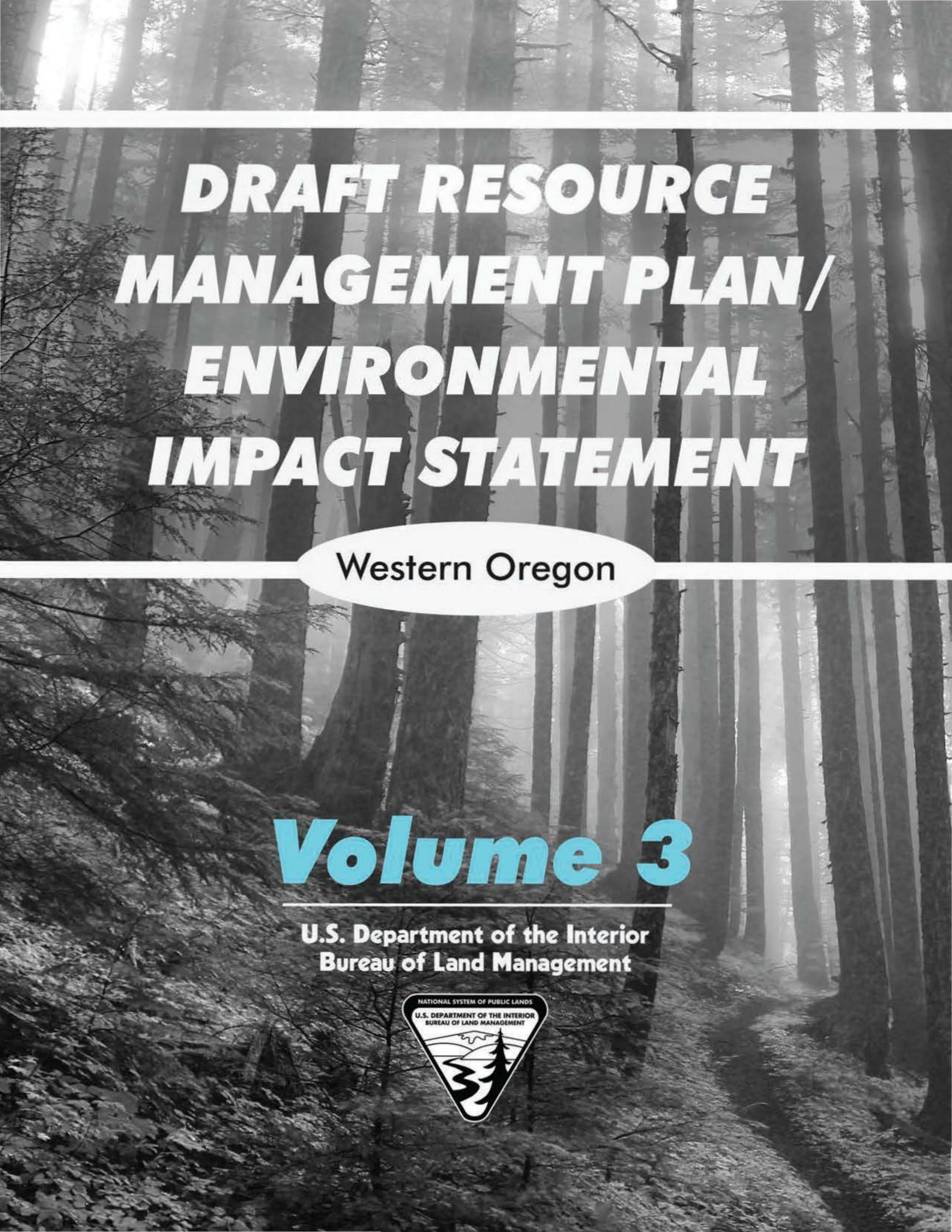

DRAFT RESOURCE MANAGEMENT PLAN/ ENVIRONMENTAL IMPACT STATEMENT

Western Oregon

Volume 3

U.S. Department of the Interior
Bureau of Land Management

The BLM manages more than 245 million acres of public land, the most of any Federal agency. This land, known as the National System of Public Lands, is primarily located in 12 western states, including Alaska. The BLM also administers 700 million acres of sub-surface mineral estate throughout the nation.

The BLM's mission is to manage and conserve the public lands for the use and enjoyment of present and future generations under our mandate of multiple-use and sustained yield. In fiscal year 2013, the BLM generated $4.7 billion in receipts from public lands.

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NATIONAL SYSTEM OF PUBLIC LANDS

U.S. DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT

Vol. 1

Vol. 4

Vol. 4

Vol. 1

Vol. 1

Vol. 1

Vol. 1

Vol. 1

Vol. 1

Vol. 1

Vol. 1

Vol. 2

Vol. 2

Vol. 2

Vol. 2

Vol. 2

Vol. 1

Vol. 1

Vol. 1

Vol. 1

Vol. 1

Vol. 2

Vol. 2

Vol. 2

Vol. 2

Vol. 2

Vol. 2

Vol. 2

Vol. 2

Vol. 2

Appendix A – Major Legal Authorities

The following is a list of the major legal authorities117 that are relevant to the BLM land use planning process, including laws, executive orders, and secretarial orders:

Laws

- The Oregon and California Railroad and Coos Bay Wagon Road Grant Lands Act of 1937 (O&C Act) as amended, (43 U.S.C. 1181a, *et seq.*) provides the legal authority for management of O&C lands by the Secretary of the Interior. The O&C Act requires that the O&C lands be managed "for permanent forest production, and the timber thereon shall be sold, cut, and removed in conformity with the principal (*sic*) of sustained yield for the purpose of providing a permanent source of timber supply, protecting watersheds, regulating stream flow, and contributing to the economic stability of local communities and industries, and providing recreational facilities."

- The Federal Land Policy and Management Act of 1976 (FLPMA), as amended (43 U.S.C. 1701 *et seq.*), provides the authority for BLM land use planning. The following are the more relevant sections:
    - Sec. 102 (a) (7) and (8) sets forth the policy of the United States concerning management of the public lands.
    - Sec. 201 requires the Secretary of the Interior to prepare and maintain an inventory of the public lands and their resource and other values, giving priority to areas of critical environmental concern (ACECs), and, as funding and workforce are available, to determine the boundaries of the public lands, provide signs and maps to the public, and provide inventory data to State and local governments.
    - Sec. 202 (a) requires the Secretary, with public involvement, to develop, maintain, and when appropriate, revise land use plans that provide by tracts or areas for the use of the public lands.
    - Sec. 202(c)(1-9) requires that, in developing land use plans, the BLM shall use and observe the principles of multiple use and sustained yield; use a systematic interdisciplinary approach; give priority to the designation and protection of areas of critical environmental concern; rely, to the extent it is available, on the inventory of the public lands; consider present and potential uses of the public lands; consider the relative scarcity of the values involved and the availability of alternative means and sites for realizing those values; weigh long-term benefits to the public against short-term benefits; provide for compliance with applicable pollution control laws, including State and Federal air, water, noise, or other pollution standards or implementation plans; and consider the policies of approved State and tribal land resource management programs, developing land use plans that are consistent with State and local plans to the maximum extent possible consistent with Federal law and the purposes of this Act.
    - Sec. 202 (d) provides that all public lands, regardless of classification, are subject to inclusion in land use plans, and that the Secretary may modify or terminate classifications consistent with land use plans.
    - Sec. 202 (f) and Sec. 309 (e) provide that Federal, State, and local governments and the public be given adequate notice and an opportunity to comment on the formulation of standards and criteria for, and to participate in, the preparation and execution of plans and

[177] This is not a complete list of all the legal authorities that direct BLM management.

programs for management of the public lands.
  - Sec. 302 (a) requires the Secretary to manage BLM lands under the principles of multiple use and sustained yield, in accordance with available land use plans developed under Sec. 202 of FLPMA. There is one exception: where a tract of the BLM lands has been dedicated to specific uses according to other provisions of law, it shall be managed in accordance with such laws.
  - Sec. 302 (b) recognizes the entry and development rights of mining claimants, while directing the Secretary to prevent unnecessary or undue degradation of the public lands.
  - Sec. 701 (b) provides that notwithstanding any provision of FLPMA, in the event of conflict with or inconsistency between FLPMA and the O&C Act, insofar as they relate to management of timber resources and disposition of revenues from lands and resources, the O&C Act shall prevail.

- The National Environmental Policy Act of 1969 (NEPA), as amended (42 U.S.C. 4321 *et seq.*), requires the consideration and public availability of information regarding the environmental impacts of major Federal actions significantly affecting the quality of the human environment. This includes consideration of alternatives and mitigation of impacts.

- The Clean Air Act of 1990, as amended (42 U.S.C. 7418), requires Federal agencies to comply with all Federal, State, and local requirements regarding control and abatement of air pollution. This includes abiding by requirements of State Implementation Plans.

- The Clean Water Act of 1987, as amended (33 U.S.C. 1251), establishes objectives to restore and maintain the chemical, physical, and biological integrity of the Nation's water.

- The Healthy Forests Restoration Act of 2003, as amended (16 U.S.C. 6501), contains a variety of provisions to expedite hazardous-fuel reduction and forest-restoration projects on specific types of Federal land that are at risk of wildland fire or insect and disease epidemics. It also provides other authorities and direction to help reduce hazardous fuel and restore healthy forest and rangeland conditions on lands of all ownerships.

- The Federal Water Pollution Control Act of 1948, as amended (33 U.S.C. 1323), requires Federal land managers to comply with all Federal, State, and local requirements, administrative authorities, process, and sanctions regarding the control and abatement of water pollution in the same manner and to the same extent as any nongovernmental entity.

- The Safe Drinking Water Act of 1974, as amended (42 U.S.C. 201), is designed to make the Nation's waters "drinkable" as well as "swimmable." Amendments in 1996 establish a direct connection between safe drinking water and watershed protection and management.

- The Endangered Species Act (ESA) of 1973, as amended, (16 U.S.C. 1531 *et seq.*):
  - Provides a means whereby the ecosystems upon which endangered and threatened species depend may be conserved and provides a program for the conservation of such endangered and threatened species (Sec. 1531 [b], Purposes).
  - Requires all Federal agencies to seek to conserve endangered and threatened species and utilize applicable authorities in furtherance of the purposes of the Endangered Species Act (Sec. 1531 [c] [1], Policy).
  - Requires all Federal agencies to avoid jeopardizing the continued existence of any species that is listed or proposed for listing as threatened or endangered, or destroying or adversely modifying its designated or proposed critical habitat (Sec. 1536 [a], Interagency

Cooperation).
  - Requires all Federal agencies to consult (or confer) in accordance with Sec. 7 of the ESA with the Secretary of the Interior, through the Fish and Wildlife Service and/or the National Marine Fisheries Service, to ensure that any Federal action (including land use plans) or activity is not likely to jeopardize the continued existence of any species listed or proposed to be listed under the provisions of the ESA, or result in the destruction or adverse modification of designated or proposed critical habitat (Sec. 1536 [a], Interagency Cooperation, and 50 CFR 402).

- The Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703 *et seq.*), decrees that all migratory birds and their parts (including eggs, nests, and feathers) are fully protected. The Migratory Bird Treaty Act is the domestic law that affirms, or implements, the United States' commitment to four international conventions (with Canada, Japan, Mexico, and Russia) for the protection of a shared migratory bird resource.

- The Wild and Scenic Rivers Act, as amended (16 U.S.C. 1271 *et seq.*), requires Federal land management agencies to identify potential river systems, and then study these rivers for potential designation as wild, scenic, or recreational rivers.

- The Wilderness Act, as amended (16 U.S.C. 1131 *et seq.*), authorizes the President to make recommendations to Congress for Federal lands to be set aside for preservation as wilderness.

- The Antiquities Act of 1906 (16 U.S.C. 431 *et seq.*), protects cultural resources on Federal lands and authorizes the President to designate National Monuments on Federal lands.

- The National Historic Preservation Act (NHPA), as amended (16 U.S.C. 470 *et seq.*), expands protection of historic and archaeological properties to include those of national, State, and local significance and directs Federal agencies to consider the effects of proposed actions on properties eligible for or included in the National Register of Historic Places. It also directs the pro-active management of historic resources.

- The American Indian Religious Freedom Act of 1978 (42 U.S.C. 1996 *et seq.*), establishes a national policy to protect and preserve the right of American Indians to exercise traditional Indian religious beliefs or practices.

- The Recreation and Public Purposes Act of 1926, as amended (43 U.S.C. 869 *et seq.*), authorizes the Secretary of the Interior to lease or convey BLM lands for recreational and public purposes under specified conditions.

- The Federal Coal Leasing Amendments Act of 1976 (30 U.S.C. 201 (a) (3) (A) (i)), requires that coal leases be issued in conformance with a comprehensive land use plan.

- The Surface Mining Control and Reclamation Act of 1977 (30 U.S.C. 1201 *et seq.*), requires application of unsuitability criteria prior to coal leasing and to proposed mining operations for minerals or mineral materials other than coal.

- The Mineral Leasing Act of 1920, as amended (30 U.S.C. 181 *et seq.*), authorizes the development and conservation of oil and gas resources.

- The Onshore Oil and Gas Leasing Reform Act of 1987 (30 U.S.C. 181 *et seq.*), provides that a

study be conducted by the National Academy of Sciences and the Comptroller General that results in recommendations for improvements which may be necessary to ensure the following are adequately addressed in Federal land use plans:
  - Potential oil and gas resources are identified.
  - The social, economic, and environmental consequences of exploration for and development of oil and gas resources are determined.
  - Any stipulations to be applied to oil and gas leases are clearly identified.

- The General Mining Law of 1872, as amended (30 U.S.C. 21 *et seq.*), allows the location, use, and patenting of mining claims on sites on public domain lands of the United States.

- The Mining and Mineral Policy Act of 1970, as amended (30 U.S.C. 21a) establishes a policy of fostering the orderly development of economically stable mining and minerals industries and studying methods for reclamation and the disposal of waste.

- The Taylor Grazing Act of 1934, as amended , (43 U.S.C. 315 *et seq.*), authorizes the Secretary of the Interior "to establish grazing districts, or additions thereto and/or to modify the boundaries thereof of vacant, inappropriate and unreserved lands from any part of the public domain . . . which in his opinion are chiefly valuable for grazing and raising forage crops[.] . . ." The Act also provides for classification of lands for particular uses.

Executive Orders

- Executive Orders 11644 and 11989 (both titled Use of Off-Road Vehicles on the Public Lands; 37 FR 2877 and 42 FR 26959, respectively) establish policies and procedures to ensure that off-road vehicle use shall be controlled to protect public lands.

- Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations; 49 FR 7629), requires that each Federal agency consider the impacts of its programs on minority and low-income populations.

- Executive Order 13007 (Indian Sacred Sites; 61 FR 26771), requires Federal agencies to the extent practicable, permitted by law, and not clearly inconsistent with essential agency functions to:
  - Accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners; and
  - Avoid adversely affecting the physical integrity of such sacred sites.

- Executive Order 13084 (Consultation and Coordination with Indian Tribal Governments; 63 FR 27655) provides, in part, that each Federal agency shall establish regular and meaningful consultation and collaboration with Indian tribal governments in developing regulatory practices on Federal matters that significantly or uniquely affect their communities.

- Executive Order 13112 (Invasive Species; 64 FR 6183) provides that no Federal agency shall authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk or harm will be taken in conjunction with the actions.

- Executive Order 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds; 66 FR 3853) directs the Fish and Wildlife Service, in coordination with Federal agencies and Executive departments, to take certain actions to further the implementation of the Migratory Bird Treaty Act in promoting conservation of migratory bird populations.

- Executive Order 13443 (Facilitation of Hunting Heritage and Wildlife Conservation; 72 FR 46537) provides, in part, that Federal agencies shall, consistent with agency missions evaluate the effects of agency actions on game species and their habitats; manage wildlife and wildlife habitats on public lands in a manner that expands and enhances hunting opportunities; work collaboratively with State governments to manage and conserve game species and their habitats; and seek the advice of State fish and wildlife agencies.

- Executive Order 13514 (Federal Leadership in Environmental, Energy, and Economic Performance; 74 FR 52117) directs agencies to measure, manage, and reduce greenhouse gas emissions toward agency-defined targets for agency actions such as vehicle fleet and building management.

- Executive Order 13653 (Preparing the United States for the Impacts of Climate Change) directs agencies to assess climate change related impacts on and risks to the agency's ability to accomplish its missions, operations, and programs and consider the need to improve climate adaptation and resilience.

Secretarial Orders

- Secretarial Order 3175 (Departmental Responsibilities for Indian Trust Resources), incorporated into the Departmental Manual at 512 DM 2, requires that if Department of the Interior (DOI) agency actions might impact Indian trust resources, the agency must explicitly address those potential impacts in planning and decision documents, as well as consult with the tribal government whose trust resources are potentially affected by the Federal action.

- Secretarial Order 3215 (Principles for the Discharge of the Secretary’s Trust Responsibility), incorporated into the Departmental Manual at 303 DM2, provides guidance to the employees of the DOI who are responsible for carrying out the Secretary's trust responsibility as it pertains to Indian trust assets.

- Secretarial Order 3289A1 (Addressing the Impacts of Climate Change on America’s Water, Land, and Other Natural and Cultural Resources) establishes a Department-wide approach for applying scientific tools to increase understanding of climate change and to coordinate an effective response to its impacts on tribes and on the land, water, ocean, fish and wildlife, and cultural heritage resources that the Department manages.

- Secretarial Order 3308 (Management of the National Landscape Conservation System) seeks to further the purposes of the Omnibus Public Land Management Act of 2009, which established the National Landscape Conservation System under the jurisdiction of the BLM in order to conserve, protect, and restore nationally significant landscapes that have outstanding cultural, ecological, and scientific values for the benefit of current and future generations, and the President’s initiative on America’s Great Outdoors.

- Secretarial Order 3310 (Protecting Wilderness Characteristics on Lands Managed by the Bureau of Land Management) affirms that the protection of the wilderness characteristics of public lands is a high priority for the BLM, and is an integral component of its multiple use mission; provides direction to the BLM regarding its obligation to maintain wilderness resource inventories on a regular and continuing basis for public lands under its jurisdiction; and further directs the BLM to protect wilderness characteristics through land use planning and project-level decisions unless it is determined that impairment of wilderness characteristics is appropriate and consistent with other applicable requirements of law and other resource management considerations.

- Secretarial Order 3330 (Improving Mitigation Policies and Practices of the Department of the Interior) establishes a Department-wide mitigation strategy that will ensure consistency and efficiency in the review and permitting of infrastructure development projects and in conserving our Nation's valuable natural and cultural resources.

- Secretarial Order 3335 (Reaffirmation of the Federal Trust Responsibility to Federally Recognized Indian Tribes and Individual Indian Beneficiaries) sets forth guiding principles that bureaus and offices will follow to ensure that the DOI fulfills its trust responsibility.

Appendix B – Management Objectives and Direction

This section identifies the management objectives and direction that would apply under all four action alternatives. This section begins by providing an overview of management objectives and direction common to all for major allocations, before providing objectives and direction common to all by resource. The following section describes the elements that are unique to each action alternative.

The BLM would permit activities that are not specifically mentioned in the management direction if they are consistent with management objectives.

Common to All by Major Allocation

Harvest Land Base

This allocation includes all lands not reserved from the Harvest Land Base.

Management Objectives

- Manage forests to achieve continual timber production that can be sustained through a balance of growth and harvest.
- Offer for sale the declared allowable sale quantity of timber.
- Recover economic value from timber harvested after a stand-replacement disturbance, such as a fire, windstorm, disease, or insect infestations.
- In harvested or disturbed areas, ensure the establishment and survival of desirable trees appropriate to the site and enhance their growth.
- Enhance the economic value of timber in forest stands.
- See also below under Fire, Fuels, and Wildfire Response; Forest Management; Northern Spotted Owl management.

Management Direction

- See below under Fire, Fuels, and Wildfire Response; Forest Management; Northern Spotted Owl management.

Late Successional Reserves

Management Objectives

- Protect stands of older, structurally-complex conifer forest.
- Maintain habitat for the northern spotted owl and marbled murrelet.
- Promote the development of habitat for the northern spotted owl in stands that do not currently meet suitable habitat criteria.
- Promote the development of nesting habitat for marbled murrelet in stands that do not currently meet nesting habitat criteria.
- See also below under Fire, Fuels, and Wildfire Response; Forest Management; Northern Spotted Owl management.

Management Direction

- See below under Fire, Fuels, and Wildfire Response; Forest Management; Northern Spotted Owl management.
- Within the LSR, the BLM may undertake activities such as individual tree removal, including the felling of hazard trees and stream logs, and the construction of linear and nonlinear rights-of-way or other facilities, including communication sites, as long as:
  - The forest stand continues to support the same northern spotted owl life history requirements.
  - Nesting-roosting habitat continues to support northern spotted owl nesting and roosting; dispersal habitat continues to support northern spotted owl movement and survival.

Riparian Reserves

Management Objectives in the Decision Area <u>West</u> of Highway 97

- Contribute to the conservation and recovery of listed fish species and their habitats and provide for conservation of special status fish and other special status riparian associated species.
- Maintain and restore the proper functioning condition of riparian areas, stream channels and wetlands by providing forest shade, sediment filtering, wood recruitment, stability of stream banks and channels, water storage and release, vegetation diversity, nutrient cycling and cool and moist microclimate.
- Maintain water quality and streamflows within the range of natural variability, to protect aquatic biodiversity, provide quality water for contact recreation and drinking water sources.
- Meet ODEQ water quality targets for 303(d) water bodies with approved Total Maximum Daily Loads (TMDLs).
- Maintain high quality water and contribute to the restoration of degraded water quality downstream of BLM-administered lands.
- Maintain high quality waters within ODEQ designated Source Water Protection watersheds.
- See also below under Fisheries.

Management Direction in the Decision Area <u>West</u> of Highway 97

- Maintain access to roads and facilities by removing danger trees and blowdown.
- Yarding corridors, skid trails, road construction, maintenance, and improvement would be allowed, where there is no practicable alternative to accomplish resource management objectives.
- Use site-specific BMPs (**Appendix I**) to maintain water quality during road construction and maintenance activities, including discretionary actions of others crossing BLM lands.
- Suspend winter haul when the ground is saturated and monitoring indicates sediment runoff to streams is predicted to occur from road degradation.
- Any substantive modifications of flood plains or wetlands must include off-site mitigation on Federal lands and maintain a “no net loss” of floodplains and wetlands value.
- Maintain equal value for floodplains and wetlands in terms of structure and function between the Selected and Offered lands in an exchange.
- Install sanitation systems that maintain water quality, (e.g. sealed vault or similar in new recreational developments).

- Mining operators with an accepted Notice or approved Plan of Operations will comply with performance standards (43 CFR 3809.420) including all applicable State and Federal water quality standards.
- Prevent slash burning within 30 feet of streams.
- Ground-based machinery for fuels reduction projects would not be operated within 50 feet of streams or on slopes >35 percent.
- Decommission streamside roads, where not needed for future management purpose.
- See also below under Fisheries.

Management Objectives for Forested Lands in the Decision Area East of Highway 97

- Provide for conservation of special status fish and other special status aquatic species.
- Provide for riparian and aquatic conditions that supply stream channels with shade, sediment filtering, leaf litter and large wood sources, and stream bank stability.
- Maintain and restore water quality and hydrologic functions.
- Maintain and restore access to stream channels for all life stages of fish species.

Management Directions for Forested Lands in the Decision Area East of Highway 97

Table B-1. Riparian Reserve distances by water feature.

Feature	Riparian Reserve Distance*
Perennial and fish-bearing streams	150 feet on each side of a stream channel as measured from the ordinary high water line.
Non-fish bearing intermittent streams, lakes, natural ponds, and wetlands >1 acre	100 feet on each side of a stream channel as measured from the ordinary high water line.
Constructed impoundments and ponds, and wetlands < 1 acre	Extent of riparian vegetation

* Reported distances are measured as slope distance

All water features

- Implement salvage harvest of timber after a stand-replacing disturbance as needed to reduce hazards to public health and safety in the Wildland Urban Interface.
- Fall and remove trees as needed for safety or operational reasons, including but not limited to: danger tree removal, creation of yarding corridors adjacent to nearby harvest units, and road construction, improvement, or maintenance.
- Implement instream and riparian restoration activities, such as placement of boulders and large wood in streams including tree lining from adjacent riparian areas for all streams. Place an emphasis on streams that have high intrinsic potential for fish, high priority fish populations (such as those defined in recovery plans), or high levels of chronic sediment inputs.
- Remove or modify constructed fish passage barriers to restore access to stream channels for all life stages of fish species.
- Apply fuels treatments and prescribed burns in the Riparian Reserve as needed to reduce the potential for uncharacteristic wildfires.

- Restrict livestock from the Riparian Reserve of streams with ESA-listed or anadromous fish species until 30 days following the emergence of salmonids from spawning beds.
- Manage livestock grazing in the Riparian Reserve at a level that allows maintenance or development of the proper functioning condition of riparian and wetland plant communities. Implement practices such as installing and maintaining livestock exclosures, managing season of use and intensity, developing off-stream watering facilities, and other appropriate techniques to attain this condition.

Perennial and fish-bearing streams

- Apply thinning and other silvicultural treatments to accelerate the development of potential natural forest stand conditions including late successional stand characteristics and native riparian shrub communities.
- Do not apply mechanical treatments within 60 feet (slope distance) on either side of the edge of the stream channel, as measured from the ordinary high water line.
- Retain snags and coarse woody debris in thinning operations, except for safety or operational reasons (e.g., maintaining access to roads and facilities).
- Do not apply mechanical treatments on slopes >35 percent, sensitive soils, or slide prone areas.
- Retain and promote long-term shade conditions.

Non-fish-bearing intermittent streams

- Apply thinning and other treatments to speed the development of large trees to provide an eventual source of large woody debris to stream channels.
- Do not apply mechanical treatments within 35 feet (slope distance) on either side of the edge of the stream channel, as measured from the ordinary high water line.
- Retain all snags and coarse woody debris in thinning operations except for safety or operational reasons (e.g., maintaining access to roads and facilities).

Lakes, natural ponds, and wetlands

- Apply thinning and other treatments to speed the development of potential natural vegetation communities. Do not apply mechanical treatments within 35 feet (slope distance) on either side of the edge of the water body, area of riparian vegetation, or seasonally saturated soils (whichever is greater).
- Retain all snags and coarse woody debris in thinning operations except for safety or operational reasons (e.g., maintaining access to roads and facilities).

Constructed impoundments and ponds

- Apply thinning and other treatments to speed the development of potential natural vegetation communities.

Management Objectives for non-forested lands in the decision area east of Highway 97

- Provide for conservation of Special Status fish and other Special Status aquatic species.
- Provide for the riparian and aquatic conditions that supply stream channels with shade, sediment filtering, leaf litter and large wood, and stream bank stabilization.
- Maintain and restore water quality.
- Maintain and restore access to stream channels for all life stages of fish species.

- Maintain and restore the proper functioning condition and ecological site potential of riparian and wetland areas.

Management Directions for non-forested lands in the decision area east of Highway 97

Table B-2. Riparian Reserve distances.

Feature	Riparian Reserve Distance[118]
Non-forested lands: all streams and wetlands	The extent of riparian vegetation as indicated by hydrophilic vegetation

- Manage livestock grazing in the Riparian Reserve at a level that allows maintenance or development of the proper functioning of riparian and wetland plant communities. Methods for attaining this condition will include, but are not be limited to, installing and maintaining livestock exclosures, managing season of use and intensity, developing off-stream watering facilities, and implementing other appropriate techniques.
- Remove conifer encroachment in the Riparian Reserve where conifers are interfering with the natural vegetation community type, or where excessive erosion may occur.
- Implement road improvement, storm proofing, maintenance, or decommissioning to reduce chronic sediment inputs along stream channels and water bodies.
- Apply prescribed burns and weed treatments in the Riparian Reserve as needed to reduce the potential for uncharacteristic wildfires.
- Implement instream and riparian restoration activities, such as placement of large wood and boulders in streams. Remove or modify constructed fish passage barriers to restore access to stream channels for all life stages of fish species.
- Apply BMPs for roads, stream and riparian restoration work, and vegetation management as needed to maintain or restore water quality (**Appendix I**).
- Manage livestock grazing where listed fish species occur to prevent direct impacts to spawning and incubation.

[118] Reported distances are measured as slope distance.

Common to All by Resource

Air Quality

Management Objectives

- Protect air quality related values in Federal mandatory Class I areas.
- Prevent exceedances of national, state, or local ambient air quality standards.

Management Direction

- For prescribed burning activities, comply with the Oregon Smoke Management Plan.
- Use BMPs to reduce dust from unpaved road surfaces during extended management operations, such as timber sales and wildfires. Example practices include reducing vehicle speed or applying dust suppressants.
- Follow State Implementation Plan requirements for activities that could negatively affect the status of air quality non-attainment or maintenance areas.

Areas of Critical Environmental Concern

Management Objective

- Maintain or restore important and relevant values in Areas of Critical Environmental Concern, including Research Natural Areas, and Outstanding Natural Areas.

Management Direction

- Implement activities as necessary to maintain or restore important and relevant values (**Appendix F**).
- Develop site-specific stipulations for leasable mineral development, as necessary, to maintain or restore relevant and important values. Examples might include no surface occupancy or conditional surface uses based on resource protection needs.
- Close Areas of Critical Environmental Concern with identified special management needs to salable mineral development.
- Petition for withdrawal from locatable mineral entry Areas of Critical Environmental Concern with identified special management needs associated with locatable mineral development.
- Manage all Areas of Critical Environmental Concern as Right-Of-Way Avoidance Areas.

Cultural/Paleontological Resources

Management Objectives for Cultural Resources

- Preserve and protect significant cultural resources and ensure that they are available for appropriate uses by present and future generations.
- Reduce imminent threats and resolve potential conflicts from natural or human-caused deterioration or potential conflict with other resources by ensuring that all authorizations for land and resource use will comply with Section 106 of the National Historic Preservation Act.

Management Direction for Cultural Resources

- Evaluate all documented cultural resources for NRHP eligibility. Protect all NRHP eligible or listed sites through avoidance or other protection measures.
- Conduct public education and outreach activities and develop materials in order to educate and interpret for the public the cultural and historic resources within the planning area.
- Assign all cultural resources into one of the use allocations in **Table B-3**.

Table B-3. Cultural use allocations with desired outcomes and management actions.

Use Allocation	Desired Outcome	Management Action
Scientific Use	Preserved until research potential is realized	Permit appropriate research including data recovery
Conservation for future use	Preserved until conditions for use are met	Propose protection measures/designations
Traditional use	Long-term preservation	Consult with Tribes; determine limitations
Public use	Long-term preservation, on-site interpretation	Determine limitations, permitted uses
Experimental use	Protected until used	Determine nature of experiments
Discharged from management	No use after recordation, not preserved	Remove Protective measures

Management Objectives for Paleontological Resources

- Protect and preserve significant localities from natural or human-caused deterioration or potential conflict with other resources.
- Provide appropriate scientific, educational, and recreational use, such as research and interpretive opportunities for paleontological resources.

Management Direction for Paleontological Resources

- Do not conduct management activities in significant localities where such activities would harm paleontological resources.
- Conduct public education, outreach activities, and develop materials to educate the public on paleontological resources existing within the planning area.

Eastside Klamath Falls Management Area

This land use allocation applies to the Klamath Falls Field Office lands east of Highway 97. The non-forested land objectives and direction apply to all non-forested lands within the Klamath Falls Field Office east of Highway 97. If there is no management direction described below for a specific resource, default to the management direction for west of Highway 97.

Management Objectives for <u>forested</u> lands

- Manage the Eastside Forest Management Area on a sustainable basis for multiple uses including wildlife habitat, recreational needs, riparian habitat, cultural resources, community stability, and commodity production, including commercial timber and other forest products.

- Promote development of fire-resilient forests. Apply prescribed burns, mechanical or hand fuels treatments to reduce the potential for uncharacteristic wildfires. Apply maintenance treatments at appropriate intervals to retain fire resilient conditions.

Management Direction for forested lands

- Utilize uneven-aged management in managing forest stands. This will include use of a combination of harvesting methods including thinning, single tree selection harvest, and group selection harvest.
- Conduct uneven-aged management harvests for the removal and sale of timber and biomass. Harvests will be applied to stands of any age for any one or more of the following purposes: maintain growth and vigor of the stand; adjust stand composition or dominance; recover anticipated mortality; reduce stand susceptibility to natural disturbance such as fire, windstorm, disease, or insect infestation; improve merchantability and value; and promote multi-structural conditions in forest stands.
- Retain an overstory component of trees in uneven-aged management harvest units to provide shade, reduce wind speed, and promote overall fire resiliency in the stand. Maintain relative density (Curtis 1982) between 15 and 55, but allow relative density to vary outside of this range based on vegetative type, site productivity, and fire risk factors such as slope, aspect, and elevation.
- Incorporate group selection harvest of up to five acres in size individually, and an aggregate level of up to 25 percent of the area of the treated stand within uneven-aged management harvest units when needed to: maintain or develop desired species composition; achieve desired diameter distribution; or address natural disturbances.
- Implement timber salvage harvest after disturbances to recover economic value and to minimize commercial loss or deterioration of damaged trees. Retain overstory trees as needed within regeneration harvest areas to provide for shade, frost protection, seeding, or other silvicultural needs.
- Convert lands historically supporting conifer species (other than juniper) that are currently growing primarily brush or hardwoods to conifer species suitable to the site.
- Apply pre-commercial thinning to forest stands to achieve long-term management objectives.
- Apply pruning to enhance timber value and for fuels and disease management.
- Retain snags and coarse woody debris during harvest of stands, except for safety or operational reasons. When the existing level of snags, on the average per acre over the stand to be treated, is either: (1) less than two snags over 16” DBH, or (2) the existing coarse woody debris over 12” in diameter and 12 feet in length totals less than 40 feet, new snags and coarse woody debris will be created to meet these levels. Also:
    - Snag and coarse woody debris levels described above will be met by any combination of the creation of new snags and coarse woody debris from live conifer trees and the retention of existing levels of snags (Class I and Class II) and coarse woody debris (Class I and Class II). If existing levels of snags and coarse woody debris are insufficient to meet these levels in a thinning project, the desired levels can be satisfied by including in the project decision the creation of snags and coarse woody debris within five years to meet these levels after completion of the harvest or associated fuels treatment.
    - Snag and coarse woody debris retention or creation levels will be met at the scale of the harvest unit and are not intended to be attained on every acre. Snag and coarse woody debris retention will be variable per acre throughout the area being treated.
    - If the pre-harvest quadratic mean diameter of the stand is less than 16” then the snags to be created or retained will be 2 snags per acre with a diameter larger than the quadratic mean diameter of the stand.

Management Objectives for <u>Non-Forested</u> Lands

- Manage non-forest lands with the intent of maintaining or improving wildlife habitat and rangeland conditions based on ecological site parameters. Where conditions are currently late seral or potential natural community, maintain these conditions. Where conditions are early or mid seral, improve conditions towards late seral or potential natural community.
- Manage non-forest lands for multiple uses in addition to those listed above including: recreational needs, community stability, and commodity production. Commodities include firewood, logs, biomass, chips, and other products and byproducts from juniper woodlands and rangelands.
- Promote development of fire-resilient forest.
- Provide for the conservation of BLM Special Status Species.
- Meet Oregon Department of Fish and Wildlife management goals for wildlife on public domain lands.

Management Direction for <u>Non-Forested</u> Lands

- Vegetation communities encroached by invasive juniper would be treated using prescribed fire, mechanical, chemical, and manual treatments. Manage to conserve juniper on sites composed of woodland soils.
- Thin, pile and burn, or remove encroaching western juniper that hinders attainment of desired forage conditions to maintain and improve forage for big game.
- Retain old “legacy” juniper when it meets the following definition. Old Juniper refers to individual trees that likely originated in the “pre-settlement” period, before 1870. It is assumed that these trees are growing on sites that they are adapted to, since they began growing there under “natural conditions” when natural processes (including lightning fires) determined vegetation patterns. Older junipers are commonly found in rocky areas where vegetation is sparse and natural fire frequency is low. Characteristics of older juniper include some or all of the following:

    - Crown is flat, rounded, broad at top, or irregular (as opposed to the more pointed tops of younger trees)
    - Spike top
    - Numerous dead branches
    - Branches covered with coarse, bright yellow-green lichen (*Letharia*, or wolf lichen)
    - Large diameter lower branches
    - Large diameter trunk relative to height
    - Trunk has spirally-twisted bark, deep furrows
    - Hollow trunk

- Apply prescribed burns, mechanical or hand fuels treatments to reduce the potential for uncharacteristic wildfires. Apply maintenance treatments at appropriate intervals to retain fire resilient conditions.
- Treat emergent or new weed populations. Contain or reduce noxious weed infestations on BLM-administered land using an integrated pest management approach. Continue to survey BLM-administered land for noxious weed infestations and implement actions to reduce infestations.
- Plant native species when quantity and quality of forage is determined to be limiting factor in achieving management goals.
- Manage unoccupied or historic sage grouse habitat consistent with the Greater Sage Grouse Conservation Assessment and Strategy for Oregon.
- Maintain or enhance wildlife habitat on rangelands.
- Continue the existing road closures to motorized vehicles, except for administrative purposes, between November 1 and April 15 in the Klamath Deer Winter Range. This seasonal road closure

includes South Gerber, Willow Valley, Harpold Ridge, Bryant Mountain, North Bryant, Windy Ridge, and Lorella.
- Maintain visual barriers such as trees or other vegetation from 25 to 50 feet wide along roads within the designated deer winter range.
- Plant forage species along roadsides, skid trails, and on disturbed areas, or create forage plots when forage quality is determined to be a limiting factor in achieving the management goals of the Oregon Department of Fish and Wildlife. Include forage retention requirements for wildlife when implementing silvicultural treatments or habitat management activities.

Fire, Fuels, and Wildfire Response

Management Objectives

For all Allocations

- Respond to wildfires in a manner that provides for public and firefighter safety while meeting land management objectives by utilizing the full range of fire management options.
- Fire management strategies should be risk-based decisions that consider firefighter and public safety, values at risk, management objectives, and costs that are commensurate with the identified risk.
- Actively manage the land to restore and maintain resilience of ecosystems to wildfire and decrease the risk of uncharacteristic large high-intensity/severity wildfires.
- Manage fuels to reduce wildfire hazard, risk, and negative impacts to communities and infrastructure, landscapes, ecosystems, and highly valued resources.

For LSR-Dry

- Apply landscape-scale, science-based adaptive restoration treatments that will better enable forests to: 1) recover from past management measures, 2) respond positively to climate-driven stresses, wildfire and other disturbance with resilience, 3) ensure positive or neutral ecological impacts to wildfire, and 4) contribute to NSO recovery.
- Reduce the risk of loss of key late-successional structure through the development of vertical and horizontal heterogeneity.
- Increase diversity of stocking levels and size classes within the stand or landscape.

Management Direction

All Allocations

- Take immediate action to suppress all human-caused ignitions at the lowest cost and with the fewest negative consequences with respect to firefighter and public safety.
- Apply the full range of fire management options to natural ignitions or escaped prescribed fires.
  - These fires may be used to achieve management objectives when expected fire behavior and potential effects of a fire, or a part of a fire, are aligned with the management objectives and direction of the underlying land use allocation.
- Conduct wildfire rehabilitation and restoration efforts to protect and sustain ecosystems, ecosystem services, public health and safety, and infrastructure adversely affected by suppression actions (fire operations) or direct fire effects.
- Treat both activity and natural hazardous fuels to modify the fuel profile (i.e., raise canopy base heights or reduce surface and ladder fuels and crown bulk density) to reduce potential wildfire spread,

intensity, and severity and improve effective fire management opportunities within the wildland urban interface and in close proximity to other highly valued resources.
  - Treat fuels in a way that increase intervals between future maintenance treatments and provide maximum effectiveness over time.
- Create fuel beds or fuel breaks that reduce the potential for high-intensity fire spread within the wildland urban interface and in close proximity to other highly valued resources.
- When applying prescribed fire do not compromise habitat of Special Status Species plants that are limited in distribution.
- Work in partnership with local, State, and Federal stakeholders to build capacity within the communities bordering Federal lands to reduce the risks and threats from wildland fire.
- Conduct necessary vegetation maintenance treatments to ensure effective and efficient ground and aerial access and utilization of existing natural and man-made strategic infrastructure (i.e., pump chances and other fire suppression water sources, key road systems, containment lines, fuel breaks and helispots, etc.) that may be used during fire management operations.

Dry Forests in all Allocations

- Treat fuels to restore landscapes with the highest risk of uncharacteristic wildfires (i.e., high frequency fire regimes) and the greatest potential for hazard reduction consistent with underlying management objectives and directions.
  - Modify fuel beds to produce characteristic fire behavior and fire effects representative of the fire regime.
- Implement prescribed fire in low/mixed severity or high-frequency fire regimes to emulate historic fire function and processes in a manner consistent with land management objectives and directions.
  - Apply prescribed fire across the landscape to create a mosaic of spatial and temporal stand conditions and patterning (appropriate to the fire regime). Based on site-specific considerations, take measures to prevent and control fire regime altering species.
- Apply maintenance treatments (thinning, prescribed burning, etc.) at appropriate intervals to retain fire resilient conditions consistent with underlying management objectives and directions.
  - Apply treatments that maintain or restore community-level structural characteristics, promote desired species composition, and emulate ecological conditions produced by historic fire regimes on non-ASQ land allocations or TPCC withdrawn areas, such as oak woodlands, meadows, grasslands, and shrublands.

Dry LSR and UTA

- Protect trees established prior to 1850 by removing adjacent fuels to reduce risk of fire related mortality

Riparian Reserve

- Implement fuel treatment and fire management strategies, practices, and activities that meet Riparian Reserve management objectives.
- In the case of prescribed fire or wildfire, apply the following principles to meet resource and management objectives, unless they would impede public or fire personnel safety or protection of private property values. Fire management plans should address requirements for additional exemption situations:
  - Locate incident bases, camps, helibases, helispots, staging areas, and other centers for incident activities outside of the Riparian Reserve.

- Avoid application of chemical retardant, foam, or other chemicals to waterways unless the fire is deemed a threat to human safety or private property.
- Locate and manage water drafting sites to minimize adverse effects on riparian habitat and water quality.

Fisheries

Management Objectives

- Improve the distribution and quantity of high quality fish habitat across the landscape for all life stages of ESA-listed, BLM Special Status Species, and other fish species.
- Maintain and restore access to stream channels for all life stages of aquatic species.

Management Direction

Riparian Reserve

- Create spawning, rearing, and holding habitat for fish using a combination of accepted techniques including log and boulder placement in stream channels, tree tipping, and gravel enhancement to create habitat for fish species.
- Where appropriate for restoration purposes, fell trees into the stream channel from the Riparian Reserve to create habitat for aquatic species and to create gaps and openings near streams to promote early seral vegetation.
- Maintain or improve roads in the Riparian Reserve in a condition that will not contribute sediment to streams that will hinder spawning habitat for fish. This could include maintaining vegetated ditch lines, improving road surfaces and installing cross drains at appropriate spacing.
- Replace stream crossings that currently or potentially block or hinder fish passage with crossings that allow aquatic species to pass at each life stage and at a range of flows.

All Allocations

- When no longer needed for stand management and where adjacent landowner rights-of-way allow, decommission roads along streams in valley bottoms.

Forest Management

Management Objectives

All allocations

- Enhance the health, stability, growth, and vigor of forest stands.
- In harvested or disturbed areas, ensure the establishment and survival of desirable vegetation appropriate to the site.
- Allow necessary falling and removal of live or dead trees for safety or operational reasons.
- Allow road construction and maintenance, placement of yarding corridors, and construction of skid trails and landings based on operational needs as well as for those with valid and existing access rights.

All allocations in the Harvest Land Base

- Manage forests to achieve continual timber production that can be sustained through a balance of growth and harvest.
- Offer for sale an allowable sale quantity.
- Recover economic value from timber harvested after a stand-replacement disturbance, such as a fire, windstorm, disease, or insect infestations.
- In harvested or disturbed areas, ensure the establishment and survival of desirable trees appropriate to the site and enhance their growth.
- Enhance the economic value of forest stands.

UTA and the Dry Forest in LSR allocations

- Increase diversity of stocking levels and size classes within the stand or landscape.

Management Direction

HITA, MITA, LITA, UTA, OHTA, LSR, and RR

- Promote the establishment and survival of desirable vegetation through stand maintenance treatments.
- Apply pre-commercial thinning to forest stands to achieve appropriate stocking levels.
- Fall and remove live or dead trees as needed for safety or operational reasons, including but not limited to: hazard tree removal, creation of yarding corridors or skid trails adjacent to nearby harvest units, and road construction, improvement, or maintenance.
- Road construction, maintenance, improvement, and decommissioning; as well as construction of skid trails and yarding corridors would be allowed.

All allocations in the Harvest Land Base

- Silvicultural treatments would be applied to remove timber volume.
- Implement timber salvage harvest after disturbances to recover economic value and to minimize commercial loss or deterioration of damaged trees.
- Prepare newly harvested and inadequately stocked areas for the regeneration of desirable tree species.
- Site preparation methods include mechanical or manual procedures, and prescribed burns.
- Apply silvicultural treatments to enhance timber value and for fuels, insect, and disease management.

In all allocations with untreated skips or aggregated group retention

- Candidate areas and features for untreated skips and aggregate retention could include any of the following:
    - Areas containing concentrations of trees that are older and larger than the prevailing stand conditions
    - Areas containing trees with unique characteristics (e.g., deformed boles, cavities)
    - Areas containing concentrations of large down wood
    - Patches dominated by hardwood trees
    - Areas of structural complexity
    - Productive native shrub patches
    - Areas containing concentrations of snags
    - Representative patches of the pre-harvest stand
    - Patches of herbaceous understory vegetation

  - Areas of "sensitive" soils (i.e., steep and unstable areas, shallow soils, and areas with a high potential for soil movement or excessive soil erosion;
  - Areas containing unique habitats such as seeps, rock outcrops, and areas of unique diversity
  - Areas with concentrated bird or rodent nest structures

Dry LSRs

- Utilize uneven-aged and integrated vegetation management in designing and implementing treatments. This will include use of a combination of silviculture treatments, fire and fuels management activities, and harvest methods. Activities include planting, prescribed fire, thinning, single tree selection harvest, and group selection harvest.
- Uneven-aged and integrated vegetation management would be applied for the following reasons:
  - promote the development of large, open grown trees and multi-cohort stands;
  - develop diverse understory plant communities;
  - To increase or maintain vegetative species diversity;
  - Promote or enhance the development of structural complexity and heterogeneity;
  - Allow for hardwood persistence;
  - To adjust stand composition or dominance;
  - To reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation.
- Uneven-aged and integrated vegetation management treatments would meet the following criteria, post-treatment:
  - Stand average relative percent max SDI targets would be between 35 percent and 45 percent.
  - For stands ≥ 10 acres:
    - Maximum group selection opening size, 4 acres
    - Maximum percentage of stand area in group selection openings, 25 percent
    - Minimum percentage of stand area in untreated skips 10 percent
    - At least ½ of the skips would be implemented as retention islands unattached to the exterior unit boundaries,
  - For stands < 10 acres:
    - Maximum group selection opening size, 2.5 acres,
    - No maximum percent of stand in openings, and no minimum percent of stand in skips.
- Following large scale disturbances and when regenerating group selection openings, develop heterogeneous vegetation patterns.
  - Regenerate a mixture of species appropriate to the site using variable spacing within 5 years of disturbance or harvest.
    - Natural regeneration, artificial regeneration, or a combination would be allowed.
    - 50-70 percent of full stocking is considered acceptable.
    - Regenerate a higher proportion of fire tolerant species at lower densities, in variable patterns, within a skip and gap framework in areas of higher relative fire probability (often southern slopes and ridge tops, and areas prone to heavy shrub/brush/hardwood regrowth) that present the highest risk of losing high density replanting.
    - Regenerate a higher proportion of fire intolerant species at higher densities in areas that coincide with low relative fire probability and provide a higher confidence of retaining these species.
- Following large scale disturbances;
  - Maintain at least 10 percent of the stand un-stocked with trees in gaps ≥ ¼ acre in size for at least two decades to accelerate development of heterogeneous fuel conditions.

UTA and Dry Forests in LSR and OHTA

- Retain dominant Douglas-fir (*Pseudotsuga menziesii*), Pine (*Pinus* spp.), incense-cedar (*Calocedrus decurrens*), madrone (*Arbutus menziessii*), bigleaf maple (*Acer macrophyllum*), and oak (*Quercus* spp.) trees established prior to 1850, except where removal is necessary for safety or operational reasons.
    - These trees will be identified based on bark, limb, and crown characteristics.
    - A reasonable effort shall be made to identify these trees and retain them, understanding there is no practicable way to ensure 100 percent retention.
- Protect and develop "legacy trees" on the landscape, by reducing competition.
    - Release "legacy trees" that originated prior to 1850 in order to improve vigor and resistance to fire, drought, disease and other disturbances.

UTA

- Utilize uneven-aged and integrated vegetation management in designing and implementing treatments. This will include use of a combination of silviculture treatments, fire and fuels management activities, and harvest methods. Activities include planting, prescribed fire, thinning, single tree selection harvest, and group selection harvest.
- Uneven-aged and integrated vegetation management would be applied to:
    - Produce timber to contribute to the attainment of the declared Annual Sale Quantity
    - Promote the development of large, open grown trees and multi-cohort stands
    - Develop diverse understory plant communities
    - Increase or maintain vegetative species diversity
    - Promote or enhance the development of structural complexity and heterogeneity
    - Allow for hardwood persistence
    - Adjust stand composition or dominance
    - Reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation
- Uneven-aged and integrated vegetation management treatments would meet the following criteria, post-treatment:
    - Post-thinning stand average relative percent max SDI targets will be between 20 percent and 45 percent.
    - For stands ≥ 10 acres:
        - Maximum group selection opening size, 4 acres
    - Maximum percentage of stand area in group selection openings, 30 percent
        - Minimum percentage of stand area in untreated skips 10 percent
        - At least ½ of the skips would be implemented as retention islands unattached to the exterior unit boundaries
    - For stands < 10 acres:
        - No maximum group selection opening size, no maximum percent of stand in openings, and no minimum percent of stand in skips
- Implement timber salvage harvest after disturbances to recover economic value and to minimize commercial loss or deterioration of damaged trees.
    - Remove all merchantable dead and down timber from disturbed areas where removal is economically viable.
- Following large scale disturbances and when regenerating group selection openings, develop heterogeneous vegetation patterns.
    - Regenerate a mixture of tree species appropriate to the site using variable spacing within 5 years of disturbance or harvest.
        - Natural regeneration, artificial regeneration, or a combination of the two would be allowed.

    - Regenerate a higher proportion of fire tolerant species at lower densities, in variable patterns, within a skip and gap framework in areas of higher relative fire probability (often southern slopes and ridge tops, and areas prone to heavy shrub/brush/hardwood regrowth) that present the highest risk of losing high density replanting.
    - Regenerate a higher proportion of fire intolerant species at higher densities in areas that coincide with low relative fire probability and provide a higher confidence of retaining these species.
- Following large scale disturbances, maintain at least 10 percent of the stand un-stocked with trees in gaps ≥ ¼-acre in size for at least two decades to accelerate development of heterogeneous fuel conditions.

Management Objectives for Density Management Study Sites

- Maintain the integrity of the study sites.

Management Direction for Density Management Study Sites

- Prohibit management activities in study sites that would adversely alter study data until the Phase 2, 10-year follow-up data collection is complete, and then return the land to underlying land use allocation.

Hydrology

Management Objective

- Maintain water quality within the range of natural variability that meets ODEQ water quality standards for drinking water, contact recreation, and aquatic biodiversity.

Management Direction

- Select and implement site-level BMPs to maintain water quality, for BLM activities and discretionary actions of others crossing BLM lands.

Invasive Species

Management Objective

- Prevent the introduction of invasive species and the spread of existing invasive species infestations on BLM-administered lands.

Management Direction

- Implement measures to prevent, detect, and rapidly control new invasive species infestations.
- Use manual, mechanical, cultural, chemical, and biological treatments to manage invasive species infestations.
- Treat invasive plants and host species for invasive forest pathogens in accordance with the Records of Decision (RODs) for the Northwest Area Noxious Weed Control Program Environmental Impact

Statement and the Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in Oregon Environmental Impact Statement (July 2010).

Lands Managed for their Wilderness Characteristics

Note: These objectives and direction apply to areas outside of designated Wilderness Areas and Wilderness Study Areas that the BLM has identified as having wilderness characteristics and for which the BLM is analyzing a plan decision to manage for the protection of those wilderness characteristics.

Management Objectives

- Provide appropriate levels of protection to preserve inventoried wilderness characteristics of areas determined to possess wilderness characteristics (e.g., appearance of naturalness, outstanding opportunities for primitive unconfined recreation or solitude) outside of existing Wilderness Study Areas, while considering competing resource demands and manageability.

Management Direction

- Petition for withdrawal from locatable mineral entry
- Establish *closed* OHV area designation
- Require no surface occupancy for leasable mineral development.
- Close to salable mineral development
- Designate as Right-Of-Way Exclusion Areas
- Designate as Visual Resource Management (VRM) Class II
- Restrict construction of new structures and facilities unrelated to the preservation or enhancement of wilderness characteristics or necessary for the management of uses allowed under the land use plan.
- Retain public lands in Federal ownership

Lands, Realty, and Roads

Management Objectives

- Make land tenure adjustments to facilitate the management of resources and enhance public resource values.
- Provide legal access to BLM-administered lands and facilities to support resource management programs.
- Provide needed right-of-ways, permits, leases, and easements over BLM-administered lands in a manner that is consistent with State and Federal laws.
- Protect lands that have important resource values or substantial levels of investment by withdrawing them, where necessary, from the implementation of nondiscretionary public land and mineral laws.
- Provide a road transportation system that serves resource management needs (administrative/commercial) and casual use needs (recreational/domestic) for both BLM-administered lands and adjacent privately owned lands.

Management Direction

- Lands in Zone 1 are retained under BLM administration. Lands in Zone 1 include:
    - National Landscape Conservation System designated lands
    - Areas of Critical Environmental Concern

  - Research Natural Areas
  - Outstanding Natural Areas
  - Lands acquired with Land and Water Conservation Funds
- Lands in Zone 2 are available for exchange to enhance public resource values, improve management capabilities, or reduce the potential for land use conflict. Zone 2 lands consist of all lands not listed in the descriptions of either Zone 1 lands or Zone 3 lands (**Appendix J**).
- Lands in Zone 3 are available for disposal using appropriate disposal mechanisms. These lands include:
  - Lands that are either not practical to manage, or are uneconomical to manage (because of their intermingled location and non-suitability for management by another Federal agency)
  - Survey hiatuses
  - Unintentional encroachments
- Survey hiatuses and unintentional encroachments discovered in the future will be assigned to Zone 3.
- Land boundary adjustments due to river movement discovered in the future, which meets the disposal criteria defined in **Appendix J** will be assigned to Zone 3.
- Reversionary interests reserved by the United States in patented lands located within the planning area may be considered for conveyance out of Federal ownership.
- The BLM may dispose of lands designated in Zones 2 and 3 that provide habitat for listed species, including critical habitat, only following consultation with the Fish and Wildlife Service or National Marine Fisheries Service and upon a determination that such action is consistent with relevant law and maximizes public resource values.
- As required by the Oregon Public Lands Transfer and Protection Act (Public Law 105-321), the acres of O&C lands of all classifications, and the acres of O&C and public domain lands that are available for harvesting, would not be reduced through disposal, exchange, or sale. The total net change in land tenure in the planning area would be evaluated at 10-year intervals.
- Lands would be acquired or disposed of to facilitate resource management objectives as opportunities occur. See the Land Tenure Adjustment Criteria section in **Appendix J**.
- The public domain lands in Zones 2 and 3 have been classified under Section 7 of the Taylor Grazing Act and would be available for disposal.
- Newly acquired lands would be managed for the purpose for which they were acquired or in a manner that is consistent with management objectives for adjacent BLM-administered lands or other BLM-administered lands having similar resource values (**Appendix J**).
- Temporary-use permits, as identified under the Federal Land Policy and Management Act (Section 302), would be issued for a variety of uses, such as, but not limited to, stockpile and storage sites and as tools to authorize unintentional trespass situations pending final resolution.
- No leases or permits would be issued for landfills or other waste disposal facilities.
- Land-use authorizations would be used to resolve agricultural or occupancy trespasses, where appropriate.
- Existing rights-of-way, permits, leases, and easements would be recognized as valid uses.
- Withdrawals would be limited to the area needed and would restrict only those activities needed to accomplish the purposes of the withdrawal.
- Formal land withdrawals being relinquished by the Bureau of Land Management or other Federal agency shall be processed according to the procedures stated under 43 CFR 2372. If the lands are found suitable for return to the public domain, the revocation order will recommend the management prescriptions developed in the environmental review. The lands shall be managed according to management prescriptions for those lands having the same or similar resource values in the same general area of the land withdrawal.
- Designated wilderness, Wild and Scenic Rivers classified as wild rivers, lands managed for wilderness characteristics, and VRM Class I areas would be Right-Of-Way Exclusion Areas where future right-of-ways would not be granted except when mandated by law.

- Recreation Management Areas, Study Areas, Areas of Critical Environmental Concern, Research Natural Areas, Wild and Scenic Rivers classified as scenic and recreational rivers, and VRM Class II areas would be Right-Of-Way Avoidance Areas. Future right-of-ways may be granted in avoidance areas if the BLM determines that the right-of-way proposals are compatible with the protection of the values for which the land use was designated, or when no feasible alternative route or designated right-of-way corridor is available as applicable with BLM laws and policy.
- Utility corridors would be the preferred location for energy transmission or distribution facilities. Corridors would generally be 1,000 feet on each side of the centerline. The rights-of-way granted would be the minimum necessary to accommodate a specific request. No development or management activities would be permitted that would conflict with construction, operation, or maintenance of facilities corresponding to the purpose of the utility corridor.
- Communication facilities would be allowed on existing developed communication sites where they do not conflict with other management objectives. Applications for communication facilities on undeveloped communication sites would require a site plan (**Appendix J**).
- Expansion of existing communication sites and the development of new sites would be allowed. The priority for accommodating the need for additional capacity would be the use of existing sites and facilities.
- Construct new permanent/temporary roads where needed to meet resource management objectives, including major culverts and bridges as necessary, to established BLM engineering design standards. Apply as needed road location, design, and construction BMPs (**Appendix I**).
- Maintain existing roads, including major culverts and bridges, to provide access for both resource management and casual use activities while protecting water quality and facility investments and providing user safety, to established BLM maintenance standards. Apply as needed road maintenance and wet weather road use BMP’s. Remove hazard trees and downed trees along roads for safety or operational reasons.
- Fully decommission or obliterate (permanent closure) roads with no future resource management need. Decommission (long-term closure) roads not currently needed for resource management but that will be operated and maintained again in the future. Apply as needed road closure BMPs. Close roads only with the approval of affected reciprocal right-of-way permittees.

Minerals

Management Objectives

- Mange the development of leasable (including traditional and non-traditional hydrocarbon resources), locatable, and salable resources in an orderly and efficient manner.
- Maintain availability of mineral material sites needed for development and maintenance of access roads for forest management, timber harvest, local communities, rights-of-way for energy production and transmission, and for other uses.

Management Direction

- Notice-level locatable mining proposals in areas known to contain Federally-proposed or listed threatened or endangered species, or their proposed or designated critical habitat, will proceed as a Notice if the BLM determines that the proposal would have no effect on listed species or their proposed or designated critical habitat. If the BLM determines that there will be an effect on listed species or critical habitat, the notice must be resubmitted as a plan of operations.
- Energy and mineral development can occur concurrently or sequentially with other resource uses.

Leasable: Oil, Gas, or Coalbed Natural Gas Resources[119]

- Maintain all lands as open to leasable mineral development except where closed by legislation.
- Maintain Recreation Management Areas, designated (where not already closed by legislation) and suitable Wild and Scenic River segments, protected lands with wilderness characteristics, and Areas of Critical Environmental Concern as open to leasable mineral development with site-specific stipulations, such as no surface occupancy or conditional surface uses based on resource protection needs.
- Apply site-specific stipulations as needed to protect Federally-listed threatened and endangered species and their critical habitats.

Locatable

- Petition for withdrawal from locatable mineral entry protected lands with wilderness characteristics and suitable Wild and Scenic River segments.
- Petition for withdrawal from locatable mineral entry Recreation Management Areas when mineral entry is not compatible with meeting recreation objectives or maintaining Recreation Setting Characteristics (RSCs).
- Petition for withdrawal from locatable mineral entry Areas of Critical Environmental Concern with identified special management needs associated with locatable mineral development.
- Retain all other areas not congressionally or secretarially withdrawn as open for locatable mineral entry.

Salable

- Close protected lands with wilderness characteristics and designated (where not already closed by legislation) and suitable Wild and Scenic River segments to salable mineral development.
- Close Recreation Management Areas to salable mineral development when not compatible with meeting recreation objectives or maintaining RSCs.
- Close Areas of Critical Environmental Concern with identified special management needs to salable mineral development.
- Maintain all other areas not closed through legislation as open to salable mineral entry.
- **Appendix L** provides a reasonably foreseeable development scenario and the stipulations that will be applied to developments.

National Landscape Conservation System (NLCS)

Management Objectives for all NLCS

- Conserve, protect, and restore the identified outstanding cultural, ecological, and scientific values of the National Landscape Conservation System and other congressionally designated lands.

Management Objectives for Wild and Scenic Rivers

- See common to all NLCS objectives

[119] The Sustainable Energy section addresses Geothermal Resources.

Management Direction for Wild and Scenic Rivers

- Protect outstandingly remarkable values of designated Wild and Scenic River corridors (including those classified as wild, scenic, or recreational).
- Provide interim protection to Wild and Scenic River corridors (including those classified as wild, scenic, or recreational) that are suitable for inclusion as components of the National Wild and Scenic Rivers system until Congress makes a decision to designate them.
- Provide interim protection to Wild and Scenic River corridors (including those classified as wild, scenic, or recreational) that are eligible but have not yet been studied for suitability as components of the National Wild and Scenic Rivers system pending suitability evaluations.
- Designate as Right-Of-Way Avoidance Areas.
- Require controlled surface use limitations.
- Require timing limitations.
- Require no surface occupancy for leasable mineral development.
- Petition for withdrawal from locatable mineral entry.
- Close to salable mineral development.
- Retain public lands in Federal ownership.

Management Objectives for Wilderness Areas

- See all common to all NLCS units
- Preserve the wilderness character of designated Wilderness Areas.

Management Direction for Wilderness Areas

- Exclude all prohibited uses of Wilderness (as defined in the Wilderness Act of 1964 and the BLM Wilderness Management Manual) unless they have been demonstrated using the minimum requirements decision guide to be the minimum necessary to administer the area for the purposes of the Wilderness Act.

Management Objectives for Wilderness Study Areas

- See all common to all NLCS units.
- Preserve wilderness characteristics in WSAs in accordance with non-impairment standards as defined under the management policy for Wilderness Study Areas (USDI BLM Manual 6330), until Congress either designates these lands as wilderness or releases them for other purposes.

Management Direction for Wilderness Study Areas

- Close all WSAs to motorized and mechanized travel. Travel required for valid existing rights would be allowed.
- Prohibit the approval of new rights-of-way that do not satisfy the non-impairment standard.
- Designate as Class I.

Management Objectives for National Trails System

- See all common to all NLCS units.

Management Direction for National Trails System

- Provide for the enjoyment and appreciation of the resources, qualities, values, and associated settings and primary uses within National Trail right-of-ways and for which National Trails are designated.
- Enhance, promote, and protect the scenic, natural, and cultural resource values associated with current and future designated National scenic and historic trails.
- For National trail management corridors:
    - Designate a Special Recreation Management Area.
    - Designate as VRM Class II.
    - Allow timber harvest activity only to protect or maintain RSCs or to achieve recreation objectives.
    - Require a controlled surface use stipulation on surface occupancy and surface disturbing activities.
    - Petition for withdrawal from locatable mineral entry.
    - Close to salable mineral development.
    - Require no surface occupancy for leasable mineral development.

Rare Plants and Fungi

Management Objectives

- Provide for conservation and contribute toward the recovery of plant and fungi species that are listed, or are candidates for listing, under the Endangered Species act.
- Support the persistence and resilience of natural communities, including those associated with non-Harvest Land Base forests, oak woodlands, shrublands, grasslands, cliffs, rock outcrops, talus slopes, meadows, and wetlands. Support ecological processes and disturbance mechanisms to allow for a range of seral conditions.

Management Direction

- Manage Federally-listed species consistent with recovery plans and designated critical habitat, including the protection and restoration of habitat; altering the type, timing, and intensity of actions; and other strategies designed to recover populations of species.
- Conduct surveys for Federally-listed and candidate species on BLM land with suitable habitat.
- Maintain or restore natural processes, native species composition, and vegetation structure in natural communities outside of the Harvest Land Base through prescribed fire, thinning, removal of encroaching vegetation, retention of legacy components (e.g., large trees, snags, and down logs), and planting or seeding native species.
- Use only species native to the plant community when re-vegetating degraded or disturbed areas.
- Retain or reconnect the hydrologic flows to wetlands.

Recreation and Visitor Services

Management Objectives

- Provide a diversity of quality recreational opportunities.
- Meet legal requirements for visitor health and safety and mitigate resource user conflicts.
- Mitigate recreational impacts on natural and cultural resources; in allocations where other resources are dominant, provide recreational opportunities where they can be managed consistent with the management of these other resources.

- Develop new recreation opportunities (e.g., trails, trailheads, restrooms) to address recreation activity demand created by growing communities, activity groups, or recreation-tourism if:
  - Recreation development is consistent with interdisciplinary land use plan objectives; and
  - The BLM has secured commitments from partners in the form of a cooperative management agreement, adopt a trail agreement, memorandum of understanding, etc.

Management Direction

- Manage Special Recreation Management Areas (SRMAs) and Extensive Recreation Management Areas (ERMAs) in accordance with their planning frameworks.
- Protect RSCs within SRMAs to prohibit activities that would degrade identified characteristics.
- Pursue and prioritize public access to BLM-administered lands that have high recreational potential or historic recreation use.
- Petition for withdrawal RMAs from locatable mineral entry as identified in specific RMA frameworks.
- Allow the discharge of firearms for recreational target shooting on BLM lands, outside areas with fire arm use restrictions (see RMA frameworks), provided that the firearm is discharged toward a proper backstop sufficient to stop the projectile’s forward progress beyond the intended target.
- Issue Special Recreation Permits as a discretionary action for a variety of uses that are consistent with resource and program objectives.
- Prohibit vending permits outside special events on BLM administered lands.
- Monitor activity participation and RSCs annually during the primary use season of June through October.
- If future monitoring indicates that social RSCs are not being protected, resource damage is occurring, or user conflicts need to be addressed, management action will be created to establish an allocation system or apply group size limits for private and commercial recreation use.
- Develop and maintain partnerships with recreation-based organizations and service providers. These partnerships should engage partners in the planning, implementation and monitoring of recreation opportunities and facilities on BLM-administered public lands.

Management Objective

- Manage significant caves to allow for appropriate access while protecting pristine and fragile resources, wildlife values, scientific and research values, and visitor safety.

Management Direction

- Manage significant caves to maintain the current level of remoteness from motorized and mechanized vehicles and to preserve the natural appearance of the cave. Prohibit construction of new facilities, roads, or trails to access the caves. Allow for only minor modifications (e.g., tape, signage, and rescue caches) for scientific purposes and to accommodate safe use. Maintain low evidence of use and other people.
- Manage visitor frequency, visitor numbers, and season of use through monitoring and subsequent implementation decisions described through cave management plans for each significant cave, group of caves, or complex of caves.
- Focus all management actions on specific activity outcomes for caving and research. Outcomes will be for participants to enjoy and learn about cave and karst resources. Specific benefit outcomes will be for environmental benefits, such as increased environmental stewardship, and the preservation and protection of unique biological, paleontological, archaeological, and mineralogical aspects. Social benefits will be to provide environmental learning and appreciation of cave and karst systems.

- Continue to allow appropriate access while addressing issues and concerns relating to visitor safety and preservation of the caves' values. If issues or concerns arise, apply necessary managerial controls, such as closures, permits, trip requirements, and gating. Administer and authorize research, inventory, work projects, and digging trips. Provide information and education materials to authorized visitors. Do not market or promote cave and karst resources.

Management Objective

- Ensure public health and safety from hazards associated with formerly used defense sites (FUDS).

Management Direction

- Manage the portion of the Modoc Aerial Gunnery and Bombing Range located within the Klamath Falls Field Office to avoid or limit exposure to areas that may contain hazards associated with munitions and explosives of concern. Munitions and explosives of concern may include unexploded ordnance, discarded military munitions, and munitions constituents when munitions constituents are present in high enough concentrations to pose an explosive hazard. The site may also be contaminated with munitions constituents that are not present in high enough concentrations to represent an explosive hazard, but in high enough concentrations to be a toxicity hazard in soil, groundwater, surface water, or air.
- Coordinate uses on BLM-administered lands within FUDS with State and Federal military agencies to ensure public safety. Develop, as needed, cooperative agreements or Memorandums of Understanding to ensure communication, coordination, and safe use of public lands within FUDS.

Soil Resources

Management Objectives

- Maintain or enhance the inherent soil functions (e.g., ability of soil to take on water, store water, regulate outputs for vegetative growth and stream flow, and resistance to erosion or compaction) of managed ecosystems so that the overall soil properties (e.g., bulk density, infiltration rate, soil texture, or organic matter levels) do not decline beyond acceptable levels that would impede said functions across the plan area.
- Provide landscapes that stay within natural soil stability failure rates during and after management activities.

Management Direction

- Apply BMPs (**Appendix I**) as needed to maintain or restore soil functions and quality.
- Allow management actions or activities that retain at least 80 percent of the inherent soil functions in proper working order. No detrimental soil disturbances of the immediately harvested or treated unit area shall exceed 20 percent of the unit area; this is a combined total of all detrimental impacts (e.g. timber harvesting, biomass removal, or fuel risk reduction treatments in various environments), including roads and landings. Detrimental soil disturbance occurs when soil properties change in a negative manner and the inherent capacity to sustain growth of vegetation is reduced (Powers *et al*. 1998, USDA 1998). Detrimental soil disturbance can occur from one or a combination of all of these processes: erosion, loss of organic matter, severe heating to seeds or microbes, soil displacement, or compaction.

- Failing to meet the following condition on areas treated constitutes an area (percentage based) with detrimental soil disturbance: The cumulative level of all soil-disturbing activities, existing or new, for each activity area is at or below the 20 percent detrimental level.
- Use the Natural Resources Conservation Service Erosion Hazard Rating System to identify areas of erosion from disturbed soil treatment sites. Maintain the percent of effective ground cover needed to control surface erosion, such as medium to large gravels, cobbles, intact duff, and slash, in addition to vegetation or biological crusts (Robichaud *et al*. 2013) for each listed hazard level outlined in the table below. In the second year these standards rise to at least 30, 40, 60, and 75 percent depending on hazard level to ensure erosion protection is established or improving.

Table B-4. Soil erosion ratings.

NRCS Erosion Hazard Rating*	Percent Cover
Very Severe	60%
Severe	45%
Moderate	30%
Slight	20%

* Rating obtained from County Soil Survey information by map unit.

- In order to avoid reaching detrimental soil conditions, no more than 49 percent of top soil and organic matter can be mechanically removed within any given area that is equal to or greater than 4.5 feet wide and 100 square feet in total area. If 50 percent or more of the topsoil or organic matter is mechanically removed, the entire disturbed area counts toward the allowable 20 percent of the project area in detrimental soil conditions.
- Do not allow land disturbing activities to cause soils to exceed the critical bulk densities outlined in **Table B-5**. Compaction is noted when a change in soil structure from crumb or granular structure to massive or platy structure takes place anywhere from the surface to depths of 36 inches. The platy structure is generally continuous, not spotty. Exceeding these conditions constitutes a detrimental soil condition that counts toward the allowable 20 percent of the detrimental soil total.

Table B-5. Critical limiting bulk densities for each soil texture class (Pierce *et al*. 1983)

Soil Texture Class	Critical Bulk Density (g/cm^3)
Sandy	1.69
Coarse-loamy	1.63
Fine-loamy	1.67
Coarse-silty	1.67
Fine-silty	1.54
Clayey (35-45%)	1.49
Clayey (45-100%)	1.39

Timber Harvest and Fuels Reduction

- Use designated skid trails and where practicable existing skid trails, prior to developing or designating new trails when harvesting or conducting fuel treatments with tracked or wheeled machinery to reduce amount of compacted area.

- When operations conclude in regeneration units, remove all compacted equipment trails with acceptable tillage methods. Such trails shall increase water routing and storage functions, limit access, improve root and microbial population growth, and improve planting access.
- When operations conclude within thinning or uneven harvest units, remove compacted equipment trails not necessary for future use with acceptable tillage methods such that residual stands do not incur root or bole damage impacts. Tilled trails shall return soil functions to the extent practical to increase water routing and storage functions, limit access, improve root and microbial population growth and improve planting access.
- Operate all ground based machinery during a seasonal period of low soil moisture content (based on soil texture; this is generally from June 1 to October 15) to provide the greatest level of resistance to the forces of compaction.
- Operate all ground-based machinery on slopes equal to or less than 35 percent except on sensitive or fragile soils in the southern part of the planning area. For those soils, operate on slopes equal to or less than 20 percent except when the percentage of clay in the top six inches averages greater than 15 percent, in which case equal, to or less than 35 percent is acceptable. Fragile soils are skeletal or shallow soils (less than 20 inches deep), soils with less than 4 inches of Horizon A, or soils from granite and schist parent materials. Mechanical harvesting equipment with tracks (e.g. excavators, loaders, forwarders, and harvesters) may be used on short pitch slopes of greater than 35 percent but less than 45 percent when necessary to access benches of lower gradient (length determined on a site-specific basis, generally less than 50 feet).
- In unit areas where less than 20 percent detrimental soil conditions exist from prior activities; do not exceed 20 percent following project implementation or restoration activities. In unit areas where more than 20 percent detrimental soil conditions exist from prior activities, at a minimum; do not exceed the prior existing conditions during implementation activities. In either case, remove unneeded or unused portions of existing conditions as well as any created conditions to meet or be below the 20 percent limit with acceptable tillage methods.
- To limit detrimental soil compaction from tracked or wheeled equipment, allow only equipment tracks that are Class 0 or 1 (ruts no more than 2 inches deep with compaction of soil no more than 4 inches below the surface) as defined in Forest Soil Disturbance Monitoring Protocol Field Guide (USDA 2009). Class 2 and 3 equipment tracks (ruts greater than 2 inches with soil compacted in platy nature up to 12 inches below surface) will constitute detrimental soil conditions and will be counted towards the allowable 20 percent any time tracked or wheeled equipment is employed.

Prescribed Fire

- Detrimental soil conditions exist when levels of heat related from burning material (broadcast or pile burning) reach the top layer of mineral soil and change the soil structure. Therefore, consume only the organic materials and prevent less than 15 percent of the mineral soil surface from changing in color. Usually to reddish color with a layer of blackened soil from charring of organic matter by heat conducted through top layer of mineral soil into a one-half inch layer below the reddish color. Soils exceeding these conditions are to be included as a portion of the 20 percent detrimental soil limit meant to preserve soil resources.
- Limit all ground-based machine use to the same conditions for compaction area of extent and determination, slope and seasonal conditions and removal of detrimental soil conditions. Till all compacted areas with an acceptable tillage method such that residual stands do not incur root or bole damage if present. Tilled trails would return soil functions to the extent practical to increase water routing and storage functions, limit access, improve root and microbial population growth, and improve planting access.
- Ensure that slope is assessed by qualified specialists (Geologist, Geomorphologist, Engineer, or Soil Scientist), to identify unstable landforms for any potential of landslides.

- If there are structures or public roads downslope from a proposed timber operation that may be effected by a rapidly moving landslide, i.e. slope gradients exceed 80 percent (except in the Tyee Core Area where it is 75 percent) or the headwall and draw slopes exceed 70 percent (except in the Tyee Core Area where it is 65 percent), follow the ODF (Technical Note Number 6) protocol or use the Timber Production Capability Classification to identify the unstable conditions and restrict forest management actions.

Sustainable Energy

Management Objectives for all Sustainable Energy

- Develop sustainable energy resources to the maximum extent possible without precluding other land uses.

