	122	16.8	30	50%	69%
24-2	9	287	133	9.2	44	50%	48%
24-1	22	80	77	13.3	21	55%	73%

The proposed variable-density thinning treatments are expected to redirect the current stand developmental trajectory away from increased uniformity and towards a more complex structure characteristic of older forests. As a result of implementing this prescription, the density within and among units would vary. See Section 2.2.2.2 (Project Design Features) of this EA for a description of design features that would promote variable stocking.

Although the proposed thinning is variable, the overall treatment could be described as light to moderate thinning.

See Table 6 for estimated stand parameters 25 years after implementing Alternative 1. Structural development of Douglas-fir forests is complex and occurs over long time periods. Mortality at the individual tree, stand and landscape levels will continue to operate and the goal is not to reach some ultimate stand condition during this entry. Because the proposed thinning are relatively light, portions of the forest canopy will re-close in a relatively short time, perhaps in 10 to 15 years. It is expected that most of the units will require at least one more entry in order to place an emphasis on the development of multistoried stands, maintain live crown ratios and diameter growth, as well as to create some CWD within the units.

Although the thinning is expected to remove most of the smaller-sized trees that would have likely died from suppression, approximately 52% of the Forest Operations Inventory Units acreage considered for density management during this proposed entry would be left unthinned because of logging difficulties, poor stocking, slope stability, disease pockets, stream buffers, and high windthrow risk. Leaving variable-sized areas unthinned will provide places where competition related mortality should continue. Following treatment, coarse wood would be expected to increase due to windthrow, damage and breakage during felling, and trees greater than or equal to 20 inches (16 inches in stands less than 40 years old) in diameter that are cut and left on the ground to facilitate logging. Project implementation is expected to set the stage for future treatments that could continue the progress of the stands towards development of more complex structures.

Table 6. Estimated stand conditions 25 years after implementing Alternative 1 as projected by ORGANON (Hann et al. 2006). Unit 13-2 is not included because data could not be combined and run in ORGANON.

Unit	Variable-Density Thinning Acres	Trees/Ac.	BA (sq. ft.)	QMD (in.)	Curtis RD	Ht/Diam Ratio
3-1	88	79	238	23.5	49	79
11-1	46	67	195	23.1	40	68
11-2	28	93	211	20.4	47	80
11-3	25	72	203	22.7	43	75
13-1	30	84	228	22.3	48	72
13-3	76	81	224	22.6	47	76
13-2	18					*
14-1	24	78	187	21	41	86
14-2	28	103	224	20	50	*
15-1	18	66	191	23	40	80
24-2	9	271	275	13.6	74	111
24-1	22	76	188	21.3	41	49

* Ht/Diam. Ratios were not calculated for Units 13-2 and 14-2 due to the difficulty in combining data for the method employed in calculating ht/diameter ratios. The relative decrease shown in other units is expected to be the same for Units 13-2 and 14-2.

2.3.1.4 Environmental Effects - Alternative 2: No Action

Under this alternative, no density management or CWD creation would take place at this time. In the absence of thinning or some other form of canopy disturbance, projections are for the density levels of the stands to generally increase to fairly high levels over the next 25 years (Table 9). Stands are expected to become increasingly dense

and uniform. As the level of competition among the trees remains high, crown development (live crown ratio, crown expansion, and branch growth) will decrease, diameter growth rate can be expected to decline, and competition-related mortality will increase, resulting in coarse wood additions mainly from the smaller-diameter trees that slowly die from suppression. This scenario is reflected in the Curtis RD numbers in Table 9. Competition mortality in Douglas-fir stands generally occurs at RD's between 50 and 60; the relative density is probably higher for competition mortality of shade tolerant western hemlock. Competitive mortality occurs at a relatively even spatial distribution, maintaining stands uniformity. RD's over 80 and height/diameter ratios greater than 80 indicate a high risk of windthrow over time. Understory development will also be limited. A declining trend in the red alder component can be expected in the future as they are out-competed (overtopped) by the conifers. In addition, the trees are expected to become less stable, as expressed by the height/diameter ratio, and therefore, more likely to experience windthrow or break off in severe winter storms.

There would not be any cumulative effects to forest vegetation associated with selecting the "No Action" alternative.

Table 7. Estimated stand conditions 25 years after implementing Alternative 2: No Action as projected by ORGANON (Hann et al. 2006). Unit 13-2 is not included because data could not be combined and run in ORGANON.

No Action Alternative: Stand Conditions in 25 years

Unit	Trees/Ac.	BA (sq. ft.)	QMD (in.)	Curtis RD	Ht/Diam Ratio
3-1	203	352	17.8	83	79
11-1	195	337	17.8	80	95
11-2	228	304	15.6	77	98
11-3	163	298	18.3	70	94
13-1	205	332	17.2	80	91
13-3	185	304	17.4	73	94
14-1	164	290	18	68	99
14-2	215	329	16.8	80	*
15-1	166	297	18.1	70	97
24-2	487	403	12.3	115	120
24-1	212	290	15.9	73	68

*Ht/Diam. Ratios were not calculated for Unit 14-2 due to the difficulty in combining data for the method employed in calculating ht/diameter ratios. The relative increase shown in other units is expected to be the same for Unit 14-2.

2.3.2 Threatened or Endangered Wildlife Species, Habitat and/or Designated Critical Habitat

The analysis below includes the direct, indirect and, in separate sections, cumulative effects of the proposed action. Unless otherwise noted, the analysis was conducted on a 5 mile radius circle (approximately 50,500 acres) out from the approximate center of the Moon Creek project harvest activity. In some cases reference may be to larger or smaller areas such as the bounds of the Moon Creek subwatershed (~ 12,500 acres).

Within the five mile radius circle there are 16,906 acres of BLM land, 8,410 acres of National Forest land, 15,174 acres of Oregon Dept. of Forestry land, and 10,000 acres of private land, including both industrial forest land and other private land.

2.3.2.1 Affected Environment

The proposed action area is within designated critical habitat for the spotted owl and is within the boundaries of designated critical habitat for the marbled murrelet but does not contain any of the constituent elements of critical habitat due to the young age of the stands to be treated and therefore is not considered to be critical habitat. Fifty-three acres of the proposed treatment areas are located within the Moon Creek Reserve Pair Area (RPA); which would treat spotted owl dispersal habitat only. The Moon Creek RPA consists of about 6880 acres of which nearly 4200 acres are of high quality suitable habitat. None of the suitable habitat would be treated with density management prescriptions. None of the stands to be treated contain any murrelet habitat but would be considered low quality spotted owl dispersal habitat, which could help support owls for short periods of time as they move though the area, however some of the stands are adjacent to high quality suitable habitat for both the spotted owl and marbled murrelet. Approximately 40 acres (units 24-1 and 24-2) of the proposed action would occur in forest stands too young and small to serve as owl dispersal habitat. One occupied owl site (Moon Creek MSNO-1965) is situated within about two miles from the nearest proposed treatment units, with two other sites within approximately four miles of the proposed project area. Occupied spotted owl territories are quite rare in the northern Oregon Coast Range mainly due to the lack of unfragmented late-seral habitat. Within a five mile radius of the approximate center of the proposed Moon Creek project harvest activity (analysis area) there are about 3900 acres of high quality murrelet habitat (~2200 acres Forest Service and ~1700 acres BLM using forest inventory and aerial photo data) and there are at least three forest stands with known murrelet activity associated with breeding, with the nearest being within ¼ mile of the density management unit planned in Section 3. Based on Late Successional Reserve data updated by 2005 aerial photos there are 11,191 acres of suitable spotted owl habitat and 19,306 acres of dispersal habitat within the analysis area. There is no established threshold amount of dispersal habitat that needs to be available to allow for adequate movement of owls between blocks of suitable habitat. However, based on work done by Thomas et. al. (1990) and other noted spotted owl scientists, a landscape comprised of forest habitat of which at least half is capable of sustaining owls during dispersal (generally conifer or mixed stands 40+ years old) should be adequate to allow for successful dispersal of owls. With 60% of the landscape in a five mile radius of the proposed action area suitable for dispersal (including over 11,000 acres of high quality suitable habitat) the analysis area is in better shape than most any other area in the northern Oregon Coast Range.

Both the BLM and ODF have been surveying for spotted owls and marbled murrelets within the Moon Creek subwatershed. Protocol surveys have been completed for stands near the proposed action area with no detections during surveys. In July of 2008 an ODF biologist observed a spotted owl on ODF land approximately ¼ mile away from two of the proposed density management units. Follow up visits have elicited distant responses seemingly well within late-successional stands more than ½ mile from any of the proposed density management units. These detections do not provide enough information to establish any new known sites and are most likely associated with the Moon Creek known site. All of the suitable and potential marbled murrelet habitat in the vicinity of the proposed harvest units has been surveyed to the accepted Pacific Seabird Group protocol with no detections.

2.3.2.2 Environmental Effects - Alternative 1: Proposed Action

Northern Spotted Owl

The project as proposed would thin approximately 420 acres of 30-55 year-old dense conifer forest. These stands currently would not support breeding owls due to the lack of structurally complex habitat. The project is designed to improve the prospects of development of high quality habitat in the future, including large trees with large limbs, canopy gaps, vertical and horizontal structural diversity, and the potential for large snags and cavities.

The conditions that keep younger more structurally simple stands from being good suitable habitat for owls are the lack of nesting substrate, such as large sheltered platforms or large cavities, lack of a vertically diverse hunting venue and the lack of habitat for a suitable prey base, which is primarily the northern flying squirrel in this area.

The proposed action should eventually result in a more structurally diverse stand, both vertically and horizontally that may provide for better owl foraging and nesting opportunity. However, one drawback of the action is that the natural development of snags would be halted for the next 20-30 years (Carey 1991). The resultant loss of the future snag potential coupled with the direct loss of some of the few snags that currently occur in the project area

through logging operations would have a negative impact on woodpecker populations and the secondary cavity users that depend on woodpeckers to provide shelter. A secondary cavity user that is of particular importance to the spotted owl is the northern flying squirrel.

Throughout the range of the northern spotted owl, flying squirrels are of primary importance as a food source for the owl. In the northern part of the range where there are few if any woodrats, the flying squirrel can make up over 60% of the diet of spotted owls (Carey 1991, Forsmen et. al. 1991). Flying squirrels have been found to be about twice as abundant in late-seral and old-growth stands as in younger seral stands and their presence is positively correlated to the abundance of large snags (Carey 1991, Corn and Bury, 1991). Carey finds that flying squirrels apparently play a major role in determining the carrying capacity of Douglas-fir and western hemlock landscapes for spotted owls; he also notes that most cavities used by flying squirrels seem to be abandoned woodpecker holes; thus postulating that the presence of woodpeckers may be essential for high population densities of northern flying squirrels (Carey 1991).

Most of the stands to be treated contain trees that are too small at this time to produce quality snag habitat for woodpeckers and the secondary cavity users that depend on them.
The degradation of approximately 380 acres of dispersal habitat has only a very small potential to impact spotted owls. These acres would still function as dispersal habitat, although to a reduced degree, but still only represent about 2% of the available dispersal habitat in the analysis area.

The potential effect to spotted owls from this project would only be through modification of dispersal habitat. Protocol surveys will be complete by the fall of 2008 and there is not anticipated to be any potential for disturbance to nesting owls through either harvest operations or road maintenance and log hauling. Due to the potential for minor short term degradation of a small amount of dispersal habitat from the loss of prey base habitat such as snags and with anticipated long term beneficial impacts, informal consultation with the U.S. Fish and Wildlife Service is warranted. Consultation would be completed programmatically within the appropriate years' Habitat Modification Biological Assessment (BA) (Light to Moderate Thinning).

The impacts to designated critical habitat would be the same as those described for the owl as a species since the project is not expected to harm individual owls, but rather would impact owls by modifying dispersal habitat.

Marbled Murrelet

Due to the nature of the density management project, the Moon Creek project would not result in any adverse impacts to marbled murrelet suitable or critical habitat. In the long term (greater than 30 years) the action area is expected to become better murrelet habitat by maintaining or increasing stand vigor and growth, and increasing horizontal and vertical structural diversity on the subwatershed scale. The direct or indirect impacts that may affect murrelets would be of the disturbance type only. The only impacts to Designated Critical Habitat that would be expected would be those potentially long term benefits that would occur in the future as a result of the proposed action.

The potential for disturbance impacts to murrelets exist where activities that generate noise above the ambient forest level occur near breeding murrelets. Surveys of all of the suitable habitat adjacent to the harvest units, completed in August of 2008, did not detected any murrelet presence within such distance that noise could cause negative impacts. There is a patch of suitable murrelet habitat adjacent to the 3-8-24.1 road in the south ½ of Section 13, where culvert re-installation and road renovation and maintenance would occur that has not been surveyed. Work done in this area would be restricted to the daily time period of two hours after sunrise until two hours before sunset. This requirement would minimize the potential for disturbance to this patch of unsurveyed marbled murrelet habitat. Although, according to the USFWS, log hauling on well developed logging roads such as the road in section 13 is not impactful enough to warrant special conservation measures for murrelets, road renovation and maintenance activities such as culvert installation, spot rocking and road grading have a greater potential to disturb murrelets than does hauling due to the longer more localized noise generation and therefore these activities would require the daily time restrictions during the breeding season during those hours when murrelets are most susceptible to disturbance.

The proposed density management project may impact marbled murrelets through noise disturbance during the critical part of the breeding season therefore informal consultation with the USFWS is warranted. Informal consultation will be completed programmatically in the appropriate years' Habitat Modification BA (Light to Moderate Thinning).

Cumulative Effects

Northern Spotted Owl

There would be no adverse cumulative effects to spotted owls as a result of implementing the Moon Creek Project. The project area would still continue to function as dispersal habitat at the completion of harvest and is expected to improve as habitat over time. Also, the density management area represents only 2% of the available dispersal habitat within the analysis area, which would still be comprised of 60% dispersal or suitable habitat at the completion of harvest. With 50% of the land in the analysis area under federal management for late successional forest conditions the overall condition of spotted owl habitat in the analysis area is expected to remain stable or improve over time.

Marbled Murrelet

There would be no adverse cumulative effects to marbled murrelets as a result of implementing the Moon Creek Project. There is no murrelet habitat on State or private land in the analysis area and there is not expected to be any at any point in the future. The proposed action would not immediately affect murrelet habitat consequently it would not contribute cumulatively to any impacts to the current habitat condition.

2.3.2.4 Environmental Effects - Alternative 2: No Action

Northern Spotted Owl and Marbled Murrelet

See the Environmental Effects section of the Forest Vegetation analysis of the "No Action" alternative (2.3.1.4) for a description of the expected impacts to the forest vegetation component of wildlife habitat.

By not managing the density of the 35 -50 year old stands, development of suitable spotted owl and marbled murrelet habitat will be retarded in the long term by the slowed growth rate and increasing instability of the stands. The lack of understory and structural diversity will limit the potential habitat for spotted owl prey species and prolong the period for the development of large platform structures suitable for murrelet nesting. Eventually the stands would self thin and small scale disturbances such as insect and windthrow events would open the canopy and release some of the trees thus providing structural diversity. However, without density management now the process would be delayed by several to many decades.

Without the proposed action, none of the potential direct impacts associated with disturbance would occur, at least in the vicinity of BLM lands and the status and population trend of these species would continue on their current trajectory.

Cumulative Effects

There would not be adverse cumulative effects resulting from selecting the "No Action" alternative. The federal lands in the analysis area may continue to conduct some level of density management thinnings and those projects would have direct and indirect impacts to wildlife. The private and State lands are expected to be managed in the same way as described in the cumulative effects sections of the proposed action alternative. The BLM will have a density management project in the vicinity of the proposed action active within the next three years and it will be active for at least one season of operation or up to three seasons. Much of the private and State lands in the analysis area are already in early seral stage with many recent harvest operations. The State lands north and east of the proposed action area are part of the Tillamook burns and generally are being managed with thinning operations and some regeneration harvest and are expected to continue those.

The forested environment on federal lands within the analysis area would continue to age and other density management projects would be expected to continue to occur and eventually the forested area on federal lands would diversify into a more complex forest structure.

2.3.3 Special Status and SEIS Special Attention Wildlife Species and Habitat

2.3.3.1 Affected Environment

See the Affected Environment section for the Forest Vegetation section (2.3.1.1) for a description of the forested environment where Special Status and SEIS Special Attention wildlife species could be found. The following describes attributes of the affected environment that are important to the species analyzed.

Red Tree Vole

The red tree vole (RTV) is an arboreal rodent that is thought to be strongly associated with mature and late-successional Douglas-fir forests. Some recent studies, and the results of many surveys over the last ten years have shown that red tree voles are found in younger forests also. At this time it is uncertain what role younger forests play in the general health of red tree vole populations, especially in the northern mesic zone. According to Eric Forsman, a noted spotted owl and red tree vole researcher, tree voles are quite uncommon in the northern coast range; and genetic work by Miller et. al. (2006) suggests that in the historical past the northern populations of red tree voles had become fragmented and discontinuous with the southern populations by climate change associated with glaciations. The red tree vole rarely comes to the ground and may live its entire life in a few acres. In the infrequent cases where red tree voles come to the ground to disperse, they tend to remain hidden under heavy vegetation and/or down wood. Due to the red tree voles' propensity for staying near its territory of birth and its low reproductive rate, the expansion of red tree vole populations into uninhabited areas is a slow process.

There are few records of the red tree vole in the northern coast range of Oregon where it remains listed as a Bureau Sensitive species. Seventeen active red tree vole sites have been found on BLM land within a five mile radius of the proposed harvest units. Location of these 17 sites resulted from an effort by the BLM to find RTV sites by looking at some of the best potential habitat on BLM land in the Nestucca drainage. One site was found in a 40 year old stand that is proximate to several older forest stands and is also currently proposed for density management. The site and approximately five additional acres of the originally proposed density management unit have been excluded from the proposal. No other surveys were conducted in the proposed harvest units because the forest stand conditions did not trigger the need to survey according to the currently accepted survey protocol. Undoubtedly there are other RTV sites within the Moon and East creek watersheds due to the availability of high quality late successional habitat adjacent to the proposed project area.

Mollusks

There are six BLM Sensitive mollusk species with potential to be located within the proposed action area. These species are generally associated with the organic duff layer and moss on the floor of cool forested areas containing coarse woody debris, sword ferns, hardwood brush species and for some species, hardwood trees, especially bigleaf maple. The warty jumping (*Hemphillia glandulosa*) slug and Tillamook westernslug (*Hesperarion mariae*) are quite common in the Nestucca River watershed (in which Moon and East Creeks reside) and would not, as a species, be affected by the proposed action. The other four species either have never been found in the Tillamook RA after approximately 9,000 acres of survey or have only been encountered a very few times. There are three known sites of the Puget Oregonian (*Cryptomastix devia*) in the Tillamook RA (none of which are in the analysis area) which represents a range extension of what was thought to be a Washington Cascades and Columbia Gorge species and these sites are the only records in the Coast Range. According to the BLM's regional database the only site of the crowned tightcoil (*Pristiloma pilsburyi*) in all of Oregon and Washington is in the Nestucca drainage less than 10 miles from the proposed action area. Little is known about the spotted taildropper (*Prophysaon vanattae pardalis*); and there appears to be some disagreement about which specimens actually represent the spotted taildropper species. The Tillamook RA has one record of finding a specimen that according to Nancy Duncan (BLM mollusk expert) represents the spotted taildropper species and there are only

three other records in the Northwest Forest Plan area. The salamander slug (*Gliabates oregonia*) has not been encountered in the Tillamook Resource Area.

Mollusk surveys will be conducted in the spring and fall of 2008 on portions of the proposed project area that either represent the best opportunity to find the Sensitive listed species or where the action has the most potential to cause the greatest harm, such as in the areas of heavier thinning ("gaps") where there may be more potential to cause microclimatic drying. If any of the species other than the Tillamook westernslug or the warty jumping slug are encountered, appropriate measures to protect the site would be incorporated such as placing no harvest buffers around the site.

Johnson's Hairstreak

Johnson's hairstreak is a small butterfly that is dependent on coniferous forests that contain mistletoes of the genus *Arceuthobium*, and is the only Bureau Sensitive insect that may be affected by the proposed action. The mistletoes occur mainly on western hemlock and occasionally true firs. The eggs of this butterfly are laid in mistletoe masses and the chrysalids over winter there. The larvae feed on the leaves of the host plant. Historically the Johnson's hairstreak was thought to occur throughout the Pacific Northwest in old-growth forests. The current range is uncertain with most of the records for this species in Oregon being pre-1980. There have been some recent sightings in eastern Multnomah County but no known records of the species occurring near the proposed Moon Creek project. The old-growth stands in the Moon and East Creek areas contain hemlocks with mistletoe infections and there is mistletoe in a few of the younger hemlock adjacent to the old forest in Section 3 of the proposed project area that could support this butterfly.

2.3.3.2 Environmental Effects – Alternative 1: Proposed Action

Red Tree Vole

Since the harvest activities associated with the Moon Creek project would be restricted to young (30-55 yr. old) stands, near term (next 5-10 years) impacts should be negligible. However, since there is a record indicating that voles are using younger stands in the vicinity of older stands in the project area, and Swingle and Forsman suggest that thinning of young conifer forest could have detrimental effects on red tree vole habitat speculating that decreased connectivity between individual tree crowns may be the reason, there may be some direct negative impact to some undiscovered individual tree voles in the vicinity of adjacent older stands where the variable thinning is heavier. A number of acres of otherwise thinning aged forest are not planned for thinning in and around the proposed action stands and would continue to provide dense canopy habitat for tree voles adjacent to or nearby the stands targeted for thinning (originally, the Moon Creek Project plan included slightly more than 700 acres of thinning opportunity, which for various reasons has been reduced to the current proposal of about 420 acres). In the longer term (10+ years) when the expanding crowns of the residual trees begin to close again the habitat quality for red tree vole would improve and is expected to be more suitable due to the improved health and vigor of the stand. Partly because approximately 40% of the original Moon Creek project would actually be reserved from harvest, overall direct impacts to the young marginal RTV habitat would be relatively small. To summarize, the proposed action may have a small negative impact to red tree voles, but would have a long term positive impact on red tree voles by providing the potential for improved habitat.