Management Direction for all Sustainable Energy

- Exclude from sustainable energy development areas that are part of the National Landscape Conservation System (e.g., Wilderness Areas, Wilderness Study Areas, National Monuments, NCAs, Wild and Scenic Rivers, and National Historic and Scenic Trails), Areas of Critical Environmental Concern (ACECs), and lands managed for the protection of wilderness characteristics.
- Development of sites will apply BMPs as needed to reduce or avoid impacts to other resource uses. Appropriate BMPs will be applied based on site-specific conditions and include, but are not limited to:
  - Outdoor light will be controlled with motion or heat sensors to the maximum extent practicable
  - Outdoor lighting will be hooded and directed downward to minimize horizontal and skyward illumination to the maximum extent practicable
  - The use of high-intensity lighting will be minimized
  - Non-disturbance buffer zones will be established to protect sensitive habitats or areas of high risk for species of concern
  - Any pets of operations staff kept on-site will be controlled to avoid harassment and disturbance of wildlife
  - Existing roads and utility corridors will be used to the maximum extent feasible; the number and length and size of new roads, lay-down areas, and borrow areas will be minimized
  - Traffic volumes will be minimized to the maximum extent practicable and roads will be maintained adequately to minimize associated impacts
  - Permanent fencing will be installed and maintained around electrical substations, emergency generators and other areas potentially hazardous to human health
  - Necessary infrastructure requirements will be consolidated wherever possible, including electric power transmission lines, pipelines and market access corridors and support utility infrastructure
  - Energy conversion sites will be kept clean of debris, garbage, fugitive trash or waste, and graffiti; the accumulation of scrap heaps, dumps and storage yards will be kept to a minimum
  - Facilities used for sustainable energy harvesting, conversion and transmission will be designed to discourage the perching or nesting by birds
  - Facilities used for sustainable energy harvesting, conversion and transmission will be integrated with the surrounding landscape including minimizing the profile of ancillary structures, burial of cables, prohibition of commercial symbols, and lighting
  - Secondary containment will be provided for all on-site hazardous materials and waste storage, including fuel.

Management Direction for Biomass Energy Development

- Timber harvest slash could be offered for sale as biomass energy conversion feedstock as an alternative to being burned on-site.
- Timber harvest slash could be offered for sale as biomass energy conversion feedstock as an alternative to being left in place for soil stabilization.

Management Direction for Wind Energy Development

- Development of sites will apply BMPs as needed to reduce or avoid impacts to other resource uses. Appropriate BMPs will be applied based on site-specific conditions and include, but are not limited to:
  - Turbine tower access doors will be locked to limit public access
  - Turbines will not be on or proximate to landscape features known to attract raptors
  - Turbines will not be on or proximate to bat hibernation, breeding, and maternity/nursery colonies, in known bat migration corridors or in known bat flight paths between colonies and feeding areas
  - Turbine arrays and turbine design will encompass design elements including visual uniformity, use of tubular towers, proportion and color of turbines, non-reflective paints, and prohibition of commercial messages on turbines
  - Inoperative turbines will be repaired, replaced, or removed in a timely manner
  - When fencing is necessary, construction will incorporate wildlife-compatible design standards
  - The use of guy wires on communication towers and meteorological towers at wind energy project sites will be avoided
  - The installation of meteorological towers on a project site will be kept to a minimum and will not be located in sensitive habitats or in areas where ecological resources known to be sensitive to human are present
  - Only a portion of the turbines within the wind project will be lighted and all pilot warning lights will fire synchronously
  - No wildlife habitat enhancements or improvements such as ponds, guzzlers, rock piles, brush piles, bird nest boxes, nesting platforms, wildlife food plots, etc. that would attract small mammals will be added to wind energy facilities
  - Only shielded, separated or insulated electrical conductors that minimize electrocution risk to avian wildlife will be used

Management Direction for Geothermal Energy Development

- Development of sites will apply BMPs as needed to reduce or avoid impacts to other resource uses. Appropriate BMPs will be applied based on site-specific conditions and include, but are not limited to:
  - Geothermal energy drilling and development will minimize impacts to livestock operations
  - Reclamation of the land disturbed during the development of geothermal resources will incorporate certified weed-free mulch
  - Above-ground piping on site will be raised for sufficient wildlife passage
  - Any liquid that is at elevated temperatures or contains contaminants that are toxic or harmful to fur or feathers will be isolated from wildlife access with fencing, netting or complete enclosure
  - Management Objectives for Sustainable Energy Transmission Corridors
  - Provide land corridors that allow overhead or underground cables or pipelines necessary to connect sustainable energy conversion sites with transmission or sales networks that do not preclude other land uses.

Management Direction for Sustainable Energy Transmission Corridors

- Development of sites will apply BMPs as needed to reduce or avoid impacts to other resource uses. Appropriate BMPs will be applied based on site-specific conditions and include, but are not limited to:
  - Overhead lines will be sited away from areas where bird crossing are frequent
  - Overhead lines will be marked in accordance with Avian Power Line Interaction Committee (APLIC) collision guidelines
  - Overhead lines will be installed such that the conductors parallel tree lines, employ bird flight diverters or are otherwise screened so that bat and bird collision risk is reduced
  - Pipeline ROW clearings will be of sufficient width so as to double as fire breaks in wildland locations
  - Pipelines constructed above ground will be raised higher to allow wildlife passage where needed to avoid potential alterations to predator-prey dynamics.

Trails and Travel Management

Management Objectives

- Maintain a comprehensive travel network that best meets the full range of public, resource management, and administrative access needs.
- Protect fragile and unique resource values from damage by OHV use and provide OHV use opportunities where appropriate.

Management Direction

- Permit motorized vehicle travel anywhere within an area designated as open to off-highway vehicle use.
- Prohibit motor vehicle travel in areas closed to off-highway vehicle use. Access by means other than motorized vehicle, such as mechanized or non-motorized use, is permitted.
- Restrict motor vehicle travel in areas limited to off-highway vehicle use. Limited area designations are established where number or type of vehicles; time or season of use; permitted or licensed use only; use limited to designated roads and trails; or other limitations or necessary to meet resource management objectives.
- Manage OHV Recreation Management Areas (SRMA/ERMA) according to interim management guidelines until subsequent comprehensive travel management plans are completed (**Appendix N**).
- Develop closed or abandoned roads, where feasible, to provide additional motorized and non-motorized trail opportunities
- Develop motorized and non-motorized trail design guidelines that are activity specific and tied to trail based experience objectives.
- Prohibit motor vehicle use within designated deer and elk winter range between November 1 and April 15.
- Develop motorized travel management areas and trails in a manner designed to minimize conflicts between OHV use and other existing, or proposed, recreational uses of the same, or neighboring, public lands; and in a manner designed to ensure the compatibility of such uses with existing conditions in populated areas, taking into account noise and other factors.

Visual Resource Management

Management Objectives (VRM General)

- Protect the quality of the scenic values on public lands where VRM is an issue or where high-value visual resources exist, and protect areas having high scenic quality, visual sensitivity, and public visibility.

Management Direction (VRM General)

- Only allow activities that are determined to meet visual management objectives using the Visual Resource Contrast Rating system.
- Manage visual resources on BLM-administered lands according to the objectives for each VRM class.

Management Objectives (VRM Class I)

- Prohibit activities that would disrupt the existing character of the landscape in VRM Class I areas.

Management Direction (VRM Class I)

- Designated, suitable, and eligible Wild and Scenic Rivers that are classified as wild, Wilderness Areas, Wilderness Study Areas, and Wilderness Instant Study Areas will be managed as VRM Class I areas.
- Manage VRM Class I areas in accordance with natural ecological changes. Prohibit activities that would lower the inventory class of VRM I areas. The level of change to the characteristic landscape will be very low and will not attract attention. Changes will repeat the basic elements of form, line, color, texture, and scale found in the predominant natural features of the characteristic landscape.
- Establish VRM Class I areas as Right-Of-Way Exclusion Areas.

Management Objectives (VRM Class II)

- Retain the existing character of the landscape in VRM Class II areas.

Management Direction (VRM Class II)

- Designated, suitable, and eligible Wild and Scenic Rivers that are classified as scenic will be managed as VRM Class II areas.
- Special Recreation Management Areas that fall within the Primitive and Backcountry category of the Recreation Opportunity Spectrum (ROS) will be managed as VRM Class II areas.
- Manage VRM Class II areas for low levels of change to the characteristic landscape. Management activities will be seen but will not attract the attention of the casual observer. Changes will repeat the basic elements of form, line, color, texture, and scale found in the predominant natural features of the characteristic landscape.

Management Objective (VRM Class III)

- Partially retain the existing character of the landscape in VRM Class III areas.

Management Direction (VRM Class III)

- Designated, suitable, and eligible Wild and Scenic Rivers that are classified as recreational will be managed as VRM Class III areas.
- Special Recreation Management Areas (SRMAs) and Extensive Recreation Management Areas (ERMAs) that fall within the Middle country category of the Recreation Opportunity Spectrum will be managed as VRM Class III areas.
- Manage VRM Class III areas for moderate levels of change to the characteristic landscape. Management activities will attract attention but will not dominate the view of the casual observer. Changes will repeat the basic elements of form, line, color, texture, and scale found in the predominant natural features of the characteristic landscape.

Management Objective (VRM Class IV)

- Allow for major modification of the existing character of the landscape in VRM Class IV areas.

Management Direction (VRM Class IV)

- All lands that are not designated as Class I, II, or III, will be managed as VRM Class IV areas.
- Manage VRM Class IV areas for high levels of change to the characteristic landscape. Management activities will dominate the view and will be the major focus of viewer attention.

Wild Horses

Management Objective

- Manage and maintain a healthy population of wild and free-roaming horses in the Pokegama Herd Management Area of the Klamath Falls Field Office.

Management Direction

- Gather horses to maintain the appropriate management level of 30-50 head. During gathers, the number of horses will normally be reduced to the low end of the appropriate management level, and then allowed to increase to the top end of the appropriate management level before another gather occurs. Horses may also be removed from private land per private landowner request. Horses straying outside the herd management area will be removed or returned to the herd management area.
- Periodically introduce horses from other herd areas to the Pokegama herd to maintain viable herd genetic diversity.
- Maintain existing water developments that provide season-long water for wild horses within the herd management area. Consider new developments that would assist in meeting the herd management objectives.
- Provide periodic repair and maintenance of fences that protect riparian areas from concentrated use by wild horses.
- Adjust the appropriate management level if monitoring data identifies a change in long-term forage availability or rangeland health assessments and evaluations determine that wild horse numbers, or patterns of grazing use is a contributing factor toward not meeting one or more of the Oregon Standards for Rangeland Health.

Wildlife

Management Objectives

- Conserve and recover ESA-listed species and the ecosystems on which they depend so that ESA protections are no longer needed for those species.
- Implement proactive conservation measures that reduce or eliminate threats to Bureau Sensitive species to minimize the likelihood of and need for listing of these species under the ESA.
- Conserve or create habitat for species addressed by the Migratory Bird Treaty Act and the ecosystems on which they depend.

Management Direction

- Implement conservation measures to mitigate specific threats to Bureau Sensitive species during the planning of activities and projects. Conservation measures include altering the type, timing, location, and intensity of actions.
- Manage naturally occurring special habitats to maintain their ecological function including: seeps, springs, wetlands, natural ponds, vernal pools/ponds, natural meadows, rock outcrops, caves, cliffs, talus slopes, mineral licks, oak savannah/woodlands, sand dunes, and marine habitats.
- Manage human-made special habitats as wildlife habitat when compatible with their engineered function including bridges, buildings, quarries, pump chances/heliponds, abandoned mines, and reservoirs.
- [Klamath Falls; Medford] Maintain or enhance Special Status Species wildlife habitat on rangelands.
- [Roseburg] For the Columbia white-tailed deer, continue to implement the record of decision for the North Bank Habitat Management Area.

Bald and Golden Eagles

- Protect known bald eagle or golden eagle nest sites and bald eagle winter roosting areas. Prohibit activities that will disrupt nesting where bald eagles or golden eagles are currently nesting.
- Routine use and maintenance of existing roads and other facilities where such use pre-dates the eagles’ successful nesting activity can continue.
- Do not remove overstory trees within 330 feet of bald eagle or golden eagle nests.
- Do not conduct timber harvest operations (including road construction, tree felling, and yarding) during the breeding season within 660 feet of bald eagle or golden eagle nests. Decrease the distance to 330 feet around alternate nests within a particular territory, including nests that were attended during the current breeding season but not used to raise young, or after eggs laid in another nest within the territory have hatched.
- Prohibit operation of off-road vehicles within 330 feet of bald eagle or golden eagle nests during the breeding season. In areas without forest cover or topographic relief to provide visual and auditory screening, prohibit operation of off-road vehicles within 660 feet of bald eagle or golden eagle nests during the breeding season.

Bats

- Protect bat maternity colonies and bat hibernacula with a 250-foot buffer. Within this 250-foot buffer, protect the site from destruction, vandalism, disturbance from road construction or blasting, or any other activity that could change temperatures or drainage patterns at the site and maintain existing habitat conditions. Restoration necessary to protect this habitat would be allowed.

- Prohibit human access into caves and abandoned structures (unless for education, monitoring, or research) where white-nose syndrome (fungal disease that infects bats) is found in the bats residing within. Prohibition of human access into such caves or abandoned structures would include signing and physical closure in such a way that air flow patterns are maintained, people are excluded, and bats can freely enter and exit. Where physical closure of the cave or mining structure is not feasible, then the roads or trails that provide human access would be closed to public access.

Deer or Elk Management Areas (Klamath Falls, Medford, and Salem)

- Restrict motor vehicle use within designated deer or elk management areas between November 1 and April 15. Techniques such as gating or signing will be used to impose the restrictions. Administrative use of all roads will occur, as needed, on a year-round basis.
- Maintain visual barriers of vegetation (e.g., brush, shrubs, small trees) 25 feet wide along roads within designated deer or elk management areas. These visual barriers may discontinuous where needed to facilitate operations.
- Plant forage species along roadsides, skid trails, and on disturbed areas, or create forage plots where forage for deer or elk is limited within designated deer or elk management areas.
- [Klamath Falls; Medford specific] Thin, pile and burn, or remove encroaching western juniper that hinders attainment of desired forage conditions to maintain and improve forage for deer or elk. Retain old juniper during these treatments.

Fisher

- Retain structures used as known fisher natal and maternal den sites.
- Within the Applegate, Chetco, Illinois, Middle Rogue, Upper Klamath, Upper Klamath Lake, and Upper Rogue sub-basins, retain conifers and hardwoods that have structures that are typically used as denning or resting sites (e.g., cavities, mistletoe, rust brooms) by fisher:
  - Live or dead conifers ≥ 36 inches DBH that have cavities, mistletoe, or rust brooms;
  - Live or dead hardwoods ≥ 24 inches DBH that have cavities, mistletoe, or rust brooms;
- Restrict activities that create noise or visual disturbance(s) above ambient conditions within 0.5 miles of known fisher natal and maternal den sites from February 1 to June 30.

Gray Wolf

- Restrict activities that create noise or visual disturbance(s) above ambient conditions within one mile of active gray wolf dens from April 15 to August 31.

Siskiyou Mountains Salamander -

- Maintain habitat conditions for the Siskiyou Mountains salamander at those high-priority sites that do not have the risk of high intensity fire by restricting activities that would have adverse effects on substrate, ground cover, forest condition (e.g. canopy cover) or microclimate.
- Reduce fuel loading at those high-priority sites that do have a risk of high-intensity fire within desired conditions to improve Siskiyou Mountains salamander habitat.

Western Snowy Plover (Coos Bay)

- The BLM's contribution to the recovery of the western snowy plover consists of the following actions:

- Prohibit disrupting activities during the breeding season where western snowy plover are currently nesting.
- Restrict public use of breeding areas during the breeding season.
- Employ predator management to reduce loss of western snowy plovers.
- Implement habitat restoration measures to maintain open sand conditions for nesting.

Northern Spotted Owl

Northern Spotted Owl Management Direction

All allocations

- Manage habitat conditions for northern spotted owl movement and survival between and through large blocks of northern spotted owl nesting-roosting habitat.

LSR

- Protect[120] stands of older, structurally-complex conifer forest.

LSR and OHTA

- Manage for large blocks of nesting-roosting habitat that support clusters of reproducing owls, such blocks are distributed across the variety of ecological conditions, and are spaced to facilitate movement of dispersing owls between and through the blocks.
- Promote the development of habitat for the northern spotted owl in stands that do not currently meet suitable habitat criteria.
- Maintain[121] habitat for the northern spotted owl.

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[120] **Protect northern spotted owl habitat** means to prohibit harvesting activities in a conifer forest stand except as provided in this definition. Harvesting activities are limited to the following: felling of live or dead hazard trees and stream logs, the construction of linear and nonlinear rights-of-way, spur roads, yarding corridors or other facilities, as long as the forest stand continues to support the same northern spotted owl life history requirements; nesting-roosting habitat continues to support northern spotted owl nesting-roosting; dispersal habitat continues to support northern spotted owl movement and survival. Other Silvicultural activities, such as fire suppression, fuels reduction, insect and disease control, and other activities needed to protect the overall health of the stand or adjacent stands may occur, even if they maintain, downgrade, or remove northern spotted owl habitat.

[121] **Maintain northern spotted owl habitat** refers to a silvicultural activity that changes a conifer forest stand but maintains structural characteristics such that the stand continues to support the same northern spotted owl life history requirements; nesting-roosting habitat continues to support northern spotted owl nesting-roosting; dispersal habitat continues to support northern spotted owl movement and survival. Scientific findings support the idea that conifer forest stands can be altered in a manner that does not necessarily change their use by northern spotted owls (see the summary in the *Revised Recovery Plan for the Northern Spotted Owl*, USDI FWS 2011, p. III-15). Although structural characteristics vary across the northern spotted owl's range, northern spotted owl *nesting-roosting habitat* generally is characterized by conifer stands with a multi-layered, multispecies canopy dominated by large (> 30 inches diameter at breast height) conifer overstory trees, and an understory of shade-tolerant conifers or hardwoods, ≥ 60 percent canopy cover, substantial decadence in the form of large, live conifer trees with deformities (such as cavities, broken tops, and dwarf mistletoe infections; numerous large snags), ground cover characterized by large accumulations of logs and other woody debris, and a canopy that is open enough to allow northern spotted owls to fly within and beneath it. Northern Spotted owl *dispersal habitat* generally is characterized by conifer forest stands with an average diameter of ≥ 11 inches at breast height and ≥ 40 percent canopy cover.

Northern Spotted Owl Management Direction

LSR

- Such stands are a subset of, and represent the highest value, northern spotted owl nesting-roosting habitat. Although specific stand characteristics vary across the northern spotted owl range due to climatic gradients and abiotic factors (e.g., aspect), they generally have large-diameter conifer trees (≥ 30 inches at breast height), a multi-layered, multispecies canopy, high canopy cover (≥ 60 percent), an understory of shade-tolerant conifers or hardwoods, decadence components such as large live trees with broken-tops, cavities and mistletoe infections, large snags, fallen trees, and a canopy that is open enough for northern spotted owls to fly through and beneath it.

LSR and OHTA

- In conifer forest stands that are not older and more structurally-complex, apply silvicultural treatments to promote the development of structurally-complex forest.
- In stands that are currently nesting-roosting habitat, maintain nesting-roosting habitat function regardless of northern spotted owl occupancy.

Alternative A

Forest Management

Management Objectives for HITA

- See common to all Harvest Land Base lands

Management Direction for HITA

- See common to all Harvest Land Base lands
- Offer for timber for sale from regeneration harvest units with area totaling not less than 8 percent and not more than 17 percent of the area in this land use allocation in each Field Office per decade.
  - Regeneration harvest would be applied in stands ≥ 60 years old for any of the following reasons:
    - To produce timber to contribute to the attainment of the declared Annual Sale Quantity.
    - To develop a balanced age class distribution: Equal number of acres in each 10-year age class throughout this LUA in each Field Office.
    - Conduct post-disturbance salvage or manage dead or dying stands due to insects or disease.
    - Insect and disease management.
    - Convert stands with a composition of commercially undesirable tree species or an inadequate stocking of commercially desirable tree species to stands that are fully stocked by commercially desirable tree species.
  - Regeneration harvest would be applied in stands < 60 years old for any one of the above reasons, or for the following reason:
    - In order to reset stand development in stands that are overly dense that would not respond well to commercial thinning. Overly dense stands are generally characterized as having average crown ratios in trees over 8” DBH of ≤ 20 percent or average height to diameter ratios of trees over 8” DBH ≥ 80.
  - Remove all merchantable material from regeneration harvest units, except when overstory trees must be left to provide protection to the regenerating understory. Harvest these trees after such protection is no longer needed.
    - Regeneration harvest units will be adequately reforested with species mix appropriate to the site within five years of project completion.
- Offer timber for sale from commercial thinning harvest units.
  - Apply commercial thinning for one or more of the following reasons:
    - To produce timber to contribute to the attainment of the declared Annual Sale Quantity.
    - To recover current or anticipated mortality,
    - To adjust stand composition or dominance,
    - To reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation;
    - To improve merchantability and value.
  - Maintain stand densities through commercial thinning at levels above that needed to occupy the site, but below densities that will result in loss of stand vigor and health.
    - Post-thinning stand average relative percent max SDI targets will be between 35 percent and 45 percent.
- Implement timber salvage harvest after disturbances to recover economic value and to minimize commercial loss or deterioration of damaged trees.
  - Remove all merchantable dead and down timber from disturbed area, where removal is economically viable.

Management Objectives for UTA

- See common to all alternatives

Management Direction for UTA

- See common to all alternatives

Grazing

Management Objectives

- Provide for livestock grazing consistent with other resource objectives while maintaining or improving the health of the public rangelands.
- Prevent livestock from causing trampling disturbance to spawning beds where Federally-listed salmonid fish species occur.

Management Direction (all Districts)

- For streams with salmonid species listed under the Endangered Species Act, livestock will not be released into riparian areas until 30 days following emergence of salmonids from spawning beds.

Management Direction (Medford, Klamath Falls)

- Manage livestock grazing in accordance with the "Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands in Oregon and Washington." **Figure 3-122** shows lands available for livestock grazing. **Appendix K** contains the Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Oregon/Washington.
- Maintain current grazing levels and management practices for the allotments shown in **Appendix K**. Make adjustments when rangeland health assessments and evaluations of monitoring data identify that livestock grazing is a contributing factor toward not meeting one or more of the Standards for Rangeland Health for Oregon and Washington.
- Develop range improvements when needed to achieve the Standards for Rangeland Health for Oregon and Washington, RMP objectives, or other allotment specific objectives.
- Rest from livestock grazing those areas disturbed by natural and human-induced events including but not limited to wildland fire, prescribed burns, timber management treatments, juniper cuts, and rehabilitation. Resume livestock grazing after determination that soil and vegetation have recovered from the initial disturbance to support livestock grazing. Exceptions would be for cases where such grazing would not impede either site recovery, or where livestock are used as a tool to aid in achieving certain recovery objectives.
- Authorize livestock grazing through management agreements, temporary nonrenewable grazing permits or leases, or special use permits on lands not available for livestock grazing through the issuance of a grazing lease or permit to control invasive plants, reduce fire danger, or accomplish other management objectives.

Management Direction (Coos Bay)

- Lands within the grazing allotments identified on **Table B-6** will not be available for livestock grazing through the issuance of a grazing lease or permit. Grazing will not continue to be authorized under Section 15 of the Taylor Grazing Act. Grazing may be authorized through management agreements, temporary nonrenewable grazing permits or leases, or special use permits consistent with the grazing regulations.

Table B-6. Allotments not available for livestock grazing, Coos Bay District.

Allotment Name	Allotment Number	Public Land (Acres)	Forage Allocation (AUMs)
Bullock	20006	8	12
Kellogg	20007	3	6
Middle Creek	20001	-	5
New River	30001	530	97
	Totals	**541**	**120**

Management Direction (Klamath Falls)

- Lands within the grazing allotments identified on **Table B-7** will not be available for livestock grazing through the issuance of a grazing lease or permit. Grazing will not continue to be authorized under Section 15 of the Taylor Grazing Act. Grazing may be authorized through management agreements, temporary nonrenewable grazing permits, or leases, or special use permits consistent with the grazing regulations.

Table B-7. Allotments not available for livestock grazing, Klamath Falls Field Office.

Allotment Name	Allotment Number	Public Land (Acres)	Forage Allocation (AUMs)
Edge Creek*	00102	5,950	-
Plum Hills	00813	160	20
	Totals	**6,110**	**20**

* The portion of the Upper Klamath Scenic River within the Edge Creek Allotment will be closed to grazing. This portion of the allotment is not allocated any AUMs. The remainder of the allotment will be available for grazing.

- Close exclosures and other areas identified on **Table B-8** to grazing.

Table B-8. Exclosures or other areas closed to grazing, Klamath Falls Field Office.

Allotment Name	Allotment Number	Area Closed (Typically Entire Area Inside the Exclosure Fencing)
Edge Creek	00102	Hayden Creek Exclosures (2) Fox Lake Exclosure
Buck Lake	00104	Tunnel Creek Exclosure Surveyor Campground Exclosure
Dixie	00107	Dixie (Long Prairie Creek) Exclosure
Jeld-Wen	00822	Aspen Exclosure
Rodgers	00852	Van Meter Flat Reservoir Exclosure
Yainax	00861	Bull Spring Exclosure Timothy Spring Exclosure
Bear Valley	00876	Holbrook Spring Exclosure
Bumpheads	00877	Bumpheads Reservoir Outlet Exclosure Antelope Creek Exclosure
Horsefly	00882	Long Branch Exclosure Caseview Spring Exclosure

Allotment Name	Allotment Number	Area Closed (Typically Entire Area Inside the Exclosure Fencing)
		Norcross Spring Exclosure/Area within the spring exclosure fence Boundary Spring Exclosure Barnes Valley Riparian Pasture (except as scheduled)
Pankey Basin	00884	Pankey Creek Riparian Exclosure
Dry Prairie	00885	Ben Hall Creek Riparian Pasture (except as scheduled)
Horse Camp Rim	00886	21 Reservoir Exclosure
Pitchlog	00887	Pitchlog Creek Exclosure Willow Spring Exclosure CCC Spring Exclosure
Willow Valley	00890	East Fork Lost River Exclosure Duncan Spring/Antelope Creek Exclosures (2) Antelope Riparian Pasture (except as scheduled)
Wood River	30855	Entire area excluded from regular grazing use via the 1996 *Upper Klamath Basin and Wood River Wetland ROD/RMP*

Management Direction (Medford)

- Lands with grazing allotments identified on **Table B-9** below will not be available for livestock grazing through the issuance of a grazing lease. Grazing will not continue to be authorized under Section 15 of the Taylor Grazing Act. Grazing may be authorized through management agreements, temporary nonrenewable grazing permits or leases, or special use permits consistent with the grazing regulations.

Table B-9. Allotments not available for livestock grazing, Medford District.

Allotment Name	Allotment Number	Public Land (Acres)	Forage Allocation (AUMs)
Trail Creek	10003	12,868	113
Longbranch*	10004	10,844	71
Antioch Road	10005	40	4
Roundtop Evans	10006	27,086	110
West Perry Road	10010	75	10
East Perry Road	10011	40	7
Obenchain Mountain	10014	120	12
Nichols Gap	10018	280	18
Eagle Point Canal	10020	465	55
Shady Branch	10025	320	32
Derby Station	10030	540	36
West Derby	10034	1,120	89
Emigrant Creek	10111	40	7
Baldy	10120	798	87
Lost Creek	10123	80	6
Cartwright	10127	40	4
Bybee Peak	10144	321	36

Allotment Name	Allotment Number	Public Land (Acres)	Forage Allocation (AUMs)
Stiehl	10210	175	18
Fielder Creek	10211	40	5
Del Rio	10216	40	5
Sugarloaf/Greensprings	20158	2,926	210
Applegate	20201	25,518	294
Tunnel Ridge	20202	2,183	14
Timber Mountain	20204	1,720	70
Sardine and Galls Creek	20205	3,765	158
Sterling Creek	20207	29,209	190
Spencer Gulch	20208	1,935	150
Quartz Gulch	20209	680	9
Burton Butte	20212	5	2
Chapman Creek	20213	3,309	81
Ecker	20217	40	6
Stage Road	20218	40	4
Lomas Road	20222	635	50
Star	20223	118	24
Pickett Mountain	20302	820	30
Jump Off Joe	20303	80	8
Deer Creek*	20308	1,247	0
Reeves Creek	20309	1,672	95
Q Bar X	20310	15	3
Esterly Creek	20312	4,457	152
Glade Creek	20315	560	17
Cherry Gulch	20316	40	6
	Totals	**136,306**	**2,298**

* These portions of the Longbranch and Deer Creek Allotments will be closed to grazing. The remainder of the allotments will be available for grazing.

All areas that are currently without allotments will remain closed to grazing through the issuance of a grazing lease or permit.

Invasive Species

Management Objectives

- See common to all alternatives.

Management Direction

- See common to all alternatives.

Sudden Oak Death
- Do not apply sudden oak death treatments.

Late Successional Reserves

Management Objectives
- See common to all alternatives.

Management Direction
- See common to all alternatives.
- When treating conifer forest stands that are not nesting-roosting habitat, limit silvicultural treatments to those that:
  - Speed the development of, or improve the quality of northern spotted owl habitat in the stand, or in the adjacent stand, or both.
  - Do not preclude or delay by 10 years or more the development of northern spotted owl nesting-roosting habitat in the stand and in adjacent stands.

Moist Forests
- Retain cut trees.

Dry Forests
- See common to all Dry LSRs
- Timber salvage is prohibited, except when necessary to protect public health and safety, or to keep roads and other infrastructure clear of debris.

Rare Plants and Fungi

Management Objectives
- See common to all alternatives
- Provide for the conservation of Bureau Special Status plant and fungi species.

Management Direction
- See also common to all alternatives
- Manage Federal candidate and Bureau Sensitive plant and fungi species consistent with any existing conservation agreements or strategies including the protection and restoration of habitat; altering the type, timing, and intensity of actions; and other strategies designed to conserve populations of the species.
- Create new and augment existing populations of ESA and Bureau Special Status plant and fungi species to meet recovery plan or conservation strategy objectives.

Riparian Reserve

Management Direction in the decision area west of Highway 97
- See common to all alternatives

Management Direction in the decision area <u>west</u> of Highway 97

- See common to all alternatives

Table B-10. Riparian Reserve distance by water feature.

Feature	Riparian Reserve Distance*
All streams	One site-potential tree height distance from the edge of its active stream channel on each side of a stream
Unstable areas that are above or adjacent to stream channels and are likely to deliver material such as sediment and logs to the stream if the unstable area fails	The extent of the unstable area. Where there is a stable area between such an unstable area and the unstable area has the potential to deliver material such as sediment and logs to the stream, extend the Riparian Reserve from the stream to include the intervening stable area as well as the unstable area.
Lakes, natural ponds, and wetlands >1 acre	One-hundred feet extending from the edge of the water feature
Ponds and wetlands <1 acre and constructed impoundments of any size	The extent of riparian vegetation
Non-forest ecosystem streams and wetlands	Edge of the water body to the limit of the water influence area, as indicated by hydrophilic vegetation
Unstable areas that are above or adjacent to stream channels and are likely to deliver material such as sediment and logs to the stream if the unstable area fails	The extent of the unstable area. Where there is a stable area between such an unstable area and the unstable area has the potential to deliver material such as sediment and logs to the stream, extend the Riparian Reserve from the stream to include the intervening stable area as well as the unstable area.

* Reported distances are measured as slope distance.

Table B-11. Zone-specific management direction.

All Streams
Inner Zone All fish-bearing streams and perennial non-fish-bearing streams: 0 to 120 feet Non-fish-bearing intermittent streams: 0 to 50 feet
Do not thin stands, except as described below under “all zones” for fuels treatments.
Outer Zone All fish-bearing and perennial non-fish-bearing streams: 120 feet to one site-potential tree height Non-fish-bearing intermittent streams: 50 feet to one site-potential tree height
Thin stands as needed to ensure that stands are able to provide stable wood to the stream. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average across the riparian reserve portion of the stand. **Moist Forests:** Remove trees only as needed for safety or operational reasons. **Dry forests:** Apply fuels reduction and thinning treatments and remove cut trees as needed to reduce the risk of large, high severity or high intensity fire. Retain at least 30 percent canopy cover and 60 trees per acre, expressed as an average across the riparian reserve portion of the stand. Merchantable timber from thinning and other silvicultural treatments may be made available for sale. Otherwise, remove trees only as needed for safety or operational reasons.
All Zones (Edge of active stream channel to one site-potential tree height)
See common to all alternatives

Fell trees as needed for stream restoration and towards the stream as feasible, if key pieces, size and volume are inadequate, based on ODFW benchmarks or NMFS habitat analytical procedure. **Moist Forest:** Retain cut or blown down trees within the Riparian Reserve. Remove trees only as needed for safety or operational reasons. **Dry Forests:** Apply low or moderate-severity burns where needed to invigorate native deciduous tree species. Moderate severity burns will be limited to no more than 20 percent of area of the Riparian Reserve subwatershed (HUC 12) each year. Apply non-commercial tree thinning as necessary to adjust fuel loads prior to a moderate-severity burn.
Lakes, Ponds and Wetlands > 1 acre (Edge of the water body to 100 feet)
See common to all **Moist Forest:** Retain cut or blow down trees within the Riparian Reserve. **Dry Forests:** Apply low or moderate-severity burns where needed to invigorate native tree deciduous species. Moderate severity burns will be limited to no more than 20 percent of area of the Riparian Reserve subwatershed (HUC 12) each year. Apply non-commercial tree thinning as necessary to adjust fuel loads prior to a moderate-severity burn.
Ponds and Wetlands < 1 acre and Constructed Water Impoundments of any size[122]
Edge of the water body to the limit of the water influence area, as indicated by hydrophilic vegetation. See management direction for all riparian zones for Alternative A.
Non-forest ecosystems streams and wetlands
Edge of the water body to the limit of the water influence area, as indicated by hydrophilic vegetation. See management direction for all riparian zones for Alternative A.
Unstable areas that are above or adjacent to stream channels and are likely to deliver material such as sediment and logs to the stream if the unstable area fails.
The extent of the unstable area. Where there is a stable area between such an unstable area and the unstable area has the potential to deliver material such as sediment and logs to the stream, extend the Riparian Reserve from the stream to include the intervening stable area as well as the unstable area. See management direction for all riparian zones for Alternative A.

Wildlife

Management Objectives

- See common to all alternatives.

122 Typically, small ponds in forest environments used for fire suppression activities.

Management Direction

- See common to all alternatives.

Marbled Murrelet

- Protect existing, occupied marbled murrelet sites as of [*ROD Date*] as they are currently mapped (*refer to map in the 2015 FEIS/ROD that depicts these sites*).
- Restrict activities that disrupt marbled murrelet nesting during the nesting period where marbled murrelets are currently nesting.
- ***Note****: There is no management direction to conduct intensive surveys for the marbled murrelet (or subsequent direction for managing future, occupied sites) under Alternative A.*

Alternative B

Forest Management

Management Objectives for LITA

- See common to all alternatives.
- Manage habitat conditions around northern spotted owl sites to promote species recovery (high vs. low).
- Provide complex early-successional ecosystems.
- Develop diverse late successional ecosystems for a portion of the rotation.
- Provide a variety of forest structural stages distributed both spatially and temporally.

Management Direction for LITA

- See common to all alternatives.

- Protect conifer forest stands (high vs. low):
  - Within the nest patch of a northern spotted owl known or historic site. The nest patch is delineated as a 200-meter radius circle around a known or historic site

- Maintain or protect all NSO nesting-roosting habitat (high vs. low):
  - Within the 500-acre core use area circle around a known or historic nest site when < 250 post-treatment acres would support nesting-roosting habitat, regardless of pre-treatment conditions or cause.
  - Within the mean provincial home range circle around a known or historic nest site when < 40 percent of the post-treatment circle would support nesting-roosting habitat, regardless of pre-treatment conditions or cause.

- Offer for timber for sale from regeneration harvest units with area totaling not less than 6 percent and not more than 10 percent of the area in this land use allocation in each field office per decade.
  - Regeneration harvest would be applied in stands ≥ 100 years old for one or more of the following reasons:
    - To produce timber to contribute to the attainment of the declared Annual Sale Quantity.
    - To develop a balanced age class distribution: Equal number of acres in each 10-year age class throughout this LUA in each field office.
    - Post-disturbance salvage or manage dead or dying stands due to insects or disease.
    - Insect and disease management.
    - Convert stands capable of supporting conifer species that are currently growing primarily hardwoods or shrubs to a mix of conifer and hardwood species suitable to the site, unless the hardwoods or shrubs would produce a higher net monetary return.
    - To produce complex early-successional ecosystems.
  - Regeneration harvest would be applied in stands < 100 years old for any one of the above reasons, or for the following reason:
    - In order to reset stand development in stands that are overly dense that would not respond well to commercial thinning. Overly dense stands are generally characterized as having average crown ratios in trees over 8” DBH of ≤ 20 percent or average height to diameter ratios of trees over 8” DBH ≥ 80.
  - Regeneration harvest units shall meet the following criteria:

        - Retain 15-30 percent of pre-harvest stand basal area in individual regeneration harvest units. If the Riparian Reserve makes up ≥ 10 percent of the stand area, retain basal area towards the low end of the range; if the Riparian Reserve makes up <10 percent of the stand area, retain basal area towards the higher end of the range.
        - Create snags sufficient to meet snag targets in **Table B-18**.
        - Retention shall be left in a variety of spatial patterns, including clumps, aggregated groups, stringers, and individual trees.
        - Retention levels can be met with trees from any species or diameter class, and retention trees should represent the range of diameters and species present in the pre-harvest stand.
        - Use natural regeneration to establish desired stocking of tree species appropriate to the site.
            - At least 30 percent of the stand would be maintained below 30 percent canopy cover in regenerated trees for at least 30 years to allow the early-successional ecosystem to develop and mature.

- Offer timber for sale from commercial thinning harvest units.
    - Apply commercial thinning for one or more of the following reasons:
        - To produce timber to contribute to the attainment of the declared Annual Sale Quantity.
        - To recover current or anticipated mortality,
        - To adjust stand composition or dominance,
        - To reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation;
        - To improve merchantability and value;
        - To increase or maintain vegetative species diversity;
        - To promote or enhance the development of structural complexity.
    - Maintain stand densities through commercial thinning at levels above that needed to occupy the site, but below densities that will result in loss of stand vigor and health.
        - Post-thinning stand average relative percent max SDI targets will be between 25 percent and 35 percent.
        - Implement unthinned skips and group selection openings to provide increased structural complexity in the post-treatment stand.
            - The total area in group selection openings shall not exceed 10 percent of the thinned portion of the stand.
            - at least ½ of the skips would be implemented as retention islands unattached to the exterior harvest unit boundaries
        - Create snags sufficient to meet snag targets in **Table B-18**.

- Implement timber salvage harvest after disturbances to recover economic value and to minimize commercial loss or deterioration of damaged trees.
    - For disturbance events causing mortality of ≥ 60 percent of overstory trees on contiguous areas ≥ 10 acres in size:
        - Follow management direction for regeneration harvest units. Areas salvaged in this way also count towards regeneration harvest percent targets.
    - For all other disturbance events:
        - Remove all merchantable dead and down timber from disturbed area in excess of snag targets set forth in table X, where removal is economically viable.

Management Objectives for MITA

- See common to all alternatives.

- Manage habitat conditions around northern spotted owl sites to promote species recovery (high vs. low).
- Provide complex early-successional ecosystems.
- Develop late-successional ecosystems for a portion of the rotation.
- Provide a variety of forest structural stages distributed both temporally and spatially.

Management Direction for MITA

- See common to all ASQ lands.
- Protect conifer forest stands (high vs. low):
  - Within the nest patch of a northern spotted owl known or historic. The nest patch is delineated as a 200-meter radius circle around a known or historic site.

- Maintain or protect all NSO nesting-roosting habitat (high vs. low):
  - Within the 500-acre core use area circle around a known or historic nest site when < 250 post-treatment acres would support nesting-roosting habitat, regardless of pre-treatment conditions or cause.
  - Within the mean provincial home range circle around a known or historic nest site when < 40 percent of the post-treatment circle would support nesting-roosting habitat, regardless of pre-treatment conditions or cause.

- Offer for timber for sale from regeneration harvest units with area totaling not less than 8 percent and not more than 10 percent of the area in this Land Use Allocation in each field office per decade.
  - Regeneration harvest would be applied in stands ≥ 60 years old for one or more of the following reasons:
    - To produce timber to contribute to the attainment of the declared Annual Sale Quantity.
    - To develop a balanced age class distribution: Equal number of acres in each 10-year age class throughout this LUA in each field office.
    - Post-disturbance salvage or manage dead or dying stands due to insects or disease.
    - Insect and disease management.
    - To convert stands capable of supporting conifer species that are currently growing primarily hardwoods or shrubs to a mix of conifer and hardwood species suitable to the site, unless the hardwoods or shrubs would produce a higher net monetary return.
    - To produce complex early-successional ecosystems.
  - Regeneration harvest would be applied in stands < 60 years old for any one of the above reasons, or for the following reason:
    - In order to reset stand development in stands that are overly dense that would not respond well to commercial thinning. Overly dense stands are generally characterized as having average crown ratios in trees over 8” DBH of ≤ 20 percent or average height to diameter ratios of trees over 8” DBH ≥ 80.
  - Regeneration harvest units shall meet the following criteria:
    - Retain 5-15 percent of pre-harvest stand basal area in individual regeneration harvest units. If Riparian Reserves make up ≥ 10 percent of the stand area, retain basal area towards the low end of the range; if Riparian Reserves make up <10 percent of the stand area, retain basal area towards the higher end of the range.
    - Create snags sufficient to meet snag targets in **Table B-18**.
    - Retention shall be left in a variety of spatial patterns, including clumps, aggregated groups, stringers, and individual trees.
      - Retention levels can be met with trees from any species or diameter class, and retention trees should represent the range of diameters and species present in the pre-harvest stand.

        - Use natural regeneration, artificial regeneration, or a combination of the two to establish target stocking of tree species appropriate to the site within 5 years following regeneration harvest.
            - Up to 10 percent of the stockable stand area may be left un-stocked with trees in order to enhance the diversity of the early-successional ecosystem.
            - 50-70 percent of full stocking is considered acceptable.
            - At least 30 percent of the stand would be maintained below 30 percent canopy cover in regenerated trees for at least 30 years to allow the early-successional ecosystem to develop and mature.

- Offer timber for sale from commercial thinning harvest units.
    - Apply commercial thinning for any the following reasons:
        - To produce timber to contribute to the attainment of the declared Annual Sale Quantity.
        - To recover current or anticipated mortality,
        - To adjust stand composition or dominance,
        - To reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation;
        - To improve merchantability and value.
        - To increase or maintain vegetative species diversity.
        - To promote or enhance the development of structural complexity.
    - Maintain stand densities through commercial thinning at levels above that needed to occupy the site, but below densities that will result in loss of stand vigor and health.
        - Post-thinning stand average relative percent max SDI targets will be between 25 percent and 35 percent.
        - Implement unthinned skips and group selection openings to provide increased structural complexity in the post-treatment stand.
            - The total area in group selection openings shall not exceed 10 percent of the thinned portion of the stand.
            - at least ½ of the skips would be implemented as retention islands unattached to the exterior harvest unit boundaries
        - Create snags sufficient to meet snag targets in **Table B-18**.

- Implement timber salvage harvest after disturbances to recover economic value and to minimize commercial loss or deterioration of damaged trees.
    - For disturbance events causing mortality of ≥ 60 percent of overstory trees on contiguous areas ≥ 10 acres in size:
        - Follow management direction for regeneration harvest units. Areas salvaged in this way also count towards regeneration harvest percent targets.
    - For all other disturbance events:
        - Remove all merchantable dead and down timber from disturbed area in excess of snag targets set forth in **Table B-18**, where removal is economically viable.

Management Objectives for UTA

- See common to all alternatives.

Management Direction for UTA

- See common to all alternatives.

- Snags (not downed wood) will be created in sufficient numbers to meet targets established in **Table B-18**

Grazing

Management Objectives

- Provide for livestock grazing consistent with other resource objectives while maintaining or improving the health of the public rangelands.
- Prevent livestock from causing trampling disturbance to spawning beds where Federally-listed salmonid fish species occur.

Management Direction (all Districts)

- For streams with salmonid species listed under the Endangered Species Act, livestock will not be released into riparian areas until 30 days following emergence of salmonids from spawning beds.

Management Direction (Medford, Klamath Falls)

- Manage livestock grazing in accordance with the "Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands in Oregon and Washington." **Figure 3-122** shows lands available for livestock grazing. **Appendix K** contains the Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Oregon/Washington.
- Maintain current grazing levels and management practices for the allotments shown in **Appendix K**. Make adjustments when rangeland health assessments and evaluations of monitoring data identify that livestock grazing is a contributing factor toward not meeting one or more of the Standards for Rangeland Health for Oregon and Washington.
- Develop range improvements when needed to achieve the Standards for Rangeland Health for Oregon and Washington, RMP objectives, or other allotment specific objectives.
- Rest from livestock grazing those areas disturbed by natural and human-induced events including but not limited to wildland fire, prescribed burns, timber management treatments, juniper cuts, and rehabilitation. Resume livestock grazing after determination that soil and vegetation have recovered from the initial disturbance to support livestock grazing. Exceptions would be for cases where such grazing would not impede site recovery, or where livestock are used as a tool to aid in achieving certain recovery objectives.
- Authorize livestock grazing through management agreements, temporary nonrenewable grazing permits or leases, or special use permits on lands not available for livestock grazing through the issuance of a grazing lease or permit to control invasive plants, reduce fire danger, or accomplish other management objectives.

Management Direction (Coos Bay)

- Lands within the grazing allotments identified on **Table B-12** will be closed to livestock grazing through the issuance of a grazing lease or permit. Grazing will not be authorized under Section 15 of the Taylor Grazing Act. Grazing may be authorized through management agreements, temporary nonrenewable grazing permits or leases, or special use permits consistent with the grazing regulations.

Table B-12. Allotments closed to grazing, Coos Bay District.

Allotment Name	Allotment Number	Public Land (Acres)	Forage Allocation (AUMs)
Middle Creek	20001	-	5
Bullock	20006	8	12
Kellogg	20007	3	6
New River	30001	530	97
	Totals	**541**	**120**

Management Direction (Klamath Falls)

- Lands within the grazing allotments identified on **Table B-13** will be closed livestock grazing through the issuance of a grazing lease or permit. Grazing will not be authorized under Section 15 of the Taylor Grazing Act. Grazing may be authorized through management agreements, temporary nonrenewable grazing permits or leases, or special use permits consistent with the grazing regulations.

Table B-13. Allotments closed to grazing, Klamath Falls Field Office

Allotment Name	Allotment Number	Public Land (Acres)	Forage Allocation (AUMs)
Edge Creek*	00102	5,950	-
Plum Hills	00813	160	20
	Totals	**6,110**	**20**

* The portion of the Upper Klamath Scenic River within the Edge Creek Allotment will be closed to grazing. This portion of the allotment is not allocated any AUMs. The remainder of the allotment will be available for grazing as described.

- Exclosures and other areas identified on **Table B-14** are closed to grazing

Table B-14. Allotments closed to grazing, Klamath Falls Field Office.

Allotment	Allotment Number	Area Closed (Typically Entire Area Inside the Exclosure Fencing)
Edge Creek	00102	Hayden Creek Exclosures (2) Fox Lake Exclosure
Buck Lake	00104	Tunnel Creek Exclosure Surveyor Campground Exclosure
Dixie	00107	Dixie (Long Prairie Creek) Exclosure
Jeld-Wen	00822	Aspen Exclosure
Rodgers	00852	Van Meter Flat Reservoir Exclosure
Yainax	00861	Bull Spring Exclosure Timothy Spring Exclosure
Bear Valley	00876	Holbrook Spring Exclosure
Bumpheads	00877	Bumpheads Reservoir Outlet Exclosure Antelope Creek Exclosure
Horsefly	00882	Long Branch Exclosure Caseview Spring Exclosure Norcross Spring Exclosure/area within the spring exclosure fence Boundary Spring Exclosure Barnes Valley Riparian Pasture (except as scheduled)

Allotment	Allotment Number	Area Closed (Typically Entire Area Inside the Exclosure Fencing)
Pankey Basin	00884	Pankey Creek Riparian Exclosure
Dry Prairie	00885	Ben Hall Creek Riparian Pasture (except as scheduled)
Horse Camp Rim	00886	21 Reservoir Exclosure
Pitchlog	00887	Pitchlog Creek Exclosure Willow Spring Exclosure CCC Spring Exclosure
Willow Valley	00890	East Fork Lost River Exclosure Duncan Spring/Antelope Creek Exclosures (2) Antelope Riparian Pasture (except as scheduled)
Wood River	30855	Entire area excluded from regular grazing use via the 1996 *Upper Klamath Basin and Wood River Wetland ROD/RMP*

Management Direction (Medford)

- Lands with grazing allotments identified on **Table B-15** below will be closed to livestock grazing through the issuance of a grazing lease. Grazing will not be authorized under Section 15 of the Taylor Grazing Act. Grazing may be authorized through management agreements, temporary nonrenewable grazing permits or leases, or special use permits consistent with the grazing regulations.

Table B-15. Allotments closed for livestock grazing, Medford District.

Allotment Name	Allotment Number	Public Land (Acres)	Forage Allocation (AUMs)
Trail Creek	10003	12,868	113
Longbranch*	10004	10,844	71
Antioch Road	10005	40	4
Roundtop Evans	10006	27,086	110
West Perry Road	10010	75	10
East Perry Road	10011	40	7
Obenchain Mountain	10014	120	12
Nichols Gap	10018	280	18
Eagle Point Canal	10020	465	55
Shady Branch	10025	320	32
Derby Station	10030	540	36
West Derby	10034	1,120	89
Emigrant Creek	10111	40	7
Baldy	10120	798	87
Lost Creek	10123	80	6
Cartwright	10127	40	4
Bybee Peak	10144	321	36
Stiehl	10210	175	18
Fielder Creek	10211	40	5
Del Rio	10216	40	5

Allotment Name	Allotment Number	Public Land (Acres)	Forage Allocation (AUMs)
Sugarloaf/Greensprings	20158	2,926	210
Applegate	20201	25,518	294
Tunnel Ridge	20202	2,183	14
Timber Mountain	20204	1,720	70
Sardine and Galls Creek	20205	3,765	158
Sterling Creek	20207	29,209	190
Spencer Gulch	20208	1,935	150
Quartz Gulch	20209	680	9
Burton Butte	20212	5	2
Chapman Creek	20213	3,309	81
Ecker	20217	40	6
Stage Road	20218	40	4
Lomas Road	20222	635	50
Star	20223	118	24
Pickett Mountain	20302	820	30
Jump Off Joe	20303	80	8
Deer Creek*	20308	1,247	0
Reeves Creek	20309	1,672	95
Q Bar X	20310	15	3
Esterly Creek	20312	4,457	152
Glade Creek	20315	560	17
Cherry Gulch	20316	40	6
	Totals	**136,306**	**2,298**

* These portions of the Longbranch and Deer Creek Allotments will be closed to grazing. The remainder of the allotments will be available for grazing.

All areas that are currently without allotments will remain closed to grazing through the issuance of a grazing lease or permit.

Invasive Species

Management Objectives

- See common to all alternatives

Sudden Oak Death

- Prevent the introduction and the spread of sudden oak death (*Phytophthora ramorum*) infections on BLM-administered lands.

Management Direction

- See common to all alternatives

Sudden Oak Death

- Apply state-of-the art, integrated pest management prescriptions for treatment at all sudden oak death (*Phytophthora ramorum*) infection sites outside of the Riparian Reserve.

Late Successional Reserves

These are older stands as defined by district layers and includes all stands inside of large block development areas (new BLM-designed).

Management Objectives

- See common to all alternatives.

Management Direction

- See common to all alternatives.
- When treating conifer forest stands that are not nesting-roosting habitat, limit silvicultural treatments to those that:
  - o Speed the development of, or improve the quality of northern spotted owl habitat in the stand, or in the adjacent stand, or both.
  - o Do not preclude or delay by 20 years or more the development of northern spotted owl nesting-roosting habitat in the stand and in adjacent stands.
- After any commercial harvest entry, create snags sufficient to meet snag targets in **Table B-18**.
- Dry Forests (defined by Potential Vegetation Type): see common to all alternatives
- Timber salvage is prohibited, except when necessary to protect public health and safety, or to keep roads and other infrastructure clear of debris.

Rare Plants and Fungi

Management Objectives

- See common to all alternatives
- Provide for the conservation of Bureau Special Status plant and fungi species
- Support the persistence and resilience of oak species within oak woodlands and within mixed hardwood/conifer communities outside of the Harvest Land Base.

Management Direction

- See common to all alternatives
- Manage Federal candidate and Bureau Sensitive species consistent with any existing conservation agreements or strategies including the protection and restoration of habitat; altering the type, timing, and intensity of actions; and other strategies designed to conserve populations of the species.
- Outside of the Harvest Land Base, manage mixed hardwood/conifer communities to maintain and enhance oak persistence and structure by removing competing conifers, thinning, and prescribed fire.

Riparian Reserve

Management Objectives (applicable throughout planning area except eastside Klamath Falls)

- See common to all alternatives

Management Direction (applicable throughout planning area except eastside Klamath Falls)

Table B-16. Riparian Reserve distance by water feature.

Feature	Riparian Reserve Distance*
All fish-bearing streams and perennial non-fish bearing streams	One site-potential tree height Riparian Reserve from the edge of its active stream channel on each side of a stream
Intermittent non-fish-bearing headwaters streams with high debris flow potential[123]	One-hundred foot Riparian Reserve from the edge of its active stream channel on each side of a stream
Intermittent non-fish-bearing streams without high debris flow potential	Fifty foot Riparian Reserve from the edge of its active stream channel on each side of a stream
Lakes, ponds, and wetlands > 1 acre	One site-potential tree height Riparian Reserve extending from the edge of its water feature
Ponds and wetlands <1 acre and constructed impoundments of any size	Fifty foot Riparian Reserve from the edge of its water body
Non-forest ecosystems: streams and wetlands	Edge of the water body to the limit of the water influence area, as indicated by hydrophilic vegetation.
Unstable areas that are above or adjacent to stream channels and are likely to deliver material such as sediment and logs to the stream if the unstable area fails.	The extent of the unstable area. Where there is a stable area between such an unstable area and the unstable area has the potential to deliver material such as sediment and logs to the stream, extend the Riparian Reserve from the stream to include the intervening stable area as well as the unstable area.

* Reported distances are measured as slope distance.

Table B-17. Zone-specific management direction.

All Fish-Bearing Streams and Non-Fish-Bearing Perennial Streams **Lakes, Ponds and Wetlands > 1 Acre**
Inner Zone (0 to 60 feet)
Do not fall or remove trees except for safety or operational reasons or as described in all zones for in stream restoration, disease treatments, alder, and brushfield conversion.
Outer Zone (60 feet to one site-potential tree height)
Apply thinning to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Apply silvicultural treatments to increase diversity of riparian species and develop structurally complex stands.

[123] High debris flow potential determined from geospatial modeling (Miller *et al*. 2006) with a calibration dataset for extreme storms to generate a relative landslide density mapping. A classification of the relative landslide density mapping is performed to isolate the most susceptible areas; generally, the upper tier (25%) based on a geometric mean or breaks in the data.

Retain at least 50 percent canopy cover and 80 trees per acre expressed as an average across the riparian reserve portion of the stand. Created canopy openings may not exceed ½ acre, and may not exceed 10 percent of the riparian reserve area in the stand. Fall and remove trees as needed for riparian restoration projects or stand maintenance. Tree tipping requirements: 15 percent of tree basal area marked for removal will be directionally felled towards the stream channel and left on site. Retain snags and coarse woody debris in thinning operations, except for safety or operational reasons (e.g. maintaining access to roads and facilities) Merchantable timber from thinning and other silvicultural treatments may be made available for sale.
All Zones (Edge of active stream channel to one site-potential tree height)
Fell trees as needed to supply wood for in-stream restoration. Apply treatments, including commercial treatments, as needed for treatment of diseases including but not limited to: Port-Orford-cedar root rot disease. Apply commercial treatments as needed for red alder (*Alnus rubra*) or brush field conversions where the desired forest community type is being constrained. Projects must maintain water quality targets along 303(d) listed streams with an approved TMDL. **Dry Forests:** Apply fuels reduction and silvicultural treatments as needed to increase stand resistance and resilience to insects, disease, and fire.
Intermittent Non-Fish-Bearing Streams with High Debris Flow Potential
Inner Zone (0 to 50 feet)
Do not fall or remove trees except for safety or operational reasons or for dry forest resiliency treatments. New permanent road crossings would not be allowed.
Outer Zone (50 to 100 feet)
Apply thinning to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Apply silvicultural treatments to increase diversity of riparian species and develop structurally complex stands for the benefit of riparian and aquatic species including early seral species. Retain at least 50 percent canopy cover and 80 trees per acre expressed as an average across the riparian reserve portion of the stand. Created canopy openings may not exceed ½ acre, and may not exceed 10 percent of the riparian reserve area in the stand. Fall and remove trees as needed for riparian restoration projects or stand maintenance, including but not limited to alder or brush field conversions, or for treatment of diseases including but not limited to Port-Orford-cedar root rot disease outbreaks. Tree tipping requirements: 15 percent of tree basal area marked for removal will be directionally felled towards the stream channel and left on site.

Retain snags and coarse woody debris in thinning operations, except for safety or operational reasons (e.g., maintaining access to roads and facilities). Merchantable timber from thinning and other silvicultural treatments may be made available for sale, where it is economically viable to do so.
All Zones (Edge of active stream channel to 100 feet)
Dry Forests: Apply fuels reduction and silvicultural treatments as needed to increase stand resistance and resilience to insects, disease, and fire.
Intermittent Non-Fish Bearing Streams with No High Debris Flow Potential (0 to 50 feet)
Do not fall or remove trees except for safety, operational reasons, or dry forest resiliency treatments. Apply commercial treatments as needed for treatment of diseases including but not limited to Port-Orford-cedar root rot disease outbreaks. **Dry Forests:** Apply fuels reduction and silvicultural treatments as needed to increase stand resistance and resilience to insects, disease, and fire.
Ponds And Wetlands <1 acre and Constructed Impoundments of Any Size (0 to 50 feet)
Do not fall or remove trees except for safety, operational reasons, or dry forest resiliency treatments. **Dry Forests:** Apply fuels reduction and silvicultural treatments as needed to increase stand resistance and resilience to insects, disease, and fire.
Non-forest Ecosystems, Streams and Wetlands
Edge of the water body to the limit of the water influence area, as indicated by hydrophilic vegetation. See management direction for all riparian zones for Alternative B.
Unstable Areas that are above or adjacent to stream channels and are likely to deliver material such as sediment and logs to the stream if the unstable area fails
The extent of the unstable area. Where there is a stable area between such an unstable area and the unstable area has the potential to deliver material such as sediment and logs to the stream, extend the Riparian Reserve from the stream to include the intervening stable area as well as the unstable area. See management direction for all riparian zones for Alternative B.

Wildlife

Management Objectives

- See common to all alternatives.

Management Direction

- See common to all alternatives.

Marbled Murrelet

- Conduct intensive surveys for the marbled murrelet prior to implementation of projects that could degrade or remove potential habitat within 0-35 miles from the coast. Potential habitat for the marbled murrelet is defined as: (1) mature (with or without a structurally-complex component) or structurally-complex coniferous forests and (2) coniferous forests < 80 years old that have platform trees[124]. Platforms can be created by a wide bare branch, moss, or lichen covering a branch, mistletoe, witches brooms, other deformities, or structures such as squirrel nests.

- If surveys indicate that habitat is occupied by marbled murrelets, then protect all potential habitat within a 300 foot of the occupied stand.
- Protect existing, occupied marbled murrelet sites as of [*ROD Date*] as they are currently mapped (*refer to map in the 2015 FEIS/ROD that depicts these sites*).
- In lieu of intensive surveys for marbled murrelets, the following options are available when conducting projects in stands < 80 years old:
  - Prohibit the removal or damage of platform trees. This includes the removal or damage of trees with platforms and the removal or damage of adjacent trees with branches that interlock the branches of any platform tree.
  - Prohibit timber harvest and associated ground disturbances during the marbled murrelet nesting period unless otherwise allowed by a biological opinion or letter of concurrence.
  - Maintain[125] marbled murrelet habitat within a ½ site-potential tree height buffer around all platform trees.
  - Restrict activities that disrupt marbled murrelet nesting during the nesting period where marbled murrelets are currently nesting.

North Oregon Coast Distinct Population Segment of the Red Tree Vole

- Survey proposed projects within the range of the North Oregon Coast Distinct Population Segment of the red tree vole that could degrade or remove habitat. Habitat that requires surveys prior to modification includes either (a) or (b) from each of the following two bullets:
  - (a) stands with a QMD ≥ 16 inches in the in the Northern Mesic Zone <u>or</u> (b) stands with QMD ≥ 18 inches in the Mesic Zone; *and*
  - (a) conifer-dominated stands that are mature or structurally complex <u>or</u> (b) conifer-dominated stands that have ≥ 60 percent canopy closure and have ≥ 2 superdominant conifer trees[126] per acre.
- The following types of projects are exempt from the above direction to survey for red tree voles prior to implementation:
  - Projects in stands < 80 years old;

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[124] **Platform Trees** are trees that provide opportunities for marbled murrelet nesting. A platform tree has the following characteristics:
• It occurs within 35 miles (56 km) of the coast;
• It is a conifer;
• It has a DBH ≥ 19.1 inches (49 cm), height > 107 feet (33 m), has at least one **platform** ≥ 4 inches (10 cm) in diameter, nesting substrate (e.g. moss, epiphytes, duff) on that platform, and an access route through the canopy that a murrelet could use to approach and land on the platform;
• It has potential structure ≥ 33 feet (10 m) above the ground;
• And it has a tree branch or foliage, either on the tree with potential structure or on a surrounding tree, which provides protective cover over the platform.

[125] **Maintain marbled murrelet habitat** refers to a silvicultural activity that changes a conifer forest stand but maintains structural characteristics such that the stand continues to support marbled murrelet nesting opportunities.

[126] **Superdominant conifer trees** typically have crowns that extend above the general stand canopy and have large branches in the upper canopy of the dominant trees in the stand. Superdominant trees may be remnant trees from an earlier cohort, or they may be trees from the dominant cohort that were more open grown and have become much larger than the rest of the trees in the stand.

- Culvert replacements on roads that are in use and part of the road system or culvert removals if the road is temporary or to be decommissioned;
- Riparian and stream improvement projects where the work is riparian planting, obtaining material for placing in-stream, and road or trail decommissioning; and where the stream improvement work is the placement of large wood, channel and flood plain reconstruction, or removal of channel diversions; or
- Portions of hazardous fuel treatments where prescribed fire is applied. Any portion of a hazardous fuels treatment project involving commercial logging will remain subject to survey requirements except for projects in stands < 80 years old.

- If surveys indicate that habitat is occupied by red tree voles from the North Oregon Coast Distinct Population Segment, then a "habitat area" will be established for each cluster of nests that are not isolated from one another by more than 330 feet and includes at least one active nest.
  - Habitat areas will be at least 10 acres in size and will include 1.0 acre per nest if there are more than 10 red tree vole nests (e.g., 15 red tree vole nests would result in a habitat area 15 acres in size).
  - Within habitat areas, do not remove or modify nest trees, the canopy structure of the stand, or remove the dominant, co-dominant, or intermediate crowns.
  - Habitat areas for the North Coast Distinct Population Segment of the red tree vole may be designated as non-high priority and released for other management objectives if they occur south of Highway 20.
  - Habitat areas north of Highway 20 will not be designated as non-high priority as they are considered a high priority for the conservation of the species.

Snags and Down Woody Material

- Retain existing snags and existing down woody material during silvicultural treatments of stands, except for safety or operational reasons. Retain snags felled for safety or operational reasons as down woody material.
- Create new snags in the amounts and sizes specified in **Table B-18** and **Table B-19** at the time of silvicultural treatment. If insufficient trees are available in the size class specified, use trees from the largest size class available. Snags and coarse woody debris retention standards would be met as an average at the scale of the harvest unit, and is not intended to be attained on every acre.

Table B-18. Snag creation levels within the Harvest Land Base (MITA, LITA OHTA, UTA), in Alternative B.

District/Field Office	Province	Create This Number of Snags/Acre at Time of Treatment in the Harvest Land Base		
		> 20 Inches DBH	> 10 Inches DBH	Total Trees to Snag
Coos Bay	All	1	-	1
Eugene	OR Coast Range	1	-	1
Eugene	Western Cascades	1	-	1
Klamath Falls	All	1	-	1
Medford	All	-	-	-
Roseburg	OR Coast Range	3	-	3
Roseburg	Western Cascades	3	3	6
Roseburg	Klamath	-	-	-
Salem	OR Coast Range	1	-	1
Salem	Western Cascades	1	-	1

Table B-19. Snag creation levels within the Reserves (LSR120, LSR no age limit, RR) in Alternative B.

District/Field Office	Province	Create This Number of Snags/Acre at Time of Treatment in the Reserve		
		> 20 Inches DBH	> 10 Inches DBH	Total Trees to Snag
Coos Bay	All	5	5	10
Eugene	OR Coast Range	5	5	10
Eugene	Western Cascades	5	20	25
Klamath Falls	All	2	5	7
Medford	All	1	1	2
Roseburg	OR Coast Range	6	7	13
Roseburg	Western Cascades	6	25	31
Roseburg	Klamath	1	1	2
Salem	OR Coast Range	5	5	10
Salem	Western Cascades	5	20	25

- Retain snags and down woody material at levels described in **Table B-20** following a stand-replacing event. Snags and coarse woody debris retention standards would be met as an average at the scale of the salvage harvest unit, and is not intended to be attained on every acre. Quantities in excess of the levels described in **Table B-20** could be salvaged to reduce fuel loading.

Table B-20. When implementing fuels treatments/prescription fire snag and down woody material retention levels within the Reserves (LSR120, LSR no age limit, RR) under Alternative B.

District/Field Office	Province	Target Number of Snags and Down Wood Cover to Have at the Time of Treatment in the Reserve		
		> 20 Inches DBH	> 10 Inches DBH	Percent Cover
Coos Bay	All	8	19	6%
Eugene	OR Coast Range	8	19	6%
Eugene	Western Cascades	8	19	10%
Klamath Falls	All	4	13	3%
Medford	All	3	7	2%
Roseburg	OR Coast Range	8	19	6%
Roseburg	Western Cascades	8	19	10%
Roseburg	Klamath	3	7	2%
Salem	OR Coast Range	8	19	6%
Salem	Western Cascades	8	19	10%

Alternative C

Forest Management

Management Objectives for High Intensity Timber Area (HITA)

- See common to all alternatives

Management Directions for HITA

- See common to all alternatives

- Offer for timber for sale from regeneration harvest units with area totaling not less than 8 percent and not more than 17 percent of the area in this Land Use Allocation in each field office per decade.
    - Regeneration harvest would be applied in stands ≥ 60 years old for one or more of the following reasons:
        - To produce timber to contribute to the attainment of the declared Annual Sale Quantity.
        - To develop a balanced age class distribution: Equal number of acres in each 10-year age class throughout this LUA in each field office.
        - Conduct post-disturbance salvage and management of dead or dying stands due to insects or disease.
        - Insect and disease management.
        - Convert stands with a composition of commercially undesirable tree species or an inadequate stocking of commercially desirable tree species to stands that are fully stocked by commercially desirable tree species.
    - Regeneration harvest would be applied in stands < 60 years old for any one of the above reasons, or for the following reason:
        - In order to reset stand development in stands that are overly dense that would not respond well to commercial thinning. Overly dense stands are generally characterized as having average crown ratios in trees over 8 inches DBH of ≤ 20 percent or average height to diameter ratios of trees over 8 inches DBH ≥ 80.
    - Remove all merchantable material from regeneration harvest units, except when overstory trees must be left to provide protection to the regenerating understory. Harvest these trees after such protection is no longer needed.
        - Regeneration harvest units will be adequately reforested with species mix appropriate to the site within five years of project completion.
- Offer timber for sale from commercial thinning harvest units.
    - Apply commercial thinning for any of the following reasons:
        - To remove timber volume
        - To recover current or anticipated mortality
        - To adjust stand composition or dominance
        - To reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation
        - To improve merchantability and value
    - Maintain stand densities through commercial thinning at levels above that needed to occupy the site, but below densities that will result in loss of stand vigor and health.
        - Post-thinning stand average relative percent max SDI targets will be between 35 percent and 45 percent.
- Implement timber salvage harvest after disturbances to recover economic value and to minimize commercial loss or deterioration of damaged trees.

- Remove all merchantable dead and down timber from disturbed area, where removal is economically viable.

Management Objectives for UTA

- See common to all alternatives

Management Direction for UTA

- See common to all alternatives
- After commercial harvest entries, retain or create snags sufficient to meet targets shown in **Tables B-27** or **B-28**.

Grazing

Management Objectives

- Provide for livestock grazing consistent with other resource objectives while maintaining or improving the health of the public rangelands.
- Prevent livestock from causing trampling disturbance to spawning beds where Federally-listed salmonid fish species occur.

Management Direction (all Districts)

- For streams with salmonid species listed under the Endangered Species Act, livestock will not be released into riparian areas until 30 days following emergence of salmonids from spawning beds.

Management Direction (Medford, Klamath Falls)

- Manage livestock grazing in accordance with the "Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands in Oregon and Washington." **Figure 3-122** shows lands available for livestock grazing. **Appendix K** contains the Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Oregon/Washington.
- Maintain current grazing levels and management practices for the allotments shown in **Appendix K**. Make adjustments when rangeland health assessments and evaluations of monitoring data identify that livestock grazing is a contributing factor toward not meeting one or more of the Standards for Rangeland Health for Oregon and Washington.
- Develop range improvements when needed to achieve the Standards for Rangeland Health for Oregon and Washington, RMP objectives, or other allotment specific objectives.
- Rest from livestock grazing those areas disturbed by natural and human-induced events including but not limited to wildland fire, prescribed burns, timber management treatments, juniper cuts, and rehabilitation. Resume livestock grazing after determination that soil and vegetation have recovered from the initial disturbance to support livestock grazing. Exceptions would be for cases where such grazing would not impede either site recovery, or where livestock are used as a tool to aid in achieving certain recovery objectives.
- Authorize livestock grazing through management agreements, temporary nonrenewable grazing permits or leases, or special use permits on lands not available for livestock grazing through the issuance of a grazing lease or permit to control invasive plants, reduce fire danger, or accomplish other management objectives.

Management Direction (Coos Bay)

- Lands within the grazing allotments identified on **Table B-21** will not be available for livestock grazing through the issuance of a grazing lease or permit. Grazing will not continue to be authorized under Section 15 of the Taylor Grazing Act. Grazing may be authorized through management agreements, temporary nonrenewable grazing permits or leases, or special use permits consistent with the grazing regulations.

Table B-21. Allotments closed to grazing, Coos Bay.

Allotment Name	Allotment Number	Public Land (Acres)	Forage Allocation (AUMs)
Bullock	20006	8	12
Kellogg	20007	3	6
Middle Creek	20001	-	5
New River	30001	530	97
	Totals	**541**	**120**

Management Direction (Klamath Falls)

- Lands within the grazing allotments identified on **Table B-22** will not be available for livestock grazing through the issuance of a grazing lease or permit. Grazing will not continue to be authorized under Section 15 of the Taylor Grazing Act. Grazing may be authorized through management agreements, temporary nonrenewable grazing permits or leases, or special use permits consistent with the grazing regulations.

Table B-22. Allotments not available for livestock grazing, Klamath Falls Field Office.

Allotment Name	Allotment Number	Public Land (Acres)	Forage Allocation (AUMs)
Edge Creek*	00102	5,950	-
Plum Hills	00813	160	20
	Totals	**6,110**	**20**

* The portion of the Upper Klamath Scenic River within the Edge Creek Allotment will be closed to grazing. This portion of the allotment is not allocated any AUMs. The remainder of the allotment will be available for grazing.

- Exclosures and other areas identified on **Table B-23** are closed to grazing.

Table B-23. Allotments closed to grazing, Klamath Falls Field Office.

Allotment Name	Allotment Number	Area Closed (Typically Entire Area Inside the Exclosure Fencing)
Edge Creek	00102	Hayden Creek Exclosures (2) Fox Lake Exclosure
Buck Lake	00104	Tunnel Creek Exclosure Surveyor Campground Exclosure
Dixie	00107	Dixie (Long Prairie Creek) Exclosure
Jeld-Wen	00822	Aspen Exclosure
Rodgers	00852	Van Meter Flat Reservoir Exclosure
Yainax	00861	Bull Spring Exclosure Timothy Spring Exclosure

Allotment Name	Allotment Number	Area Closed (Typically Entire Area Inside the Exclosure Fencing)
Bear Valley	00876	Holbrook Spring Exclosure
Bumpheads	00877	Bumpheads Reservoir Outlet Exclosure Antelope Creek Exclosure
Horsefly	00882	Long Branch Exclosure Caseview Spring Exclosure Norcross Spring Exclosure/area within the spring exclosure fence Boundary Spring Exclosure Barnes Valley Riparian Pasture (except as scheduled)
Pankey Basin	00884	Pankey Creek Riparian Exclosure
Dry Prairie	00885	Ben Hall Creek Riparian Pasture (except as scheduled)
Horse Camp Rim	00886	21 Reservoir Exclosure
Pitchlog	00887	Pitchlog Creek Exclosure Willow Spring Exclosure CCC Spring Exclosure
Willow Valley	00890	East Fork Lost River Exclosure Duncan Spring/Antelope Creek Exclosures (2) Antelope Riparian Pasture (except as scheduled)
Wood River	30855	Entire area excluded from regular grazing use via the 1996 *Upper Klamath Basin and Wood River Wetland ROD/RMP*

Management Direction (Medford)

- Lands with grazing allotments identified on **Table B-24** below will be closed to livestock grazing through the issuance of a grazing lease. Grazing will not be authorized under Section 15 of the Taylor Grazing Act. Grazing may be authorized through management agreements, temporary nonrenewable grazing permits or leases, or special use permits consistent with the grazing regulations.

Table B-24. Allotments not available for livestock grazing, Medford District.

Allotment Name	Allotment Number	Public Land (Acres)	Forage Allocation (AUMs)
Trail Creek	10003	12,868	113
Longbranch*	10004	10,844	71
Antioch Road	10005	40	4
Roundtop Evans	10006	27,086	110
West Perry Road	10010	75	10
East Perry Road	10011	40	7
Obenchain Mountain	10014	120	12
Nichols Gap	10018	280	18
Eagle Point Canal	10020	465	55
Shady Branch	10025	320	32
Derby Station	10030	540	36
West Derby	10034	1,120	89
Emigrant Creek	10111	40	7
Baldy	10120	798	87
Lost Creek	10123	80	6

Allotment Name	Allotment Number	Public Land (Acres)	Forage Allocation (AUMs)
Cartwright	10127	40	4
Bybee Peak	10144	321	36
Stiehl	10210	175	18
Fielder Creek	10211	40	5
Del Rio	10216	40	5
Sugarloaf/Greensprings	20158	2,926	210
Applegate	20201	25,518	294
Tunnel Ridge	20202	2,183	14
Timber Mountain	20204	1,720	70
Sardine and Galls Creek	20205	3,765	158
Sterling Creek	20207	29,209	190
Spencer Gulch	20208	1,935	150
Quartz Gulch	20209	680	9
Burton Butte	20212	5	2
Chapman Creek	20213	3,309	81
Ecker	20217	40	6
Stage Road	20218	40	4
Lomas Road	20222	635	50
Star	20223	118	24
Pickett Mountain	20302	820	30
Jump Off Joe	20303	80	8
Deer Creek*	20308	1,247	0
Reeves Creek	20309	1,672	95
Q Bar X	20310	15	3
Esterly Creek	20312	4,457	152
Glade Creek	20315	560	17
Cherry Gulch	20316	40	6
	Totals	**136,306**	**2,298**

* These portions of the Longbranch and Deer Creek Allotments will be closed to grazing. The remainder of the allotments will be available for grazing.

All areas that are currently without allotments will remain closed to grazing through the issuance of a grazing lease or permit.

Invasive Species

Management Objectives

- See common to all alternatives

Sudden Oak Death

- Prevent the introduction and the spread of sudden oak death infections on BLM–administered lands.

Management Direction

- See common to all alternatives

Sudden Oak Death

- Apply state-of-the art, integrated pest management prescriptions for treatment at all identified sudden oak death infection sites.

Late Successional Reserves

Management Objectives

- See common to all alternatives
- Recover economic value from timber harvested after disturbances from fire, weather events, natural disasters, diseases, or insect infestations.

Management Direction

- See common to all alternatives
- When treating conifer forest stands that are not nesting-roosting habitat, limit silvicultural treatments to those that:
  - Speed the development of, or improve the quality of northern spotted owl habitat in the stand, or in the adjacent stand, or both.
  - Do not preclude or delay by 20 years or more the development of northern spotted owl nesting-roosting habitat in the stand and in adjacent stands.
- After commercial harvest entries, retain or create snags sufficient to meet targets shown in **Table B-29**.
- Implement timber salvage harvest after disturbances to recover economic value and to minimize commercial loss or deterioration of damaged trees.
  - For disturbance events causing mortality of ≥ 60 percent of overstory trees on contiguous areas ≥ 10 acres in size:
    - Salvage all dead wood volume in excess of down wood and snag requirements set forth in **Table B-29**.
  - For all other disturbance events:
    - Salvage timber only where needed to reduce hazards to public health and safety.

Rare Plants and Fungi

Management Objectives

- See common to all alternatives
- Provide for the conservation of Bureau Special Status plant and fungi species

Management Direction

- See common to all alternatives
- Manage Federal Candidate and Bureau Sensitive species consistent with any existing conservation agreements or strategies including the protection and restoration of habitat; altering the type, timing, and intensity of actions; and other strategies designed to conserve populations of the species.
- Create new and augment existing populations of ESA and Special Status Species listed plants and fungi to meet recovery plan or conservation strategy objectives.

Riparian Reserve

Management Objectives (applicable throughout planning area except eastside Klamath Falls)

- See common to all.

Management Objectives (applicable throughout planning area except eastside Klamath Falls)

Table B-25. Riparian Reserve distance by water feature.

Riparian Reserve	Riparian Reserve Distance*
All fish-bearing streams and perennial non-fish-bearing streams	150 feet from the edge of its active stream channel on each side of a stream
Intermittent non-fish-bearing streams	50 feet from the edge of its active stream channel on each side of a stream
Lakes, ponds, and wetlands > 1 acre	150 feet extending from the edge of its water feature
Ponds and wetlands < 1 acre and constructed impoundments of any size	50 feet from the edge of its water body
Non-forest ecosystems streams and wetlands	Edge of the water body to the limit of the water influence area, as indicated by hydrophilic vegetation
Unstable areas that are above or adjacent to stream channels and are likely to deliver material such as sediment and logs to the stream if the unstable area fails	The extent of the unstable area. Where there is a stable area between such an unstable area and the unstable area has the potential to deliver material such as sediment and logs to the stream, extend the Riparian Reserve from the stream to include the intervening stable area as well as the unstable area.

* Reported distances measured as slope distance.

Table B-26. Zone-specific management direction.

All Fish-Bearing Streams and Non-Fish-Bearing Perennial Streams **Lakes, Ponds, and Wetlands > 1 Acre**
Inner Zone (0 to 60 feet)
Do not fall or remove trees except for safety or operational reasons or as described in all zones for in-stream restoration, disease treatments, alder, and brush field conversion.
Outer Zone (60 to 150 feet)
Apply thinning to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence.

Apply silvicultural treatments to increase diversity of riparian species and develop structurally complex stands. Retain at least 50 percent canopy cover and 80 trees per acre expressed as an average across the riparian reserve portion of the stand. Created canopy openings may not exceed ½-acre, and may not exceed 10 percent of the riparian reserve area in the stand. Fall and remove trees as needed for riparian restoration projects or stand maintenance. Tree tipping requirements: 15 percent of tree basal area marked for removal will be directionally felled towards the stream channel and left on site. Retain snags and coarse woody debris in thinning operations, except for safety or operational reasons (e.g., maintaining access to roads and facilities). Merchantable timber from thinning and other silvicultural treatments may be made available for sale.
All Zones (Edge of active stream channel to 150 feet)
Fell trees as needed to supply wood for in-stream restoration. Apply treatments, including commercial treatments, as needed for treatment of diseases including but not limited to: Port-Orford cedar root rot disease and sudden oak death outbreaks. Apply commercial treatments as needed for red alder (*Alnus rubra*) or brush field conversions where the desired forest community type is being constrained. Projects must maintain water quality targets along 303(d) listed streams with an approved TMDL. **Dry Forests:** Apply fuels reduction and silvicultural treatments as needed to increase stand resistance and resilience to insects, disease, and fire.
Non-Fish Bearing Intermittent Streams (0 to 50 feet)
Do not fall or remove trees except for safety, operational reasons, or dry forest resiliency treatments. Apply treatments, including commercial treatments, as needed for treatment of diseases including but not limited to Port-Orford-cedar root rot disease and sudden oak death outbreaks. **Dry Forests:** Apply fuels reduction and silvicultural treatments as needed to increase stand resistance and resilience to insects, disease, and fire.
Constructed Water Impoundments,[127] Ponds, and Wetlands < 1 Acre (0 to 50 feet)
Do not fall or remove trees except for safety, operational reasons, or dry forest resiliency treatments. **Dry Forests:** Apply fuels reduction and silvicultural treatments as needed to increase stand resistance and resilience to insects, disease, and fire.
Non-forest ecosystems streams and wetlands
Edge of the water body to the limit of the water influence area, as indicated by hydrophilic vegetation.

[127] Typically, small ponds in forest environments used for fire suppression activities.

See management direction for all riparian zones for Alternative C.
Unstable areas that are above or adjacent to stream channels and are likely to deliver material such as sediment and logs to the stream if the unstable area fails
The extent of the unstable area. Where there is a stable area between such an unstable area and the unstable area has the potential to deliver material such as sediment and logs to the stream, extend the Riparian Reserve from the stream to include the intervening stable area as well as the unstable area. See management direction for all riparian zones for Alternative C.

Wildlife

Management Objectives

- See common to all alternatives

Management Direction

- See common to all alternatives

Marbled Murrelet

- Conduct intensive surveys for the marbled murrelet prior to implementation of projects that could degrade or remove potential habitat. Potential habitat for the marbled murrelet is defined as conifer stands ≥ 120 years of age.
- If future surveys indicate that habitat is occupied by marbled murrelets, then protect all mature or structurally complex stands (or portions thereof) within a 300 foot radius of the occupied stand. The protection of occupied marbled murrelet sites lasts for 10 years from the time of discovery at each site.
- Protect mature or structurally complex stands within existing, occupied marbled murrelet sites as of [*ROD Date*] as they are currently mapped (*refer to map in the 2015 FEIS/ROD that depicts these sites).* The protection of occupied marbled murrelet sites lasts for 10 years from the time the ROD is signed.
- Restrict activities that disrupt marbled murrelet nesting during the nesting period where marbled murrelets are currently nesting.

Snags and Down Woody Material

- Snags and coarse woody debris would be retained during thinning harvest of stands, except for safety or operational reasons. Stands where the quadratic mean diameter is > 14 inches before stand treatment are considered stands of large trees. Stands where the quadratic mean diameter is < 14 inches before stand treatment are considered stands of small trees. New snags and coarse woody debris would be created when existing levels of snags and coarse wood debris do not meet the levels defined in **Table B-27** and **Table B-28.** The requirement to create new snags and coarse woody debris would not apply to thinning and other silviculture treatments that do not remove cut trees from the stand.
- Live and dead trees would be felled and removed as needed for safety or operational reasons, including, but not limited to, danger tree removal, creation of yarding corridors adjacent to nearby harvest units, and road construction or maintenance.

- Snag and coarse woody debris retention or creation requirements would be met by any combination of new snags and coarse woody debris from live conifer trees and the retention of existing levels of snags (Class I and Class II) and coarse woody debris (Class I and Class II). If existing levels of snags and coarse woody debris are insufficient to meet these requirements in a thinning project, the requirement can be satisfied by including in the project decision the creation of snags and coarse woody debris to meet these standards using the trees remaining within 5 years after completion of the thinning harvest. Snag and coarse woody debris retention or creation levels would be met at the scale of the harvest unit and is not intended to be attained on every acre. Snag and coarse woody debris retention would be variable per acre throughout the area being treated. If sufficient snags or coarse woody debris of the minimum sizes are not available, an equivalent number of smaller snags or coarse woody debris would be retained. Noncommercial snags and coarse woody debris would be retained, except for safety or operational reasons.
- Salvage harvest of timber after a stand-replacing disturbance would occur to recover economic value of the stand, so long as the salvage harvest would meet retention standards for snags and coarse woody debris described in **Table B-29** Snags and coarse woody debris retention standards would be met as an average at the scale of the salvage harvest unit, and is not intended to be attained on every acre.
- Timber from thinning, tree-falling, and salvage operations would be made available for sale.

Table B-27. Snag and down woody material levels for stands of larger trees (QMD > 14inches) in the UTA, LSR no age limit, and RR land use allocations under Alternative C.

Province	Snag Retention or Creation		DWM Retention or Creation		
	Total Trees Per Acre (TPA)	Component Diameter[a] (DBH)	Totals	Component Diameter[a] (DBH)	Component Length
Western Hemlock	6	≥ 14 inches	240 feet/acre	> 14 inches	> 20 feet
Douglas-fir and true firs	3	≥ 14 inches	120 feet/acre	> 14 inches	> 16 feet
Tanoak	4	≥ 14 inches	120 feet/acre	> 14 inches	> 16 feet

[a] Diameter measured at the small end of the log
DBH – diameter breast height

Table B-28. Snag and down woody material levels for stands of smaller trees (QMD < 14inches) in the UTA, LSR no age limit, and RR land use allocations under Alternative C.

Province	Snag Retention or Creation		DWM Retention or Creation		
	Total Trees Per Acre (TPA)	Component Diameter[a] (DBH)	Totals	Component Diameter[a] (DBH)	Component Length
Western Hemlock	3	≥ 12 inches	120 feet/acre	> 12 inches	> 20 feet
Douglas-fir and true firs	2	≥ 10 inches	60 feet/acre	> 10 inches	> 16 feet
Tanoak	2	≥ 10 inches	60 feet/acre	> 10 inches	> 16 feet

[a] Diameter measured at the small end of the log
DBH – diameter breast height

Table B-29. Snag and down woody material levels for salvaging after a stand-replacement event in the "UTA, LSR no age limit," land use allocations under Alternative C.

Province	Snag Retention or Creation		DWM Retention or Creation		
	Total Trees Per Acre (TPA)	Component Diameter[a] (DBH)	Totals	Component Diameter[a] (DBH)	Component Length
Western Hemlock	8	≥ 20 inches	480 feet/acre	> 20 inches	> 20 feet
Douglas-fir and true firs	4	≥ 16 inches	240 feet/acre	>16 inches	> 16 feet
Tanoak	4	≥ 20 inches	240 feet/acre	> 20 inches	> 20 feet

[a] Diameter measured at the small end of the log
DBH – diameter breast height

Alternative D

Forest Management

Management Objectives for Owl Habitat Timber Area (OHTA)

- Manage habitat conditions around northern spotted owl sites to promote species recovery.
- Provide complex early-successional habitat.
- Promote and maintain function of large blocks of spotted owl habitat.

Management Direction for OHTA

- Protect conifer forest stands:
    - Within the nest patch of a northern spotted owl known or historic site. The nest patch is delineated as a 200-meter radius circle around a known or historic site.
- When treating conifer forest stands that are not nesting-roosting habitat, limit silvicultural treatments to those that:
    - Speed the development of, or improve the quality of northern spotted owl habitat in the stand, or in the adjacent stand, or both.
    - Do not preclude or delay by 20 years or more the development of northern spotted owl nesting-roosting habitat in the stand and in adjacent stands.
- Utilize uneven-aged harvesting in managing forest stands for one or more of the following reasons:
    - To produce timber to contribute to the attainment of the declared Annual Sale Quantity.
    - To increase or maintain vegetative species diversity.
    - To promote or enhance the development of structural complexity.
    - To adjust stand composition or dominance,
    - To reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation;
    - Conduct post-disturbance salvage and management dead or dying stands due to insects or disease.
    - Insect and disease management.
    - Convert stands capable of supporting conifer species that are currently growing primarily hardwoods or shrubs to a mix of conifer and hardwood species suitable to the site, unless the hardwoods or shrubs would produce a higher net monetary return.
    - To produce complex early-successional ecosystems.
    - In order to reset stand development in portions of stands that are overly dense that would not respond well to commercial thinning. Overly dense stands are generally characterized as having average crown ratios in trees over 8” DBH of ≤ 20 percent or average height to diameter ratios of trees over 8” DBH ≥ 80.
- Uneven-aged harvesting may include use of a combination of harvesting methods including thinning, single tree selection harvest, and group selection harvest.
- Uneven-aged harvest units shall meet the following criteria, post-harvest:
    - For stands ≥ 10 acres; maximum group selection opening size, 4 ac.; maximum percentage of stand area in group selection openings, 25 percent; minimum percentage of stand area in untreated skips, 25 percent.
    - For stands < 10 acres: Maximum group selection opening size, 2.5 ac, no maximum percent of stand in openings, and no minimum percent of stand in skips.
    - Snags (not downed wood) shall be created in sufficient numbers to meet targets established in **Table B-32**.
    - Following large scale disturbances and when regenerating group selection openings develop heterogeneous vegetation patterns to increase complexity of the early-successional ecosystem.

        - Regenerate a mixture of tree species appropriate to the site using variable spacing within 5 years of disturbance or harvest.
        - Natural regeneration, artificial regeneration, or a combination of the two would be allowed.
        - 50-70 percent of full stocking is considered acceptable.
    - Following large scale disturbances;
        - Maintain at least 10 percent of the stand un-stocked with trees in gaps ≥ ¼-acre in size for at least two decades to accelerate development of heterogeneous fuel conditions and contribute to the complexity of the early-successional ecosystem.
- Implement timber salvage harvest after disturbances to recover economic value and to minimize commercial loss or deterioration of damaged trees.
    - For disturbance events causing mortality of ≥ 60 percent of overstory trees on contiguous areas ≥10 acres in size:
        - Salvage all dead wood volume in excess of down wood and snag requirements set forth in **Table B-32**. These targets are meant to be averages across the project area; not every acre is expected to meet these target levels.
    - For all other disturbance events:
        - Salvage timber only where needed to reduce hazards to public health and safety.

Management Objectives for Moderate Intensity Timber Area (MITA)

- Also see common to all alternatives
- Manage habitat conditions around northern spotted owl sites to promote species recovery.
- Provide complex early-successional ecosystems.
- Develop late successional ecosystems for a portion of the rotation.
- Provide a variety of forest structural stages distributed both temporally and spatially.

Management Directions for MITA

- Also see common to all alternatives
- Protect conifer forest stands:
    - Within the nest patch of a northern spotted owl known or historic. The nest patch is delineated as a 200-meter radius circle around a known or historic site.
- Maintain or protect all NSO nesting-roosting habitat:
    - Within the 500-acre core use area circle around a known or historic nest site when < 250 post-treatment acres would support nesting-roosting habitat, regardless of pre-treatment conditions or cause.
    - Within the mean provincial home range circle around a known or historic nest site when < 40 percent of the post-treatment circle would support nesting-roosting habitat, regardless of pre-treatment conditions or cause.
- Offer for timber for sale from regeneration harvest units with area totaling not less than 8 percent and not more than 10 percent of the area in this Land Use Allocation in each field office per decade.
    - Regeneration harvest would be applied in stands ≥ 60 years old for one or more of the following reasons:
        - To produce timber to contribute to the attainment of the declared Annual Sale Quantity.
        - To develop a balanced age class distribution: i.e. Equal number of acres in each 10 year age class throughout this LUA in each field office.
        - Conduct post-disturbance salvage and management of dead or dying stands due to insects or disease.
        - Insect and disease management.

        - To convert stands capable of supporting conifer species that are currently growing primarily hardwoods or shrubs to a mix of conifer and hardwood species suitable to the site, unless the hardwoods or shrubs would produce a higher net monetary return.
        - To produce complex early-successional ecosystems.
    - Regeneration harvest would be applied in stands < 60 years old for any one of the above reasons, or for the following reason:
        - In order to reset stand development in stands that are overly dense that would not respond well to commercial thinning. Overly dense stands are generally characterized as having average crown ratios in trees over 8” DBH of ≤ 20 percent or average height to diameter ratios of trees over 8” DBH ≥ 80.
    - Regeneration harvest units shall meet the following criteria:
        - Retain 5-15 percent of pre-harvest stand basal area in individual regeneration harvest units. If Riparian Reserves make up ≥ 10 percent of the stand area, retain basal area towards the low end of the range; if Riparian Reserves make up <10 percent of the stand area, retain basal area towards the higher end of the range.
        - Create snags sufficient to meet snag targets in **Table B-32**.
        - Retention shall be left in a variety of spatial patterns, including clumps, aggregated groups, stringers, and individual trees.
            - Retention levels can be met with trees from any species or diameter class, and retention trees should represent the range of diameters and species present in the pre-harvest stand.
        - Regeneration harvest units shall be reforested with species mix appropriate to the site within 5 years following regeneration harvest.
- Offer timber for sale from commercial thinning harvest units.
    - Apply commercial thinning for one or more of the following reasons:
        - To produce timber to contribute to the attainment of the declared Annual Sale Quantity.
        - To recover current or anticipated mortality,
        - To adjust stand composition or dominance,
        - To reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation;
        - To improve merchantability and value.
        - To increase or maintain vegetative species diversity.
        - To promote or enhance the development of structural complexity.
    - Maintain stand densities through commercial thinning at levels above that needed to occupy the site, but below densities that will result in loss of stand vigor and health.
        - Post-thinning stand average relative percent max SDI targets will be between 25 percent and 35 percent.
- Implement unthinned skips and group selection openings to provide increased structural complexity in the post-treatment stand. The total area in group selection openings shall not exceed 10 percent of the thinned portion of the stand.
        - Create snags sufficient to meet snag targets in **Table B-32**.
- Implement timber salvage harvest after disturbances to recover economic value and to minimize commercial loss or deterioration of damaged trees.
    - For disturbance events causing mortality of ≥ 60 percent of overstory trees on contiguous areas ≥ 10 acres in size:
        - follow management direction for regeneration harvest units. Areas salvaged in this way also count towards regeneration harvest percent targets.
    - For all other disturbance events:
        - Remove all merchantable dead and down timber from disturbed area in excess of snag targets set forth in **Table B-32**, where removal is economically viable.

Management Objectives for Uneven-aged Timber Area (UTA)

- See common to all alternatives

Management Direction for UTA

- See also common to all alternatives
- Snags (not downed wood) shall be created in sufficient numbers to meet targets established in **Table B-32**.

Grazing

Management Objective

- Eliminate livestock grazing.

Management Direction

- Terminate all livestock grazing authorizations.
- Do not authorize additional livestock grazing by any means, including, but not limited to, leases, management agreements, temporary nonrenewable grazing permits or leases, or special use permits.
- Issue grazing decisions for the planning area to close preference permitting grazing.

Invasive Species

Management Objective

- See also common to all
- Prevent the introduction and the spread of sudden oak death (*Phytophthora ramorum*) infections on BLM – administered lands.

Management Direction

- See also common to all
    - Apply state-of-the art, integrated pest management prescriptions for treatment at all identified sudden oak death (*Phytophthora ramorum*) infection sites.

Late Successional Reserves

Management Objectives

- See common to all

Management Direction

- See also common to all
- When treating conifer forest stands that are not nesting-roosting habitat, limit silvicultural treatments to those that:
    - Speed the development of, or improve the quality of northern spotted owl habitat in the stand, or in the adjacent stand, or both.
    - Do not preclude or delay by 20 years or more the development of northern spotted owl nesting-roosting habitat in the stand and in adjacent stands.
- After commercial harvest entries, create snags sufficient to meet targets shown in **Table B-33**.

- Timber salvage is prohibited, except when necessary to protect public health and safety, or to keep roads and other infrastructure clear of debris.

Rare Plants and Fungi

Management Objectives

- See also common to all
- Provide for the conservation of Bureau Special Status plant and fungi species

Management Direction

- See also common to all
- Manage Federal candidate and Bureau Sensitive species consistent with any existing conservation agreements or strategies including the protection and restoration of habitat; altering the type, timing, and intensity of actions; and other strategies designed to conserve populations of the species.
- Protect known Bureau Special Status plant and fungi sites from adverse impacts where protection does not conflict with sustained-yield forest management in areas dedicated to timber production.

Riparian Reserve

Management Objectives (applicable throughout planning area except eastside Klamath Falls)

- See common to all.

Management Direction: applicable throughout planning area except eastside Klamath Falls)

Table B-30. Riparian Reserve distance by water feature.

Feature	Riparian Reserve Distance*
All streams	One site-potential tree height distance from the edge of its active stream channel on each side of a stream
Unstable areas that are above or adjacent to stream channels and are likely to deliver material such as sediment and logs to the stream if the unstable area fails	The extent of the unstable area. Where there is a stable area between such an unstable area and the unstable area has the potential to deliver material such as sediment and logs to the stream, extend the Riparian Reserve from the stream to include the intervening stable area as well as the unstable area.
Lakes, natural ponds, and wetlands > 1 acre	One-hundred feet extending from the edge of the water feature
Ponds and wetlands < 1 acre and constructed impoundments of any size	The extent of riparian vegetation
Non-forest ecosystems: streams and wetlands	Edge of the water body to the limit of the water influence area, as indicated by hydrophilic vegetation
Unstable areas that are above or adjacent to stream channels and are likely to deliver material such as sediment and logs to the stream if the unstable area fails	The extent of the unstable area. Where there is a stable area between such an unstable area and the unstable area has the potential to deliver material such as sediment and logs to the stream, extend the Riparian Reserve from the stream to include the intervening stable area as well as the unstable area.

* Reported distances are measured as slope distance.

Table B-31. Zone-specific management direction.

All Streams
Inner Zone (0 to 120 feet)
Do not thin stands, except as described below under "all zones" for disease treatments and fuels treatments.
Outer Zone (120 feet to one site-potential tree height)
Thin stands as needed to ensure that stands are able to provide stable wood to the stream. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average across the riparian reserve portion of the stand. Merchantable timber from thinning and other silvicultural treatments may be made available for sale. Retain existing snags and coarse woody debris in thinning operations, except where needed to be removed for safety. **Dry forests:** Apply fuels reduction treatments as needed to reduce the risk of catastrophic fire. Retain at least 30 percent canopy cover and 60 trees per acre.
All Zones (Edge of active stream channel to one site-potential tree height)
Fell trees as needed to supply wood for in-stream restoration. Sudden Oak Death (SOD) eradication activities in watersheds (HUC 10) shall not exceed: 1. Removal of >30 percent canopy cover over a contiguous 0.5 mile stream length or removal of > 50 percent canopy cover over a contiguous 0.25 mile stream length for small perennial streams (active channel width < 27 feet) where a 4,600-foot separation of non-treatment between sequential contiguous treatments would be maintained, 2. Removal of >50 percent canopy cover over a contiguous 0.5 mile stream length for medium-large perennial streams (active channel width > 27 feet) where a 4,600-foot separation of non-treatment between sequential contiguous treatments would be maintained, 3. Limit of three miles of treatment for any 5-year period and 3 percent of the total Federal perennial stream miles (Aquatic Restoration Activities in States of Oregon and Washington (ARBO II) NWR-2013-9664). **Dry Forests:** Apply low or moderate-severity burns where needed to invigorate native tree deciduous species. Moderate severity burns will be limited to no more than 20 percent of area of Riparian Reserves subwatershed (HUC 12) each year (ARBO II) NWR-2013-9664). Apply non-commercial tree thinning as necessary to adjust fuel loads prior to a moderate-severity burn.
Lakes, Ponds, and Wetlands > 1 Acre
Edge of the water body to 100 feet. See management direction for all riparian zones for Alternative D.
Ponds And Wetlands < 1 acre (0 to 50 feet) and Constructed Water Impoundments[128]of any size
No treatments, except for restoration, road access, or safety
Non-forest Ecosystems, Streams and Wetlands

Edge of the water body to the limit of the water influence area, as indicated by hydrophilic vegetation. See management direction for all riparian zones for Alternative D.
Unstable Areas that are above or adjacent to stream channels and are likely to deliver material such as sediment and logs to the stream if the unstable area fails.
The extent of the unstable area. Where there is a stable area between such an unstable area and the unstable area has the potential to deliver material such as sediment and logs to the stream, extend the Riparian Reserve from the stream to include the intervening stable area as well as the unstable area. See management direction for all riparian zones for Alternative D.

Wildlife

Management Objectives

- See common to all

Management Direction

- See also common to all

Marbled Murrelet

- Conduct intensive surveys for the marbled murrelet prior to implementation of projects that could degrade or remove potential habitat. Potential habitat for the marbled murrelet is defined as: 1) mature (with or without a structurally complex component) or structurally complex coniferous forests and 2) coniferous forests < 80 years old that have platform trees.[129] Platforms can be created by a wide bare branch, moss, or lichen covering a branch, mistletoe, witches brooms, other deformities, or structures such as squirrel nests.
- If future surveys indicate that habitat is occupied by marbled murrelets, then protect all contiguous habitat within a 0.5 mile radius of the occupied stand. Contiguous habitat is that which contains no gaps wider than 328 feet (100 m) in forest cover comprised of structurally complex, mature, or young stands that have platforms.
- Protect existing, occupied marbled murrelet sites as of [*ROD Date*] as they are currently mapped (*refer to map in the 2015 FEIS/ROD that depicts these sites*).
- In lieu of intensive surveys for marbled murrelets, the following options are available when conducting projects in stands < 80 years old:
    - Prohibit the removal or damage of platform trees. This includes the removal or damage of trees with platforms and the removal or damage of adjacent trees with branches that interlock the branches of any platform tree.

[129] **Platform trees** are trees that provide opportunities for marbled murrelet nesting. A platform tree has the following characteristics:
• It occurs within 50 miles (81 km) of the coast;
• It is a conifer tree;
• It has a DBH ≥ 19.1 inches (49 cm), height > 107 feet (33 m), has at least one **platform** ≥ 4 inches (10 cm) in diameter, nesting substrate (e.g. moss, epiphytes, duff) on that platform, and an access route through the canopy that a murrelet could use to approach and land on the platform;
• It has potential structure ≥ 33 feet (10 m) above the ground;
• And it has a tree branch or foliage, either on the tree with potential structure or on a surrounding tree that provides protective cover over the platform.

- Prohibit timber harvest and associated ground disturbances during the marbled murrelet nesting period unless otherwise allowed by a biological opinion or letter of concurrence.
- Maintain[130] marbled murrelet habitat within a ½ site-potential tree-height un-thinned buffer around all platform trees.
- Restrict activities that disrupt marbled murrelet nesting during the nesting period where marbled murrelets are currently nesting.

North Oregon Coast Distinct Population Segment of the Red Tree Vole

- Survey proposed projects within the range of the North Oregon Coast Distinct Population Segment of the red tree vole that could degrade or remove habitat. Habitat that requires surveys prior to modification includes either (a) or (b) from each of the following two bullets:
  - (a) stands with QMD ≥ 16 inches in the in the Northern Mesic Zone or (b) stands with QMD ≥ 18 inches in the Mesic Zone; *and*
  - (a) conifer-dominated stands that are mature or structurally complex or (b) conifer-dominated stands that have ≥ 60 percent canopy closure and have ≥ 2 superdominant conifer trees[131] per acre.
- The following types of projects are exempt from the above direction to survey for red tree voles within the North Coast Distinct Population Segment prior to implementation:
  - Projects in stands < 80 years old;
  - Culvert replacements on roads that are in use and part of the road system or culvert removals if the road is temporary or to be decommissioned;
  - Riparian and stream improvement projects where the work is riparian planting, obtaining material for placing in-stream, and road or trail decommissioning; and where the stream improvement work is the placement of large wood, channel and flood plain reconstruction, or removal of channel diversions; or
  - Portions of hazardous fuel treatments where prescribed fire is applied. Any portion of a hazardous fuels treatment project involving commercial logging will remain subject to survey requirements except for projects in stands < 80 years old.
- If surveys indicate that habitat is occupied by red tree voles from the North Oregon Coast Distinct Population Segment, then a "habitat area" will be established for each cluster of nests that are not isolated from one another by more than 330 feet and includes at least one active nest.
  - Habitat areas will be at least 10 acres in size and will include 1.0 acre per nest if there are more than 10 red tree vole nests (e.g. 15 red tree vole nests would result in a habitat area 15 acres in size).
  - Within habitat areas, do not remove or modify nest trees, the canopy structure of the stand, or remove the dominant, co-dominant, or intermediate crowns.
- Habitat areas for the North Coast Distinct Population Segment of the red tree vole may be designated as non-high priority and released for other management objectives if they occur south of Highway 20. Habitat areas north of Highway 20 will not be designated as non-high priority as they are considered to be high priority for the conservation of the species.

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[130] **Maintain marbled murrelet habitat** refers to a silvicultural activity that changes a conifer forest stand but maintains structural characteristics such that the stand continues to support marbled murrelet nesting opportunities.
[131] **Superdominant conifer trees** typically have crowns that extend above the general stand canopy and have large branches in the upper canopy of the dominant trees in the stand. Superdominant trees may be remnant trees from an earlier cohort, or they may be trees from the dominant cohort that were more open grown and have become much larger than the rest of the trees in the stand.

Snags and Down Woody Material

- Retain existing snags and existing down woody material during silvicultural treatments of stands, except for safety or operational reasons. Retain snags felled for safety or operational reasons as down woody material.
- Create new snags in the amounts and sizes specified in **Table B-32** and **Table B-33** at the time of silvicultural treatment. If insufficient trees are available in the size class specified, use trees from the largest size class available. Snags and coarse woody debris retention standards would be met as an average at the scale of the salvage harvest unit, and is not intended to be attained on every acre.
- Retain snags and down woody material at levels described in **Table B-34** following a stand-replacing event. Snags and coarse woody debris retention standards would be met as an average at the scale of the salvage harvest unit, and is not intended to be attained on every acre. Quantities in excess of the levels described in **Table B-34** could be salvaged.

Table B-32. Snag creation levels within the Harvest Land Base (MITA, UTA, OHTA) under Alternative D.

District/Field Office	Province	Create This Number of Snags/Acre at Time of Treatment in the Harvest Land Base		
		> 20 Inches DBH	> 10 Inches DBH	Total Trees to Snag
Coos Bay	All	1	-	1
Eugene	OR Coast Range	1	-	1
Eugene	Western Cascades	1	-	1
Klamath Falls	All	1	-	1
Medford	All	-	-	-
Roseburg	OR Coast Range	3	-	3
Roseburg	Western Cascades	3	3	6
Roseburg	Klamath	-	-	-
Salem	OR Coast Range	1	-	1
Salem	Western Cascades	1	-	1

Table B-33. Snag creation levels within the Reserve land use allocations (LSR no age limit, RR) under Alternative D.

District/Field Office	Province	Create This Number of Snags/Acre at Time of Treatment in the Reserve		
		> 20 Inches DBH	> 10 Inches DBH	Total Trees to Snag
Coos Bay	All	5	5	10
Eugene	OR Coast Range	5	5	10
Eugene	Western Cascades	5	20	25
Klamath Falls	All	2	5	7
Medford	All	1	1	2
Roseburg	OR Coast Range	6	7	13
Roseburg	Western Cascades	6	25	31
Roseburg	Klamath	1	1	2
Salem	OR Coast Range	5	5	10
Salem	Western Cascades	5	20	25

Table B-34. Snag and down woody material retention levels within the OHTA land use allocation following stand-replacement events under Alternative D.

District/Field Office	Province	Target Number of Snags and Down Wood Cover to Have at the Time of Treatment in the OHTA		
		> 20 Inches DBH	> 10 Inches DBH	Percent Cover
Coos Bay	All	8	19	6%
Eugene	OR Coast Range	8	19	6%
Eugene	Western Cascades	8	19	10%
Klamath Falls	All	4	13	3%
Medford	All	3	7	2%
Roseburg	OR Coast Range	8	19	6%
Roseburg	Western Cascades	8	19	10%
Roseburg	Klamath	3	7	2%
Salem	OR Coast Range	8	19	6%
Salem	Western Cascades	8	19	10%

Appendix C – Vegetation Modeling

Introduction

The BLM contracted with the forestry consulting firm of Mason, Bruce & Girard of Portland, Oregon, to jointly develop and build the model described in this appendix. Personnel from both of these entities constituted the Modeling Team and they are listed at the end of this appendix.

The BLM considered alternatives in this Draft RMP/EIS that encompassed a range of approaches for managing BLM-administered forestlands. The BLM did this by varying the land allocations and intensity with which the BLM would manage these forests. These different management approaches would result in a range of outcomes in terms of the forest structural stages and types of habitat over time and the sustain-yield timber harvest levels. The Modeling Team used models in this analysis to simulate the application of the land use allocations, management action, and forest development assumptions to characterize forest conditions 10, 20, 30, 40, 50, and 100+ years into the future. The Modeling Team also used models to determine the timber harvest level that the BLM would be able to sustain over time. The BLM used the outputs from modeling to provide a relative basis for comparing and evaluating these different land management strategies.

The vegetation modeling in this analysis is composed of three primary vegetation models:

- ORGANON version 9.1 – an individual tree growth model that the BLM used for the development of growth and yield projections for the major species groups on the BLM-administered lands. Oregon State University developed ORGANON (http://www.cof.orst.edu/cof/fr/research/ORGANON/). In this appendix, ORGANON refers to the generic model available in the public domain.
- Forest Vegetation Simulator (FVS) (Dixon 2002, revised 2014) – an individual tree, distance-independent growth model that the BLM used for projections of northern spotted owl habitat and marbled murrelet habitat variables.
- Remsoft Spatial Planning System (Woodstock) (version 2012.12.0) – a spatially explicit strategic planning model that the BLM used to project the forest conditions over time by simulating the land allocations and management action of the alternatives. Woodstock is proprietary software created by Remsoft Corp. http://www.remsoft.com.

All three of these models have been in use and under continued development for approximately 30 years. These models provide a framework to bring the data and assumptions together to simulate these management scenarios.

This appendix provides an overview of the following key components used in formulating the models:

- BLM Forest Inventory
- Use of Inventory Data in Modeling
- GIS – Defining the Land Base and Spatial Projections
- Moist versus Dry Delineation
- Forest Growth and Yield Modeling
- Forest Structural Stage Definitions
- Woodstock Modeling
- Woodstock Products

BLM Forest Inventory

The Modeling Team used three inventories in the vegetation modeling for this analysis:

- GIS Vegetation mapping with stand level attributes
- Timber Productivity Capability Classification (TPCC)
- Current Vegetation Survey (CVS) – measured permanent plot data

GIS Vegetation Mapping – Forest Operations Inventory and Micro*Storms

The Forest Operations Inventory (FOI) is a GIS layer that delineates vegetation polygons across BLM-administered lands within the planning area. There are approximately 77,000 stands identified that average 32 acres in size. The BLM has set the minimum mapping feature size at five acres, but some finer scale non-forest vegetation and harvest features are identified. The BLM delineated polygons based on the vegetation attributes of cover condition, size class, density of trees, and age.

The Micro*Storms database contains the attributes for the FOI polygons. The vegetation classification represents stand average characteristics, which include:

- Cover condition – conifer, hardwood, mixed, or non-forest
- Single or multi-canopy layer stands
- Species – top five tree species with percent occupancy within a stand layer and listing of other species present
- Stocking class
- Size class – Diameter of the trees species by layer in 10-inch groupings
- Diameter class
- Birthdate of the layer
- Ten-year age class of the managed stand layer

The BLM records land management treatment history in Micro*Storms for the FOI polygons. These treatments include timber harvest, site preparation, planting, stand maintenance/protection, pre-commercial thinning, fertilization, pruning, and a variety of other treatments.

The BLM updates data on stand characteristics on a regular basis as the BLM implements treatments and as conditions change. The FOI and its companion database, Micro*Storms, are operational datasets that are in daily use by the BLM offices for planning and tracking purposes.

The FOI and Micro*Storms data, as used in this analysis, reflects the conditions of the BLM-administered lands as of January 2013. The FOI data is the spatial representation of the forest conditions, while the Micro*Storms database provides a complete listing of treatments, conditions, and surveys that have occurred on that stand. The Modeling Team used these data to develop logical groupings called ‘strata’ that were the building blocks for the growth and yield curves. The Modeling Team stratified the Micro*Storms data by existing stand condition, modeling group, site productivity, age, and species groups.

Timber Productivity Capability Classification

The Timber Productivity Capability Classification (TPCC) is a classification of BLM-administered lands based on the physical and biological capability of the site to support and produce commercial forest products on a sustained yield basis. The BLM classifies each TPCC unit based on four assessments:

- Forest/Non-forest
    - Forest – capable of 10% tree stocking
    - Non forest
- Commercial Forestlands

- Commercial forestlands – capable of producing 20 cubic feet of wood per year of commercial species
- Non-commercial forestlands – not capable of producing 20 cubic feet of wood per year of commercial species
- Suitable Woodland – Non-commercial species or low site

- Fragile Conditions
  - Non-fragile – forest yield productivity is not expected to be reduced due to soil erosion, mass wasting, reduction in nutrient levels, reduction in moisture supplying capacity, and or the rise of ground water
  - Fragile – forest yield productivity may be expected to be reduced by soil erosion, mass wasting, reduction in nutrient levels, reduction in moisture supplying capacity, and or the rise of ground water table
  - Fragile sites are classified as:
    - Restricted – Special harvest and or restricted measures are required.
    - Non-suitable Woodland – Future production will be reduced even if special harvest and or restricted measures are applied due to the inherent site factors. These lands are not biologically and or environmentally capable of supporting a sustained yield of forest products.
- Reforestation - Reforestation problem sites are those where environmental, physical, and biological factors have the potential to reduce the survival and or growth of commercial tree seedlings. These factors include light, temperature, moisture, frost, surface rock, animals, and disease.
  - Non Problem – Sites that can be stocked to meet or exceed target stocking levels, of commercial species, within five years of harvest, using standard practices.
  - Restricted – Commercial forestland where operational reforestation practices in addition to standard practices are necessary to meet or exceed the minimum stocking levels of commercial species within five years of harvest.
  - Suitable Woodland - Operational practices will not meet or exceed minimum stocking levels of commercial species within five years of harvest. These sites are biologically capable of producing a sustained yield of timber products.

BLM Handbook 5251-1 (1986) provides the standards for the TPCC Classification.

There are approximately 66,000 TPCC units mapped in GIS on the BLM-administered lands within the planning area. The minimum mapping feature is generally five acres, but the BLM identifies some finer scale non-forest features in the data. The BLM did the initial classification of all BLM-administered lands in the planning area in the late 1980s. The BLM updates the data as needed when new lands are acquired, or new information is obtained through field examination.

The data, as used in this analysis, reflects the classification of the BLM-administered lands as of January 2013. For this analysis, the Modeling Team used TPCC data to identify what portions of the BLM-administered lands would contribute to the Allowable Sale Quantity under each alternative. The BLM does not include non-forest, suitable woodlands, and non-suitable woodland categories in the lands contributing to the Allowable Sale Quantity under the current plan.

Current Vegetation Survey – Measured Plot Inventory

The Current Vegetation Survey (Max *et al*. 1996) provides comprehensive information on vegetative resources on BLM-administered lands within western Oregon. The BLM did the initial data collection during the years 1997 to 2001. The BLM then did a complete re-measurement from 2001 to 2011. This analysis utilizes the re-measurement data. The CVS plot design consists of four 3.4-mile grids of field plots that are offset from one another to produce a single 1.7-mile grid across BLM-administered lands for 1,376 plots. The primary sampling unit is one hectare (approximately 2.5 acres) with five, fixed-radius sets of nested subplots for measuring trees by size class:

- to 2.9 inches DBH on the 11.8 foot radius subplot
- to 12.9 inches DBH on a 24.0 foot radius subplot
- 13.0 to 47.9 inches DBH on a 51.1 foot radius subplot
- 48.0 inches DBH and larger on the 1/5 hectare (approximately ½ acres) nested subplots

There is one subplot located at the plot center and four subplots each in a cardinal direction and 133.9 feet from the center of the plot (**Figure C-1**). In addition, the BLM determines potential natural vegetation at each subplot using plant indicator keys, and the BLM measures coarse woody debris along two transects. For specific information on the attributes that the BLM collects, refer to USDI BLM (2010).

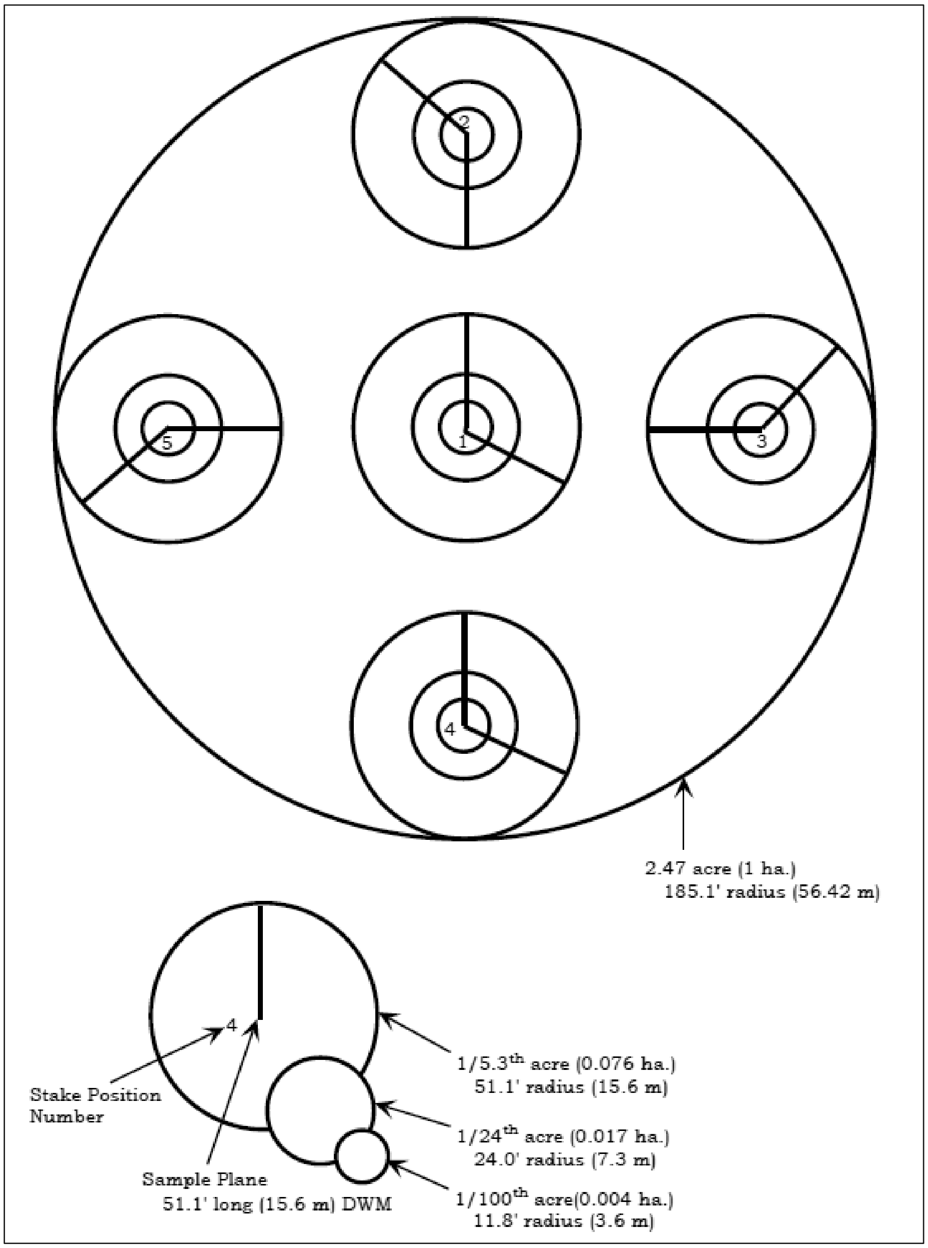

Figure C-1. CVS primary sample unit design.

The location of the plot centers have differentially corrected GPS coordinates. Because the BLM located each subplot center at a precise distance from the plot center, the BLM calculated the coordinates for the subplot centers included them in a GIS layer. The CVS inventory provides an independent, unbiased estimate of the forested BLM-administered land in the planning area. In the graphic below, the crosshair dot symbols are examples of CVS plot center locations on a 1.7-mile grid on top of the FOI units (**Figure C-2**).

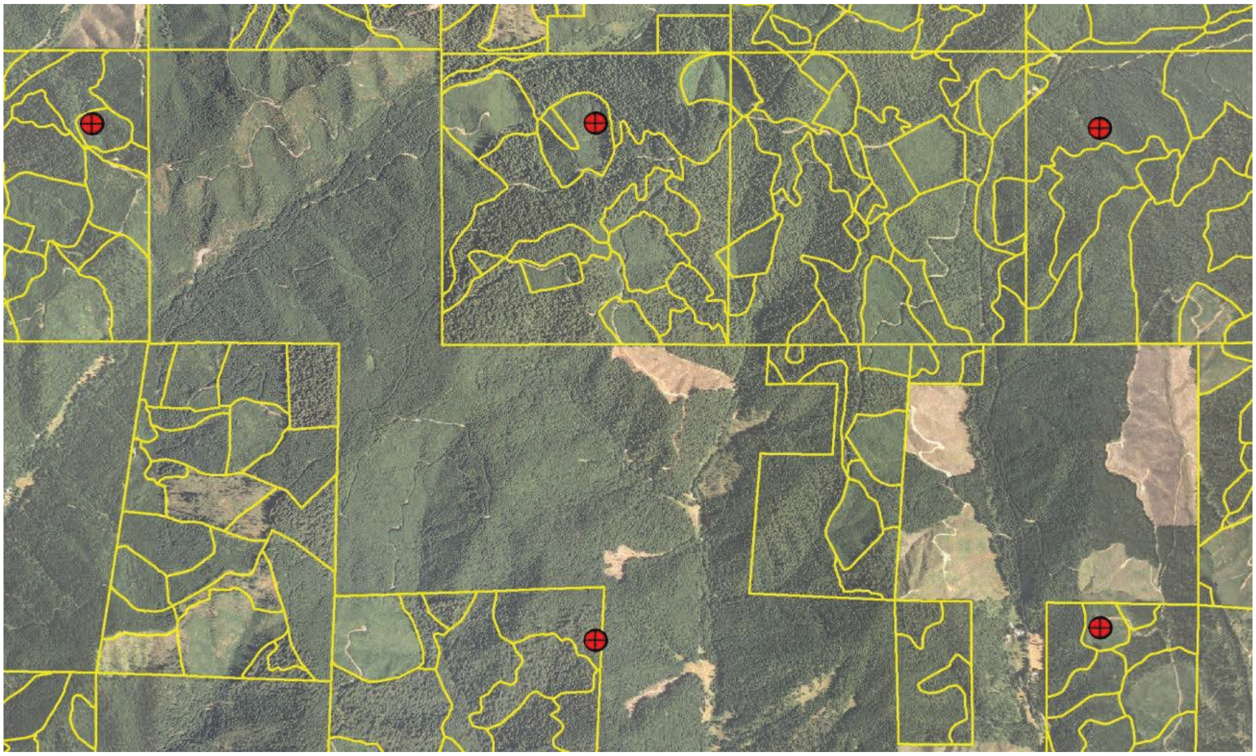

Figure C-2. CVS plot locations and FOI units.

Use of the Inventory Data in the Modeling

Introduction

The Modeling Team divided the FOI and the Current Vegetation Survey data into 1,582 unique categories, called ‘strata’ and classified each stand (FOI unit) by the characteristics listed below. The CVS plots that overlay an FOI represent that FOI and all the FOI found in that stratum. The Modeling Team averaged the CVS tree lists for each stratum and developed a stand table from these average tree lists. The Modeling Team used four components to derive each of the stratum: modeling group, species group, ten-year age class, and site productivity class.

1) Modeling Group

The purpose of these groups is to identify broad classes of stands that are sufficiently similar for growth and yield modeling (**Table C-1**). The Modeling Team placed each of the existing stands in to 79 different categories, based on their ‘existing condition’ (**Table C-2**). The existing stand condition (ESC) describes the type of harvest, the tree density, and other silvicultural information. The Modeling Team than further collapsed the existing stand condition categories into sixteen different modeling groups that are shown in **Table C-1**.

Table C-1. Modeling groups used to develop strata.

2013 Modeling Group	Modeling Group - Definition and Description
MG_A	Pre-NFP regeneration harvest units with target or greater level of stocking. Also includes age class 30 stands with past thinning (CT or DM), and un-managed, well-stocked stands, age class < 50 (< 70) without legacy.
MG_B	Pre-NFP regeneration harvest units with below target level of stocking. Also includes age class < 50 (< 70) stands from ESC 52 (no past management) categorized as having as low density and without legacy trees.
MG_C	NFP regeneration harvest units with the full range of retention tree levels. Stand data merged across stock types (genetic vs. non-improved), stocking levels, and retention levels. Also includes age class < 50 stands with no past management and with a legacy tree component, similar to NFP regeneration harvest structure.
MG_D1	DM and CT stands in age classes 40-90. Stands treated age 80+, now age class > 100 (mostly Salem), merged with No Past Management stands (MG_E).
MG_D2	DF species group only, DM and CT units (Roseburg and Medford), age class 40-90. Stands treated age 80+, now age class > 100, merged with No Past Management (MG_E).
MG_D3	Primarily Klamath Falls DM stands. Model all species groups together, and use age bands for low acreage age classes above 120 and below 50.
MG_E1	No past management, limited mortality salvage, or conifer non-suitable woodlands. Non-conifer (hardwood) stands were merged with (red alder) stand conversions units in NWO (MG_F) or with hardwood suitable woodlands in SWO (MG_G).
MG_E2	Northwest Oregon stands with no past management, mature single story.
MG_E3	Southwest Oregon stands with no past management, mature single story.
MG_E4	Northwest Oregon stands with no past management, mature multi-story.
MG_E5	Southwest Oregon stands with no past management, mature multi-story.
MG_F	NWO stand conversion opportunities or stands extracted from ESC 51 (no past management and essentially all red alder species group).
MG_G	Hardwood woodlands for all SWO species groups. Includes woodlands categorized as suitable, non-suitable, and non-commercial forest land (NCFL). Also includes stands from ESC 51 (no past management) with hardwood species group or hardwood cover condition. The 6 FOIs from NWO may be best modeled using SWO growth curves.
MG_H	Conifer suitable woodlands. Includes stands from ESCs 68 and 70 (hardwood suitable woodlands) identified with a conifer species group designation.
MG_J	NCFL conifer suitable woodlands. Conifer species groups only, including stands extracted from ESCs 68 and 70 (hardwood suitable woodlands), and stands with a juniper species group stands from any ESC code.
MG_X	Non-forest. Also includes stands from other ESCs with inconsistent cover condition or species group data, which denotes a non-forest unit.

Table C-2. Existing stand condition coding.

Category	Description	GIS Acres
	No category	8
1	GFMA target stocking (≥ 80%) and 250-400 TPA density (unimproved TI)	361,885
2	GFMA target stocking (≥ 80%) and 250-400 TPA density (unimproved TI) FERTILIZED	98,712
3	GFMA minimum stocking (60-79%) – 150-249 TPA density (unimproved TI)	118,539
4	GFMA minimum stocking (60-79%) – 150-249 TPA density (unimproved TI) FERTILIZED	25,021
5	GFMA below minimum stocking (< 60%) – 50-149 TPA density (unimproved TI)	18,846
6	GFMA overstocked/over-dense - > 400 TPA density (unimproved TI)	31,492
7	GFMA target stocking (≥ 80%) and 250-400 TPA density (TI genetic stock)	22,543
8	GFMA target stocking (≥ 80%) and 250-400 TPA density (TI genetic stock) FERTILIZED	3,005
9	GFMA minimum stocking (60-79%) – 150-250 TPA density (TI genetic stock)	8,368
10	GFMA minimum stocking (60-79%) – 150-250 TPA density (TI genetic stock) FERTILIZED	443
11	GFMA below minimum stocking (< 60%) – 50-149 TPA density (TI genetic stock)	1,457
12	GFMA overstocked/over-dense - > 400 TPA density (TI genetic stock)	3,634
13	6-8 retention trees - at GFMA target stocking and density (TI genetic stock)	2,594
14	6-8 retention trees - at GFMA minimum stocking and density (TI genetic stock)	242
15	6-8 retention trees - below GFMA minimum stocking and density (TI genetic stock)	662
16	6-8 retention trees - overstocked GFMA standard- need PCT (TI genetic stock)	845
17	6-8 retention trees - at GFMA target stocking and density (unimproved stock TI)	19,188
18	6-8 retention trees - at GFMA minimum stocking and density (unimproved stock TI)	6,497
19	6-8 retention trees - below GFMA minimum stocking and density (unimproved stock TI)	2,312
20	6-8 retention trees - overstocked GFMA standard- need PCT (unimproved stock)	2,451
21	12-18 retention trees - at GFMA target stocking and density (TI genetic stock)	480
22	12-18 retention trees - at GFMA minimum stocking and density (TI genetic stock)	358
23	12-18 retention trees - below GFMA minimum stocking and density (TI genetic stock)	130
24	12-18 retention trees - overstocked GFMA standard- need PCT (TI genetic stock)	8
25	12-18 retention trees - at GFMA target stocking and density (unimproved stock TI)	1,091
26	12-18 retention trees - at GFMA minimum stocking and density (unimproved stock TI)	189
27	12-18 retention trees - below GFMA minimum stocking and density (unimproved stock TI)	108
28	12-18 retention trees - overstocked GFMA standard- need PCT (unimproved stock TI)	518
30	Density Mgt. at age class 30	1,310
31	Density Mgt. at age class 40	7,251
32	Density Mgt. at age class 50	12,964
33	Density Mgt. at age class 60	14,625
34	Density Mgt. at age class 70	8,562
35	Density Mgt. at age class 80	6,594
36	Density Mgt. at age class 90 Plus	49,611
37	CTed at age class 30	1,415
38	CTed and fertilized at age class 30	132
39	CTed at age class 40	11,323
40	CTed and fertilized at age class 40	689

Category	Description	GIS Acres
41	CTed at age class 50	33,402
42	CTed and fertilized at age class 50	4,644
43	CTed at age class 60	29,265
44	CTed and fertilized at age class 60	3,000
45	CTed at age class 70	21,726
46	CTed and fertilized at age class 70	505
47	CTed at age class 80	14,883
48	CTed at age class 90	8,541
49	CTed at age class 100	3,605
50	CTed at age class 110	9,928
51	Mortality Salvaged or Sanitation Cut	40,280
52	56-500 years old, no past silvicultural treatment	974,320
53	Brush field, hardwood, non-commercial conifer or backlog conversion opportunity	22,871
55	Cut, needs site preparation	139
57	Non-forest	126,922
58	> 18/15 retention trees/acre - at GFMA target stocking and density (TI genetic stock)	149
62	> 18/15 retention trees/acre - at GFMA target stocking and density (unimproved stock TI)	496
63	> 18/15 retention trees/acre - at GFMA minimum stocking and density (unimproved stock TI)	31
64	> 18/15retention trees/acre - below GFMA minimum stocking and density (unimproved stock TI)	78
66	Hardwood-suitable woodland CFL	2,642
67	Conifer-suitable woodland CFL	78,034
68	Hardwood-non-suitable woodland CFL	3,628
69	Conifer-non-suitable woodland CFL	45,148
70	Hardwood-suitable woodland Non-CFL	34,426
71	Conifer-suitable woodland Non-CFL	152,345
72	GFMA target stocking (≥ 80%) and 250-400 TPA density (unimproved TI) PRUNED	8,887
73	GFMA target stocking (≥ 80%) and 250-400 TPA density (unimproved TI) FERTILIZED PRUNED	3,333
74	GFMA minimum stocking (60-79%) – 150-249 TPA density (unimproved TI) PRUNED	3,353
75	GFMA minimum stocking (60-79%) – 150-249 TPA density (unimproved TI) FERTILIZED PRUNED	3,719
76	GFMA target stocking (≥ 80%) and 250-400 TPA density (TI genetic stock) PRUNED	1,372
77	GFMA target stocking (≥ 80%) and 250-400 TPA density (TI genetic stock) FERTILIZED PRUNED	47
78	GFMA minimum stocking (60-79%) – 150-250 TPA density (TI genetic stock) PRUNED	946
79	GFMA minimum stocking (60-79%) – 150-250 TPA density (TI genetic stock) FERTILIZED PRUNED	96
	Totals	**2,478,864**

2) Species Groups for RMP Modeling

The Micro*Storms database has a listing of the top five species within each stand layer, with a ranking of relative abundance. The Modeling Team utilized this data to classify each FOI into five broad groups - Douglas-fir, true fir, mixed conifer, conifer/hardwood mix, and hardwood - attributed by north or south within the planning area. The Modeling Team applied the northwest Oregon version of ORGANON (NWO) to the northern species groups, and the southwest Oregon version of ORGANON (SWO) to model the southern species groups. The Modeling Team modeled ponderosa pine and juniper species groups in southern Oregon only.

Douglas-fir (DF) - Stands with single species DF and stands with minor quantities of other conifers or hardwoods. They would typically be “FCO” stands (forest conifer), and have either single or multiple sizes and ages indicated.

Northern true fir (N_TF) - Noble or Silver fir are dominant, but other species are mixed in, such as Douglas-fir, western hemlock, or western red cedar.

Northern mixed conifer (N_MX_CON) - Stands with single species of western hemlock, western red cedar, Sitka spruce, or mixed conifer stands where Douglas-fir is not dominant. They would typically be “FCO” stands (forest-conifer).

Northern conifer/hardwood mix (N_CON_HWD) - These stands have both conifer and hardwood species listed, but they are dominated by neither. Conifers or hardwoods could be indicated in the dominant or secondary position. Hardwoods would include big leaf maple and red alder mixed with conifer species. Many FMX stands (forest - conifer and hardwoods) would be located here.

Northern hardwood (N_HWD) - Maple/alder mixes and pure alder are here. Pure or nearly-pure alder stands, with limited maple fractions. FHD stand (forest-hardwoods) descriptions are here.

Southern mixed conifer (S_MX_CON) - Stands containing incense cedar, sugar pine, ponderosa pine, Douglas-fir and white fir in varying fractions, but not including pure types without any secondary species indicated; may include some hardwood, but less than the southern conifer/hardwood mix.

Southern conifer/hardwood mix (S_CON_HWD) - Stands with mixed conifer species and a component of southern hardwoods such as oak, madrone, tanoak, and myrtle that may be in the majority or minority. FMX types (forest-conifer and hardwoods) are here.

Southern hardwood (S_HWD) - Southern hardwood species are dominant with limited mixed conifer component. Hardwoods are the dominant species, possibly FHD types (forest - conifer and hardwoods).

Southern true fir (S_TF) - This type includes Shasta red fir and white fir types. White fir types could have other secondary species such as Douglas-fir.

Ponderosa pine (PP) - Ponderosa pine is dominant; may include Douglas-fir, juniper or other species, but not as the dominant species.

Juniper (J) - This type is juniper dominant, but contains limited pine, occurs on dry, low site lands.

Depending on the district and the ORGANON variant used, lodgepole pine and knobcone pine types would go into Northern Mixed Conifer or Southern Mixed Conifer. Jeffery pine would go into a low site Ponderosa pine type. Mountain hemlock would go into northern true fir. Port-Orford-cedar would go into Southern Mixed Conifer.

3) Ten-Year Age Class

Table C-3 displays forest stand ten-year age classes from Micro*Storms database as of January 1, 2013. These stand ages reflect the conditions of the forest at the beginning of the analysis period and represent the current condition of BLM forests. The Modeling Team did not assign stand ages to the Eastside Management lands in the Klamath Falls Field Office for vegetation modeling purposes.

Table C-3. BLM western Oregon acreage by age class distribution and sustained yield unit.

10-Year Age	Coos Bay	Eugene	Klamath Falls	Medford	Roseburg	Salem	GIS Acres
Non-forest	20,206	13,841	167,312	66,556	24,477	24,765	317,157
≤ 10	3,288	2,669	4,656	17,555	3,187	2,406	33,762
20	24,281	18,455	1,159	37,409	35,366	20,426	137,097
30	27,727	27,480	2,025	46,037	33,084	32,210	168,562
40	39,740	32,952	451	22,672	38,470	36,446	170,731
50	36,309	38,225	1,896	42,766	44,666	45,334	209,196
60	25,366	32,545	3,301	23,975	20,410	44,157	149,754
70	17,852	41,702	3,124	25,965	9,084	33,833	131,560
80	9,007	22,302	3,693	21,373	7,276	24,002	87,654
90	3,884	8,026	5,304	29,789	6,284	14,335	67,622
100	4,395	5,057	5,182	32,715	5,758	13,233	66,340
110	4,083	6,171	3,927	55,621	15,789	13,181	98,773
120	9,318	8,004	1,519	33,784	6,335	21,855	80,814
130	10,406	6,219	1,477	44,408	8,041	21,080	91,632
140	6,967	1,597	2,905	48,694	10,584	9,358	80,105
150	8,287	1,201	1,064	39,172	25,877	7,349	82,950
160	8,138	2,083	1,297	35,847	1,723	1,867	50,956
170	2,523	404	525	24,123	8,098	2,787	38,460
180	2,190	433	235	42,019	788	454	46,119
190	1,769	3,989	375	14,781	1,908	156	22,978
200+	58,499	37,707	2,657	101,414	116,433	29,923	346,634
Totals	**324,236**	**311,063**	**214,084**	**806,675**	**423,640**	**399,157**	**2,478,856**

4) Site Productivity Class

The distribution of site class on each sustained yield unit came directly from the measured site index trees on the CVS subplots. The Modeling Team assigned five site classes from highly-productive (Site Class 1) to relatively-low productivity (Site Class 5). The Modeling Team used King (1966) Douglas-fir site index for the geographic area where the NWO version of ORGANON was applicable, and the Hann and Scrivani (1987) Douglas-fir site index for areas where the SWO version of ORGANON was appropriate. **Table C-4** shows the distribution of productivity classes within each sustained yield unit. The Modeling Team assigned a site class to each FOI based on the following order of priority:

1. measured tree data from either the CVS inventory associated with a FOI
2. the Continuous Forest inventory (CFI) data associated with a FOI
3. Ecosurvey (stand exam) data with site index averages associated with a FOI
4. a soil-type based classification from Natural Resources Conservation Service (NRCS) mapping or imputation based on climate variables (Latta *et al*. 2009)

The Modeling Team held the FOI unit-level productivity assignments constant for the Woodstock modeling of all alternatives and sub-alternatives.

Table C-4. Percentage of site class productivity within each sustained yield unit.

Site	Coos Bay	Eugene	Klamath Falls	Medford	Roseburg	Salem
Site 1	20%	28%	-	-	7%	15%
Site 2	42%	56%	-	6%	23%	48%
Site 3	25%	13%	22%	20%	32%	27%
Site 4	10%	2%	46%	43%	25%	6%
Site 5	1%	-	32%	30%	11%	3%

* Numbers have been rounded.

Strata to Stand Table

Of the 1,582 unique strata that include all FOI polygons, 601 strata had at least one overlaying CVS plot (**Table C-5**). These strata represent 83 percent of the forested BLM-administered acres. The Modeling Team modeled the remaining 981 strata, 17 percent of the forested BLM-administered acreage, using the 'most similar' CVS tree list. By broadening FOI site class, species groups, or stand age classes, the Modeling Team developed a decision matrix to determine which tree list was most similar for unmatched strata. Each stratum has a stand table that the Modeling Team developed from at least one CVS subplot tree lists. Each stratum represented by more than one tree list had an average tree list developed to represent that stratum. The Modeling Team modeled all of the FOIs in a particular stratum using the same stand table.

Table C-5. Strata representation with CVS subplots.

CVS Subplot Coverage	Strata Count	Forested Acres
Stratum with CVS subplots	601	1,775,011
Stratum with no CVS subplots	981	353,671
Totals	**1,582**	**2,128,682**

Application of the Stratification in Growth and Yield Modeling

The consulting firm Mason, Bruce & Girard, Inc. (MBG) projected the stand table for each stratum in the ORGANON growth and yield model utilizing a software program called YTGTools, which is MBG's proprietary software. MBG used YTGTools to batch multiple ORGANON runs and convert the outputs into Woodstock-compatible yield tables. MBG grew each stand table for a 200-year planning horizon to simulate future development with and without future silvicultural treatments.

ORGANON Comparison to Measured CVS Growth

In an effort to understand how comparable the tree growth on BLM stands was with the ORGANON model, the first step was to test actual tree growth with the projected growth from ORGANON. The Modeling Team did this by comparing projected tree growth on 2,609 CVS subplots with the actual growth recorded on those subplots, between their first and second measurements. The Modeling Team compared two metrics: stand basal area and volume (Scribner Mbf) per acre. On average, the model predicted 95 percent of the basal area actual growth, and 102 percent of the actual Mbf per acre. The results of the basal area projection reflect the ability of the model to predict tree mortality and diameter growth. The volume growth projection reflects mortality rates and growth in both height and diameter. The Modeling Team did not make any adjustments to the ORGANON model, as the Modeling Team considered these differences to be minor, and the time frames used to make the estimates fairly short.

Comparison of Stratified Inventory to Regional Permanent Plot Inventories

The Modeling Team compared the net and gross total volume estimates from the stratified inventory data with the unbiased total inventory estimate from both the Forest Inventory and Analysis plots and the CVS plots within that are located on BLM-administered land within the planning area (**Table C-6**). The stratified total and net volume estimate, as represented by the No Timber Harvest modeling run (explained later in this appendix), was within one 95 percent confidence interval of both estimates, from both regional inventories.

Table C-6. Results from net inventory comparison (MMbf volume).

Inventory Comparison	CVS Plot Calculations	FIA Plot Calculations	No Timber Harvest Run
Net volume 2013	76,766	79,100	73,961
95% CI Upper	80,698	87,100	
95% CI Lower	72,833	71,100	

GIS – Defining the Land Base and Spatial Projections

Introduction

The Modeling Team used the Geographic Information System (GIS) data to develop a set of polygons with unique identifiers (RMPWO_ID), which cover the BLM-administered lands in the planning area. The Modeling Team defined the attribute data for each these polygons as well as the land base for application of modeling rules for simulation of the alternatives and sub-alternatives. The Modeling Team used GIS data for mapping the Woodstock projections results of the forest conditions over time. This section provides an overview of the GIS process, and the data the Modeling Team used for analyzing the alternatives. The BLM recorded the details on the GIS processing and datasets with GIS metadata.

Defining BLM-administered lands

The Land Lines Information theme (LLI) is the BLM corporate GIS layer for land status - O&C lands, public domain, and Coos Bay Wagon Road lands. The FOI is the spatial vegetation layer used for the Woodstock modeling. The FOI and Land Lines themes are not vertically integrated in GIS, which results in slivering in the areas of misalignment. For the analytical purposes, BLM-administered lands are defined by the area in which the FOI and LLI overlap. This FOI and LLI mask was subsequently used to minimize the slivers from all GIS layers used in the analysis.

Intersection versus Majority Rules

Where the subdivision of the FOI was important for simulating different modeling rules within each stand (e.g., Riparian Reserves and roads), the BLM intersected the data layers in GIS to create unique areas. Some data layers came from external sources that were captured at coarser scales than the FOI mapping and do not align well with BLM checkerboard ownership (e.g., northern spotted owl Critical Habitat Units). In these situations, the BLM performed a majority rules analysis, where 50 percent or more of the FOI unit would need to coincide with the data theme, such as critical habitat, to receive the designation. The BLM applied this majority rules process to themes where spatial subdivision of FOI polygons was unnecessary and stand level designation was sufficient for the analysis.

Rasterizing and Unique ID Assignment

To facilitate GIS processing, the BLM converted all vector GIS data layers to 10 by 10 meter raster cells (1 cell = 0.025 acres – UTM zone 10, NAD83) and partitioned the data into tiles, which were based on 1:24,000 U.S. Geological Survey quadrangle grids (approximately 35,000 acres, 6 miles east/west by 8.5 miles north/south). Within each tile, the BLM intersected every unique combination of GIS data layers with the FOI. The BLM gave each resulting polygon a unique identifier (RMPWO_ID). The example below in **Table C-7** illustrates one FOI unit (840369) being subdivided into four unique areas based on how Riparian Reserves and roads intersected the forest stand. This GIS subdivision of the forest stands allows the Woodstock model to simulate how each portion of the stand would develop.

Table C-7. Example of one FOI unit subdivided into four unique areas.

RMPWO_ID	FOI #	GIS Acres	Riparian Reserve	Road Buffer	Description
124000005	840369	28.84	N	N	Outside riparian reserve; outside of road buffer
124000008	840369	0.99	N	Y	Outside riparian reserve; within road buffer
124000004	840369	10.90	Y	N	Inside riparian reserve; outside of road buffer
124000013	840369	0.49	Y	Y	Inside riparian reserve; within road buffer

The unique ID (RMPWO_ID) carries through the Woodstock modeling projections for tracking each spatial entity. The Modeling Team stored the resultant information in 10 by 10 meter pixels. The Modeling Team combined those pixels with the same information to form polygons. The Modeling Team returned Woodstock classification of allocations or projections of forest conditions to GIS as attributes with the unique IDs, which were linked back to the original grid to produce spatial products.

Data Vintage

The Modeling Team captured a snapshot of the Forest Operations Inventory (FOI), Land Use Allocation (LUA), Timber Production Capability Classification (TPCC), Occupied Marbled Murrelet Sites (OMMS), and the LLI data for this analysis. The data represents the conditions as of the beginning of January 2013. The BLM updated other GIS datasets during the winter and spring of 2013, and used the best available information at the time of the analysis. For example, **Table C-8** displays the GIS data themes that the Modeling Team used in the analysis for Alternative A.

Table C-8. GIS data themes used in the analysis for Alternative A.

Source Vector	Description
pol_dob_a_v2_poly	BLM district (in file but not used, see MStorms based)
fst_foi_a_v3_poly	FOI coincident with BLM ownership
trn_highways_aoi_a_v1_arc , trn_roads_aoi_a_v1_arc	Roads buffered 22.5' per side
hyd_waterbody_aoi_a_v1_poly , hyd_areas_aoi_a_v1_poly	Surface water (no buffers)
fst_tpc_a_v2_poly	No Timber Harvest-Harvest Land Base (N, X, Y)
fst_foi_a_v3_poly	Unique FOI ID
Micro*Storms (flat file)	Yield strata ID
Micro*Storms (flat file)	Model group by OI unit
Micro*Storms (flat file)	Species group by OI unit
Micro*Storms (flat file)	Site class by OI unit
Micro*Storms (flat file)	Ten-year age class by OI unit
Micro*Storms (flat file)	BLM district name by OI unit
Micro*Storms (flat file)	AgeInPeriods_TS (starting age) by OI unit
Micro*Storms (flat file)	WOPR structure stage by OI unit
Micro*Storms (flat file)	Township/Range/Section by OI unit
Micro*Storms (flat file)	ORGANON variant by OI unit
lch_MoistDry_a_aoi_v2_poly	Moist/Dry by OI unit
fir_Predicted_FireSeverity_10m_a_v1_rst	Predicted fire severity moderate/high, decade 1, weighted by OI unit
fst_tpc_a_v2_poly	Primary management
fst_tpc_a_v2_poly	Primary class
hyd_wbd_hu10_a_v2_poly	Watersheds HUC 10
hyd_wbd_hu12_a_v2_poly	Subwatershed HUC 12
smg_ond_a_v2_poly	Other national designations
trn_pacificcresttrail_a_v1_arc	Pacific Crest Trail (25 ft. buffer per side)
lsc_provphys_a_v2_poly	Physiographic provinces
smg_wilderness_a_v2_poly	Wilderness
smg_wsrcorr_a_v2_poly	Wild and scenic river corridors, designated
pol_cob_a_v2_poly	County name
smg_wsa_a_v1_poly	Wilderness Study Areas
hyd_keywatersheds_a_v1_poly	Key watersheds

Source Vector	Description
lup_riparian_reserveInner_alta_a_v1_poly, lup_riparian_reserveOuter_alta_a_v1_poly, (hyd_flowline_aoi_a_v1_arc , hyd_waterbody_aoi_a_v1_poly , hyd_areas_aoi_a_v1_poly , hyd_wetland_aoi_a_v1_poly, lup_treeheightdistance_wpr_a_v1_poly)	Inner Riparian Reserves Alt. A, outer Riparian Reserves Alt. A
rec_vrm_a_v1_poly	Visual resource management No Action
lup_lua_a_v2_poly	Land Use Allocations, No Action
smg_WildernessCharacteristics_a_aoi_v1_poly	Wilderness Characteristics
smg_wsrcorr_a_v2_poly	Wild and scenic river corridors, designated, type (wild, scenic, recreation)
smg_wsrcorr_proposed_a_v2_poly	Wild and scenic river corridors, Y/N, eligible ,and suitable
pol_ownership_blm_aoi_a_v3_poly	Land status (O&C, public domain, etc.)
FLORA_CHUs	Flora Critical Habitat areas
FAUNA_CHUs	Fauna Critical Habitat areas, non-owl/murrelet
smg_acec_proposed_aa_a_v4_poly	ACECs proposed (action alternatives)
wld_mmz_5mi_a_v1_poly	Marbled murrelet zones with 5 mi. bands
GB_FLORA_SITES (RWOR39)	Flora survey and manage species 2001 list, buffered
GB_FLORA_SITES (RWOR39)	Flora special status T&E species, buffered
GB_FAUNA_SITES (RWOR36)	Species group report units (buffered, terrestrial) new buffers per alternatives
GB_FAUNA_SITES (RWOR36)	Fauna survey and manage species 2001 list, buffered
GB_FAUNA_SITES (RWOR36)	Fauna special status T&E species , buffered
Not included for Alt. A	Predicted murrelet sites
Not included for Alt. A	Predicted red tree vole sites
rec_recmgt_a_v1_poly	Recreation Management Areas, Alt. A
fst_swissneedlecast_a_v1_poly	Swiss needle cast
min_fragile_soils_a_v1_poly	Fragile soils action alternatives
lup_wopr_ueamgt_aoi_a_poly	Uneven Age Management Areas
wld_marbledmurrelet_chu_a_2011_v1_poly	Marbled murrelet Critical Habitat
atm_frost_prone_med_a_v1_poly	Frost prone areas
lup_Kfalls_EastsideLands_a_v1_poly	Eastside Management Lands
pol_rab_a_v3_poly	Field Office name and code (final modifications done in database)
lsc_NWFP_NSO_MRegions_aoi_a_v1_poly	Northern spotted owl modeling groups
wld_nsochu_a_2013_v1_poly	Northern spotted owl Critical Habitat

See the modeling rules section for further description of the GIS data themes used in the modeling.

Moist vs. Dry Delineation of BLM-administered Lands in the Planning Area

Moist vs. Dry Forests

The Modeling Team recognizes that forested lands fall within two broad categories - moist forests and dry forests - that are relevant to management decisions and analysis. The Modeling Team recognizes that the spectrum from moist to dry is more accurately described along a continuous gradient from moist to dry rather than a “one or the other” binary classification. However, the Modeling Team has made these discrete classifications to facilitate specifying management objectives and direction based on mapped land use allocations. Recognizing and managing both moist and dry forests within the range of the northern spotted owl is a major underpinning in the Revised Recovery Plan for the Northern Spotted Owl (USDI FWS 2011, pp. III-17 – III-41).

Moist forests are typically highly productive, often with deep, nutrient-rich soils, abundant precipitation, and relatively cool, temperate climates. Historically, these forests have experienced relatively infrequent, high, or mixed severity fires. Moist forests are concentrated in the coastal/northern districts (Salem, Eugene, and Coos Bay, and the north half of the Roseburg District). Moist forests also occur in the southern/interior districts (the southern half of the Roseburg district, Medford, and Klamath Falls Field Office of the Lakeview District), but they are less abundant, often on northern aspects, in higher elevations, or in coastal influence zones.

Dry forests are typically lower productivity forests, occurring in warmer/drier environments, and often on shallower, nutrient-poor soils when compared to moist forests. Historically, these forests have experienced frequent, low to mixed severity fires. Dry forests are concentrated in southern/interior districts (the southern half of the Roseburg District, Medford, and the Klamath Falls Field Office). Dry forests also occur in the coastal/northern districts, but they are less abundant, often on southern aspects, ridge tops, and low-elevation valley margins.

The distinction between moist forests and dry forests represents a complicated relationship between climate, species, topography, soils, and disturbance history. For this reason, a map based on any one of these factors would likely create an incorrect representation of the spatial arrangement of these forests. Fortunately, the BLM and the U.S. Forest Service has collected and compiled data on Plant Association Groups (PAG), which are also the product of climate, species, topography, soils, and disturbance history. Therefore, the Modeling Team can use PAG to determine whether a forest stand is moist or dry (Franklin *et al*. 2013, pp. 12-23). Trained professionals in the field can readily make Plant Association Group determinations and large spatial mapping datasets are available for many parts of the planning area.