Mollusks

In general, light to moderate thinning of younger forest stands cause minor changes in the microclimate at the ground level post harvest. Results from studies of microclimate changes between various thinning densities compared to unthinned stands seem to indicate that, although thinned stands are warmer and dryer than unthinned stands, there is considerable overlap in conditions between them suggesting that these stands provide a wide range of microclimates (Chan et. al. 2004). The Moon Creek project proposes to thin the stands in a variable spaced manner where on average the resulting canopy closure will be 50-60% after harvest. Considering that even in unthinned stands there are long periods in a given year when the climate is unsuitable for terrestrial mollusk activity, it stands to reason that there may only be a slight change in the average time when conditions in the thinned stands are unsuitable for mollusk activity compared with the unthinned stand condition; presumably on

the cusps of the dry weather in the early summer and later fall; and if there is a change, it may be within the range of natural variability. On 3-10% of the acres in the harvest units the canopy would be reduced below 40% in small "gaps" of ¼ to 1 acre in size; however the average for the whole unit will still remain 50-60%. In the "gap" areas, ground conditions could be changed to a point where they are unfavorable to terrestrial mollusks for a longer portion of a year, perhaps by as much as 6-8 weeks. Additionally, harvest activities, especially ground-based harvesting can have direct impact on mollusks by crushing individuals or breaking apart later decay stage coarse wood.

The principles of conservation biology hold that species with patchy distribution and that have genetically isolated populations are at greater risk of extinction. With so little available information and few records of the crowned tightcoil, salamander slug, spotted taildropper and Puget Oregonian (in Oregon) it is impossible to accurately assess the impacts of a project like the Moon Creek project on these species. The true rarity of these species cannot be determined by the available data since only the Puget Oregonian, Tillamook westernslug and warty jumping slug were included in the Survey and Manage program and thus the other species were not specifically searched for during surveys (although all good surveyors learned to identify all species encountered, however the non-S&M species were not always recorded). That said, we expect the level of direct and indirect impacts to Sensitive mollusks to be minor based on the design features. While negative survey results do not guarantee that a Sensitive species is not in a given area, surveys can lower the odds that any species that is of concern would be impacted since, if found they would be afforded protection that would not otherwise be available.

Johnson's Hairstreak

None of the old stands in the vicinity of the Moon Creek project would be impacted by the density management thinning. Hemlocks will be maintained within the thinned stands at approximately the same proportion that they occur now. Since there would be no intention to eradicate mistletoe from any of the thinning units, overall there could be a very minor potential impact to Johnson's hairstreak habitat by the incidental removal of a few young hemlocks that are infected with mistletoe. Over the long term (greater than 20 years) the thinned stands would continue to develop into later seral stage forest including those trees that remain with mistletoe infections and over time may develop into improved habitat by allowing hemlocks to maintain or increase their growth and, especially in the vicinity of the old-growth stands, would be an optimal substrate for new introductions of hemlock associated mistletoes.

Cumulative Effects

This cumulative effects discussion is general to all of the species analyzed above.

The Oregon Dept. of Forestry plans to either thin or clearcut approximately 210 acres in the Moon and East Creek drainages in the next 2-7 years and has completed a regeneration harvest of approximately 225 acres within the last five years. The BLM has recently completed a variable spaced thinning of about 200 acres in Section 1 in the northeast portion of the watershed. Green Diamond Resource Company is preparing to clearcut harvest much of the remaining timber in Section 12 to the east of the proposed action area which will effectively eliminate any remaining habitat for the sensitive species addressed here on private land within the East and Moon Creek drainages. Individually these actions will have varying degrees of negative impacts to sensitive species habitat. However, between the BLM and US Forest Service lands, there would remain 4000 acres, or about 1/3 of the subwatershed, of good to excellent older forest habitat (stands over 80 years old) that would remain intact for the foreseeable future, and another 850 acres of stands of various densities aged 40-80 years old. In general the proposed action would cause a short term (~ 10 years) degradation of habitat for species preferring dense canopy cover, but would result in improved late successional habitat in the longer term. Considering the intensity of the actions occurring on State and private land that could affect Special Status and SEIS Special Attention species, the proposed action would not add any further impacts that would result in additional adverse effect to any of the aforementioned species.

2.3.3.3 Environmental Effects - Alternative 2: No Action

Under the "No Action" alternative none of the activities described for the Proposed Action alternative would occur. The current habitat condition for Special Status species would be unaffected now and in the near future. There would not be any potential for additional drying of the terrestrial environment that may otherwise result from a thinned canopy that would affect terrestrial mollusks, nor would there be any damage or destruction of existing coarse woody debris. Habitat for red tree voles would remain as it is today with young dense canopy stands surrounding and interspersed with high quality old forest stands and would probably improve at a rate similar to that of the Proposed Action alternative. The young stands would continue to grow at a declining rate and become less stable over time. Eventually disturbances such as windthrow or insect attack (or possibly fire) would influence the character of the stands and introduce more structural diversity into the ecosystem thus affecting the suite of animals that would use these stands. The attainment of a more structurally complex stand may take longer under the No Action alternative and would eventually result in an old forest system with more smaller trees with more coarse wood (although of smaller piece size) than would occur with the Proposed Action alternative. It is not clear if in the long term whether the overall animal species composition and abundance resulting from the No Action alternative would be appreciably different than from what would result from the Proposed Action alternative.

Cumulative Effects

Generally speaking the Special Status Species listed above would not experience any cumulative effects in the next several decades as a result of selecting the No Action alternative. Beyond the next two to three decades, a very small adverse cumulative effect could occur for species that desire older forest structure such as the Johnson's Hairstreak and perhaps the red tree vole. None of the effects, if realized would change the level of population viability for any of the Special Status Species.

2.3.4 Migratory Bird Treaty Act – Species of Conservation Concern

Executive Order (EO) 13186, issued Jan. 17, 2001 directs federal agencies to enter into a Memorandum of Understanding (MOU) with the U.S. Fish and Wildlife Service to further the goals of the Migratory Bird Treaty Act of 1918. The pertinent goals of the EO are to "support the conservation intent of the migratory bird conventions by integrating bird conservation principles, measures and practices into agency activities and by avoiding or minimizing to the extent practicable adverse impacts on migratory bird resources when conducting agency actions"; and to "ensure that environmental analyses for Federal actions required by the NEPA or other established environmental review processes evaluate the effects of actions and agency plans on migratory birds, with emphasis on species of concern". To date the BLM has not completed the MOU process, but has issued interim guidance in the form of Instruction Memorandum No. 2008-050 instructing administrative units to minimize unintentional take as defined by EO 13186 and to optimize migratory bird efforts related to BLM activities.

The Moon Creek Density Management Thinning project would cut and remove trees, and construct and renovate roads which could result in the unintentional take of adult or nestling birds that are covered by the MBTA, or result in failed nesting attempts. In general thinning of young dense conifer forests results in greater abundance of birds and, depending on the presence of other habitat features such as snags, hardwoods, etc, can also increase bird species richness. The following bird species are those covered by the MBTA that are included in the USFWS's list of "Birds of Conservation Concern" that have the potential, either negatively, positively or both, to be impacted by the Moon Creek Density Management Thinning project.

2.3.4.1 Affected Environment

See the Affected Environment section for the Forest Vegetation section (2.3.1.1) for a description of the forested environment where MBTA species of conservation concern could be found. The following describes attributes of the affected environment that are important to the individual species analyzed.

<u>Black-throated Gray Warbler</u>

Black-throated gray warblers are widespread in Oregon and use a variety of habitats. Some sources suggest that black-throated gray warblers can be found in shrubby habitats of regenerating clearcuts, declining in abundance as stands mature (Gilbert and Allwine 1991, Ralph et. al. 1991; in *Birds of Oregon*). Several other authors found, in the Coast Range, that the greatest densities of this species were nesting in conifer stands ~ 40-80 years old, with no nesting activity in the 16-40 year old successional stage, and that presence of deciduous cover is important (Carey et. al. 1991). These young stands typically had high densities of small diameter trees with low densities of trees with diameters over 50cm (19.7 inches) dbh. Based on these findings, virtually all of the proposed action area would be suitable nesting habitat for the black-throated gray warbler. On Vancouver Island, British Columbia, this species was most often found in 50- to 60-year-old stands of mixed forests with an important element being relatively open but brushy undergrowth (Campbell et al. 2001). Local experience also finds many if not most black-throated gray warblers detected by song in areas where conifer forest is adjacent to an alder riparian area. The literature also suggests that black-throated gray warblers tend to favor lower elevations (< 2050 feet in Coast Range). Surveys for this species have not been conducted in the proposed action area.

Northern Goshawk

Goshawks are rare breeders in the Oregon Coast Range, with most records from the central portion of the range then south. There is at least one breeding record of the goshawk north of the proposed project area. Goshawks are the largest of the native forest hawks and are for the most part migratory. Goshawks have been observed within the Nestucca drainage in spring in past years but no breeding has ever been documented there. The foraging range on the breeding ground is 5000 – 6000 acres and comprises a forest mosaic that includes large trees, snags, down logs interspersed with openings (David B. Marshall in *Birds of Oregon*, 2003). Nest sites tend to be in the largest trees within mature and late successional stands. Breeding commences in March or April with young fledged by early July. Young are usually fed by the adults into early September. The Moon and East Creek watersheds are probably the best potential goshawk breeding habitat within the Tillamook Resource Area. The old-growth stands in the area provide very good potential nesting habitat, the mid-seral forests with low ground cover provide good foraging habitat as does the juxtaposed early seral forest structure on State and private lands in the area, and hardwood clumps interspersed throughout.

Olive-sided Flycatcher

In the Coast Range, the olive-sided flycatcher builds nests in mature conifer stands, preferring western hemlock and Douglas-fir, with openings nearby such as early seral forest stands, marshes, ponds etc. over which they forage. This bird arrives on the breeding grounds in early to mid May with nest building most evident in early to mid-June and fledging in mid July. Olive-sided flycatchers are conspicuous when singing and flycatching from high perches on snags or tall trees in or adjacent to openings.

Olive-sided flycatchers were quite common in the Moon Creek area in the late 1980's and early 1990's when there were a number of recent clearcuts with snags and wildlife trees in them, adjacent to mature and old-growth stands that were suitable for nesting. Since implementation of the Northwest Forest Plan, there has not been any new clearcut harvest on BLM or Forest Service land in the vicinity of the proposed project and most of the State and private land was already in early seral stage forest. Consequently, the suitability of the Moon and East Creek watersheds has declined in habitat abundance for the flycatcher.

Rufous Hummingbird

Rufous hummingbirds can be found in a variety of habitats as long as a well developed flowering shrub layer is present. Foraging consists of feeding on nectar from flowering shrubs such as red-flowering current and red elderberry, as well as on tiny insects, spiders and mites that are gleaned from plants. Nests are generally found between ground level and about 16 feet (Mike Patterson in *Birds of Oregon*, 2003). This hummingbird is the most common in Oregon and is the only breeding hummingbird in the Moon Creek area. Areas of recent clearcut on state and private land in the vicinity of the proposed density management units provide good habitat for the rufous hummingbird. The proposed units themselves do not include good hummingbird habitat in that there is little foraging opportunity.

Band-Tailed Pigeon

The band-tailed pigeon is a forest bird with a somewhat unusual breeding life history. Band-tails in this area nest primarily in Douglas-fir forests with closed canopies such as those proposed for variable-density thinning, while using open forest for foraging, such as thinned forests or the margin of forests and clearcuts where there are fruiting shrubs and trees available. These birds start nesting later in the spring than many birds and are at the height of breeding in late July with some birds still nesting into September. These native pigeons lay one egg, fledge that young and then re-nest, sometimes up to three times (thus the breeding season can extend into September). (Sanders and Jarvis in *Birds of Oregon,* 2003)

2.3.4.2 Environmental Effects - Alternative 1: Proposed Action

Black-throated Gray Warbler

Evaluating the impacts of the proposed density management on black-throated-gray warblers is somewhat difficult when the description of preferred habitat is rather broad depending on the source. Two studies (Hagar et al, 1996 and Hayes et al, 2003) that looked at bird community response to thinning of young Douglas-fir forests in the Oregon Coast Range, one in 40-55 year old stands and the other in 35-45 year old stands, found that Black-throated gray warblers declined by about ½ after thinning but were not extirpated. Both of these studies assessed the effects of thinning dense Douglas-fir stands and did not elucidate whether alder stands were part of the landscape or not. If, as has been the local experience, black-throated gray warblers are more associated with the deciduous component within conifer forest, then the results of these studies may not have as much pertinence to the possible effects of the proposed action, where virtually all of the hardwoods would be reserved and the structure of the riparian corridor would remain unaltered. At any rate there could be some negative effect to black-throated gray warblers in the Moon and East Creek area by making about 420 acres of conifer forest less desirable for nesting (and possibly resulting in "taking" some individuals or nestlings), but should still not result in an overall negative impact to the species since within the five mile radius analysis circle there would still be approximately 15,000 acres of potential habitat in the 40 to 80 year old seral stage, including the nearby ~ 280 acres that were part of the original Moon Creek Project proposal that have been dropped for a variety of reasons.

Northern Goshawk

The proposed action would not affect any areas that could be considered good nest site habitat for goshawks but could affect foraging habitat in the 45 to 50 year old stands, especially those with a small hardwood component, therefore inadvertent "take" probably would not occur. Goshawks are averse to disturbance and most likely would avoid areas where harvesting activities are ongoing. Other suitable foraging habitat is not limiting within the five mile analysis circle so little direct adverse impact would occur as a result of implementation of the proposed action. In both the short and longer term the proposed density management would benefit the goshawk by providing more complex habitat on the landscape, including additional snags and down wood, small forest openings and larger trees sooner as a result of decreased tree-to-tree competition.

Olive-sided Flycatcher

The proposed density management project would probably not affect individual flycatchers or nestlings since there would be no impact to mature stands in the vicinity of the harvest units. The larger heavily thinned gaps may function as foraging openings for flycatchers as the shrub layer develops and more insects are attracted there. Over all the proposed action would be expected to improve olive-sided flycatcher habitat slightly in the next one to two decades until such time that the gaps become forested again and the proximity to forest openings favored for foraging becomes reduced.

Rufous Hummingbird

The proposed action most likely would not directly impact any hummingbirds except for the very slight possibility that there may be a few nesting in a proposed harvest unit near an opening with suitable forage. "Take" under the MBTA is possible but remote. On the other hand, the expected development of the understory

brush layer from the thinning of the overstory, especially in the "gap" areas would improve hummingbird habitat for the next ten to twenty years.

Band-tailed Pigeon

The density management project would occur in stands that are suitable for band-tailed pigeon nesting and would occur simultaneous with the nesting season due to other seasonal constraints. Individual nesting pigeons could be negatively impacted by possibly being forced to abandon nests or attempts within stands under harvest operations (which could result in the "take" of nestlings). However, the thinning of these dense stands would promote the development of the shrub layer and, especially in the "gap" areas, result in better foraging opportunities for pigeons. Without specific population numbers for the Moon Creek area it would be impossible to evaluate if there are any limiting habitat factors, but based on the number of undisturbed suitable nesting habitat acres in the area (>35,000 acres in the five mile radius circle based on GIS analysis)it is almost certain that nesting habitat would not be limiting. The expected shrub development would result in a boost in foraging habitat for as much as the next 10-20 years so overall, the Moon Creek project would probably have a very minor positive impact for the band-tailed pigeon over time.

Cumulative Effects

Generally speaking the Migratory Bird Treaty Act listed Species of Conservation Concern listed above would not experience any cumulative effects in the next several decades. Beyond the next two to three decades, a very small cumulative effect could occur for species that desire older forest structure such as the northern goshawk and perhaps the olive-sided flycatcher. None of the effects, if realized would change the level of population viability for any of these species.

2.3.4.3 Environmental Effects - Alternative 2: No Action

General for All Species Analyzed

Under the "No Action" alternative none of the activities described for the Proposed Action alternative would occur at this time. The current habitat condition for Migratory Bird Treaty Act listed Species of Concern would be unaffected now and in the near future. Neither the negative nor the beneficial effects to habitat for migratory birds would be realized. The young stands would continue to grow at a declining rate and become less stable over time. Eventually disturbances such as windthrow or insect attack (or possibly fire) would influence the character of the stands and introduce more structural diversity into the ecosystem thus affecting the suite of animals that would use these stands. The attainment of a more structurally complex stand may take longer under the No Action alternative and would eventually result in an old forest system with more smaller trees with more coarse wood (although of smaller piece size) than would occur with the Proposed Action alternative. It is not clear if in the long term whether the overall animal species composition and abundance of MBTA Species of Concern resulting from the No Action alternative would be appreciably different from what would result from the Proposed Action alternative.

Cumulative Effects

Generally speaking the Migratory Bird Treaty Act listed Species of Concern listed above would not experience any cumulative effects in the next several decades as a result of selecting the No Action alternative. Beyond the next two to three decades, a very small cumulative effect could occur for species that desire older forest structure such as the northern goshawk or possibly the olive-sided flycatcher. None of the effects (or non-effects), if realized would change the level of population viability for any of the Special Status Species.

2.3.5 Soil Resources

The main soil resource concern and focus of this analysis is the effect the proposed action may have on long-term tree growth (i.e., long-term soil productivity) and slope instability (mass wasting). The analysis area used for direct, indirect, and cumulative effects is the project activity area. The project activity area includes timber

harvest units and roads used to access harvest units. This activity area is chosen because the changes in soil productivity being analyzed are "on-site" and do not have measurable off-site impacts. The analysis area used for direct and indirect effects to slope stability is the activity area and the Moon Creek subwatershed. These areas are chosen because mass wasting can affect areas beyond the activity area.

Potential for off-site soil effects to water runoff and water quality (e.g. sediment delivery) are analyzed in the Water Resources section. Information used to describe the setting and to characterize the soils in the project were largely acquired from BLM GIS data, aerial photos, Soil Survey of Tillamook County, Oregon (NRCS), and field evaluations by the Tillamook Resource Area Soil Scientist.

2.3.5.1 Affected Environment

Physical and Geographical Setting

The Density Management project area can be broadly classified into three landtypes based on similarities in topography, geology, and soil; Volcanic Uplands, Mid-Slope Bench, and Alluvial Terrace.

The Volcanic Highlands occurs mostly in the northern portion of the subwatershed, occupying approximately 45% of the subwatershed and 44% of the proposed timber harvest units. The landtype consists of steep, dissected hillslopes and narrow ridges. The dominant soil series are Klistan, Harslow, and Hemcross on lower elevations (under 1,800 feet) and Caterl, Laderly, and Murtip on elevations over 1,800 feet. They are moderately to very deep, moderate textured, mostly very gravelly or very cobbly, and of low cohesiveness. They formed in colluvium weathered from volcanic rocks. The dominant natural erosional process is shallow landsliding (e.g., debris slides, debris flows, and debris torrents). A combination of steep slopes, weak and fractured rock, low cohesive soils, and high rainfall and intensity make this area highly susceptible to landslide activity.

The Mid-Slope Bench occurs mostly in the southern portion of the subwatershed, occupying approximately 53% of the subwatershed and 56% of the proposed timber harvest units. The landtype consists of moderate sloping structural benches, with nearly level summits, rounded ridges, punctuated by short (usually less than 200 feet) steep slopes or escarpments produced by erosion or faulting. Ancient (Holocene and Pleistocene) landslides and earthquakes probably shaped most of this area. The dominant soil series is Ginsberg, commonly found on benches. It is very deep, fine textured, cohesive, well-drained soil that formed in residuum and colluvium from tuffaceous sedimentary rock. The subdominant soil series is Klistan, often found on escarpments. It is deep and very deep, well-drained, moderate textured, very gravelly, low cohesive soil that formed in colluvium and residuum from volcanic materials. Small wetlands are scattered throughout the landtype including several acre size wetlands in-between harvest units 13-1, 13-2, 13-3, and 14-2. There are also few small (<1/2 acre) isolated wetlands within harvest units including 13-3 and 24-1. Deep-seated rotational slides, slumps, and soil creep are the dominant erosional process in this landform. Road crossing landslide activity is relatively uncommon on this landtype.

The Alluvial Terrace occurs primarily along the middle and lower Moon Creek and upper East Creek. The land type consists of nearly level to gently sloping floodplains, stream terraces and alluvial fans. It comprises approximately 3% of the subwatershed. None of the proposed activity area would occur within this land type. The nearest alluvial terrace to the proposed activity area is located downslope of harvest units in Section 14 and 15. The surface consists of level to gently sloping platform underlain by unconsolidated clay, silt, sand, and gravel. The dominant soil series are Condorbridge and Siletz. They are very deep, moderate textured (medial or loamy) and well drained. Small inclusions of poorly drained soils are present. Some of it is subject to periodic flooding and has high water tables. The dominant erosional process is stream bank erosion and slumping. Most of this landform is or formerly was used for pasture.

Past Actions and Natural Disturbances

Current soil conditions reflect past forest management activities, large fires and storm events. Most of Moon Creek subwatershed burned in the Nestucca fire in 1876. Most of the subwatershed was roaded and clearcut logged in the 1950s to mid 1980s. Early roads to access timber were built to low engineering standards (e.g., sidecasting with little or no end hauling, inadequate fill compaction, insufficient number of road drainages, and

undersizing of drainage structures). Clearcut logging occurred on steep landslide prone areas. Because of these practices, erosion and mass wasting processes greatly accelerated.

A landslide inventory conducted in 1988-89 on the Moon Creek Block (including an additional 4,891 acres in Wolfe Creek and Bays Creek drainages) identified 170 active debris slides and flows, 85% of them caused by road and timber harvest (Nestucca WA, 1994). Debris slides were typically less than ¼ acre.

Some of the soils within the proposed harvest area were heavily disturbed by past timber harvest and site preparation activities. Prior to 1975, logs were high lead yarded both down and uphill without suspension and often resulted in severe soil displacement. "Loggers' choice" tractor yarding occurred on moderately steep slopes, often cutting skid trails into the slope, resulting in widespread soil disturbance (30 to 60% of the area). Based upon a review of aerial photos and field observations, primary skid roads and landings occupy about 2 to 10% of the proposed ground-based harvest units. Brush, scattered alder and small conifers cover most of these surfaces.

Soil Productivity

Collectively, soils in the analysis area are classified as Andisols. Andisols contain significant amounts of weathered material in their upper horizons from volcanic glass. These Andisols, as most do, have favorable physical and biological properties, are very productive, and recover quickly. They have low bulk density, high organic content, high infiltration rates, and high water-holding capacities (Meurisse, 1999, Kimble, et al., 2000). Soil moisture for project soils is generally not limiting. Plant competition and lack of light can be moderate to severe. The site index ranges from 109 to 125 on Douglas fir, 50-year basis (NRCS). Excluding roads, primary skid roads and landings, the current soil productivity in the proposed harvest units appears to be near its potential.

Roads occupy about 2% (96.6 miles) of the Moon Creek subwatershed and about 1% (6.4 miles) of the BLM land within the subwatershed. About half is surfaced with gravel and the other half is natural surfaced.

Mass Wasting

Shallow rapid-moving landslides dominate mass wasting in the analysis area. They are generally initiated by infrequent, high-intensity or prolonged rainfall events during the late fall and winter months. These landslides typically occur in predictable settings, most frequently in areas on slopes of greater than 70 percent and areas where the surface topography converges such as swales and drainage headwalls. An Oregon Department of Forestry study of the effects of the 1995-96 storms, reported that 84% of the upland non-road associated landslides occurred on slopes over 70%.

To provide a preliminary indication of lands potentially prone to shallow rapidly moving landslides, a GIS slope stability analysis using a 10-meter DEM (Digital Elevation Model) was performed on the Moon Creek subwatershed. Areas with slopes greater than 65% were assumed to be at risk for landsliding. Results are presented below in Table 10.

Table 8. Acres within the Moon Creek subwatershed with slopes greater than 65%.

Land Ownership	Slopes >65% (Acres)
BLM	1,642
US Forest Service	219
Private Industrial	193
State	411
Unknown	65
Total	2,530

Field observations and a review of past and recent aerial photos confirm that the vast majority of landslides were associated with roads (fill and cut slope failures) and clearcut logging on steep (>65 percent) concave slopes.

Most of the historic timber harvest associated landslides observed in the area were small (<1/3 acre) and nearly all occurred on headwalls, inner gorges, or slopes over 100 percent after clear-cut harvest.

2.3.5.2 Environmental Effects – Alternative 1: Proposed Action

Soil Productivity

Soil disturbances from forest management activities can alter soil properties and reduce soil productivity. Soil disturbance can be detrimental, neutral, or beneficial. The probability of adverse effects to soil productivity is the greatest where high soil disturbance occurs on sites with low inherent soil productivity and where climate conditions are stressful (*Beschta, 1995*). Surface displacement and compaction are the main concerns for these soils. Management activities from this project that have the highest potential to adversely affect soil properties and subsequent soil productivity are timber harvest, road construction and maintenance, and burnings.

Best Management Practices and Project Design Features (Section 2.2.2.2) would minimize soil disturbance. Examples include the following: Minimizing the number of skid trails,trails, landings, and other high-disturbance areas and the reusing of such areas when possible and appropriate. Restricting equipment use to periods of low soil moisture when soils are strong and less prone to compaction and gouging. Equipment use would be avoided in sensitive areas including steep slopes. New skid trails would be limited to slopes of 35 percent or less.

Timber Harvest

Ground-based Yarding

Ground-based yarding approximately 161 acres would be expected to result in severe soil compaction and topsoil displacement on skid trails and landings on less than 16.1 acres or <10% of each harvest unit – (Salem RMP standards and guidelines, p. C-1-2).

The ground-based units would be logged by traditional crawler/skidder system, by a mechanical harvest system, or by some combination of both systems. If a traditional crawler/skidder system were used, soil disturbance would be concentrated in landings and primary skid trails, averaging 12 feet wide spaced 150 feet apart. If a mechanical harvest system is used, soil disturbance would generally be lighter and deeper disturbance more spread out. The amount of severe soil disturbance (severe compaction/topsoil removal/mixing with subsoil) would decrease to approximately 10 to 13 acres (6% to 8% of 161 acres).

Skyline Yarding

Skyline yarding the harvest units would result in approximately 5 to 10 acres of soil disturbance (2% to 4% of 252 acres). Yarding with at least one end suspension would result in light compaction and minor gouging in narrow (<4 feet wide) yarding corridors. Heavy compaction and topsoil displacement would occur in landings. About half of the landings would be located on roads.

Timber Harvest Effects to Soil Productivity

Recent studies in northern California and the Pacific Northwest indicate that effects of logging (i.e. soil disturbance) on subsequent tree growth are variable and are dependent on site-specific soil properties and climate. In a northern California study in an area with relatively dry climate, compaction of a coarse textured soil resulted in improved young tree growth; compaction of a moderate textured soil had no effect on subsequent tree growth; and, compaction of a fine textured soil decreased growth (Gomez et al, 2002). In a ten year study in the Oregon Cascades with relatively harsh climate, researchers reported annual seedling growth height reductions (-10%) for 10 years after planting on severely disturbed soil (*Heninger et al, 2002*). In contrast, in a study (Miller et al, 1996) at three coastal Washington sites with moderate climate and productive soils, severe soil disturbance did not appear to slow growth rates of Douglas–fir seedlings. Most recently, investigators (*Heninger et al, 2007*) measured the growth of 20 to 60 year-old Douglas-fir stands seven and 11 years after commercial thinning at

three locations in the Oregon Coast Range. They found that ground-based yarding on dry, moderately fine textured soils did not reduce, and probably slightly increased tree growth of trailside residual trees.

Given that BMPs and Project Design Features (PDFs) would minimize soil disturbance, substantial proportion of the organic matter would be retained, affected soils having favorable physical and biological properties, and the mild climate, soil disturbances from the proposed thinning is not likely to retard future tree growth. The thinning would probably slightly increase tree diameter growth and crown development due to reduced competition for site resources by the retained trees. The highest probability of soil productivity loss is in areas where more than 5 or 6 inches of topsoil is completely removed (e.g., landings, along roadsides, and heavily traveled skid trails). These areas would probably total less than 8 acres (<2% of the harvest units).

Road Construction and Maintenance

Constructing approximately 0.5 mile of new roads would displace surface soils and organic material, and compact subsoil on approximately 1.2 acres (less than 0.3 percent of the total harvest acreage). Road renovation activities such as blading, ditching, and drainage structure improvement or replacement would result in approximately 1.2 to 2.4 acres of soil disturbance (20% to 40% of 2.5 miles of road). The road construction, renovation, and decommissioning work would result in some minor short-term roadside (1 to 2 years) erosion. Measures such as closing or blocking roads after use, seeding with native vegetation, installing water bars, and blocking vehicle access would decrease surface erosion and runoff.

After timber harvest and site preparation work is completed, approximately 2.5 miles of roads (all newly constructed roads and most of the renovated roads) would be fully decommissioned. Decommissioning would include subsoiling, re-establishing natural drainage patterns, out-sloping, waterbarring, seeding and/or planting, blocking access to all motorized vehicles, and/or scattering woody debris on the road surface. This action would improve soil conditions for growing forest vegetation by increasing soil porosity and reducing bulk density, improving soil drainage by increasing water infiltration, decreasing water runoff and surface erosion, and by reducing potential slope and drainage failures.

New road clearings would be narrow and similar to the spacing in treated harvested units. Some of the trees along the edge of the road prisms may grow quicker from the lack of competition and, in fill portions of the road, better rooting environment. All of these roads would be closed and fully decommissioned. Consequently, the road clearings would have a small effect on soil productivity.

Burning

No mechanical fuel treatments are proposed. To reduce the potential risk of wildfires and improve conditions for underplanting of trees, small areas of excessive fuel loadings would be burned. Little soil damage (soil sterilization and reduced water infiltration) would be expected because the amount of area would be miniscule compared to the amount treated, most of the area would be already disturbed, and burning would take place during wet soil conditions when soil damage (soil sterilization and reduced water infiltration) would be less likely.

Mass Wasting

Forest management actions can contribute to slope instability and result in increased landsliding. Usually the most important impact of mass wasting is sediment delivery to streams. Potential effects of sediment delivery to streams are discussed in the Water Resources section. Mass wasting can also affect soil productivity in the areas directly involved with the failure.

This analysis focuses on the effect of the proposed harvest on slope stability. The effect of the proposed road actions on slope stability is minimal because they would occur on stable terrain (ridge tops, benches, and gentle-to-moderate sideslopes). Water runoff from roads and landings would be directed away from unstable slopes.

Prior to this analysis, all sites judged to be at high risk to landsliding were identified and removed from the proposed project. High-risk sites were identified by using GIS generated maps (e.g., geology, soils, topographic, slope steepness, and BLM's fragile site inventory {TPCC}), aerial photographs, and field observations. Examples of areas removed are 1) those showing active movement (slopes with tension cracks, unvegetated soil scarps, or jackstrawed trees caused by slope movement, 2) inner gorges of more than 70 percent slopes, bedrock hollows of more than 70 percent slopes, and 3) headwalls near streams of greater than or convergent headwalls of more than 70 percent slopes.

Under the proposed action, approximately 420 acres would be variable-density thinned. Approximately half of the trees, mostly smaller than 20 inches dbh would be removed within the harvest units. Essentially all of the understory vegetation would be retained. Approximately 60 acres have slopes 70% to 80% and approximately 7 acres have 80 to 90% slopes. Most of these areas are less than 200 feet long and under ½ acre. A majority of this area is within unit 3-1.

Thinning is generally less likely to initiate shallow landsliding than clear-cutting. Thinnings retain trees and most of the understory vegetation and substantial live root mass. Many field and experimental studies have confirmed the importance of retaining trees and root mass on shallow forest soils for slope stability (Roering, 2001, Schmidt, 2000, Krogstad, 1995; Sidle, 1992, Ziemer, R.R., 1981, Burroughs, 1977.) Based upon a theoretical model, Sidle (1992) found that a 75% thinning reduced the maximum probability of failure by more than 500% compared with clearcut simulation. In an intensive post 1996 storm landslide survey conducted in eight study areas across western Oregon, the Oregon Department of Forestry reported relatively few landslides occurred in partially cut areas (Robison et al, 1999). The ODF study also found that fewest landslides and smallest erosion volumes occurred in intermediate age stands, 31 to 100 years.

In conclusion, the proposed density management thinning would slightly increase the risk of harvest-related landslides, primarily on 67 acres where slopes are 70 to 90 percent. The increased risk, while difficult to quantify, would be small and would fall between the low risk of no timber harvest and the moderate risk of clear-cut harvest. Most of the increased risk due to harvest would disappear after 10 to 15 years after most of the root systems and canopies have recovered. Any landslides that might result from the thinning would likely be few in number and be less than 0.2 acre.

Cumulative Effects

Soil Productivity

All disturbance effects on soil productivity from project action would be localized and not extend beyond the project area. Project actions (i.e., timber harvest, road work, fuel treatments) would add a small amount of new disturbance and re-disturb some of the soils that are currently recovering from past disturbances. Most of the harvest units in this action are likely be re-entered at least once during the next 40 years. Most of the routes used by heavy equipment would probably be reused. However, any incremental cumulative effect to soil productivity from these actions would likely be minimal due to favorable growing conditions and soil properties.

Mass Wasting

The frequency of occurrence of landsliding, based upon a review of aerial photos, has declined considerably in the subwatershed during the past 25 to 30 years. The decrease corresponds with improved forest and road management practices and reduced clear-cut logging. There are no other timber sales planned on BLM lands in the subwatershed. Most of the steep lands prone to landsliding within the subwatershed occur on federal land. As a result, cumulative effect to mass wasting at subwatershed scale would be minimal and would not exceed those analyzed in the 1994 Salem District PRMP/EIS.

2.3.5.3 Environmental Effects - Alternative 2: No Action

There would be no change to existing soil conditions. No new soil disturbance would occur and no thinning would take place on steep slopes, which would slightly increase the risk of landsliding. Current conditions and trends as described in the Affected Environment would continue. Existing disturbed soils would continue to recover until there is another major disturbance such as wildfires or windstorms. Landslides would continue to occur infrequently in managed and unmanaged timber stands.

Cumulative Effects

Because the no action alternative would not alter current soil condition or trends, when combined with other past, present, and reasonably foreseeable actions, there would be no incremental cumulative effect to soil resources.

2.3.6 Water Resources

The main water resources concern and focus of this analysis is how the proposed action would affect streamflow, physical integrity, water temperature, and sedimentation and turbidity. Other water quality parameters (e.g., nutrients, dissolved oxygen, pesticide levels, etc.) will not be affected by the proposed action. Consequently, they were not analyzed.

The analysis area for direct and indirect effects is the stream reach directly in or adjacent to areas where proposed project activities would occur. The analysis area used for cumulative effects is the Moon Creek subwatershed. The risk of mass movement is analyzed in the Soil Resource section. Project effects on large woody debris (LWD) are analyzed in the Threatened or Endangered Fish Species or Habitat section.

2.3.6.1 Affected Environment

The project area lays approximately 16 miles inland from the Pacific Ocean in the Oregon Coast Range physiographic province. The project area is entirely within the Nestucca River watershed (HUC # 1710020302), a designated Tier 1 Key Watershed. Key Watersheds are areas containing high quality habitat for at-risk aquatic species, and are believed to have high potential for restoration. The bulk of the project is within the Moon Creek sixth field subwatershed (HUC # 171002030205). Approximately 22 acres of unit 24-1 has a potential hydrologic connection to Clarence Creek (within the Niagara Creek sixth field watershed (HUC # 171002030204)) and approximately 5 acres of unit 13-1 are in Bear Creek (within the Testament Creek subwatershed (HUC # 171002030203)). The harvest area in Clarence Creek would be skyline yarded. The harvest area in Bear Creek is a gentle sloping ridgetop that would be ground-based yarded. Because only a small area in these subwatersheds would be harvested and there are no streams or roads in the vicinity, there would be minimal alteration to existing hydrologic conditions. Therefore, the focus of the analysis is the Moon Creek subwatershed.

The Moon Creek subwatershed contains approximately 12,471 acres. It is nearly completely forested. Elevations in the subwatershed range from 240 feet to 2,980 feet. The maritime climate of the subwatershed is characterized by mild, wet winters, and warm, dry summers. The subwatershed faces southwest and is subject to periodic high storm winds (>50 mph). Some scattered windthrow is present within the project area. Annual precipitation averages about 100 to 150 inches, most of it falling as rain in October through April. A small portion of the subwatershed (approximately 7.7%) is located within the transient snow zone (areas above 2,000 feet elevation), making it less prone to flood events that often occur as a result of rain on snow events.

Land Use

The federal government manages nearly 80% of the land within the subwatershed (BLM-63% and US Forest Service- 17%). Located about a half mile to the west of the project area is the High Peak/Moon Creek Research Natural Area (RNA). No encroachments or activities, such as logging, that could change ecological processes or conditions are allowed within the RNA. The remainder of the subwatershed is nearly equally divided by industrial timber companies and lands managed by ODF. Most industrial timberlands are managed for 40 to 60 year rotations that culminate in clearcut harvest.

Past Actions and Natural Disturbances

Current watershed conditions reflect past forest management activities, large fires, and storm events. Most of the Moon Creek subwatershed burned in the Nestucca fire in 1876 and was heavily clearcut logged in the late 1950s to early 1990s. Many roads were built on steep mountainous terrain. These actions in a landslide prone watershed resulted in numerous debris slides and flows (See soil resources section). Fill failures at road-stream crossings often resulted in debris flows or debris torrents scouring channels to bedrock and loading draws and headwater streams with wood (including logs left from previous logging) and sediment. Sediment delivered into headwater streams channels was transported downstream onto floodplains and terraces. Logging removed riparian trees that provided critical large wood input to stream channels. Stream cleaning activities often accompanied timber harvest in the 1960s and 1970s. Removal of wood from streams reduced channel complexity. Between 1985 and 1995, BLM constructed and/or installed in-stream LWD and boulders structures and off-channel alcoves and planted riparian vegetation on approximately 1.5 miles of East Creek in Sections 14 and 15.

During the past 15 years there has been little logging and road building on federal lands within the subwatershed. Road-building techniques and forest management practices have improved substantially. DEQ has noted significant water quality improvement in the last decade (DEQ, 2004).

Logging has resulted in a subwatershed where the majority of land within the subwatershed is in mid-seral stage forest. Based upon a review of 1988 and 2005 aerial photo interpretation, about 14% of the subwatershed is in pioneer or very early-seral stage.

Much of the historic coarse material (boulders, cobbles, gravel, and large wood) contribution to area streams has emanated from the relatively large amount of steep, shallow landslide prone areas found within this subwatershed. These areas are the major contributor of background sediment delivery into the streams.

There are a total of approximately 97 miles of roads within the Moon Creek subwatershed. Approximately 23 of these miles are BLM controlled. The road density of the subwatershed is approximately 5.0 mi/sq mi., near the average for watersheds within the Resource Area. These figures are based upon BLM GIS data.

Streams

The majority (approximately 80%) of the streams adjacent to proposed timber units are small (1st and 2nd order), non-fish bearing headwaters. They are primarily origin and transport reaches. Typically, they have average annual flows less than one cubic foot per second and bankfull widths of less than 5 feet. Channels are typically steep and strongly to moderately confined by hillslopes. Channel types are mostly cascade and step-pool. Cobbles and boulders dominate channel substrates.

Two fifth-order tributaries, Moon Creek and East Creek, drain the subwatershed and flow into the Nestucca River. The upper reaches of East Creek (near Units 11-1, 11-2, 11-3) are mainly steep, and moderately to strongly confined by mountain hill-slopes. The dominant channel types are rapids and cascades. Gravels, cobbles, boulders, and basalt bedrock dominate substrates. Further downstream (near Unit 14-1), the grade decreases (1 to 3%) and becomes weakly confined by stream terraces and hillslopes. These reaches are primarily depositional. Channel types are dominated by riffles and substrates are dominated by sand and gravel. Large wood is low in most streams throughout the subwatershed due to past fires, logging, and stream cleaning. Approximately 0.6 miles of East Creek (3rd to 5th order) are within 200 feet of proposed harvest units.

Beneficial Uses

As a designated management agency, BLM is responsible for implementing the federal Clean Water Act on public lands. BLM management actions/directions are to comply with state water quality requirements to restore and maintain water quality to protect the recognized beneficial uses in District watersheds (Salem ROD/RMP, 1995).

The major beneficial uses of water in the Nestucca River watershed include domestic and municipal consumption, cold-water fisheries (including anadromous fish), recreation, irrigation, livestock watering and wildlife. There are no known municipal or domestic water uses within ten miles downstream of the project area. There is some irrigation and watering use several miles downstream from the project area.

The most sensitive beneficial uses of water in the vicinity of the project area are for anadromous and resident fish and aquatic life, and salmonid spawning and rearing habitat. Important habitat conditions for salmonid populations include cool, clean water, appropriate water quantity and depth, flow velocities, clean gravel, LWD, food, varied channel forms and upland and riparian (stream bank) vegetation (NOAA, 2006).

Water Quality

Oregon Department of Environmental Quality Standards

The Oregon Department of Environmental Quality (DEQ) is responsible for developing water quality standards and determining where there is impairment. In 1998, DEQ identified several streams with impairment within the Nestucca River watershed and placed them on the 303(d) list of waters that do not meet established water quality standards. DEQ subsequently developed Total Maximum Daily Loads (TMDLs) for bacteria, sediment, and temperature from this list to address these water quality problems (DEQ, 2002). TMDLs describe the amount of each pollutant that a waterbody can receive and not violate water quality standards. More recently, the DEQ placed the Nestucca River (River Mile 0-40.9) on the 2004/2006 303d list for dissolved oxygen problems.

Beginning in 2004, BLM conducted a three-year water quality and physical habitat assessment of the BLM administered stream network within the Nestucca River watershed (Mico, 2007). The purpose of the study was to assess the physical condition of the Nestucca stream network and to validate the 303(d) listing for sediment impairment. Methods to characterize conditions included an adaptation of the Environmental Monitoring and Assessment Program (EMAP) protocol and the OWEB Oregon Water Quality Monitoring Guidebook for temperature. The results of the study indicate the following: 1) The Nestucca River stream network is not impaired by fine sediments. 2) Effective shade level is slightly below modeled system potential effective shade. 3) The amount of large woody debris, pool frequency, and bankfull width to depth ratios are within the normal ranges of the reference data.