The following plant association series and groups are generally considered moist (Franklin and Johnson 2012): western hemlock (*Tsuga heterophylla*), Sitka spruce (*Picea sitchensis*), western redcedar (*Thuja plicata*), Pacific silver fir (*Abies amabilis*), mountain hemlock (Tsuga mertensiana), sulbalpine fir-Engelmann spruce (*Abies lasiocarpa-Picea engelmanni*), moist grand fir (*Abies grandis*), and moist white fir (*Abies concolor*).

The following plant association series and groups are generally considered dry (Franklin and Johnson 2012): ponderosa pine (*Pinus ponderosa*), Oregon white oak (*Quercus garryana*), Douglas-fir

(*Pseudotsuga menziesii*), Jeffrey pine (*Pinus jeffreyi*), dry grand fir (*Abies grandis*), and dry white fir (*Abies concolor*).

These very general categories provided the Modeling Team with a starting point for categorization of forested lands in the decision area. The Modeling Team produced a set of PAG moist/dry categorizations that were distributed to U.S. Forest Service regional ecologists and BLM experts for review. Based on this evaluation and review, the Modeling Team labeled each PAG in the planning area as either moist or dry.

The next challenge was to categorize forested stands in the decision area as either moist or dry. While PAG data is available for many regions, there is not a seamless coverage available for the entire decision area for this planning effort. However, the Integrated Landscape Assessment Project (ILAP) had derived a single, seamless coverage of Potential Vegetation Type (PVT) for the entire decision area. This PVT map consists of a raster grid to a 30-meter pixel size derived from underlying PAG and necessary interpolation. The Modeling Team updated the southwest Oregon portion of the map to reflect the most up-to-date PAG information for the region. Then, the Modeling Team labeled each FOI unit (stand) in the database as either moist or dry based on the PVT map and a majority rules process. The Modeling Team labeled stands exactly split between moist and dry as dry, this was very rare.

The Modeling Team sent these maps to BLM offices for review by experienced local experts. The BLM corrected mapping errors by location where the maps did not accurately reflect local knowledge of conditions on the ground. The accuracy of PVT for the Salem District was not satisfactory because they had very few dry forest acres. The Salem District BLM experts used a combination of biophysical setting data and local knowledge to manually select dry stands from their operational land base.

This mapping effectively produced a seamless, spatial moist/dry classification scheme for the entire decision area (**Table C-9**). **Table C-10** is a representation of the final categories that the BLM offices selected, prior to area corrections being applied. Roseburg N refers to the Roseburg District outside of the Klamath East or Klamath West modeling region, while Roseburg S refers to the Roseburg District inside of those modeling regions. The Modeling Team customized these calls based on local knowledge and spatial coverage for each district by local BLM ecological vegetation experts. Very Dry forests are a subset of dry forests that the Modeling Team modeled as uneven-aged management where they reside in the Harvest Land Base in Alternatives C and D.

Table C-9. Moist vs. dry forested acres by district/field office.

Class	Coos Bay	Eugene	Klamath Falls	Medford	Roseburg	Salem	Totals
Dry	2,300	1,010	43,043	715,509	170,588	6,851	939,300
Moist	301,837	296,212	4,968	24,610	228,575	367,690	1,223,893
Totals	**304,137**	**297,222**	**48,011**	**740,119**	**399,163**	**374,541**	**2,163,193**

Table C-10. Moist/dry potential vegetation type categorization by district/field office.

Plant Vegetation Type (PVT)	Coos Bay (Moist/Dry)	Eugene (Moist/Dry)	Klamath Falls (Moist/Dry)	Medford (Moist/Dry)	Roseburg N (Moist/Dry)	Roseburg S (Moist/Dry)	Salem (Moist/Dry)
Douglas-fir-Dry	Moist	Dry	Very Dry	Very Dry	Dry	Very Dry	Moist
Douglas-fir-Moist	Moist	Dry	Dry	Dry	Dry	Dry	Moist
Douglas-fir-White oak	Moist	Dry	Very Dry	Very Dry	Dry	Very Dry	Moist
Douglas-fir-Xeric	Moist	Dry	Very Dry	Very Dry	Dry	Very Dry	Moist
Grand fir-Valley	Moist	Moist	Moist	Moist	Moist	Moist	Moist
Grand fir-Warm/Dry	Moist	Moist	Moist	Moist	Moist	Moist	Moist
Grand fir-Cool/Moist	Moist	Moist	Moist	Moist	Moist	Moist	Moist
Mixed Conifer-Moist	Moist	Moist	Dry	Dry	Moist	Moist	Moist
Mixed Conifer-Dry	Moist	Dry	Very Dry	Very Dry	Dry	Dry	Moist
Mixed Conifer-Cold/Dry	Moist	Dry	Very Dry	Very Dry	Dry	Dry	Moist
Mixed Conifer-Dry (pumice soils)	Moist	Dry	Very Dry	Very Dry	Dry	Dry	Moist
Mountain hemlock-Cold/Dry	Moist	Moist	Moist	Moist	Moist	Moist	Moist
Mountain hemlock-Cold/Dry (Coastal/W. Cascades)	Moist	Moist	Moist	Moist	Moist	Moist	Moist
Mountain hemlock-Intermediate	Moist	Moist	Moist	Moist	Moist	Moist	Moist
Mountain hemlock-Wet	Moist	Moist	Moist	Moist	Moist	Moist	Moist
Oregon white oak	Moist	Dry	Very Dry	Very Dry	Dry	Very Dry	Moist
Oregon white oak-ponderosa pine	Moist	Dry	Very Dry	Very Dry	Dry	Very Dry	Moist
Pacific silver fir-Intermediate	Moist	Moist	Moist	Moist	Moist	Moist	Moist
Pacific silver fir-Warm	Moist	Moist	Moist	Moist	Moist	Moist	Moist
Ponderosa pine-Dry	Moist	Very Dry	Very Dry	Very Dry	Very Dry	Very Dry	Moist
Ponderosa pine-Xeric	Moist	Very Dry	Very Dry	Very Dry	Very Dry	Very Dry	Moist
Shasta red fir-Dry	Moist	Moist	Moist	Moist	Moist	Moist	Moist
Shasta red fir-Moist	Moist	Moist	Moist	Moist	Moist	Moist	Moist
Sitka spruce	Moist	Moist	Moist	Moist	Moist	Moist	Moist
Subalpine fir	Moist	Moist	Moist	Moist	Moist	Moist	Moist
Subalpine fir-Cold/Dry	Moist	Moist	Moist	Moist	Moist	Moist	Moist
Subalpine parkland	Moist	Moist	Moist	Moist	Moist	Moist	Moist
Tan oak-Douglas-fir-Dry	Moist	Moist	Very Dry	Very Dry	Dry	Very Dry	Moist
Tan oak-Douglas-fir-Moist	Moist	Moist	Moist	Moist	Dry	Dry	Moist
Tan oak-Moist	Moist	Moist	Moist	Moist	Dry	Dry	Moist
Western hemlock-Coastal	Moist	Moist	Moist	Moist	Moist	Moist	Moist
Western hemlock-Cold	Moist	Moist	Moist	Moist	Moist	Moist	Moist
Western hemlock-Hyperdry	Moist	Moist	Moist	Moist	Moist	Moist	Moist
Western hemlock-Intermediate	Moist	Moist	Moist	Moist	Moist	Moist	Moist
Western hemlock-Moist	Moist	Moist	Moist	Moist	Moist	Moist	Moist
Western hemlock-Moist (Coastal)	Moist	Moist	Moist	Moist	Moist	Moist	Moist
Western hemlock-Wet	Moist	Moist	Moist	Moist	Moist	Moist	Moist

Plant Vegetation Type (PVT)	Coos Bay (Moist/Dry)	Eugene (Moist/Dry)	Klamath Falls (Moist/Dry)	Medford (Moist/Dry)	Roseburg N (Moist/Dry)	Roseburg S (Moist/Dry)	Salem (Moist/Dry)
Western red cedar/Western hemlock-Moist	Moist	Moist	Moist	Moist	Moist	Moist	Moist
White fir-Cool	Moist	Moist	Very Dry	Very Dry	Moist	Moist	Moist
White fir-Intermediate	Moist	Moist	Dry	Dry	Dry	Dry	Moist
White fir-Moist	Moist	Moist	Moist	Moist	Moist	Moist	Moist
White fir-Warm Moist	Moist	Moist	Moist	Moist	Moist	Moist	Moist
Lodgepole pine	Moist	Very Dry	Very Dry	Very Dry	Very Dry	Very Dry	Moist
Ultramafic	Very Dry	Very Dry	Very Dry	Very Dry	Very Dry	Very Dry	Moist
Other Non-forest	Moist	Dry	Very Dry	Very Dry	Dry	Very Dry	Moist
Jeffrey Pine	Dry	Very Dry	Very Dry	Very Dry	Very Dry	Very Dry	Dry
Lodgepole pine Cold	Dry	Very Dry	Very Dry	Very Dry	Very Dry	Very Dry	Dry
Not Modeled	Moist	Dry	Very Dry	Very Dry	Dry	Very Dry	Moist
Barren	Moist	Dry	Very Dry	Very Dry	Dry	Very Dry	Moist
Wetland	Moist	Moist	Moist	Moist	Moist	Moist	Moist
Water or Ice	Moist	Moist	Moist	Moist	Moist	Moist	Moist
Subalpine meadows-Green Fescue	Moist	Moist	Moist				Moist
Bitterbrush-With Juinper	-	-	Very Dry				-
Idaho fescue-Prairie junegrass	-	-	Very Dry				-
Low Sage-Mesic, no juniper	-	-	Very Dry				-
Low Sage-Mesic, with juniper	-	-	Very Dry				-
Montane and canyon shrubland	-	-	Very Dry				Dry
Mountain big sagebrush-With juniper	-	-	Very Dry				-
Mountain Mahogany	-	-	Very Dry				-
Ponderosa Pine-Dry, with juniper	-	-	Very Dry				-
Ponderosa pine-Lodgepole pine	-	-	Very Dry				-
Salt desert shrub-lowland	-	-	Very Dry				-
Western juniper woodland	-	-	Very Dry				-
Wetland	Moist	Moist	Moist	Moist	Moist	Moist	Moist
Wyoming big sagebrush-No juniper	-	-	Very Dry				-
Wyoming big sagebrush-With juniper	-	-	Very Dry				-

Forest Growth and Yield Modeling

Introduction

This section describes the silvicultural systems, practices, modeling tools, and modeling assumptions for forest growth simulations at the stand level. The purpose of simulating forest stand growth and development is to permit analysis of the effects of different silvicultural systems and silvicultural practices on timber yield, stand structural class, wildlife habitat, hydrologic function, carbon budgets, etc. The Modeling Team used the simulated growth and yield output tables described in this section in the Woodstock model to help answer the analytical questions for different resources identified in this RMP for each of the alternatives.

Silvicultural Systems, Practices, and General Modeling Approaches

Silvicultural Systems and Associated Regeneration Harvest Types

A silvicultural system is a planned series of treatments for tending, harvesting, and re-establishing a stand to meet specific management objectives (i.e., a set of treatments that could be repeated in perpetuity). The system name is commonly based on the number of age classes created within a stand (Tappeiner et al. 2007). The regeneration harvest method associated with a particular silvicultural system defined by age class has such a decisive influence on stand form and development that the harvest method name is also commonly applied to the silvicultural system (Smith 1962). For example, the terms uneven-aged and selection system are often used interchangeably to characterize the same silvicultural system.

Within a land use allocation being managed with a particular silvicultural system, the planned series of treatments are fine-tuned to meet the specific conditions and growth potential of individual stands or modeling group. These more specific combination and sequence of treatments is called a silvicultural prescription or management regime.

The Modeling Team used three recognized silvicultural systems in simulating forest stand development and timber harvest on lands identified as contributing to sustained-yield management. These are even-aged (clearcut and shelterwood), two-aged (variable-retention), and uneven-aged (selection). Two-aged and uneven-aged systems are described collectively as multi-aged (O'Hara 2014). The systems analyzed for this analysis exhibit a gradient of timber harvest intensity (**Figure C-3**) and stand structural complexity (**Figure C-4**). The system used depends on the land use allocations objectives of each alternative (see **Tables C-11** and **C-12**).

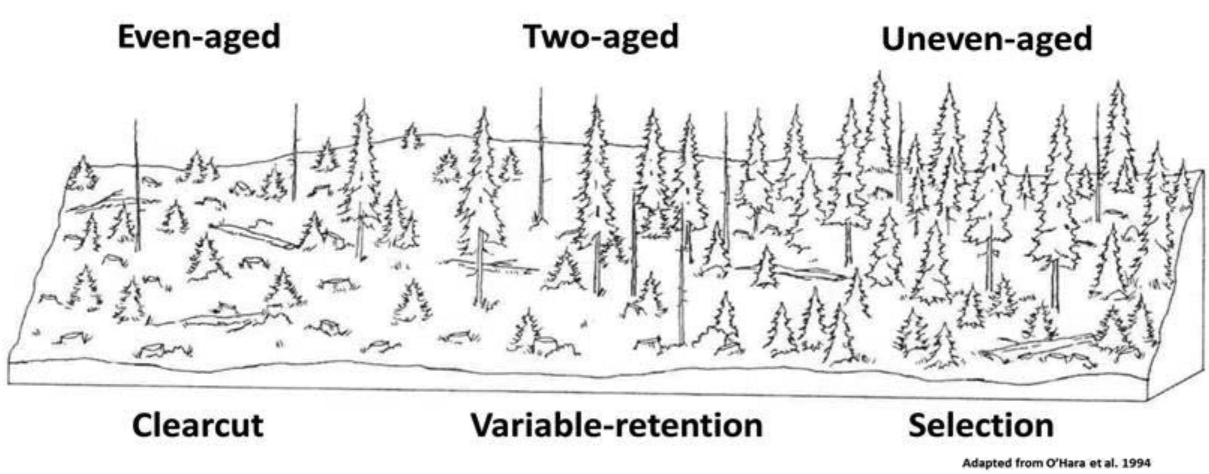

Figure C-3. Gradient of silvicultural systems and regeneration harvest methods.

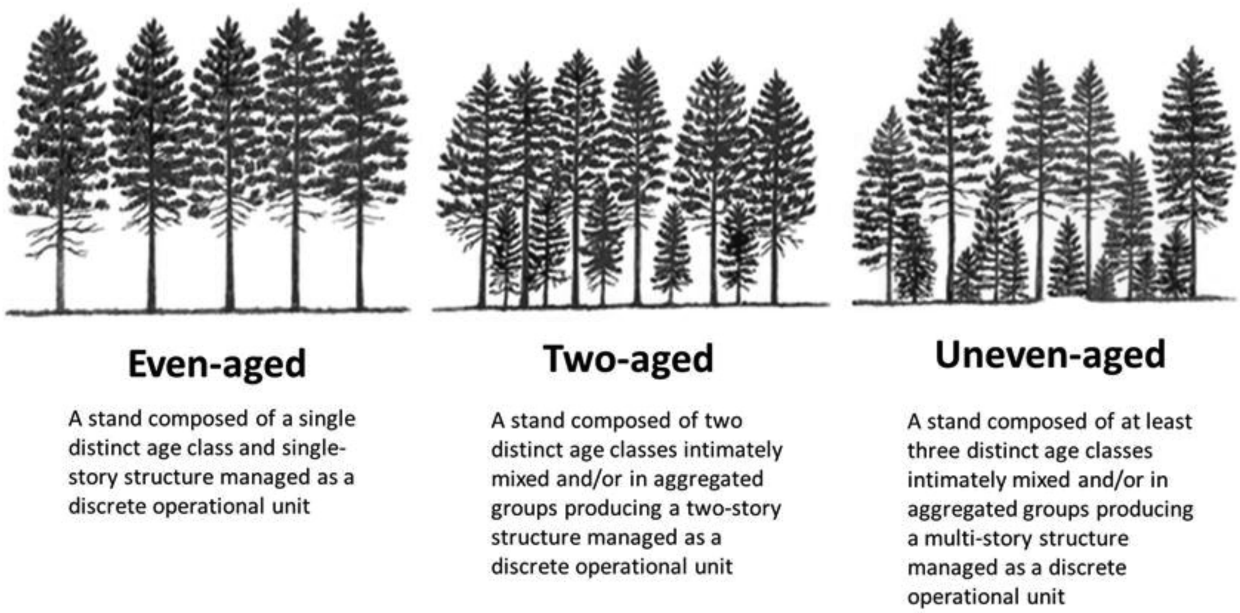

Figure C-4. Stand structural types produced by various silvicultural systems. Figure adapted from USDA FS NCRS (no date).

Table C-11. Silvicultural systems/harvest method by land use allocation.

Land Use Allocation	LUA Abbrev.	No Action	Alt. A	Alt. B	Alt. C	Alt. D
General Forest Management Area	GFMA	Two-aged	*	*	*	*
Adaptive Management Area[1]	AMA	Two-aged	*	*	*	*
Moderate Intensity Timber Area	MITA	*	*	Two-aged	*	Two-aged
Connectivity/Diversity Block	CONN	Two-aged	*	*	*	*
Low Intensity Timber Area	LITA	*	*	Two-aged	*	*
Southern General Forest Management Area	SGFMA	Two-aged	*	*	*	*
Uneven-aged Timber Area	UTA	*	Uneven-aged	Uneven-aged	Uneven-aged	Uneven-aged
Owl Habitat Timber Area	OHTA	*	*	*	*	Uneven-aged
High Intensity Timber Area	HITA	*	Even-aged	*	Even-aged	*
Late-Successional Reserve	LSR	Thinning	Thinning[3]	Thinning/ Uneven-aged[4]	Thinning/ Uneven-aged[4]	Thinning/ Uneven-aged[4]
Adaptive Management Reserve[2]	AMR	Thinning	*	*	*	*
Riparian Reserve	RR	Thinning	Thinning[3]	Thinning	Thinning	Thinning

[1] Adaptive Management Area is represented by the General Forest Management Area in subsequent tables
[2] Adaptive Management Reserve is represented by the Late-Successional Reserves in subsequent tables
[3] No commercial harvest, cut trees are left on-site
[4] Varies by moist forest (Thinning) – dry forest (Uneven-aged) classifications

Table C-12. Silvicultural systems selected modeling assumptions.[1]

Land Use Allocation Abbreviation	Regeneration Harvest Method[2]	Target Stand Structure Type	Alternative	Primary Regeneration Method and Simulation Timing[3]	Pre-commercial Thinning Residual Density (Trees/Acre)	Genetic Improve-ment[4]	Commercial Thinning	Fertilize
GFMA	VRH	Two-Aged	No Action	Plant - 15	200-260	X	X	X
MITA	VRH	Two-Aged	D	Plant - 15	260	X	X	X
MITA	VRH	Two-Aged	B	Plant - 30	260			
CONN	VRH	Two-Aged	No Action	Plant - 15	150-220		X	
LITA	VRH	Two-Aged	B	Natural - 30	220		X	
LITA	VRH	Two-Aged	B	Natural - 30	100			
LITA	VRH	Two-Aged	B	None	0			
SGFMA	VRH	Two-Aged	No Action	Plant - 15	260		X	
UTA	Selection	Uneven-aged	A, B, C, D	Plant - 15	260		X	
OHTA	Selection	Uneven-aged	D	Plant - 15	260		X	
HITA	Clearcut	Even-aged	A, C	Plant - 15	260	X	X	X
LSR	Variable by Alternative							
RR	N/A	Multi-aged	All	Natural	120			

[1] Actions that are applicable outside of fire scenario areas
[2] VRH = variable-retention harvest
[3] "Natural" indicates that no artificial regeneration (tree planting) is permitted; "Plant" indicates a planting cost applies. The number following the primary regeneration method is the number of years post-harvest that a tree list representing 15-years-old trees is added to the growth simulation at a density reflecting post-pre-commercial thinning, or if less than 150 the assumed density reflecting stand density if below target density for that land use allocation.
[4] Refer to use of genetically improved Douglas-fir seedlings for reforestation and use of growth modifiers in ORGANON simulations.

The even-aged system uses the clear-cutting or shelterwood harvest method to regenerate existing stands. Clear-cutting essentially removes all trees from an area in a single harvest operation (see **Figure C-5**). Shelterwood harvest initially retains a number of "shelter" trees to protect new tree regeneration by mitigation of detrimental on-site environmental conditions (e.g., heat or frost). Immediately post-harvest, a shelterwood has the appearance of a two-aged stand resulting from a variable-retention harvest (see **Figure C-3**). However, unlike the two-aged system, the shelter trees are only temporarily retained (approximately 10-20 years) and are harvested when they no longer required for protection of the new tree regeneration.

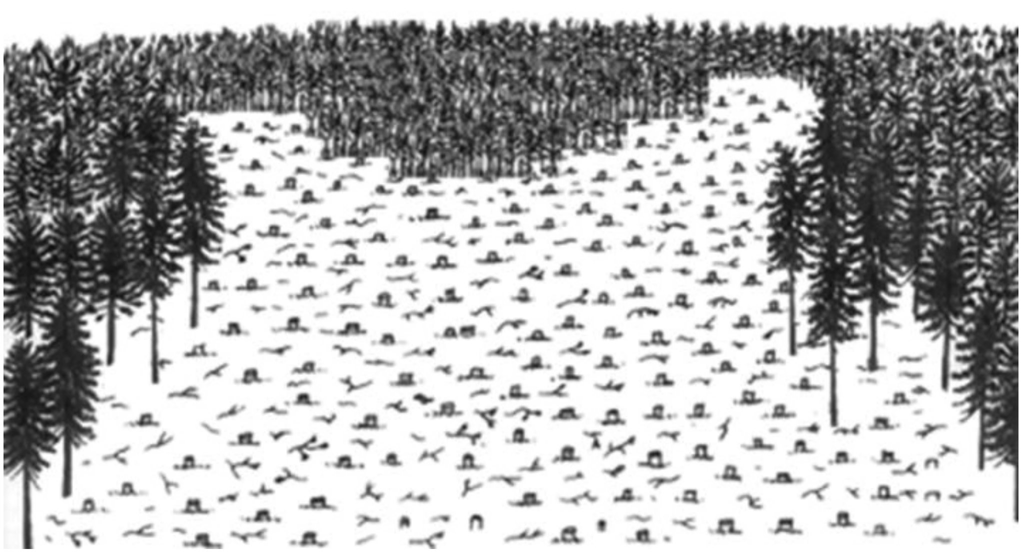

Figure C-5. Clearcut stand immediately post-harvest. Figure adapted from USDA FS NCRS (no date).

The two-aged system uses a variable-retention harvest method to achieve the goal of establishing new tree regeneration (see **Figures C-3** and **C-4**). At regeneration harvest, live trees are retained long-term (reserved from harvest) to facilitate the development of a two-aged stand structure. The retained trees may be left in a dispersed, aggregated, or mixed spatial pattern (see **Figure C-6**). For modeling purposes, the Modeling Team assumed dispersed retention for variable-retention harvests in the No Action alternative and Alternatives B and D.

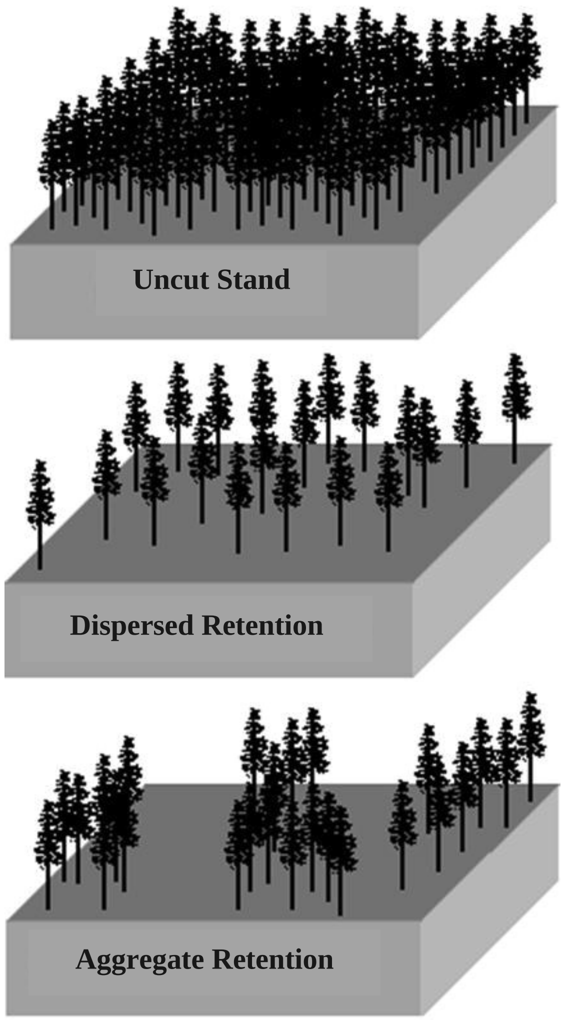

Figure C-6. Variable-retention (regeneration) harvest-idealized retention patterns. Figure adapted from USDA FS NCRS (no date).

The uneven-aged system uses selection harvests to establish new regeneration. Trees are harvested singly and/or in groups with the objective of creating an uneven-aged multi-story (canopy) stand structure (See **Figures C-3**, **C-4**, and **C-7**). Classically defined uneven-aged management assumes that over time the entire area of the stand is harvested. A feature of the uneven-aged system in the action alternatives is the long-term retention or reservation from harvest of a portion of each stand similar to retention concept of the two-aged system.

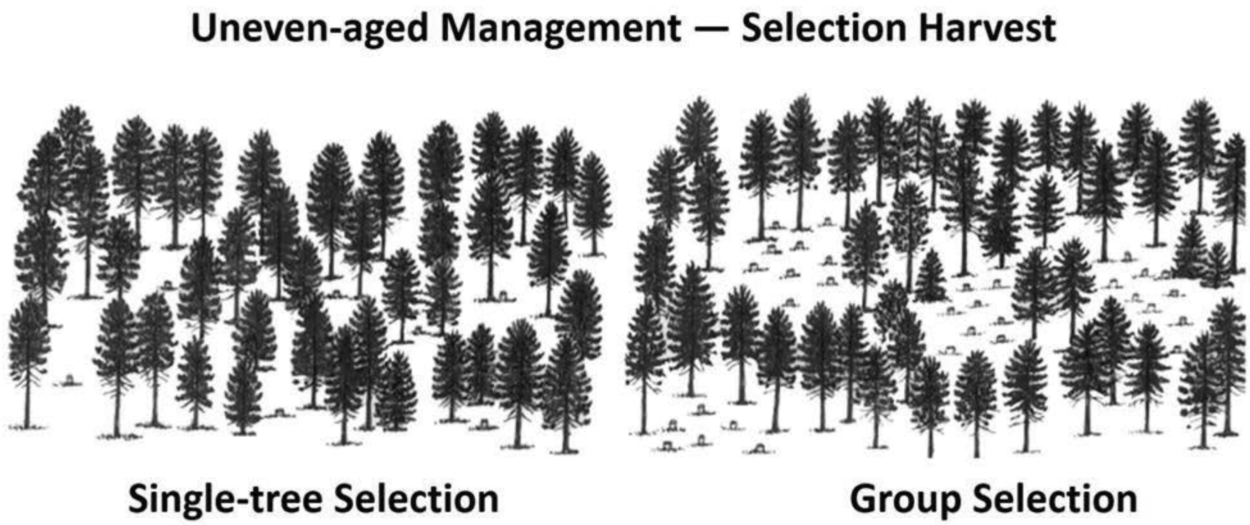

Figure C-7. Uneven-aged management/selection harvest – idealized harvest patterns. Figure adapted from USDA FS NCRS (no date).

In addition to being used in simulating forest stand development and timber harvest on lands identified as contributing to sustained yield management, the Modeling Team modeled uneven-aged management in the "dry forest" portions of the Late-Successional Reserves in the action alternatives.

The Modeling Team modeled timber harvests on portions of land use allocations managed for emphases other than timber. For example, Late-Successional Reserves would employ a harvest approach commonly referred to as variable-density thinning (Harringon *et al*. 2005). Variable-density thinning employs elements of commercial thinning and selection harvest of the uneven-aged system to promote stand heterogeneity through the development of a multi-story stand. Provision of conditions conducive to the initiation and growth of regeneration is an objective of variable-density thinning to encourage understory development to contribute to stand heterogeneity. Variable-density thinning in the context of the alternatives analyzed is not a silvicultural system as such, since silvicultural treatments are assumed to end by a specified stand age (i.e., there is no assumption of a repeatable cycle of treatments in perpetuity). The Modeling Team modeled variable-density thinning as a series of proportional commercial thinnings with simulated tree regeneration following the thinning harvests in Riparian Reserves in all alternatives, Late-Successional Reserve in the No Action alternative, and "moist forest" areas in the Late-Successional Reserve in the action alternatives.

Silvicultural Practices and Modeling Assumptions

For each modeling group, the Modeling Team may plan a variety of practices in addition to harvesting for specific periods in the life of the stand. These practices act to keep forest stands on desired developmental trajectories. The type and timing sequence of those practices vary by the current and the desired future condition of the stand or modeling stratum.

The other major silvicultural practices besides regeneration harvesting that affect forest stand growth, value and structure are site preparation, regeneration (reforestation), stand maintenance and protection, pre-commercial thinning, commercial thinning, fertilization, and pruning. The Modeling Team derived estimates of the proportion of future treatment needs from historical experience in individual BLM offices and the specifics of the various alternatives.

Of these practices, the Modeling Team simulated regeneration harvest, regeneration, pre-commercial thinning, commercial thinning, and fertilization implementation in the growth and yield projections.

Site Preparation

The BLM conducts site preparation to prepare newly harvested or inadequately stocked areas for tree planting, artificial seeding, or natural regeneration. Objectives of site preparation are to provide physical access to planting sites, fuels management, influence the plant community that redevelops on the site, and influence or control animal populations. The types of site preparation techniques are prescribed burning, mechanical, and manual methods.

Regeneration (Reforestation)

Following a regeneration harvest or wildfire, the BLM establishes tree regeneration by artificial and natural regeneration. Artificial regeneration includes tree planting and/or seeding. Natural regeneration is obtained from natural seed fall from adjacent forest stands of seed-bearing age or retention trees reserved at the time of timber harvest. Where available, the BLM may emphasize the planting of genetically improved seedlings for even-aged and two-aged systems with low levels of green-tree retention. Genetic improvements include increased growth (e.g., Douglas-fir and western hemlock) or disease resistance (e.g., sugar pine, western white pine, and Port-Orford-cedar). The BLM plants trees outside of the Harvest Land Base to supplement, or in lieu of natural regeneration to enhance development of complex stand structure.

The Modeling Team based tree lists representing the tree regeneration component of future stands following a major stand disturbing event, such as a timber harvest or wildfire on an analysis done for the 2008 RMP/EIS of the Current Vegetation Survey (CVS) plots in the then 5- to 20-year-old age classes (USDI BLM 2008). The Modeling Team stratified plots by species group and site class where possible. The Modeling Team assumed that future young reforested stand species composition would be similar to that of current young stands.

The ORGANON model lacks a “regeneration component” to generate small seedlings (< 4.5 feet tall) that simulates a reforestation action. However, an “ingrowth” function in the model permits the insertion of a regeneration tree list into a simulation when trees are larger than the minimum. For modeling purposes, the Modeling Team developed tree lists of species mix and size range appropriate to the various modeling groups from the database described above for the 2008 RMP/EIS. The Modeling Team considers that these same lists are still appropriate for use in this analysis. The Modeling Team simulated a reforestation event by introducing one of these tree lists with the ORGANON ingrowth function, 15 to 35 years after a regeneration harvest or wildfire in the modeling sequence. The wide range in timing reflects varying assumptions of the alternatives on the level of residual live overstory present following harvest or wildfire, site productivity differences, lag time for natural regeneration, administrative delays in salvage harvest situations, and intensity of stand maintenance actions.

Regeneration for the Low Intensity Timber Area (LITA) and the Moderate Intensity Timber Area (MITA) of Alternative B were special cases. Management direction for the LITA would allow only natural regeneration for reforestation purposes. Management direction for the MITA would require delayed reforestation to maintain open stand conditions (≤ 30 percent tree canopy cover) for thirty years after a regeneration harvest. The Modeling Team could not readily develop assumptions on reforestation success using natural regeneration from existing BLM data, so the Modeling Team used region-wide data instead.

Reliance on natural regeneration following regeneration harvests on BLM-administered lands in western Oregon was common until about 1960. Around 1960, the BLM shifted to a paradigm of prompt reforestation by artificial seeding and tree planting. The BLM reforestation records from the earlier era of natural regeneration emphasis are spotty. However, pre-1960 regional studies and reports are available for approximating potential levels of natural regeneration success. Data in the pre-1960 literature on post-harvest natural regeneration (Isaac 1943, Lavender *et al.* 1956, USDA FS 1958) characterizes reforestation success in categories, which correspond closely to BLM stocking groupings of target (260 trees per acre), minimum/understocked (100 trees per acre), and non-stocked (0 trees per acre). The Modeling Team assumed that reforestation outcomes in the LITA in Alternative B would approximate proportions of 60 percent of harvested acres would achieve target stocking, 30 percent minimum/understocked, and 10 percent non-stocked. After regeneration harvest, the Modeling Team apportioned acres harvested as stated above and simulated further stand development. The Modeling Team doubled the lag time before inserting a regeneration tree list into the ORGANON growth simulations for natural regeneration, compared to prompt planting. This doubled lag time represented an extended seed-in period.

In the MITA in Alternative B, the Modeling Team assumed target stocking levels for all acres harvested but doubled the lag time before inserting a regeneration tree list in the growth simulations.

Newer literature on natural regeneration following wildfire was considered for evaluating reforestation success, but was rejected for this analysis. The reason is that un-salvaged wildfire stands, by virtue of fire effects and the generally high number of residual dead standing trees, create different microclimate conditions for natural regeneration than a harvested area.

Stand Maintenance and Protection

The BLM conducts stand maintenance and protection treatments after planting or seeding to promote the survival and establishment of trees and other vegetation by reducing competition from undesired plant species. Maintenance and protection techniques include mulching, cutting, or pulling of unwanted vegetation species, placing plastic tubes/netting over seedlings to protect from animal damage, and animal trapping.

The effects of past maintenance and protection treatments are reflected in the current condition of existing young forest stands. The Modeling Team assumed in the simulation of future regenerated stands that the same types and level of treatments would occur as in the current young existing stands that were used to derive the initial regeneration tree lists. Herbicides for stand maintenance were not available to the BLM during the time in which the current young stands developed, and the Modeling Team did not model herbicide use for stand maintenance in any of the action alternatives. Therefore, the initial conditions of the future tree lists derived from current stands attributes should exhibit the effects of non-herbicide stand maintenance treatment methods only.

Pre-commercial Thinning

The BLM conducts pre-commercial thinning to reduce the densities of tree and shrubs, manipulate species composition, and promote dominance and growth of selected species. The BLM usually implements treatments during the mid-range of the stand establishment structural stage. For modeling purposes, the Modeling Team assumed pre-commercial thinning would occur at the time a regeneration tree list is inserted into the ORGANON simulation. Pre-commercial thinning enhances the growth and vigor of the residual trees by reducing inter-tree and shrub competition. The average number of trees remaining following treatment can vary by land use allocation and modeling group.

Commercial Thinning

Commercial thinnings are intermediate harvests implemented to recover anticipated mortality; control stand density for maintenance of stand vigor, provide revenue, and to alter or maintain stands on developmental paths so that desired stand characteristics result in the future. The BLM schedules commercial thinnings when stands reach a combination of relative density stem diameter and timber volume to permit an economical harvest entry.

The Modeling Team used the same basic silvicultural prescriptions developed for the 2008 RMP/EIS for all silvicultural systems (USDI BLM 2008). The BLM formulated these prescriptions from iterative ORGANON simulations with four evaluation criteria:

1. Stand relative density (Curtis 1982)
2. Attainment of minimum average stand diameter
3. Minimum harvest volumes
4. Residual canopy cover (Late-Successional Reserves and Riparian Reserves only)

The Modeling Team based relative density (RD) thresholds on published recommendations, including Curtis and Marshall (1986), Hayes *et al.* (1997), Chan *et al.* (2006), and professional judgment. The Modeling Team scheduled thinning when relative density met or exceeded a minimum of 45-55, depending on the land use allocation objectives.

The Modeling Team based minimum diameter and volume thresholds for economically viable thinning sales on historical BLM timber sales experience. The Modeling Team assumed the minimum diameter to be 12 inches, measured at breast height, and minimum volume thresholds of 8,000 board feet per acre on the Salem, Eugene, Coos Bay, and Roseburg Districts, and 5,000 board feet per acre on the Medford District and the Klamath Falls Field Office.

Relative density rules can vary by land use allocation within alternatives. For example, the Modeling Team modeled commercial thinning prescriptions for land use allocations with higher timber production emphasis goals Northern General Forest Management Area (No Action alternative), High Intensity Timber Area (Alternatives A and C), and Moderate Intensity Timber Area (Alternatives B and D) to maintain relative densities between approximately 35 and 55. The Modeling Team designed the timing and degree of the final thinning so that relative density would recover to a minimum of 55 at the long-term rotation age. The Modeling Team modeled thinnings for late-successional habitat development objectives within a lower range of relative density thresholds - 25 to 50.

Commercial thinnings promote the establishment of conifer regeneration in the understory of thinned stands (Bailey and Tappeiner 1998). The Modeling Team simulated the recruitment of this regeneration in the growth simulations to reflect expected stand dynamics following commercial thinning harvests. The ORGANON growth and yield model (Hann 2011) does not recognize trees with diameters less than 4.5 feet at breast height. Therefore, the Modeling Team developed regeneration tree lists using existing CVS data and growth relationships from current published and unpublished studies. The Modeling Team added regeneration trees to ORGANON simulations 20 to 25 years after any commercial thinning. The time lag represents the estimated time for all trees in the regeneration tree list to reach a minimum height of at least 4.5 feet.

Fertilization

Stand growth in western Oregon is often limited by the supply of available nutrients, particularly nitrogen. The supply of soil nutrients can be augmented through fertilization (Miller *et al*. 1988). The Modeling Team modeled fertilization assuming the application of 200 pounds of fertilizer in the form of urea-based prill (46 percent available nitrogen). Occasionally, fertilizer may be applied in a liquid urea-ammonia form or with a mixture of other nutrient elements in addition to nitrogen. The Modeling Team simulated fertilization in the Harvest Land Base after a thinning action in stands that would be managed with even-aged or two-aged with low green tree retention, contain 80 percent or more Douglas-fir by basal area, and have a total stand age less than or equal to 70 years old.

Pruning

The objectives for pruning are the improvement of wood quality, disease mitigation (e.g., white pine blister rust), and fuels management. Pruning for wood quality usually removes the live and dead limbs on selected trees up to height of about 18 feet. The BLM generally implements pruning treatments as a two-phase process or "lifts" between stand ages of approximately 15-40 years-old. Timing varies by site productivity (i.e., treatments occur earlier on stands of higher site productivity). Removal of up to one-third to one-half of the live tree crown at each lift would not substantially affect diameter growth at breast height or height growth (Staebler 1963, Stein 1955, BCMOF 1995). Because the BLM would typically implement pruning treatments within this range and therefore would not have a substantial effect on tree growth, the Modeling Team did not simulate pruning in ORGANON.

Stand Modeling Process

The prediction of forest stand development requires the projection of growth of BLM's existing forest stand types into the future, with and without further silvicultural treatments, and the simulation of stands, which represent future stands (i.e., new stands created following future timber harvest or natural disturbance). Depending on the management direction of the alternatives, both existing and future stands may be subject to different intensities of silvicultural treatments.The Modeling Team used two linked computer models, ORGANON and YTGTools, to project the growth and development of forest stands under various silvicultural systems.

ORGANON Model Description

ORGANON is an individual-tree, distance-independent model developed by Oregon State University from data collected in western Oregon forest stands (Hann 2011). The architecture of the model makes it applicable for simulations of traditional and non-traditional silviculture (Hann 1998). Three variants of ORGANON are available for use in western Oregon. The Modeling Team used the northwest Oregon variant (NWO-ORGANON) to project the growth of forest stands located on the Salem, Eugene, Coos Bay and Roseburg (partial) Districts. The basic data underpinning of this variant of the model is from predominantly conifer forest stands with ages ranging from about 10 to 120-years-old breast height age (Hann 2011). The Modeling Team used the southwest Oregon variant (SWO-ORGANON) to project forest stand growth on the Medford and Roseburg (partial) Districts, and the Klamath Falls Field Office. The original basic data underpinning this variant of the model is from mixed-conifer forest stands with ages of the dominant trees ranging from about 13 to 138-years-old breast height age (Ritchie and Hann 1985). Subsequently, additional new data has extended the applicability of the model to stands with older trees, higher proportions of hardwoods, and more complex spatial structure (Hann and Hanus 2001).

Simulations of stand growth of the 2008 RMP silvicultural prescriptions extend beyond the ORGANON model's range of data for both variants. However, the timing of harvests and other silvicultural treatments generally occur within the range of the model's validated height growth projection and volume prediction capabilities. Height growth is the primary driving function in ORGANON (Ritchie 1999). Hann (1998) found that the SWO-ORGANON height growth equations can be extended to up to 245 years without loss of accuracy or precision.

The standard ORGANON configuration is not conducive to the efficient processing of large numbers of individual tree lists representing forest stands within a stratum. It is not configured to merge multiple simulation results to into average timber yield functions. In addition, the standard model does not produce specific stand structural characteristics that have utility for effects analysis on resources other than timber production, or for the incorporation of factors to simulate growth improvement of trees due to genetic improvement programs. To overcome these shortcomings, the Modeling Team linked ORGANON with the YTGTools computer program.

YTGTools

YTG Tools is a proprietary computer software program designed to create and analyze yield tables in conjunction with a growth and yield simulation model that flow into the Woodstock harvest scheduling model. MBG designed YTGTools to automate the process of simulating large amounts of management regime projections for many stand conditions and to facilitate analyzing and reporting attributes of the resulting yield tables. The Modeling Team used YTGTools in conjunction with a growth and yield model to project future timber yields and stand attributes under the various management regimes applied to different forest inventory strata (Mason, Bruce & Girard, Inc. 2006).

Existing Stands Modeling Description

The land base consists of existing forest stands that are the result of past harvests and natural disturbances, of various ages, structures, past management histories and potential for forest management. The Modeling Team stratified tree lists from CVS inventory subplots into modeling groups as described previously in this appendix. Using ORGANON and YTGTools, the Modeling Team used these modeling groups for depicting current stand condition and simulating future development with and without future silvicultural treatments. The Modeling Team applied the same base silvicultural prescription to each subplot within a modeling group.

Future Stands Modeling Description

The Modeling Team developed modeling groups and tree lists for forest stand types or silvicultural prescriptions for which little or no specific CVS data existed using tree lists developed for the 2008 RMP/EIS (USDI BLM 2008). Stand projections of "future" stands formed the basis for initiating new stands following regeneration harvests in all alternatives. The future stands category includes "existing" stand types created because of regeneration harvest prescriptions with green-tree retention under the current RMPs, which is due to the low number of CVS subplots representing this condition. The Modeling Team applied the same base silvicultural prescription to each subplot within a modeling group.

Special Case – Swiss Needle Cast Zone (Salem District)

For all alternatives, the Modeling Team developed a special subset of yield tables for modeling future stands within geographic areas currently identified with a high incidence of Swiss needle cast disease on the Salem District. The Modeling Team based future tree list species composition in the Swiss needle cast zone on an assumption of higher proportions of disease-resistant species (e.g., cedar and hemlock) being used for the reforestation of future harvested areas.

Special Case – Wildfire Modeling (All Districts)

For all alternatives, the Modeling Team modeled future wildfire occurrence and severity (see Appendix D – Modeling Large Stochastic Wildfires and Fire Severity within the Range of the Northern Spotted Owl). For growth and yield projections, the Modeling Team modeled two fire severity regimes: high and moderate. The Modeling Team did not model a low-severity regime, because the stand disturbance would not affect stand structural development enough to merit separate modeling. The Modeling Team assumed 90 percent tree mortality in the high-severity fire regime and 50 percent tree mortality in the moderate-severity fire regime. The Modeling Team modeled salvage of live and dead trees following both high-severity and moderate-severity fires in those alternatives that would allow salvage, subject to management direction for green-tree, snag, and down wood retention.

The Modeling Team determined through preliminary analysis that most modeled stands that would experience high-severity fire and salvage would strongly resembled two-aged regeneration harvest stands in terms of post-burn structural characteristics. In an effort to reduce the unwieldy number of yield tables in the Woodstock growth model, the Modeling Team used the existing two-aged overstory tree lists in modeling for land use allocations with green-tree retention requirements in conjunction with their corresponding regeneration tree list. The Modeling Team modeled salvaged stands in the High Intensity

Timber Area as clearcut harvests. The Modeling Team modeled stands that would experience moderate-intensity fire but would not be salvaged as thinning harvests and assumed tree regeneration ingrowth similar to that described under the commercial thinning section.

Types of Growth and Yield Tables

The ORGANON simulations produced two types of tables or curves for further use by the Woodstock model: simple and composite tables.

Simple Growth and Yield Tables

Simple tables are produced from simulations representing a single sequence of silvicultural actions applied to an entire forest stand within a land use allocation. In other words, the entire area of the stand receives the same prescribed treatment at the same time. Simple tables were produced for all land use allocations with the exception of those where an uneven-aged management system was used.

Composite Growth and Yield Tables

Uneven-aged management treatments required the construction of composite growth and yield tables. Simulating uneven-aged management requires subdividing the stand into four or five separate components, depending on the land use allocation. The Modeling Team simulated growth in each of these stand components separately in ORGANON. The components have the same starting condition, but diverge over time due to the difference in the timing of harvest treatments applied to each one independently. The Modeling Team created two separate varieties of uneven-aged management.

The first variety of uneven-aged management emphasizes the development of fire resilient stands structures over time. The Modeling Team modeled this variety in the Uneven-aged Timber Area (UTA) land use allocation. For modeling purposes, the Modeling Team divided stands into four separate components. The Modeling Team modeled three stand components, each comprising 30 percent of the stand area, to be available for harvest at repeating intervals. The Modeling Team modeled a forth stand component, comprising 10 percent of the stand area, which would be reserved from future treatments.

The second variety of uneven-aged management primarily emphasizes the development and maintenance of northern spotted owl habitat. The Modeling Team modeled this variety in the Owl Habitat-Timber Area (OHTA) and Late-Successional Reserve - dry land use allocations. For modeling purposes, the Modeling Team divided stands into five separate components. The Modeling Team modeled four stand components, each comprising 15 percent of the stand area, to be available for harvest at repeating intervals. The Modeling Team modeled a fifth stand component, comprising 40 percent of the stand area, which would be reserved from future treatments.

The Modeling Team modeled the application of a combination of group selection (patch cut) harvests and thinning to various stand components at intervals of 40 to 50 years, depending on site productivity.

The Modeling Team created composite uneven-aged stand tables by combining the source stand tables in the proportions appropriate for each individual component's simulation. The Modeling Team created a single composite stand table with YTGTools that describes an "average" condition across the stand. For some table attributes, such as trees per acre and timber volume, the combined data equals the weighted average of the components. Other outputs, such as canopy layers and conifer canopy cover, are a function of some stand parameters, and the calculation for the combined table does not equal the weighted average of the components.

Within both varieties of uneven-aged management, there are two kinds of silvicultural pathways. All eligible strata have a silvicultural prescription that begins with a group selection harvest if the initial relative density is too low to trigger a commercial thinning or the stand exceeds 80-90 years old. Strata less than 80-90-years-old have a regime that starts with a commercial thinning if the initial relative density is high enough to trigger a thinning treatment and then is followed by group selection harvests. **Table C-13** shows stand component allocations for each land use allocation.

Table C-13. Uneven-aged management modeling strategies.

Stand Component #	Land Use Allocation					
	Owl Habitat Timber Area (OHTA)[1]			Uneven-aged Timber Area (UTA)		
	% of Stand	Option A	Option B	% of Stand	Option A	Option B
1	40%	Grow only	Grow only	10%	Grow only	Grow only
2	15%	1st GS	CT then 1st GS	30%	1st GS	CT then 1st GS
3	15%	2nd GS	CT then 2nd GS	30%	2nd GS	CT then 2nd GS
4	15%	3rd GS	CT then 3rd GS	30%	3rd GS	CT then 3rd GS
5	15%	4th GS	CT then 4th GS	NA	NA	NA

GS = Group selection (patch cut) harvest
CT = Commercial thinning harvest
[1] Also Late-Successional Reserve -dry

Growth and Yield Adjustments

The Modeling Team adjusted ORGANON projections of timber yields to account for the effects of genetic tree improvement and Swiss needle cast disease through direct inputs of growth modifiers to the ORGANON model. The Modeling Team accounted for other factors that could substantially affect recoverable commodity volumes as a percent reduction in volume. The Modeling Team applied reduction factors in the YTGTools program for timber defect and breakage, endemic insects and disease, soil compaction, future snag creation, future coarse woody debris creation, and green tree retention.

Tree Improvement (Genetics)

The BLM has selected Douglas-fir and western hemlock for genetically controlled characteristics such as high growth rates and tree form. The BLM, in cooperation with other landowners, has established field test sites using progeny from the selected trees. The BLM has established seed orchards to produce locally adapted seed from these selected trees for reforestation. The Modeling Team accounted for the increase in growth and yield from the planting of genetically improved Douglas-fir seedlings by the use of the regeneration tree lists and ORGANON growth modifiers of 7 percent for height growth and 8 percent for diameter growth. The Modeling Team used the tree lists to simulate tree planting following a regeneration harvest. After insertion of a tree list into a growth simulation, the growth modifiers act to increase the growth of Douglas-fir trees in the tree list (USDI BLM 2008). The Modeling Team applied these growth modifiers only to Douglas-fir trees within the General Forest Management Area (No Action alternative), High Intensity Timber Area (Alternatives A and C), and the Moderate Intensity Timber Area (Alternative D).

Defect and Breakage

A proportion of harvested trees can contain defects, which reduce their utility from a commodity standpoint. In addition, damage can occur during harvesting that reduces recoverable timber volume. The proportion of volume which is not recoverable for commodity use increases with stand age. The Modeling Team reduced ORGANON-generated timber volumes by district-specific factors derived from historical timber sale cruise and scale data. **Table C-14** shows the district-specific deductions for defect and breakage applicable to all alternatives.

Table C-14. Defect and breakage deductions.

Stand Age (Years)	District/Field Office					
	Coos Bay	Eugene	Klamath Falls	Medford	Roseburg	Salem
30	3%	0%	0%	0%	5%	4%
40	3%	5%	1%	1%	5%	5%
50	4%	5%	2%	2%	5%	5%
60	4%	5%	2%	2%	5%	5%
70	4%	6%	3%	3%	5%	6%
80	5%	6%	4%	4%	5%	6%
90	5%	7%	5%	5%	5%	7%
100	6%	8%	6%	6%	6%	8%
110	6%	9%	7%	7%	7%	9%
120	7%	10%	8%	8%	8%	10%
130	7%	11%	9%	9%	9%	11%
140	7%	12%	9%	9%	9%	12%
150	8%	13%	9%	9%	9%	13%
160	9%	14%	10%	10%	10%	14%
170	9%	15%	11%	11%	11%	15%
180	10%	16%	12%	12%	12%	16%
190	12%	17%	13%	13%	13%	17%
>200	17%	23%	20%	20%	20%	23%

Soil Compaction

The Modeling Team calculated district-specific deductions for soil compaction based on assumptions of the proportion of harvest types and associated area lost to new road construction. The Modeling Team modeled the same percentage reductions in all alternatives. **Table C-15** shows the assumed proportion of harvest types and soils deduction by district.

Table C-15. District-specific deductions for soil compaction.

District/Field Office	Timber Harvest Yarding System		Total Soils Deduction
	Cable and Helicopter	Ground-Based	
Coos Bay	95%	5%	1%
Eugene	94%	6%	2%
Klamath Falls	6%	94%	9%
Medford	81%	19%	4%
Roseburg	82%	18%	3%
Salem	69%	31%	4%

Snag Retention

The Modeling Team modeled the yield impact of retaining varying amount of green trees for the creation of future snags by applying a percent volume reduction to meet the minimum snag requirements at the time of harvest. Retention requirements vary by alternative, land use allocation, and district. **Table C-16** shows the deductions applied to the action alternatives. The Modeling Team based the reduction per retained tree on analysis for the 2008 RMP/EIS for the action alternatives (USDI BLM 2008). The Modeling Team assumed a reduction for snags in the No Action alternative of one and one-half percent of the regeneration harvest volume for all districts.

Table C-16. Snag retention yield deductions applied to the action alternatives.

Alternative	Land Use Allocation	Coos Bay	Eugene	Klamath Falls	Medford	Roseburg	Salem
Alt. A	Uneven-aged Timber Area	2%	2%	2%	2%	2%	2%
	High Intensity Timber Area	-	-	-	-	-	-
	Late-Successional Reserve	2%	2%	2%	2%	2%	2%
	Riparian Reserve	2%	2%	2%	2%	2%	2%
Alt. B	Moderate Intensity Timber Area	2%	3%	2%	-	3%	2%
	Low Intensity Timber Area	2%	3%	2%	-	3%	2%
	Uneven-aged Timber Area	2%	3%	2%	-	3%	2%
	Late-Successional Reserve	10%	12%	7%	2%	10%	11%
	Riparian Reserve	10%	12%	7%	2%	10%	11%
Alt. C	Uneven-aged Timber Area	2%	2%	2%	2%	2%	2%
	High Intensity Timber Area	-	-	-	-	-	-
	Late-Successional Reserve	2%	2%	2%	2%	2%	2%
	Riparian Reserve	2%	2%	2%	2%	2%	2%
Alt. D	Moderate Intensity Timber Area	2%	3%	2%	-	3%	2%
	Uneven-aged Timber Area	2%	3%	2%	-	3%	2%
	Owl Habitat Timber Area	2%	3%	2%	-	3%	2%
	Late-Successional Reserve	10%	12%	7%	2%	10%	11%
	Riparian Reserve	10%	12%	7%	2%	10%	11%

Coarse Woody Debris Retention

The Modeling Team modeled the yield impact of retaining varying amounts for future down woody debris as a percent volume reduction at the time of harvest. Retention requirements vary by alternative, land use allocation, and district. **Table C-17** shows the deductions applied to the action alternatives. The Modeling Team based reduction per retained tree on analysis for the 2008 RMP/EIS for the action alternatives (USDI BLM 2008). The Modeling Team assumed a coarse woody debris deduction for the No Action alternative as a flat 300 cubic feet per acre for the Coos Bay, Roseburg, Medford Districts, and the Klamath Falls Field Office and 600 cubic feet per acre for the Salem and Eugene Districts.

Table C-17. Coarse woody debris yield deductions applied to the action alternatives.

Alternative	Land Use Allocation	Coos Bay	Eugene	Klamath Falls	Medford	Roseburg	Salem
Alt. A	Uneven-aged Timber Area	5%	4%	4%	5%	5%	4%
	High Intensity Timber Area	-	-	-	-	-	-
	Late-Successional Reserve	5%	4%	4%	5%	5%	4%
	Riparian Reserve	5%	4%	4%	5%	5%	4%
Alt. B	Moderate Intensity Timber Area	-	-	-	-	-	-
	Low Intensity Timber Area	-	-	-	-	-	-
	Uneven-aged Timber Area	-	-	-	-	-	-
	Late-Successional Reserve	-	-	-	-	-	-
	Riparian Reserve	-	-	-	-	-	-
Alt. C	Uneven-aged Timber Area	5%	4%	4%	5%	5%	4%
	High Intensity Timber Area	-	-	-	-	-	-
	Late-Successional Reserve	5%	4%	4%	5%	5%	4%
	Riparian Reserve	5%	4%	4%	5%	5%	4%
Alt. D	Moderate Intensity Timber Area	-	-	-	-	-	-
	Uneven-aged Timber Area	-	-	-	-	-	-
	Owl Habitat Timber Area	-	-	-	-	-	-
	Late-Successional Reserve	-	-	-	-	-	-
	Riparian Reserve	-	-	-	-	-	-

Stocking Irregularity

A stand may contain non-stocked openings of a size sufficient to affect timber yield. These openings fall into two categories: openings permanently incapable of growing commercial tree species and openings temporarily unoccupied by desirable trees.Portions of stands may contain permanent areas of non-productive rock or other areas incapable of growing commercial tree species. The Modeling Team partially accounts for these openings through reductions in the Harvest Land Base as a result of the Timber Productivity Capability Classification. Temporarily non-stocked areas occur due to variation in reforestation success from a variety of non-permanent factors, such as vegetative competition or logging slash.

The ORGANON model accounts for stocking variation by assuming that the degree of local competition experienced by a tree is reflected in its crown size. Trees growing next to openings have longer crowns and poor growth reflected as stem taper which reduces the volume of a tree next to the opening, compared to a similar size tree with shorter crown in an area with more uniform tree distribution. As long as the crown characteristics of sample trees are measured, then any long-term spatial variation within the stand will be modeled appropriately (FORsight 2006). Since existing CVS data used for existing stands and the development of future stands modeling groups contain the necessary crown measurement, the Modeling Team applied no external adjustment for stocking irregularity to ORGANON yields.

Green-tree Retention

Green-tree retention is the long-term reservation of live trees within the context of a regeneration harvest to provide for various ecological functions. Green-tree retention has two effects from a stand growth and yield standpoint. First, otherwise harvestable volume is foregone for commodity use at the time of harvest. Second, retention trees compete for growing space with the newly regenerated trees (Di Lucca *et al.* 2004). The Modeling Team modeled the first effect of retained trees on foregone harvest volume as a percent volume reduction applied to volume outputs. These yield reductions were the same ones calculated for the No Action alternative for the 2008 RMP/EIS: the retention of 7 to 16 conifers over 20 inches in diameter at an average harvest age of 100 years-old. The Modeling Team modeled the second effect within ORGANON through retention of overstory trees when a stand is regeneration harvested. The retained trees slow the growth of the new understory regeneration trees relative to the amount of retained overstory trees. The Modeling Team used modeling group-specific overstory tree lists to suppress regeneration growth and provide structural complexity.

The Modeling Team used the same overstory tree lists for the General Forest Management Area and in the No Action and the Moderate Intensity Timber Area in Alternatives B and D, and the Connectivity/Diversity Blocks in the No Action alternative and the Low Intensity Timber Area in Alternative B. **Table C-18** shows the deductions applied at the time of a regeneration harvest by land use allocation by alternative for trees reserved from harvest.

Table C-18. Green-tree retention deductions applied at the time of a regeneration harvest.

Land Use Allocation	No Action (%)	Alt. A (%)	Alt. B (%)	Alt. C (%)	Alt. D (%)
General Forest Management Area	11%	*	*	*	*
Moderate Intensity Timber Area	*	*	11%	*	11%
Connectivity/Diversity Block	18%	*	*	*	*
Low Intensity Timber Area	*	*	18%	*	*
Southern General Forest Management Area	24%	*	*	*	*
Uneven-aged Timber Area[1]	*	11%	11%	11%	11%
Owl Habitat Timber Area[1]	*	*	*	*	11%
High Intensity Timber Area[1]	*	0%	*	0%	*
Late-Successional Reserve[2]	*	11%	11%	11%	11%
Riparian Reserve	*	*	*	*	*

[1] The Modeling Team applied green-tree deductions in Uneven-aged Timber Area and Owl Habitat Timber Area to reflect edge effect competition on regeneration in group selection and retention of some green trees in the larger group selection areas.
[2] Applies to uneven-aged management in Late-Successional Reserves - dry only.

Disease

Portions of the Salem District are located in an area with a moderate to high occurrence of Swiss needle cast (SNC) disease. This disease infects Douglas-fir trees only and reduces growth rates. It does not affect the growth of other tree species. The Modeling Team used a growth modifier approach similar to that used for modeling the growth of genetically improved trees in ORGANON to reflect the estimated growth reductions for Douglas-fir in the Swiss needle cast zone. For the 2008 RMP/EIS, the BLM calculated a mean foliage retention value modifier of 2.41 for the Swiss needle cast zone. The Modeling Team considers this modifier to be adequate for modeling the impacts of Swiss Needle Cast disease for this analysis. See the 2008 RMP/EIS (USDI BLM 2008) for more details.

The Modeling Team assumed that the effects of endemic levels of insects and disease other than Swiss needle cast on timber yields are reflected in the defect and breakage allowance described previously and the additional overstory mortality factor described below. In addition to those factors, the Modeling Team assumed a further reduction by adjusting timber yields down by a percent volume reduction. These factors generally vary from about 1 to 3 percent, increasing with stand age and are based are based on literature and professional judgment.

Constraint on Maximum Stand Density Index

Maximum values of basal area observed in preliminary simulations of various strata commonly exceeded values reported in empiric yield tables for well-stocked stands at later periods in the simulations. The probable cause is that the ORGANON model may be underestimating tree mortality from causes other than inter-tree competition, such as insects, disease, windthrow, and stem breakage (Tappeiner *et al.* 1997). This type of mortality is often irregular or episodic in nature, and it is inherently difficult to predict the exact time in which it will occur (Franklin *et al*. 1987). Mortality from inter-tree competition becomes less significant as stands age, and irregular mortality caused by other factors becomes more substantial (Franklin *et al.* 2002)

Through sensitivity analysis, the Modeling Team determined that by setting the maximum stand density index (SDI) to 500 in ORGANON, the maximum basal area values were generally constrained below 400 square feet per acre. Simulation results with an SDI maximum of 500 were more in accordance with published normal and empiric yield tables at older ages (Chambers and Wilson 1978, Chambers 1980, McArdle *et al*. 1961, Schumacher 1930, Dunning and Reineke 1933).

Forest Structural Stage Classification

For this analysis, the Modeling Team classified forested land within the decision area in a five-stage structural classification:

- Early-successional
- Stand-establishment
- Young
- Mature
- Structurally-complex

The Modeling Team further sub-divided these five structural classes by additional structural divisions and by the moist/dry designation as described below.

Classification:

1. Early-successional – Moist
   Forests that are ≤ 30 years old, with <30% canopy cover.

   1.1 (ES-WSL) With structural legacies
   ≥ 6 trees per acre ≥ 20 inches diameter breast height

   1.2 (ES-WOSL) Without structural legacies
   < 6 trees per acre ≥ 20 inches diameter breast height

   Early-successional – Dry
   Forests that are ≤ 50 years old, with < 30% canopy cover.

   1.1 (ES-WSL) With structural legacies
   ≥ 6 trees per acre ≥ 20 inches diameter breast height

1.2 (ES-WOSL) Without structural legacies
< 6 trees per acre ≥ 20 inches diameter breast height

2. Stand establishment – Moist
Forests that are ≤ 30 years old, with ≥ 30% canopy cover.

2.1 (SE-WSL) With structural legacies
≥ 6 trees per acre ≥ 20 inches diameter breast height

2.2 (SE-WOSL) Without structural legacies
< 6 trees per acre ≥ 20 inches diameter breast height

Stand establishment – Dry
Forests that are ≤ 50 years old, with ≥ 30% canopy cover.

2.1 (SE-WSL) With structural legacies
≥ 6 trees per acre ≥ 20 inches diameter breast height

2.2 (SE-WOSL) Without structural legacies
< 6 trees per acre ≥ 20 inches diameter breast height

3. Young – Moist
Forests that are over 30 years old

Young – High Density
Relative density (Curtis RD)[132] ≥ 25

3.1 (YHD-WSL) With structural legacies
< 24 trees per acre ≥ 20 inches diameter breast height and the coefficient of variation of tree diameters over 10 inches[133] ≥ 0.35

3.2 (YHD-WOSL) Without structural legacies
< 24 trees per acre ≥ 20 inches diameter breast height and the coefficient of variation of tree diameters over 10 inches < 0.35

Young – Low Density
Relative density (Curtis RD) < 25

3.3 (YLD-WSL) With structural legacies
<2 4 trees per acre ≥ 20 inches diameter breast height and the coefficient of variation of tree diameters over 10 inches ≥ 0.35

3.4 (YLD-WOSL) Without structural legacies

[132] Curtis Relative Density = stand basal area/square root of the quadratic mean diameter

[133] The coefficient of variation of tree diameters over 10 inches = standard deviation of the DBH/mean diameter breast height.

< 24 trees per acre ≥ 20 inches diameter breast height and the coefficient of variation of tree diameters over 10 inches < 0.35

Young – Dry
Forests that are over 50 years old

Young – High Density
Relative density (Curtis RD) ≥ 25

3.1 (YHD-WSL) With structural legacies
< 12 trees per acre ≥ 20 inches diameter breast height and the coefficient of variation of tree diameters over 10 inches ≥ 0.35

3.2 (YHD-WOSL) Without structural legacies
< 12 trees per acre ≥ 20 inches diameter breast height and the coefficient of variation of tree diameters over 10 inches <0.35

Young – Low Density
Relative density (Curtis RD) < 25

3.3 (YLD-WSL) With structural legacies
< 12 trees per acre ≥ 20 inches diameter breast height and the coefficient of variation of tree diameters over 10 inches ≥ 0.35

3.4 (YLD-WOSL) Without structural legacies
< 12 trees per acre ≥ 20 inches diameter breast height and the coefficient of variation of tree diameters over 10 inches < 0.35

4. Mature – Moist
Forests that are over 30 years, ≥ 24 trees per acre, ≥ 20 inches diameter breast height.

4.1 (M-Single) Single-layered canopy
The coefficient of variation of tree diameters over 10 inches < 0.35

4.2 (M-Multi) Multi-layered canopy
The coefficient of variation of tree diameters over 10 inches ≥ 0.35 and < 4.7 trees per acre ≥ 40 inches diameter breast height.

Mature – Dry
Forests that are over 50 years, ≥12 trees per acre, ≥ 20 inches diameter breast height.

4.1 (M-Single) Single-layered canopy
The coefficient of variation of tree diameters over 10 inches < 0.34

4.2 (M-Multi) Multi-layered canopy
The coefficient of variation of tree diameters over 10 inches ≥ 0.34 and < 2.1 trees per acre ≥ 40 inches diameter breast height.

5. Structurally-complex

5.1 (SC-Dev)Developed Structurally-complex – Moist

Forests that are over 30 years old, ≥ 24 trees per acre that are ≥ 20 inches diameter at breast height, and ≥ 4.7 trees per acres ≥ 40 inches diameter breast height. The coefficient of variation of tree diameters over 10 inches ≥ 0.35.

Developed Structurally-complex – Dry
Forests that are over 50 years old, ≥ 12 trees per acre that are ≥ 20 inches diameter at breast height, and ≥ 2.1 trees per acres ≥ 40 inches diameter breast height. The coefficient of variation of tree diameters over 10 inches ≥ 0.34.

5.2 (SC-OF) Existing Old Forest
Stands currently ≥ 200 years old, but < 400 years old.

5.3 (SC-VOF) Existing Very Old Forest
Stands currently ≥ 400 years old

Woodstock Modeling

The Woodstock Model

The Woodstock model is at the heart of the Remsoft Spatial Planning System. Woodstock is a planning system used for decision support analyses and planning projects. It uses inventory and growth and yield data, and business rules to project forest growth and development over time, subject to management objectives and resource allocation constraints.

The Woodstock model is a linear programming model that produces optimized results using complex decision matrixes. Linear programming models are inherently different from a simulation or scenario-based model such as the OPTIONS model that the BLM used for the 2008 RMP/EIS (USDI BLM 2008). In a simulation model, the user decides what prescriptions to implement, and determines what order to implement them. In a linear programming (LP) model, the user decides what kind of outcome is desired, and the model determines the best means of accomplishing that objective.

Because there are many constraints that influence the management of BLM-administered land within the planning areas, for this project, the Woodstock model functioned as an optimization model within a tightly controlled set of limitations. The Modeling Team used the optimization function primarily within the Harvest Land Base, to maximize the amount of volume produced through the 200-year modeling period.

The Woodstock system uses spatial data (ESRI geodatabases) to provide inputs to the model and to display maps of management schedules and forest conditions. It has been in use for over 30 years and is regularly updated and improved by the Remsoft Corporation. Remsoft software is currently being used for forest management planning by all ten Canadian Provinces, six U.S. states, as well as the U.S. Army. The Washington Department of Natural Resources recently used Remsoft Spatial Planning to revise their management plans to create better northern spotted owl habitat in the long term and generate more revenue in the short-term without a significant decrease in the long-term sustainable harvest.

Woodstock Model Overview

Each Woodstock model has an objective function - the mathematical expression of what the model will optimize. The Modeling Team chose the objective function to maximize the sum of allowable sale quantity timber volume production over the full 200-year planning horizon. Within the constraints that the

Modeling Team provided in the GIS-based modeling rules and the landscape-level modeling rules, the Woodstock model produced a solution with the highest possible level of timber volume production.

While this objective function works well for the goals and objectives of the Harvest Land Base, it is not appropriate for the reserve thinning in either the Riparian Reserve or the Late-Successional Reserve. In both of these land-use allocations, the Modeling Team applied specific constraints for both acres and volume, to provide a realistic level of harvest, given the management direction of the alternative and the extensive experience the BLM has with reserve thinning. These specific constraints varied by alternative, and are presented later in this appendix.

The Woodstock model determines the timing and type of management activities needed to optimize the constrained objective function within a BLM sustained yield unit. Land management units are created in a GIS process that combines multiple layers of resource information and objectives into a single resultant layer. Examples of these resource layers include FOI units, administrative boundaries, Riparian Reserves, Late-Successional Reserves, Visual Resource Management areas, etc.

The Modeling Team built strata-based Woodstock models that respond to the modeling instructions. The Modeling Team developed Woodstock models for each BLM office and each alternative. For each alternative, the Modeling Team developed a model for a single ‘test’ district first. Once the Modeling Team checked and confirmed the test model outputs, the Modeling Team applied its essential structure to new Woodstock models for the other BLM offices. Using this methodology, the Modeling Team was able to adaptively develop modeling guidelines that represented the management direction in alternatives.

The BLM and MBG conducted extensive quality control and quality assurance on each Woodstock model. In total, the Modeling Team developed 43 final Woodstock models for the No Timber Harvest reference analysis, No Action alternative, Alternatives A, B, C, and D, and Sub-alternative B and Sub-alternative C. All of these Woodstock models had at least two iterations.

In the final step in the modeling process, the Modeling Team took the results from the strata-based models and allocated them back into the spatially explicit GIS polygons that represent the decision area. The Modeling Team used the Spatial Woodstock software for this final task. The Modeling Team then combined the results from Spatial Woodstock into Microsoft Access databases and pivot tables that the interdisciplinary team used for their analyses.

The Modeling Team used a 200-year planning horizon for the modeling runs. The Modeling Team chose this time length because it represents a long-term view for sustained yield calculations. The dataset behind the ORGANON growth and yield curves provides reasonable modeling results for this period.

Management Activities and Rules

Management Activities

Within the Woodstock model, forest management activities can occur on a stand level or landscape level. These management activities occur by either defining constraints or targets. Constraints are used to control the flow of outputs on a period by period basis. For example, even-flow of timber volume would force the model to keep a constant volume level over the planning horizon. Targets are specific goals that the model is trying to reach: for example, a specified number of Riparian Reserve acres to be harvested in a specific period. The Modeling Team defined each one of these different sets of instructions used within the model.

Stand-level silviculture treatments include planting, pre-commercial thinning, pruning, and fertilization. Stand-level harvesting activities include commercial thinning, two-age harvest, selection harvest, salvage harvest, and clearcut harvest. Each one of these activities had specific controls within the ORGANON model or modifers within the Woodstock model. The Modeling Team limited the number of potential pathways that any strata could have, as well as ‘hardwired’ certain treatments for certain strata. This was to limit the complexity of options that could be considered, in order to efficiently utilize the model resources and have the models run more quickly. For example, the BLM always included pre-commercial thinning in some strata and limited most thinning to stands less than 80 years old in the moist forest. The part of this appendix on Growth and Yield Modeling provides more detail on this topic.

Landscape-level constraints applied to all of the polygons within a particular region. For example, in the No Action alternative, the Modeling Team placed a constraint on each fifth-field watershed to not harvest any older forest until at least 15% of the watershed was composed of older forest to reflect management direction in the 1995 RMPs.

The model would not apply specific silvicultural treatments unless all eligibility criteria were met for that treatment.

GIS-based Modeling Rules

This section will describe, by topic area, the modeling rules and GIS data as applied by the Modeling Team to simulate the alternatives within the Woodstock model. The Woodstock model uses attributes associated with the GIS spatial data to identify where the modeling rules are applied.

The Modeling Team applied the following modeling rules to all alternatives:

- **Sustained Yield Units -** The Modeling Team divided the decision area into sustained yield units for the purpose of defining the area in which the model would determine the allowable sale quantity. The Sustained Yield Units are the BLM-administered lands within the district boundaries for the Salem, Eugene, Roseburg, Coos Bay, and Medford Districts, and the western portion of the Klamath Falls Field Office (all land west of Highway 97) within the Lakeview District. The eastern portion of the Klamath Falls Field Office does not contain any O&C lands, and is not a designated sustained yield unit. The Modeling Team used the district attribute in the FOI data as the basis for the sustained yield units in the Woodstock modeling. The Modeling Team used land use allocation data to segregate the Klamath Falls Field Office into the Klamath Falls Sustained Yield Unit and the Eastside Management Lands. The Modeling Team did provide an estimate of the sustainable harvest level for the Eastside Management Lands as part of this analysis.
- **Minimum Commercial Thinning Volumes -** The Modeling Team derived the minimum commercial thinning volumes from historical BLM data for economically viable timber sales. The definition of minimum commercial thinning volumes for a harvest removal varied by ORGANON variant:
  - Northwest ORGANON variant: Salem, Eugene, north Roseburg, north Coos Bay – 8 Mbf gross volume
  - Southwest ORGANON variant: Medford, K-Falls, southern Roseburg and southern Coos Bay – 5 Mbf gross volume
- **Structural Stage Calculations –** the Forest Structural Stage Classification section earlier in this appendix describes the structural stage calculations for moist and dry forests.
- **Swiss Needle Cast (SNC) –** The Modeling Team used specific SNC yield tables and harvest yield tables in the Swiss Needle Cast zone, which are described in Forest Growth and Yield section earlier in this appendix.

- **Timing of Reporting Actions –** The model reported all actions in the period that they would occur. For example, if a thinning would occurs in period 2, the harvest acres and volumes would be reported for period 2 after harvest.
- **Wildfire Modeling -** Appendix D – Modeling Large Stochastic Wildfires and Fire Severity within the Range of the Northern Spotted Owl describes how the BLM modeled wildfire. The location and intensity of the modeled wildfire did not vary among alternatives, but the specific silvicultural prescriptions modeled in each alternative did change in the wildfire areas. The Forest Growth and Yield section earlier in this appendix provides more information on wildfire modeling.
- **Riparian Reserve Thinning -** For all of the action alternatives, the BLM divided the Riparian Reserves into inner zones and outer zones. The Modeling Team did not model timber harvest in the inner zone, and did model harvest in the outer zone in both moist and dry forests consistent with alternative-specific management direction. The Modeling Team modeled harvest in Riparian Reserves as commercial thinning and included stands from 30-80 years old. The number of acres harvested and the volume removed varied by district and alternative. In Alternative A, the harvest in the outer zone of moist Riparian Reserves did not produce any non-ASQ volume, consistent with Alternative A management direction.

Modeling Directions Specific to the No Action Alternative

Connectivity/Diversity Blocks

The Modeling Team aggregated Connectivity/Diversity blocks based on BLM field office boundaries. The Modeling Team did not model regeneration harvest unless at least 25 percent of the forest acres in the block were in stands age 80 years or older. For each block, a maximum of 1/15 of the acres could be in age zero (regenerated) in any one decade of the projection to simulate the area control requirement.

15 Percent Standard and Guideline

Within each fifth-field watershed, the Modeling Team did not model regeneration harvest until at least 15 percent of the forested area was in stands 80 years and older. In those watersheds that were in deficit, the Modeling Team earmarked the oldest stands for recruitment to meet the 15 percent target. Until the watershed reached the 15 percent level, the Modeling Team modeled only commercial thinning.

Minimum Harvest Age

The Modeling Team did not model regeneration harvest in stands below the minimum harvest ages described in **Table C-19**. The northern districts include the Salem, Eugene, and Coos Bay Districts, and the southern districts include the Roseburg and Medford Districts and the Klamath Falls Field Office. The Modeling Team set these minimum ages by site productivity class 1 through 5, as shown in the following table.