In the future, BLM will be developing a Water Quality Restoration Plan (WQRP) for impaired waters on BLM lands in the basin to address water temperature impairment. The BLM will not be developing a WQRP for bacteria because its presence is not associated with timber management activities.

Project Area Water Quality

With the implementation of the Northwest Forest Plan (NWFP) and resultant reduction in logging and related forest management activities (i.e., clearcutting, burning, road building) on federal lands (nearly 80% of the subwatershed), water quality conditions are recovering within the subwatershed. Road-building techniques and forest management practices have generally improved with the implementation the State Forest Practices Act and new rules under the NWFP. Few recent landslides have been observed in the upper watershed. Stream temperature data in the project area is lacking. Field observations and a review of aerial photos indicate that most streams adjacent to project activities are adequately shaded by streamside vegetation to maintain cool summer temperatures. Shade levels based upon ocular estimates by ODFW indicate that shade levels on mainstem East Creek and Moon Creek appear to be slightly below full potential (ODFW, 2007).

The results from recent stream survey data on sediment conditions within Moon Creek subwatershed are largely inconclusive. According to Oregon Department of Fish and Wildlife (ODFW) 2007 aquatic habitat survey on the upper half of East Creek, organic matter/silt/sand sediment in riffles averaged 23%, slightly above the TMDL target of < 20% instream streambed fines (ODFW, 2007). This data is based upon visual estimates over a large area. A more scientifically rigorous and defensible method to assess and monitor impairment by fine sediment method was employed in the Nestucca Water Quality and Physical Habitat Assessment (Mico, 2007). Four randomly selected sites in the Nestucca study were in the Moon Creek subwatershed. Three of the four sites

collected in the Moon Creek subwatershed showed no sediment impairment. Sediment impairment on the one site was slight. Additional sampling would be needed to determine conclusively whether streams within the Moon Creek subwatershed are or are not impaired by sediment.

To help give a context for understanding the potential sediment effects of the proposed action and to provide a basis for assessing the severity of potential effects, a coarse estimate of annual sediment yield for the Moon Creek subwatershed was extrapolated from data reported in scientific literature. Total sediment yields from all sources for small forested watersheds in the Pacific Northwest range from 13 to 12,400 tons/sq mi/yr with a mean of 1,100 tons/sq mi/yr (Patric, 1984). The average annual sediment in southwest Oregon and northern California was estimated to vary from 5,000 to 8,000 tons/sq mi/yr (Reiter and Beschta 1995). Sediment production in this subwatershed is assumed higher than the reported mean of the forested watersheds in the Pacific Northwest and less than the sheared geology in southwest Oregon and northern California. Assuming 3,000 tons/sq mi/yr for current conditions and 163 tons/sq mi/yr for background conditions, the Moon Creek subwatershed (19.5 sq miles) has an average total sediment yield of about 58,500 tons/year.

2.3.6.2 Environmental Effects – Alternative 1: Proposed Action

Streamflows

Annual Water Yields and Base Flows

The proposed action is unlikely to measurably change annual water yields and base flow. Harvest treated areas would retain about 50% of the forest canopy. After thinning, the remaining vegetation would quickly use the newly available soil moisture.

Peak Flows

The risk of this proposal to result in enhanced peak flows in individual streams or at the subwatershed scale is low for the following reasons: 1) It is located in a rain-dominated watershed. Rain-dominated watersheds are generally less susceptible to peak flow increases. 2) The proposed timber sale is located within an area with relatively little harvested area. A recent literature review found that effects on peak flows are not detectible in rain-dominated watersheds until at least 40% in the area is harvested (Grant et al., 2007). This would not change. Approximately 14%, of the affected subwatershed is currently in clearcut or early-seral state. 3) The proposed treatment is a thinning that would retain about 50% of the forest canopy. After thinning, the remaining vegetation would quickly use the newly available soil moisture. There is little evidence to support that partial harvest contributes to peak flow effects in rain-dominated watersheds (Ziemer, 1981). The Oregon State Assessment (OWEB, 1999) does not consider forest with canopy closure less than 30% to be a substantial factor in Rain-On-Snow events. 4) Roads occupy a small proportion of the area, about 2% of the Moon Creek subwatershed. The Oregon State Assessment (OWEB, 1999) consider roads occupying less 5% to have low potential risk in enhancing peak flows. 5) Most of the roads that would be utilized under this proposal already exist. Most new temporary roads would be built on ridgetops or benches without direct stream drainage network connections. Upon project completion, all of the new temporary roads, and approximately 80% of the renovated roads (those that are natural surfaced) would be decommissioned and an additional 1.7 miles of existing natural surfaced roads would be blocked to motorized vehicle traffic.

Physical Integrity

Stream channel integrity is primarily affected by road stream crossings and by the condition of the adjacent forest, which provides gravel, boulders, and large wood inputs that are important in maintaining stream complexity. Stream banks, stream channels, and wetlands would be protected from timber felling and yarding activities. All ground-based yarding equipment would be kept at least 60 feet from stream channels. When yarding over streams or wetlands, logs would be fully suspended over stream banks and channels. Large woody debris recruitment, which could potentially influence future stream complexity, is not expected to be adversely affected by the proposed action. (See discussion of LWD in the Threatened or Endangered Fish Species or Habitat section.)

The proposed action would reinstall approximately 13 culverts, which were removed earlier. Approximately five of the reinstalled culverts and one old existing small culvert would be removed, at the latest, by the end of the timber sale and the crossing on upper East Creek would be removed before the fall rainy season of the same year it was installed. Seven of the crossing are deep (approximately 7 to 20 feet) and would require additional fill material. All but one stream crossing (upper East Creek) are small 1st and 2nd order headwater streams that will have little or no flow during installation. All of the installed culverts would be small (<36 inch diameter) but would still accommodate 100 year flood events. The culverts would be designed to minimize erosion, and reduce the risk of future road failure.

In the process of reinstalling and removing culverts, material within the road prism (up to about 30 feet in width) and the channel surface, banks and bed would be mixed, compacted and displaced. Stream channels at these crossings appear to be stable. Due to the stable nature and small size of channels at these locations, effects are expected to be short-term (1 to 3 years) and there should be little to no additional alterations to channel morphologies either upstream or downstream from the crossings.

Water Quality

Sedimentation and Turbidity

The primary means by which the proposed action could contribute sediment and turbidity to local streams are timber yarding, road construction and maintenance, and timber hauling. Skyline yarding corridors and ground-based skid trails, if sufficiently compacted or gouged, could potentially route surface water and sediment into local streams.

- Timber Harvest

A recent Washington State study (Rashin et al, 2006) evaluated the timber harvest best management practices during the first two years after timber harvest. They found that a 10-meter (approximately 33 feet) wide, "no ground disturbance" buffer along streams prevents about 95 percent of harvest related sediment delivery to streams. The proposed action design uses no-harvest buffers nearly double to three times that width. All yarding (both ground-based and cable) would occur in the dry season and few skyline corridors would cross streams. With the implementation of BMPs and PDFs that would minimize compaction and soil displacement, residual slash left behind on yarding corridors, and high surface roughness in riparian areas, measurable sediment delivery would be unlikely.

The proposed density management thinning would increase the risk of landsliding from "low" to "low to moderate" within the next 10 to 15 years if a damaging storm was to occur. Based upon photo interpretation and field observations, any landslides that might result from the thinning would likely be few in number and be less than 0.2 acre. (See Mass Wasting analysis under Soil Environmental Effects.) The nearest streams to these higher risk sites (70 to 90% slopes) are small, low order, non-fish bearing streams. The small channels typically have adequate supplies of in-stream wood. Large wood in channels provide a physical obstruction to sediment transport. The proposed action includes thinning uplands and riparian reserves with a minimum of 60-feet no-harvest buffers.

If a landslide were to occur, the most likely result would be a localized short-term increase in sediment and small and large wood. Increased levels of fine sediment in the streambed would not likely be measurable more than a few hundred feet downstream from the landslide delivery point because these small streams have low capability for carrying sediment due to their small in size and have high roughness in their streambeds. Over the long-term, the relative landslide occurrence in the project area would decline because the amount of larger and older trees would increase. Landslide occurrence would be substantially similar to the amount that would occur under the no action alternative.

- Timber Hauling

Timber hauling on approximately 40 miles of gravel-surface road will include approximately 106 stream crossings. The majority of the stream crossings occur on intermittent headwater channels (1st and 2nd order) that are likely to have minimal or no flow during periods of hauling.

Dry season hauling, suspension of operations during periods of heavy precipitation when there is a potential risk to road damage or water quality, road improvements before hauling (*e.g.*, rocking and placing bark bags or other material in the ditch to filter sediment out of the water), and other design features would reduce the potential for sediment generation and transport. Most of the fine material created by hauling activities and transported into stream channels would remain stored for long periods due to the low sediment transport capacity of small headwater streams.

- Road Construction and Maintenance

New road construction activities are not likely to contribute sediment to local stream channels because it will be limited to ridge tops and gently sloping benches that will be hydrologically disconnected from stream channels. The risk of road related landslides in these locations is minimal.

Soil disturbance from reinstallation of approximately 13 culverts and subsequent removal of approximately seven, would cause a short-term (<2 years) increase in turbidity and sediment delivery to adjacent intermittent and perennial streams. Through project design features that include location and timing of use and other best management practices, sediment would be reduced to the maximum extent practicable. All road work would occur during the dry season when water runoff is less likely and there is little or no water flowing in channels. Turbidity in flowing streams would be visually monitored during construction and be maintained so that it would not exceed DEQ water quality standards.

Most affected streams are small flowing streams located high in the subwatershed. The drainage areas above these crossings range from 3 to 53 acres. For these streams, visible turbidity may increase slightly after drainage work and subsequent first or second winter but visible turbidity would not extend more than a few hundred feet from work sites. Essentially all of the sediment produced by project actions would remain near the work site until it is moved a short distance downstream during the first runoff events. Because of the limited sediment transport capacities of these headwater channels, most of the sediment would be stored in banks and channels for long periods of time (Montgomery and Buffington, 1997). Periodically, when flows are very high or the channel storage capacities are exceeded, the sediment would be as suspended sediment and transported downstream into lower gradient stream channels.

The largest stream crossing is located on upper East Creek. This crossing is over a 4th order, medium size perennial stream. The culvert(s) would be installed and removed during the same summer dry season. Increased visible turbidity during project work and subsequent winter or two would extend less than one-half mile downstream of the crossings. Most of the sediment produced would be temporarily stored in riffles and pools a short distance (<150 feet) downstream. During subsequent fall and winter flows, most of it would be re-mobilized and routed through steeper gradient channels (generally >3%) and deposited downstream in lower gradient channels (generally <3%).

We estimate that about one-quarter to two cubic yards of sediment would be delivered to the stream channel for each reinstallation or removal event depending on the site, producing a total of up to about 17 cubic yards or about 26 tons of sediment. This estimate is based upon field observations from previous projects and reviews of other monitoring studies.

Turbidity levels and sedimentation loads caused by project activities would decrease as disturbed roads and soil surfaces become stabilized. The strongest effect would be in the first year following treatment. Within one to three years after project activity, sediment delivery would return to pre-project levels. Over the long- term, road renovation, re-decommissioning previously decommissioned roads used for the density management thinning and fully decommissioning an additional two miles of renovated road, would help reduce the risks to water quality and watershed hydrology by improving road drainage and stability.

Water Temperature

The proposed action is not expected to measurably alter stream temperatures and would comply with the requirements of the temperature TMDL for this basin (DEQ, 2002).

The majority of streams adjacent to proposed harvest units are small and do not flow during most summers and therefore are not at risk for summer heating. Very few skyline yarding corridors would go across streams. No-harvest buffers placed along all streams adjacent to harvest units would be designed to meet stream temperature goals by avoiding harvest in the primary shade zone and by retaining at least 50% canopy closure in the secondary shade zone.

Effects Summary

Detectable effects to subwatershed stream flows, physical integrity, and water quality as a result of the proposed action are unlikely. The proposed action would slightly increase the short-term (<15 years) risk of landsliding from "low" to "low to moderate" range. If a landslide were to occur, the most likely result would be a localized short-term increase in sedimentation and addition of small and large wood into small, low order, non-fish bearing stream. It would likely not be measureable more than few hundred feet downstream. Road construction and maintenance activities (mainly culvert reinstallations and removals) around stream crossings would result in small, localized alterations in channel surface, banks and beds and localized short-term (< 3 years) increase in sediment and turbidity. Most project affected stream channels have sufficient trapping abilities and storage capacities to retain the small amounts of sediment that may be generated. Upon the completion of the proposed project, roads would be left in a condition that is resistant to erosion and sedimentation. These effects are unlikely to be measurable or visible beyond the third year following disturbance or beyond a distance of approximately ½ mile downstream from the disturbance. Given the relatively small amount of sediment generated by the project action and the inherent variability in sediment yield, this is likely not a detectable effect at the subwatershed scale. The project action is unlikely to generate sediment to a level that would adversely affect beneficial uses.

Cumulative Effects

Streamflows

Since no direct or indirect effects on streamflows are expected from the proposed action, no cumulative effects to streamflows are anticipated. Current and forseeable future condition of the subwatershed indicates low risk for augmentation of peak flows due to forest openings.

Physical Integrity

The proposed action is unlikely to contribute to cumulative effect on stream channel integrity in this subwatershed. The only effect on stream channel integrity from the proposed action would be at stream crossing from the reinstallation and removal of culverts. However this effect would be short-term (<3 years) and localized, would not overlap with the effects from other actions in the subwatershed.

Water Quality

Past harvest activities and road building have likely increased sediment yields in the Moon Creek subwatershed relative to an undisturbed condition. Relatively little disturbance has occurred the past 25 years. The BLM has recently thinned about 200 acres in Section 1 in the northeast portion of the subwatershed. No future timber sales on BLM lands are currently planned. Many of the forest stands are at harvestable age. Recent clearcutting on private and state lands is occurring and more clearcutting in the future is likely. This could increase sediment yields. The amount of sediment produced from these lands is not known. These lands comprise a minor portion of the subwatershed (approximately 20%). Most of these lands are on less steep ground and therefore are less prone to shallow landsliding.

Other than possibly sedimention, the proposed action is unlikely to have a measurable effect to water quality. The proposed action would cause short-term, localized increases in sediment and turbidity. However, because of the relatively small magnitude (roughly 0.04% of the average annual sediment yield of the subwatershed); these increases would likely not be detectable at the subwatershed scale. Increased project related sediment would quickly decrease over the next two or three years. Because effects would be largely localized, there should be very little overlap with the effects with other actions inside the subwatershed. Any combined effects from other actions with the effects of this action are unlikely to produce cumulative degradation of water quality or adverse effect to beneficial uses. Absent a large-scale disturbance (e.g., wildfire), water quality conditions should continue to improve.

This quantity represents approximately 0.04% of the average annual sediment yield (approximately 58,500 tons) of this subwatershed.

Over the long-term, the proposed density management treatment would add and enhance elements of structural diversity to portions of the Riparian Reserve, increase the tree diameter growth, and increase the long-term potential LWD delivery to streams within the project area.

2.3.6.3 Environmental Effects - Alternative 2: No Action

There would be no direct effects to water resources from the No Action alternative. No forest management, road building, or decommissioning would occur. Current conditions and trends as described in the Affected Environment section (2.3.5.1) would continue.

Cumulative Effects

There would be no cumulative effects to water resources from the No Action alternative. No forest management, road building, or decommissioning would occur. Current conditions and trends as described in the Affected Environment section (2.3.5.1) would continue.

2.3.7 Threatened or Endangered Fish Species or Habitat

Oregon Coast (OC) coho are listed as "Threatened" under the Endangered Species Act (ESA). The listing is posted in Federal Register notice Vol. 73 No. 28 dated February 11, 2008. The effective date of this listing was May 12, 2008 and also designates Critical Habitat (CH) for the Oregon Coast coho evolutionary significant unit (ESU). OC coho and designated Critical Habitat are present in both Moon and East Creeks.

2.3.7.1 Affected Environment

Landscape Setting

The Moon Creek sixth field watershed contains approximately 12,471 acres and is not typical of the patterns of federal land ownership seen in the Northern Coast Range of Oregon. The Moon Creek sixth field has BLM ownership that is in contiguous blocks unlike the usual checkerboard fashion seen throughout the northwest. Approximately 80% (9,980 acres) of the Moon Creek watershed is managed by the BLM and USFS. This being the case, forest management in these watersheds is significantly guided by federal policy rather than private industrial management practices. This has left the watershed in a trajectory toward a less disturbed condition, with more forested stands progressing toward late seral habitat types.

Existing Habitat Conditions

The above factors combined have contributed to the presence of quality fish habitat throughout the mainstem of East and Moon Creeks. The terrain within the Moon Creek sixth field is very rugged and steep consequently the majority of small 1st and 2nd order tributaries in the watershed do not support fish. Approximately 80% of the streams adjacent to proposed timber units are small (1st and 2nd order), non-fish bearing headwaters. They are

primarily origin and transport reaches. Typically, they have average annual flows less than one cubic foot per second and bankfull widths of less than 5 feet. Channels are typically steep and moderately to strongly confined by hillslopes. Channel types are mostly cascade and step-pool. Cobble and boulder substrates dominate these smaller stream channels.

Fish use and Critical Habitat conditions

Fish use is restricted almost exclusively to the larger mainstem channels of both East and Moon Creeks due to steep stream gradients on most tributaries. Oregon Coast coho are present in both East and Moon Creek main-stems. Distribution and Critical Habitat in Moon Creek goes upstream to about the northern section line of T3S, R8W section 9, and to just downstream of the major bend to the north in the northeast portion of T3S, R8W section 14 on East Creek. (Figure 4) Both of these streams are considered to fall within gradient and flow criteria generally accepted as high quality OC coho habitat.

Habitat data for East Creek is from an ODFW Aquatic Habitat Inventory (AQI) throughout the project area completed in 2007. This survey included four reaches and started just above the large culvert on East creek in the Northwest quarter of T3S, R8W section 15, and ended at the proposed temporary culvert (#1), (Figure 3). The lower two surveyed reaches, (1 and 2), overlay the upper extent of OC coho critical habitat on East creek (Figure 4), and are summarized below.

The most recent AQI surveys in Moon Creek were completed in 1996. Moon Creek ODFW habitat data only incorporates one reach, however this reach overlays the upper extent of OC coho distribution and Critical Habitat (Figure 4). This reach begins in the middle of T3S, R8W section 17 and continues upstream through the Research Natural Area (RNA) and ends at a large log jam approximately 0.8 miles below the proposed treatment unit 3-1. Oregon Coast coho distribution and Critical habitat ends approximately 200 meters below the end of the ODFW reach survey. Data and habitat characteristics for these stream reaches are also comes from the Tillamook Resource Area fish biologists. Habitat characteristics of both East and Moon Creek are likely degraded from pre-disturbance levels; however they are both in relatively good shape when compared to the typical Oregon coastal stream habitat post-human influence. Both streams support populations of OC Coho that typically follow the general population trends of the Oregon Coast ESU.

East Creek

East Creek stream reaches are generally low gradient, averaging from 1.5 - 4.5 %. The active channel width averages about 9 meters and stream channels are moderately constrained by low terraces, with good access to multiple braided channels and the floodplain during higher flows. On average, stream characteristics in these reaches fall very close to the "Desirable" stream channel benchmarks set by ODFW. Channel substrates are dominated by gravel and cobble. Habitat types are predominantly scour pools and riffles in Reach 1, and scour pools and rapids in Reach 2. LWD levels within critical habitat in Reach 1 of East Creek are at $31m^3$/100m, just above the minimum ODFW desirable volume of $30m^3$/100m and below desirable volume at $6.4m^3$/100m in Reach 2. Though volume of LWD was good, key pieces we a little low with 1.5 key pieces per 100m in reach 1 and 0.0 in reach 2. Shade throughout these reaches is also at about 80%, 10% above the desirable threshold of 70% set by ODFW. Riparian areas in Reach 1 are dominated by smaller hardwoods (3-30cm class), mainly red alder located within 0-10m from active channel. Riparian areas in Reach 2 are dominated by similar species and size class, but are concentrated on average within 20-30m from active channel. The stream channel in East Creek has been actively moving over the last few years, creating new scour and deposition areas, and accessing old channels and alcoves. A large amount of gravel has moved into these reaches and created new terraces and increased spawning gravels throughout OC coho critical habitat. East Creek throughout the BLM ownership has had several rounds of fish habitat enhancement work including extensive LWD placement projects from the early 80's up to the mid 90's. No fish habitat work has occurred in the analysis area since the last LWD placement project in 1995.