Table C-19. Minimum harvest age by site productivity class for the No Action alternative.

Location	Site Prod. 5	Site Prod. 4	Site Prod. 3	Site Prod. 2	Site Prod. 1
Northern Districts	110	100	90	90	80
Southern Districts	150	120	110	110	100

Coos Bay – Projection of Future Marbled Murrelet Sites

The Modeling Team modeled all existing stands 120 years and older within approximately 4 townships of the coast as no harvest to simulate future occupied marbled murrelet sites.

Bald Eagle Management Sites (BEMA)

The Modeling Team modeled Bald Eagle Management Areas as available for commercial thinning only in stands less than 80 years old.

Salem Adaptive Management Area (AMA)

The Modeling Team modeled the Salem Adaptive Management Area with commercial thinning in stands less than 110 years old and no regeneration harvest.

Reserve Northern Spotted Owl Pair Areas

The Modeling Team modeled no harvest in the northern spotted owl habitat classified as suitable and next best dispersal categories within the reserve pair areas in the Salem District. The Modeling Team modeled no regeneration harvest in the northern spotted owl habitat classified as non-suitable dispersal, and non-habitat within the reserve pair areas in the Salem District.

Salvage Harvesting

The Modeling Team modeled salvage harvest in the Harvest Land Base after high, moderate or multiple, high severity burns. The harvest occurred in the same decade as the burn and contributed to the ASQ.

Modeling Directions Specific to Alternative A

Riparian Reserve

The Modeling Team modeled harvest in the outer zone differently in the moist and the dry forest. In the moist forest, harvest in the outer zone did not contribute to either ASQ or non-ASQ timber volume. In the dry forest, harvest did contribute to non-ASQ timber volume. The Modeling Team modeled thinning up to age 80 in both the moist and dry forest. The Modeling Team assumed that fifteen percent of the outer zone acreage would be eligible for thinning, and assumed a maximum volume harvested of 10 Mbf/acre.

Late-Successional Reserve

The Late-Successional Reserve consists of five different components: large block reserves-moist, large block reserves-dry; older forest reserves, occupied marbled murrelet sites, and existing red-tree vole sites in the North Coast DPS. The Modeling Team modeled harvest only in the large block reserves, with different harvest treatments in the moist and the dry forests. In the dry forests, the harvest counted towards non-ASQ volume. The Modeling Team assumed no age limit on harvest in the dry forest. In the moist forest, the harvest did not count towards non-ASQ volume (assuming that cut trees would not be removed). The Modeling Team assumed that non-commercial thinning would occur up to age 80 in the moist forest.The Modeling Team assumed that older forest reserves, the occupied marbled murrelet sites, and the existing red tree vole sites would not have any harvest.

Table C-20 shows the volume and acre constraints in the Late-Successional Reserve and Riparian Reserve for Alternative A. The constraints were different for northern and southern districts within the Late-Successional Reserve and different for moist and dry forests. The target percentage of eligible treatment acres was met over the entire modeling period (20 decades) with the following exception: for Late-Successional Reserve - dry, the target was met in the first five modeling periods (decades) in the Medford District and Klamath Falls Field Office, and in the first four modeling periods in the Roseburg District.

Table C-20. Reserve harvesting constraints for Alternative A.

Land Use Allocation (Region)	Maximum Average Mbf/Acre	% of Eligible Acres Treated
Riparian Reserve		
Northern District[1]	10	15
Southern District[2]	10	15
Late-Successional Reserve		
Northern District[1] Moist	10	15
Northern District[1] Dry	N/A	N/A
Southern District[2] Moist	10	15
Southern District[2,3] Dry	15	50

[1] Salem, Eugene, Coos Bay
[2] Roseburg, Medford, Klamath Falls
[3] Dry LSR has 2 constraints. The first is that the maximum volume for the first 5 decades was 15 Mbf, after 5 decades it can be higher. The second is that on Roseburg 50% of the eligible acres was treated during the first 4 decades, in Medford/Klamath Falls 50% of the eligible acres were treated in the first 5 decades.

Harvest Land Base

The Harvest Land Base consists of two components, the Uneven-aged Timber Area (UTA) and the High Intensity Timber Area (HITA). All harvest in the Harvest Land Base would contribute to the ASQ. The Modeling Team modeled that all acres in UTA would be harvested within the first eight modeling periods (decades).

The Modeling Team modeled timber harvest on the Harvest Land Base using a combination of non-declining and even flow constraints. The Modeling Team modeled the HITA using an even-flow constraint, in which timber harvest from this allocation does not vary from decade to decade. The Modeling Team modeled the UTA using an even-flow constraint where it composed 10 percent or less of the Harvest Land Base by sustained yield unit area. Where the UTA composed greater than 10 percent of the Harvest Land Base by sustained yield unit area, the Modeling Team used only a non-declining flow constraint. Non-declining flow constraints allow timber harvest to increase but not decrease from decade to decade. Where the Modeling Team used a non-declining flow constraint, the Modeling Team forced the timber harvest to also meet an even-flow constraint for the first four decades.

The Modeling Team applied a minimum regeneration harvest age of 50 years in the HITA.

In the HITA, the Modeling Team set a target of applying regeneration harvest on 8 to 17 percent of acres in the HITA per decade. Because of this goal, the average rotation ages trended between 60-120 years.

The Modeling Team modeled salvage harvesting occurred in the Harvest Land Base after high, moderate, or multiple, high-severity burns. The harvest occurred in the same decade as the burn and contributed to the ASQ.

Modeling Direction Specific to Alternative B

Scenarios

The Modeling Team modeled Alternative B and Sub-alternative B as two scenarios because of their overall similar design. Scenario 1 corresponds to Sub-alternative B, in which all known and historic northern spotted owl sites are included in the Late-Successional Reserve. Scenario 2 corresponds to Alternative B, in which some known and historic northern spotted owl sites are included in the Harvest Land Base.

Riparian Reserve

The Modeling Team assumed that 50 percent of the outer zone would be eligible for thinning in both the moist and dry forest, and assumed a maximum volume harvested of 20 Mbf/acre in the northern districts and 15 Mbf/acre in the southern districts.

Late-Successional Reserve

The Modeling Team modeled no harvest activities in the older forest Reserve, occupied marbled murrelet sites, occupied red tree vole sites, or within known or historic northern spotted owl sites. In the large block reserves, the Modeling Team assumed that 50 percent of the Late-Successional Reserve - moist that is less than or equal to 80 years old would be available for thinning, and that 50 percent of the Late-Successional Reserve –dry would be available for uneven-aged management regardless of age. The Modeling Team assumed a maximum volume harvested of harvested of 20 Mbf/acre in the northern districts and 15 Mbf/acre in the southern districts.

The Modeling Team modeled the Late-Successional Reserve - dry with two specific constraints. The Modeling Team assumed a maximum volume harvest of 15 Mbf for the first 5 decades, after which it could increase. Second, the Modeling Team assumed that 50 percent of the eligible acres in the Roseburg District would treated during the first four decades, and that 50 percent of the eligible acres in the Medford District and Klamath Falls Field Office would be treated in the first five decades.

Harvest Land Base

The Harvest Land Base consists of three components: the Uneven-aged Timber Area (UTA), the Moderate Intensity Timber Area (MITA), and the Low Intensity Timber Area (LITA), each with different silvicultural prescriptions. The Modeling Team modeled regeneration harvest to occur on 8 to 17 percent of the area in the MITA in each decade. The Modeling Team modeled regeneration harvest to occur on 6 to 10 percent of the area in the LITA in each decade.

The Modeling Team modeled timber harvest on the Harvest Land Base using a combination of non-declining and even flow constraints. The Modeling Team modeled the LITA and MITA using an even-flow constraint, in which timber harvest from this allocation does not vary from decade to decade. The Modeling Team modeled the UTA using an even-flow constraint where it composed 10 percent or less of the Harvest Land Base by sustained yield unit area. Where the UTA composed greater than 10 percent of the Harvest Land Base by sustained yield unit area, the Modeling Team used only a non-declining flow constraint. Non-declining flow constraints allow timber harvest to increase but not decrease from decade to decade. Where the Modeling Team used a non-declining flow constraint, the Modeling Team forced the timber harvest to also meet an even-flow constraint for the first four decades.

The Modeling Team used the minimum harvest age constraints in the model shown in **Table C-21**. These constraints allowed the BLM to transition a relatively young land base to long rotations without excessively reducing the acreage available for short-term harvesting.

Table C-21. Minimum harvest age by ten-year Woodstock period.

Area (Intensity Type)	Periods 1 through 7	Periods 8 through 20
Northern Districts[1]		
Moderate Intensity Timber Area	50	90
Low Intensity Timber Area	50	110
Southern Districts[2]		
Moderate Intensity Timber Area	50	120
Low Intensity Timber Area	50	140

1 Salem, Eugene, Coos Bay
2 Roseburg, Medford, Klamath Falls

The Modeling Team modeled salvage harvesting occurred in the Harvest Land Base after high, moderate, or multiple, high-severity burns. The harvest occurred in the same decade as the burn and contributed to the ASQ.

Modeling Direction Specific to Alternative C

Riparian Reserve

The Modeling Team assumed that 50 percent of the outer zone would be eligible for thinning in both the moist and dry forest, and assumed a maximum volume harvested of 20 Mbf/acre in the northern districts and 15 Mbf/acre in the southern districts.

Late-Successional Reserve

The Modeling Team modeled no harvest activities in the older forest Reserve, occupied marbled murrelet sites, occupied red tree vole sites. In the large block reserves, the Modeling Team assumed that 50 percent of the Late-Successional Reserve - moist that is less than or equal to 80 years old would be available for thinning, and that 50 percent of the Late-Successional Reserve –dry would be available for uneven-aged management regardless of age. The Modeling Team assumed a maximum volume harvested of harvested of 20 Mbf/acre in the northern districts and 15 Mbf/acre in the southern districts.

The Modeling Team modeled the Late-Successional Reserve - dry with two specific constraints. The Modeling Team assumed a maximum volume harvest of 15 Mbf for the first 5 decades, after which it could increase. Second, the Modeling Team assumed that 50 percent of the eligible acres in the Roseburg District would treated during the first four decades, and that 50 percent of the eligible acres in the Medford District and Klamath Falls Field Office would be treated in the first five decades.

Harvest Land Base

The Harvest Land Base consists of two components, the Uneven-aged Timber Area (UTA) and the High Intensity Timber Area (HITA). All harvest in the Harvest Land Base would contribute to the ASQ. The Modeling Team modeled that all acres in UTA would be harvested within the first eight modeling periods (decades).

The Modeling Team modeled timber harvest on the Harvest Land Base using a combination of non-declining and even flow constraints. The Modeling Team modeled the HITA using an even-flow constraint, in which timber harvest from this allocation does not vary from decade to decade. The Modeling Team modeled the UTA using an even-flow constraint where it composed 10 percent or less of the Harvest Land Base by sustained yield unit area. Where the UTA composed greater than 10 percent of the Harvest Land Base by sustained yield unit area, the Modeling Team used only a non-declining flow constraint. Non-declining flow constraints allow timber harvest to increase but not decrease from decade to decade. Where the Modeling Team used a non-declining flow constraint, the Modeling Team forced the timber harvest to also meet an even-flow constraint for the first four decades.

The Modeling Team applied a minimum regeneration harvest age of 50 years in the HITA.

In the HITA, the Modeling Team set a target of applying regeneration harvest on 8 to 17 percent of acres in the HITA per decade. Because of this goal, the average rotation ages trended between 60-120 years.

The Modeling Team modeled salvage harvesting occurred in the Harvest Land Base after high, moderate, or multiple, high-severity burns. The harvest occurred in the same decade as the burn and contributed to the ASQ. The Modeling Team also modeled salvage harvesting in the Late-Successional Reserve after high severity fire events.

Modeling Direction Specific to Alternative D

Riparian Reserve

The Modeling Team assumed that fifteen percent of the outer zone acreage would be eligible for thinning, and assumed a maximum volume harvested of 10 Mbf/acre.

Late-Successional Reserve

The Modeling Team assumed no harvest in the Late-Successional Reserve.

Harvest Land Base

The Harvest Land Base consists of six components: predicted marbled murrelet sites, predicted red tree vole sites, the home ranges of known and historic northern spotted owl sites, the Owl Habitat Timber Area (OHTA), the Uneven-aged Timber Area (UTA), and the Moderate Intensity timber area (MITA).

The Modeling Team assumed no harvest in the predicted marbled murrelet sites or the predicted red tree vole sites, as these sites would become Late-Successional Reserve when the BLM would identify new sites.

The Modeling Team modeled timber harvest on the Harvest Land Base using a combination of non-declining and even flow constraints. The Modeling Team modeled the MITA using an even-flow constraint, in which timber harvest from this allocation does not vary from decade to decade. The Modeling Team modeled the OHTA, UTA, and the home ranges of known and historic northern spotted owl sites using the discounted non-declining flow constraint.

The Modeling Team used the minimum harvest age constraints for the MITA as shown for the MITA in Alternative B in **Table C-21**.

GIS Data – Modeled Harvest and Contribution to ASQ

Table C-22 provides a summary of how the Modeling Team modeled each category of GIS data and which categories contribute to the Allowable Sale Quantity. A data code of X = non-forest; N=forested, modeled without any harvest; P= forested, modeled with non-ASQ harvest; Y=forested, modeled with ASQ harvest; S= forested, modeled with no harvest; L=forested, modeled with harvest does not contribute to either ASQ or non-ASQ harvest, N/A = not applicable.

Table C-22. Modeled harvest and contribution to ASQ.

GIS Modeling Data Category	No Action	Alt. A	Alt. B	Alt. C	Alt. D
Roads	X	X	X	X	X
Water	X	X	X	X	X
TPCC Non Forest	X	X	X	X	X
TPCC Non Suitable Woodlands	N	N	N	N	N
TPCC Suitable Woodlands – Low site and Non Commercial Species	N	N	N	N	N
TPCC Suitable Woodlands - Reforestation	N	N	N	N	N
Recreation Sites – existing	N	N	N	N	N
Recreation Sites- proposed	N/A	N	N	N	N
Visual Resource Management Class 1	N	N	N	N	N
Visual Management class 2	N	N	N	N	N
Areas of Critical Environmental Concern – existing	N	N	N	N	N
Areas of Critical Environmental Concern – proposed	Y/P	N/Y/P	N/Y/P	N/Y/P	N/Y/P
Occupied Marbled Murrelet Sites	N	N	N	N	N
Simulated Future Murrelet Sites	S	S	S	S	S
Known Owl Activity Centers	N	N	N	N	N
Reserve Pair Areas (Salem only)	N	N/A	N/A	N/A	N/A
Survey and Manage Species	N	N/A	N/A	N/A	N/A
Special Status Species	N/A	N	N	N	N
Species Management Areas	N	N/A	N/A	N/A	N/A
Riparian Reserves	P	P	P	P	P
LUA – Congressionally Reserved	N	N	N	N	N
LUA- Administratively Reserved	N	N	N	N	N
LUA- Late-Successional Reserve	P	P	P	P	N
LUA – Adaptive Management Areas	Y	N/A	N/A	N/A	N/A
LUA – Adaptive Management Reserve	P	N/A	N/A	N/A	N/A
LUA – Harvest Land Base	N/A	Y	Y	Y	Y
LUA – General Forest Management Areas	Y	N/A	N/A	N/A	N/A
LUA – Connectivity Diversity Blocks	Y	N/A	N/A	N/A	N/A
LUA_Southern General Forest Management Area	Y	N/A	N/A	N/A	N/A
LUA_-District Defined Reserved	N	N	N	N	N
Burned Areas	N/Y/P	N/Y/P	N/Y/P	N/Y/P	N/Y/P
LUA-Eastside Management Lands	X	X	X	X	X
Fauna Critical Habitat	N/A	N	N	N	N
Flora Critical Habitat	N/A	N	N	N	N
Existing Red Tree Vole Sites	N/A	N	N	N	N
Predicted Red Tree Vole Sites	N/A	N	N	N	N
Pacific Crest Trail	N/A	N	N	N	N
Wild and Scenic Rivers, Designated Corridors	N	N	N	N	N
Wild and Scenic Rivers, eligible and suitable	N	N	N	N	N
Wilderness	N	N	N	N	N
Wilderness Study Areas	N	N	N	N	N
Lands with Wilderness Characteristics	N/A	N/Y/P	N/Y/P	N/Y/P	N/Y/P

Reference Analysis and Sub-alternative Modeling Rules

No Timber Harvest

The Modeling Team tested and calibrated the data and the model, by running the first model for 150 years without any management. This run provided the Modeling Team with a baseline of comparison to the action alternatives. The Modeling Team conducted the No Timber Harvest reference analysis run both with and without wildfire. The Modeling Team modeled a full range of outputs, including stand structure, stand metrics, wildlife modeling metrics, and growth and yield. BLM inventory specialists reviewed the results to determine that attributes from GIS and strata were properly applied to the modeling and that stand metrics and projections were reasonable. In all, the Modeling Team completed five iterations of the No Timber Harvest reference analysis. As a result of these reviews, the Modeling Team made several revisions to the modeling process:

- Cap maximum stand density index (SDI) at 500 to prevent unrealistically high growth and volume projections
- Calculate canopy cover using ORGANON equations in addition to FVS
- Revise stand structural classifications to 'hardwire' reversion to early seral stages after regeneration harvests or fire, despite significant legacy retention
- Re-set stand age to zero after high severity fire
- Track stands that are currently over 200 years old as a separate structural class, "old", and currently over 400 years as "very old[134]

Sub-alternative B

The Modeling Team developed Sub-alternative B to provide a comparison for the effects of precluding harvest in the home ranges of the known and historic northern spotted owl sites. The BLM provided one input database to MBG that had the variables for both Alternative B and Sub-alternative B. This database had two sets of land-use allocations, two sets of harvest modeling codes (HMC), and two sets of harvest modeling pieces (HMP).

Sub-alternative C

The Modeling Team developed Sub-alternative C to provide a comparison to alternative C of precluding harvest in stands 80 years and older. The BLM provided one input database to MBG, used for both modeling runs.

Establishing Harvest Levels

The Modeling Team based harvest volume projections on the lands available for harvest, under the assumptions of each alternative, within each sustained yield unit. Due to the assumed timber management limitations, harvest from moist forest reserves (Late-Successional Reserve and or Riparian Reserve) would diminish as stands grow past the conditions suitable for thinning and would not produce a sustainable harvest over time. The Modeling Team assumes that timber volume from selection harvesting in Late-Successional Reserve – dry would continue perpetually where the BLM would use timber harvest to maintain fire-resilient conditions.

[134] Throughout the modeling process, no new stands were allowed to grow into the "old" and "very old" classes. The purpose of this modification is for transparency of fate of all stands currently over 200 years of age.

The Modeling Team modeled the sustain-yield harvest level from the land base supporting the ASQ separately from the harvest volume from the reserves. Segregating the land base and modeling of harvest volume in this manner eliminated the interaction of these two types of allocations.

Within the Harvest Land Base, the Modeling Team applied two different harvest flow strategies. These include a non-declining, even-flow strategy and a non-declining discounted flow strategy. The Modeling Team always applied the non-declining even-flow strategies to the HITA, LITA, and MITA. The Modeling Team also applied this same non-declining, even-flow strategy to the UTA and OHTA where they comprise 10 percent or less of the Harvest Land Base within a sustained yield unit.

Where the UTA or OHTA comprise more than 10 percent of the Harvest Land Base in a sustained yield unit, the Modeling Team applied a non-declining discounted flow strategy, because it provided

- a relatively even-distribution of both selection harvest and even-aged harvest across the Harvest Land Base through time,
- a predictable, even-flow harvest in the even-aged components of the Harvest Land Base, and
- a relatively high level of ASQ in the selection harvest in the Harvest Land Base.

The selection prescriptions in UTA and OHTA increased the amount of harvest volume that would be removed through time with successive entries. Without being able to adjust harvest level in the course of the 200-year modeling horizon, it would not be possible to implement the management direction for the UTA and OHTA.

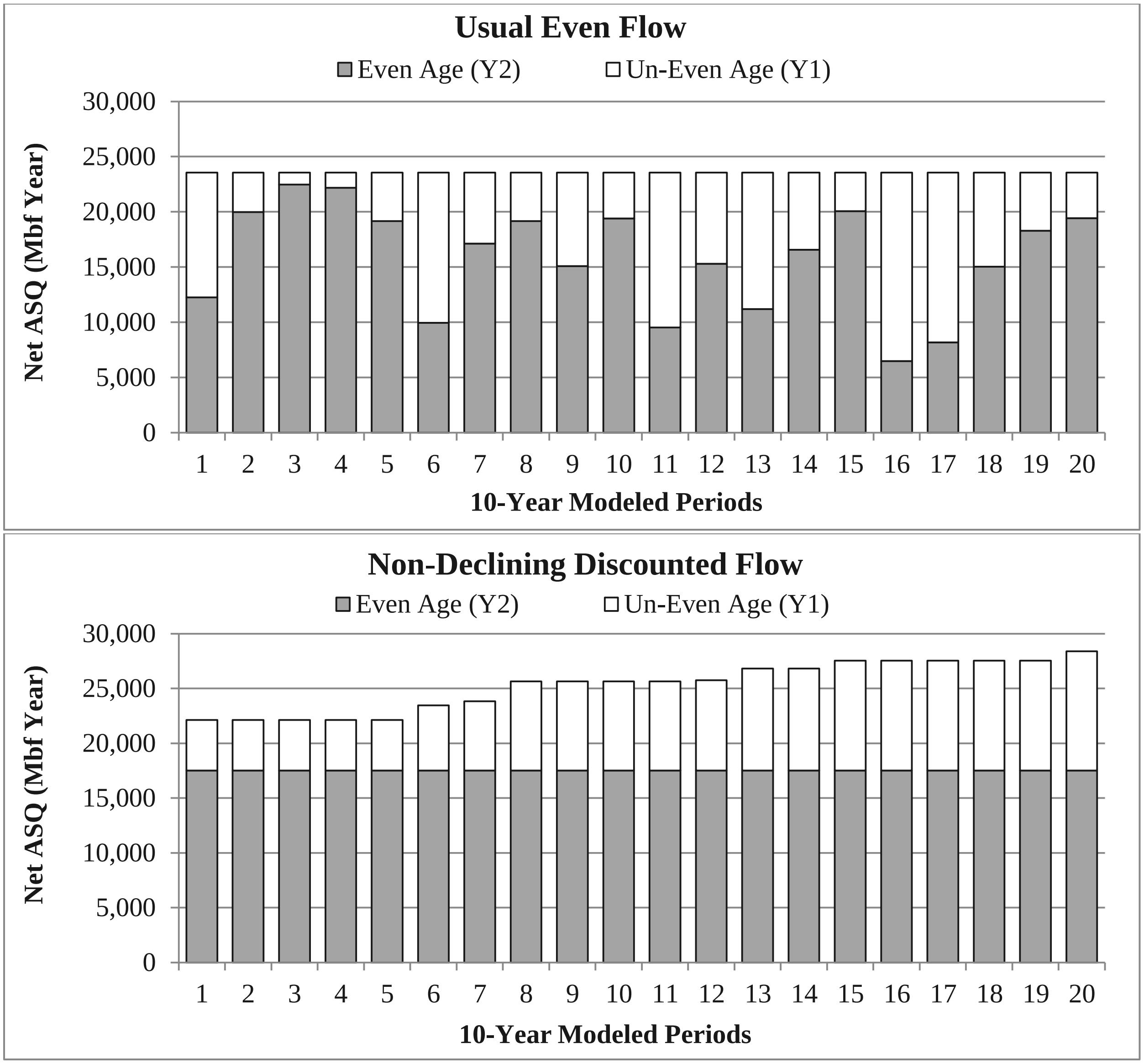

Figure C-8. Even-flow (top) and non-declining discounted flow (bottom).

Woodstock Products

The final product from all Woodstock modeling runs was a Microsoft Access relational database, covering the entire project area, and containing all of the output variables for each individual polygon (RMPWO_ID) (**Table C-23**). The model generated outputs for time steps: 0, 1, 2, 3, 4, 5, 10, and 20 (2013, 2023, 2033, 2043, 2053, 2063, 2113, and 2213).

Table C-23. Woodstock modeling output variables.

Table	Field Name	Description
Wildlife	District	District name (Woodstock Theme 9)
	RMPWO_ID	Unique polygon ID #
	GIS_ACRES	Area in acres
	Platforms1_yr2013	Murrelet platforms(1) per acre in period 0 - after treatment
	Platforms2_yr2013	Murrelet platforms(2) per acre in period 0 - after treatment
	QMDCON_yr2013	Quadratic mean diameter of all live conifers in centimeters in period 0 - after treatment
	StructBLM_yr2013	Structural stage code in period 0 - after treatment
	StructBLM_CurrentAge_yr2013	Current age of stand used for structural stage code in period 0
	StructBLM_StartingAge_yr2013	Starting age of stand used for structural stage code in period 0
	StructBLM_TPA20_yr2013	TPA of trees ≥ 20 inch DBH used for structural stage code in period 0 - after treatment
	StructBLM_TPA40_yr2013	TPA of trees ≥ 40 inch DBH used for structural stage code in period 0 - after treatment
	StructBLM_CV_yr2013	CV of the DBHs of all trees used for structural stage code in period 0 - after treatment
	StructBLM_RD_yr2013	Curtis RD used for structural stage code in period 0 - after treatment
	StructBLM_Height_yr2013	Average height of reported trees greater or equal to 7 inch DBH, SS code - after treatment
	StructBLM_CanopyCover_yr2013	ORGANON Canopy cover from all trees used for SS code in period 0 - after treatment
	DDivBLM_yr2013	Diameter Diversity Index in period 0 - after treatment
	TPHaLgCon_yr2013	Trees per hectare of large conifers (≥ 30") in period 0 - after treatment
	TFir_PCT_yr2013	Percent of total basal area in subalpine fir species list in period 0 - after treatment
	Pine_PCT_yr2013	Percent of total basal area in pine species list in period 0 - after treatment
	Oak_PCT_yr2013	Percent of total basal area in oak species list in period 0 - after treatment
	EvgHdw_PCT_yr2013	Percent of total basal area in evergreen hardwoods species list in period 0 - after treatment
	Redwd_PCT_yr2013	Percent of total basal area in redwood (always 0) in period 0 - after treatment
	CCovCon_FVS_PCT_yr2013	FVS canopy cover of all live conifers in percent in period 0 - after treatment
	CCovCon_ORG_PCT_yr2013	ORGANON canopy cover of all live conifers in percent in period 0 - after treatment
	CCovHdw_FVS_PCT_yr2013	FVS canopy cover of all live hardwoods in percent in period 0 - after treatment
	CCovHdw_ORG_PCT_yr2013	ORGANON canopy cover of all live hardwoods in percent in period 0 - after treatment
	VegCl_1011_yr2013	GNN Vegetation Class code in period 0 - after treatment
	TCanopyLyr_yr2013	Number of tree canopy layers present in period 0 - after treatment
	StndDomHt_yr2013	Average height of dominant and co-dominant trees in meters in period 0 - after treatment
Harvest	District	District name (Woodstock Theme 9)
	RMPWO_ID	Unique polygon ID #

Table	Field Name	Description
	GIS_ACRES	Area in acres
	CurrPeriod_yr2013	Current period in 2013 = 0
	GrossToNet_yr2013	Adjustment factor for gross to net inventory volume in period 0
	TenYrAge_yr2013	FOI 10-year age in years in period 0
	TotNetInv_yr2013	Net inventory volume per acre (Mbf/Ac.) commercial species 16' scale in period 0
	TotNetInv_Extended_yr2013	Net inventory total volume (Mbf) commercial species 16' scale (TotNetInv_yr2013 × GIS_ACRES) in period 0
	BlmTotGross_yr2013	Gross inventory volume per acre (Mbf/Ac.) all species 16' scale in period 0 - after treatment
	BlmTotGross_Extended_yr2013	Gross inventory total volume (Mbf) all species 16' scale (BlmTotGross_yr2013 × GIS_ACRES) in period 0
	ASQ_yr2013	Gross inventory volume per acre (Mbf/Ac.) commercial species 16' scale in period 0 - after treatment
	TPA_yr2013	Trees per acre in period 0 - before treatment
	BA_yr2013	Basal area in square feet per acre in period 0 - before treatment
	QMD_yr2013	Quadratic mean diameter in inches, all species in period 0 - before treatment
	thin_acres	Acres of thinning in period 0
	clearcut_acres	Acres of clearcut in period 0 (NRTA only)
	selection_acres	Acres of selection (uneven-aged) harvest in period 0 (LSUMA prescription, UEMA, OHTA)
	salvage_acres	Acres of salvage harvest in period 0 (GFMA, HLB in action alternatives, LSR in Alt. C)
	thin_vol	Volume of thinning in period 0 (Alt. A only)
	clearcut_vol	Volume of clearcut harvest in period 0 (NRTA)
	selection_vol	Volume from selection (uneven-age) harvest in period 0 (net volume, 16' scale)
	salvage_vol	Volume of salvage harvest in period 0 (net volume, 16' scale)
	restoration_acres	Acres of restoration harvest in period 0 (Alt. A only)
	restoration_vol	Volume from restoration harvest (gross, does not count towards ASQ) Alt. A only
	2-age_acres ^^	Acres of 2-age harvest in period 0 (GFMA, CONN, SGFMA, LRTA and MRTA)
	2-age_vol ^^	Volume from 2-age harvest in period 0 (net volume, 16' scale)
	Grade_1_vol	Volume harvested in size/grade class 1 in period 0 (net volume, 16' scale)
	Grade_2_vol	Volume harvested in size/grade class 2 in period 0 (net volume, 16' scale)
	Grade_3_vol	Volume harvested in size/grade class 3 in period 0 (net volume, 16' scale)
	Grade_4_vol	Volume harvested in size/grade class 4 in period 0 (net volume, 16' scale)
	ASQ_harv_vol	Total volume harvested that counts towards ASQ (net volume, 16' scale)
	nonASQ_harv_vol	Total volume harvested that doesn't count towards ASQ (net volume, 16' scale)
Baseline	District	District name (Woodstock Theme 9)
	RMPWO_ID	Unique polygon ID #
	GIS_ACRES	Area in acres

Table	Field Name	Description
	SUBJ_FOI	FOI Stand ID #
	YieldStrataID	Timber stratification Yield Strata ID # (Woodstock Theme 1)
	Modeling_Group	Timber stratification Modeling Group (Woodstock Theme 2)
	Species_Group	Timber stratification Species Group (Woodstock Theme 3)
	Site_Class	Timber stratification Site Class (Woodstock Theme 4)
	Age_Group	Timber stratification Age Group (Woodstock Theme 5)
	LandUseAllocation_init	Land Use Allocation (Woodstock Theme 6)
	Regine_GrowOnly	Management regime; GrowOnly or Fire (Woodstock Theme 7)
	HarvestLandBaseCodes	Harvest Land Base code; Y, N, or X (Woodstock Theme 8)
	Rotation	Current rotation; EX or RE (Woodstock Theme 10)
	StartingTenYearAge	FOI Ten Year Age in years in 2013 (Woodstock Theme 11)
	StartingAge_inPeriods	Timber stratification age in periods in 2013 (Woodstock Theme 12)
	Swiss_Needle_Cast	Swiss needle cast presence; Y or N (Woodstock Theme 13)
	Burn_Regime	Burn regime timing and severity in periods (Woodstock Theme 14)
	Wet_Or_Dry_Site	Wet or dry site; W or D (Woodstock Theme 15)
Economic	RMPWO_ID	Unique polygon ID #
	GIS_ACRES	Area in acres
	oG_RevCC$	Gross Revenue from CC ($)
	oG_RevSL$	Gross Revenue from 2-Age ($)
	oG_Rev2A$	Gross Revenue from Selection ($)
	oG_RevThn$	Gross Revenue from Thins ($)
	oG_RevTot$	Total Gross Revenue ($)
	oLog_CC$	Clearcut Logging Cost ($)
	oLog_2A$	2-Age Logging Cost ($)
	oLog_SL$	Selection Logging Cost ($)
	oLog_Thn$	Thin Logging Cost ($)
	oLog_Tot$	Total Logging Costs ($)
	oUnd_Brn$	Underburn/Broadcast Burn Cost ($)
	oHnd_Brn$	Handpile/Burn Cost ($)
	oLnd_Brn$	Landing Pile/Burn Cost ($)
	oMchn_Brn$	Machine Pile/Burn Cost ($)
	oSlsh_Sct$	Slashing/Lop/Scatter Cost ($)
	oMstctn$	Mastication Cost ($)
	oPlant$	Planting Cost ($)
	oManClear$	Manual Clearing Cost ($)
	oManCut$	Manual Cutting Cost ($)
	oMulch$	Mulching Cost ($)
	oTubing$	Leader Protection Cost ($)
	oShading$	Shading Cost ($)
	oTrapping$	Trapping Cost ($)
	oScalp$	Scalping Cost ($)
	oHerb$	Herbicide Cost ($)
	oBlstCtrl$	Blister Rust Control Cost ($)
	oPCT$	Pre-commercial Thin Cost ($)
	oFert$	Fertilization Cost ($)
	oPrune$	Pruning Cost ($)
	oConversn$	Stand Conversion Cost ($)

Table	Field Name	Description
	oTotCosts$	Total Costs ($)
	oNetRev$	Net Revenue ($)
Silviculture	RMPWO_ID	Unique polygon ID #
	GIS_ACRES	Area in acres
	oUnd_Brn_Ac	Underburn/Broadcast Burn Acres
	oHnd_Brn_Ac	Handpile/Burn Acres
	oLnd_Brn_Ac	Landing Pile/Burn Acres
	oMchn_Brn_Ac	Machine Pile/Burn Acres
	oSlsh_Sct_Ac	Slashing/Lop/Scatter Acres
	oMstctn_Ac	Mastication Acres
	oPlant_Ac	Planting Acres
	oManClear_Ac	Manual Clearing Acres
	oManCut_Ac	Manual Cutting Acres
	oMulch_Ac	Mulching Acres
	oTubing_Ac	Leader Protection Acres
	oShading_Ac	Shading Acres
	oTrapping_Ac	Trapping Acres
	oScalp_Ac	Scalping Acres
	oHerb_Ac	Herbicide Acres
	oBlstCtrl_Ac	Blister Rust Control Acres
	oPCT_Ac	Pre-commercial Thin Acres
	oFert_Ac	Fertilization Acres
	oPrune_Ac	Pruning Acres
	oConversn_Ac	Stand Conversion Acres

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Appendix D – Modeling Large Stochastic Wildfires and Fire Severity within the Range of the Northern Spotted Owl

Raymond Davis, Louisa Evers, Yanu Gallimore, Jena DeJuilio and C. Belongie

Introduction

Wildfire is a natural process within the identified range for the northern spotted owl (*Strix occidentalis caurina*), especially in the southern and eastern portions of the range. While the bird has adapted to wildfire and its effects in an intact landscape, human development and land use have reduced and fragmented habitat and populations in large portions of the region (Davis and Lint 2005, Davis *et al*. 2011). One result has been to increase the potential for adverse effects of large, high severity wildfires on remnant northern spotted owl habitats and populations. Over the past two decades, large wildfires have accounted for the majority of northern spotted owl nesting and roosting habitat losses on federally managed forests (Davis *et al*. 2011). In addition, fire suppression, inadequate levels of natural or prescribed fire, and climate change are believed to have created conditions considered more favorable for frequent, higher severity, and larger wildfires (Westerling *et al*. 2006, Littell *et al*. 2009, Dillion *et al*. 2011a, Miller *et al*. 2012).

In 2008, the Bureau of Land Management (BLM) attempted to revise six resource management plans in western Oregon, although the decisions were subsequently withdrawn. A scientific review of that effort noted that one significant weakness was the failure to account for the potential effects of high severity wildfire on habitat for the northern spotted owl, a threatened species under the Endangered Species Act. Specifically, the review stated that the models overestimated amounts of owl habitat and did not assume that any would be lost to high severity wildfire during the projected modeling timeline (Drake *et al*. 2008). To address that weakness under the current planning effort, BLM assembled a team of northern spotted owl experts, fire ecologists, silviculturists, and modelers to develop an approach to model the occurrence of future wildfires and analyze their potential effects on northern spotted owl habitat and populations.

This effort is also intended to support a U.S. Fish and Wildlife Service request that BLM evaluate whether the resulting plan would provide sufficient habitat to assure persistence of the northern spotted owl for the next 50 years. Estimating the quantity of habitat affected by fire over the next five decades is needed to better inform the development of land management strategies for the BLM-managed lands in western Oregon. This report describes the methods used to determine potential burned area and fire severity and the results of that analysis. Subsequent modeling will evaluate the potential results on habitat availability for the northern spotted owl. Since this analysis was conducted to directly support the analysis of environmental effects in conjunction with an environmental impact statement, model parameters are constrained by the “reasonably foreseeable” criteria in BLM’s planning regulations.

Study Area

The range of the northern spotted owl used in this analysis extends from the Canadian border through northern California and from the west coast to the eastern foothills of the Cascade and Klamath Mountain ranges. The BLM planning area for western Oregon comprises 19,647,000 acres, or approximately 34 percent, of the lands within this range and is located within the core of that range (**Figure D-1**), divided among six Districts (Salem, Eugene, Roseburg, Coos Bay, Medford and Lakeview). The majority of BLM-managed lands consist of so-called checkerboard (alternating square mile sections) largely intermingled with privately owned industrial and non-industrial forests, along with state-owned lands, and a limited amount of National Forest System lands and tribal lands. Large contiguous blocks of BLM-managed lands are rare within the range of the northern spotted owl. The largest concentration of BLM-managed lands in western Oregon occurs on Medford and Roseburg Districts in southwestern Oregon (**Figure D-1**).

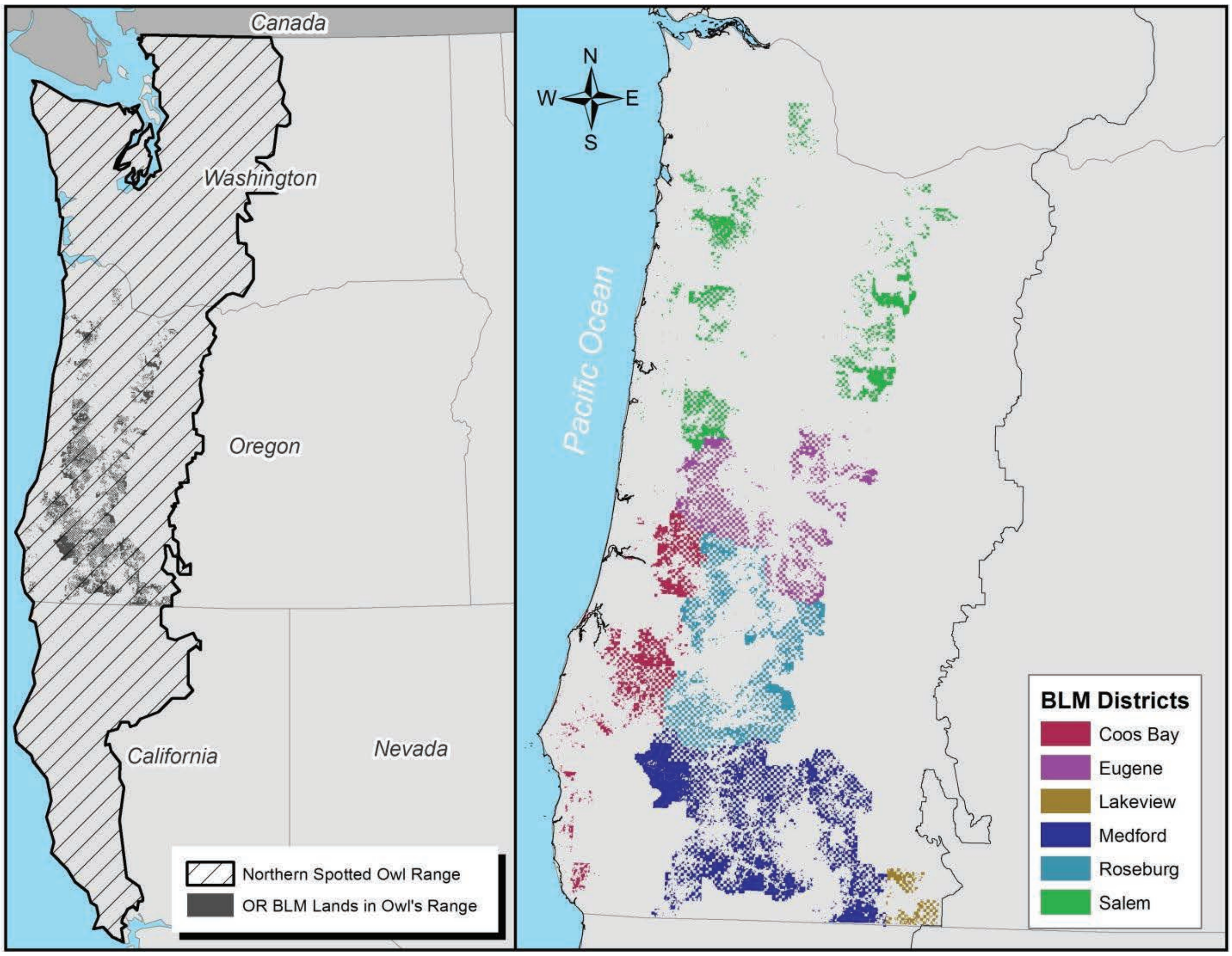

Figure D-1. Analysis area. We used the entire range of the northern spotted owl for the analysis area to maintain consistency with the previous fire analyses conducted within the range of the northern spotted owl.

Forest types within the study area range from dry mixed evergreen forests in California and southwestern Oregon to temperate rainforests along the coast and in much of western Washington. The climate ranges from maritime in western Washington, northwestern Oregon, and the coast to Mediterranean in southwestern Oregon and northern California. Soils are highly variable in texture, depth, and other characteristics and are largely derived from volcanic parent materials with ultramafic soils common in southwestern Oregon.

Methods

We used the entire range of the northern spotted owl for our analytical framework to provide sufficient data to capture the potential range of annual area burned and fire severity proportions to more accurately reflect impacts to northern spotted owl habitat unaffected by arbitrary divisions along biologically irrelevant lines, such as state, ownership, and administrative boundaries. The modeling regions used in this analysis were similar to those used by the U.S. Fish and Wildlife Service (FWS) for the revised Northern Spotted Owl Recovery Plan and designation of critical habitat (USDI FWS 2011 and 2012).

The median northern spotted owl territory size ranges from 1,300 to 11,800 acres, depending on geographic location (Appendix B in Davis *et al*. 2011), thus it takes a rather large wildfire to have a substantial effect on one owl territory (Davis and Lint 2005). We used the large wildfire suitability model (LWSM) developed as part of the 15-year monitoring report for the Northwest Forest Plan (Chap. 4, in Davis *et al*. 2011). This model was developed using large wildfires (≥ 1,000 acres) from 1970 through 2002, and validated against large wildfires that occurred from 2003 through 2009. The LWSM represents a relative probability surface for large wildfire occurrence within the range of the northern spotted owl that has continued to predict the locations of nearly all large wildfires that have occurred since 2009.

Using the regional wildfire history from 1970 through 2013 (4.4 decades), we modeled large wildfires five decades into the future using a three-step process to determine; 1) number and location, 2) size distribution, and 3) severity.

Step 1 - Estimating Number and Location of Future Large Wildfires

Large wildfire occurrence records from 1970 through 2013 showed a marked increased occurrence of large wildfires in the last decade of this time record (**Figure D-2**). Whether this is a trend that will continue to increase is uncertain, so for purposes of this analysis we used the decadal average of 100 to generate 500 potential large wildfires over the next 5 decades. To do this, we used the "Generate Random Points" tool in Geospatial Modeling Environment (GME version 0.7.2.1) software (Beyer 2012) to produce five sets of randomly placed points (n=100) for each decade using the LWSM as a relative probability surface for point placement. Points could occur anywhere, but were more likely to occur where the probability of a large wildfire (a.k.a. wildfire suitability) was higher (**Figure D-3**).

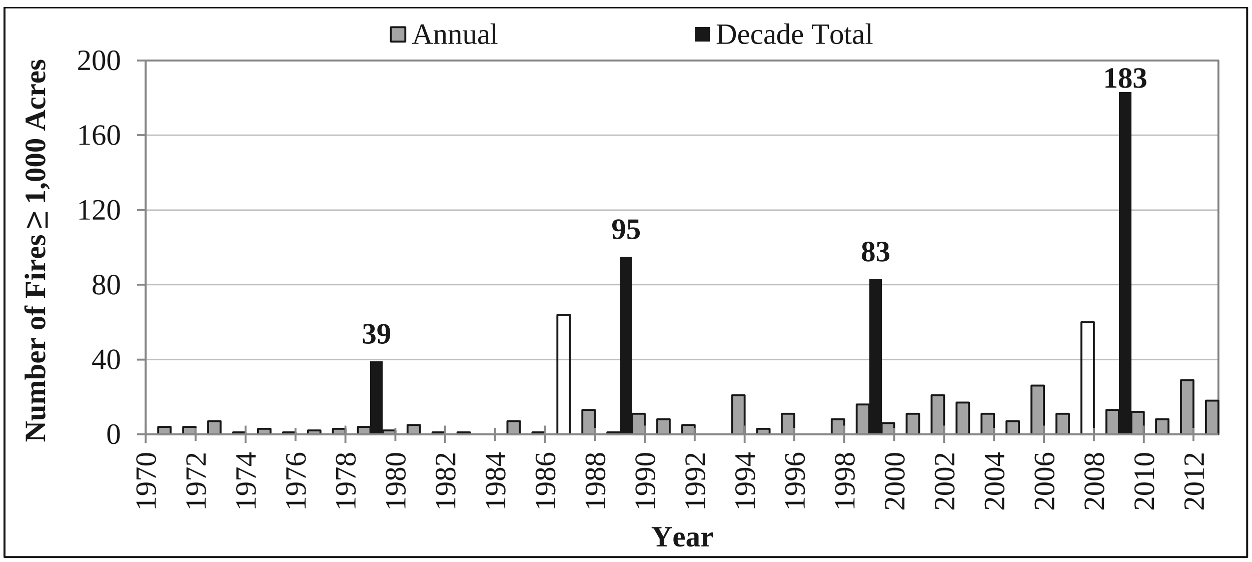

Figure D-2. Annual and decadal number of large wildfires (>1,000 acres) in the analysis area for 1970-2013. The numbers above the dark bars are decadal totals. While the decadal totals suggest the number of large wildfires is increasing, the short period of record and the influence of the phase and annual sign of the Pacific Decadal Oscillation are confounding factors in identifying a definite trend.

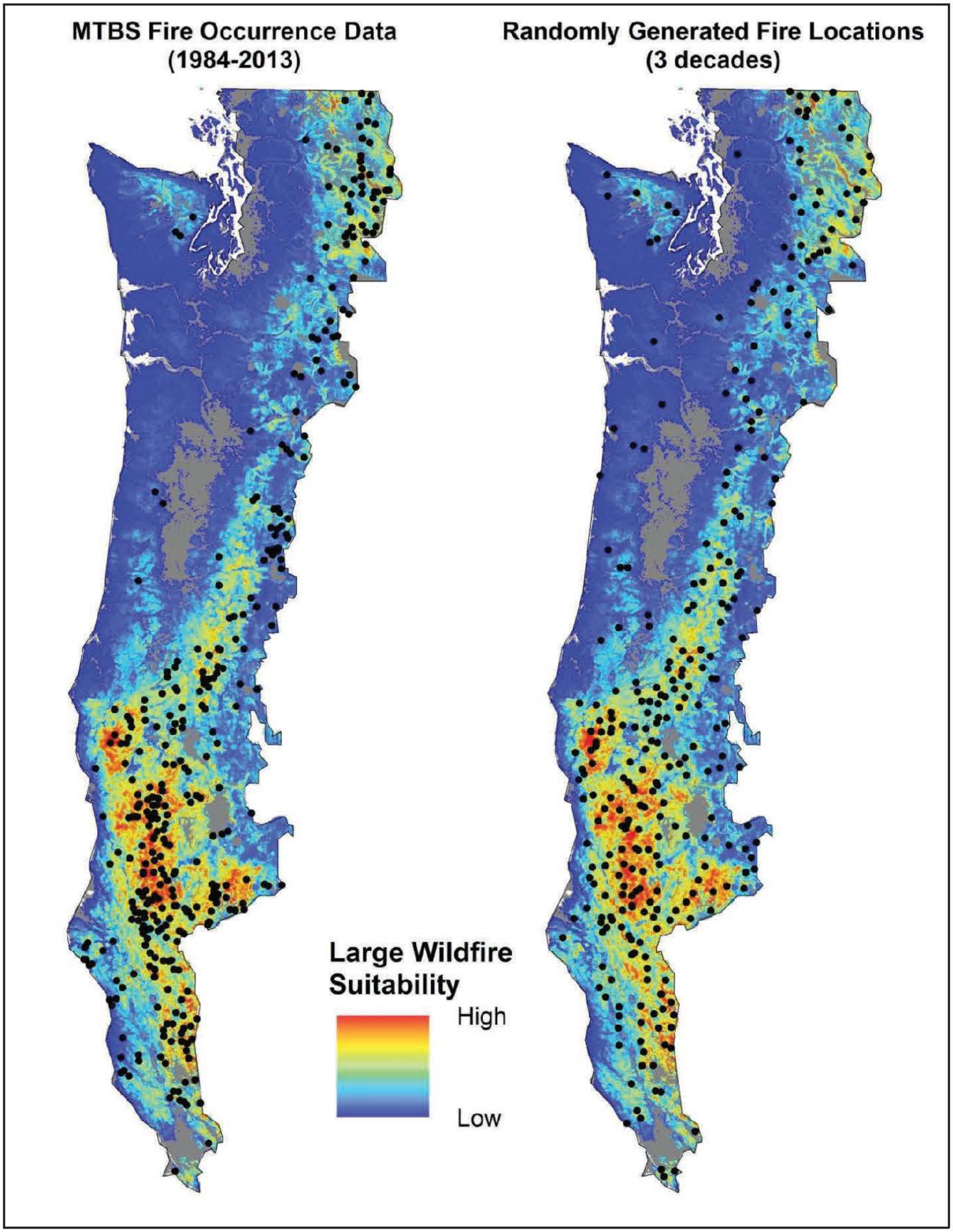

Figure D-3. Comparison of three decades of observed large wildfire history from MTBS fire occurrence data (left) with the first three decades of randomly generated fire locations (right).

Reburning has been observed within the Northwest Forest Plan area on several occasions, for example, the Biscuit Fire in 2002 reburned nearly all of the 1987 Silver Fire, and a portion of this area burned again in 2013. Portions of the 1933 Tillamook Fire area reburned as much as five times before 1960. To account for reburns we calibrated the model by comparing the area burned by projected large wildfires to the actual area burned by past large wildfires. Initially, the model projected much more reburning than has been observed. To correct for this over-prediction, we added a decadal constraint parameter on reburning by preventing the placement of random points within 5 km of fire "perimeter" locations from the prior decade. In subsequent decades, and consistent with historical observations, random points could occur within or adjacent to previous modeled fire perimeters. Subsequent model runs produced similar levels of acres burned and proportion of area reburned as the observed record.

Step 2 - Estimating Size of Future Large Wildfires

The majority of large wildfires within the study area burned less than 15,000 acres and only 1 percent of them exceeded 100,000 acres in size (**Figure D-4**). Using this information, we created eight fire size bins. We then calculated the median fire size for each bin and determined the appropriate radius to create a circular fire perimeter of the median size (**Table D-1**). Because we were concerned more with the overall potential loss of habitat than with accurately representing fire shapes, we simply represented wildfires as circles associated with the median sizes. We then used the LWSM value for each random point to determine fire size. The higher the underlying LWSM score, the more likely a random point would "burn" more acres, although smaller fires could also occur in the higher probability areas.

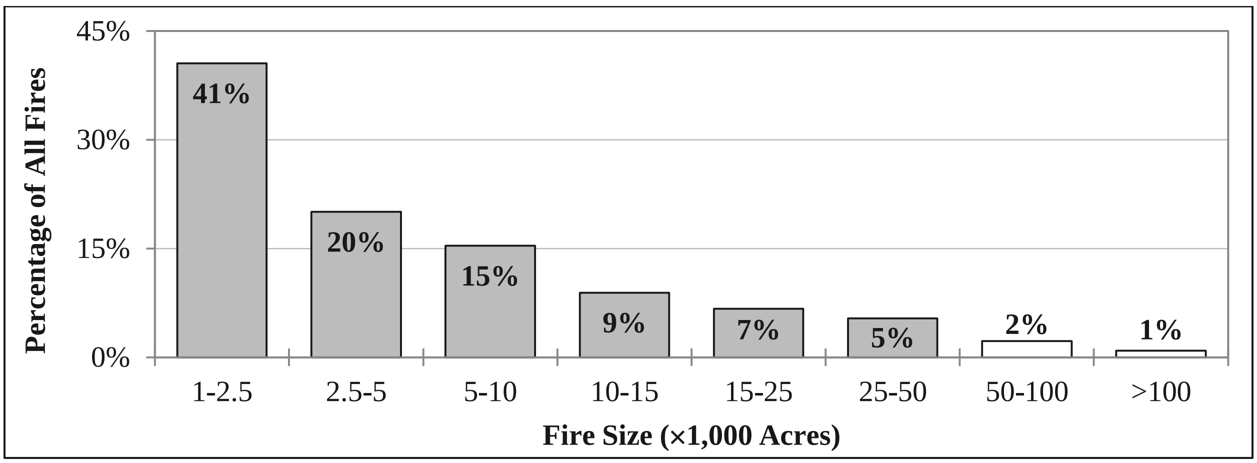

Figure D-4. Historical (1970-2013) large wildfire size distribution within the range of the northern spotted owl. Most fires burn less than 2,500 acres while very few fires burn more than 100,000 acres.

Table D-1. Parameters used to assign random points a wildfire size by buffering the point location.

Number of Random Points	Buffer Radius (Miles)	Simulated Wildfire Size (Acres)
41	0.79	1,250
20	1.37	3,750
15	1.93	7,500
9	2.55	12,500
7	3.15	20,000
5	4.32	37,500
2	6.11	75,000
1	7.05	100,000

By decade, beginning with random points with the lowest wildfire suitability score, we assigned the smallest radius to each point based on **Table D-1** until the last random point with the highest wildfire suitability score was assigned the largest radius. Each point was then buffered by their assigned radii to form the hypothetical fire perimeters. These individual or overlapping circles represented that decade's "footprint" of large wildfires. We repeated this process for each decade.

Step 3 - Estimating Fire Severity of Future Large Wildfires

Once we determined potential future wildfire locations and sizes, we estimated fire severities within their perimeters. We relied on data from the Severe Fire Potential Map (Dillon *et al*. 2011a and 2011b, Dillon *et al*. 2012) portion of the Fire Severity Mapping Tools (FIRESEV) project (Keane *et al*. 2013) to assign fire severities within each decadal wildfire footprint. FIRESEV data reflect spatial predictions of the conditional likelihood of high severity fire. These projections were based on empirical models relating topographic, vegetation, and fire weather variables to wildfire severity observed on wildfires from 1984 to 2007, as mapped by the Monitoring Trends in Burn Severity (MTBS) program (Eidenshink *et al*. 2007). The model's spatial predictions were based on 90th percentile fuel moisture conditions for dryness, although actual fuel moistures often varied over the spatial and temporal extent of any given large fire (Dillon *et al*. 2011a and 2011b, Miller *et al*. 2012).

Since FIRESEV only estimated the probability for high severity fire, we classified this probability into three quantile classes. We assumed that lower severity fires would occur in areas modeled as having a lower probability for high severity fire and that high severity fires would most likely occur in areas modeled as high probability. These three quantile classes served as our low, moderate, and high severity map classification for assignment of fire severity to the fire footprints created in step 2. To test this assumption, we compared relative proportions of observed wildfire severity (based on MTBS severity mapping from 1986–2011) to the classified FIRESEV model from the five decadal maps. We found similar proportions between observed and modeled wildfire severities indicating that the assumption was a valid one and would produce proportions of area burned by low to high severity that were similar to the observed record (**Figure D-5**).

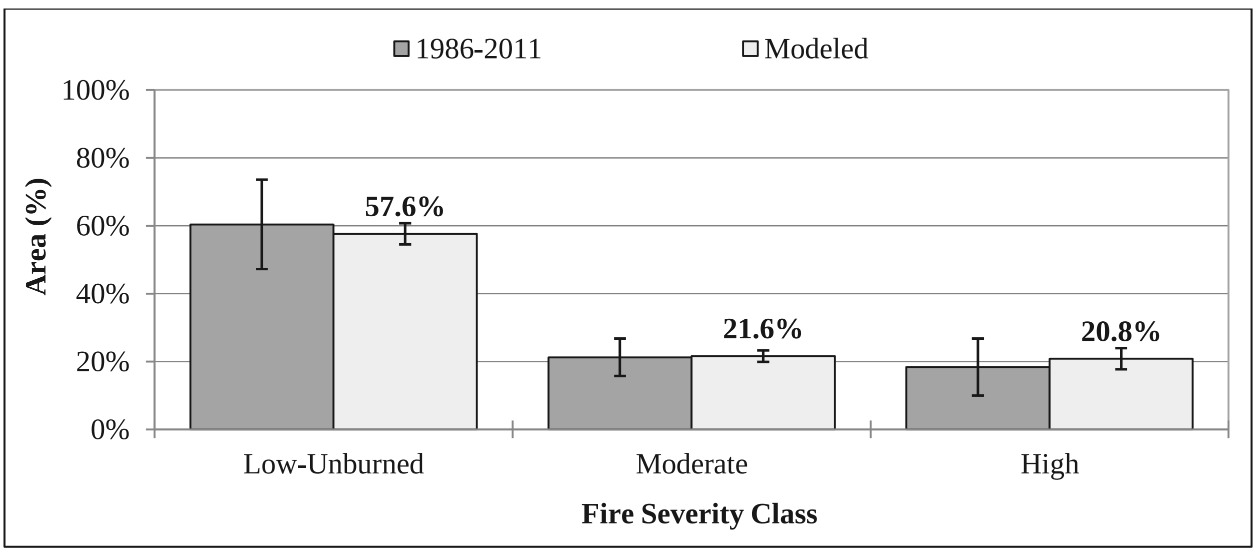

Figure D-5. Comparison of annual proportion of area burned by mapped fire severity from MTBS data from 1986 to 2011 with modeled severity based on a three quantile classification of the FIRESEV map for the five decadal models. Labels show modeled estimates of proportion of area burned by severity class.

Finally, we also examined the MTBS data for any obvious temporal trends in wildfire severity, but did not detect a strong signal (**Figure D-6**). Over the course of 25 years, there appears to be a slight increase in the percentage of area burned by low and moderate severity wildfire, and a slight decrease in the percent of area burned in high severity wildfire, although these trends are not statistically significant. We also noted that the variability in the amount of area burned in the different severity classes has declined since about 2002, but are not certain why this apparent smoothing has occurred. Given the non-significance of the observed trends and the uncertainty over whether these slight trends will continue into the future, we did not attempt to model any fire severity trends in our framework.

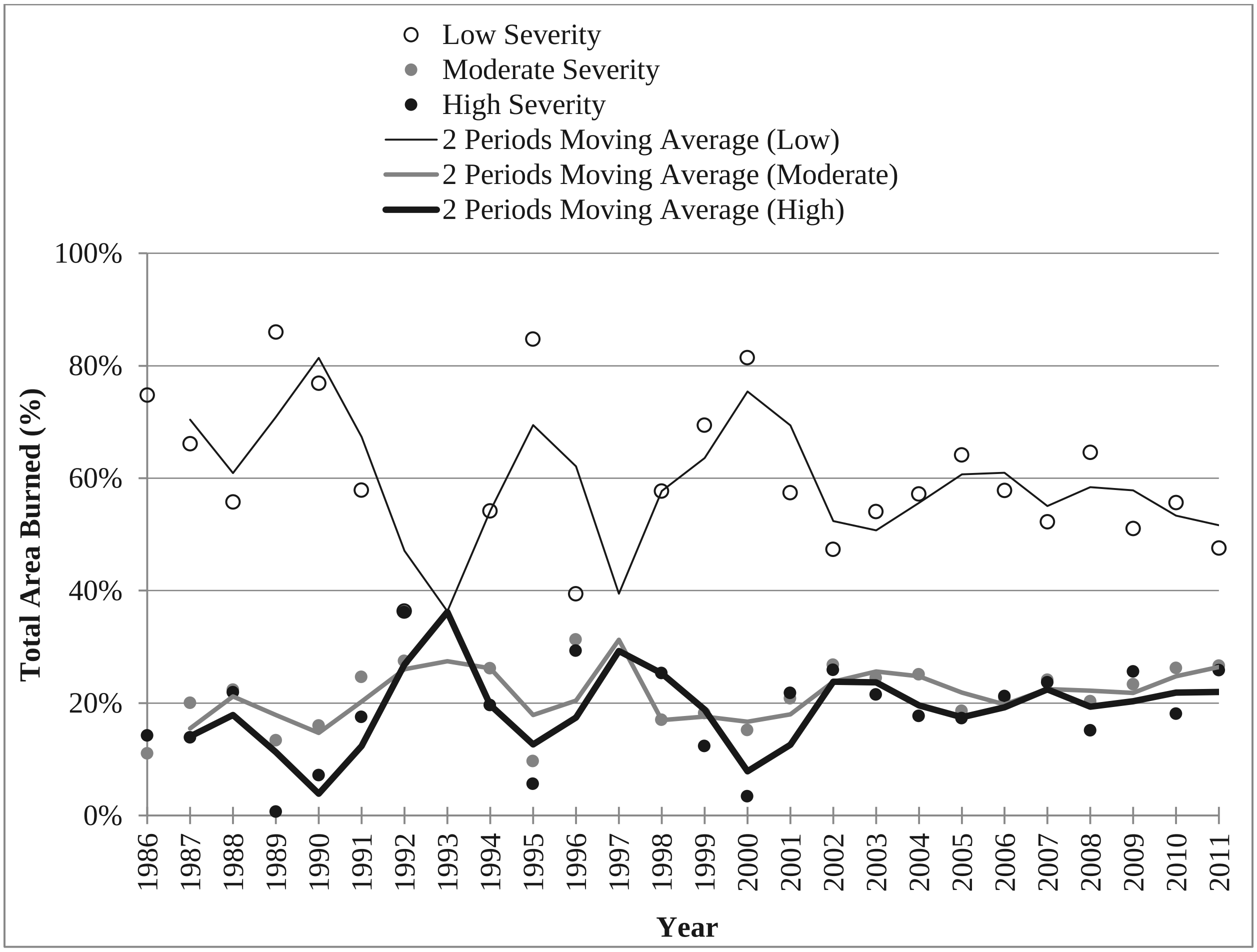

Figure D-6. Trends in area burned by fire severity class. Interannual variability in the amount of area burned in the different severity classes was much greater prior to 2003. The cause(s) for declining variability are not known. Linear trend analysis indicates non-significant trends towards decreasing amount of high severity fire and increasing amount of low and moderate severity fire, with much of the change coming after variability declined.

Results

We produced five decadal maps of potential large wildfire “footprints” over the entire range of the northern spotted owl along with potential wildfire severities. Given an average of 100 large wildfires per decade, our model estimated that approximately 4.4 million acres would burn within the range of the northern spotted owl over the next 50 years with 10 percent of the area burning twice and 0.2 percent burning three times. On BLM-managed lands only, the model estimated that approximately 192,000 acres would burn with 10 percent burning twice and no areas burning three times. In comparison, approximately 4.4 million acres have burned within the range of the northern spotted owl over the past 44 years (1970-2013) with 16 percent of the area burning twice and 1.6 percent burning three times. In that same time span, approximately 153,500 acres burned on BLM-managed lands with 16 percent burning twice. Both spatially (**Figure D-7**) and from the burned area comparisons above, the model produced a plausible scenario based on recent observed wildfire history for potential future large wildfires both rangewide and on BLM lands in western Oregon over the next five decades.

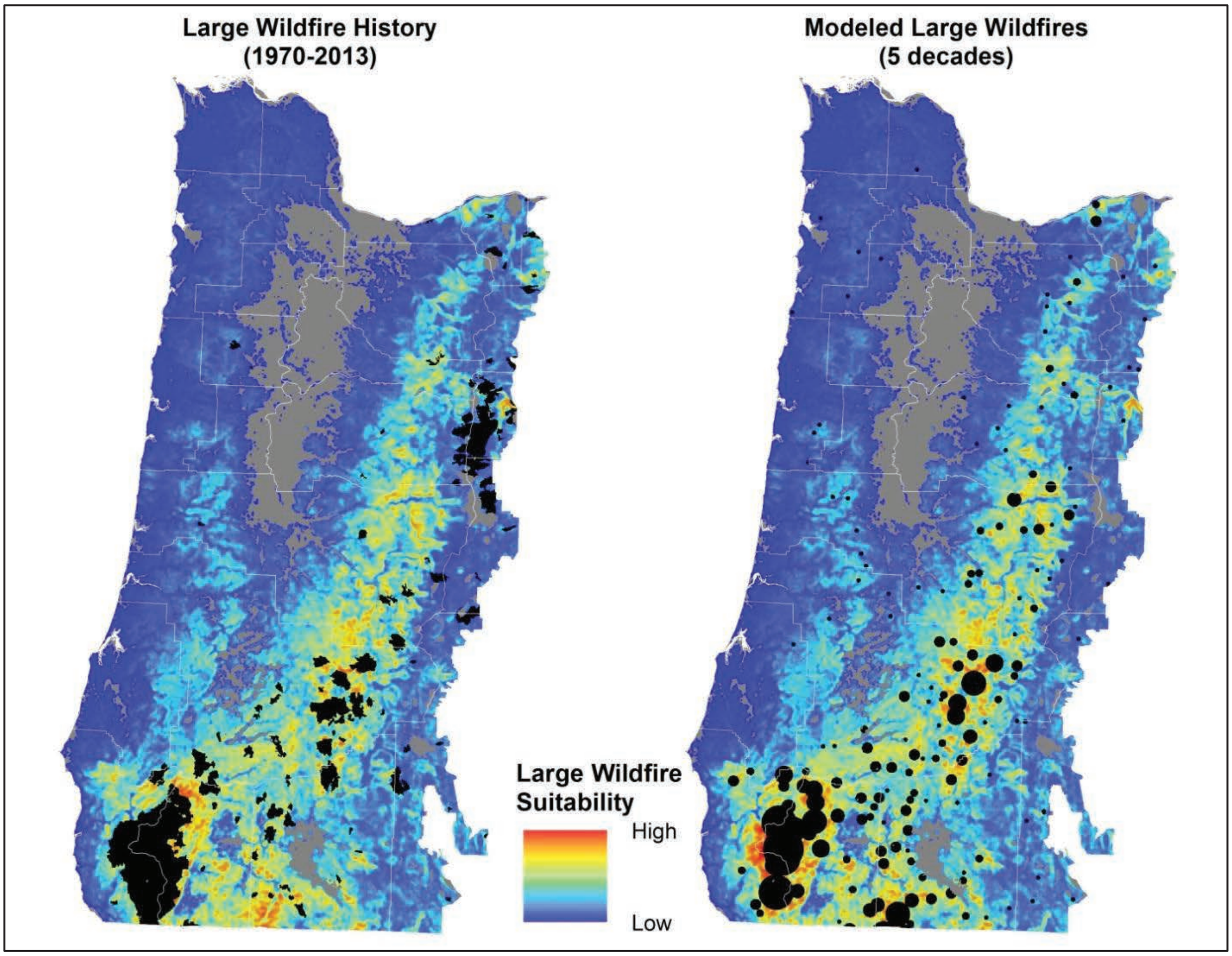

Figure D-7. Comparison of actual area burned (black shading) by large wildfires between 1970 to 2013 (left) with modeled large wildfires over five decades (right).

Discussion

For the given analysis period (5 decades), our model projected relatively minor changes in potential burned area within the range of the northern spotted owl generally and on Oregon BLM-managed lands within that range. While the observed decadal trends suggest an increasing trend in the number of large fires over time (**Figure D-2**), it is not clear that this trend will continue to increase. The observed large wildfire history records contain a small number of anomalous years that may distort the data. Particular stand-out years are 1987, 2002, and 2009. The 1987 fire season was particularly severe in southwest Oregon and northwest California, while 2002 was particularly severe in southwest Oregon and 2009 particularly severe in northwest California. All three years were characterized by an unusually high number of wildfire starts and an unusually high number of acres burned. Miller *et al*. (2012) did find an trend of increasing numbers of large fires in the Klamath Mountains of northwestern California, but this same trend is not apparent in the analysis area as a whole (Littell *et al*. 2009, supplemental information). We note that this decade is no quite half over and there have already been a recorded 67 large wildfires as of 2013. It is possible that future decades might incur more than the 100 large wildfires per decade used in this analysis; however, selection of a higher number would be speculative and the decision was made to base the analysis on what has been observed in recent decades.

While several studies have indicated that high severity fires are increasing across the western United States (Westerling *et al*. 2006, Dillon *et al*. 2011a, Miller *et al*. 2012), no such trends were apparent in the observed record within the range of the northern spotted owl (**Figure D-6**). The observed trends in increasing fire severity in various studies appear to be scale-dependent in that these trends were typically for the western United States as a whole. Much of the observed change is either occurring in other areas besides that are encompassed by the range of the northern spotted owl or becomes apparent only when analyzing a larger area that provides a much larger sample size. In such cases, many small changes that are difficult to detect at finer scales can add up to larger, detectable changes for the aggregate area, reflective of how the aggregate number of small emissions of greenhouse gases cumulatively are affecting global climate. In part, trends in the amount of area burned as high severity is a function of total area burned – the more area burned, the greater the amount of high severity fire (Dillon *et al*. 2011a, Miller *et al*. 2012). In the absence of any clear trends, the 50-year projection could fall within a reasonable range of what should be expected.

Given the uncertainty surrounding trends in frequency, size, and severity, our model results may be proven, with time, to either underestimate or overestimate potential fire sizes and severity because of several confounding factors we did not include in the model, such as extreme weather events and interactions with insect outbreaks, management affects to vegetation composition and structure, and climate change. Forest management in particular has potential to alter the outcomes of wildfires ((Pollet and Omi 2002, Prichard *et al*. 2010, Kennedy and Johnson 2014, Wimberly and Liu (in press), Stevens-Rumann *et al*. 2013), although it is less clear if forest management can effectively alter the size distribution of large fires (Cochrane *et al*. 2012). Historically, extremely large wildfires have occurred outside of the areas modeled as highly suitable for large wildfires, consistently associated with either extreme weather events, such as the severe drought and east wind event that preceded the initial Tillamook Burn in 1933, or with heavy, continuous, dry fuels, such as following an insect outbreak (McClure 2005, Morris 1935). The large wildfires that do occur in areas of low suitability west of the Cascade crest tend to be infrequent, but extremely large and severe and typically associated severe drought and high winds (Agee 1993, Littell *et al*. 2009, Davis *et al*. 2011). The above management affects to vegetation, stochastic disturbance, extreme environmental variables, and fire occurrence datasets reflective of long fire return interval timelines were not included in our modeling.

It was far less clear how to incorporate projected climate changes into our model. We can estimate how the large wildfire suitability area may change as climate changes (**Figure D-8**) since LWSMs include climate parameters. But to what extent these changes may influence the frequency of large wildfires is uncertain. Additionally, large wildfires, particularly in moist forests, in the Pacific Northwest are at least modestly associated with the phase of the Pacific Decadal Oscillation (PDO) and not associated with the phase of El Niño-Southern Oscillation (ENSO) (Hessl *et al*. 2004, Gedalof *et al*. 2005). Interannual variability within a given PDO phase appears to have a stronger influence than the interdecadal variability, as well (Gedalof *et al*. 2005). Hessl *et al*. (2004) also found about a 5-year lag between PDO and regional fire years in eastern Washington. The period of record used for this large wildfire analysis does include the latter stages of a cool phase PDO that ended in about 1977 and a warm phase that began in 1977 and appears to have ended around 2005 with considerable interannual variability between circa 1998 and 2005 (Gedalof *et al*. 2005, http://www.jisao.washington.edu/pdo/). Given that we have apparently entered a cool phase PDO, we should expect to see a reduction in the number of fires and acres burned for one or two decades unless the current climate forcing from greenhouse gas emissions "over-rides" the PDO signal. The apparent increase in number of fires and acres burned may be more a reflection of the combined influences of increasing fuel loadings due to land use changes, the PDO phase, and the sign of PDO in a given year than of a trend useful for predicting future losses of northern spotted owl habitat from wildfire.

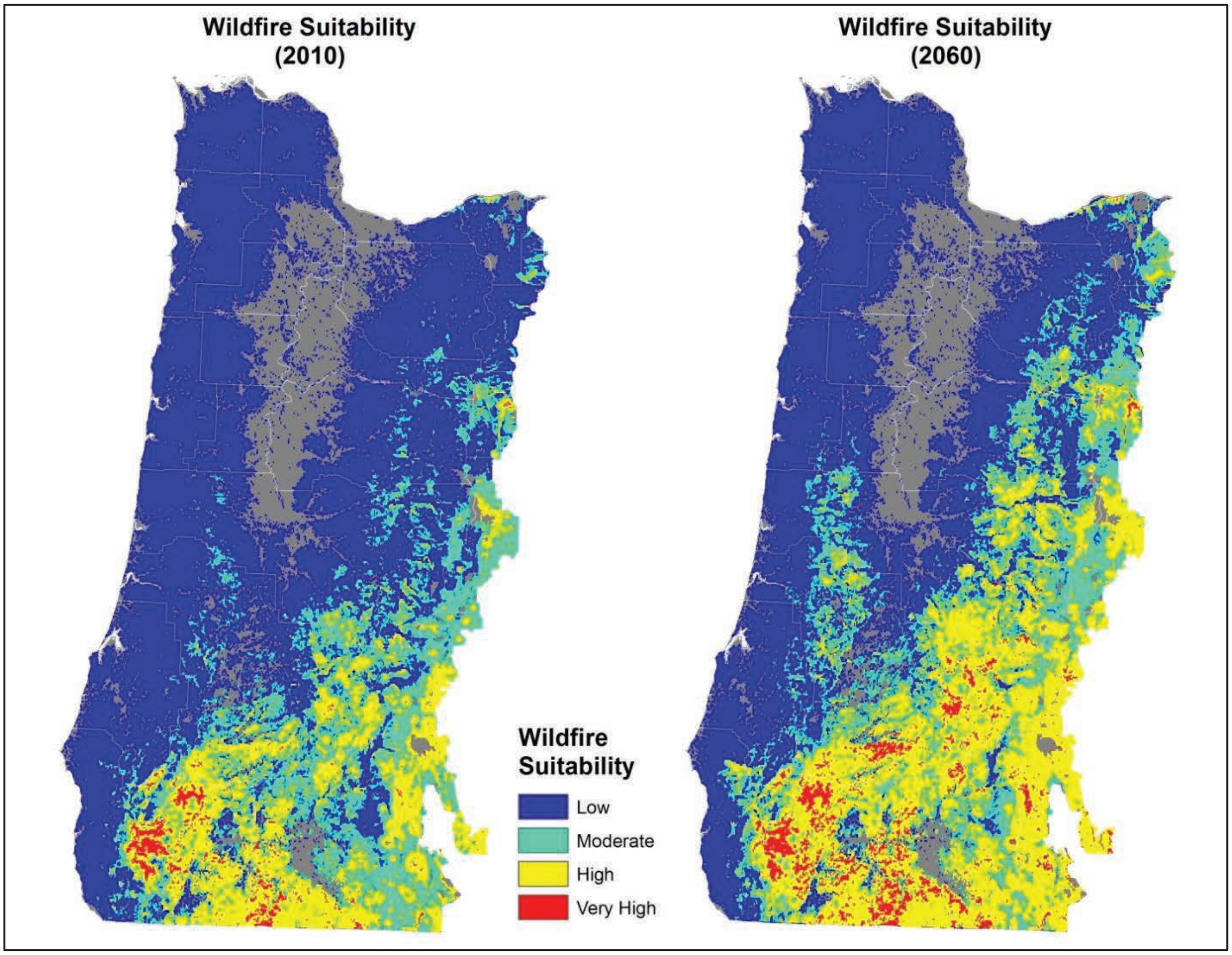

Figure D-8. Comparison of a large wildfire suitability model based on the current climate normal (left) with same model based on projected climate normal changes in temperature and precipitation by 2060 (right) (from Yang *et al*. in prep.).

Most climate change projections that discuss wildfire indicate that fires are expected to get larger and more severe. Several studies have found that as the climate warms in forested ecosystems, burned area increases (Westerling *et al*. 2006, Halofsky *et al*. 2011, Loudermilk *et al*. 2013) with large increases projected by mid-century within the range of the northern spotted owl (McKenzie *et al*. 2004, Spracklen *et al*. 2009, Littell *et al*. 2009 and 2010, Rogers *et al*. 2011). Many of these same studies indicate an increase in overall fire severity as well. However, projections in burned area do not tell us how to adjust the potential number of fires, the relative distribution of the size classes, or the proportion burned in the different severity classes over time. If these projections are accurate, our model results could underestimate the potential to adversely affect northern spotted owl habitat, particularly towards the end of the analysis period.

Lastly, there is the problem that climate change is not linear. Natural variability in the climate system is still an important factor. Thus, overall changes in burned area until mid-century would also not be linear. We expect to continue to experience considerable variability in fire season severity (number of fires, acres burned, and extent of high severity fire). Despite our inability to include these confounding factors, our model successfully predicted the locations of many of the large wildfires that occurred in 2013 and which were ultimately included in the final analysis.

Conclusions

Over the next 50 years, large wildfires will continue to affect suitable northern spotted owl nesting/roosting habitat on BLM-managed lands. Wildfires do not always remove nesting/roosting habitats; often low to moderate severity wildfire alters habitat such that it may still be suitable for nesting and roosting. Some spotted owl studies show that low to moderate severity wildfire may actually benefit the owl, perhaps due to changes in prey species habitat (Bond *et al.* 2002, Ganey *et al*. 2014). However, extensive high severity wildfire usually removes nesting/roosting habitats, decreasing survival and occupancy rates related to loss and fragmentation of suitable nesting and roosting habitat (Clark *et al*. 2011 and 2013, Tempel *et al*. in press).

Although the relationship between large wildfire frequency and severity on owl demography is not fully understood, habitat loss was the primary reason for the bird's decline and subsequent listing as "threatened" under the Endangered Species Act (USDI FWS 1990). The map products produced from this modeling effort will be input into the vegetation modeling process being used to inform the BLM on habitat changes due disturbance and recruitment over the next five decades. The results of that modeling in turn will be used in their northern spotted owl population modeling effort. The results of all these modeling efforts will be used to make more informed management decisions on lands administered by the Bureau of Land Management in western Oregon.

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Appendix E – Air Quality Detailed Analysis Methods

Estimating Emissions from Wildfires

Wildfire emissions are much more difficult to estimate since there are no records of how much material any given fire consumes. Due to differences in the type of available data, BLM used two different methods for estimating particulate emissions from past wildfires and future wildfires.

Past Wildfires

The BLM downloaded records of all wildfires for Coos Bay, Eugene, Medford, Roseburg, and Salem Districts and the Klamath Falls Field Office from the FAMWEB site (http://fam.nwcg.gov/fam-web/weatherfirecd/), imported them into FireFamily Plus 4.1, extracted all wildfires 100+ acres in size and exported this information to an Excel Spreadsheet. Using a variety of methods, the BLM deleted as many fires as could be identified as burning on the Klamath Falls Field Office. The BLM combined the data for Coos Bay, Eugene, and Salem into one group and the data for Medford and Roseburg into one group. Over the 34-year period of record (1980-2013), 7,763 acres burned in the Coos Bay-Eugene-Salem group, 277,605 acres in the Medford-Roseburg group, and 29,447 acres in Klamath Falls Field Office.

The BLM downloaded assessments of burn severity for individual large fires that originated on BLM-administered lands between 1984 and 2012, the latest year available, from the Monitoring Trends in Burn Severity website (http://mtbs.gov/data/individualfiredata.html). The BLM averaged acres burned in the difference categories of unburned to low, low, moderate, high, increased greenness, and mask, and calculated the proportion for each category. Mask areas consist of features such as clouds, water and rock as well as missing lines of image data. The BLM combined high, increased greenness, and mask into a single category; and unburned to low and low into a single category. The resulting proportions of area burned were 59.1 percent low severity, 21.8 percent mixed severity, and 19.0 percent high severity. Because the documented fire severity record is sparse, the BLM used these same severity proportions across the planning area.

Since preburn fuel loadings are not known, BLM used the Fuels Characteristic Class System (FCCS) module in Fuel & Fire Tools (FERA and UW 2014) to select representative fuelbeds (**Table E-1**). Since the BLM did not know the relative proportion of each fuelbed included in each analysis group, it weighted all fuelbeds equally. In order to assess emissions from the different burn severities, BLM multiplied the total number of acres burned in each group by the proportional amount in the low, mixed, and high severity classes and created separate units in Fuel & Fire Tools. For example, the group comprised of Coos Bay, Eugene and Salem Districts had three units labeled low, mixed, and high with assigned acres equaling the proportion estimated for each severity class (**Table E-2**). Each unit consisted of the set of fuelbeds selected through FCCS. The Consume module in Fuel & Fire Tools used this information to calculate greenhouse gas emissions for CO_2 and CH_4. Since the Consume module only uses 1000-hour and duff fuel moisture to drive the consumption algorithms, the BLM’s could not fully meet the intent of adjusting the amount of live fuel consumed.

Table E-1. Fuels Characteristic Classification System fuelbeds used in each analysis group to estimate particulate emissions from wildfire.

District/ Field Office	Fuelbed Number	Fuelbed Name
Coos Bay – Eugene – Salem	2	Western hemlock – western redcedar – Douglas-fir
	5	Douglas-fir – white fir
	8	Western hemlock – Douglas-fir – western redcedar/vine maple
	9	Douglas-fir – western hemlock – western redcedar/vine maple
	10	Western hemlock – Douglas-fir – Sitka spruce
	11	Douglas-fir – western hemlock – Sitka spruce
	18	Douglas-fir/oceanspray
	24	Pacific ponderosa pine – Douglas-fir
	52	Douglas-fir – Pacific ponderosa pine/oceanspray
	208	Grand fir – Douglas-fir
	322	Sitka spruce – western hemlock
Klamath Falls	20	Western juniper/curl-leaf mountain mahogany
	24	Pacific ponderosa pine – Douglas-fir
	25	Pinyon – Utah juniper
	53	Pacific ponderosa pine
	55	Western juniper/sagebrush
	58	Western juniper/sagebrush
	67	Interior ponderosa pine – Douglas-fir
	210	Pinyon – Utah juniper
Medford – Roseburg	2	Western hemlock – western redcedar – Douglas-fir
	4	Douglas-fir/ceanothus
	5	Douglas-fir – white fir
	6	Oregon white oak – Douglas-fir
	7	Douglas-fir – sugar pine – tanoak
	15	Jeffrey pine – red fir – white fir/greenleaf - snowbrush
	16	Jeffrey pine – ponderosa pine – Douglas-fir – California black oak
	24	Pacific ponderosa pine – Douglas-fir
	37	Ponderosa pine – Jeffrey pine
	38	Douglas-fir – madrone – tanoak
	39	Sugar pine – Douglas-fir – oak
	208	Grand fir – Douglas-fir
	215	Douglas-fir – madrone – tanoak
	239	Douglas-fir – sugar pine – tanoak

Table E-2. Acres, fuel moistures, and targeted consumption rates for live woody fuels in each severity class for past wildfires.

	Low Severity	Mixed Severity	High Severity
	Consume Inputs		
1000-hour Fuel Moisture	20%	10%	6%
Duff Moisture	200%	100%	10%
Shrub Black	-	50%	100%
Crown Black	-	50%	100%
District/Field Office	**Acres In Each Severity Class**		
Coos Bay – Eugene – Salem	1,475	1,692	4,588
Klamath Falls	5,595	6,419	17,403
Medford – Roseburg	52,745	60,518	164,065

Large fires that originate on BLM-administered lands typically burn onto other lands. However, the future wildfire acres burned applied only to BLM-administered lands. In order to provide an appropriate comparison, BLM had to adjust the emissions from past fires downward. BLM calculated the average number of acres burned using the data for fires that originated on BLM-administered lands and compared that to the average number of acres burned just on BLM-administered lands as reported in Davis *et al*. (2014, p. 7), resulting in a reduction of 62 percent.

Future Wildfires

The Woodstock harvest model included wildfire under all alternatives, including No Action, with the number of polygons affected and the type of fire held constant across all alternatives. The BLM modeled only high and mixed severity fire. To estimate particulate emissions from future wildfires, the BLM used the estimated acres burned in mixed and high severity fires each period from the Woodstock model. Using the same set of FCCS fuelbeds from **Table E-1** and the same fuel moistures and targeted consumption rates from **Table E-2**, the BLM used Consume to estimate the per acre emissions for particulate matter. Since low severity fire was not included in Woodstock under the assumption that there was no impact to volume, BLM assumed no change in the proportional relationship between low, mixed, and high severity fire and used the acres burned in mixed and high severity combined to estimate the acres burned in low severity fire. The BLM summarized the results on an average annual basis for each decade analyzed.

Estimating Emissions from Fuels Treatment

Past Fuels Treatments

Particulate emissions from past prescribed burning were based on estimated tons of biomass consumed as reported to ODF under the state's smoke management plan (http://www.oregon.gov/odf/pages/fire/smp/smkmgtannualrpts.aspx). ODF's reports include prescribed burns on BLM-administered lands in the Other Federal category, which includes U.S. Fish and Wildlife Service and Bureau of Indian Affairs, and consolidates prescribed burns for both Lake and Klamath Counties into a single number. The BLM conducts most of prescribed burning in the Other Federal category, as indicated by the harvest records. The BLM calculated the particulates emitted from burning wood by multiplying the tons consumed with standardized emission factors for PM_{10} and $PM_{2.5}$ (Hardy *et al*. 2001, p. 100).

Future Fuels Treatments

The BLM used two different methods to estimate emissions from future prescribed burning. For pile burning (hand piles, machine piles, and landing piles), the BLM used a standard description for each type of pile (size, shape, and composition) and a standard estimate of the number of piles per acre to estimate emissions per acre using the pile utility in Consume. The BLM then multiplied these estimates by the number of acres treated by piling. The Woodstock model provided estimates of the acres treated by each type of piling method for harvest treatments and historical averages used for the hazardous fuels program. For broadcast and under burning, BLM selected a single representative fuel bed for each district that would result in the approximate number of tons consumed that had been estimated by past burning, as reported by the team’s fuels specialist.

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Appendix F – Areas of Critical Environmental Concern

This appendix provides detailed information about Areas of Critical Environmental Concern.
This section contains detailed information about Areas of Critical Environmental Concern .**Table F-1** shows Areas of Critical Environmental Concern by alternative, includes relevant and important value categories, acreages and planning status. **Table F-2** provides information about the special management direction that would be applied if the area becomes designated. **Table F-3** contains more specific information about the relevant and important values for each Area of Critical Environmental Concern.

Table F-1. Areas of Critical Environmental Concern designations by alternative.

District/ Field Office	Location # on Map F-1	ACEC Name	Total Area (Acres)	Alt. A	Alt. B	Alt. C	Alt. D	Relevant and Important Value Category
Coos Bay	1	Brownson Ridge	398	Yes	Yes	Yes_a	Yes_a	Natural processes
	2	Cherry Creek	579	Yes	Yes	Yes	Yes	Natural processes, fish and wildlife
	3	China Wall	304	Yes	Yes	Yes	Yes_a	Historical, natural processes
	4	Euphoria Ridge	241	Yes	Yes	Yes	Yes	Natural processes
	5	Hunter Creek Bog	721	Yes	Yes	Yes	Yes	Cultural, fish and wildlife, natural processes
	6	New River	1,135	Yes	Yes	Yes	Yes	Fish and wildlife, natural processes
	7	North Fork Chetco	604	Yes	Yes	Yes	Yes	historical, fish and wildlife
	8	North Fork Coquille River	311	Yes	Yes	Yes	Yes_a	Fish and wildlife, natural processes
	9	North Fork Hunter Creek	1,924	Yes	Yes	Yes	Yes	Cultural, historical, fish and wildlife, natural processes
	10	North Spit	709	Yes	Yes	Yes	Yes	Fish and wildlife, natural processes
	11	North Spit Addition	45	Yes	Yes	Yes	Yes	Natural processes
	12	Rocky Peak	1,827	Yes	Yes	Yes	Yes	Natural processes
	13	Roman Nose	205	Yes	Yes	Yes	Yes_a	Natural processes
	14	Steel Creek	1,091	Yes	Yes	Yes	Yes	Fish and wildlife, natural processes
	15	Tioga Creek	41	Yes	Yes	Yes	Yes	Fish and wildlife
	16	Upper Rock Creek	472	Yes	Yes_a	Yes_a	Yes_a	Fish and wildlife, natural processes
	17	Wassen Creek	3,395	Yes	Yes	Yes	Yes_a	Fish and wildlife, natural processes
Eugene	18	Camas Swale	315	Yes	Yes	Yes	Yes	Natural processes
	19	Cottage Grove Old Growth	76	No_a	No_a	No_a	Yes	Natural processes
	20	Cougar Mountain Yew Grove	9	No_a	No_a	No_a	No_a	Natural processes
	21	Dorena Prairie	10	Yes	Yes	Yes	Yes	Natural processes
	22	Esmond Lake	351	Yes	Yes	No_a	Yes_a	Fish and wildlife, natural processes
	23	Ferguson Creek	23	Yes	Yes	Yes	Yes	Natural processes
	24	Fox Hollow	161	Yes	Yes	Yes	Yes	Natural processes
	25	Garoutte Prairie	46	Yes	Yes	Yes	Yes	Fish and wildlife, natural processes
	26	Grandmother's Grove	63	Yes	Yes	Yes_a	Yes_a	Fish and wildlife, natural processes
	27	Grassy Mountain	72	Yes_a	Yes_a	Yes_a	Yes_a	Natural processes
	28	Heceta Sand Dunes	210	Yes	Yes	Yes	Yes	Natural processes
	29	Horse Rock Ridge	378	Yes	Yes	Yes	Yes	Natural processes
	30	Hult Marsh	167	Yes	Yes	Yes	Yes	Natural processes
	31	Jordan Creek	21	Yes	Yes	Yes	Yes	Natural processes
	32	Lake Creek Falls	54	Yes	Yes	Yes	Yes	Cultural, historical, fish and wildlife, natural processes, natural hazards
	33	Lorane Ponderosa Pine	106	Yes	Yes	Yes	Yes	Fish and wildlife, natural processes
	34	Low Elevation Headwaters of the McKenzie River	10,502	Yes	Yes	Yes	Yes	Fish and wildlife, natural processes
	35	McGowan Meadow	75	Yes_a	Yes_a	Yes_a	Yes_a	Fish and wildlife, natural processes
	36	Mohawk	289	Yes	Yes	Yes	Yes	Natural processes
	37	Nails Creek	57	Yes	Yes	Yes	Yes	Natural processes

District/ Field Office	Location # on Map F-1	ACEC Name	Total Area (Acres)	Alt. A	Alt. B	Alt. C	Alt. D	Relevant and Important Value Category
	38	Oak Basin Prairies	224	Yes	Yes	Yes	Yes	Fish and wildlife, natural processes
	39	Upper Elk Meadows	214	Yes	Yes	Yes	Yes	Natural processes
	40	Upper Willamette Valley Margin	5,994	Yes	Yes	Yes	Yes	Fish and wildlife, natural processes
	41	Willamette Valley Prairie Oak and Pine Area	1,664	Yes	Yes	Yes	Yes	Fish and wildlife, natural processes
Klamath Falls	42	Bumpheads	113	Yes	Yes	Yes	Yes	Cultural, natural processes
	43	Old Baldy	470	Yes	Yes	Yes	Yes	Natural processes
	44	Spencer Creek	137	Yes	No_a	No_a	No_a	Fish and wildlife, natural processes
	45	Surveyor	182	Yes	Yes	Yes	Yes	Fish and wildlife, natural processes
	46	Tunnel Creek	81	Yes	Yes	Yes	Yes	Fish and wildlife, natural processes
	47	Upper Klamath River	5,206	Yes	No_a	No_a	Yes	Cultural, historical, scenic, fish and wildlife
	48	Upper Klamath River Addition	874	Yes	No_a	No_a	Yes	Cultural, scenic, fish and wildlife, natural processes
	49	Yainax Butte	706	Yes	Yes	Yes	Yes	Natural processes
Medford	50	Baker Cypress	48	Yes	Yes	Yes	Yes	Cultural, scenic, fish and wildlife, natural processes
	51	Bobby Creek	1,914	Yes	Yes	Yes	Yes	Fish and wildlife, natural processes
	52	Brewer Spruce	1,704	Yes	Yes	Yes	Yes	Natural processes
	53	Cobleigh Road	1,096	Yes	Yes	Yes	Yes	Cultural, natural processes
	54	Dakubetede	1,785	Yes	Yes	Yes	Yes	Cultural, natural processes
	55	Deer Creek	4,090	Yes	Yes	Yes	Yes	Fish and wildlife, natural processes
	56	East Fork Whiskey Creek	3,187	Yes	Yes	Yes	Yes	Natural processes
	57	Eight Dollar Mountain	1,250	Yes	Yes	Yes	Yes	Natural processes
	58	French Flat	652	Yes	Yes	Yes	Yes	Natural processes
	59	Grayback Glades	1,018	Yes	Yes	Yes	Yes	Natural processes
	60	Green Springs Mt Scenic	959	Yes	Yes	Yes	Yes	Scenic
	61	Hole-In-The-Rock	63	Yes	Yes	Yes	Yes	Scenic, natural processes
	62	Holton Creek	421	Yes	Yes	Yes	Yes	Natural processes
	63	Hoxie Creek	256	Yes	No_a	No_a	Yes	Fish and wildlife, natural processes
	64	Iron Creek	285	Yes	Yes	Yes	Yes	Fish and wildlife, natural processes
	65	King Mountain Rock Garden	67	Yes	Yes	Yes	Yes	Natural processes
	66	Lost Lake	386	Yes	Yes	Yes	Yes	Natural processes
	67	Moon Prairie	91	Yes	No_a	Yes	Yes	Natural processes
	68	North Fork Silver Creek	499	Yes	Yes	Yes	Yes	Natural processes
	69	Old Baldy	470	Yes	Yes	Yes	Yes	Natural processes
	70	Pickett Creek	78	Yes	Yes	Yes	Yes	Natural processes
	71	Pipe Fork	516	Yes	Yes	Yes	Yes	Natural processes
	72	Poverty Flat	29	Yes	Yes	Yes	Yes	Natural processes
	73	Reeves Creek	118	Yes	Yes	Yes	Yes	Natural processes
	74	Rough and Ready	1,189	Yes	Yes	Yes	Yes	Natural processes

District/ Field Office	Location # on Map F-1	ACEC Name	Total Area (Acres)	Alt. A	Alt. B	Alt. C	Alt. D	Relevant and Important Value Category
	75	Round Top Butte	606	Yes	Yes	Yes	Yes	Natural processes
	76	Sterling Mine Ditch	143	Yes	Yes	Yes	Yes	Cultural, natural processes
	77	Table Rocks	1,330	Yes	Yes	Yes	Yes	Cultural, scenic, fish and wildlife, natural processes
	78	Tin Cup	82	Yes	Yes	Yes	Yes	Fish and wildlife, natural processes
	79	Waldo-Takilma	1,758	Yes	Yes	Yes	Yes	Cultural, historical, natural processes
	80	West Fork Illinois River	1,284	Yes	Yes	Yes	Yes	Natural processes
	81	Woodcock Bog	264	Yes	Yes	Yes	Yes	Natural processes
Roseburg	82	Bear Gulch	351	Yes	Yes	Yes	Yes	Natural processes
	83	Beatty Creek	1,235	Yes	Yes	Yes	Yes	Natural processes
	84	Bushnell-Irwin Rocks	1,089	Yes	Yes	Yes	Yes	Natural processes
	85	Callahan Meadows	82	Yes	Yes	Yes	Yes	Natural processes
	86	Myrtle Island	20	Yes	Yes	Yes	Yes	Natural processes
	87	North Bank	6,179	Yes	Yes	Yes	Yes	Fish and wildlife
	88	North Myrtle Creek	453	Yes	Yes	Yes	Yes	Natural processes
	89	Red Pond	141	Yes	Yes	Yes	Yes	Natural processes
	90	Tater Hill	304	Yes	Yes	Yes	Yes	Natural processes
Salem	91	Beaver Creek	24	Yes	Yes	Yes	Yes	Natural processes
	92	Crabtree Complex	1,251	Yes	Yes	Yes	Yes	Scenic, fish and wildlife, natural processes
	93	Elk Creek	940	Yes	Yes	Yes	Yes	Fish and wildlife, natural processes
	94	Forest Peak	160	Yes	Yes	Yes	Yes	Natural processes
	95	Grass Mountain	1,305	Yes	Yes	Yes	Yes	Natural processes
	96	High Peak - Moon Creek	1,500	Yes	Yes	Yes	Yes	Fish and wildlife, natural processes
	97	Little North Fork Wilson River	1,825	Yes	Yes	Yes	Yes	Fish and wildlife, natural processes
	98	Little Sink	80	Yes	Yes	Yes	Yes	Natural processes
	99	Lost Prairie	60	Yes	Yes	Yes	Yes	Natural processes
	100	Lower Scappoose Eagle	314	Yes	Yes	No_a	Yes	Fish and wildlife
	101	Mary's Peak	491	Yes	Yes	Yes	Yes	Scenic, natural processes
	102	McCully Mountain	102	Yes	Yes	Yes	Yes	Scenic, fish and wildlife, natural processes
	103	Middle Santiam Terrrace	206	Yes	Yes	Yes	Yes	Cultural, natural processes
	104	Mill Creek Ridge	113	Yes	Yes	Yes	Yes	Fish and wildlife, natural processes
	105	Molalla Meadows	144	Yes	Yes	Yes	Yes	Scenic, fish and wildlife, natural processes
	106	Nestucca River	1,179	Yes	Yes	Yes	Yes	Scenic, fish and wildlife
	107	Rickreall Ridge	604	Yes	Yes	No_a	Yes	Natural processes
	108	Saddle Bag Mountain	304	Yes	Yes	Yes	Yes	Natural processes
	109	Sandy River	11,045	Yes	Yes	Yes	Yes	historical, scenic, fish and wildlife, natural processes
	110	Silt Creek	118	Yes	Yes	Yes	Yes	Historical, fish and wildlife, natural processes
	111	Snow Peak	1,186	Yes	Yes	Yes	Yes	Historical, fish and wildlife, natural processes
	112	Soosap Meadows	343	Yes	Yes	Yes	Yes	Natural processes
	113	The Butte	41	Yes	Yes	Yes	Yes	Natural processes
	114	Valley of the Giants	1,667	Yes	Yes	Yes	Yes	Scenic, fish and wildlife, natural processes

District/ Field Office	Location # on Map F-1	ACEC Name	Total Area (Acres)	Alt. A	Alt. B	Alt. C	Alt. D	Relevant and Important Value Category
	115	Walker Flat	10	Yes	Yes	Yes	Yes	Natural processes
	116	Waterloo	8	Yes	Yes	Yes	Yes	Natural processes
	117	White Rock Fen	66	Yes	Yes	Yes	Yes	Fish and wildlife, natural processes
	118	Wilhoit Springs	146	Yes_a	Yes_a	No_a	No_a	Historical, natural processes
	119	Williams Lake	74	Yes	Yes	Yes	Yes	Natural processes
	120	Yaquina Head	91	Yes	Yes	Yes	Yes	Cultural, scenic, fish and wildlife, natural processes
	121	Yellowstone Creek	805	Yes	Yes	Yes	Yes	Scenic, fish and wildlife, natural processes

Table F-2. Management direction for Areas of Critical Environmental Concern.

District/ Field Office	ACEC Name	Off Highway Vehicle Designation	Leasable Mineral Entry	Salable Mineral Entry	Locatable Mineral Entry	Timber Harvest	Grazing Management
Coos Bay	Brownson Ridge	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	N/A Geology not suitable	Manage vegetation (including timber harvest) to promote late-successional structure in younger stands	N/A
	Cherry Creek	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Withdrawn in 1965 by PLO3530	No timber harvest	N/A
	China Wall	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	N/A Geology not suitable	Manage vegetation (including timber harvest) to restore and maintain bald knobs and meadow habitat	N/A
	Euphoria Ridge	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	N/A Geology not suitable	No timber harvest	N/A
	Hunter Creek Bog	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation to restore and maintain bog habitat	N/A
	New River	Closed (portion)/Limited (portion): OHV roads and trails have been officially designated within Limited area	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation to restore bog and meadow habitat	N/A
	North Fork Chetco	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation (including timber harvest) to promote late-successional structure in younger stands. Conduct treatments to control sudden oak death disease	N/A
	North Fork Coquille River	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	N/A Geology not suitable	Manage vegetation (including timber harvest) to promote late-successional structure in younger stands	N/A
	North Fork Hunter Creek	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation to restore and maintain meadows, oak habitat, and Jeffery pine savannah	N/A
	North Spit	OHV roads and trails have been officially designated	Open – No Surface Occupancy	Closed	Withdrawn in 2000	Manage vegetation to restore and maintain wetland habitat	N/A
	North Spit Addition	OHV roads and trails have been officially designated	Open – No Surface Occupancy	Closed	Withdrawn in 2000	N/A	N/A
	Rocky Peak	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation to restore and maintain bald knobs/meadow habitat	N/A
	Roman Nose	Limited to existing roads and trails	Open – No Surface Occupancy	Limit salable to existing quarry	N/A Geology not suitable	Manage vegetation (including timber harvest) to restore and maintain meadow habitat	N/A
	Steel Creek	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	N/A Geology not suitable	No timber harvest	N/A

District/ Field Office	ACEC Name	Off Highway Vehicle Designation	Leasable Mineral Entry	Salable Mineral Entry	Locatable Mineral Entry	Timber Harvest	Grazing Management
	Tioga Creek	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	N/A Geology not suitable	No timber harvest	N/A
	Upper Rock Creek	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	N/A Geology not suitable	Manage vegetation (including timber harvest) to promote late-successional structure in younger stands	N/A
	Wassen Creek	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	N/A Geology not suitable	Manage vegetation (including timber harvest) to promote late-successional structure in younger stands	N/A
Eugene	Camas Swale	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	N/A	Maintenance of existing forest.	
	Cottage Grove Old Growth	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	N/A Geology not suitable	No timber harvest	
	Cougar Mountain Yew Grove	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	
	Dorena Prairie	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	N/A Already withdrawn as part of the Dorena Lake withdrawal	N/A	
	Esmond Lake	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	N/A Geology not suitable	Manage young stands for late-successional forest. Preclude harvest in existing late successional.	N/A
	Ferguson Creek	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	N/A Geology not suitable	Restoration management for prairie/oak/woodland.	N/A
	Fox Hollow	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	N/A Geology not suitable	Restoration and maintenance harvest.	N/A
	Garoutte Prairie	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	N/A Already withdrawn as part of the Dorena Lake withdrawal	N/A	N/A
	Grandmother's Grove	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	N/A Geology not suitable	Maintain, protect, or restore natural processes or systems. Withdraw from planned commercial extraction activities including timber harvest.	N/A
	Grassy Mountain	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Forest management to maintain hydrological integrity of meadow/grassland.	N/A
	Heceta Sand Dunes	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Forest management for restoration management of dunes.	N/A

District/ Field Office	ACEC Name	Off Highway Vehicle Designation	Leasable Mineral Entry	Salable Mineral Entry	Locatable Mineral Entry	Timber Harvest	Grazing Management
	Horse Rock Ridge	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Forest management for maintenance and restoration of R&Is	N/A
	Hult Marsh	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	N/A Geology not suitable	Forest management to maintain scenic quality and hydrologic function.	N/A
	Jordan Creek	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	N/A Geology not suitable	Forest restoration management for pine/oak/woodland.	N/A
	Lake Creek Falls	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	N/A Geology not suitable	Forest management would have no bearing on R&Is.	N/A
	Lorane Ponderosa Pine	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	N/A Geology not suitable	Forest management for maintenance and restoration of R&Is.	N/A
	Low Elevation Headwaters of the McKenzie River	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	WSR corridor is already withdrawn and would remain; Recommend for withdrawal area originally identified as Marten Bald; remainder of ACEC = N/A	Timber management as appropriate to manage or enhance R&I values.	N/A
	McGowan Meadow	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	N/A
	Mohawk	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Forest management for maintenance and restoration of R&Is.	N/A
	Nails Creek	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	N/A Geology not suitable	Forest management for maintenance and restoration of R&Is.	N/A
	Oak Basin Prairies	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Forest management for maintenance and restoration of R&Is.	N/A
	Upper Elk Meadows	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Forest management for maintenance and restoration of R&Is	N/A
	Upper Willamette Valley Margin	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Forest management for maintenance and restoration of R&Is.	N/A
	Willamette Valley Prairie Oak and Pine Area	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Forest management for maintenance and restoration of R&Is.	N/A
Klamath Falls	Bumpheads	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	N/A	Maintain gap fence to exclude livestock.
	Old Baldy	Closed to off-highway	Open – No Surface	Closed	Recommend for	No timber harvest	Closed

District/ Field Office	ACEC Name	Off Highway Vehicle Designation	Leasable Mineral Entry	Salable Mineral Entry	Locatable Mineral Entry	Timber Harvest	Grazing Management
		vehicle use	Occupancy		withdrawal		
	Spencer Creek	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Rx conditioned to Maintain Relevant and Important Values	Closed
	Surveyor	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	Open with stipulations: Fencing to control cattle grazing.
	Tunnel Creek	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	Open with stipulations: Fencing to keep cattle out of sensitive wetland areas.
	Upper Klamath River	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Rx conditioned to Maintain Relevant and Important Values	Current condition
	Upper Klamath River Addition	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Rx conditioned to Maintain Relevant and Important Values	Current condition
	Yainax Butte	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	Current condition
Medford	Baker Cypress	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Low potential, withdrawal not necessary	Manage vegetation for fire resiliency and to stimulate regeneration of Baker's cypress.	N/A
	Bobby Creek	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	N/A
	Brewer Spruce	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	N/A
	Cobleigh Road	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Low potential, withdrawal not necessary	Manage vegetation to improve and maintain habitat for Gentner's fritillary.	Open with stipulations: Monitor important values and fence or implement other protection measures if needed.
	Dakubetede	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation for fire resiliency and to improve and maintain habitat for Gentner's fritillary.	N/A
	Deer Creek	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Most of ACEC included in Crooks Creek withdrawal expansion (in process)	Buffer caves. Manage vegetation for fire resiliency.	N/A
	East Fork Whiskey Creek	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Limited treatments for restoration and fire resiliency, potentially resulting in	N/A

District/ Field Office	ACEC Name	Off Highway Vehicle Designation	Leasable Mineral Entry	Salable Mineral Entry	Locatable Mineral Entry	Timber Harvest	Grazing Management
						commercial products.	
	Eight Dollar Mountain	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation for fire resiliency and to improve and maintain habitat for rare plants.	N/A
	French Flat	Closed to off-highway vehicle use: Federal Register Notice, June 8, 1992.	Open – No Surface Occupancy	Closed	Recommend for withdrawal, but note existing POO.	Manage vegetation for fire resiliency and to improve and maintain habitat for Cook's lomatium.	N/A
	Grayback Glades	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	N/A
	Green Springs Mt Scenic	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Low potential, withdrawal not necessary	Manage vegetation to maintain meadows and oak woodlands.	Open with stipulations: Monitor important values and fence or implement other protection measures if needed.
	Hole-In-The-Rock	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Low potential, withdrawal not necessary	Maintain no-harvest buffer around arch to protect from damage and to maintain scenic value.	Open with stipulations: Monitor important values and fence or implement other protection measures if needed.
	Holton Creek	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	N/A
	Hoxie Creek	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Low potential, withdrawal not necessary	Limited treatments for restoration and fire resiliency, potentially resulting in commercial products.	Open with stipulations: Monitor important values and fence or implement other protection measures if needed.
	Iron Creek	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	N/A	N/A
	King Mountain Rock Garden	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Low potential, withdrawal not necessary	Manage vegetation for fire resiliency.	N/A
	Lost Lake	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Low potential, withdrawal not necessary	No timber harvest	Closed
	Moon Prairie	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Low potential, withdrawal not necessary	N/A	Open with stipulations: Monitor important values and fence or implement other protection measures if

District/ Field Office	ACEC Name	Off Highway Vehicle Designation	Leasable Mineral Entry	Salable Mineral Entry	Locatable Mineral Entry	Timber Harvest	Grazing Management
							implement other protection measures if needed.
	North Fork Silver Creek	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	N/A
	Old Baldy	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Low potential, withdrawal not necessary	No timber harvest	Closed
	Pickett Creek	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation for fire resiliency and to improve and maintain habitat for Gentner's fritillary.	N/A
	Pipe Fork	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	N/A
	Poverty Flat	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Low potential, withdrawal not necessary	N/A	Closed: maintain existing fences.
	Reeves Creek	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation for fire resiliency and to improve and maintain habitat for Cook's lomatium.	N/A
	Rough and Ready	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation to improve and maintain habitat for Cook's lomatium.	N/A
	Round Top Butte	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Low potential, withdrawal not necessary	Limited treatments for restoration and fire resiliency, potentially resulting in commercial products.	Closed
	Sterling Mine Ditch	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Low potential, withdrawal not necessary	N/A	N/A
	Table Rocks	Closed (portion)/Limited (portion): Closed except for administrative road on Parcel 2 (TNC easement providing access to PacifiCorp, FAA, BLM to top of Upper Table Rock, entering BLM at SE corner of S 34 and SW corner of S 35.)	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Limited treatments for restoration and fire resiliency, potentially resulting in commercial products.	Closed
	Tin Cup	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Low potential, withdrawal not	Limited treatments for restoration and fire resiliency, potentially resulting in	Open with stipulations: Monitor important

District/ Field Office	ACEC Name	Off Highway Vehicle Designation	Leasable Mineral Entry	Salable Mineral Entry	Locatable Mineral Entry	Timber Harvest	Grazing Management
					necessary	commercial products.	values and fence or implement other protection measures if needed.
	Waldo-Takilma	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal, but note existing POO.	Manage vegetation for fire resiliency and to protect or maintain cultural landscapes and rare plant habitat.	N/A
	West Fork Illinois River	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	N/A
	Woodcock Bog	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	N/A
Roseburg	Bear Gulch	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	N/A
Roseburg	Beatty Creek	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	N/A
Roseburg	Bushnell-Irwin Rocks	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	N/A
Roseburg	Callahan Meadows	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	N/A
Roseburg	Myrtle Island	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	N/A
Roseburg	North Bank	Closed (portion)/Limited (portion): Closed except for access road to Comstock day use area which is controlled by a gate. The gate is open four days/week.	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation to maintain oak woodlands according to the 2001 North Bank Habitat Management Area/ACEC Record of Decision, Habitat Management Plan and Monitoring Plan	N/A
Roseburg	North Myrtle Creek	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	N/A
Roseburg	Red Pond	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	N/A
Roseburg	Tater Hill	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	N/A
Salem	Beaver Creek	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation to maintain oak woodland and native prairie flora.	N/A
Salem	Crabtree Complex	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation with limited timber harvests in the northeast edge of the Outstanding Natural Area to maintain and enhance the scenic quality and native plant communities.	N/A

District/ Field Office	ACEC Name	Off Highway Vehicle Designation	Leasable Mineral Entry	Salable Mineral Entry	Locatable Mineral Entry	Timber Harvest	Grazing Management
	Elk Creek	limited to existing roads	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation with selection harvests and variable retention to promote the development or maintenance of late seral habitat in previously entered stands.	N/A
	Forest Peak	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	N/A
	Grass Mountain	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	N/A
	High Peak - Moon Creek	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	N/A
	Little North Fork Wilson River	Limited to existing roads	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation to promote the development or maintenance of late seral habitat.	N/A
	Little Sink	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	N/A
	Lost Prairie	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation to maintain and enhance the fen and meadow habitats, rare botanical species occurrences, mixed conifer species, and older forest structure. Management can include limited timber harvest in young stands to promote the development of old growth characteristics and to reduce fire hazards.	N/A
	Lower Scappoose Eagle	Closed (portion)/Limited (portion): Limited portion on road going through the northeast corner of section 35. Closed elsewhere.	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation to maintain or enhance Bald Eagle habitat.	N/A
	Mary's Peak	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation to enhance scenic, botanical, and wildlife habitat values.	N/A
	McCully Mountain	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation to maintain meadow and forest edge habitat. Permit limited timber harvest in the eastern portion of Section 29.	N/A
	Middle Santiam Terrace	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	N/A

District/ Field Office	ACEC Name	Off Highway Vehicle Designation	Leasable Mineral Entry	Salable Mineral Entry	Locatable Mineral Entry	Timber Harvest	Grazing Management
	Mill Creek Ridge	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation primarily to enhance oak and meadow habitats and to maintain botanical, wildlife and natural system values. Limited timber harvests designed with the maintenance of the relevant and important values in mind would be permitted.	N/A
	Molalla Meadows	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation to enhance oak woodland, native prairie flora and to maintain the scattered Oregon white oaks. Vegetation management may include limited timber harvest with an emphasis on maintaining the relevant and important values.	N/A
	Nestucca River	Limited to existing roads	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation to maintain and enhance scenic and wildlife values	N/A
	Rickreall Ridge	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation (including timber harvests) to enhance the mosaic of special habitats and plant communities, with emphasis on protecting native plant communities and microclimate around the ridge in the northeastern corner.	N/A
	Saddle Bag Mountain	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	N/A
	Sandy River	Limited to existing roads and trails	Open – No Surface Occupancy for most of the ACEC, minerals are owned by non-federal entities in portions of parcels 14 and 33	Closed for most of the ACEC, minerals are owned by non-federal entities in portions of parcels 14 and 33	Recommend for withdrawal for most of the ACEC, minerals are owned by non-federal entities in portions of parcels 14 and 33	Manage vegetation to maintain or restore native plant communities through invasive plant treatments and native plantings. Permit limited timber harvests, designed to not detract from the maintenance of the relevant and important values, in selected parcels.	N/A
	Silt Creek	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest: Active landslide area	N/A
	Snow Peak	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation, including limited timber harvests, with emphasis on	N/A

District/ Field Office	ACEC Name	Off Highway Vehicle Designation	Leasable Mineral Entry	Salable Mineral Entry	Locatable Mineral Entry	Timber Harvest	Grazing Management
						protecting and maintaining native plant communities and wildlife habitat.	
	Soosap Meadows	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation, including uneven-age management, with an emphasis on maintaining existing hydrologic conditions and the natural ecology of the subalpine meadows.	N/A
	The Butte	limited to existing road	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	N/A
	Valley of the Giants	Limited to existing roads and trails	BLM does not own sub-surface mineral rights, except for 07S-08W-31 NE1/4.	Closed	Recommend for withdrawal	Manage vegetation, including uneven-age and variable retention timber harvests, with an emphasis on reducing fire hazards and developing late-successional structure.	N/A
	Walker Flat	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest: Manage vegetation to maintain meadow habitat	N/A
	Waterloo	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	N/A
	White Rock Fen	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	No timber harvest	N/A
	Wilhoit Springs	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Limit timber harvests to uneven-age management or variable retention in the young stand in the southern portion of the ACEC.	N/A
	Williams Lake	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation, including uneven-age and variable retention timber harvests, with an emphasis on maintaining existing hydrologic conditions to protect the fragile lakeside native plant community.	N/A
	Yaquina Head	Closed to off-highway vehicle use	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation management to enhance the multiple relevant and important values, with emphasis on protecting native plant communities and meadow habitat. Thick stands of coastal pine may need to be thinned.	N/A
	Yellowstone Creek	Limited to existing roads and trails	Open – No Surface Occupancy	Closed	Recommend for withdrawal	Manage vegetation to promote old growth characteristics and reduce fire hazards.	N/A

Table F-3. Specific relevant and important values.

District/ Field Office	ACEC Name	Status	Relevant and Important Value Category			
			Historic, Cultural, Scenic	Fish and Wildlife	Natural Process or System	Natural Hazard
Coos Bay	Brownson Ridge	Potential		Northern spotted owl (FT) site and mostly contains occupied marbled murrelet (FT) site. four Survey and Manage (S&M) fungi: (*Phaeocollybia attenuata*, *P. piceae*, *P. sipei* and *Sparassis crispa*).	Well-developed Port-Orford-cedar stand with all age classes. Potential to fill ONHP Cell for Port Orford cedar/Douglas-fir forest with dry shrubs/forbs.	
	Cherry Creek RNA	Existing		Northern spotted owl (FT) site and portion contains occupied marbled murrelet (FT) site. Two Survey and Mange species (*Diplophyllum plicatum*) and (*Phaeocollybia pseudofestiva*) found in ACEC.	Mid 1700s birthdate with remnant 445 year old Douglas fir. Fills two (Western hemlock/oxalis; Western hemlock/rhododendron-Oregon-grape) ONHP Coast Range Ecological Cells The RNA/ACEC preserves examples of natural ecosystems for comparison with those influenced by humans.	
	China Wall	Existing	Remnant of historic Brewster Trail; two prehistoric sites, all eligible National Register of Historic Places.	Northern spotted owl (FT) site. Spring Phacelia (*Phacelia verna*) (ORBIC) list 4 species is located in two of the eight meadows.	Unique plants associated with bald meadows; These meadows accounted for 72% of the botanical diversity of the area. A total of 170 species of vascular plants were documented, including, 10 species of trees, 20 species of shrub, 12 species of grasses, sedges and rushes, and 122 species of forbs.	
	Hunter Creek Bog	Existing			Fills ONHP Coast Range Ecoregion Cell (Port Orford Cedar on ultramafic soils). Botany - large, diverse serpentine bog.	
	New River	Existing	Prehistoric sites	Western snowy plover (FT), Northwestern pond turtle (BS). Coho, Chinook, cutthroat trout, steelhead.	Fills two ONHP Coastal lowlands ecological cells (lacustrine and palustrine); special status plants - pink sand verbena (*Abronia umbellata ssp. breviflora)* (BS), *Calypogeia sphangnicola* (liverwort)(BS), timwort *(Cicendia quadrangularis)* (BS),	

District/ Field Office	ACEC Name	Status	Relevant and Important Value Category			
			Historic, Cultural, Scenic	Fish and Wildlife	Natural Process or System	Natural Hazard
					russet cotton-grass (*Eriophorum chamissonis*) (BS), western lily (*Lilium occidentale*) (FE), silvery phacelia (*Phacelia argentea*) (BS)	
	North Fork Chetco	Existing	Undisturbed cultural site potentially eligible for addition to the National Register of Historic Places.	Anadromous fish habitat - sea run cutthroat trout. Northern spotted owl (FT) site and portion contains occupied marbled murrelet (FT) site.	Fill two ONHP Coast Range cells riparian hardwood forest along a major river 4th order stream segment on coastal stream with California laurel riparian forest in the Klamath Mountains Province.	
	North Spit	Existing	Scenic coastal landscapes comprised of dunes, deflation plain wetlands and Sitka Spruce forest islands. Historic US Lifeguard Service sites and artifacts, and potential prehistoric site.	Western snowy plover (FT), marbled murrelet (FT), northwestern pond turtle (BS), purple martin (BS).	Numerous outstanding plant associations and wetlands. Special status plants: *Bryoria pseudocapillaris* (lichen) (BS), *Byoria spiralifera* (lichen) (BS), Point Reyes bird's-beak (*Cordylanthes maritimus ssp. palustris)* (BS), *Heterodermia leucomela* (lichen) (BS), *Niebla cephalota* (lichen) (BS). Natural Heritage Marine and Estuarine Special Species Cell, Newcomb's littorine snail, Coast Range Special Species Cell #205 *Bryoria spiralifera*, Cell # 222 *Niebla cephalota*, and Cell # 230 *Ramalina pollinaria*.	
	North Spit Addition	Potential			Potential to fill an ONHP Coast Range Special Species Cell #45 (*Bryoria pseudocapillaris* [lichen]), #63 (*Diplophyllum plicatum* [liverwort], and #68 (*Erioderma sorediatum* [lichen]). It also fills an Oregon Natural Heritage Plan (ONHP) Ecological Cell #7 (Sitka spruce-Port Orford cedar forest on sand [*Picea sitchensis/Chamaecyparis*	

District/ Field Office	ACEC Name	Status	Relevant and Important Value Category			
			Historic, Cultural, Scenic	Fish and Wildlife	Natural Process or System	Natural Hazard
					lawsoniana]).	
	Rocky Peak	Potential	Historic trail and lookout sites. Panoramic views of coastline plains, foothills and ocean.	Habitat for marbled murrelet (FT), northern spotted owl (FT), fringed myotis (BS), foothill yellow-legged frog (BS), spotted tail-dropper (BS). Portion contains occupied marbled murrelet (FT) site.	ONHP Special species Siskiyou monardella (*Monardella purpurea)* (BS); rare meadow, knob-cone pine plant communities.	
	Steel Creek	Potential	Portion of historic Brewster Trail	One of the most productive spawning reaches in Coquille Basin; supports sea run and resident cutthroat trout, chinook, coho, steelhead and Pacific lamprey. Northern spotted owl (FT) site and portion contains occupied marbled murrelet (FT) site.	Large, structurally complex unmanaged and undisturbed late-successional forest community uncommon in Coast Range. supports one of the most productive spawning reaches that BLM manages in the Coquille Basin for all anadromous species found on district including Coho salmon (FT).	
	Tioga Creek	Existing		High quality stream/riparian conditions and spawning habitat for coho, steelhead, and cutthroat trout. Northern spotted owl (FT) site.	400+ year old, Old-growth riparian Douglas-fir/hardwood community on 4th order stream with high value as reference site.	
Eugene	Camas Swale RNA	Existing		Provides habitat for wildlife species, but does not explicitly list distinct species.	The site is an example of a dry-site, mature Douglas-fir forest in the Willamette Valley foothills. It also includes a small, xeric, meadow community. It is included in the Oregon Natural Heritage Plan (2010) and is the best remaining example found for representing this plant community type in Oregon. It fills the natural heritage cell or element as: Douglas-fir/swordfern and Douglas-fir/Oregon-grape forest.	
	Cottage Grove Old Growth	Existing		This site is within the City Creek spotted owl pair home range and contains suitable nesting/roosting/foraging habitat.	Douglas-fir old-growth stand. Multiple canopy layers represent the late-successional stage of mesic Douglas-fir plant community with some existing	

District/ Field Office	ACEC Name	Status	Relevant and Important Value Category			
			Historic, Cultural, Scenic	Fish and Wildlife	Natural Process or System	Natural Hazard
					older trees representing ages of 500 years old or more. *Cimicifuga elata* (BS).	
	Cougar Mountain Yew Grove	Existing		Good cavity nester habitat	Site represents one of the lowest elevation stands of Pacific Yew remaining in the Willamette Valley. Trees contained in this site an unique grove of record yew trees (70-500 years old) based on height or diameter, include one tree that has been described as the 5th largest at 9'1" in circumference.	
	Dorena Prairie	Potential			One of the few remaining representative examples of the less than 1% remaining native upland prairie plant community within the Willamette Valley.	
	Esmond Lake	Potential	Esmond lake is one of ten lakes in the Coast Range caused by landslides and can only be reached by foot which has left the lake in an undisturbed state.	Coho salmon and steelhead migrate through Esmond Lake and spawn in tributaries above the lake. This lake appears to contain one of the best Coho rearing habitats in the Siuslaw Basin on BLM-administered lands.	Esmond Lake has an uncommon geologic feature formed by a large deep-seated landslide. Spawning counts indicate that Coho numbers are increasing in Esmond Creek drainage. This is likely due in part to surrounding old-growth forests, and the large woody debris in the creek and lake that improve the quality of juvenile rearing habitat. Only known site of *Fissidens fontanus* (BS) (moss) in Oregon thought to be extinct.	
	Ferguson Creek	Potential		Special status wildlife species may benefit from increasing oak woodland habitats which have been reduced to 10% of their pre-1850s footprint. Oak trees provide an important mast resource. The current oak habitat are not extensive enough to	This unit contains one of the only remaining stands of mature oak trees in substantial numbers. However are at risk due to the encroachment of Douglas fir forest resulting from fire suppression.	

District/ Field Office	ACEC Name	Status	Relevant and Important Value Category: Historic, Cultural, Scenic	Fish and Wildlife	Natural Process or System	Natural Hazard
				provide quality habitat.		
	Fox Hollow RNA	Existing			The site fills the natural area cell or element described in the Oregon Natural Heritage Plan (2010) as: Douglas-fir/swordfern and Douglas-fir/Oregon-grape forest. A mixed stand of Douglas-fir and ponderosa pine is found on the south slopes and ridge tops, with minor amounts of Oregon white oak and Incense-cedar. Inclusion in this 2010 Plan signifies that this site is the best remaining example that could be found for representing these plant community types for Oregon.	
	Garoutte Prairie	Potential			Relic Willamette Valley prairie plant community, currently occupying about 1% of its historic extent. Invasive non-native plants are now displacing native plant species.	
	Grandmother's Grove	Potential			Low elevation, unmanaged mature and late successional forest providing interior habitat and adjacent mid-seral stands contribute to these values. Unique location above and/or proximity to the valley floor.	
	Grassy Mountain	Existing	Highly visible grassy bald.	Screening results recognize contribution to wildlife habitat, but no species explicitly mentioned.	The site fills the natural heritage cell or element as: Blue wildrye or red fescue grass bald communities; vernal seepage slopes on low to mid elevation rocky bald communities, with monkey flower, saxifrages and moss. One of the finest, undisturbed representative examples of a grassy bald on the western margin of the Cascades.	
	Heceta Sand	Existing	Scenic dune system. The widest	Area supports special status	Seashore bluegrass association;	

District/ Field Office	ACEC Name	Status	Relevant and Important Value Category			
			Historic, Cultural, Scenic	Fish and Wildlife	Natural Process or System	Natural Hazard
	Dunes ONA		dune sheets along the Oregon Coast only extends four miles inland from the coastline. The coastline by Florence (Heceta region) extended outward four times farther than areas to the south. This wider shelf provided abundant fine sand for eolian transport from the south through northward littoral drift.	wildlife species potentially occurring at this site including: marbled murrelet, California brown pelican, white-tailed kite, American peregrine falcon, bald eagle, fringed myotis, Oregon plant bug, western bumble bee, horary elfin butterfly, insular blue butterfly.	Red Fescue association; Shore pine/slough sedge association; Shore pine/bearberry association; shore pine/hairy manzanita association. Site is identified in the 2010 OR Natural Heritage Plan. Several coastal endemic Special Status Species and the supporting plant communities are now rare along the coast.	
	Horse Rock Ridge RNA	Existing	Highly visible grassy bald and exemplary with views of the Cascade Mountains from much of the site.	Provides habitat for wildlife species, but does not explicitly list distinct species.	The site fills the natural area cell or element in the Oregon Natural Heritage Plan and is one of the best remaining examples of West Cascades Ecoregion/shrub and Grassland type blue wildrye or Roemer's fescue grass bald communities.	
	Hult Marsh	Existing	Hult Marsh is situated in a peaceful, often serene and placid setting where visitors can seek solitude and reflection.	Missing data - though the evaluation indicated site met relevance and importance for Wildlife.	While the site is the result of a manmade mill pond, this large forested wetland/marsh >35 acres is classified as significant under the Oregon Forest Practices Act which considers such marshes >8 acres as significant. The site supports two Bureau sensitive plants *Utricularia gibba* and *Lycopodiella inundata*.	
	Jordan Creek	Potential		This 38-acre stand is currently composed of spotted owl dispersal habitat. Releasing the oak habitat could run counter to management strategies for the spotted owl.	Jordan Creek is a Willamette oak woodland. These oak habitats are declining, and represent just 10% of the original footprint observed pre-1850.	
	Lake Creek Falls	Existing	Lake Creek Falls is the only waterfall of its size in the Siuslaw Resource Area. Numerous cultural and historic points of interest.	Species that potentially utilize the habitat or could be viewed from this ACEC: northern spotted owl, marbled murrelet, black swift, bald eagle, purple martin, Oregon red tree vole, Townsend's big-	Large natural waterfalls are uncommon on higher order streams and rivers like Lake Creek.	Popular swimming area with dangerous rocks/logs often submerged. The algae that creates a slippery rock slide also creates a very unstable walking surface in the stream. Sharp, poorly visible,

District/ Field Office	ACEC Name	Status	Relevant and Important Value Category			
			Historic, Cultural, Scenic	Fish and Wildlife	Natural Process or System	Natural Hazard
				earred bat, fisher, fringed myotis, Cascades axetail slug, Roth's blind ground beetle, western bumble bee, Johnson's hairstreak butterfly.		underwater boulders in pools present hazards to divers. Unstable logs tend to jam up in the pools following winter floods and present hazards to swimmers.
	Lorane Ponderosa Pine 1, 2, 3	Potential			Willamette Valley Ponderosa Pine; The Willamette Valley population of ponderosa pine is considered a separate and distinct population from other ponderosa pine populations within Oregon. Decline of *Pinus ponderosa* var. *willamettensis* stands both within the Willamette Valley and on federal lands, less than 1% remain.	
	Low Elevation Headwaters of the McKenzie River	Potential	McKenzie River (11 miles) suitable for inclusion in National Wild and Scenic System as a Recreational Segment	Bull trout; Upper Willamette spring chinook; cutthroat trout; northern spotted owl, tailed frog; Harlequin duck	Unique nature of a large continuous block of native forest. Minimally disturbed blocks of land under 2,000 feet on the east side of Willamette Valley.	
	McGowan Meadow	Potential	Proposed Celebrating Wildflower Site		Site exemplifies a wet meadow with flora of both the Cascades and Willamette Valley ecoregions.	
	Mohawk RNA	Existing		Provides habitat for wildlife species, but does not explicitly list distinct species (possible habitat for Spotted Owls).	The site fills the natural heritage cell or element as: Douglas-fir/western hemlock/Oregon-grape and salal forest. Old-growth Douglas-fir and western hemlock within low elevation Willamette Valley foothills. Site contains small marsh. Tributaries of McGowan Creek flow through or originate in the area.	
	Nails Creek	Potential		This 80-acre stand is currently composed of spotted owl dispersal habitat. Releasing the oak habitat could run counter to management strategies for the spotted owl.	Nails Creek is a Willamette oak woodland. These oak habitats are declining, and represent just 10% of the original footprint observed pre-1850.	

District/ Field Office	ACEC Name	Status	Relevant and Important Value Category			
			Historic, Cultural, Scenic	Fish and Wildlife	Natural Process or System	Natural Hazard
	Oak Basin Prairies 1, 2, 3	Potential		Fender's blue butterfly (FE), Taylor's checkerspot butterfly (BS).	These tracts are portions of a large upland prairie complex on the west side of the Coburg hills. Kincaid's lupine (*Lupinus sulphureous* ssp. *kincaidii*) (FT), Hitchcock's blue-eyed grass (BS).	
	Upper Elk Meadows RNA	Existing			Four distinct plant communities are in the area: open, wet sedge meadow; wet red alder/willow/hawthorn thickets; open forest dominated by old-growth silver and grand fir; and closed forest dominated by old-growth Douglas-fir. This site has been selected as a part of an interagency network of sites to be retained and managed primarily for research and educational purposes.	
	Upper Willamette Valley Margin Parcels 1 - 42	Potential	Proximity to large water bodies, McKenzie, Willamette, Row Rivers; Cottage Grove, Dorena, Fall Creek Reservoirs. Adjacent to major travel corridors (interstate 5, Highways 58 and 126) and popular recreation destinations.	Contribute to regional population viability and recovery, including key raptor area and bald eagle habitat areas.	Low elevation, unmanaged mature and late successional forest providing interior habitat and adjacent mid-seral stands contribute to these values. Unique location above and/ or proximity to the valley floor.	
	Willamette Valley Prairie/Oak and Pine Area (multiple parcels)	Potential			These sites represent some of the few remaining upland red fescue prairies and oak habitats in the Willamette Valley Province.	
Klamath Falls	Miller Creek	Existing	Deep canyon within high desert plateau	Riparian habitat for migratory songbirds and raptors	Old-growth ponderosa pine community, perennial stream within high desert environment.	
	Old Baldy RNA	Existing	Scenic viewing opportunities from section of Pacific Crest Trail, which dissects the RNA.		Natural Heritage cells: high elevation white fir communities with Shasta red fir, mountain hemlock, Pacific silver fir, and	

District/ Field Office	ACEC Name	Status	Relevant and Important Value Category			
			Historic, Cultural, Scenic	Fish and Wildlife	Natural Process or System	Natural Hazard
					Western white pine; Southern Oregon Cascades chaparral.	
	Spencer Creek	Potential		Upper Klamath redband trout, Pacific giant salamander, future anadromous salmonid species (when Klamath River dams are removed or passage restored).	Intact functioning low gradient floodplain meadow habitat important for several aquatic species. Floodplain provides critical riparian processes important to filtering fine sediments, providing water quality benefits. Inundation during moderate to high flood events provide refuge for aquatic organisms and robustness to this riparian ecosystem not found elsewhere along private reaches of this stream.	
	Surveyor	Potential	Historically unlogged forest unique to surrounding area with short educational trail providing a scenic opportunity in old growth forest.	Characterized by an unlogged, old growth forest community with designated critical nesting habitat for Northern Spotted Owl (FT).	Unlogged old growth forest community of large Douglas fir and other mixed conifer species. Unique site with several Bureau Sensitive fungi species.	
	Tunnel Creek	Potential		Oregon spotted frog (FT)	High altitude lodgepole pine swamp with bog blueberry (*Vaccinium uliginosum*) and high diversity of sedge species. Riparian and wetland processes. Several Bureau Sensitive Species of rare plants: *Carex capitata, Utricularia minor, Tomentypnum nitens,* and *Gentiana newberryi* var. *newberryi*, *Carex lasiocarpa* var. *americana*.	
	Upper Klamath River	Existing	Historic road, prehistoric cultural artifacts/sites. The Klamath River Canyon holds great spiritual and religious significance for the Klamath Tribe and the Shasta Nation. The unique landform, diverse vegetation, water, and a low level of adverse cultural modifications has been given a	Lost River and shortnose suckers (FE), Klamath largescale sucker, native inland redband trout, bald eagle (BS) nests, Townsend's big-eared bat (BS), Northern Spotted Owl (FT) critical habitat.	Unique plant communities bisecting the Cascade Mountains which range from montane conifer forest communities to high desert communities, and from riparian communities to oak savannah communities. Red-root yampah (*Perideridia erythrorhiza* a BS plant species), *Astragalus*	

District/ Field Office	ACEC Name	Status	Relevant and Important Value Category			
			Historic, Cultural, Scenic	Fish and Wildlife	Natural Process or System	Natural Hazard
			Scenic Quality A classification.		*californicus* (BS), *Carex comosa* (BS).	
	Upper Klamath River Addition	Potential	Historic road, prehistoric cultural artifacts/site. The Klamath River Canyon holds great spiritual and religious significance for the Klamath Tribe and the Shasta Nation. The unique landform, diverse vegetation, water, and a low level of adverse cultural modifications has been given a Scenic Quality "A" classification.	Lost River and shortnose suckers (FE), Klamath largescale sucker, native inland redband trout, and bald eagle (BS) nests, Northern spotted owl (FT) critical habitat.	Unique plant communities bisecting the Cascade Mountains, and that range from montane conifer forest communities to high desert communities, and from riparian communities to oak savannah communities. Red-root yampah (*Perideridia erythrorhiza*), a BS plant species), *Astragalus californicus* (BS), *Carex comosa* (BS).	
	Wood River Wetland	Existing	Numerous documented prehistoric sites. Village sites and scattered clusters of houses. Served as central area for many economic, spiritual, and social activities. Important focus gathering site.	Oregon spotted frog (FT), Lost River sucker (FE), shortnose sucker (FE), redband trout, bald eagle (BS), peregrine falcon (BS), and several other Bureau Sensitive bird species.	In the process of restoring site to a functioning, natural wetland with water quality and quantity benefits. Complex wetland community, including *Wolffia borealis* (BS).	
Medford	Baker Cypress	Existing	High scenic value		Most northern Baker cypress (*Hesperocyparis bakeri*) stand in North America.	
Medford	Bobby Creek RNA	Existing		Northern spotted owl (FT) and critical habitat.	Intact Port-Orford cedar stands. Represents Oregon Natural Areas Plan cells for western hemlock and tanoak-bigleaf maple-canyon live oak communities. Late-successional forest. Paired-watershed study catchments. Long-term vegetation monitoring site.	
Medford	Brewer Spruce RNA	Existing		Northern spotted owl (FT) and critical habitat.	Unique conifer assemblage with Brewer spruce, Port-Orford-cedar, and Alaska yellow cedar (rare inland). Oregon Natural Areas Plan cells for mid/high-elevation marsh/pond and white fir forest with Brewer spruce. Long-term vegetation monitoring	

District/ Field Office	ACEC Name	Status	Relevant and Important Value Category			
			Historic, Cultural, Scenic	Fish and Wildlife	Natural Process or System	Natural Hazard
					site.	
	Cobleigh Road	Potential	Prehistoric cultural sites		Oak-madrone-conifer woodland supporting Gentner's fritillary (*Fritillaria gentneri*) (FE). Gentner's fritillary recovery management area.	
	Dakubetede Wildland	Potential			Gentner's fritillary (*Fritillaria gentneri*) (FE). Western-most stands of western juniper, rare water birch (*Betula occidentalis*), intact native grasslands. Gentner's fritillary recovery management area.	
	Deer Creek	Potential		Cool water refugia for juvenile SONCC coho salmon (FT).	Limestone cave system supporting bats and rare invertebrates, including a new species of spider (*Trogloraptor marchingtoni)*.	
	East Fork Whiskey Creek RNA	Potential			Rogue River stonecrop (*Sedum moranii*) (BS). Represents Oregon Natural Areas Plan cells for late-successional tanoak - Douglas-fir communities, stands of knobcone pine.	
	Eight Dollar Mountain	Existing		Coronis fritillary butterfly (*Speyeria coronis coronis*) (BS).	Serpentine fens and Jeffrey pine savannahs and associated rare plants, including Howell's mariposa lily (*Calochortus howelli*) (BS), Oregon willow-herb (*Epilobium oreganum*) (BS), Waldo gentian (*Gentiana setigera*) (BS), western bog violet (*Viola primulifolia* ssp. *occidentalis*) (BS).	
	French Flat	Existing	Historic mining values, including Logan Cut (National Register of Historic Places)	Coronis fritillary butterfly (*Speyeria coronis coronis*) (BS).	Jeffrey pine savannahs and California oaktgrass-tufted harigrass grasslands and associated rare plants, including Cook's lomatium (*Lomatium cookii*) (FE), Howell's adder's tongue (*Erythronium howellii*)	

District/ Field Office	ACEC Name	Status	Relevant and Important Value Category			
			Historic, Cultural, Scenic	Fish and Wildlife	Natural Process or System	Natural Hazard
					(BS), slender meadow foam (*Limnanthes gracilis* ssp. *gracilis*) (BS). Cook's lomatium recovery management area.	
	Grayback Glades RNA	Existing			Represents Oregon Natural Areas Plan cells for high elevation white fir forest and Siskiyou alder glades. Large Port-Orford cedar trees, mostly uninfested by Port-Orford-cedar root rot.	
	Green Springs Mt. Scenic	Potential	Contains a particularly scenic segment of the Pacific Crest Trail, which is part of a popular hiking loop providing views into the Rogue River Valley.			
	Hole-In-The-Rock	Existing			Unique geological feature, a natural basalt arch, created by natural weathering and erosional processes.	
	Holton Creek RNA	Existing			Represents Oregon Natural Areas Plan cells for low-elevation late-successional white fir-Douglas-fir forest. Long-term vegetation monitoring site.	
	Hoxie Creek	Existing			Remnant late-successional white fir-Douglas-fir-ponderosa pine forest.	
	Iron Creek	Existing			Late-successional dry Douglas-fir-sugar pine-ponderosa pine forest.	
	King Mountain Rock Garden	Existing	High scenic value		High-elevation serpentine community.	
	Lost Lake RNA	Existing			Represents an Oregon Natural Areas Plan cell for a mid-montane lake surrounded by mixed-conifer forest. Example of a landslide-dammed lake. Long-term vegetation monitoring plots.	
	Moon Prairie	Existing			Late-successional, multi-layered stand of Douglas-fir and white fir	

District/ Field Office	ACEC Name	Status	Relevant and Important Value Category			
			Historic, Cultural, Scenic	Fish and Wildlife	Natural Process or System	Natural Hazard
					with Pacific yew, ponderosa pine and sugar pine.	
	North Fork Silver Creek RNA	Existing			Represents Oregon Natural Areas Plan cells for Port-Orford cedar-western hemlock and white fir forests. Includes serpentine fens. Long-term vegetation monitoring plots. Burned area reference site (1987 and 2002).	
	Old Baldy RNA	Existing			Represents Oregon Natural Areas Plan cells for chinquapin/manzanita chaparral and high-elevation white fir-Shasta red fir forest. Long-term vegetation monitoring site.	
	Pickett Creek	Potential			Large populations of Gentner's fritillary (*Fritillaria gentneri*) (FE). Gentner's fritillary recovery management area.	
	Pipe Fork RNA	Existing			Represents Oregon Natural Areas Plan cells for Port-Orford cedar-white fir and Port-Orford cedar-tanoak communities.	
	Poverty Flat	Existing			Rare Rogue River grassland and vernal pool community supporting Bellinger's meadow foam (*Limnanthes floccosa* ssp. *bellingeriana*) (BS).	
	Reeves Creek	Potential			Cook's lomatium (*Lomatium cookii*) (FE), slender meadowfoam (*Limnanthes gracilis* ssp. *gracilis*) (BS). Cook's lomatium recovery management area.	
	Rough and Ready	Existing			Ultramafic alluvial deposits and serpentine soil support unique plant community and rare plants including Cook's lomatium (*Lomatium cookii*) (FE), large-flowered rush lily (*Hastingsia bracteosa* var. *bracteosa*) (BS),	

District/ Field Office	ACEC Name	Status	Relevant and Important Value Category			
			Historic, Cultural, Scenic	Fish and Wildlife	Natural Process or System	Natural Hazard
					Howell's mariposa-lily (*Calochortus howellii*) (BS), Howell's adder-tongue (*Erythronium howellii)* (BS), slender meadowfoam (*Limnanthes gracilis* ssp. *gracilis)* (BS). Cook's lomatium recovery management area.	
	Round Top Butte RNA	Existing			Represents Oregon Natural Areas Plan cells for seasonally flooded bottomland prairie, dry grasslands, and Oregon white oak savannah. Long-term vegetation monitoring site. Designated National Natural Landmark.	
	Sterling Mine Ditch	Existing	Historic ditch used for hydraulic gold mining (National Register of Historic Places)			
	Table Rocks ONA	Existing	Native American refuge and ceremonial site.	Vernal pool fairy shrimp (FT).	Example of erosional remnants of an intracanyon basaltic lava flow, vernal pools, oak woodlands, and upland grasslands. Rare plants include dwarf woolly meadowfoam (*Limnanthes pumila* ssp. *pumila*) (BS), Austin's plagiobothrys (*Plagiobothrys austiniae*) (BS), Greene's popcornflower (*Plagiobothrys greenei*) (BS), southern Oregon buttercup (*Ranunculus austrooreganus*) (BS).	
	Table Rocks ACEC	Potential	Native American refuge and ceremonial site.		Example of erosional remnants of an intracanyon basaltic lava flow, vernal pools, oak woodlands, and upland grasslands. Rare plants include dwarf woolly meadowfoam (*Limnanthes pumila*ssp. *pumila*) (BS), Austin's plagiobothrys (*Plagiobothrys austiniae*) (BS), Greene's	

District/ Field Office	ACEC Name	Status	Relevant and Important Value Category			
			Historic, Cultural, Scenic	**Fish and Wildlife**	**Natural Process or System**	**Natural Hazard**
					popcornflower (*Plagiobothrys greenei*) (BS), southern Oregon buttercup (*Ranunculus austrooreganus*) (BS).	
	Tin Cup	Existing			Late-successional white fir community.	
	Waldo-Takilma	Potential	Intact historic mining sites (National Register of Historic Places).		Serpentine plant communities supporting rare plants, Cook's lomatium (*Lomatium cookii*) (FE), Howell's mariposa-lily (*Calochortus howellii*) (BS), clustered lady's-slipper (*Cypripedium fasciculatum*) (BS), Howell's adder-tongue (*Erythronium howellii*) (BS), slender meadowfoam (*Limnanthes gracilis* ssp. *gracilis*) (BS).	
	West Fork Illinois River	Potential			Represents Oregon Natural Areas Plan cells for serpentine fens, western white pine forest, knobcone pine forest, and Jeffrey pine savannah and woodlands. Supports rare plants, Howell's mariposa-lily (*Calochortus howellii*) (BS), Oregon willow-herb *(Epilobium oreganum*) (BS), Waldo gentian (*Gentiana setigera*) (BS), western bog violet (*Viola primulifolia* ssp. *occidentalis*) (BS).	
	Woodcock Bog RNA	Existing			Serpentine fens and Jeffrey pine savannah supporting rare plants Oregon willow-herb (*Epilobium oreganum*) (BS), Waldo gentian (*Gentiana setigera*) (BS), large-flowered rush-lily (*Hastingsia bracteosa* var. *bracteosa*) (BS), western bog violet (*Viola primulifolia* ssp. *occidentalis*) (BS). Long-term vegetation	

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			Historic, Cultural, Scenic	Fish and Wildlife	Natural Process or System	Natural Hazard
					monitoring site.	
Roseburg	Bear Gulch RNA	Existing			Douglas-fir/canyon live oak woodland with poison oak and dwarf Oregon-grape; and Douglas-fir/canyon live oak forest.	
	Beatty Creek RNA	Existing			Jeffrey pine community on serpentine. Wayside aster (*Eucephalus vialis*) (BS), California sword fern (*Polystichum californicum*) (BS).	
	Bushnell-Irwin Rocks RNA	Existing			Oregon white oak savanna; Oregon white oak/Douglas-fir/poison oak woodland; Thompson's mistmaiden (*Romanzoffia thompsonii*) (BS), California sword fern	
	Callahan Meadows	Potential			Kincaid's lupine (*Lupinus oreganus*) (FT), serpentine meadow, Umpqua mariposa lily (*Calochortus umpquaensis*) (BS).	
	Myrtle Island RNA	Existing			Old-growth stand of California bay laurel and Douglas-fir (riparian hardwood forest along a major river).	
	North Bank	Existing	Important cultural site	Columbian white-tailed deer	Koehler's rock cress (*Arabis koehleri* var. *koehleri*) (BS), Red-rooted yampah (*Perideridia erythrorhiza*) (BS), rough popcorn flower (*Plagiobothrys hirtus*) (FE).	
	North Myrtle Creek RNA	Existing			Douglas-fir/ponderosa pine forest; white fir/dwarf Oregon-grape; Douglas-fir/bigleaf maple forest.	
	North Umpqua River	Existing	Scenic	Fish		
	Red Pond RNA	Existing		Northern spotted owl, western pond turtle	Low elevation permanent pond; dotted water-meal (*Wolffia borealis*) (BS), *Phaeocollybia*	

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					californica (BS).	
	Tater Hill RNA	Existing			Western hemlock/oceanspray community.	Active landslide
	Umpqua River Wildlife Area	Existing		Bald Eagle		
Salem	Beaver Creek	Potential			Intact mid-elevation oak meadow and native prairie flora rare along the western slopes of the northern Oregon Cascades.	
Salem	Crabtree Complex RNA/ONA	Existing	Scenic qualities such as forest cover type, complex of habitats and geologic features are considered exceptional within the Salem District.	Relatively undisturbed old-growth forest that contains Special Status Species wildlife species and is used by northern spotted owls (FT). Cliffs provide unique habitat with potential for raptor use.	Fills several West Cascades Ecosystem elements identified in the Oregon Natural Areas Plan 2010. This area has a population of Alaska-cedar that is fairly uncommon in this region.	
Salem	Elk Creek	Existing		Elk Creek provides inland bald eagle (BS) forage and roosting habitat, a north Coast Range marbled murrelet (FT) site, and numerous red tree vole sites. Historic nest sites for both the bald eagle (BS) and northern spotted owl (FT). Elk Creek is also considered to be the most important and biologically complex tributary to the Nestucca River system because Oregon Coastal coho, chinook, summer and winter steelhead, sea-run and resident cutthroat trout and Pacific lamprey all spawn in this stream.	This contiguous block of old forest is a rare example of a fully functional natural system in the north Oregon Coast Range as evidenced by the extensive list of late-successional forest dependent species that occur there. The area abuts the 360,000-acre "Tillamook Burn", which was burnt over in a series of our catastrophic fires from 1933 to 1951.	
Salem	Forest Peak RNA	Existing		Forest Peak provides undisturbed Willamette Valley margin meadows adjacent to old growth forests. This meadow may provide habitat for several at risk butterfly species and declining Willamette valley songbirds, including common nighthawk,	Willamette Valley Ecosystem Elements: Willamette Valley Douglas-fir-bigleaf maple forest with some grand fir; Douglas-fir/poison oak forest; Lemmon's needlegrass-moss bald. The area represents an intact and natural 3rd order stream system located	

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				Oregon vesper sparrow, western bluebird, and acorn woodpecker.	on the fringes of the Willamette Valley.	
	Grass Mountain RNA	Existing	The area is visible from the Willamette Valley and has remnants of the lookout that was once stationed on the summit of Grass Mountain. The cement foundation, disposal area and pieces of metal roofing for the lookout still remain onsite. In the early 1900s Grass Mountain was a stopping place for grazing cattle as they were moved between the Alsea Valley and Mary's Peak.	The area contains a high elevation grassy bald habitat juxtaposed with mature noble fir and forest that offers undisturbed refugia for rare and endemic invertebrate species including Roth's blind ground beetle (BS). The older forest stands have a long history of use and offer nesting habitat for northern spotted owl (FT) and marbled murrelet (FT).	The area represents the Coast Range Ecoregion's Noble fir-western hemlock forest and the Grass bald on Coast Range mountain ecosystem elements. In addition it represents a natural 3rd order stream system and old growth conifer habitat.	
	High Peak - Moon Creek RNA	Existing		One of few remaining relatively large contiguous blocks of late-successional forest habitat found in north Oregon coast range that is relatively inaccessible and undisturbed within a very steep canyon that is ideal for supporting northern spotted owls (FT) and marbled murrelets (FT). Moon Creek provides high quality spawning habitat for anadromous fish of regional significance, including Oregon Coastal coho and steelhead.	Rare example of northern Oregon coast range old-growth forest with intact functioning late-successional forest system. Adjacent to the "Tillamook Burn". Coast Range Ecoregion ecosystem elements: Western hemlock/swordfern, Western hemlock/vine maple-salal.	
	Jackson Bend	Existing			Within the floodplain of the Willamette River, but not on BLM ownership.	
	Little Grass Mountain ONA	Existing	Little Grass Mountain provides for a limited scenic vista once located at the summit. Although designated as an ONA, recreational opportunities are limited due to restricted and remote access to the site.	Little Grass Mountain is just high enough in elevation to provide noble fir habitat and is similar to Grass Mountain and Mary's Peak. It provides additional grassy bald habitat adjacent to mature conifer forest.	Grass balds are uncommon in the Oregon Coast Range. However, there are no specific values with this area that set it apart from other grassy balds that are not designated as ACECs.	
	Little North Fork Wilson	Potential		This area represents one of few remaining relatively large	Intact old-growth conifer riparian habitat is rare throughout Oregon	

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	River			contiguous blocks of late-successional forest habitat found in north Oregon coast range that is relatively inaccessible and undisturbed. One of the few areas in the northern Oregon Coast Range which supports the northern spotted owl (FT) that isn't also occupied by barred owls. The area supports significant salmon populations (Chinook, coho, chum, steelhead, sea run cuttthroat) that contribute to both sport and commercial fisheries production.	and is especially rare in coastal ecosystems. A relict old-growth plant community of 450 year old Douglas-fir, Sitka spruce, Western hemlock, and Western red cedar within the canyon of the Little North Fork of the Wilson River.	
	Little Sink RNA	Existing		The area provides an excellent example of a low elevation coast range old-growth forest adjacent to the Willamette Valley. The area supports northern spotted owls (FT), red tree voles and a great blue heron rookery. The ponds are important breeding sites for native amphibians and are free from non-native predatory vertebrate species.	The area fulfills the following Willamette Valley Ecoregion's Ecosystem Elements: Douglas fir - grand fir/vine maple-salal; Slump pond at margin of valley, with aquatic beds and marshy shore. Congress has designated Little Sink as an "Instant Study (wilderness) Area. Rare botanical species reported from this location include: Dotted water-meal (BS) and a lichen, *Calicium adspersum* (BS).	The past slumping soils or unstable ground at Little Sink has created at least 3 distinct ponds within a coniferous forest habitat.
	Lost Prairie	Existing		Lost Prairie supports a large Sphagnum/sedge rich fen and wetland habitat which supports a diverse assemblage of uncommon invertebrate species. The site also offers nesting habitat for songbirds, and high quality forage for deer and elk.	Coast Range Ecoregion's Ecosystem Element: Mid to high elevation sedge and sphagnum fens and a beaver marsh. The most outstanding botanical feature is the presence of a complex of sphagnum species and fen associated bryophytes and vascular plants. Rare vascular plants include the *Erythronium elegans* (BS), *Fritillaria camschatcensis* (BS) and *Anenome oregana* var. *felix* (BS).	