Moon Creek

Channel gradient is generally low throughout this reach averaging 2.4%. The average active channel width is approximately 10.5m, and is moderately constrained by multi-level terraces and hillslopes. Access to the

floodplain is moderate to good, with approximately 17% of channel area in secondary channels. The multi-level terraces suggest that multiple flood level events carrying large amounts of bed-load have occurred at some time in the past. Most channel characteristics throughout the Moon Creek reach falls close to desirable benchmarks set by ODFW. Habitat types are predominantly scour pools and riffles. This reach also has a substantial component of backwater pools, at 9% of the wetted area. These backwater pools function as quality refugia areas during high flow events. Combined pool area is also very desirable at approximately 45% of the wetted stream area, well above the 35% ODFW desirable cut-off. Substrates in this reach are also in good shape being dominated by gravel (33%) and cobble (28%). Stream shade is within desirable limits and considering the elapsed time since the Moon Creek surveys and lack of disturbance in this watershed, it is likely the canopy has closed in and shade is still well within desired limits. LWD was lacking key pieces in the 1996 survey, at approximately 0.9 pieces per 100m, where greater than three pieces per 100m is considered desirable. Total wood volume in this reach was not as bad with the level at 26.5m^3 per 100m of stream. The desirable category starts at 30m^3 per 100m. The riparian area is dominated by large (30-50cm) hardwoods and conifers, with large (>89cm) conifers present. As these riparian stands mature and take on late-seral habitat characteristics, it is likely that natural recruitment of LWD will improve and contribute to beneficial habitat features linked to LWD in the stream channel. The BLM has pursued no stream enhancement work in Moon Creek due to much of its length being designated as a Research Natural Area, as well as its remoteness.

OC Coho Critical Habitat / ODFW Surveys and Proposed Density ManagementTreatment Areas

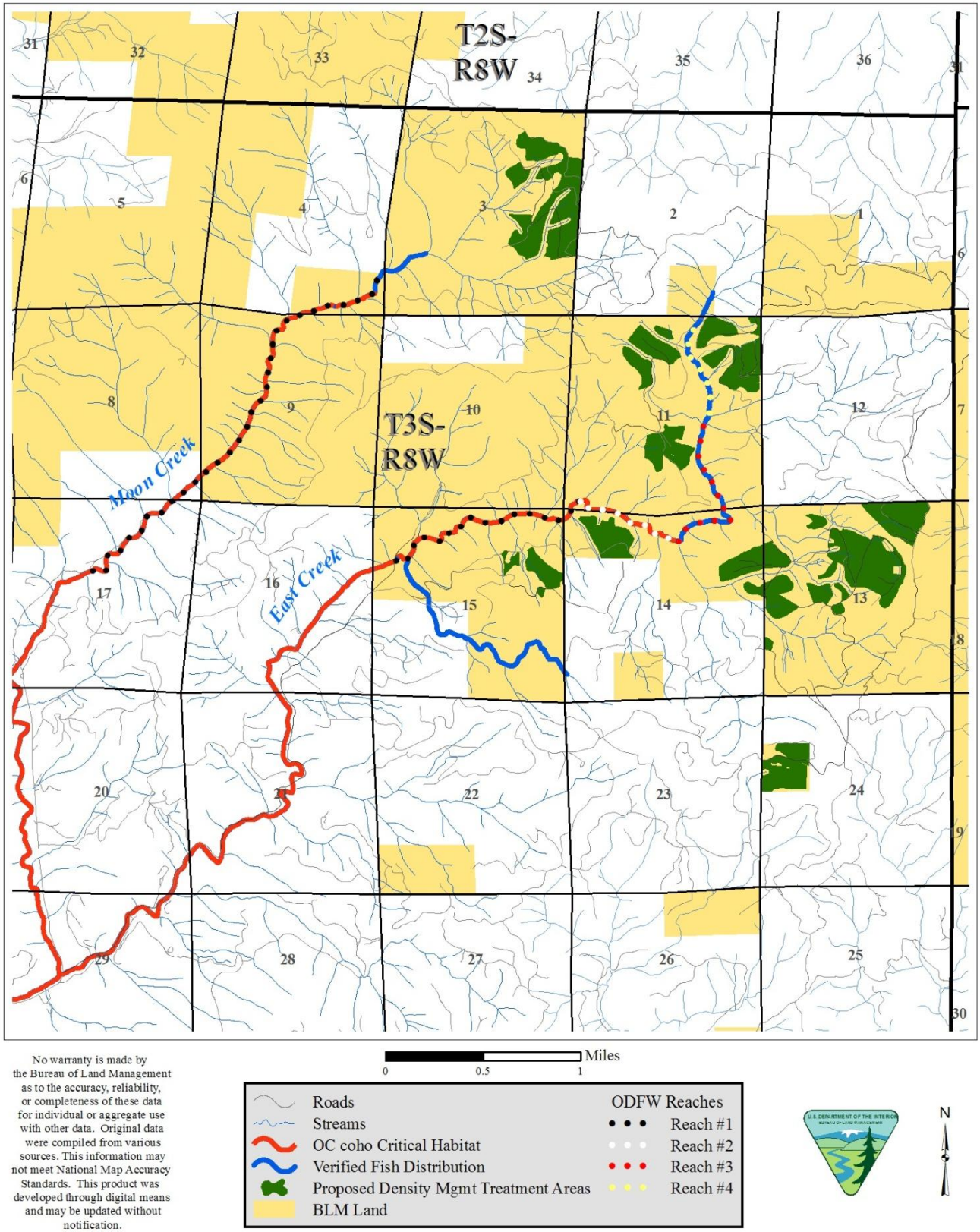

Figure 4

2.3.7.2 Environmental Effects – Alternative 1: Proposed Action

The fisheries analysis area for the Moon Creek Projects is divided into two categories to logically address impacts to listed fish and their habitat. The direct and indirect effects analysis area is limited to any area that may be disturbed by project actions, stream reaches adjacent to, and downstream of, proposed treatment units to the confluence of East and Moon Creeks, as well as streams that may be potentially affected by hauling timber from the project area. The Cumulative Effects analysis area encompasses all of the Moon and East Creek drainages designated as the Moon Creek sixth field (HUC # 171002030205), and the upper portion of Clarence Creek in section 24. The bulk of the project is within the Moon Creek sixth field subwatershed. Approximately 22 acres of the Density Management treatment area are located within the Niagara Creek sixth field watershed (HUC # 171002030204) in the very top of the Clarence Creek drainage. (See Figure 2)

The main concern for the fisheries resource is how the proposed action or lack of action would affect sediment inputs, water quality, stream channels, temperature, and shade.

The discussion below is intended to disclose any environmental impacts, both positive and negative, to OC coho and their habitat directly, indirectly or cumulatively, resulting from the Moon Creek Projects action and no action alternatives.

The most likely sources of negative impacts to OC coho come from road construction and culvert work required to access the proposed treatment units, timber harvest and hauling, and road decommissioning after the proposed treatments are finished. Effects are addressed by proposed project action below.

Timber Harvest

Unit 14-1 is the only proposed density management treatment area adjacent to OC coho Critical Habitat. This is a cable yarding unit approximately 150 ft from LFH at its closest point. Approximately 616 linear ft of the unit edge is within 200 ft of LFH (See Figure 2). This unit would require skyline cable to be hung over LFH on East Creek, but would require no yarding over the stream channel. The riparian area between this unit and the stream has a moderate average slope of ~50% and is well vegetated. As discussed in section 2.3.6.2 under Water Quality, a recent erosion study (Rashin et al, 2006) showed that a "no ground disturbance" buffer of 33 feet prevents approximately 95% of harvest related sediment delivery to streams. The no-harvest buffer for this unit is a minimum of almost five times that distance to LFH, and twice that distance to several small 1st order tributaries that are adjacent to this unit. It is unlikely that any disturbance in this unit would deliver a measurable amount of sediment to LFH.

All other proposed density management treatment units are separated hydrologically from LFH by at least 0.2 miles and all have appropriate buffers and BMPs in place (See Table 11 below). There is no cable yarding proposed over LFH.

It is unlikely that timber harvest would increase sediment inputs to streams due to the incorporated project design features (PDFs) and BMPs and proximity to LFH. These features include; (1) minimum 60 ft no harvest buffers that also exclude disturbance from ground-based equipment (100 ft on fish streams), (2) limits on thinning activities in riparian reserves, (3) seasonal restrictions, (4) no cable yarding over LFH, (5) full suspension requirements for cable yarding over streams, (6) proposed density management unit's proximity to LFH, (7) small size and sediment carrying potential of streams near proposed harvest units.

Table 9. Density Management Treatment Unit Proximity to LFH (At closest Hydrological connection)

Unit	LFH Stream	Proximity to Listed Fish/Habitat (miles)
3-1	Moon Creek	1.1
11-1	East Creek	0.85
11-2	East Creek	1.0
11-3	East Creek	0.4
13-1	East Creek	1.1
13-2	East Creek	0.65
13-3	East Creek	0.9
13-4	East Creek	1.1
14-1	East Creek	0.02
14-2	East Creek	0.38
15-1	East Creek	0.2
24-1	Clarence Creek	3.0
24-2	East Creek	1.4

New Road Construction/Decommissioning

All proposed new construction (~0.5 mile) for this project would occur on ridges or benches, is over 500 feet from any stream, and would also be decommissioned at the end of the project. The project proposes to decommission approximately 2.5 miles of roads at the end of the project. See section 2.2.2.2 for a description of road decommissioning activities. Due to their proximity to stream channels, LFH and incorporated PDFs (section 2.2.2.2) it is unlikely that new road construction or decommissioning would affect OC coho or their Critical Habitat.

Road Renovation

Moderate renovation is proposed on ~ 2.5 miles of existing roads. No renovation would occur within 500 feet of LFH, with the closest renovation work occurring approximately 0.7 miles from LFH. Implementing the road renovation as proposed is unlikely to have any effect on OC coho or their Critical habitat for the following reasons; lack of proximity of renovation activities to LFH, the inability of small 1st and 2nd order stream channels to transport sediment to LFH, and the incorporation project design features (PDF's) to minimize or eliminate impacts.

Culvert Work

This analysis considered and evaluated all potential stream crossings associated with the proposed density management project, including those along the potential haul routes, and assigned numbers to each crossing. Of all of the stream crossings there are 14 that would involve culvert work of some sort. Figure 3 shows the locations of the proposed culvert work including only the assigned crossing numbers where work would occur; the numbers are; #'s 1-5 in Section 11 and #'s 6-14 in Section 13.

All proposed culvert work would be done in the dry season (ODFW instream work July 1 – Sept 15) when most of these streams have very low or no flow. Work on 12 of these would be re-installations of culverts on small 1st and 2nd order non-fish bearing streams, one would be a temporary one-season re-installation on the mainstem of East Creek in section 11, and one would involve the removal of a small existing culvert, post harvest, on a small 2nd order tributary. The culvert work is broken into two main groups for analysis purposes, one group in section 13 and one in section 11.

In section 13, culvert work is proposed on nine small 1st and 2nd order stream crossings. Eight of these culverts would be re-installations on roads that were previously put into non-drivable status by the BLM and would need

to be re-installed in order to gain access to units 13-2&3 and 14-2. The ninth culvert (#6) is a small pipe that is currently in place that would be removed at the end of the sale. Of these nine culverts, #s 10-13 would remain in place at the end of the timber sale, while the others would be removed (See Figure 3). The culverts that would remain in place after the sale would be designed to 100 year flood criteria. Culvert #14 is the closest to LFH at 0.66 miles above, the next closest crossing is # 9 at 0.81 miles, with the remainder at over 1.0 mile above LFH. None of the proposed culvert work in section 13 is likely to have any effect on OC coho or their designated Critical Habitat due to the distances above LFH, presence of marshy areas that capture and hold sediment, and the inability of the low gradient 1st and 2nd order tributaries to move sediment down the channel to LFH. Sediment would likely be stored for years if not indefinitely in these small channels and marshy areas.

The section 11 group proposes to re-install culverts at four stream crossings where culverts were previously removed; three 1st or 2nd order tributaries to East Creek, and the 4th order mainstem of East Creek. The small tributaries are between 1.1 and 1.25 miles above LFH, however unlike the section 13 group, these are closer to the mainstem of East Creek. The closest crossing is approximately 75 feet from East Creek, and the furthest is approximately 2,700 feet from East Creek. The crossing on the East Creek mainstem (#1) is approximately 1.26 miles above LFH. Crossing #2 is a very shallow fill with a relatively low-gradient channel above the culvert, and is the crossing closest to the East Creek mainstem. The other three small crossings are steeper channels with moderate to deep fill, but are farther from the mainstem. Crossings #1 and #5 would be temporary installations while the other three culverts would be replaced permanently with pipes sized to accommodate 100 year flood events (see Figure 3).

Work on the small stream crossings would likely input a small amount of sediment (< 1cu yard per crossing) to these channels. These small headwater streams have minimal capacity to carry sediment downstream. Any sediment generated from the culvert work would likely settle out within a short distance downstream. This sediment would remain in these small channels until the first heavy fall and winter storms raise stream flows and move it downstream when background turbidity levels are normally at their highest.

The most likely potential source of impact to OC coho would come from the proposed temporary re-installation of the pipe(s) on the mainstem of East Creek (#1). The culvert or culverts (side by side) would be installed and removed within one ODFW in-stream work period during low flows (July 1 – Sept 15) to facilitate dry-season haul out of unit 11-1. Crushed rock material would be used around the pipe and previously used on-site material would be used for the remainder of the fill. The use of crushed rock material around the pipe would result in a lower percentage of fine sediments entering the streambed than typical soil fill material. The crossing has a shallow fill and would require stream flow to be diverted around the work area during installation and removal. Work at this crossing would likely introduce a total of approximately 4 cubic yards of sediment to the stream channel, 2 from installation and 2 from removal. Stream gradients above and below this crossing are very moderate at approximately 3-4%. The stream reach below the crossing site has a substantial amount of wood in the channel to help store any sediments generated by work at this crossing. The sediment generated at this crossing would likely settle out and remain in pools and around log structures within 1000 feet of the crossing during the low summer flows. With the first fall freshets, small amounts of sediment would begin to move downstream and mix with existing suspended sediments generated from areas of natural and/or man-made disturbance upstream. By the time these suspended sediments reached LFH approximately 1.26 mile below, it is highly unlikely they would be distinguishable from background levels.

Timber Hauling

Timber haul would likely generate a small amount of sediment. Sediment would likely settle on the road surface, roadside vegetation and in ditch-lines until the first heavy rains in the fall. Vegetation and sediment storage structures such as waddles, cross-drains, and sediment sumps in ditch lines (see section 2.2.2.2 PDF's) would likely store most of the sediment during the fall and winter run-off. An indistinguishable amount of sediment would likely reach stream channels during heavy rains over the first winter after haul. As discussed in the Water Quality section (2.3.6.2), very little sediment delivery is expected as a result of hauling timber as proposed.

Stream Temperature

As discussed in the Water Quality section (2.3.6.2) streams adjacent to the proposed thinning units are generally small 1st and 2nd order waterways and would have very little flow during the typical dry season when thermal exposure has the potential to increase stream temperature. No-harvest buffers would be in place on all units and no thinning is proposed in the primary shade zone for any of the proposed project units. Taking these factors into account, it is highly unlikely that the proposed project would alter stream temperature.

Physical Integrity

The only elements of the proposed project that may alter stream channel physical integrity would be the proposed culvert replacements and removals. By following PDFs and BMPs, all other project elements are not expected to alter the physical integrity of stream channels in the project area.

The proposed culvert work (see culvert work above) would likely have short term (1 to 3 years) impacts on physical integrity See Water Quality section (2.3.6.2).

Large Woody Debris

Approximately 80% of the Moon Creek subwatershed is federally managed. As discussed in the Water Quality section (2.3.6.2), much of the watershed is recovering from natural disturbances and historic management practices that reduced the long-term potential large woody debris (LWD) input by removing a large number of trees from the riparian areas. These same practices dramatically increased the short term input of LWD by creating landslide prone areas that sent debris flows down stream channels. As a result, much of the watershed is in a trend toward mid- and late-seral habitat after being reforested following natural disturbances such as large-scale fires, and management actions such as clearcut logging. LWD would be naturally recruited as late-seral habitat features develop and trees start to die and fall into stream channels.

Approximately 36% of the proposed density management (about 148 acres) would occur within Riparian Reserves, representing a very small percentage of the suitable riparian stands in the watershed that are potential sources of LWD. These riparian reserve treatments would occur outside no-harvest buffers along streams as described in section 2.2.2.2. Harvesting trees within the riparian reserve would remove a short term potential source of small trees (Trees w/ 10-15" dbh) to stream channels. This small wood is recognized to be an important element in both sediment routing and nutrient cycling processes for the aquatic system. Although the thinning of riparian reserves removes some potential small diameter wood available for future stream recruitment, small diameter wood does not last as long and is more readily moved out of the system than large diameter wood. Thinning is expected to accelerate the growth rate of the trees that remain in the riparian reserves and increase the quality and volume of LWD naturally recruited to the stream channel, improving beneficial uses in the future.

The Curtis relative stand density following treatment would range from 30 to 44. A Curtis relative density of greater than or equal to 30 immediately following timber harvest leaves approximately 50% canopy closure and would allow the remaining trees to take advantage of the new space and sunlight to increase growth rates, and provide larger, higher quality LWD for future natural recruitment.

Due to the very small acreages and relative densities of proposed thinning in riparian reserves compared to that available in the watershed, the use of no-harvest buffers along all streams, no adverse effects to quantity or quality of LWD is expected from implementing the project as proposed.

Road Density

There would be a short-term increase in road density of approximately 0.5 miles during the projects and then a net decrease in road density of approximately two miles as a result of the proposed actions. All new construction and approximately 80% of the renovated roads (those that are natural surfaced) would be fully decommissioned at the end of timber harvest work.

Streamflow

A discussion on peak flows in the hydrology section (2.3.5.1), states that the proposed action is unlikely to alter streamflow. With no likely effect to streamflows there is no expected effect to OC coho or their critical habitat.

Conclusion:

The environmental effects resulting from implementing the proposed action alternative are highly unlikely to have a negative effect on OC coho. The incorporated design features, proximity of project actions to OC coho, and seasonal restrictions for this project would most likely prevent measurable adverse effects to OC coho. In summary the proposed actions are expected to have discountable and unmeasureable short term effects on ESA listed fish resulting from culvert work, and hauling timber out of the project area, however due to the criteria set forth by the ESA regulatory agency (NMFS) regarding effects determinations, the proposed action "May Affect but is Not Likely to Adversely Affect" OC coho or their designated Critical Habitat.

Cumulative Effects

The analysis area for cumulative effects is comprised of the Moon Creek subwatershed and includes past present and foreseeable future actions that the BLM is aware of and includes short term effects (1-3 years) and long term effects (3-25 years).

There has been some timber harvest by land managers in the project area over the last five years; private industrial ~640 acres, ODF ~225 acres, and BLM ~100 acres. There is minimal harvest activity, ~ 420 acres planned in this watershed in the foreseeable future (Appendix 3). Based on the analysis of the affected environment, there would be no identified long-term adverse cumulative effects as a result of implementing the Moon Creek Projects as proposed. Long term beneficial effects would include increased size of trees in the riparian zone providing increased shade and future LWD inputs to stream channels. For the reasons stated above in the Conclusion section, the proposed actions, when combined with other actions that have occurred, or are likely to occur (appendix 3) within this watershed, are unlikely to result in cumulative effects to OC coho or their designated critical habitat.

2.3.7.3 Environmental Effects – Alternative 2: No Action

None of the forest management activities described in the proposed action would occur at this time. The stands proposed for treatment would continue on a slow trajectory toward late-seral habitat. Inputs of LWD to stream channels would continue at the current rate influenced by natural disturbances such as landslides, debris flows and natural tree mortality and competition. Long term sizes of LWD would continue to be relatively small due to reduced growth rates of overstocked stands. Inputs of small woody debris would continue along the current trends. There would be no new roads or landings built or additional ground disturbance from forest management activities.

Water quality, sediment input, stream channel integrity/geometry would all continue to be influenced by the existing conditions in the watershed.

Most of the sources of fine sediment in the Moon Creek watershed would continue to come from current road stream crossings and natural soil disturbance regimes (soil creep, rotational slumping, landslides, debris flows).

Cumulative Effects

The "No Action" alternative would have no causal mechanism to create cumulative effects to the fisheries resource. No management activity would occur that when combined with other activities in the past, present or reasonably foreseeable future would have any effect on OC coho or their Critical Habitat. There are no identified cumulative effects that would result from implementing the "No Action" alternative.

2.3.8 Fish Species with Bureau Status and Essential Fish Habitat Assessment

Oregon Coast Steelhead are the only species with Bureau Status located in the proposed project area, and are present in essentially the same distribution as OC coho. Oregon Coast Steelhead are also listed as a species of

concern by NOAA Fisheries, and are a sensitive species in Oregon under BLM's Special Status Species listing. Effects to Oregon Coast steelhead are discussed below.

2.3.8.1 Affected Environment

The Affected environment for steelhead is essentially the same as that of OC coho discussed above. See section (2.3.7.1 T&E Fish). Steelhead use slightly different habitat types than OC coho for different life stages, but have essentially the same distribution.

2.3.8.2 Environmental Effects – Alternative 1: Proposed Action

For the purposes of this effects analysis Oregon Coast Steelhead are so similar to OC coho in distribution as well as physical, and biological requirements, that the effects to them are considered the same as those discussed for OC coho. (See section 2.3.7.2).

The proposed action would likely have unmeasureable short term effects to water quality, but would not adversely affect or contribute to the need to list any Bureau Status species under the ESA, or MSA.

Cumulative Effects

The cumulative effects on fish species with Bureau status and/or EFH would be the same as those identified in the cumulative effects section for T&E Fish (section 2.3.7.2)

2.3.8.3 Environmental Effects – Alternative 2: No Action

None of the forest management activities described in the proposed action would occur at this time. The identified effects of the proposed action alternative would not occur. The stands proposed for treatment would continue on a slow trajectory toward late-seral habitat. Inputs of LWD to stream channels would not benefit from increased growth rates as a result of thinning, and would continue at the current rate influenced by natural disturbances such as landslides, debris flows and natural tree mortality and competition. Long term sizes of LWD would be reduced due to reduced growth rates of overstocked stands. Inputs of small woody debris would continue along the current trend. There would be no new roads or landings built or additional ground disturbance from forest management activities. Water quality, sediment input, stream channel integrity/geometry would all continue to be influenced by the existing conditions in the watershed and future natural disturbances such as. Most of the sources of fine sediment in the Moon Creek watershed would continue to come from current road stream crossings and natural soil disturbance regimes. (soil creep, rotational slumping, landslides, debris flows).