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					Lost Prairie also provides a refuge for many uncommon bryophyte species.	
	Lower Scappoose Eagle	Potential		The area includes an active and productive bald eagle (BS) communal winter roost site and an active, productive bald eagle (BS) nest. The consistent, high eagle usage of the area is due to its proximity to Sauvie Island where the eagles forage on the very rich, unique resource of large concentrations of waterfowl.	The area is included in the final integrated portfolio within The Nature Conservancy's Pacific Northwest Coast Ecoregional Assessment.	
	Mary's Peak	Existing	Mary's Peak is the highest mountain in the Oregon Coast Range Mountains north of Coquille. The summit of Mary's Peak is a favorite for recreationalists and local photographers because the views include interlaced open meadow habitats with coniferous forests with distant view of the Willamette Valley, Oregon Coast Range Mountains and the snow covered peaks of the Cascades.	The mature noble-fir forest, high elevation grassy bald, rocky outcrops, wet meadows, seeps, springs, and Douglas-fir old-growth are uniquely assembled here to provide a refuge for a minimum of ten rare or endemic invertebrates including Haddock's rhyacophilan caddisfly (BS) and Roth's blind ground beetle. The older forest stands have a long history of use and offer nesting habitat for northern spotted owls (FT) and marbled murrelets (FT).	Highly diverse assemblage of native plant communities. Special habitats or natural values include: high elevation grass meadows, noble fir community, and shallow soils with 'rock garden' plants.	
	McCully Mountain	Potential		Potential for nesting raptors, use by Neotropical Migratory birds and occurrence of wildlife species associated with older forest.	Natural system associated with mid-elevation oak meadow and native prairie flora seldom seen along the western slopes of the northern Cascades in Oregon adjacent to the Willamette Valley.	
	Middle Santiam Terrace	Existing	A Native American cultural site at this location is one of few in the region on public lands.		Old-growth fir and hemlock forest at a relatively low elevation river terrace. Lower elevation old growth forests are relatively unique and have an increased value for research. Represents several native plant community	

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					types in the Western hemlock zone in the western slopes of the Cascades.	
	Mill Creek Ridge	Potential		Mill Creek Ridge supports a great diversity of uncommon or endemic invertebrate species, and provide nesting habitat for declining Willamette Valley songbirds, including common nighthawk, western bluebird, and white-breasted nuthatch.	Mill Creek Ridge provides protection for an Oregon white oak community located in northwest Oregon on the eastern slopes of the Coast Range Mountains. This rare valley margin oak habitat provides a refuge of uncommon plant species known from adjacent coniferous forests. Many of the species found on this location are more common in the Cascades Mountains and from Southern Oregon. Also, several plant species known from this site extend the northern range of these species to Mill Creek Ridge.	
	Molalla Meadows	Potential	The Molalla River has been found to be both eligible and suitable for inclusion into the National Wild and Scenic River (WSR) System for outstandingly remarkable values that include geology, scenic and recreation. The area has been recognized for both its scenic and recreation values and included within a BLM Special Recreation Management Area.	Nesting raptors, use by Neotropical Migratory birds and occurrence of wildlife species associated with older forest. Harlequin duck (BS) occur here.	The meadows represent a unique ecotype with natural systems and geologic features seldom seen on BLM lands in the Salem District. The oak meadows represent a rare transition from valley oak savannas' to upland conifer forests. These large meadows contribute to the regional oak meadow network.	
	Nestucca River	Existing	Designated State scenic waterway and BLM backcountry byway. The upper Nestucca River is eligible for inclusion in National Wild and Scenic River system (recreational designation). The river corridor is designated VRM 1. The area is a an important foraging habitat for bald eagles (BS), thereby providing the	The Nestucca River corridor includes high quality habitat for bald eagles (BS), spotted owls, marbled murrelet (FT)s and red tree voles. The area is the only known site Oregon Coast Range breeding site for the harlequin duck (BS). The Nestucca River is also a high quality anadromous fish stream and contributes		

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			Historic, Cultural, Scenic	Fish and Wildlife	Natural Process or System	Natural Hazard
			public with opportunity for viewing and photographing wildlife.	significantly to wild fish production on the north Oregon Coast. Oregon Coastal coho (FT), chinook (FT), summer and winter steelhead (BS), sea-run and resident cutthroat trout (BS) and Pacific lamprey are all present.		
	North Santiam	Existing			BLM ownership is not where it was thought to be when this ACEC was first designated. The values that were provided by the designation of this ACEC are not represented on BLM ownership.	
	Rickreall Ridge	Existing		Rickreall Ridge provides for unique high elevation rocky outcrops and adjoining older forests which support a diversity of rare or endemic invertebrate species. Western grey squirrels and California ground squirrels common to lower elevations are also found at this higher elevation.	Rickreall Ridge is a rocky "hogback" ridge with steep talus slopes, with unique vegetation and is located within the Oregon Coast Range. Rickreall Ridge has a disjunct flora in which the vegetation is similar to vegetation known from the southern Cascades. This area has steep slopes much of which is withdrawn. The site also includes some older forest stands and associated coniferous forested species. Rickreall ridge provides a refuge for many uncommon mesic bryophytes species.	
	Saddle Bag Mountain RNA	Existing		Old-growth western hemlock supporting mistletoe in the Coast Range provides habitat for Johnson's hairstreak (BS) butterflies. The area also provides potential nesting habitat for northern spotted owls (FT) and marbled murrelets (FT).	Old-growth Pacific silver fir and western hemlock community. Saddlebag may be the last remaining mature naturally occurring Pacific silver fir stand in the Oregon Coast Range. Pacific silver fir was once thought to be more widespread but due to climatic changes may now be isolated to a few areas in the Oregon Coast Range. Rare	

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					botanical species include: *Erythronium elegans* (BS), several BS fungal species and a collection of uncommon lichen and bryophyte species.	
	Sandy River ONA	Existing	Cultural: Barlow Road and Rock Corral (currently listed) are National Register sites within the corridor. A prehistoric site eligible for the National Register also exists. Scenic: The inner gorge has steep canyon walls, deep, trench-like pools, waterfalls and cliff-dwelling plant communities. The Mt. Hood corridor (Highway 26) has a VRM 1 classification due to it scenic qualities and is congressionally designated as the Mt. Hood Scenic Corridor.	Stocks of Lower Columbia River chinook (BS), winter steelhead (BS), coho (FT)and cutthroat trout are present in this portion of the Sandy River. Spawning grounds for chinook salmon, rearing habitat for steelhead and chinook salmon are also present. Peregrine falcons, bald eagles (BS), and harlequin ducks (BS) have been known to use the Sandy River Gorge. Migratory birds such as the willow flycatcher have been documented within the ACEC.	Diverse vegetative communities and low elevation old-growth forest ecosystems. Riparian old-growth forests in the Middle Sandy are rare in the watershed downstream from Marmot Dam.	Precipitous slopes and canyon walls that line the inner gorge are a threat to outdoor enthusiasts enjoying the captivating views.
	Sheridan Peak	Existing			Former special status botanical species, *Poa marcida* is reported from this location.	
	Silt Creek	Potential			Active, natural landslide with an old-growth forest and unique habitat related to the slow but continual mass earth movement. The area is also host to an abnormally large population of *Pseudocyphellaria rainierensis*.	Large scale, active natural landslide.
	Snow Peak	Potential		High quality natural ecosystem supporting considerable biological diversity because of the fairly intact forest with a variety of associated special habitats. Contains one occupied known northern spotted owl (FT) site and core area. Known to be used by various migratory bird species.	Snow Peak's elevation of 4,280 feet makes it an uncharacteristically high point very close to the Willamette Valley. Hosts a variety of special habitats including wet meadows, dry meadows, rock outcrops/crevice habitat, talus slopes, mature to old-growth forests, headwater streams with adjacent riparian and brushy	

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					thickets in close proximity to one another. This habitat complex provides for an abundant array of rare botanical fungi, lichens and vascular plants including several Bureau Sensitive species. Deer cabbage, a wetland botanical species (*Fauria crista-galli*) found nowhere else in Oregon occurs here.	
	Soosap Meadows	Existing			These meadows are the only large, undisturbed expanse of natural Cascadian subalpine meadows in the Salem District. Streams which have cut through the glacial moraine have left behind a unique and diverse remnant of subalpine habitat.	
	The Butte RNA	Existing			The area represents the Willamette Valley Douglas-fir-bigleaf maple forest with some grand fir and the Oregon white oak/grass savanna ecosystem elements. It represents an uncommon transitional ecotone involving Willamette Valley margin plant communities and upland Coast Range forested communities.	
	Valley of the Giants	Existing	Outstanding example of a large, remnant, coastal old-growth forest. Educational organizations often visit the area for informal studies. The area also provides for scenic values and provides an excellent opportunity for photography.	Valle of the Giants lies within the largest contiguous patch of old-growth forest habitat in the northern Oregon Coast Range (over 800 acres, 400+ years old). This older forest provides nesting habitat for one of the largest concentrations of breeding marbled murrelets (FT) in Oregon. Habitat for northern spotted owls (FT), bald eagles	Valley of the Giants is well studied as a remnant 'old-growth' western hemlock plant association. This area incorporates the largest contiguous stand of ancient old growth forest in the northern Oregon Coast Range. The age of the forest, diversity of plants and bryophytes and huge size of the conifers are unique to this area.	

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				(FT), and Oregon Coastal steelhead (summer-run and winter-run; both FC). Exceptionally large refugium for invertebrate species that are closely associated with older forest conditions.	Rare or uncommon botanical species reported from this location include: *Schistostega pennata* (BS), *Filipendula occidentalis (*BS), and *Tetraphis geniculata* (BS).	
	Walker Flat	Existing			The only natural occurrence of *Sidalcea nelsonia* (FT) in the Salem District and one of the few in the Coast Range.	
	Yampo	Existing			Yampo supports a late-seral Willamette Valley bottom plant community that once included rare botanical vascular plant species. *Lathyrus holochlorus* (BS) has not been seen at this parcel since the 1980s and *Cimicifuga elata* no longer has special status.	
	Waterloo	Potential			This is the only known Salem District parcel with naturally-occurring Ponderosa Pine. The map of historic (mid-1800s) vegetation shows this as part of a large oak-fir-pine savanna, with prairie located just to the east. this small parcel is an integral part of a larger system of target conservation areas for the oak-pine-fir habitats.	
	Wells Island	Existing	Wells Island supports a low elevation, diverse, mature forest in the Willamette River that is visited by boaters.		Diverse floodplain forests, with seasonally exposed gravel bars and side-channel habitats on an island in the Willamette River. Wells Island provides a good representation of an intact native low elevation mature Douglas-fir and black cottonwood forest with a second story of fifty year old Oregon ash and Oregon white	

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					oak, which is a rare in the Willamette River. Special management is not needed to maintain these values.	
	White Rock Fen	Existing		Unique and diverse habitat with nesting and foraging potential for neotropical migratory birds and other wildlife species.	Four poor fens present at this location are unique to the region and are fragile. Streams which have cut through the glacial moraine have left behind a unique and diverse remnant of subalpine habitat for botanical, wildlife and aquatic species.	
	Wilhoit Springs	Existing			A rare community with regionally significance as an intact low elevation old-growth conifer forest.	
	Williams Lake	Existing			Cascade lake and bog habitats with lakeside plant community that is unique and fragile. William's Lake and its bog ecosystem is the best example within the Salem District of a Cascadian massive seep formed lake undergoing peat bog/quaking bog succession.	
	Yampo	Existing			Yampo supports a late-seral Willamette Valley bottom plant community that once included rare botanical vascular plant species. *Lathyrus holochlorus* (BS) has not been seen at this parcel since the 1980s and *Cimicifuga elata* no longer has special status.	
	Yaquina Head ONA	Existing	Yaquina Head occurs at a headland on the shores of the eastern Pacific Ocean. The area is known as a cultural site for past native Americans use and as a historical site with an operating	Yaquina Head includes a diverse assemblage of coastal habitats such as; tide pools, rocky islands, cliffs, coniferous forest and upland meadows. These diverse habitats provide for a high	This headland on the eastern Pacific Ocean provides for several unique habitats including: Sitka spruce forest, lodgepole forest, headland grass/shrub communities, wildlife roosts and	There are naturally occurring and man-made cliffs from past quarry opera-tions and both provide safety concerns from falling rocks and dangerous, steep slopes.

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			lighthouse. The lighthouse located at Yaquina Head is one of the most highly visited areas in the Oregon coast. The area is a photographers paradise.	diversity of marine invertebrates, nesting seabirds, and marine mammals. The BLM facility offers the unique opportunity to view wildlife on adjacent state and federal refuge lands including one of the largest nesting populations of common murres and other colonial nesting seabirds in North America. Bald Eagles frequently forage at Yaquina Head and the quarry cliffs provide nesting habitat for Peregrine Falcons.	nesting habitat, tide pools and associated ocean organisms. Rare bryophyte species *Eucladium verticillatum* is reported from the Yaquina Head ONA. Botanically unique and distinct from all other Salem BLM administered lands.	
	Yellowstone Creek	Potential	The creek contains numerous waterfalls and cascades in a steep, v-shaped canyon surrounded by old-growth forest. The lower portions are in the Quartzville Creek Wild and Scenic River. The diversity and old age of the vegetation combined with geologic features creates high intrinsic quality scenery.	More than 90% of the area is covered by existing home ranges for four northern spotted owl (FT) sites.	This tributary to Quartzville Creek is an undisturbed area of low elevation (1,200 - 3,100 feet), high quality, contiguous, old growth forest which is rare in the physiographic province. The area supports a broad diversity of overstory tree species including: Douglas-fir, western hemlock, western redcedar, Pacific yes, Pacific silver-fir, noble fir, western white pine, sugar pine, bigleaf maple, red alder and black cottonwood. This forest stand, situated deep in the inner-gorge has been protected from stand replacement fires for more than 250 years.	

Appendix G – Climate Change

Carbon Storage Modeling

Analysis of Carbon Storage

The analysis of carbon storage estimated the amount of carbon stored in the forest and in harvested wood products as well as carbon stored in non-forest portions of the planning area. The analysis divided carbon into four pools:

- Live trees
- Above-ground carbon other than live trees
- Soil to 1 m depth (3.3 ft.)
- Harvested wood

The BLM summed the carbon in these four pools to estimate the total carbon stored by alternative. The BLM assumed carbon stored in soil and in non-forest portions of the planning area was constant through time, largely due to the lack of information about how these pools change over time.

Carbon Storage in Live Trees

The BLM estimated carbon storage in live trees for each alternative, including a "grow only scenario" using the following process:

1. Obtain estimates of standing tree volumes for each period from the Woodstock model. See Appendix C – Vegetation Modeling for more detail on how the BLM estimated volume over time.
2. Convert live tree volume in thousand board feet (Mbf) to cubic feet using the following formula: $ft^3 = (Mbf \div 6.0) \times 1000$.
3. Estimate the composite density of wood (lb./ft.^{3}) based on specific gravity at 12 percent moisture content for several species, but primarily Douglas-fir (Forest Products Laboratory 2010)
4. Convert cubic foot volume to pounds using the following formula:
$$pounds = ft^3 \times 33.5 \frac{pounds}{ft^3}$$
5. Multiply pounds of wood by 0.5 to estimate pounds of carbon (Smith *et al.* 2006).
6. Estimate megagrams of carbon (Mg C) for whole trees (branches, roots, and bark) using the following formula:
$$Mg\ C = (lb\ C \times 1.85) \div 2200$$

The BLM based initial tree volumes on the total gross volume, or the estimated volume per acre multiplied by the number of acres. This estimate avoided the need to convert from acres to hectares for live tree carbon storage.

Carbon Storage in Forest Vegetation Other than Live Trees

Forest vegetation other than live trees includes snags, understory vegetation, downed wood, and the forest floor (litter and duff). The BLM downloaded tables of carbon stock estimates using the Carbon On Line

Tool version 3.0 (COLE 3.0), available at http://www.ncasi2.org/GCOLE3/gcole.shtml. The BLM generated reports using the county or counties that comprise most of the individual district or Klamath Falls Field Office. The BLM applied a filter consisting of federal lands within the county. Although the BLM could have filtered for just BLM-administered lands, the data used to generate the estimates did not include enough plots on BLM-administered lands for statistically sound estimates. The analysis used table 1 of the report, which consists estimates of carbon stocks by age class for years 0 through 100, subtracting out the estimates for soil and live trees. Since many stands are older than age 100, we needed to estimate understory carbon beyond year 100. Using the COLE table 1, we plotted the understory carbon stock estimates for every decade between year 10 and year 100 in an Excel spreadsheet and then used the trendline tool to create a regression equation for each district and Klamath Falls Field Office. We then used the resulting equation to estimate understory carbon stocks for every decade between year 110 and 210, assuming that after year 210, understory carbon reaches equilibrium between input and decay.

Above-ground Carbon Storage in Un-modeled Forest

A portion of each district consisted of polygons that included an initial stand age, but the BLM did not model subsequent growth and did not include these lands in the harvest land base. Generally, these sites consist of administratively reserved areas, such as Areas of Critical Environmental Concern and Research Natural Areas, Congressional reserves such as designated Wild and Scenic Rivers, areas that support trees but which the BLM determined not suitable for sustained yield timber production. For these areas, BLM used the estimates from COLE that included live trees. Using the same process as with the vegetation other than live trees (see above), BLM extrapolated carbon from age 110 to 210, assuming that after age 210, above ground biomass reached a dynamic equilibrium between the carrying capacity for live biomass and the accumulation and decay of dead biomass.

Carbon Storage in Soil

Little is actually known about carbon storage in soils due to the difficulties and expense in studying this carbon pool (Johnson and Curtis 2001). The scientific community knows even less about how soil carbon changes over time following natural disturbances and management, although some studies have attempted to understand soil carbon dynamics better. Decreases in soil carbon have generally been low and of relatively short duration (Smith *et al*. 2006, McKinley *et al*. 2011). For that reason, we assumed no changes in soil carbon over time. We used the soil column from table 1 of each COLE 3.0 output and multiplied that value by the number of hectares analyzed on each district to estimate the Mg C stored in soils.

Carbon Storage in Harvested Wood

Carbon stored in harvested wood depends on the volume of wood harvested, the resulting wood product, and the amount of carbon in that wood emitted through harvesting, processing, waste, disposal, and decomposition. Earles *et al.* (2012) developed decay equations for harvested wood based on the above factors for various parts of the world. Although we were unable to obtain copies of the actual equations, we developed a regression function based on the graphs for the U.S. Pacific Northwest provided in the supplemental information for the study:

$$Percent\ C\ remaining = (-0.0026 \times years\ since\ harvest) + 0.4989$$

This regression accounts for the life expectancy of different wood products such as paper, fiberboard, and lumber.

For the existing condition, BLM used annual harvest records from the Oregon Department of Forestry (http://www.oregon.gov/odf/Pages/state_forests/frp/RP_Home.aspx#Annual_Timber_Harvest_Report) to estimate the volume harvested over time from BLM-administered lands within the planning area. We converted the volume in thousands of board feet (Mbf) to carbon using the conversion factor of 0.443 Mg C per Mbf (Smith *et al*. 2006, p. 35). Total carbon remaining equaled the percent carbon remaining multiplied by the total carbon initially in the harvested wood.

To estimate the effects of the alternatives, BLM multiplied the estimated volume harvested per decade by the same conversion factor to carbon and the same regression function as for the existing condition. The BLM added these results to the estimated carbon stored in previously harvested wood products as of 2013.

Carbon in Polygons with No Data

A certain portion of each district consisted of polygons for which there was no vegetation information. For the purposes of this analysis, BLM assumed vegetation was present but that the predominant vegetation was not forest. To estimate aboveground carbon, we used biomass information based on the Fuels Characteristic Class System (FCCS) version 3.0 for savanna, shrubland and grassland types considered representative of typical non-forest plant communities for each district or group of districts. Since the BLM did not know the relative abundance of the non-forest plant communities, it used a simple average of the estimated aboveground carbon for the selected FCCS fuelbeds. The BLM multiplied the result by the estimated number of hectares in non-forest community types to estimate aboveground carbon stored in each district and assumed these carbon stocks did not change over time.

Effects of Wildfire on Carbon Storage

The Woodstock model included occurrence of high and mixed severity fire on each district in each decade based on historical occurrence levels. Following high severity wildfire, the model reset stand age to zero in the decade in which the fire occurred. To mimic the effects of burning on aboveground carbon in a high severity fire, BLM estimated the remaining carbon to equal 25 percent of the carbon at age zero in the COLE tables. The BLM based this reduction on a combination of experience in assessing post-fire effects following fires considered high severity and the standard definition of high severity used by LANDFIRE (high severity equals greater than 75 percent mortality of the dominant plant life form). Thereafter, the BLM based carbon on stand age.

The BLM did not reset stand age following a mixed severity fire. The BLM assumed 50 percent of the carbon associated with the stand age at the time of the fire was lost, based on the standard definition of mixed severity used by LANDFIRE (mixed severity equals 25 to 75 percent mortality of the dominant plant life form). The BLM assumed subsequent ages to contain only 75 percent of the carbon that would have been present in the absence of fire. While full recovery to carbon likely does occur, at some point, there is no scientific basis for determining when full recovery occurs. Further, recovery rates differ widely across the planning area.

Sources of Uncertainty in Carbon Estimates

There are a large number of sources of uncertainty in estimating the amount of carbon stored on the BLM-administered lands within the planning area. These include the quality of the inventory data used, estimation methodology selected, and reliability of the data. Inventory data for live trees is generally the highest quality and most accurate, but the amount of time since the inventory and subsequent disturbance types and severities affect the accuracy of that data. Further, BLM does not have a vegetation database such that no direct information was available concerning species, extent, and biomass for litter and duff, dead wood, herbaceous vegetation, shrubs, and non-commercial tree species.

There are several methodologies available for estimating the amount of carbon in a given unit of land and in harvested wood products; the likelihood of obtaining the same answer using different methodologies is low. Estimating soil carbon is particularly problematic due to the lack of data and different authors have generated estimates to differing depths in the soil profile. The BLM did not locate any studies that estimated time to full recovery of carbon to the equivalent of an unburned stand of the same age and general species composition following a mixed severity wildfire.

Since many of the sources used to estimate carbon do not include measures of uncertainty, variance, or error, the level of uncertainty is not known, but likely large and could well exceed 50 percent. As such, the potential error in the estimate for any one alternative likely exceeds the amount of variance between the alternatives.

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Greenhouse Gas Emissions Estimation

Analysis of Greenhouse Gas Emissions

For this planning effort, the BLM estimated greenhouse gas emissions from four sources:

- Enteric fermentation from permitted grazing on BLM-administered lands
- Timber harvest operations
- Prescribed burning
- Wildfires

The BLM summed emissions for each alternative, although emissions from grazing, the hazardous fuels program, and wildfires did not vary by alternative.

Greenhouse gases emitted by activities on BLM-administered lands include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Both CH_4 and N_2O emissions have a greater global warming potential than CO_2 so the BLM multiplied the estimates by 25 and 298, respectively, to estimate carbon dioxide equivalents (CO_2e). All greenhouse gas emissions are converted to the standard megagrams of carbon dioxide equivalent (Mg CO_2e) used for reporting greenhouse gas emissions nationally and globally.

Enteric Fermentation (Grazing)

The BLM based grazing emissions on the number of permitted animal unit months on BLM-administered lands in the planning area. Although the actual number of cow-calf pairs are less than the permitted number for the past several years, this analysis used the permitted number. The formula used to estimate was derived from IPCC guidelines (Eggleston *et al*. 2006, Chapter 10):

$$\left(AUMs \times \left(\frac{4.4\ kg\ CH4}{month}\right) \div 10000\right) \times 25 = Mg\ CO2e$$

The CH_4 emissions factor of 4.4 kg mo^{-1} equals the annual emission factor in North America for beef cattle divided by 12 (EPA 2014).

Harvest Operations

Greenhouse gas emissions from harvest operations are based on the study by Sonne (2006) in the Oregon Coast Range for private industrial lands and on harvest records maintained by the Oregon Department of Forestry (ODF) for all lands in western Oregon and for Klamath County in eastern Oregon (available at: http://www.oregon.gov/odf/pages/pubs/publications.aspx#agency_annual_reports). The BLM first converted harvest records in thousands of board feet to millions of board feet and divided by six to estimate millions of cubic feet. From Sonne (2006), BLM used the expected greenhouse gas emissions based on planting 1235 trees per acre, and applying a precommercial thinning, commercial thinning, and fertilization prior to final harvest:

$$\left(\left(\frac{1.38\ Mg\ Co2e}{100\ m^3}\right) \times \left(\frac{100\ m^3}{3531.467\ ft^3}\right) \times 1{,}000{,}000 = 390.77\ \frac{Mg\ CO2e}{MMcf}\right)$$

The BLM then multiplied the number of million cubic feet harvested by 390.77 to estimate Mg CO_2e. This emission factor is based on a shorter rotation and more intensive management practices than BLM typically uses and, therefore, may somewhat overestimate emissions from harvest activities on BLM-administered lands as well as on other federal lands.

Prescribed Burning

Greenhouse gas emissions from past prescribed burning are based on estimated tons of biomass consumed as reported to ODF under the state's smoke management plan (available at http://www.oregon.gov/odf/pages/fire/smp/smkmgtannualrpts.aspx). ODF's reports include prescribed burns on BLM-administered lands in the Other Federal category, which includes U.S. Fish and Wildlife Service and Bureau of Indian Affairs, and consolidates prescribed burns for both Lake and Klamath Counties into a single number. The BLM conducts most of prescribed burning in the Other Federal category, as indicated by the harvest records. The BLM calculated the various greenhouse gas types emitted from burning wood (CO_2, CH_4, and N_2O) by multiplying the tons consumed with EPA-provided emission factors (EPA 2014, Table 1). The BLM used emission factors for burning wood and wood residuals for power generation. Since power generation typically consumes all material, the BLM may have overestimated emissions as compared to open burning where larger pieces of wood may or may not completely consume.

The BLM used two different methods to estimate emissions from future prescribed burning. For pile burning (hand piles, machine piles, and landing piles), the BLM used a standard description for each type of pile (size, shape, and composition) and a standard estimate of the number of piles per acre to estimate emissions per acre using the pile utility in Consume. The BLM multiplied these estimates by the number of acres treated by piling. The Woodstock model provided estimates of the acres treated by each type of piling method for harvest treatments and historical averages used for the hazardous fuels program. For broadcast and under burning, BLM selected a single representative fuel bed for each district that would result in the approximate number of tons consumed that had been estimated by past burning, as reported by the team's fuels specialist.

Wildfires

Wildfire emissions are much more difficult to estimate since there are no records of how much material any given fire consumes. The BLM used the following procedures to estimate greenhouse gas emissions from past wildfires.

The BLM downloaded records of all wildfires for Coos Bay, Eugene, Lakeview, Medford, Roseburg, and Salem Districts from the FAMWEB site (http://fam.nwcg.gov/fam-web/weatherfirecd/), imported the records into FireFamily Plus 4.1, extracted all wildfires 100+ acres in size, and exported the results into an Excel Spreadsheet. Using a variety of methods, the BLM deleted as many fires as it could identify as burning on Lakeview Resource Area. The BLM combined the data for Coos Bay, Eugene, and Salem into one group and the data for Medford and Roseburg into one group. Over the 34-year period of record (1980-2013), 7,763 acres burned in the Coos Bay-Eugene-Salem group, 277,605 acres in the Medford-Roseburg group, and 29,447 acres in Klamath Falls Field Office.

The BLM downloaded assessments of burn severity for individual large fires that originated on BLM-administered lands between 1984 and 2012, the latest year available, from the Monitoring Trends in Burn Severity website (http://mtbs.gov/data/individualfiredata.html). The BLM averaged acres burned in the difference categories of unburned to low, low, moderate, high, increased greenness, and mask and calculated the proportion for each category. Mask areas consist of features such as clouds, water and rock as well as missing lines of image data. The BLM combined high, increased greenness, and mask into a single category and unburned to low and low into a single category. The resulting proportions of area burned were 59.1 percent low severity, 21.8 percent mixed severity, and 19.0 percent high severity. Because the documented fire severity record is sparse, BLM used these same severity proportions across the planning area.

Since preburn fuel loadings are not known, BLM used the Fuels Characteristic Class System (FCCS) module in Fuel & Fire Tools (FERA and UW 2014) to select representative fuelbeds (**Table G-1**). Since BLM did not know the relative proportion of each fuelbed included in each analysis group, it equally weighted all fuelbeds. In order to assess emissions from the different burn severities, BLM multiplied the total number of acres burned in each group by the proportional amount in the low, mixed, and high severity classes and created separate units in Fuel & Fire Tools. For example, the group comprised of Coos Bay, Eugene and Salem Districts had three units labeled low, mixed, and high with assigned acres equaling the proportion estimated for each severity class (**Table G-2**). Each unit consisted of the set of fuelbeds selected through FCCS. The Consume module in Fuel & Fire Tools used this information to estimate greenhouse gas emissions for CO_2 and CH_4. Since the Consume module only uses 1000-hour and duff fuel moisture to drive the consumption algorithms, the BLM could not fully meet its intent of adjusting the amount of live fuel consumed.

Table G-1. Fuels Characteristic Classification System fuelbeds used in each analysis group to estimate greenhouse gas emissions from wildfire.

District/ Field Office	Fuelbed Number	Fuelbed Name
Coos Bay – Eugene – Salem	2	Western hemlock – western redcedar – Douglas-fir
	5	Douglas-fir – white fir
	8	Western hemlock – Douglas-fir – western redcedar/vine maple
	9	Douglas-fir – western hemlock – western redcedar/vine maple
	10	Western hemlock – Douglas-fir – Sitka spruce
	11	Douglas-fir – western hemlock – Sitka spruce
	18	Douglas-fir/oceanspray
	24	Pacific ponderosa pine – Douglas-fir
	52	Douglas-fir – Pacific ponderosa pine/oceanspray
	208	Grand fir – Douglas-fir
	322	Sitka spruce – western hemlock
Klamath Falls	20	Western juniper/curl-leaf mountain mahogany
	24	Pacific ponderosa pine – Douglas-fir
	25	Pinyon – Utah juniper
	53	Pacific ponderosa pine
	55	Western juniper/sagebrush
	58	Western juniper/sagebrush
	67	Interior ponderosa pine – Douglas-fir
	210	Pinyon – Utah juniper
Medford – Roseburg	2	Western hemlock – western redcedar – Douglas-fir
	4	Douglas-fir/*Ceanothus*
	5	Douglas-fir – white fir
	6	Oregon white oak – Douglas-fir
	7	Douglas-fir – sugar pine – tanoak

	15	Jeffrey pine – red fir – white fir/greenleaf - snowbrush
	16	Jeffrey pine – ponderosa pine – Douglas-fir – California black oak
	24	Pacific ponderosa pine – Douglas-fir
	37	Ponderosa pine – Jeffrey pine
	38	Douglas-fir – madrone – tanoak
	39	Sugar pine – Douglas-fir – oak
	208	Grand fir – Douglas-fir
	215	Douglas-fir – madrone – tanoak
	239	Douglas-fir – sugar pine – tanoak

Table G-2. Acres, fuel moistures, and targeted consumption rates for live woody fuels in each severity class for past wildfires.

Live Woody Fuels	Low Severity	Mixed Severity	High Severity
	Consume Inputs		
1,000-hour Fuel Moisture	20%	10%	6%
Duff Moisture	200%	100%	10%
Shrub Black	-	50%	100%
Crown Black	-	50%	100%
District/Field Office	**Acres In Each Severity Class**		
Coos Bay – Eugene – Salem	1,475	1,692	4,588
Klamath Falls	5,595	6,419	17,403
Medford – Roseburg	52,745	60,518	164,065

Large fires that originate on BLM-administered lands typically burn onto other lands. However, the future wildfire acres burned applied only to BLM-administered lands. In order to provide an appropriate comparison, BLM had to adjust the emissions from past fires downward. The BLM calculated the average number of acres burned using the data for fires that originated on BLM-administered lands and compared that to the average number of acres burned just on BLM-administered lands as reported in Davis *et al*. (2014, p. 7), resulting in a reduction of 62 percent.

Consume does not estimate N_2O. However, the amount of N_2O emitted by wood is relatively small (EPA 2014, Table 1). In addition, since the consumption algorithms in Consume are largely based on data collected during prescribed burning of logging debris, the program typically over-predicts consumption of natural fuels (Prichard *et al*. no date).

To estimate greenhouse gas emissions from future wildfires, BLM used the estimated acres burned in mixed and high severity fires each period from the Woodstock model. Using the same set of FCCS fuelbeds from **Table G-1** and the same fuel moistures and targeted consumption rates from **Table G-2**, BLM used Consume to estimate the per acre emissions for methane and carbon dioxide and converted the mass measure of pounds per acre to megagrams per acre. Since Consume does not include an estimate for nitrous oxide, BLM used the EPA (2014) emission factor for N_2O for wood products of 63 g per short ton. Since low-severity fire was not included in Woodstock under the assumption that there was no impact to volume, BLM assumed maintenance of the proportional relationship between low, mixed, and high severity fire and used the acres burned in mixed and high severity combined to estimate the acres burned in low severity fire.

Uncertainties in Greenhouse Gas Emissions

Several factors can affect the actual greenhouse gas emissions from the different sectors analyzed in this document. Generally, limited input data, measurement errors associated with the available data, the need to simplify complex systems, and creating or using models based on limited data are the main sources of uncertainty in emissions estimation (Eve *et al*. 2014, p. 8-4).

Emissions from livestock grazing account only for the emissions from the animals and not for emissions from the soil that can arise based on grazing system, stocking rate, utilization levels, and season of grazing (Eve *et al*. 2014). Further, greenhouse gas emissions from grazing also depend on animal size and growth rate, which the BLM does not know for this analysis and likely varies from year-to-year. Thus, the estimation method the BLM used in this analysis has an estimated uncertainty of ± 50 percent (Eggleston *et al*. 2006, p. 10.33).

Emissions from harvest operations used in this analysis are based on a life cycle analysis conducted by Sonne (2006), which attempted to account for emissions from fuel used by vehicles and equipment, electricity, and fertilizer production in order to harvest trees; prepare sites for planting using prescribed fire or herbicides; produce, transport and plant seedlings; fertilize the site, and conduct one or more thinning operations before the final harvest of the subsequent stand. Although Sonne (2006) examined several different rotation ages, this analysis used age 60, the longest. BLM typically manages even-aged stands on longer rotations and under the limitations of the 1995 RMPs, conducts far more thinning operations than final harvests, affecting actual greenhouse gas emissions. Further, BLM conducts some uneven-aged management in the drier forests, which likely results in different emissions levels than even-aged management, although whether uneven-aged management produces less or greater emissions than even-aged management is not known. The BLM does not know the uncertainty associated with harvest operations, but expects that it is greater than ± 50 percent.

Greenhouse gas emissions from fire are particularly large. Estimates of preburn biomass and the amount of biomass consumed vary widely and the BLM does not know this information in sufficient detail for wildfires. Various estimating tools are available for prescribed fires, such as the debris prediction module in the Forest Vegetation Simulator (Rebain 2014) and the pile calculator in Fuel & Fire Tools (FERA and UW 2014). However, the districts may or may not use these tools in a given situation and the BLM does not know the consistency of use. The tons recorded by ODF are simply those reported by the people who conducted the burn, who do not have effective methods for estimating actual consumption. Canopy consumption in wildfires of both trees and shrubs is particularly difficult to estimate with high variability both within and between wildfires. As with harvest operations, the BLM does not know the uncertainty associated with emissions from fire, but expects that it varies by a factor of two (between half and twice as much as the estimate).

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Appendix H – Fire and Fuels

Issue 1 - Assumptions, Methods, etc.

Methods

Study Area

The Nature Conservancy assessed forest vegetation restoration needs across five million acres of forest across southwestern Oregon (**Figure H-1**). Within the study area, they focused on the 1.2 million acres of BLM land as the lands that changed by Alternative (**Figure H-2**). This geography generally includes the extent of historically frequent fire forests within SW Oregon. These forests cover very broad climatic, edaphic, and topographic gradients with varying natural disturbance regimes.

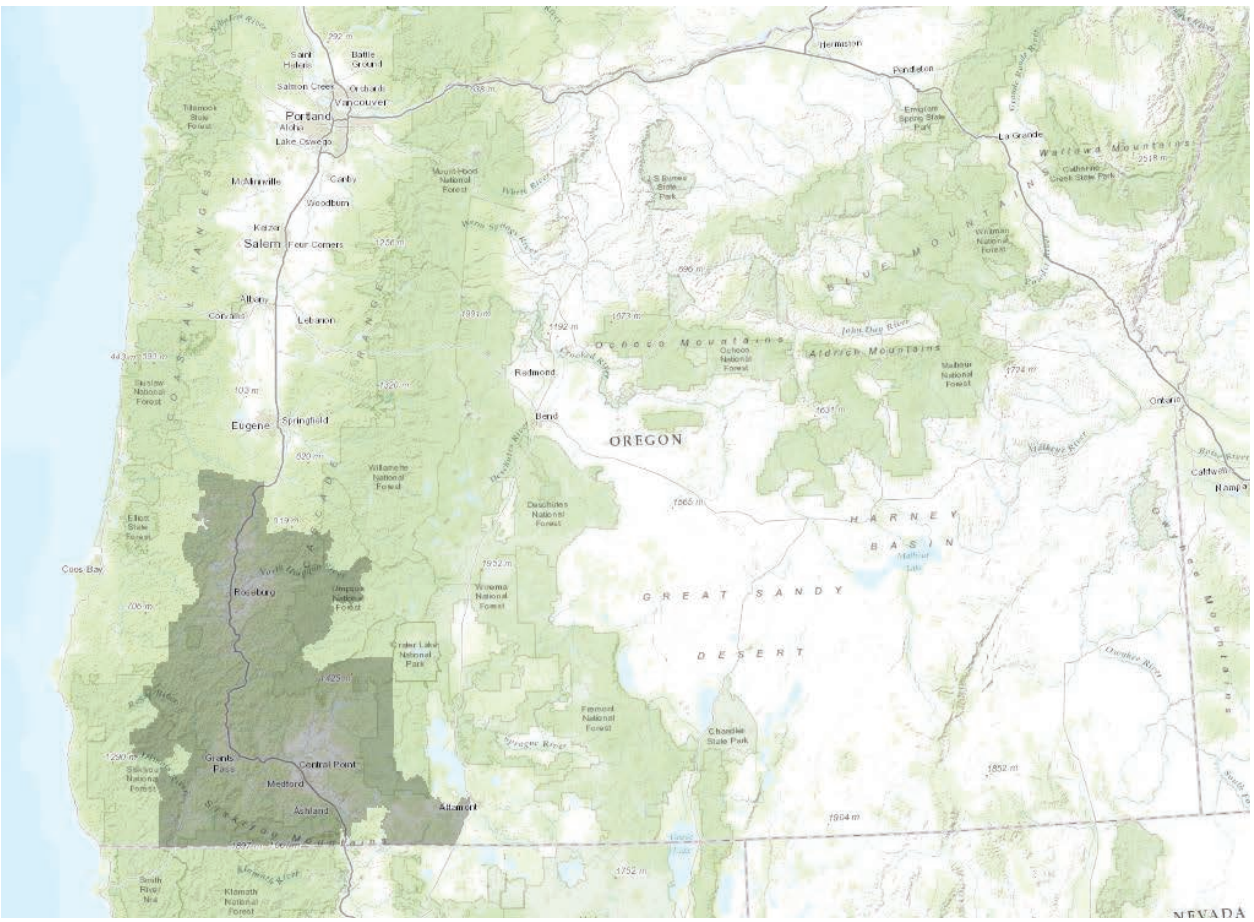

Figure H-1. Analysis area.

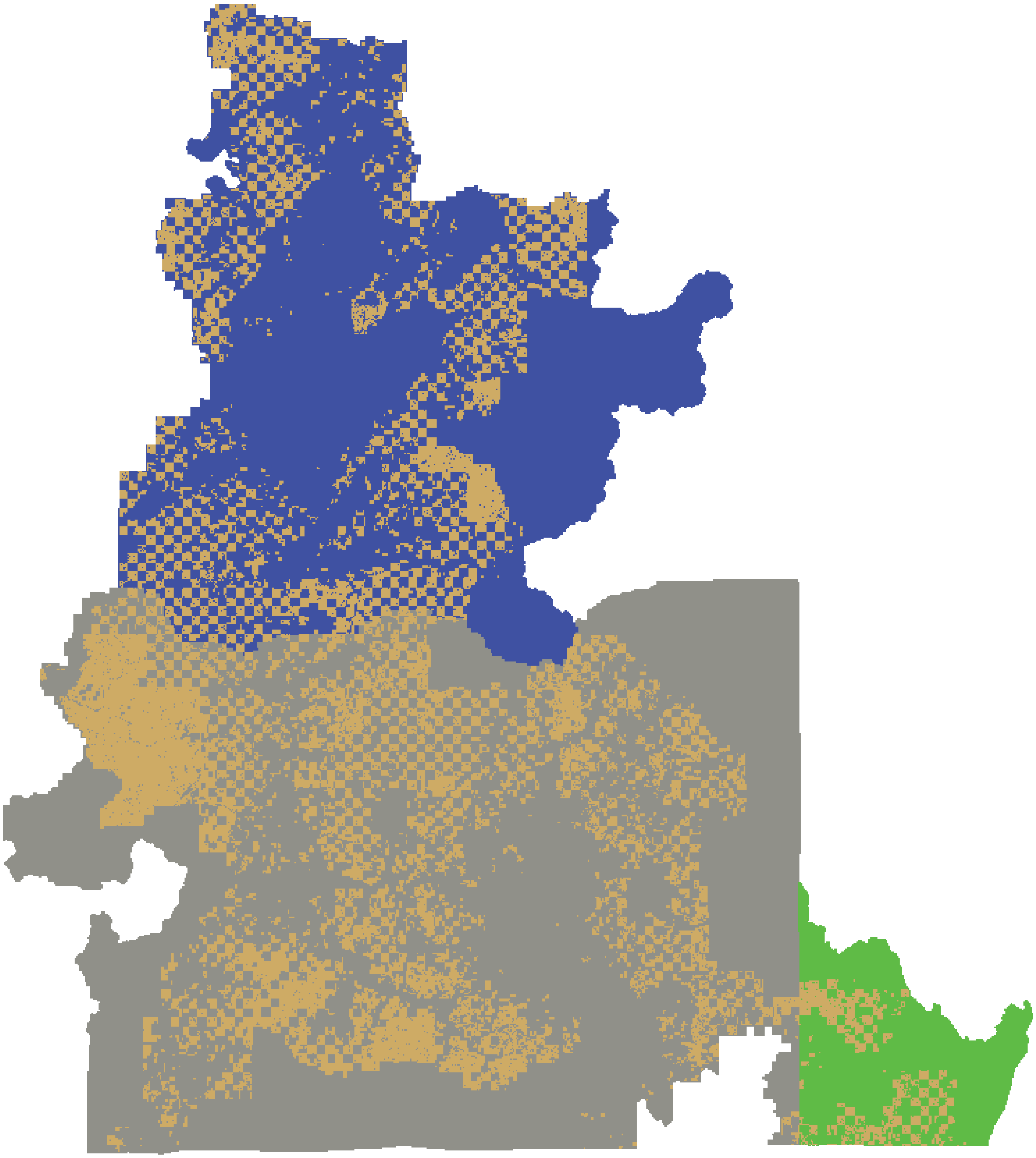

Figure H-2. BLM-administered land within the analysis area.

Core Concepts and Data Sources

The Nature Conservancy (TNC) built upon the conceptual framework of the LANDFIRE and Fire Regime Condition Class (FRCC) programs (Barrett *et al*. 2010, Rollins 2009) and incorporated Oregon and BLM specific datasets. TNC's assessment of forest vegetation departure is based on four primary data inputs: 1) a classification and map of forested biophysical settings, 2) NRV reference conditions for each biophysical setting, 3) a delineation of "landscape units" for each biophysical setting, and 4) a map of present day forest vegetation structure.

Mapping Forested Biophysical Settings

Biophysical settings are potential vegetation units associated with characteristic land capabilities and disturbance regimes (Barrett *et al*. 2010). Many different forested biophysical settings are found across Washington and Oregon based on vegetation, soils, climate, topography, and historic disturbance regimes (Keane *et al*. 2007, Pratt *et al*. 2006, Rollins 2009). They provide the framework for describing fire regimes. TNC mapped biophysical settings using the 30m pixel Integrated Landscape Assessment Projects' Potential Vegetation Type (PVT) dataset (Halofsky *et al*. In press), which compiled previous potential forest vegetation classification and mapping efforts including Simpson (2007) and Henderson *et.al*. (2011). TNC also incorporated subsequent refinements to PVT mapping in southwestern Oregon by Henderson (2013).

A biophysical setting model from either the LANDFIRE Rapid Assessment or the later LANDFIRE National program (Rollins 2009, Ryan and Opperman 2013) was assigned to each PVT mapping unit (**Table H-1**). Assignments were made by staff in the U.S. Forest Service Pacific Northwest Region Ecology Program based upon the geographic, environmental, and biological characteristics of the biophysical setting models and the PVT mapping units. TNC defined forests across our study area as those described as a "forest" or "forest and woodland" land cover class in the biophysical setting model. National Forest System lands are typically considered "forest" if they have >10% tree canopy cover, and this generally coincides with forest, and forest and woodland land cover classes (USDA FS 2004).

Table H-1. ILAP PVT to LANDFIRE BpS model crosswalk.

Integrated Landscape Assessment Project Potential Vegetation Type (ILAP PVT)	LANDFIRE Biophysical Settings (BpS)
Douglas-fir - White oak	0210290
Oregon white oak	0210290
Douglas-fir - Dry	0710270
Douglas-fir - Moist	R#DFHEwt
Douglas-fir - Moist	R#DFHEwt
Western hemlock - Coastal	R#DFHEwt
Western hemlock - Cold	R#DFHEwt
Western hemlock - Moist	R#DFHEwt
Western hemlock - Moist (Coastal)	R#DFHEwt
Western hemlock - Wet	R#DFHEwt
Douglas-fir - Dry	R#MCONdy
Douglas-fir - Dry	R#MCONdy
Douglas-fir - Dry	R#MCONdy
Douglas-fir - Xeric	R#MCONdy
Grand fir - Warm/Dry	R#MCONdy
Mixed Conifer - Dry	R#MCONdy
Mixed Conifer - Dry (Pumice soils)	R#MCONdy
Grand fir - Cool/moist	R#MCONms
Grand fir - Cool/moist	R#MCONms
Grand fir - Cool/moist	R#MCONms
Mixed Conifer - Moist	R#MCONms
Douglas-fir - Moist	R#MCONsw
White fir - Intermediate	R#MCONsw
White fir - Moist	R#MCONsw

Integrated Landscape Assessment Project Potential Vegetation Type (ILAP PVT)	LANDFIRE Biophysical Settings (BpS)
Tan oak - Douglas-fir - Dry	R#MEVG
Ultramafic	R#MEVG
Idaho fescue - Prairie junegrass	R#MGRA
Oregon white oak - Ponderosa pine	R#OAPI
Lodgepole pine - Dry	R#PICOpu
Lodgepole pine - Wet	R#PICOpu
Jeffery Pine	R#PIJEsp
Ponderosa pine - Dry	R#PIPOm
Ponderosa pine - Lodgepole pine	R#PIPOm
Ponderosa pine - Dry, with juniper	R#PIPOxe
Ponderosa pine - Xeric	R#PIPOxe
Shasta red fir - Dry	R#REFI
Shasta red fir - Moist	R#REFI
White fir - Cool	R#REFI
Mixed Conifer - Cold/dry	R#SPFI
Subalpine fir - Cold/Dry	R#SPFI
Sitka spruce	R#SSHE
Tan oak - Douglas-fir - Moist	R#TAOAco
Tan oak - Moist	R#TAOAco
Shasta red fir - Moist	R1RFWF
White fir - Cool	R1RFWF

Natural Range of Variability Reference Conditions

Each biophysical setting model is composed of a suite of 3-5 successional/structural stages (s-classes). These classes typically include: A) Early Development, B) Mid-Development Closed Canopy, C) Mid-Development Open Canopy, D) Late Development Open Canopy, and E) Late Development Closed Canopy. The definition of each s-class in terms of species composition, stand structure, and stand age is unique for each biophysical setting (**Table H-2** and **Table H-3**). The percentage of a biophysical setting in each s-class will differ depending on disturbance frequencies and/or intensities. The LANDFIRE and FRCC conceptual framework assumes that, given natural processes, a biophysical setting will have a characteristic range of variation in the proportion in each s-class and that an effective indicator of "ecological condition" for a given landscape is the relative abundance of each s-class within biophysical settings (Barrett *et al*. 2010, Keane *et al*. 2011).

Table H-2. BLM-administered lands.

	LANDFIRE BpS	Included in BLM Dry Extent	Early-Seral (A)				Mid-Seral Closed (B)				Mid-Seral Open (C)				Late-Seral Open (D)				Late-Seral Closed (E)			
			Size Class*		Canopy Closure		Size Class*		Canopy Closure		Size Class*		Canopy Closure		Size Class*		Canopy Closure		Size Class*		Canopy Closure	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Standard LANDFIRE 5-Box Models	0210290	x	1	2	0	100	3	4	31	100	3	4	0	31	5	5	0	30	5	5	31	100
	0710270	x	1	2	0	100	3	4	41	100	3	4	0	40	5	5	0	40	5	5	41	100
	R#DFHEwt	x	1	2	0	100	3	4	61	100	3	4	0	60	5	5	0	60	5	5	61	100
	R#MCONdy	x	1	2	0	100	3	4	41	100	3	4	0	40	5	5	0	40	5	5	41	100
	R#MCONms	x	1	2	0	100	3	4	56	100	3	4	0	55	5	5	0	55	5	5	56	100
	R#MCONsw	x	1	2	0	100	3	4	41	100	3	4	0	40	5	5	0	40	5	5	41	100
	R#MEVG	x	1	2	0	100	3	4	41	100	3	4	0	40	5	5	0	40	5	5	41	100
	R#OAPI	x	1	2	0	100	3	4	31	100	3	4	0	30	5	5	0	30	5	5	31	100
	R#PICOpu	x	1	2	0	100	3	4	41	100	3	4	0	40	5	5	0	40	5	5	41	100
	R#PIPOm	x	1	2	0	100	3	4	31	100	3	4	0	30	5	5	0	30	5	5	31	100
	R#PIPOxe	x	1	2	0	100	3	4	26	100	3	4	0	25	5	5	0	25	5	5	26	100
	R#REFI	x	1	2	0	100	3	4	41	100	3	4	0	40	5	5	0	40	5	5	41	100
	R#TAOAco	x	1	2	0	100	3	4	61	100	3	4	0	60	5	5	0	60	5	5	61	100
	R1RFWF	x	1	2	0	100	3	4	41	100	3	4	0	41	5	5	0	41	5	5	41	100
	R#PIJEsp	x	1	2	0	100	3	4	41	100	3	4	0	40	5	5	0	40	5	5	41	100
	LAND-FIRE BpS	Included in BLM Dry Extent	Early-Seral (A)				Mid-Seral Closed (B)				Mid-Seral Open (C)				Late-Seral Open (D)				Late-Seral Closed (E)			
			Size Class		Canopy Closure		Size Class		Canopy Closure		Size Class		Canopy Closure		Size Class		Canopy Closure		Size Class		Canopy Closure	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
	F#SPFI	x*	1	2	0	10	1	2	11	100	3	4	41	100	3	4	0	40	5	5	0	100

* BLM size-class values are numeric representations of structure classes used to categorize early, stand establishment, young, mature and older complex structural stages (see Vegetation Modeling Appendix). Canopy cover from BLM vegetation-modeling outputs was used for open and closed thresholds.

The term canopy closure in this table is synonymous with canopy cover and is based on modeled cover and not field bases closure measurements.

Table H-3. Other non-BLM lands

	LANDFIRE BpS	Early-Seral (A)				Mid-Seral Closed (B)				Mid-Seral Open (C)				Late-Seral Open (D)				Late-Seral Closed (E)			
		Size Class		Canopy Closure		Size Class		Canopy Closure		Size Class		Canopy Closure		Size Class		Canopy Closure		Size Class		Canopy Closure	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Standard LANDFIRE 5-Box Models	0210290	1	2	0	100	3	5	31	100	3	5	0	31	6	7	0	30	6	7	31	100
	0710270	1	2	0	100	3	6	41	100	3	6	0	40	7	7	0	40	7	7	41	100
	R#DFHEwt	1	2	0	100	3	5	61	100	3	5	0	60	6	7	0	60	6	7	61	100
	R#MCONdy	1	2	0	100	3	5	41	100	3	5	0	40	6	7	0	40	6	7	41	100
	R#MCONms	1	2	0	100	3	5	56	100	3	5	0	55	6	7	0	55	6	7	56	100
	R#MCONsw	1	2	0	100	3	5	41	100	3	5	0	40	6	7	0	40	6	7	41	100
	R#MEVG	1	2	0	100	3	4	41	100	3	4	0	40	5	7	0	40	5	7	41	100
	R#OAPI	1	2	0	100	3	3	31	100	3	3	0	30	4	7	0	30	4	7	31	100
	R#PICOpu	1	2	0	100	3	5	41	100	3	5	0	40	6	7	0	40	6	7	41	100
	R#PIPOm	1	2	0	100	3	4	31	100	3	4	0	30	5	7	0	30	5	7	31	100
	R#PIPOxe	1	2	0	100	3	5	26	100	3	5	0	25	6	7	0	25	6	7	26	100
	R#REFI	1	2	0	100	3	5	41	100	3	5	0	40	6	7	0	40	6	7	41	100
	R#TAOAco	1	2	0	100	3	4	61	100	3	4	0	60	5	7	0	60	5	7	61	100
	R1RFWF	1	2	0	100	3	5	41	100	3	5	0	41	6	7	0	41	6	7	41	100
	R#PIJEsp	1	2	0	100	3	5	41	100	3	5	0	40	6	7	0	40	6	7	41	100
	LAND-FIRE BpS	Early-Seral (A)				Mid-Seral Closed (B)				Mid-Seral Open (C)				Late-Seral Open (D)				Late-Seral Closed (E)			
		Size Class		Canopy Closure		Size Class		Canopy Closure		Size Class		Canopy Closure		Size Class		Canopy Closure		Size Class		Canopy Closure	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
	R#SPFI	1	2	0	10	1	2	11	100	3	4	41	100	3	4	0	40	5	7	0	100

The term canopy closure in this table is synonymous with canopy cover and is based on modeled cover % and not field bases closure measurements.

NRV reference models describe how the relative distribution of s-classes for a biophysical setting were shaped by succession and disturbance prior to European settlement and provide a comparison to present-day forest conditions (Keane *et al*. 2009, Landres *et al*. 1999). LANDFIRE biophysical setting models are used to develop NRV estimates using state-and-transition models incorporating pre-European settlement rates of succession and disturbance. Rates were determined through an intensive literature and expert review process (Keane *et al*. 2002, Keane *et al*. 2007, Pratt *et al*. 2006, Rollins 2009).

The distribution of s-classes for each biophysical setting, which results from running state-and-transition models for many time-steps (**Table H-4**) does not represent a specific historical date, but instead approximates characteristic conditions that result from natural biological and physical processes operating on a landscape over a relatively long time. NRV is frequently represented by a single value, the mean relative abundance of each s-class from a collection of Monte Carlo state-and-transition model simulations (e.g., Low *et al*. 2010, Shlisky *et al*. 2005, Weisz *et al*. 2009). However, TNC developed and used ranges for each s-class resulting from the stochastic variation within the state-and-transition models. TNC ran 10 simulations for each biophysical setting state-and-transition model over 1,000 pixels and 1,000 annual time steps. Simulations were started with an equal portion in each s-class and it took 200 to 400 years for the initial trends to stabilize. TNC calculated the range for each s-class as ±2 standard deviations from the mean abundance from the last 500 time steps (Provencher *et al*. 2008). Simulations were modeled using the Vegetation Dynamics Development Tool (ESSA Technologies 2007).

Table H-4. Reference condition range by PVT/BpS.

LANDFIRE BpS	BpS Name	Early-Seral (A)				Mid-Seral (B)				Mid-Seral (C)				Late-Seral Open (D)				Late-Seral Closed (E)			
		LAND-FIRE RC	VDDT Mean	HRV Low	HRV High	LAND-FIRE RC	VDDT Mean	HRV Low	HRV High	LAND-FIRE RC	VDDT Mean	HRV Low	HRV High	LAND-FIRE RC	VDDT Mean	HRV Low	HRV High	LAND-FIRE RC	VDDT Mean	HRV Low	HRV High
0210290	Mediterranean California Mixed Oak Woodland	10	9.3	7	11	1	1.1	0	2	20	21.2	19	24	64	64.9	62	68	5	3.5	2	5
0710270	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	10	9.0	7	11	5	6.3	5	8	20	20.1	18	22	40	42.3	40	45	25	22.3	20	25
R#DFHEwt	Douglas-fir Hemlock-Wet Mesic	5	4.6	3	6	15	17.0	15	19	1	0.6	0	1	4	3.5	2	5	75	74.3	71	77
R#MCONdy	Mixed Conifer - Eastside Dry	15	14.0	12	16	1	0.7	0	1	30	31.6	29	34	40	41.5	38	45	14	12.3	10	14
R#MCONms	Mixed Conifer - Eastside Mesic	15	14.5	12	17	40	44.4	42	47	15	12.5	10	15	10	9.6	8	11	20	18.9	17	21
R#MCONsw	Mixed Conifer - Southwest Oregon	15	14.6	12	17	5	2.9	2	4	10	12.6	11	14	50	51.9	49	55	20	18.1	16	20
R#MEVG	California Mixed Evergreen North	15	16.6	14	19	10	7.5	6	9	50	51.6	48	55	20	20.5	18	23	5	3.8	3	5
R#OAPI	Oregon White Oak/Ponderosa Pine	25	25.1	22	28	5	3.8	3	5	20	19.2	17	22	47	48.7	45	52	3	3.2	2	4
R#PICOpu	Lodgepole Pine - Pumice Soils	20	21.6	19	24	15	13.9	12	16	50	47.7	45	51	10	10.9	9	13	5	5.9	4	7
R#PIJEsp	Pine Savannah - Ultramafic	15	15.0	13	17	0	1.0	0	3	45	44.0	41	47	40	39.0	36	42	0	1.0	0	2
R#PIPOm	Dry Ponderosa Pine - Mesic	10	10.8	9	13	10	6.9	5	8	35	37.2	34	40	40	42.4	39	45	5	2.8	2	4
R#PIPOxe	Ponderosa Pine - Xeric	25	23.6	21	26	5	5.8	4	7	25	22.4	20	25	40	43.2	41	46	5	4.9	4	6
R#REFI	Red Fir	10	6.9	5	8	20	22.5	20	25	15	13.2	11	15	20	21.9	19	24	35	35.5	33	39
R#TAOCco	Oregon Coastal Tanoak	10	9.7	8	12	10	12.5	10	15	50	47.4	44	51	25	26.2	23	29	5	4.2	3	5
R1RFWF	Red Fir / White Fir	15	16.9	15	19	25	25.2	23	28	10	8.8	7	11	20	16.6	14	19	30	32.5	30	35
R#SPFI	Spruce-Fir	3	3.0	2	4	22	22.3	19	25	30	24.6	22	27	20	20.6	18	23	25	29.4	27	32

Landscape Units

Following the LANDFIRE and FRCC conceptual framework, TNC defined discrete landscape units to compare present-day forests to modeled NRV reference conditions (Barrett *et al*. 2010, Pratt *et al*. 2006). Landscape units were chosen that would adequately represent the scale of disturbance of a particular PVT and were composed of forested lands within a BLM management district. This would allow summarization in an accurate and usable way for managers (**Figure H-3**).

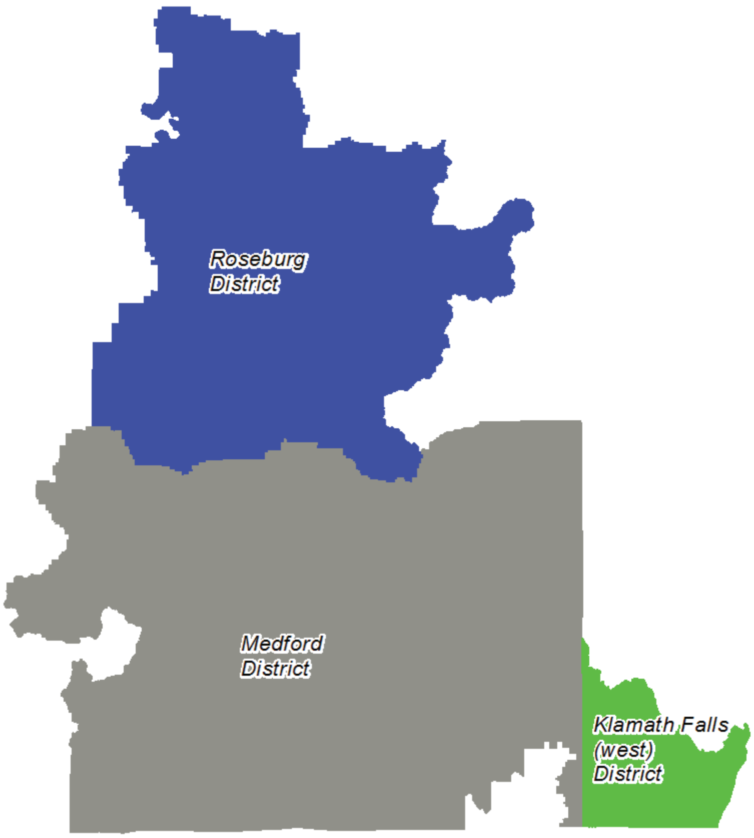

Figure H-3. Landscape units.

Present-Day Forest Structure and Composition

TNC characterized present-day forest vegetation with the gradient nearest neighbor imputation (GNN, Ohmann and Gregory 2002, Figure 3) datasets produced by the US Forest Service Pacific Northwest Research Station and Oregon State University Landscape Ecology, Modeling, Mapping, and Analysis research group (www.fsl.orst.edu/lemma) and outputs from the BLM vegetation modeling process (see the Vegetation Modeling Appendix).

All lands that are outside of BLM ownership used the GNN data for current conditions; the BLM land used the RMP data.

To compare present-day forest vegetation to the NRV reference conditions, TNC mapped the current distribution of s-classes for each biophysical setting using BLM Alternative data for the BLM lands and GNN data for all other ownerships. S-class mapping was based upon tree canopy cover and tree size thresholds provided for each s-class in the biophysical setting model descriptions (**Appendix A.2**).

Departure Analysis

Departure in ths project is defined as is the difference between a modeled reference condition and the current conditions in acres (**Figure H-4**). In an effort to frame ecological departure appropriately, TNC chose to look at the whole landscape and summarize departure for each analysis area (district) by alternative. This meant that the BLM s-class by alternative (**Figure H-5**) was mosaiced with the base GNN data (**Figure H-6**) to create a landscape s-class layer that combined both the BLM data and the GNN data (**Figure H-7**).

This process of combining BLM data and GNN data was completed for each Alternative and departure was calculated for each of these mosaiced dataset. Seven different landscape s-class layers were developed: Current Condition, Alternative A, Alternative B, Alternative C, Alternative D, No Action alternative, and No Timber Harvest alternative.

Departure was calcuated for each combination of PVT and landscape unit (strata) and summarized as an acre value. Departue can be summarized in a deficit or excess acres of s-class or in a combined overall departure acres; both were summarized in this analysis.

All the results were summerized by alternative and analysis unit in Excel as well as summarys of s-class by alternative to help frame the conversation and discussion in the RMP.

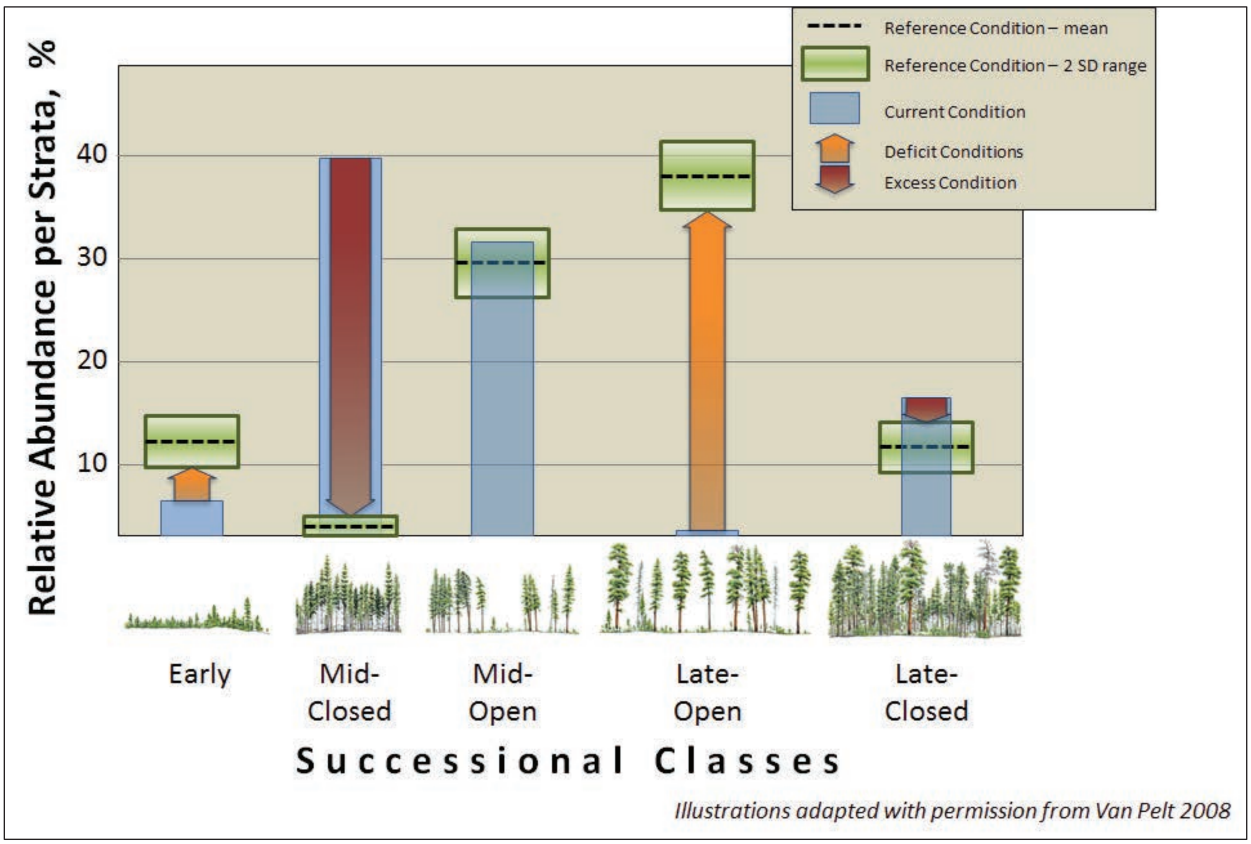

Figure H-4. Example strata departure summary calculation.

Figure H-5. BLM s-class.

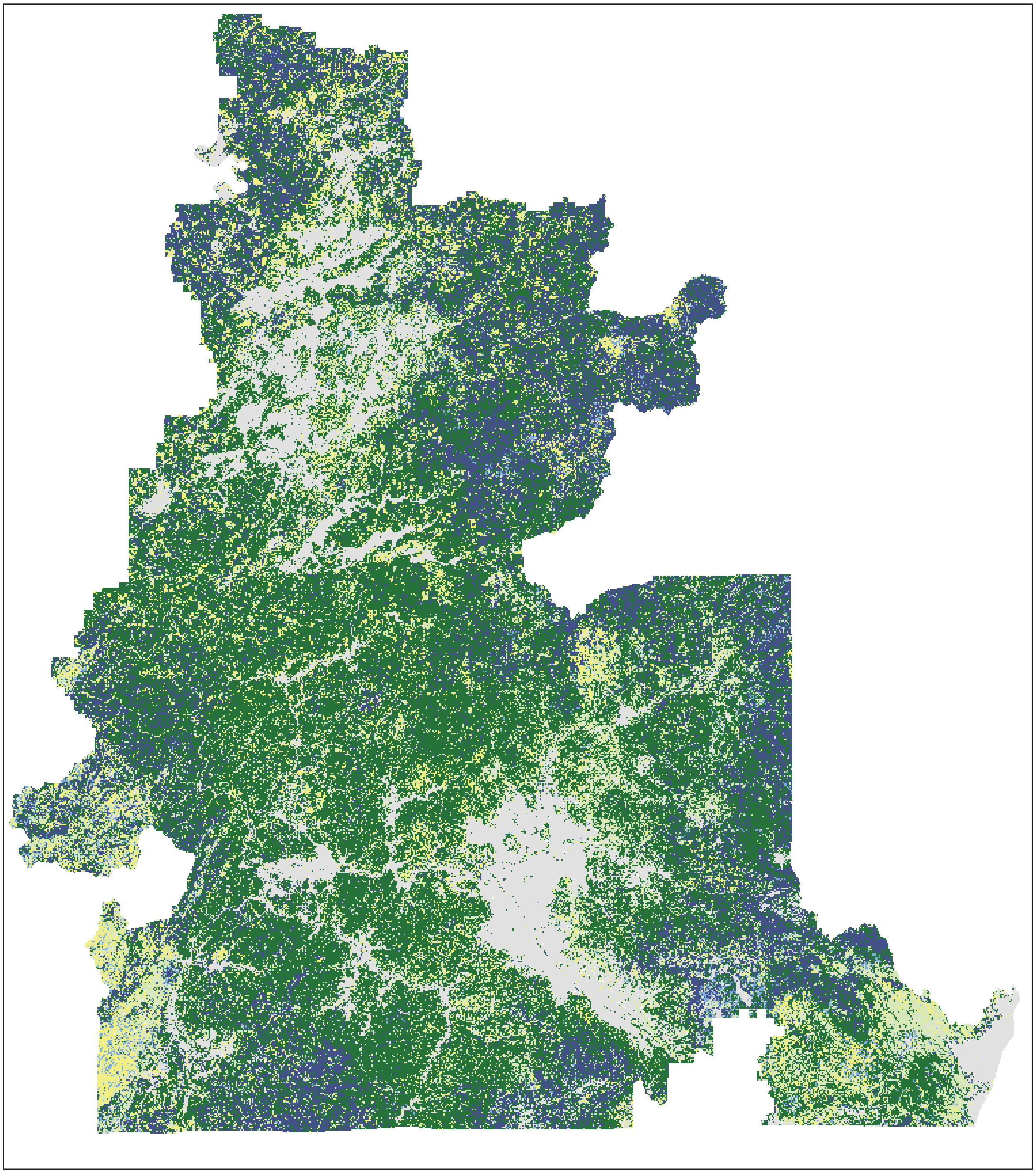

Figure H-6. GNN s-class data.

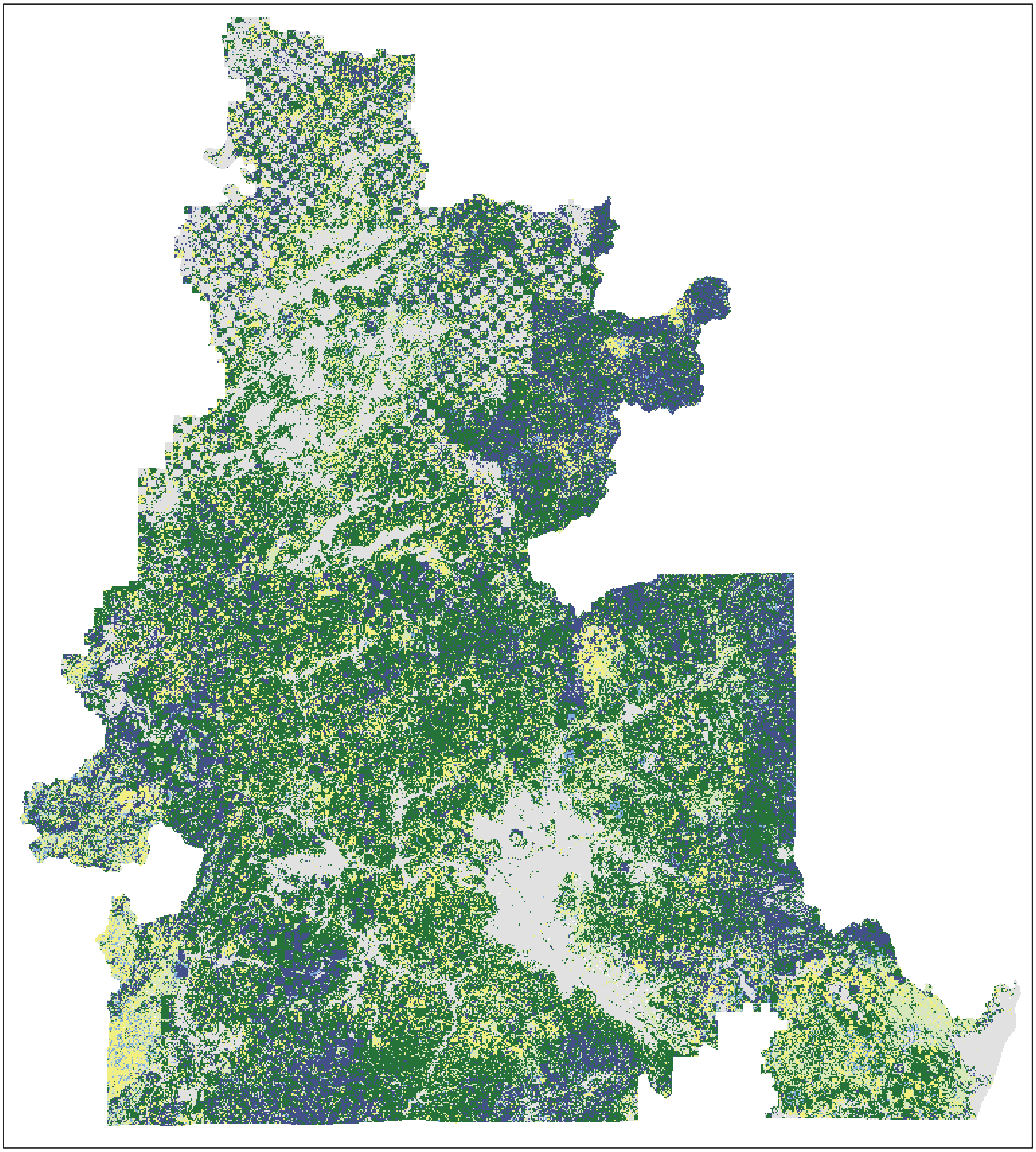

Figure H-7. BLM and GNN s-class data combined.

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Issue 2 and 3 - Assumptions and District-Specific Results

Issue 2

How would the alternatives affect fire resistance in the fire-adapted dry forests at the stand level?

Issue 3

How would the alternatives affect wildfire hazard at the stand – level within close proximity to developed areas?

Common Analytical Assumptions

- The results of this analysis does not include effects from non-commercial hazardous fuels work, which would contribute toward increasing fire resistance and reducing fire hazard similarly among all alternatives. A large portion of non-commercial hazardous fuels work takes place on non-forested lands, which are not included in this analysis.

- Vegetation community structure is an important factor affecting potential fire behavior, post-fire effects, fire resistance, and fire hazard.
- General assumptions regarding vegetation structural stage classification and the probable fire behavior based on vertical and horizontal fuel profile were used to generate relative stand-level resistance to replacement fire and fire hazard ratings.

Table H-5. Acres of forested and non-forested BLM-administered lands within the planning area by district/field office.