Cumulative Effects

The "No Action" alternative would have no causal mechanism to create cumulative effects to the fisheries resource. There are no identified cumulative effects that would result from implementing the "No Action" alternative. No management activity would occur that when combined with other activities in the past, present or reasonably foreseeable future would have any effect on Bureau Status fish or contribute to the need to list them under the ESA.

2.3.8.4 Essential Fish Habitat Assessment (EFH)

When the Magnuson-Stevens Act (MSA) of 1976 was re-authorized in 1996, it directed Regional Fishery Management Councils to identify Essential Fish Habitat (EFH) for commercial fish species of concern. Essential Fish Habitat is defined as "those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity (16 U.S.C. 1802(10))". Federal action agencies must analyze effects to EFH resulting from proposed project actions. The assessment below describes the likely effects from implementing the project as proposed to Essential Fish Habitat (EFH) for Oregon Coast coho and chinook salmon. Oregon Coast coho and chinook salmon are located in the analysis area of East and Moon creeks. Chinook distribution ends

approximately ¼ mile below coho in both streams. A detailed description of coho distribution is located above in section 2.3.7.1.

Water Quality, Water Quantity, and Substrate Characteristics

As described in the Stream Flows analysis (section 2.3.6.2) the proposed action is unlikely to measurably alter stream flows, temperature or shade. Physical integrity, sediment regimes and substrate characteristics would also likely be maintained by following the project design features and BMPs. Implementation of the proposed action would potentially input a small amount of sediment into streams from timber yarding, road construction, reconstruction, decommissioning, culvert work and use of haul roads.

Any increases in sedimentation would likely be short term and occur during the first year or two after disturbance. Any sediment generated from project actions would likely be stored in the upper reaches of small 1st and 2nd order streams (except the mainstem culvert replacement and removal in section 11) where it would remain in these small channels indefinitely in some cases or until a storm event occurs and generates enough energy to transport it downstream, where it would mix with and become indistinguishable from background turbidity levels during high flows. A detailed description of the effects of the proposed culvert work is located in section 2.3.7.2. In the long-term (5-15 years) decommissioning and blocking roads, associated with the timber sale would likely decrease sediment delivery and turbidity levels, maintain or improve water quality and lower the likelihood of debris flows associated with road/stream crossing failures.

Large Woody Debris (LWD) in channel and source areas

Approximately 36% of the proposed density management (about 148 acres) would occur within Riparian Reserves. There would also be approximately 300 acres of wildlife treatments in older stands (90 – 125 years old) that would create snags, snag topped trees, and downed wood along some headwaters streams (See Figure 4). This project proposes to enter riparian reserves in an effort to improve the riparian stand condition with silvicultural prescriptions intended to increase growth and vigor of riparian stands in portions of the project area, as well as increase the amount of LWD in headwater channels (wildlife project). Harvesting trees within the Riparian Reserve would directly remove a short term potential source of small wood (i.e. Trees with dbh < 20") to stream channels. These younger trees are recognized to be an important element in both sediment routing and nutrient cycling processes for the aquatic system. However smaller diameter wood does not last long and is more readily moved out of the system than larger diameter wood that would be the desired result from thinning these riparian stands. Thinning in the riparian reserves would likely accelerate the growth rate of the trees that remain and increase the quality and volume of large woody debris in the future. This would provide long - term future sources of in-stream wood in headwater reaches above and near EFH.

Fish Passage

All culvert work proposed in this project is well above distributions of both OC coho and chinook salmon. The proposed project would have no effect on passage for MSA listed species.

Forage Species

There are no project actions proposed within or in close proximity to essential fish habitat. None of the proposed actions have a causal mechanism to affect forage species for MSA listed fish.

Channel Geometry

As discussed in the Physical Integrity analysis (2.3.6.2) the proposed culvert work would likely have short term (1-3 year) effects on channel geometry. However these changes would occur well above EFH. The closest culvert work would occur 0.66 miles above EFH on a small 1st order tributary with shallow fill, and the rest are mostly on 1st and 2nd order tributaries well above EFH. The only large culvert replacement (4th order) would be temporary (placed and removed in one dry season) and is approximately 1.5 miles above EFH. Due to the lack of

proximity of the culvert work to EFH, along with the PDFs and BMPs described in section 2.2.2.2, there is no likely effect to channel geometry resulting from implementing the proposed actions.

Road Density

There would be a short-term increase in road density of approximately 0.5 miles during the projects and then a net decrease in road density of approximately two miles as a result of the proposed actions. All new construction and approximately 80% of the renovated roads (those that are natural surfaced) would be fully decommissioned at the end of timber harvest work.

Conclusion:

The environmental effects resulting from implementing the proposed action alternative are highly unlikely to have any effect on EFH. Potential long term beneficial effects could include larger sized LWD entering the stream network sooner as a result of increased growth rates of trees in the treated units. Based on the incorporated design features, proximity of project actions to MSA fish species and their habitat, and seasonal restrictions it is unlikely that the proposed action would have any measurable negative effect on EFH. Effects to EFH resulting from implementing the project as proposed are expected to be discountable and unmeasureable, and are unlikely to contribute to the need to list any fish species under the MSA or ESA.

2.3.9 Invasive, Nonnative Species (Executive Order 13112)

2.3.9.1 Affected Environment

Botanical surveys for invasive, non-native plant species within the Moon Creek project area began in spring 2007. Where native plant communities were established, non-native invasive species were non-existent. Invasive species that were identified consisted of Bull Thistle (*Cirsium vulgare*), Scot's Broom (*Cytisus scoparius*), Tansy Ragwort (*Senecio jacobaea*), Himalayan Blackberry (*Rubus discolor*), and St. John's-wort (*Hypericum perforatum*) and were located along road edges and areas that tended to have soil disturbance (i.e. open meadows, riparian areas and motorcycle trails). These species are considered Priority III (established infestations) on the Oregon Department of Agriculture (ODA) Noxious weed list. These aggressive weed species are prevalent throughout Western Oregon and proliferate easily through vectors such as motor or foot traffic, birds, wind, and water into previously unaffected areas. Ground disturbing activities such as new road construction, reconstruction and decommissioning, bank stabilization, yarding corridors, tractor skid trail development, landing use, and haul road maintenance are the most likely activities that could produce conditions conducive to noxious weed establishment. Some degree of noxious/exotic weed introduction or spread is probable as management activities occur in the project areas.

2.3.9.2 Environmental Effects – Alternative 1: Proposed Action

Minimal Effect - Most Priority III noxious weed species found were located along existing roadways. Culvert replacement and bank stabilization will cause ground disturbance that will likely contribute to the further establishment of invasive species. Initial increase in population size and new establishment due to density management thinning activities should be confined to disturbance areas as described above in "affected environment" and would be expected to decrease over time as native species re-vegetate and the recovery of canopy closure occurs. The noxious weed species identified do not tolerate overtopping and can be negatively affected by competition for light. The various design features that are incorporated into this project such as: planting native plant species on disturbed sites; blocking access to vehicular traffic on decommissioned roads; and washing equipment prior to entering the project area, will all help ensure that there are not any longer term increases in weed populations.

Cumulative Effects

The analysis area for cumulative effects to noxious/non-native invasive plant species is in the Northern Oregon Coast Range approximately 10-12 miles east of the town of Beaver, Oregon located in the Nestucca River

watershed. Examples of forest management activities within the affected area that will create soil disturbance and influence the spread of noxious/non-native invasive plant species are regeneration harvest, commercial and pre-commercial density management thinning, young stand maintenance, new road construction, road decommissioning, road maintenance, culvert replacements, and motorcycle trails. Activities that do not necessarily create disturbance but influence the spread of weed seeds are recreational hiking, biking, horseback riding, fishing, and hunting. Other sources of seed dispersal are from wildlife that are either passing through or frequent the area, water movement, and wind. Many past and present management activities tend to open dense forest settings and disturb soils therefore provide opportunities for widespread weed infestations to occur. Many, if not all of the weed species identified as Priority III (established infestations) on the Oregon Department of Agriculture's (ODA) noxious weed list are present throughout the area. Because they are present in the project area, seed is readily available for dispersal. Most non-native weed species are not shade tolerant and will not persist in a forest setting as they compete for light when tree canopies close and light to the under-story is reduced.

2.3.9.3 Environmental Effects – Alternative 2: No Action

No Effect - Most Priority III species found were located along existing roadways. No appreciable increase in the noxious weed populations identified during the field surveys is expected to occur if no action is taken.

Cumulative Effects

There would be no cumulative effects under the No Action alternative.

3 PROJECT 2 - Coarse Wood Development

3.1 Purpose of and Need for Action

Objectives

By comparing the existing conditions of the landscape in the Moon Creek subwatershed to the management direction contained in the Salem ROD/RMP and the desired future condition envisioned in the Nestucca Watershed Analysis (October 1994), the IDT identified a number of specific resource conditions that do not meet the long-term management objectives. The proposed action is designed to modify these conditions, and move towards achieving the management direction described in the ROD/RMP and the management opportunities found in the watershed analysis.

The objective of this project is to implement the following management direction from the ROD/RMP, pertaining to management of lands in the Late-successional Reserve and Riparian Reserve land use allocations.

- Enhance and maintain biological diversity and ecosystem health in order to contribute to healthy wildlife populations (pg. 24);
- Design projects to improve conditions for wildlife if they provide late-successional habitat benefits or if their effect on late-successional associated species is negligible (pg. 25);
- Provide down wood and snags in the size and decay class distribution reflective of the stand age (Nestucca WA pg. 64)
- Design and implement watershed restoration projects that promote long-term ecological integrity of ecosystems…(pg 23)

3.2 Alternatives

Pursuant to Section 102(2) (E) of NEPA (National Environmental Policy Act of 1969, as amended), Federal agencies shall "…study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources." No unresolved conflicts concerning alternative uses of available resources (section 102(2) (E) of NEPA were identified. Consequently there are no action alternatives to the proposed action in Project 2

3.2.1 Alternative 1: The Proposed Action

The Moon Creek Coarse Wood Development project would treat up to 5 trees per acre using a variety of techniques including felling, basal and top girdling, and topping. The treatments would occur on approximately 300 acres of 90 to 115 year old forest stands in about 20 separate units ranging between 2 and 85 acres in size. One 30 acre stand is approximately 125 years old, but it was thinned and salvaged in the 1960s and consequently is deficient in snags and large down wood. See figure 5 for a map of the proposed treatment areas. Review of these stands has found that there are few sound snags and large down wood in recent decay stage. Creating snag and down wood features would have immediate benefit to animals that require those elements such as pileated woodpeckers, which are important ecological engineers that in turn provide habitat for a host of secondary cavity users, one of which is the flying squirrel, the primary prey species for the spotted owl.

Another element of the Coarse Wood Development project would be to "seed" some steep headwater streams with large wood by falling some trees directly into the stream channel. The effect would be such that if the headwall were to fail, the resultant debris flow would contain stabilizing structure that may slow the flow and thus reduce the amount of sediment that may potentially reach fish bearing stream sections or, if the failure is on a large enough scale, the wood could reach the fish bearing stream and provide additional structure there.

3.2.1.1 Connected Actions

There are no connected actions associated with Project 2.

3.2.1.2 Project Design Features

- Treat Douglas-fir trees 18 – 30 inches dbh. Selected trees would have live crown ratios generally less than 30% and smaller than average crown spread. Within the prescribed diameter range approximately an equal number of trees would be selected larger and smaller than the average dbh of 24 inches. The largest healthiest dominant trees would ***not*** be selected.
- Treatments include – Falling, basal girdling, crown girdling, topping.
- Trees would be selected both singly and in small clumps of 3-5 trees (50% of trees in clumps).
- Selected trees would not contain any nests or suspected nests of birds or mammals.
- No tree would be felled within one hundred feet of any known site of the lichen *Hypogymnia duplicata* and any tree felled within 150 feet will be felled away from the known site (sites would be mapped).
- Trees will be felled in a manner to avoid hitting decay class 3 and 4 down wood larger than 24"
- Felling of trees would be conducted in such a way as to assure no damage to potentially suitable spotted owl or marbled murrelet nest trees, or any tree containing a suspected nest of a bird or mammal.
- Created snags or felled trees would generally not be located within approximately 150 feet of a drivable road or a property line boundary where BLM land abuts non-federal ownership. This would reduce the potential for the creation of a safety hazard and/or the likelihood that the material would be stolen or sold as firewood.
- Treatments applied in the Riparian Reserves would extend down to the stream channel however trees in this area would be selected so that stream shading would not be appreciably affected.
- No activities would be allowed from March 1 through July 7; also any work conducted between July 7 and September 30 would be restricted to the time of day between 2 hours after sunrise and 2 hours before sunset.
- Trees felled into the active stream channels would only be allowed between July 7 and September 15 during the ODFW in-stream work window unless an in-stream work window waiver is obtained from ODFW.

Proposed Coarse Wood Development Areas

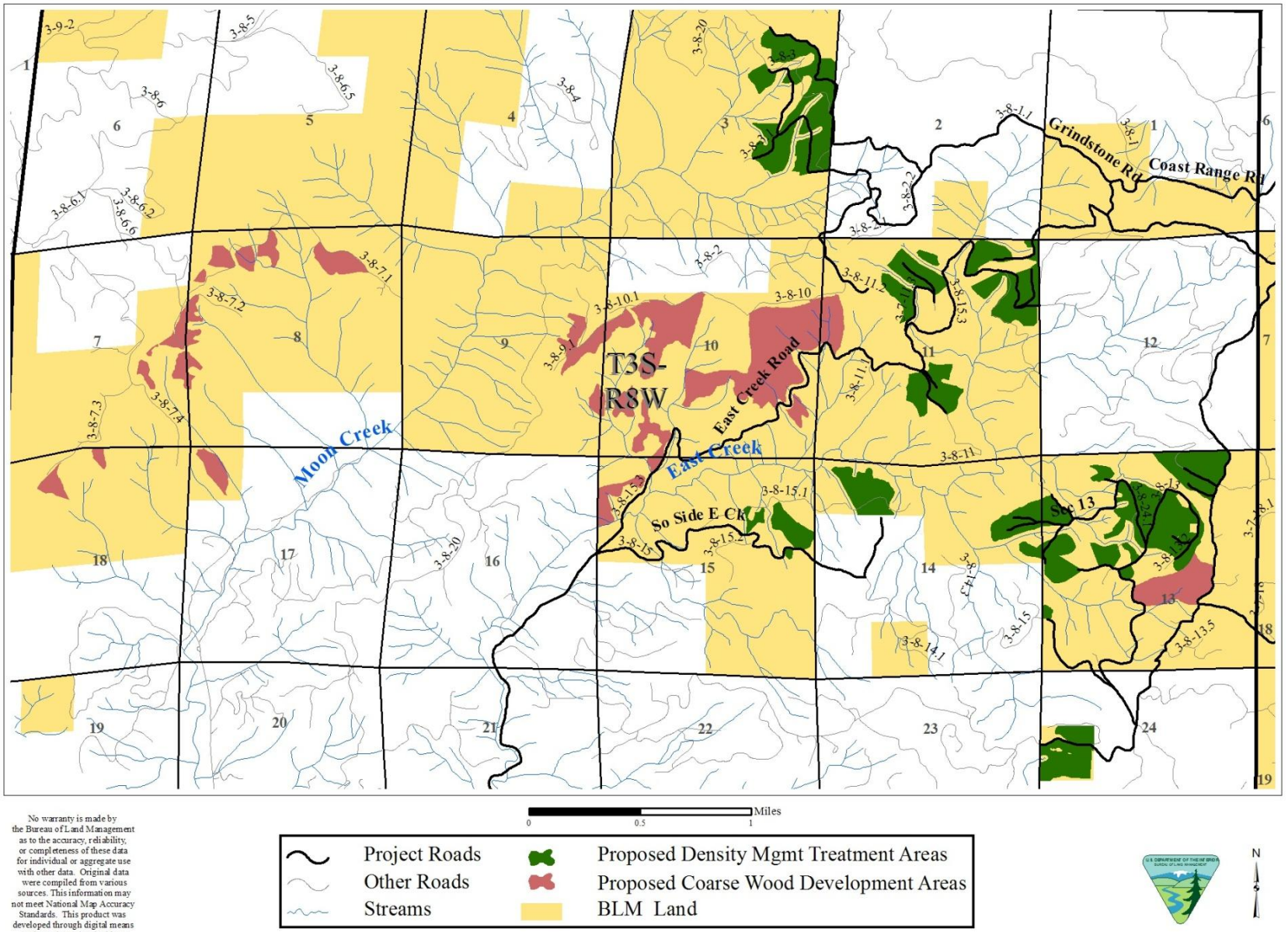

Figure 5

3.2.2 Alternative 2: No Action

No trees would be treated nor would any trees be felled into headwater stream areas.

3.3 Affected Environment and Environmental Effects

3.3.1 Forest Vegetation

3.3.1.1 Affected Environment

See description of the affected environment under section 2.3.1 for an overall description of the stands in the project area. The stands proposed for the coarse wood development project are outside of the areas planned for variable-density thinning and are considerably older stands. The stand dates of origin range from 1880 to 1910. As would be expected in stands of these ages, the overstory trees are generally >21 inches in diameter. They are generally dominated by Douglas-fir, but some contain various amounts of other conifers, primarily western hemlock as well as hardwoods, primarily red alder. Stocking in the stands tend to be variable, but the proposed treatments will occur in the well- stocked portions of the stands.

Approximately 39% of the Federal land within the Nestucca 5th field watershed is 80-years-old or older (including US Forest Service lands). Many of the forest stands proposed for treatment in the Coarse Wood Development project are located within stands that were identified in the analysis for the 15% Retention Standard and Guideline (Salem District RMP - pg. 48, as updated 11/15/99). The proposed project would add habitat features that are lacking while not compromising any of the currently existing late-successional habitat features.

3.3.1.2 Environmental Effects - Alternative 1: Proposed Action

Implementation of the proposed coarse wood development project should increase the structural complexity of the treated stands by adding larger-sized conifer snags and some recent-decay-class down wood both in a dispersed as well as in an aggregated pattern, creating small canopy gaps containing concentrations of snags and down wood and increase crown development of large individual conifer trees that may be released. In addition, project implementation should help improve the balance in the total coarse wood volume between snags and down wood as well as the balance in the total coarse wood volume among decay classes.

There is some risk from Douglas-fir beetle attack and associated Douglas-fir mortality, however, the number of additional trees that would be killed by bark beetles as a result of this treatment would be slight. The rule-of-thumb is that during several years following the felling of the trees, the number of standing trees infested and killed would be about 60% of the number of downed, infested logs. (Hostetler and Ross 1996). Down logs, which are only a portion of the proposed treatment, are preferred for beetle breeding sites over standing trees. The risk could be reduced by requiring that this treatment be accomplished during mid-July through September because this is after the major beetle flight period and would allow the cambium of the felled trees to dry out and be less suitable for breeding material the following spring flight period (Hostetler and Ross 1996). At the most, it is expected that the treatment would result in a few more snags in the area.

Cumulative Effects

Considering other sources of fresh killed conifer trees such as cull logs from logging operations, CWD left in yarding corridors, and recent windthrow, the Coarse Wood Development project would cause an imperceptible increase in bark beetle population which could result in a very small increase in residual tree mortality.

3.3.1.3 Environmental Effects - Alternative 2: No Action

The stands proposed for treatment are older, natural stands and as such are already beginning to exhibit or develop some late-successional stand characteristics. Under the no action alternative, the balance in the total coarse wood volume between snags and down wood would remain heavily in favor of down wood, and the total coarse wood

volume would continue to be skewed towards the more advanced stages of decay. In addition, the crown development of some larger-sized trees would be restricted by encroachment from adjacent trees.

Cumulative Effects

There would not be any cumulative effects associated with the No Action alternative.

3.3.2 Threatened or Endangered Wildlife Species, Habitat and/or Designated Critical Habitat

3.3.2.1 Affected Environment

There are approximately 1,100 acres of high quality spotted owl and marbled murrelet habitat within the Moon Creek subwatershed (~ 9% of the watershed), all on Forest Service and BLM lands (stands >120 years old, including old-growth forest). In addition there are about 2,800 acres of lower quality suitable owl habitat which is not suitable murrelet habitat, again all on Forest Service and BLM lands (~ 23% of watershed). This lower quality suitable habitat is comprised of stands that are ~ 80 – 110 years old and tend to be deficient in structural complexity such as large down wood, snags and small openings. Some of these stands do have a hardwood component that provides for some structural diversity.

3.3.2.2 Environmental Effects Alternative 1: Proposed Action

Spotted Owl

The proposed Coarse Wood Development project would occur in stands comprised mostly of Douglas-fir with some hemlock and, in some stands, a mix of red alder. These stands are currently defined as suitable spotted owl habitat because of age, but are not considered to be high quality habitat due to the lack of structural complexity that would provide nesting habitat and better prey habitat. The project design is such that if trees suitable for owl nest platforms or that contain cavities exist within the stands, they would not be affected. Currently the proposed stands are deficient in snags and large down wood in the more recent decay classes and thus may be limiting optimal abundance of potential spotted owl prey, most notably the northern flying squirrel which predominantly uses cavities in this area. See the Project 1 Environmental Effects section for Threatened or Endangered Wildlife Species, Habitat and/or Designated Critical Habitat (section 2.3.2.2) for more discussion concerning spotted owls and flying squirrels.

By creating larger diameter snags these stands would become more attractive to pileated woodpeckers which, being the largest primary excavators in the Pacific Northwest could provide new cavity habitat in the stands. Overall the Coarse Wood Development project would benefit spotted owls by potentially providing more habitat for prey species. If the coarse wood development work is done during the spotted owl non-critical breeding season (July 7 – September 15), there could be an adverse effect to owls associated with disturbance (activities prior to July 7 would not be allowed). This potential effect would warrant informal consultation with the USFWS and would be done through the programmatic Biological Assessment process.

Marbled Murrelet

None of the coarse wood development units contains structures that could be used by marbled murrelets for nesting platforms. Several of the units are, however, within a distance of suitable nesting trees (Approximately 700 feet) where the USFWS feels the potential for habitat modification could occur. The nature of the project, which includes design features that would minimize changes to the stand canopy structure, is such that the stands where the action would occur would not affect those suitable nesting stands nearby; therefore suitable habitat modification would not occur. In areas where small patches of 3-5 trees are treated, the adjacent trees could respond by maintaining rapid growth of limbs into the small opening thus possibly producing suitable nesting platforms sooner than may occur without treatment.

Since the Coarse Wood Development project is within ¼ mile of suitable nesting habitat and would require the use of equipment that would generate noise above the ambient forest noise level, or would involve climbing into the canopy of trees within a distance determined by the USFWS to have the potential to disturb nesting murrelets, the project could result in the disturbance of murrelets in some unsurveyed suitable nesting habitat and therefore would require the use of daily time restrictions during the breeding season (July 7 - September 30; activities prior to July 7 would not be allowed). These time restrictions would limit work to those hours between 2 hours after sunrise to two hours before sunset. Because the potential for disturbance to murrelets exists, informal consultation with the USFWS is warranted and would be completed programmatically in the year most appropriate to cover the proposed action.

Cumulative Effects

None of the impacts associated with the proposed Coarse Wood Development project would rise to an intensity level that would result in cumulative impacts to any of the Threatened or Endangered wildlife species or their habitat that are addressed in this EA.

3.3.2.3 Environmental Effects - Alternative 2: No Action

Spotted Owl

By selecting the No Action alternative none of the immediate impacts associated with the Proposed Action, such as noise disturbance during the non-critical breeding period, would occur. The 300 acres of 90-115 year old stands would continue to grow and diversify over time. Eventually snags and down wood would develop as tree to tree competition and small scale disturbances cause mortality, at which time understory release may occur. Eventually a more structurally complex forest stand characterized by platforms for nesting and cavities for flying squirrel use would result, although it could take several decades longer for these features to emerge without immediate intervention.

Marbled Murrelet

If the No Action alternative were selected none of the potential disturbance impacts in the vicinity of suitable murrelet habitat would occur. Alternatively, any potential for positive murrelet habitat response, such as maintenance of growth of large lower limbs into openings caused by treatment, would be foregone.

Cumulative Effects

Selecting the No Action alternative would not result in any cumulative impacts to any of the Threatened or Endangered wildlife species or their habitat that are addressed in this EA.

3.3.3 Special Status, SEIS Special Attention Wildlife, and MBTA Species of Conservation Concern and Their Habitat

3.3.3.1 Affected Environment

These 80-110 year old stands that are proposed for treatment are high quality red tree vole habitat and provide good habitat for species of birds that prefer denser more continuous forest canopy, such as some warbler and kinglet species. Habitat for sensitive mollusk species is provided for in areas where there is currently coarse wood and hardwoods, including in the riparian areas. Habitat for wildlife species that require snags (woodpeckers) and cavities (flying squirrels, chickadees, etc.) is limited due to the general seral stage development where the dominant trees are still rapidly growing and have not yet begun to succumb to competition with the surrounding trees. Only those forest stands that have hemlock mistletoe infection would provide habitat for the Johnson's hairstreak (primarily those oldest stands that are also high quality spotted owl and marbled murrelet habitat).

See also Affected Environment section for Special Status, SEIS Special Attention Wildlife, and MBTA Species of Conservation Concern and Their Habitat for Project 1 (section 2.3.3.1) and the Affected Environment section for Forest Vegetation above (section 3.3.1.1).

3.3.3.2 Environmental Effects - Alternative 1: Proposed Action

None of the environmental effects associated with the Coarse Wood Development Project would result in the need to elevate the concern for any Special Status Species.

Red Tree Vole

The only Coarse Wood Development unit that has been surveyed for red tree voles is in Section 13, where one active nest was found in 2005. This site would be protected and therefore would not be affected by the proposed action. The proposed action has been designed to minimize potential impacts to red tree voles but it is possible that a tree or trees with hidden active nests could inadvertently be felled or girdled resulting in either the loss of individual voles or nesting habitat. The fact that the project would only impact about 3% of the trees in any given stand makes the odds of actually impacting a vole very small, especially given the relative rarity of red tree voles in the northern Oregon Coast Range. Also with so few trees actually impacted, the overall impact to habitat would be imperceptible. Over time the project could have both positive and negative impacts by introducing more complexity to the stand. Having additional down wood would provide more cover for voles dispersing over land and small openings in the canopy could provide a boost in growth for the surrounding trees allowing the development of larger limbs which would provide more nest site location for voles. On the negative side, these same feature changes would benefit spotted owls which could have direct negative impact to voles by eating them.

Mollusks

The proposed Coarse Wood Development project would have little direct impact to any of the special status mollusk species. The canopy of any of the proposed treatment units would not be opened enough to cause any change in the microclimate at the forest floor. The addition of large down wood would have a positive benefit to those species that gravitate toward coarse wood. None of these possible impacts would cause any change in the status of any of the Sensitive mollusk species.

Johnson's Hairstreak

Since the Coarse Wood Development project would only target Douglas-fir trees for treatment there is very little likelihood that the Johnson's hairstreak would be affected by the project. The only possibility would be if a tree that was felled impacted a western hemlock limb that is infected by mistletoe, and that happened to be host to the butterfly larvae; a very small possibility but a possibility nonetheless. It is virtually impossible for this project to cause adverse impact to the population of Johnson's hairstreak.

Migratory Bird Treaty Act

While it is true that a number of birds would benefit from the proposed Coarse Wood Development project, there would not be any appreciable impact on any listed "species of conservation concern" with the possible exception of the northern goshawk which may possibly benefit from having a little more structural diversity and slightly less canopy continuity as would result from creating snags and down wood in small clumps of 5 trees. None of the openings created from the clumping of treatments would be large enough to influence the habitat quality of any other of the species of conservation concern. Some birds that would benefit from the treatments would be the suite of woodpeckers (pileated, hairy, downy and flicker) and also, more indirectly, those species that are secondary cavity users such as chestnut-backed chickadees and even spotted owls who have been known to use old pileated woodpecker holes that have been enlarged by other processes.

Cumulative Effects

This project when considered with other activities in the five mile analysis area would not result in any measurable increase in negative or positive effects to any species analyzed here.

3.3.3.3 Environmental Effects - Alternative 2: No Action

None of the environmental effects associated with not implementing the Coarse Wood Development Project would result in the need to elevate the concern for any Special Status Species.

Red Tree Vole

The No Action alternative would have very little impact on the red tree vole. The very small possible negative impacts associated with the Proposed Action would not occur, nor would the small beneficial impacts. The stands would continue to provide good habitat for red tree voles now and into the future.

Mollusks

By not implementing the Coarse Wood Development project the potential positive impact of immediately providing desirable habitat features such as large down wood would be foregone. The forest stands would continue to age and through small disturbances and site competition, would eventually input favorable structural features over time.

Johnson's Hairstreak

Implementing the No Action alternative would not affect the Johnson's hairstreak.

Migratory Bird Treaty Act

Selection of the No Action alternative would not have any appreciable impact to any Species of Conservation Concern. The benefits for birds covered by the MBTA that could be realized from the Proposed Action would be foregone, especially for those species that are intricately connected to coarse wood such as woodpeckers.

Cumulative Effects

None of the impacts associated with the No Action alternative would rise to an intensity level that would result in cumulative impacts to any of the wildlife resources addressed in this EA.

3.3.4 Soils

3.3.4.1 Affected Environment

The project area is in the same general area as Project 1 (See Section 2.3.4.1). The affected environment is similar to Project 1 except that it is limited to the Volcanic Highlands landtype that are located in headwater drainage areas on mostly steeper slopes that are more prone to shallow landsliding.

3.3.4.2 Environmental Effects - Alternative 1: Proposed Action

Implementation of the proposed action would result in minimal soil disturbance and no expected loss in long-term soil productivity. Treating smaller diameter trees (18 to 30 inches dbh) would add a small amount of organic matter to the forest floor.

This addition would have a slight beneficial effect on soil productivity at the site scale, but no measurable effect beyond that scale. Current soil processes and conditions would continue to occur based on current conditions.

Cumulative Effects

No cumulative effects to soil resources would result from the proposed action in the project area. Effects would be contained within the project areas, and there would be no other uses affecting this resource.

3.3.4.3 Environmental Effects - Alternative 2: No Action

Implementation of the No action alternative would result in no soil disturbance; therefore, there would be no effect. The soil resource within the project area would continue to evolve dependant on ecological processes currently in place.

Cumulative Effects

Since there would be no soil disturbance, no cumulative effects to soil resources would result from the proposed action in the project area.

3.3.5 Water Resources

3.3.5.1 Affected Environment

The project area is in the same general area as Project 1 (See Section 2.3.5.1). See the affected environment under section 2.3.5.1 for an overall description of the water resources in the project area. Stand age is 78 to 118 years old.

3.3.5.2 Environmental Effects - Alternative 1: Proposed Action

The proposed action is unlikely to result in detectable effects to watershed hydrology, channel morphology, and water quality. The action would not permanently alter the aquatic system either by affecting its physical integrity, water quality, sediment regime or stream-flow. It may result in a small amount of sediment input and localized stream bank material being displaced. Any short-term sediment and turbidity inputs would be in short pulses and likely not be measurable or visible far (>50 feet) downstream. In the long-term, the project could improve water quality by increasing the amount of LWD. Added wood would increase the streambed roughness, decrease the local slope of the channels, and increase the sediment storage capacity of these channels. Channels would become less effective in transporting sediment and wood downstream.

Cumulative Effects

The proposed project would have a small additive local effect by adding wood to channels. It is unlikely that the project would have a cumulative effect for water quality on the scale of the subwatershed or to any designated beneficial uses.

3.3.5.3 Environmental Effects - Alternative 2: No Action

Under this alternative, there would be no direct or indirect effects to water quality and stream hydrology. Trees would not be felled along streams that could interact with stream channels and collect sediment and debris. Current low levels of LWD in streams and poor sediment storage in channels would continue at current trends, changing periodically with new disturbance.

Cumulative Effects

Since there would no change to current conditions and trends, there would be no cumulative effects to water resources.

3.3.6 Threatened or Endangered Fish Species or Habitat

A recent District Court decision has prompted the National Marine Fisheries Service (NMFS) to list Oregon Coast (OC) coho as "Threatened" under the Endangered Species Act (ESA). The listing is posted in Federal Register notice Vol. 73 No. 28 dated February 11, 2008. The effective date of this listing is May 12, 2008 and also designates Critical Habitat (CH) for the Oregon Coast coho evolutionary significant unit (ESU).

OC coho and designated Critical Habitat are present in both Moon and East Creeks.

3.3.6.1 Affected Environment

The Coarse Wood Development project would occur within the Moon Creek sub watershed in upland forest and within the riparian reserve LUA. Wildlife treatments in general would not overlap treatment areas proposed in project 1. Approximately 300 acres are proposed for treatment. There is only one treatment unit that is in close proximity to listed fish. This unit is located in T3S-R8W section 15 in the Northwest quarter with approximately 400 ft of the treatment unit adjacent to East Creek. All other proposed habitat enhancement treatments are located in upland areas or riparian reserves that are not in close proximity to listed fish.

3.3.6.2 Environmental Effects - Alternative 1: Proposed Action

The only causal mechanism for potential effects to listed fish from coarse wood development treatments would come from falling trees or portions of trees directly into streams where listed fish are present. This project does not propose to fall any trees or portions of trees into listed fish habitat and therefore is expected to have "*No Effect*" on OC coho or their designated critical habitat.

Cumulative Effects

There would be no cumulative effects as a result of implementing Alternative 1 as proposed.

3.3.6.3 Environmental Effects - Alternative 2: No Action

No wildlife habitat treatments as described in the proposed action would occur at this time. The effects identified in the action alternative would not occur. The stands proposed for treatment would continue on a slow trajectory toward late-seral habitat. Potential downstream movement of LWD to EFH would continue at the current rate influenced by natural disturbances such as landslides, debris flows and natural tree mortality and competition. This alternative would not implement any actions and therefore is expected to have "No Effect" on OC coho or their designated critical habitat.

3.3.7 Fish Species with Bureau Status and Essential Fish Habitat Assessment

Oregon Coast Steelhead are the only species with Bureau Status located in the proposed project area, and are present in essentially the same distribution as OC coho. Oregon Coast Steelhead are also listed as a species of concern by NOAA Fisheries, and are a sensitive species in Oregon under BLM's Special Status Species listing. Effects to Oregon Coast steelhead are discussed below.

Steelhead are present in essentially the same distribution as OC coho in the project area. Oregon Coast Steelhead are listed as a species of concern under the ESA, and are a sensitive species in Oregon under BLM's Special Status Species listing.

3.3.7.1 Affected Environment

See section 3.3.6.1 Affected environment T&E Fish

3.3.7.2 Environmental Effects - Alternative 1: Proposed Action

For the purposes of this effects analysis Oregon Coast Steelhead are so similar to OC coho in distribution as well as physical, and biological requirements, that the effects to them are considered the same as those discussed for OC coho. (See section 3.3.6.2 T&E Fish)

The actions as proposed in project 2 would have "No Effect" on Oregon coast steelhead or contribute to the need to list any Bureau Status species under the ESA, or MSA.

Conclusion:

The environmental effects resulting from implementing the proposed action alternative are highly unlikely to have any effect on EFH. Potential long term beneficial effects could include larger sized LWD entering the stream network sooner as a result of increased growth rates of trees in proximity to headwater streams in the treated units. Based on the incorporated design features, proximity of project actions to MSA fish species and their habitat, and seasonal restrictions it is highly unlikely that the proposed action would have any negative effect on EFH, and is unlikely to contribute to the need to list any fish species under the MSA or ESA.

Cumulative Effects

There would be no cumulative effects as a result of implementing Alternative 1 as proposed.

3.3.7.3 Environmental Effects Alternative 2: No Action

No wildlife habitat treatments as described in the proposed action would occur at this time. The effects identified in the action alternative would not occur. The stands proposed for treatment would continue on a slow trajectory toward late-seral habitat. Potential downstream movement of LWD to EFH would continue at the current rate influenced by natural disturbances such as landslides, debris flows and natural tree mortality and competition.

3.3.7.4 Essential Fish Habitat Assessment (Project 2)

The assessment below describes the likely effects from implementing project 2 as proposed to Essential Fish Habitat (EFH) for OC coho and chinook salmon. Coho and Chinook salmon are located in the analysis area of East and Moon creeks. Chinook distribution ends approximately ¼ mile below coho in both streams. A detailed description of coho distribution is located above in section (2.3.7.1 T&E fish).

Water Quality, Water Quantity, LWD, and Substrate Characteristics

Project 2 does not propose to fall any trees directly in to the stream channel within EFH. The trees or tops of trees that would end up in stream channels are well above EFH and would not be expected to negatively affect water quantity, quality or substrate characteristics. Potential benefits of falling LWD in these upper stream reaches include sediment storage and increased in channel complexity as well as potential movement downstream into EFH. The small number of trees that would be treated within the riparian reserves would not be expected to alter future LWD input. In the event of large scale disturbances such as debris flows, LWD in headwaters could improve the quality and quantity of LWD downstream within EFH.

Fish Passage

The implementation of project 2 would have "No Effect" on fish passage in the Moon Creek watershed.

Forage Species

Actions proposed in project 2 do not have a causal mechanism to affect forage species. It is expected that there would be "No Effect" to forage species from implementing project 2 as proposed.

Channel Geometry

Inputs of LWD into headwater stream reaches would not directly alter channel geometry within EFH. However, LWD does have the potential to eventually reach and affect EFH in the event of large scale natural disturbances such as debris flows or floods. The LWD in headwater streams could move down stream channels and create debris jams and increased channel complexity that has a tendency to alter stream geometry by diverting flows, storing sediment, and creating scour and deposition zones.

Road Density

Project 2 proposes no actions with causal mechanism to affect road density and therefore would have "No Effect" on road density in the Moon Creek subwatershed.

3.3.8 Invasive, Nonnative Species (Executive Order 13112)

3.3.8.1 Affected Environment

Botanical surveys for noxious weeds at the Moon Creek project area began in spring 2007. There are many Priority III invasive species that grow within the project area, including Bull Thistle (*Cirsium vulgare*), Scot's Broom (*Cytisus scoparius*), Tansy Ragwort (*Senecio jacobaea*), Himalayan Blackberry (*Rubus discolor*), and St. John's-wort (*Hypericum perforatum*), however, established populations are most commonly located along existing roads. Within undisturbed timber stands, established native plant associations typically prevent the establishment of invasive, non-native populations. Most non-native weed species are not shade tolerant and will not persist in a forest setting as they compete for light when tree canopies close and light to the under-story is reduced.

3.3.8.2 Environmental Effects - Alternative 1: Proposed Action

Minimal to No Effect - Project design features such as girdling or felling of individual trees would not result in the type or amount of disturbance that would allow for an increase in populations of invasive, non-native species. Because these activities would occur within established native plant associations, existing competition from native populations would mitigate the establishment of any invasive, non-native species.

Cumulative Effects

Refer to the Cumulative Effects for Project #1 Density Management Thinning

3.3.8.3 Environmental Effects Alternative 2: No Action

No Effect – The plant communities within the project area would continue to be dependant on ecological processes currently in place if no action is taken. No appreciable increase in the noxious weed populations identified during the field surveys is expected to occur.

Cumulative Effects

There would be no cumulative effects under the No Action alternative.

4 LIST OF PREPARERS

The following individuals participated on the interdisciplinary team or were consulted in the preparation of this EA:

Interdisciplinary team lead	Andy Pampush
Assistant Team Lead	David Larson
NEPA review	Bob McDonald
Silviculturist	John Johansen
Wildlife Biologist	Andy Pampush
Soils	Dennis Worrel
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Fisheries Biologist	Russ Chapman
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Logging Systems Specialist	Sandra Holmberg
Engineering	Brett Jones
Fuels	Kent Mortensen
Outdoor Recreation and Visual Quality	Debra Drake
GIS Specialist	Russ Chapman

APPENDIX 1 – Public Comments to Scoping for the Moon Creek Projects, Including BLM Responses

On November 7, 2007, a Scoping Letter was sent to 44 individuals, organizations and agencies (Project Record Document 6). As a result of this scoping effort, four letters providing comments were received (Project Record Documents 9-12). All comments presented in this appendix are direct quotes from the comment letter received.

Project Record Document 9

Keith Braun
District Fish Biologist
Oregon Department of Fish and Wildlife
North Coast Watershed District
4907 Third Street
Tillamook, OR 97141

Thinning

"During timber density management activities, we recommend that minor species (cedar, hemlock, true fir, etc.) be reserved from cutting to promote diversity within stands. When creating snags or considering leave trees for future snag and down wood recruitment, we recommend selecting trees > 18 inches dbh (ideally those that have significant stem defects) as providing greatest benefit to wildlife species. We would recommend that coarse wood proposed to be left in the units be located well away from roads, or at locations within the unit that would make them less accessible to theft for firewood or other purposes."

BLM Response:

The project design features (Sections *2.2.2.2* and *3.2.1.2*) are consistent with the commenters recommendations

Fish Bearing Streams

"We would encourage BLM to be proactive on any opportunities within these project locations to place large wood material in fish bearing streams.

"Any culvert installations, or replacements, on fish bearing streams must meet, or exceed, ODFW's fish passage criteria."

BLM Response:

The placement of large wood in fish bearing streams is not part of the Moon Creek Projects since the design for such a project was found to be beyond the scope of the Moon Creek Projects EA.

The only culvert location that would be on a fish bearing stream is in the upper reaches of East creek and is planned to be a temporary pipe that would be installed and removed during the same "in-stream work period". See section *2.2.2.1*.

Project Record Document 10

Katherine Skinner
South District Planner
Oregon Department of Forestry
5005 Third Street
Tillamook, OR 97141

The Oregon Department of Forestry did not provide comments related to the project. They provided maps of planned current and future operations adjacent to the proposed Moon Creek projects.

Project Record Document 11

Chandra LeGue
Oregon Wild - Western Field Office
P.O. Box 11648
Eugene, OR 97440

Thinning

"In general, Oregon Wild supports thinning that enhances forest health. In particular, we support variable density thinning which allows young stands to develop into more complex and resilient forests. This means that thinning should be done in a way that creates ¼ to ½ acre gaps, dense patches, lightly thinned, moderately thinned, and heavily thinned patches in every stand.

"Please consider using the principles of VDT in planning harvest prescriptions for this project.

"In young stands in Riparian Reserves, we support thinning activities that enhance development of trees to shade streams and become sources of coarse woody debris, as long as these activities do not result in yarding corridors, roads, or other yarding activities impacting water quality and aquatic habitat. We encourage you to plan on entering riparian reserves only once. This may mean thinning a little heavier, completely removing roads leading to the stand, and creating more snags and down wood."

"Please be sure your objectives include controlling the spread of invasive weeds and reducing populations of these weeds, which serve as seed sources in disturbed areas."

BLM Response:

The stands proposed for treatment are relatively dense, single-storied 31- to 58-year-old Douglas-fir-western hemlock stands with few small openings and scattered hardwoods and one unit with a fairly distinct laminated root rot pocket. The proposal would thin the stands in a variable-density manner, including "gaps" where heavier thinning would occur in ¼ to 1 acre patches encompassing approximately 10% of the unit acreage. Many stands of similar type as the proposed units were evaluated for density management but for various reasons such as slope instability and lack of suitable access were not included in the density management proposal. These stands would remain in a dense condition and would provide a measure of diversity to the treated stands upon project completion.

Thinning of the Riparian Reserve stands is included in the proposed density management. The prescription for these stands is somewhat conservative due to concerns from NOAA – Fisheries regarding potential impacts to ESA listed fish. There would be no "gaps" within the first site-potential tree height from fish-bearing steams and the thinning would be fairly light. Some yarding corridors necessarily would need to be cut through some riparian buffers but they would be kept to a minimum width and number and would not be across fish bearing streams, additionally full suspension of logs would be required over any stream to protect stream banks and water quality.

No new road or landing construction is planned in Riparian Reserves and an overall decrease of approximately 2.0 miles of road in the Moon Creek subwatershed would result from the implementation of the Moon Creek Project.

Equipment washing has been incorporated as part of the project to help minimize the potential for the introduction of invasive weeds. Other projects in the Tillamook Resource Area independent of the Moon Creek project are addressing reducing invasive species on BLM lands in the Salem District (Westside Salem Integrated NNP Management Plan).

A detailed description of the proposed treatments can be found in *EA section 2.2.2*.

Road Construction

"Oregon Wild believes it is possible for the BLM to conduct young stand thinning without extensive construction of new roads. For example, Eugene BLM planned the Upper Siuslaw LSR Restoration Project with five action alternatives. One alternative would thin 6525 acres and construct no new roads. Another would treat 5660 acres and construct no spurs over 200 feet."

"The BLM should do an analysis that illuminates how many acres of thinning are reached by each road segment so that we can distinguish between short segments of spur that allow access to large areas (big benefit, small cost) and long spurs that access small areas (small benefit, big cost)."

"In such a heavily managed landscape, additional roads will almost certainly lead to significant cumulative effects to the watershed and forest vegetation."

BLM Response:

The Moon Creek Project proposes to construct 0.5 miles or less of new road, mostly short spurs to landing locations that would allow cable yarding of areas that were previously ground-based yarded. The longest new road segment is less than 700 feet and would connect two existing old roads in a more ecologically sound way than was done when the roads were constructed approximately 40 years ago.

The BLM did and does informally consider the cost (both ecologically and monetarily) verses the benefit of constructing road to access harvest units. However, we feel that a simple road length:acres accessed analysis could render very misleading results. As an example, a road that may be marginally acceptable due to its length relative to the acres accessed by one project in time may not factor in the potential benefit for accessing units in the future that are not part of the current project. Another consideration is that not all roads and construction incur the same impacts per unit of distance; for instance a long road constructed on a rocky ridgetop may have much less ecological impact than a shorter road constructed mid slope with several stream crossings. The Moon Creek IDT did considerable deliberation regarding roads and made every effort to keep road impacts to a minimum. Figure 3 of the EA shows the proposed road and culvert work and offers a pictorial view of the road construction/renovation vs. acres accessed.

Cumulative effects of road impacts was considered and the Moon Creek project plans to have an overall reduction in road mileage in the subwatershed at the completion of the project.

Fish & Wildlife – *"Special status species surveys must be completed prior to developing NEPA alternatives and before the decision is determined. On-the-ground field reconnaissance surveys must be done and used to develop NEPA alternatives."*

"We support the planned wildlife enhancement project activities (adding snags and down wood, and possibly placing logs in East Creek), but hope new roads are not needed to access these areas."

Water Quality – "*Project analysis should separately discuss each of the Aquatic Conservation Strategy objectives (under the Northwest Forest Plan). Commercial harvest activities or road construction in key watersheds or municipal watersheds should be avoided in order to protect water quality."*

NEPA Alternatives – "*A full range of action alternatives should be considered for this project. These alternatives should include higher levels of wildlife enhancement (over more acres as needed), fewer roads (if possible), and more road decommissioning in the watershed."*

BLM Response:

Surveys for red tree voles were completed in the vicinity of the Moon Creek density management project and the results were used in developing the unit configuration and design features. Terrestrial mollusk surveys have been completed for the spring season in 2008 and surveys will also be conducted in the fall prior to timber sale decisions and the project will be modified if any of the truly rare species are encountered (see section *2.3.3.2* of the EA).

The proposed Coarse Wood Development project would not involve any road construction or renovation. Activities would involve hand tools (including chainsaws), not any kind of heavy equipment.

Appendix 4 of the EA discusses the Aquatic Conservation Strategy objectives for both Moon Creek projects.

The Moon Creek Projects are the result of the Tillamook BLM's integrated planning process which looked at the whole Moon Creek subwatershed and considered a wide array of projects from pre-commercial thinning to road projects to wildlife projects. The two projects analyzed here include most of the density management and coarse wood development opportunities to be found in the watershed. Approximately 38% of the acres that otherwise meet the criteria for density management have been considered but subsequently dropped from consideration due to various reasons such as slope instability, access or other environmental constraints. The forest stands being considered for coarse wood development were evaluated for current suitability and reasonable access. Many stands in the Moon Creek subwatershed already are developing late-successional characteristics while many others are too young and comprised of trees too small to be good candidates for wildlife treatments.

Project Record Document 12

Jacob Groves
Western Oregon Field Forester
American Forest Resource Council
2300 Oakmont Way
Suite 205-A
Eugene, OR 97401

Economic Viability

"AFRC would like to see all timber sales be economically viable. Appropriate harvesting systems should be used on all units to achieve economically viable sale and increase the revenues to the government. AFRC supports road construction, reconstruction, and maintenance that will help the Salem BLM offer economically viable timber sales, (and) give them greater access to the area for future silvicultural treatments." Temporary roads can always be removed, or made inaccessible to vehicles after logging operations are completed."

"Seasonal, recreational, and wildlife restrictions often make timber sales extremely difficult to complete within the contract guidelines. AFRC would like to encourage the Salem BLM to offer sales that will

allow winter harvesting on improved roads or allow for roads and spurs to be improved so that winter harvesting can be accomplished."

BLM Response:

The Moon Creek Projects IDT analyzed the impacts associated with the most economically viable harvest system for each unit, while keeping the adverse impacts to within limits set by our planning documents and Best Management Practices. Ground-based harvest systems would be employed to keep logging costs as low as possible wherever practicable. The density management project would take advantage of old roads to provide access to harvest areas while keeping new road construction to a minimum.

While the IDT investigated ways to allow for extended season or winter time harvest operations, the reality is that hauling logs within watersheds where Endangered Species Act listed fish are present precluded that option. The potential for increased sedimentation associated with hauling in a Tier 1 Key Watershed with listed fish would cause the consultation process to delay the planning and implementation of the Moon Creek Projects beyond what would be reasonable for a project of this scope.

Fuels Treatment

"AFRC would like to see the Salem BLM have some flexibility for fuels treatments in the Moon Creek Project. Rather than specifying a specific method of accomplishing your resource objectives, you should instead identify the objectives you are trying to accomplish and any limitations to resource disturbance you require. The purchaser could then identify the method they would like to implement to meet the resource objectives given their particular employee/equipment mix."

BLM Response:

The Moon Creek Density Management project is not expected to require a great deal of fuels treatment. Treatment areas would generally be along roads, landings, property lines, and potentially in some of the heavier thinned "gap" areas (less than 10% of the unit areas), or root rot pockets (<5 acres). The EA does not specify at this point which method would be used in any given area but anticipated impacts would be expected based on the type of harvesting system used. As an example, piling at a landing would most likely be done by the loader at the landing whereas fuels reduction in a "gap" area in a cable yarded unit would be done by some hand piling or swamper burning method. In order to meet the requirements of NEPA the BLM has to be able to predict with some certainty what methods would be employed in order to predict the impacts. Cost consideration would be a factor in deciding how to accomplish the objectives of fuels reduction at the time of sale preparation.

Thinning Riparian Areas

"AFRC would like to voice support for thinning treatments in the riparian areas of the Moon Creek Project. By prescribing small no cut buffers (25-60 feet) to be left to maintain stream temperatures and thinning the remaining acres inside the riparian reserves you can achieve the management objectives of moving them into a late seral habitat faster. By reducing the no cut buffers to 25-60 feet and thinning down to that distance, the forest also harvests more volume during the sale thus reducing unit cost."

BLM Response:

The BLM has for many years been treating Riparian Reserves as part of the forest restoration activities and plans to continue to do so. However, in order to conduct Section 7 ESA consultation the riparian no-harvest buffers for non-fish bearing streams are prescribed to be 60 feet, and 100 feet for fish bearing. The vast majority of the streams in and around the harvest units are non-fish bearing and thus would have 60 foot no-harvest buffers. These no-harvest buffers are considered part of the unthinned portions of the units that provide density variability on the landscape scale.

APPENDIX 2 - Past, Present, and Reasonably Foreseeable Future Actions for the Moon Creek Projects

List of Other Actions – This list contains a number of identified ongoing and/or past, present or reasonably foreseeable future projects, activities or programs of work; it serves as a source or pool of activities that various specialists may have considered while describing affected environments or conducting effects analysis for the Moon Creek Projects. Depending upon the resource and/or temporal or spatial scale of the analysis, projects to be considered include those projects which may continue to impact or are expected to impact the same resource at the same time and place as the proposed action, and/or have contributed to the current condition in a manner that still has impacts upon the same resources.

- An occasional discretionary O&C Road Use Permit to haul timber or rock on BLM-controlled roads.
- Road use and new road construction via non-discretionary right-of-way agreements with Green Diamond Resource Company and Oregon Dept. of Forestry.
- Road maintenance (rock replacement, grading, ditch maintenance, drainage structure maintenance and replacement, landslide repairs) on BLM and private logging roads (OR-086-06-01 DNA).
- Several culverts have been replaced and sidecast has been pulled back along upper East Creek Road in Section 10 and 11 of T3S, R8W (Coastal Road Stabilization EA OR-086-00-04)
- Issuance of Special Forest Products permits in compliance with the Special Forest Products program (OR-086-02-02CX).
- Large wood removal from stream channels (stream cleaning) associated with timber sales near streams up until the late 1970s.
- Extensive Fish habitat enhancement including, large wood placement, alcove construction, and riparian planting projects in the lower portion of East Creek from the large culvert on East Creek Rd in section 15 upstream approximately 1.5 miles. There were several phases of habitat enhancement that occurred on this reach. There were multiple extensive large wood placement projects, including the construction of alcoves throughout the 80's. The last habitat enhancement work on this reach was in 1995 and included maintenance to existing structures and also added some new structures. Riparian planting was also conducted at numerous times throughout the 80's and mid 90's.
- It is expected that another fish habitat enhancement project will occur on East Creek within the next ten years
- The deep fill culvert on East Creek in Section 15 may possibly be removed or replaced with a bridge, or large pipe arch to facilitate fish passage sometime within the next ten years.
- The Tillamook Resource Area has completed Activity Planning in the Moon Creek and East Creek subwatersheds, which includes the Moon Creek Projects area. This planning process identified a number of potential projects which could be selected for development. The Moon Creek projects are projects identified in the Activity Plan which have not yet been accomplished.
- There is one BLM density management project recently completed located within and/or near the Moon and East Creek subwatershed area (Southern Flame I Timber sale TS05-104) (T3S-R8W, sec 1) This project had similar objectives as the proposed action; to promote late-seral habitat..
- ODF has completed approximately 225 acres of regeneration harvest in approximately the last five years (from aerial photos), and plans to either thin or regeneration harvest another 210 acres within the next five years (from scoping information supplied by ODF, project record document #10).
- Based on preliminary road work and recent boundary postings, Green Diamond Resource Company is expected to clearcut harvest the remaining ~210 acres of mid-seral forest within the subwatershed (Sec. 12, T3S, R7W). Also, within the last ~ five years private industrial forest operators have clearcut harvested approximately 640 within the subwatersheds.
- According to personnel at the Hebo Ranger Station, the U. S. Forest Service will be conducting a Nestucca basin-wide planning effort beginning in the fall of 2008. All of the Forest Service land in the Nestucca Basin is managed for spotted owl and marbled murrelet recovery and therefore only thinning

projects would be planned. The soonest they expect any projects to be ready is in three to five years. It is unknown presently if any projects would be planned and implemented within the Moon Creek Projects planning area.

- Historic BLM forest management practices in the area have had results which are still being realized today. Thousands of acres of mid-seral stands were commercially thinned in the late 1960s and the 1970s throughout the Nestucca watershed including the mature stand in the south ½ of T3S, R8W, Sec. 13. Most of this thinning was light and uniform; most of the snags or green trees with defect which were present at the time of the thinnings within or near the thinning units were felled or harvested. Clearcut harvesting fragmented much of the existing mature forest habitat and reduced patch sizes.
- BLM has implemented coarse wood development projects on approximately 300 acres of mature conifer forestland within the adjacent Bear Creek subwatershed in the mid 1990's. These projects primarily involved snag creation through girdling green trees within the live crown or at the base, along with some falling of green trees.
- There are approximately 250 acres of lands within the East and Moon Creek subwatersheds that are in permanent pasture. These lands are in the lower elevations near the main creeks and receive varying degrees of grazing use.
- Firewood cutting and salvage logging on state lands, and on federal lands consistent with the LSRA, including routine hazard tree felling would continue.

APPENDIX 3 - Aquatic Conservation Strategy Objectives

Aquatic Conservation Strategy Objective	*Remarks (No Action Alternative addresses all projects)*
1. Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features. *None of the Alternatives retard or prevent the attainment of ACS objective 1*	**No Action Alternatives:** The No Action alternative would maintain the development of the existing vegetation and associated stand structure at its present rate. The current distribution, diversity and complexity of watershed and landscape-scale features would be maintained. **Project 1 Density Management Action Alternative:** The proposed variable thinning in portions of the Riparian Reserve Land Use Allocation (Riparian Reserves) would result in forest stands that exhibit attributes typically associated with stands of a more advanced age and stand structural development (larger trees, a more developed understory, and an increase in the number, size and quality of snags and down logs) sooner than would result from the No Action Alternative. Since Riparian Reserves provide travel corridors and resources for aquatic, riparian dependant and other late-successional associated plants and animals, the increased structural and plant diversity would ensure protection of aquatic systems by maintaining and restoring the distribution, diversity and complexity of watershed and landscape features. **Project 2 Coarse Wood Development Action Alternative:** Creation of CWD in the project area would enhance, to a small degree, the diversity and complexity of forest stands in the affected watershed. At the landscape scale, diversity and complexity would be maintained.
2. Maintain and restore spatial and temporal connectivity within and between watersheds. *None of the Alternatives retard or prevent the attainment of ACS objective 2*	**No Action Alternatives:** The No Action alternative would have little effect on connectivity except in the long term within the affected watersheds. **Project 1 Density Management Action Alternative:** Long term connectivity of terrestrial watershed features would be improved by enhancing conditions for stand structure development. In time, function in these Riparian Reserves would improve as refugia habitat for late successional, aquatic and riparian associated / dependent species. Both terrestrial and aquatic connectivity would be maintained, or improved over the long-term, as Riparian Reserves develop late successional characteristics, lateral, longitudinal and drainage connectivity would be restored. **Project 2 Coarse Wood Development Action Alternative:** Creation of CWD would improve connectivity within and between watersheds by enhancing habitat for late successional dependant species in the treatment areas.

Aquatic Conservation Strategy Objective	*Remarks (No Action Alternative addresses all projects)*
3. Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations. *None of the Alternatives retard or prevent the attainment of ACS objective 3*	**No Action Alternatives:** It is assumed that the current condition of physical integrity would be maintained. **Project 1 Density Management Action Alternative:** Physical integrity of channels at crossings with culvert work would be altered for one to several years following repair/maintenance. The majority of stream crossings are on small 1st and 2nd order stream channels with little to no flow. Maintenance on these stream channels would not have long term effects to physical integrity of these stream channels. Due to the stable nature of channels at these locations, little to no additional disturbance to channel morphology would be expected either upstream or downstream from the crossing. The one larger order stream crossing on East Creek is on a very low gradient reach < 5% slope and is not expected to alter physical integrity upstream or downstream of the stream crossing at this location after removal. **Project 2 Coarse Wood Development Action Alternative:** This project would have no effect on the physical integrity of the aquatic system; therefore the current condition would be maintained.
4. Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. *None of the Alternatives retard or prevent the attainment of ACS objective 4*	**No Action Alternatives:** It is assumed that the current condition of the water quality would be maintained. **Project 1 Density Management Action Alternative:** No-cut buffers in Riparian Reserves would be maintained. The proposed temporary roads are on ridge top or mid-slope locations with no hydrologic connections or proximity to streams or riparian areas. Overall, the action alternative would be unlikely to have any measurable effect on stream temperatures, pH, or dissolved oxygen. Sediment transport and turbidity in the affected watersheds is likely to increase over the short term as a direct result of road repair and construction, hauling and yarding in and around the Riparian Reserve LUA. Over the long-term (beyond 3-5 years), current conditions and trends in turbidity and sediment yield would likely be maintained under the action alternative. **Project 2 Coarse Wood Development Action Alternative:** This project would have no effect on water quality; therefore the current condition would be maintained.
5. Maintain and restore the sediment regime under which aquatic ecosystems evolved. *None of the Alternatives retard or prevent the attainment of ACS objective 5*	**No Action Alternatives:** It is assumed that the current levels of sediment into streams would be maintained. **Project 1 Density Management Action Alternative:** No-cut buffers in Riparian Reserves would be maintained (minimum of 60 feet in treatment areas). Dry season hauling would minimize sediment delivery. After the sale short-term

Aquatic Conservation Strategy Objective	*Remarks (No Action Alternative addresses all projects)*
	localized increases in stream sediment can be expected during culvert removal and replacement, but BMPs and mitigation measures would be implemented to limit acceleration of sediment delivery to streams. As a result, it is unlikely that the action alternative would lead to a measurable change in sediment regime, including increases in sediment delivery to streams, stream turbidity, or the alteration of stream substrate composition or sediment transport regime. **Project 2 Coarse Wood Development Action Alternative:** This project would have no effect on the sediment regime; therefore the current condition would be maintained.
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. *None of the Alternatives retard or prevent the attainment of ACS objective 6*	**No Action Alternatives:** No change in in-streams flows would be anticipated. **Project 1 Density Management Action Alternative:** Because the proposed action would remove less than half the existing forest cover, it is unlikely to produce any measurable effect on stream flows. Within the Riparian Reserve LUA, substantial portions of the riparian canopy would be retained, therefore maintaining riparian microclimate conditions and protecting streams from increases in temperature. **Project 2 Coarse Wood Development Action Alternative:** The project would have no effect on in-stream flows.
7. Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands. *None of the Alternatives retard or prevent the attainment of ACS objective 7*	**No Action Alternatives:** The current condition of flood plains and their ability to sustain inundation and the water table elevations in meadows and wetlands is expected to be maintained. **Project 1 Density Management Action Alternative:** There would be no alteration of any stream channel, wetland or pond morphological feature. All operations, equipment and disturbances are kept a minimum of 60 feet from all wetlands and stream channels. Thus, the current condition of floodplain inundation and water tables would be maintained. **Project 2 Coarse Wood Development Action Alternative:** This project would no effect on floodplains or water table elevation; therefore the current condition would be maintained.
8. Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands. *None of the Alternatives retard or prevent the attainment of ACS objective 8*	**No Action Alternatives:** The current species composition and structural diversity of plant communities will continue along the current trajectory. Diversification will occur over a longer period of time. **Project 1 Density Management Action Alternative:** No-cut buffers would maintain structural diversity of plant communities within a minimum of 60 feet from all streams and wetlands in treatment areas. Thinning in Riparian Reserve LUA outside of the no-cut buffers would help to restore species composition by allowing more understory development and

Aquatic Conservation Strategy Objective	*Remarks (No Action Alternative addresses all projects)*
	structural diversity by creating horizontal and vertical variations that are currently lacking in the riparian treatment areas. **Project 2 Coarse Wood Development Action Alternative:** This project would have very little effect on the species composition and structural diversity of plan communities.
9. Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species. *None of the Alternatives retard or prevent the attainment of ACS objective 9*	**No Action Alternatives:** Habitats will be maintained over the short-term and continue to develop over the long-term with no known impacts on species currently present. **Project 1 Density Management Action Alternative:** The proposed action would have no adverse effect on riparian dependent species. Although thinning activities may affect invertebrates within the treatment areas, adjacent non-thinned areas should provide adequate refugia for the species. In the long term, the treatments would restore elements of structural diversity to treatment areas in Riparian Reserves. These attributes would help to provide resources that are currently lacking or are of low quality, and over the long-term, would benefit both aquatic and terrestrial species. **Project 2 Coarse Wood Development Action Alternative:** Creation of CWD would provide more habitat for populations of native invertebrate and vertebrate riparian-dependant species.

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