District/Field Office	Forest (Acres)	Non-Forest (Acres)	Totals (Acres)
Coos Bay	304,031	20,206	324,237
Eugene	297,223	13,841	311,065
Klamath Falls	46,773	167,312	214,085
Medford	749,112	66,556	806,678
Roseburg	399,165	24,477	423,642
Salem	374,394	24,765	399,159

Assumptions of General Stand Structure-Stage and Fire Interactions

Early-Successional

The BLM assumes that although early-successional communities have less than 30 percent canopy cover, resulting in somewhat discontinuous surface fuel loading, this structural stage is typically comprised of highly flammable vegetation (Agee 1993). When combined with open conditions that can increase surface wind speeds and flames lengths (Pollet and Omi 2002, Rothermel 1983), in general, this structural stage presents relatively moderate resistance to replacement fire and moderate fire hazard.

Stand–establishment and High-Density Young Stands

The stand establishment and high-density young stand structural stages maintain low canopy base heights and a combination of highly flammable early-successional vegetation, along with increased cover. In general, these structural stages present relatively low resistance to replacement fire and high fire hazard (Odion *et al*. 2004, Weatherspoon and Skinner 1995).

Low-Density Young Stands

Although, the canopy base height may be low in young stands of lower density, in general, there is greater separation between crowns (vertically and horizontally). This discontinuity in the fuel profile results in relatively lower canopy bulk densities, moderate fire hazard, and moderate resistance to replacement fire within both the younger and structural legacy components of the stand.

Structural Legacies

The stand establishment and high-density young stand structural stages maintain low canopy base heights and a combination of highly flammable early-successional vegetation, along with increased cover. In general, these structural stages present relatively low resistance to replacement fire and high fire hazard (Odion *et al*. 2004, Weatherspoon and Skinner 1995). However, both early-successional and stand establishment phases with structural legacies would have some separation of crown layers between legacy trees and understory vegetation, resulting in somewhat discontinuous ladder fuels and increased fire resistance in structural legacies. Pockets of heavy surface and ladder fuels may result in potential mortality to structural legacies from cambial damage (trees < 20" DBH have a 35-70% mortality, USDI BLM 2008 WOPR) or passive torching. This potential for cambial damage to overstory legacy structures increases along with understory vegetative cover and height (Peterson *et al*. 2005). Despite some potential separation in crown layers, in general, young high density stands have high continuous surface and ladder fuel loading, low canopy fuel base heights, and taller vegetation, relative to early successional and stand establishment vegetation. This fuel profile in the young high density stands increases crown fire potential of the young stand component and structural legacies (Odion *et al*. 2004), resulting in lower relative resistance to replacement fire and higher fire hazard.

Overstory canopy cover from structural legacies could also partially shelter the stand, reducing surface winds and slowing the drying of fuels (NWCG 2014 Fire Behavior Field Reference Guide), and thus help moderate fire behavior. Alternatively, open stand conditions have the potential to increase surface winds and thus flame lengths (Pollet and Omi 2002, Rothermel 1983). Increased winds in combination with low canopy base heights can increase torching potential and fire hazard, therefore no distinction is made between early-successional, stand establishment, and young stands with structural legacies in regards to fire hazard.

Mature Single-layered Canopy

In general, mature single layer stands have low surface fuel loading (due to closed canopy shading inhibiting understory growth), higher canopy base heights, and thus a lower probability of torching and crown fire initiation within stand, creating a low stand-level fire hazard condition (Jain *et al*. 2012). Although, continuous canopy cover of high canopy bulk density is susceptible to crown fire spread from adjacent stands (Scott and Reinhardt 2001, Jain and Graham 2007, Jain *et al*. 2012).

Mature Multi-layered Canopy and Structurally-complex

Multi-layered and structurally mature and older forests have the potential to exhibit the full range of fire behavior (surface to crown fire). In general, these structural stages have heterogeneous composition, which can alter fire spread (Jain *et al*. 2012, Finney 2001) and a greater number of large diameter (> 20 in. DBH) trees with thick bark, improving stand-level fire resistance, and reducing stand-level fire hazard (Agee and Skinner 2005) and potentially increasing the likelihood of burning at low to moderate severity (Alexander *et al*. 2006). Multi-aged closed forest conditions can potentially create a vertical fuel ladder for surface fire to reach the canopy (North *et al*. 2009) and support accumulations of continuous heavy surface and ladder fuels, and increase the potential for torching and crown fire, significantly reducing resistance to control. Alternatively, these structural types can create influential microclimates and shelter surface winds, harboring conditions that are more likely to result in lowered fire severity (Odion *et al*. 2004), particularly in topographic locations with low fire probability.

Ultimately, fire behavior in these structural stages will result from several factors, including weather, fuel moisture, and topographic influences, along with the vertical and horizontal continuity of the fuel profile.

Table H-6. BLM defined structural stages and subdivisions, relative stand-level resistance to replacement fire ratings and assumptions regarding overall fuel profile continuity, and vertical and horizontal fuel continuity.

Structural Stages	Subdivisions	Resistance to Replacement Fire	Assumptions Behind Resistance Ratings		
			Entire Fuel Profile continuity	Horizontal Fuel Profile Continuity	Vertical Fuel Profile Continuity
Early Successional	with Structural Legacies	Moderate	Semi-discontinuous	Semi-discontinuous	Semi-discontinuous
	without Structural Legacies	Moderate	Semi-discontinuous	Continuous	Semi-discontinuous
Stand Establishment	with Structural Legacies	Moderate	Semi-discontinuous	Semi-discontinuous	Continuous
	without Structural Legacies	Low	Continuous	Continuous	Continuous
Young Stands – High Density	with Structural Legacies	Low	Continuous	Continuous	Continuous
	without Structural Legacies	Low	Continuous	Continuous	Continuous
Young Stands – Low Density	with Structural Legacies	Moderate	Semi-discontinuous	Continuous	Semi-discontinuous
	without Structural Legacies	Moderate	Semi-discontinuous	Continuous	Semi-discontinuous
Mature	Single-Layered Canopy	High	Discontinuous	Discontinuous	Continuous
	Multi-layered Canopy	Mixed	Mixed continuity	Mixed continuity	Mixed continuity
Structurally Complex	Developed Structurally Complex	Mixed	Mixed continuity	Mixed continuity	Mixed continuity
	Existing Old Forest	Mixed	Mixed continuity	Mixed continuity	Mixed continuity
	Existing Very Old Forest	Mixed	Mixed continuity	Mixed continuity	Mixed continuity

Table H-7. BLM defined structural stages and subdivisions, relative stand-level fire hazard ratings and assumptions regarding surface fuel loading, canopy base height, and canopy fuel bulk density (continuity) as the basis for the hazard rating.

<table>
<tr><th rowspan="2">Structural Stages</th><th rowspan="2">Subdivisions</th><th rowspan="2">Fire Hazard Rating</th><th colspan="3">Assumptions Behind Hazard Ratings</th></tr>
<tr><th>Surface Fuel Loading</th><th>Canopy Base Height</th><th>Canopy Fuel Bulk Density (Continuity)</th></tr>
<tr><td rowspan="2">Early Successional</td><td>with Structural legacies</td><td>Moderate</td><td rowspan="8">Low</td><td rowspan="8">Low</td><td rowspan="2">Moderate</td></tr>
<tr><td>without Structural Legacies</td><td>Moderate</td></tr>
<tr><td rowspan="2">Stand Establishment</td><td>with Structural Legacies</td><td>High</td><td rowspan="4">High</td></tr>
<tr><td>without Structural Legacies</td><td>High</td></tr>
<tr><td rowspan="2">Young Stands – High Density</td><td>with Structural Legacies</td><td>High</td></tr>
<tr><td>without Structural Legacies</td><td>High</td></tr>
<tr><td rowspan="2">Young Stands – Low Density</td><td>with Structural Legacies</td><td>Moderate</td><td rowspan="3">Moderate</td></tr>
<tr><td>without Structural Legacies</td><td>Moderate</td></tr>
<tr><td rowspan="2">Mature</td><td>Single-Layered Canopy</td><td>Low</td><td>Moderate</td><td>High</td></tr>
<tr><td>Multi-Layered Canopy</td><td>Mixed</td><td rowspan="4" colspan="3">Mixed</td></tr>
<tr><td rowspan="3">Structurally Complex</td><td>Developed Structurally Complex</td><td>Mixed</td></tr>
<tr><td>Existing Old Forest</td><td>Mixed</td></tr>
<tr><td>Existing Very Old Forest</td><td>Mixed</td></tr>
</table>

Issue 2 - Stand-Level Fire Resistance in the Harvest Land Base by District

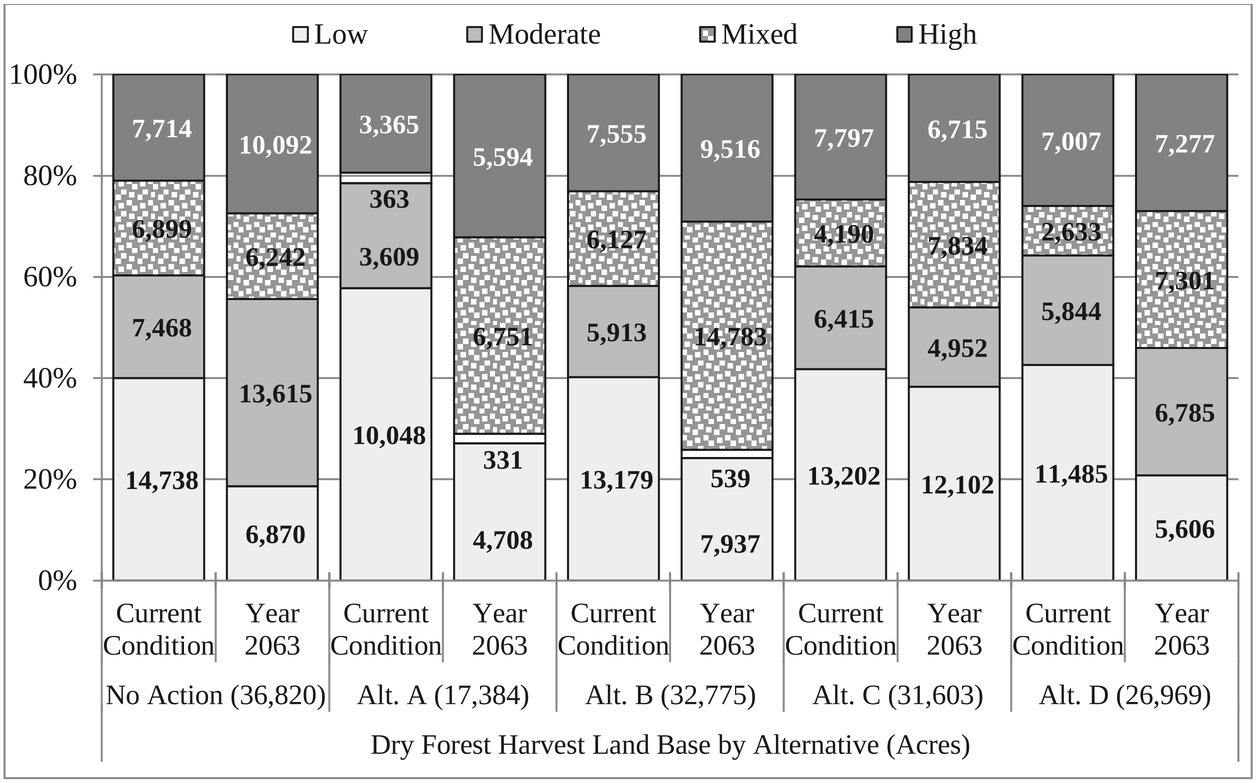

Figure H-8. Stand-level fire resistance categories in the Harvest Land Base in the dry forest in the Klamath Falls Field Office for the current condition and each alternative in 50 years.

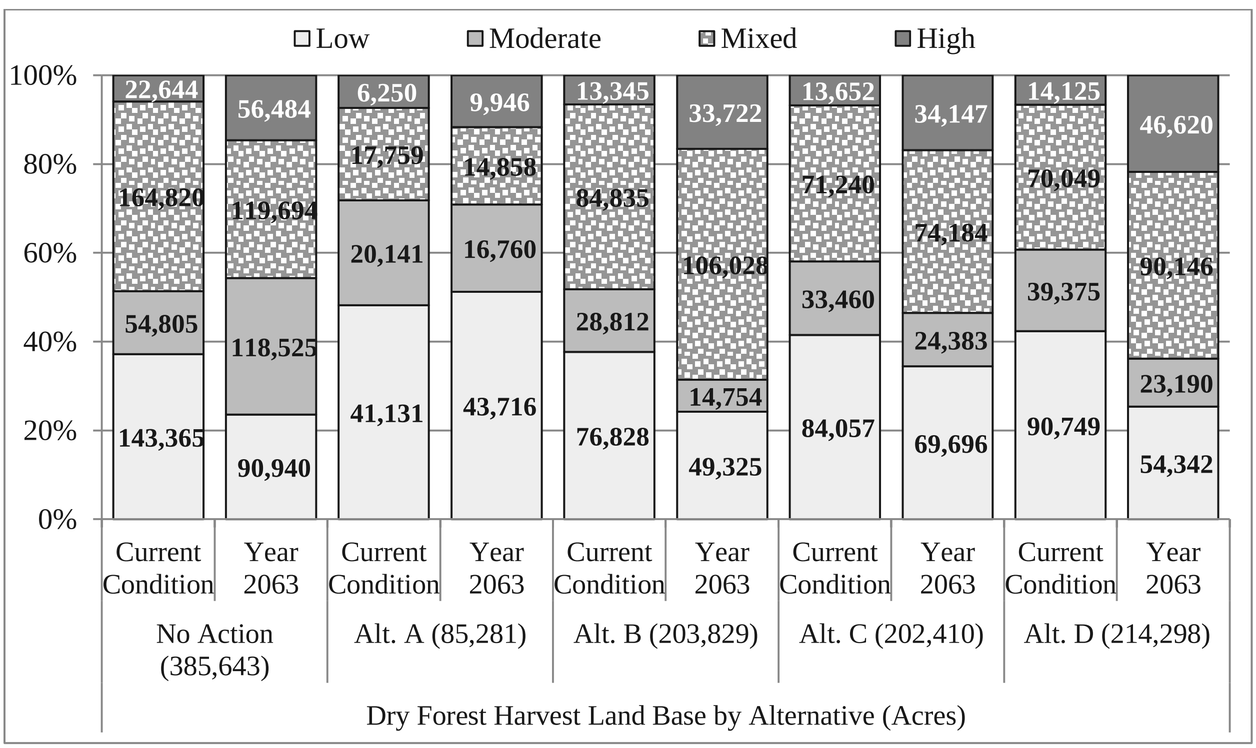

Figure H-9. Stand-level fire resistance categories in the Harvest Land Base in the dry forest on the Medford District for the current condition and each alternative in 50 years.

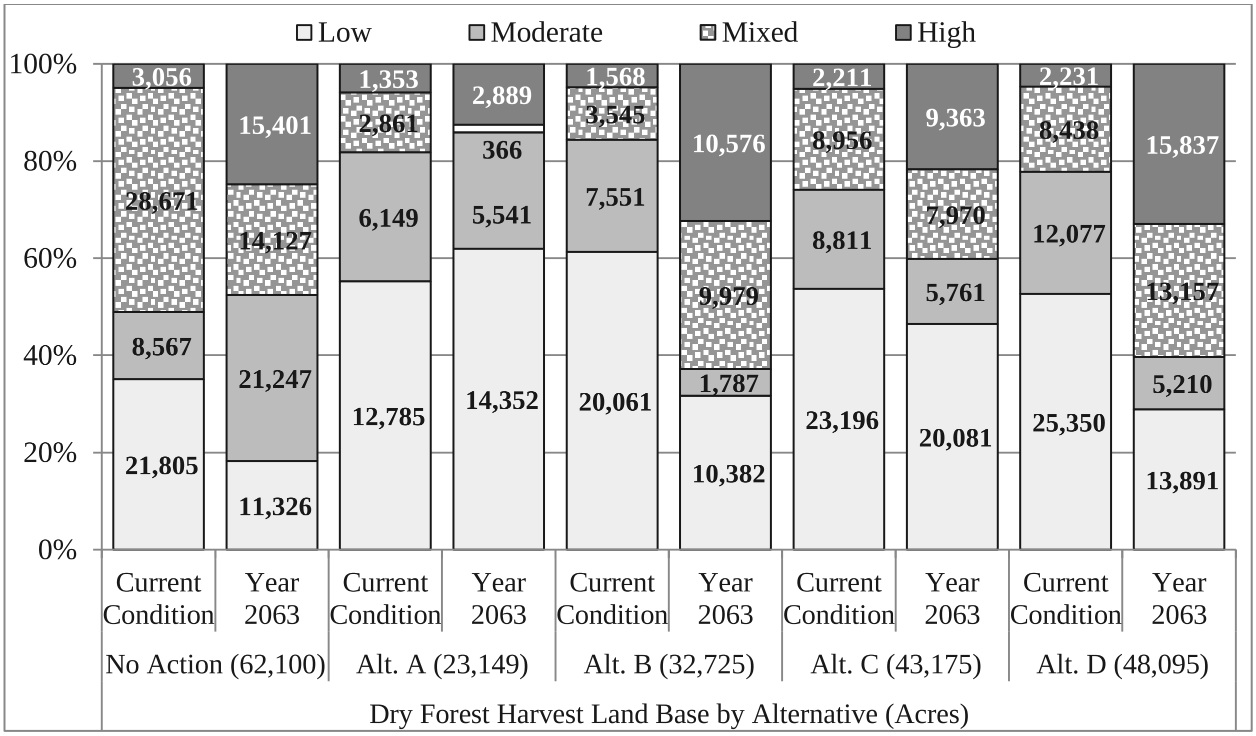

Figure H-10. Stand-level fire resistance categories in the Harvest Land Base in the dry forest on the Roseburg District for the current condition and each alternative in 50 years.

Issue 3 - Stand-Level Fire Hazard Within Wildland Developed Areas by District

Stand-level fire hazard within close proximity to developed areas – All BLM lands by District

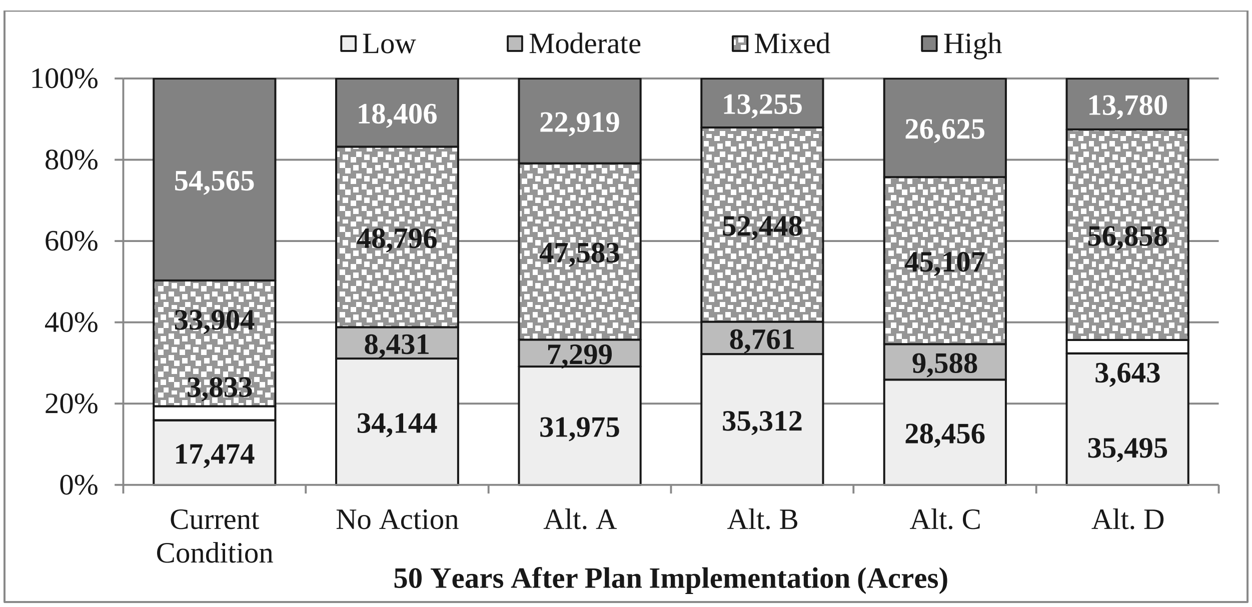

Figure H-11. Stand-level fire hazard for all BLM-administered lands on the Coos Bay District within the WDA, current condition and by alternative in 2063.

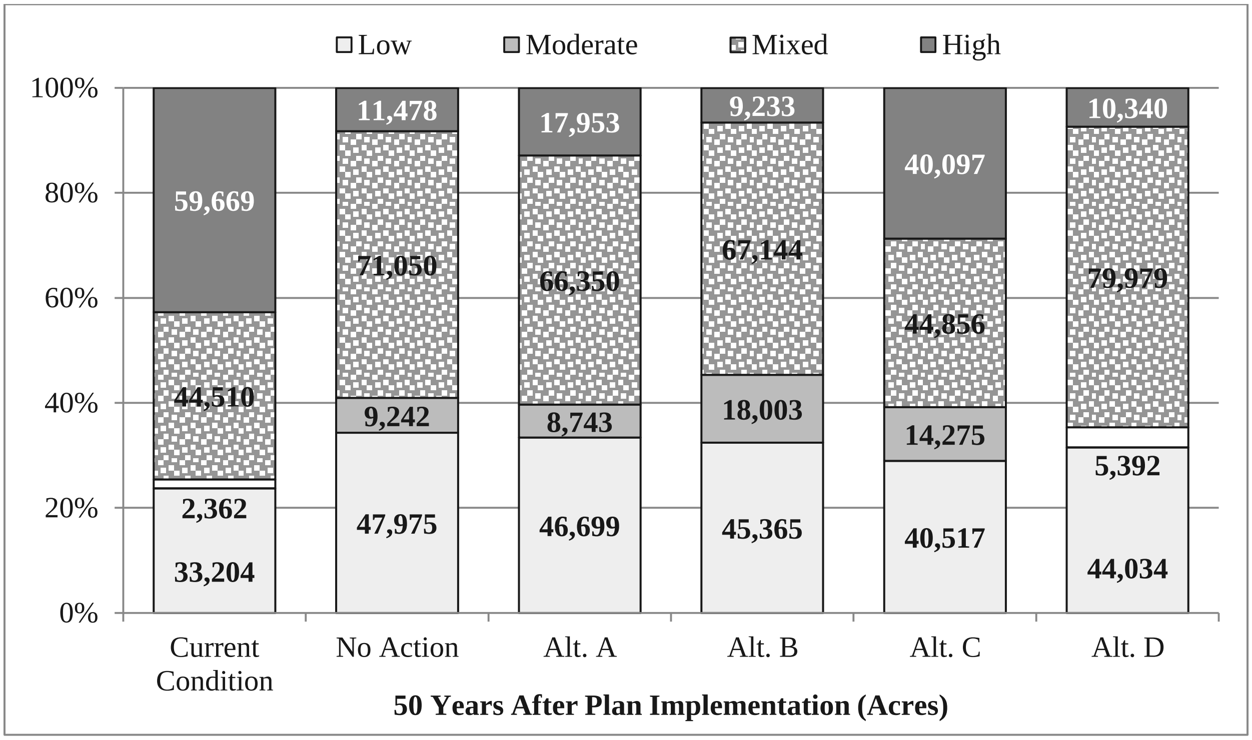

Figure H-12. Stand-level fire hazard for all BLM-administered lands on the Eugene District within the WDA, current condition and by alternative in 2063.

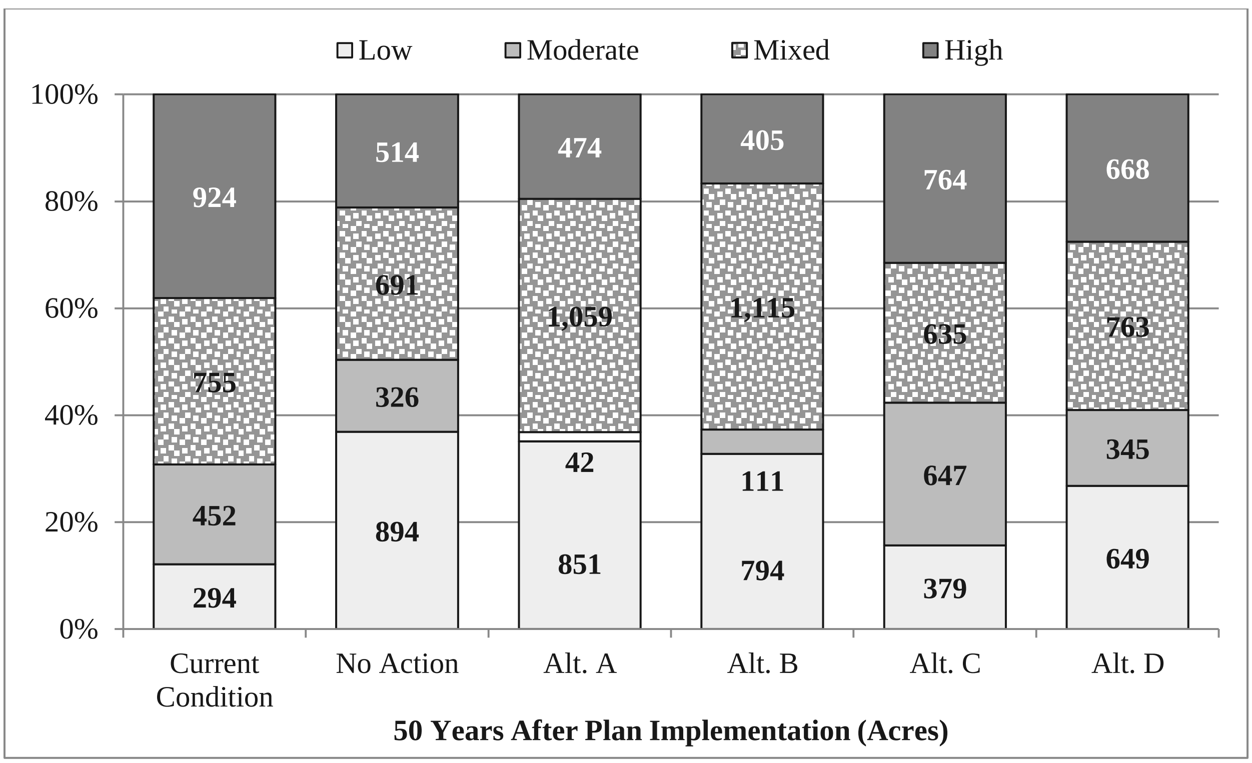

Figure H-13. Stand-level fire hazard for all BLM-administered lands on the Klamath Falls Field Office within the WDA, current condition and by alternative in 2063.

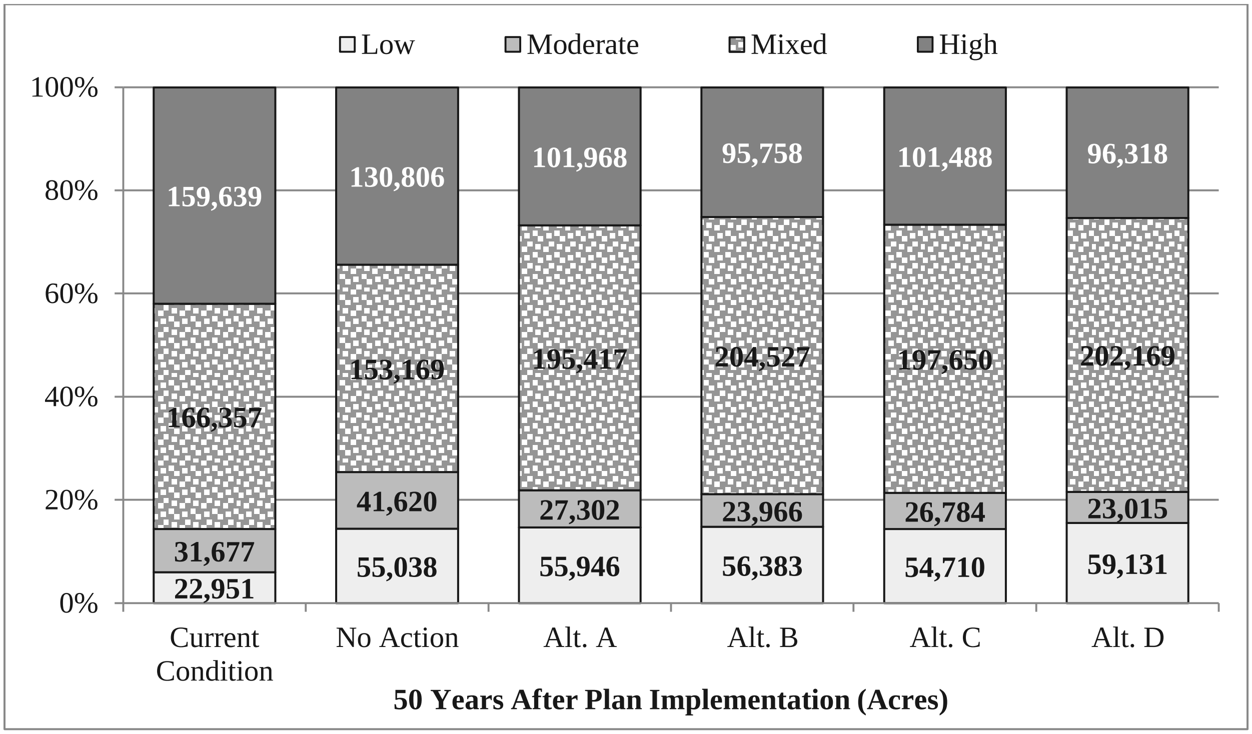

Figure H-14. Stand-level fire hazard for all BLM-administered lands on the Medford District within the WDA, current condition and by alternative in 2063.

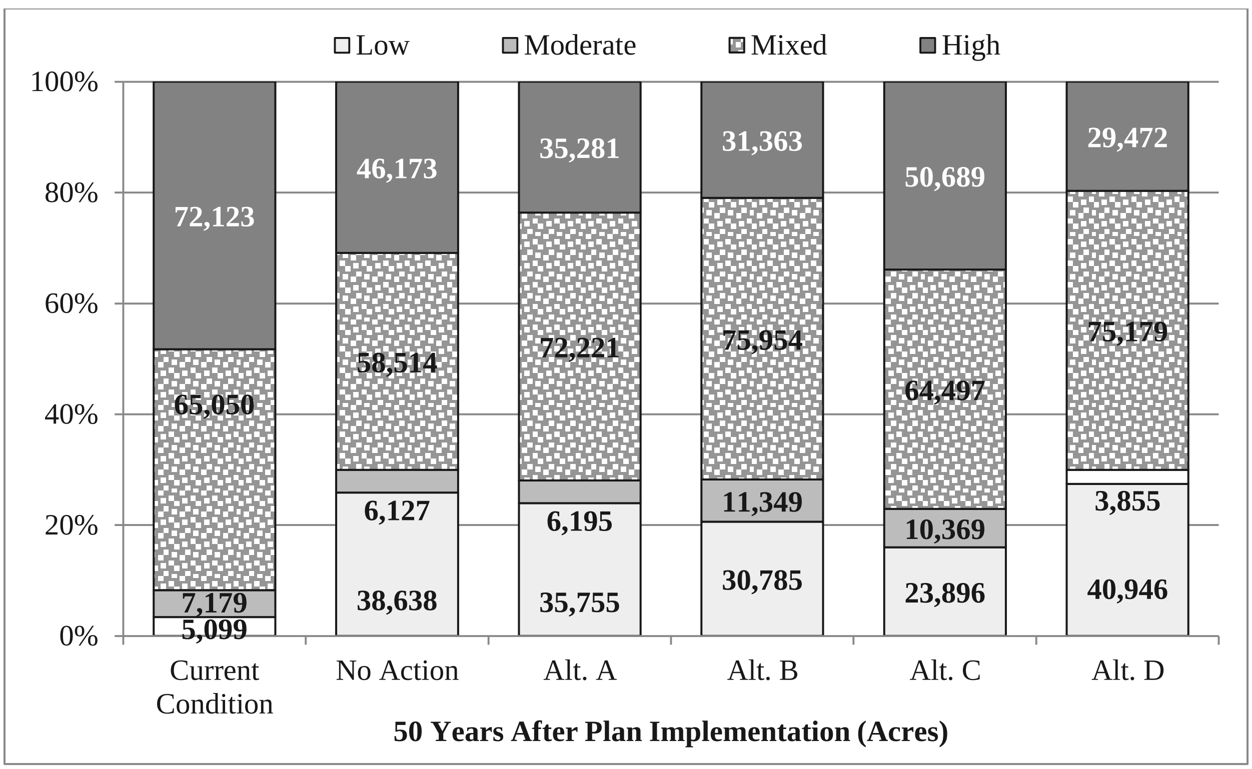

Figure H-15. Stand-level fire hazard for all BLM-administered lands on the Roseburg District within the WDA, current condition and by alternative in 2063.

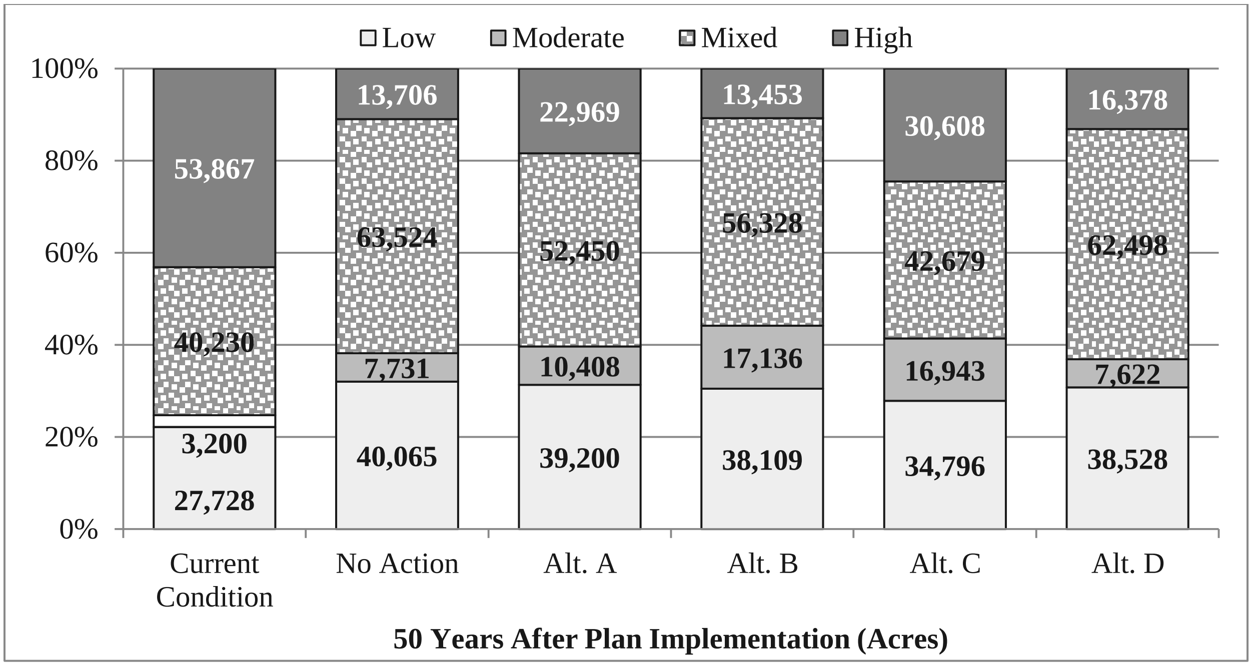

Figure H-16. Stand-level fire hazard for all BLM-administered lands on the Salem District within the WDA, current condition and by alternative in 2063.

Issue 3 - Stand-Level Fire Hazard for Late-Successional Reserves Within Wildland Developed Areas by Planning Area Region

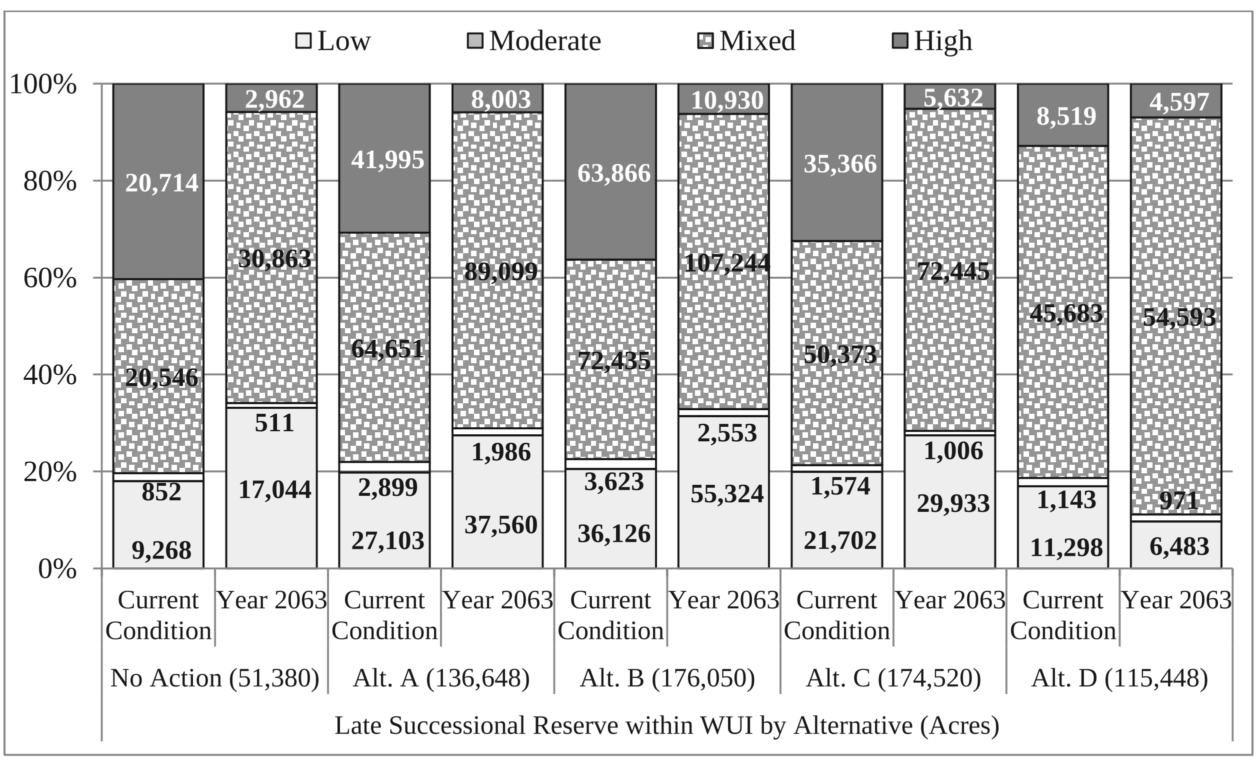

Figure H-17. Stand-level fire hazard in the Late-Successional Reserves in the dry forest in the coastal/north for the current condition and each alternative in 50 years.

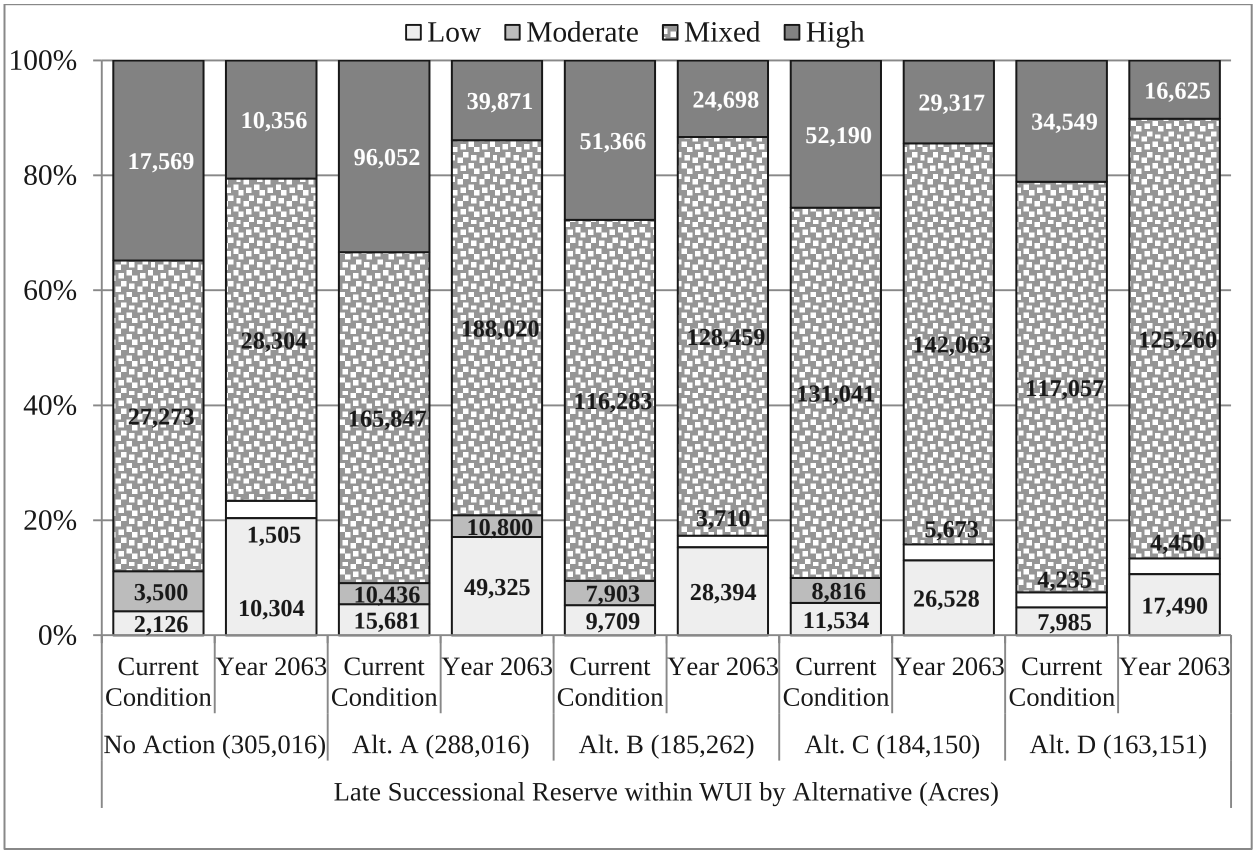

Figure H-18. Stand-level fire hazard in the Late-Successional Reserves in the dry forest in the interior/south for the current condition and each alternative in 50 years.

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Appendix I – Best Management Practices

Introduction

A Best Management Practice or BMP is a practice, or combination of practices that have been determined to be the most effective and practicable in preventing or reducing the amount of pollution generated by diffuse sources to a level compatible with water quality goals (40 CFR 130.2 [m]).

The BMPs described in this appendix are methods, measures, or practices selected based on site-specific conditions to ensure that water quality would be maintained at its highest practicable level to meet water quality standards and TMDL load allocations as set by the State of Oregon, Department of Environmental Quality. These site-specific BMPs are a compilation of commonly employed practices developed through professional experience or research, and designed to minimize water quality degradation and loss of soil productivity. The BMPs include, but are not limited to, avoidance, structural and nonstructural treatments, operations, and maintenance procedures. Although normally preventative, BMPs can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters (40 CFR 130.2, EPA Water Quality Standards Regulation). The implementation of these BMPs would be the beginning of an iterative process that includes the monitoring and modification of BMPs, where needed, to achieve water quality goals. This cyclic process would be the primary mechanism to achieve Oregon's water quality standards.

The BLM is responsible for implementing BMPs on the lands it administers.[135] The BMPs provide compliance with the Clean Water Act of 1972, as amended, State of Oregon water quality legislation (chapter 340), and the O&C Act. For proposed management actions, BMPs would be designed and implemented in a manner that is consistent with the DEQ Memorandum of Understanding (2011), and with the Clean Water Act. The BLM believes the BMPs are at least as protective as the rules adopted under the Oregon Forest Practices Act, covering similar operations on state and private forestlands.

The Resource Management Plan allocations and Management Objectives, especially relating to the Riparian Reserve, are broad scale BMPs. For vegetation treatments using herbicides on BLM-administered lands in the decision area, BMPs are included in *Vegetation Treatments Using Herbicides on BLM Lands in Oregon Record of Decision, October 2010* as mitigation measures and standard operating practices, incorporated by reference. Briefly, mitigation and standard operating procedures in *Attachment A; General, Soil, Water Resources, Wetlands and Riparian Areas, Fish and Other Aquatic Organisms, Recreation* and other beneficial uses and values (pp. 33-45), and additional mitigation (pp. 13-15) are considered BMPs for herbicide treatments. For other management activities, including minerals exploration and development, linear transmission projects and most hazardous materials, the mechanism to achieve Oregon State Water Quality Standards would be guided by existing Management Direction, other regulations or separate Environmental Analysis and not necessarily be covered by the BMPs contained in this RMP. For example, management of locatable minerals is non-discretionary and governed by regulations found in 43 CFR 3809. The BMPs for locatable minerals include language from 43 CFR 3809 that requires operators to prevent unnecessary and undue degradation from mining operations.

135 The DEQ has granted Designated Management Agency status to the BLM through the Memorandum of Understanding.

The following lists of site-specific BMPs are more detailed than, and in addition to, the Management Objectives contained in the RMP. The BMPs are not intended to be all-inclusive nor replace site-specific project planning, which may require the use of different or additional BMP practices.

Purpose

Best management practices (BMPs) are required by the federal Clean Water Act (1972), as amended to reduce nonpoint source pollution to the maximum extent practicable. Nonpoint source pollution is defined as pollutants detected in water bodies such as a streams, or lakes that come from the landscape in a dispersed manner, often related to a wide range of forest and rangeland ground disturbing activities. The BMPs are the primary controls for achieving Oregon’s water quality standards pertaining to nonpoint source pollution. Oregon’s narrative and numeric criteria within water quality standards, are designed to protect designated beneficial uses (such as salmonid spawning and rearing, resident fish and aquatic life, domestic water supplies, and water-contact recreation).

BLM’s and DEQ's strategy for managing and controlling nonpoint source water pollution from BLM-managed lands in the State of Oregon is through a Memorandum of Understanding (2011) between the State of Oregon, Department of Environmental Quality (DEQ) and the United States Department of the Interior, Bureau of Land Management, (BLM).This MOU defines the process by which the BLM and DEQ will cooperatively meet State and Federal water quality rules and regulations. The physical, chemical, and biological conditions of "waters of the State" that support beneficial uses (defined in Oregon Revised Statute (ORS), Chapter 468B Water Quality, and Oregon Administrative Rules (OAR), Division 41) would be protected, restored, and maintained by working in a proactive, collaborative, and adaptive manner. The MOU specifies that the BLM would implement site-specific BMPs as specified in Management Objectives, standards, guidelines, design features, and mitigation developed in Resource Management Plans (RMP), RMP amendments, project level plans, and Water Quality Restoration Plans (WQRP) to meet applicable water quality standards. Monitoring is required, under the MOU, to ensure that practices are properly designed and applied, to determine the effectiveness of practices in meeting water quality standards, and adjustment of BMPs when it is found that water quality standards are not being protected.

Organization, Selection, and Application of BMPs

The tables that follow this introduction are organized by core activities on BLM-administered lands in the Decision Area. For each core activity, the sequential number, and Best Management Practice is listed first in the left columns, the source, or reference in the center column, and the applicable DEQ narrative or numeric water quality standards in the right column. The right column identifies the DEQ Oregon Administrative Rules (OAR) number(s), and provides OAR references within the roads and landings section, to compare these BMPs to similar Oregon Department of Forestry OARs.

Core activities with BMPs include:

- Road and landing maintenance and construction
- Timber harvest activities
- Silvicultural activities
- Fire and fuels management
- Surface source water for drinking water
- Recreation management
- Range management

- Minerals (salable) development
- Spill prevention and abatement
- Restoration activities
- Dry forest-specific BMPs

Those BMPs that are necessary for typical situations have been included. When applied, the BLM would expect BMPs to prevent water quality degradation and to meet water quality standards and TMDL load allocations.

Selection of BMPs are made by decision-makers using input from soil, water, fisheries, geology and other professionals during project-level analyses. It is not intended that all of the BMPs listed will be selected for any specific management action. Each activity is unique, based on site-specific conditions and the selection of an individual BMP or a combination of BMPs and measures that becomes the BMP design. Resource aspects of land management activities normally have many facets that require site-specific BMP design. Therefore, there may be some repetition of the BMPs between sections of the following tables. An activity may use an individual BMP, whereas another activity may involve BMPs in combination from several core management activities for water quality protection.

BMPs that relate to instream activities may coincidently be similar to applicable practices specified in Army Corps of Engineers, Department of State Lands, and ODFW joint removal/fill permits, DEQ water quality permits and 401 certifications, or project design criteria contained in biological assessments. The BMPs in the following tables are not specific permit requirements, but rather demonstrate the process by which nonpoint source pollution from instream activities would be controlled.

The BMPs are practices, techniques, or management strategies that have been evaluated through common practice or studies, and are shown to be an effective and practical means of preventing or reducing nonpoint source pollution. The BMPs are not intended to serve as detailed engineering specifications or design criteria. Such specifications are available for field use from various sources.

The BMPs would be applied in a manner that is consistent with all Resource Management Plan objectives. The overall goal is not to adhere strictly to a particular BMP(s), but to meet water quality objectives when implementing management actions. Although this appendix does not provide an exhaustive list of BMPs, the included BMPs, when applied correctly for varying ground-disturbing activities, would maintain water quality for the range of project activities in the Decision Area. Additional nonpoint source control measures would be identified during the interdisciplinary process when evaluating site-specific management actions.

Monitoring and Adjustment

BMPs are selected and applied, based upon site-specific conditions, technical feasibility, resource availability and the water quality of those water bodies potentially impacted. Specialists may consider baseline environmental conditions, type of activity, proximity to water, disturbance level, direct, indirect, and cumulative effects and timing. They may also evaluate new technology and relevant implementation or effectiveness monitoring data, and published studies or other sources of information, in refining existing BMPs or recommending new BMPs. Post-project implementation monitoring of selected BMPs demonstrate that BMPs are carried forward from the project level plans, and properly designed and applied. Effectiveness monitoring demonstrates that selected BMPs meet water quality standards and criteria and assure protection of beneficial uses. Modification of BMPs would be initiated when it is found that water quality standards are not being protected. This process involves continued learning and applying monitoring feedback. Summarizing thousands of on-site evaluations show that BMPs protect surface waters and are implemented correctly at least 86% of the time and are effective in 85% to 99% of applications (Rogers 2007, USDA FS 2012).

Review and update of this appendix, including BMP corrections or additions that are within the core subject areas of existing BMPs, would be completed through plan maintenance.

Roads and Landings

See *Summary of Oregon Water Quality Standards* for additional details about the standards and regulations that are associated with the best management practices.

Table I-1. Best management practices for roads and landings.

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
General Construction			
R 1	Locate temporary and permanent roads and landings on stable locations, e.g., ridge tops, stable benches, or flats, and gentle-to-moderate side slopes. Minimize construction on steep slopes, slide areas, and high landslide hazard locations.	USDI BLM 2008, Appendix I-Water, R 1, p. 270. OAR 629-625-0200 (3)	OAR 629-625-0200–ODF, Road Location DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 2	Locate temporary and permanent road construction or improvement to minimize the number of stream crossings.	USDI BLM 2008, Appendix I-Water, R 2, p. 270. OAR 629-625-0200 (3-4)	OAR 629-625-0200–ODF, Road Location DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 3	Locate roads and landings away from wetlands, Riparian Reserves, floodplains and waters of the State, unless there is no practicable alternative. Avoid locating landings in areas that contribute runoff to channels.	USDI BLM 2008, Appendix I-Water, R 4, p. 270. OAR 629-625-0200 (2)	OAR 629-625-0200–ODF, Road Location DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 4	Locate roads and landings to reduce total transportation system mileage. Renovate or improve existing roads or landings when it would cause less adverse environmental impact. Where roads traverse land in another ownership, investigate options for using those roads before constructing new roads.	USDI BLM 2008, Appendix I-Water, R 2, p. 270. EPA 2005, pp. 3-12, Bullet 1 OAR 629-625-0200 (5) EPA 2005, pp. 3-10, Bullet 1	OAR 629-625-0200–ODF, Road Location DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 5	Design roads to the minimum width needed for the intended use as referenced in BLM Manual 9113.	USDI BLM 2008, Appendix I-Water, R 8, p. 271. OAR 629-625-0310 (3)	OAR 629-625-0310-ODF, Road Prism DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 6	Confine pioneer roads to the	USDI BLM 2008,	OAR 629-625-0410-ODF, Disposal of Waste

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
	construction limits of the permanent roadway to reduce the amount of area disturbed and avoid deposition in wetlands, Riparian Reserves, floodplains and waters of the State. Install temporary drainage, erosion, and sediment control structures. Storm proof or close pioneer roads prior to the onset of the wet season.	Appendix I-Water, R 11, p. 271. EPA 2005, p. 3-41, Bullet 2	Materials DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 7	Design road cut and fill slopes with stable angles, to reduce erosion and prevent slope failure.	USDI BLM 2008, Appendix I-Water, R 3, p. 270. EPA 2005	OAR 629-625-0310-ODF, Road Prism DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 8	End-haul material excavated during construction, renovation, and/or maintenance where side slopes generally exceed 60 percent and any slope where side-cast material may enter wetlands, floodplains, and waters of the State.	USDI BLM 2008, Appendix I-Water, R 10, p. 271. EPA 2005, pp. 3-12, Bullet 5	OAR 629-625-0310-ODF, Road Prism DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 9	Construct road fills to prevent fill failure using inorganic material, compaction, buttressing, sub-surface drainage, rock facing, or other effective means.	USDI BLM 2008, Appendix I-Water, R 13, p. 271. OAR 629-625-0310-5	OAR 629-625-0310-ODF, Road Prism DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 10	Design and construct sub-surface drainage in landslide prone areas and saturated soils (e.g., trench drains using geo-textile fabrics and drain pipes).	USDI BLM 2008, Appendix I-Water, R 19, p. 272. DEQ 2005, RC-1, RC-6, pp.4-5, 4-6	OAR 629-625-0300-ODF, Road Design DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 11	Locate waste disposal areas outside wetlands, Riparian Reserves, floodplains and unstable areas to minimize risk of sediment delivery to waters of the State. Apply surface erosion control prior to the wet season. Prevent overloading areas, which may become unstable.	USDI BLM 2008, Appendix I-Water, R 80, p. 281. OAR 629-625-0340	OAR 629-625-0340-ODF, Waste Disposal Areas DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 12	Use controlled blasting techniques to minimize loss of material on steep slopes or into wetlands, Riparian Reserves, floodplains, and waters of the State.	USDI BLM 2008, Appendix I-Water, R 12, p. 271.	OAR 629-625-0410-ODF, Disposal of Waste Materials DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 13	Use temporary sediment control measures (e.g., check dams, silt fencing, bark bags, filter strips and mulch) to slow runoff and contain	USDI BLM 2008, Appendix I-Water, R 14, p. 271.	OAR 629-625-0430-ODF, Stream Protection DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1)

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
	sediment from road construction areas. Remove any accumulated sediment and the control measures when work or haul is complete. When long-term structural sediment control measures are incorporated into the final erosion control plan, remove any accumulated sediment to retain capacity of the control measure.	DEQ 2005, RC-11	Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 14	Avoid use of road fills for water impoundment dams unless specifically designed for that purpose. Impoundments over 9.2-acre feet or 10 feet in depth will require a dam safety assessment by a registered engineer. Upgrade existing road fill impoundments to pass 100-year flood events.	OAR 629-625-0310-5	OAR 629-625-0310-ODF, Road Prism DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Permanent Stream Crossings			
R 15	Design culverts, bridges, and other stream crossings for the 100-year flood event including allowance for bed load and anticipated floatable debris.	USDI BLM 2008, Appendix I-Water, R 45, p. 276.	OAR 629-625-0320-ODF, Stream Crossing Structures DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 16	Minimize fill volumes at permanent and temporary stream crossings by restricting width and height of fill to amounts needed for safe travel and adequate cover for culverts. For deep fills (generally greater than 15 feet deep,) incorporate additional design criteria (e.g., rock blankets, buttressing, bioengineering techniques) to reduce the susceptibility of fill failures.	USDI BLM 2008, Appendix I-Water, R 47, p. 276. OAR 629-625 -0320 (1b)	OAR 629-625-0320-ODF, Stream Crossing Structures DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 17	Locate stream-crossing culverts on well-defined, unobstructed, and straight reaches of stream. Locate these crossings as close to perpendicular to the streamflow as stream allows. When structure cannot be aligned perpendicular, provide inlet and outlet structures that protect fill, and minimize bank erosion. Choose crossings that have well defined stream channels with erosion resistant bed and banks.	USDI BLM 2008, Appendix I-Water, R 48, p. 276. EPA 2005, pp. 3-14 Gesford and Anderson 2006, pp. 5-30	OAR 629-625-0320-ODF, Stream Crossing Structures DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 18	On new construction, install culverts at the natural stream grade, unless a lessor gradient is required for fish passage.	USDI BLM 2008, Appendix I-Water, R 49, p. 276.	OAR 629-625-0320-ODF, Stream Crossing Structures DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
R 19	Use stream crossing protection techniques to allow floodwater and debris to flow over the top of the road prism without the loss of the fill or diversion of streamflow. This protection could include hardening crossings, armoring fills, dipping grades, oversizing culverts, hardening inlets and outlets, and lowering the fill height.	USDI BLM 2008, Appendix I-Water, R 53, p. 277.	OAR 629-625-0320-ODF, Stream Crossing Structures DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 20	Design stream crossings to prevent diversion of water from streams into downgrade road ditches or down road surfaces.	USDI BLM 2008, Appendix I-Water, R 31, p. 274. OAR 629-625 -0330 (3)	OAR 629-625-0330-ODF, Drainage DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 21	Place instream grade control structures above or below the crossing structure, if necessary, to prevent stream headcutting, culvert undermining and downstream sedimentation. Employ bioengineering measures to protect the stability of the streambed and banks.	DEQ 2005 , RC - 2 Gesford and Anderson 2006, pp 5-31. USDA FS 2002 Chapter 20	OAR 629-625-0320-ODF, Stream Crossing Structures DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 22	Prevent culvert plugging and failure in areas of active debris movement with measures such as beveled culvert inlets, flared inlets, wingwalls, over-sized culverts, trash racks, or slotted risers.	USDI BLM 2008, Appendix I-Water, R 59, p. 278.	OAR 629-625-0320-ODF, Stream Crossing Structures DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 23	Utilize stream diversion and isolation techniques when installing stream crossings. Evaluate the physical characteristics of the site, volume of water flowing through the project area and the risk of erosion and sedimentation when selecting the proper techniques.	USDI BLM 2008, Appendix I-Water, R 50, R 51, p. 277.	OAR 629-625-0430-ODF, Stream Protection DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 24	Limit activities and access points of mechanized equipment to streambank areas or temporary platforms when installing or removing structures. Keep equipment activity in the stream channel to an absolute minimum.	USDI BLM 2008, Appendix I-Water, R 52, p. 277. OAR 629-625-0430 (2)	OAR 629-625-0430-ODF, Stream Protection DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 25	Install stream crossing structures before heavy equipment moves beyond the crossing area.	USDI BLM 2008, Appendix I-Water, R 60, p. 278.	OAR 629-625-0430-ODF, Stream Protection DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
			Turbidity OAR 340-041-0036
R 26	Disconnect the road runoff to the stream channel by outsloping the road approach. If outsloping is not possible, use runoff control, erosion control and sediment containment measures. These may include using additional cross drain culverts, ditch lining, and catchment basins. Prevent or reduce ditch flow conveyance to the stream through cross drain placement above the stream crossing.	USDI BLM 2008, Appendix I-Water, R 26, p. 273, R 33 p. 274. Gesford and Anderson 2006, pp. 5-22. OAR 629-625-0330 (4)	OAR 629-625-0330-ODF, Drainage DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Temporary Stream Crossings for Roads and Skid Trails			
R 27	When installing temporary culverts, use washed rock as a backfill material. Use geotextile fabric as necessary where washed rock will spread with traffic and cannot be practicably retrieved.	USDI BLM 2008, Appendix I-Water, R 63, p. 279. DEQ 2005, NS-3	OAR 629-625-0320-ODF, Stream Crossing Structures DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 28	Use no-fill structures (e.g., portable mats, temporary bridges, or improved hardened crossings) for temporary stream crossings. When not practicable, design temporary stream crossings with the least amount of fill and construct with coarse material to facilitate removal upon completion.	OAR 629-625-0320 (2)	OAR 629-625-0320-ODF, Stream Crossing Structures DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 29	Remove temporary crossing structures promptly after use. Follow practices under the Closure/Decommissioning section for removing stream crossing drainage structures and reestablishing the natural drainage.	USDI BLM 2008, Appendix I-Water, R 65, p. 279. OAR 629-625-0430 (5)	OAR 629-625-0430-ODF, Stream Protection DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
Surface Drainage			
R 30	Effectively drain the road surface by using crowning, insloping or outsloping, grade reversals (rolling dips) and waterbars or a combination of these methods. Avoid concentrated discharge onto fill slopes unless the fill slopes are stable and erosion proofed.	USDI BLM 2008, Appendix I-Water, R 22, p. 272. EPA 2005, p. 3-41	OAR 629-625-0330-ODF, Drainage DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 31	Outslope temporary and permanent low volume roads to provide surface drainage on road gradients up to 6% unless there is a traffic hazard from the road shape.	USDI BLM 2008, Appendix I-Water, R 23, R 24, p. 273. EPA 2005, p. 3-42 USDA FS 2002 Chapter 13	OAR 629-625-0330-ODF, Drainage DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 32	Consider using broadbased drainage dips and/or lead-off ditches in lieu of cross drains for low volume roads. Locate these surface water drainage	USDI BLM 2008, Appendix I-Water, R 25, R 26, p. 273.	OAR 629-625-0330-ODF, Drainage DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1)

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
	measures where they will not drain into wetlands, floodplains, and waters of the State.	EPA 2005, pp. 3-41-45 USDA FS 2002 Chapter 13	Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 33	Avoid use of outside road berms unless designed to protect road fills from runoff. If road berms are used, breach to accommodate drainage where fill slopes are stable.	USDI BLM 2008, Appendix I-Water, R 27, p. 273. Gesford and Anderson 2006, pp. 3-7.	OAR 629-625-0330-ODF, Drainage DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 34	Construct variable road grades and alignments (e.g., roll the grade, grade breaks) which limit water concentration, velocity, flow distance and associated stream power.	USDI BLM 2008, Appendix I-Water, R 28, p. 273. Gesford and Anderson 2006, pp. 5-20. OAR 629-625-0310 (1)	OAR 629-625-0330-ODF, Drainage DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 35	Install underdrain structures when roads cross or expose springs, seeps, or wet areas rather than allowing intercepted water to flow downgradient in ditchlines.	USDI BLM 2008, Appendix I-Water, R 29, p. 273. OAR 629-625-0330 (5)	OAR 629-625-0330-ODF, Drainage DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 36	Design roads crossing low-lying areas so that water does not pond on the upslope side of the road. Provide cross drains at short intervals to ensure free drainage.	USDI BLM 2008, Appendix I-Water, R 19, p. 272. EPA 2005, p. 3-14, Bullet 1	OAR 629-625-0320-ODF, Stream Crossing Structures DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 37	Divert road and landing runoff water away from headwalls, slide areas, high landslide hazard locations, or steep erodible fill slopes.	USDI BLM 2008, Appendix I-Water, R 29, p. 273. OAR 629-625-0330 (2)	OAR 629-625-0330-ODF, Drainage DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 38	Design landings to disperse surface water to vegetated stable areas.	USDI BLM 2008, Appendix I-Water, R 30, p. 274.	OAR 629-625-0330-ODF, Drainage DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Cross Drains			
R 39	Locate cross drains to prevent or minimize runoff and sediment conveyance to wetlands, Riparian Reserves, floodplains, and waters of the State. Implement sediment reduction techniques such as settling basins, brush filters, sediment fences, and check dams to prevent or minimize sediment conveyance.	USDI BLM 2008, Appendix I-Water, R 33, p. 274. OAR 629-625 -0330 (4)	OAR 629-625-0330-ODF, Drainage DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
R 40	Space cross drain culverts at intervals sufficient to prevent water volume concentration and accelerated ditch erosion. At a minimum, space cross drains at intervals referred to in the BLM Road Design Handbook 9113-1, Illustration 11 -"Spacing for Drainage Lateral." Increase cross drain frequency through erodible soils, steep grades, and unstable areas.	USDI BLM 2008, Appendix I-Water, R 34, p. 274.	OAR 629-625-0330-ODF, Drainage DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 41	Choose cross drain culvert diameter and type according to predicted ditch flow, debris and bedload passage expected from the ditch. Minimum diameter is 18 inches.	USDI BLM 2008, Appendix I-Water, R 35, p. 274. Johansen *et al*. 1997, p. 3.	OAR 629-625-0330-ODF, Drainage DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 42	Locate surface water drainage measures (e.g., cross drain culverts, rolling dips, water bars) where water flow will be released on convex slopes or other stable and non-erosive areas that will absorb road drainage and prevent sediment flows from reaching wetlands, floodplains and waters of the State. Where possible locate surface water drainage structures above road segments with steeper downhill grade.	USDI BLM 2008, Appendix I-Water, R 26, p. 273. Johansen *et al*. 1997, p 3.	OAR 629-625-0330-ODF, Drainage DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 43	Armor surface drainage structures (e.g., broad based dips, leadoff ditches) to maintain functionality in areas of erosive and low strength soils.	USDI BLM 2008, Appendix I-Water, R 38, p. 275.	OAR 629-625-0330-ODF, Drainage DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 44	Discharge cross drain culverts at ground level on non-erodible material. Install downspout structures and/or energy dissipaters at cross drain outlets or drivable dips where water is discharged onto loose material, erodible soils, fills, or steep slopes.	USDI BLM 2008, Appendix I-Water, R 39, R 40, p. 275. DEQ 2005, RC-2 Gesford and Anderson 2006, pp. 5-31.	OAR 629-625-0330-ODF, Drainage DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 45	Cut protruding "shotgun" culverts at the fill surface or existing ground. Install downspout and/or energy dissipaters to prevent erosion.	USDI BLM 2008, Appendix I-Water, R 41, p. 275.	OAR 629-625-0330-ODF, Drainage DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 46	Skew cross drain culverts 45 to 60 degrees from the ditchline as referenced in BLM Road Design Handbook 9113-1 and provide pipe gradient slightly greater than ditch gradient to reduce erosion at cross drain inlet.	BLM Road Design Handbook H9113-1 2009	OAR 629-625-0330-ODF, Drainage DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 47	Provide for unobstructed flow at culvert inlets and within ditch lines during and	OAR 629-625-0420	OAR 629-625-0330-ODF, Drainage

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
	upon completion of road construction prior to the wet season.		DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Timing of In-Water Work			
R 48	Conduct all nonemergency in-water work during the ODFW instream work window.	USDI BLM 2008, Appendix I-Water, R 44, p.276, R 65, p. 279. Oregon guidelines for timing of in-water work to protect fish and wildlife resources. ODFW 2008 OAR 629-625-0430	OAR 629-625-0430-ODF, Stream Protection DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 49	Remove stream crossing culverts and entire in-channel fill material during ODFW instream work period.	USDI BLM 2008, Appendix I-Water, R 93, p. 283. Oregon guidelines for timing of in-water work to protect fish and wildlife resources. ODFW 2008	OAR 629-625-0650-ODF,Vacating Forest Roads DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
Low-Water Ford Stream Crossings			
R 50	Harden low water ford approaches with durable materials. Provide cross drainage on approaches.	USDI BLM 2008, Appendix I-Water, R 67, p. 279. EPA 2005, pp.3-50.	OAR 629-625-0430-ODF, Stream Protection DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 51	Restrict access to unimproved low water stream crossings.	USDI BLM 2008, Appendix I-Water, R 69, p. 280. OAR 629-625-0430 (5)	OAR 629-625-0430-ODF, Stream Protection DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 52	Use permanent low water fords in debris-flow susceptible streams (e.g., concrete, well-anchored concrete mats, etc.).	USDI BLM 2008, Appendix I-Water, R 70, p. 280. EPA 2005, pp. 3-50.	OAR 629-625-0320-ODF, Stream Crossing Structures DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
Maintaining Water Quality - Noxious Weeds			
R 53	Locate equipment-washing sites in areas with no potential for runoff into wetlands, Riparian Reserves, floodplains, and waters of the State. Do not use solvents or detergents to clean equipment on site.	USDI BLM 2008, Appendix I-Water, R 75, p. 280. DEQ 2005 , NS-5	OAR 629-625-0430-ODF, Stream Protection DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7)

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
			Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
Water Source Development and Use			
R 54	Limit disturbance to vegetation and modification of streambanks when locating road approaches to in-stream water source developments. Surface these approaches with durable material. Employ erosion and runoff control measures.	USDI BLM 2008, Appendix I-Water, R 102, p. 285.	OAR 629-625-0430-ODF, Stream Protection DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 55	Direct pass-through flow and/or overflow from in-channel and any connected off-channel water developments back into the stream.	USDI BLM 2008, Appendix I-Water, R 104, p. 285.	OAR 629-625-0430-ODF, Stream Protection DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 056	Overflow from water harvesting ponds should be directed to a safe non-eroding dissipation area, and not into a stream channel.	USDI BLM 2008, Appendix I-Water, R 105, p. 285.	OAR 629-625-0430-ODF, Stream Protection DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 057	Limit the construction of temporary in-channel water drafting sites. Develop permanent water sources outside of stream channels and wetlands.	USDI BLM 2008, Appendix I-Water, R 106, p. 286. DEQ 2005, NS-1	OAR 629-625-0430-ODF, Stream Protection DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 058	Do not place pump intakes on the substrate or edges of the stream channel. When placing intakes instream, place on hard surfaces (e.g., shovel, rocks) to minimize turbidity. Use a temporary liner to create intake site. After completion of use, remove liner and restore channel to natural condition.	USDI BLM 2008, Appendix I-Water, R 107, p. 286. DEQ 2005, NS-1	OAR 629-625-0430-ODF, Stream Protection DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 059	Placement of road fill shall not be located in the proximity of a public water supply intake (404(f) exemption criteria xi), in waters of the State.	ACOE 404(f) exemption criteria xi	OAR 629-625-0430-ODF, Stream Protection DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
Erosion Control Measures			
R 060	During roadside brushing, remove vegetation by cutting rather than uprooting.	OAR 629-625-0430 (4)	OAR 629-625-0430-ODF, Stream Protection DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7)

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
			Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 061	Limit road and landing construction, reconstruction, or renovation activities to the dry season. Keep erosion control measures concurrent with ground disturbance to allow immediate stormproofing.	USDI BLM 2008, Appendix I-Water, R 9, p. 271.	OAR 629-625-0440-ODF, Stabilization DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 062	Apply native seed and certified weed free mulch to cut and fill slopes, ditchlines, and waste disposal sites with the potential for sediment delivery to wetlands, Riparian Reserves, floodplains and waters of the State. Apply upon completion of construction and as early as possible to increase germination and growth. Reseed if necessary to accomplish erosion control. Select seed species that are fast growing, have adequate provide ample ground cover and soil-binding properties. Apply mulch that will stay in place and at site-specific rates to prevent erosion.	USDI BLM 2008, Appendix I-Water, R 17, p. 272.	OAR 629-625-0440-ODF, Stabilization DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 063	Place sediment-trapping materials or structures such as straw bales, jute netting, or sediment basins at the base of newly constructed fill or side slopes where sediment could be transported to waters of the State. Keep materials away from culvert outlets.	USDI BLM 2008, Appendix I-Water, R 14, p. 271, R 21, p. 272. USDA FS 2002 Chapter 18	OAR 629-625-0440-ODF, Stabilization DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 064	Use biotechnical stabilization and soil bioengineering techniques to control bank erosion (e.g., commercially produced matting and blankets, live plants or cuttings, dead plant material, rock or other inert structure).	USDI BLM 2008, Appendix I-Water, R 54, p. 277. USDA FS 2002, Chapters 18 and 20	OAR 629-625-0440-ODF, Stabilization DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 065	Suspend ground-disturbing activity if projected forecasted rain will saturate soils to the extent that there is potential for movement of sediment from the road to wetlands, floodplains, and waters of the State. Cover or temporarily stabilize exposed soils during work suspension. Upon completion of ground disturbing activities, immediately stabilize fill material over stream crossing structures. Measures could include but not limited to erosion control blankets and mats, soil binders, soil tackifiers, slash placement.	USDI BLM 2008, Appendix I-Water, R 57, p. 278, R 88, p. 282.	OAR 629-625-0440-ODF, Stabilization DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 066	Apply fertilizer in a manner to prevent direct fertilizer entry to wetlands, Riparian Reserves, floodplains, and waters of the State.	OAR 629-625-0440 Aquatic Resources Biological Opinion NMFS-ARBO 2013.	OAR 629-625-0440-ODF, Stabilization DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1),

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
			(7) Turbidity OAR 340-041-0036
Road Use and Dust Abatement			
R 067	Apply water or approved road surface stabilizers/dust control additives to reduce surfacing material loss and buildup of fine sediment that can enter into wetlands, floodplains and waters of the State. Prevent entry of road surface stabilizers/dust control additives into waters of the State during application.	USDI BLM 2008, Appendix I-Water, R 76, p. 281. DEQ 2005, EP-13	OAR 629-625-0600-ODF, Road Maintenance DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Road Maintenance			
R 068	Prior to the wet season, provide effective road surface drainage maintenance. Clear ditch lines in sections where there is lowered capacity or obstructed by dry ravel, sediment wedges, small failures, or fluvial sediment deposition. Remove accumulated sediment and blockages at cross-drain inlets and outlets. Grade natural surface and aggregate roads where the surface is uneven from surface erosion or vehicle rutting. Restore crowning, outsloping or insloping for the road type for effective runoff. Remove or provide outlets through berms on the road shoulder.	USDI BLM 2008, Appendix I-Water, R 81, R 84, R 85, p. 281. OAR 629-625 0600 (2-4) EPA 2005, pp. 361-362.	OAR 629-625-0600-ODF, Road Maintenance DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 069	Retain ground cover in ditch lines, except where sediment deposition or obstructions require maintenance.	USDI BLM 2008, Appendix I-Water, R 86, p. 282.	OAR 629-625-0600-ODF, Road Maintenance DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 070	Maintain water flow conveyance, sediment filtering and ditchline integrity by limiting ditchline disturbance and groundcover destruction when machine cleaning within 200 feet of road stream crossings.		DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) TurbidityOAR 340-041-0036
R 071	Avoid undercutting of cut-slopes when cleaning ditch lines.	USDI BLM 2008, Appendix I-Water, R 78, p. 281. EPA 2005, p. 362	OAR 629-625-0600-ODF, Road Maintenance DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 072	Remove and dispose of slide material when it is obstructing road surface and ditchline drainage. Place material on stable ground outside of wetlands, Riparian Reserves, floodplains, and waters of the State. Seed with native seed and weed-free mulch.	USDI BLM 2008, Appendix I-Water, R 79, p. 281. OAR 629-625-0600 (6)	OAR 629-625-0600-ODF, Road Maintenance DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 073	Do not sidecast loose ditch or surface material where it can enter wetlands, Riparian Reserves, floodplains, and	USDI BLM 2008, Appendix I-Water, R 80, p. 281.	OAR 629-625-0600-ODF, Road Maintenance DEQ-Water Pollution:

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
	waters of the State.	OAR 629-625-0600 (7)	Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 074	Retain low-growing vegetation on cut-and-fill slopes.	USDI BLM 2008, Appendix I-Water, R 86, p. 282. EPA 2005, EP-6	OAR 629-625-0600-ODF, Road Maintenance DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 075	Seed and mulch cleaned ditch lines and bare soils that drain directly to wetlands, floodplains, and waters of the State, with native species and weed-free mulch.		OAR 629-625-0600-ODF, Road Maintenance DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Road Stormproofing			
R 076	Inspect and maintain culvert inlets and outlets, drainage structures and ditches before and during the wet season to diminish the likelihood of plugged culverts and the possibility of washouts.	USDI BLM 2008, Appendix I-Water, R 81, R 82, p. 281. OAR 629-625 -0600 (3)	OAR 629-625-0600-ODF, Road Maintenance DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 077	Repair damaged culvert inlets and downspouts to maintain drainage design capacity.	USDI BLM 2008, Appendix I-Water, R 82, p. 281. OAR 629-625 -0600 (3)	OAR 629-625-0600-ODF, Road Maintenance DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 078	Blade and shape roads to conserve existing aggregate surface material retain or restore the original cross section, remove berms and other irregularities that impede effective runoff or cause erosion, and ensure that surface runoff is directed into vegetated, stable areas.	USDI BLM 2008, Appendix I-Water, R 84, p. 281. OAR 629-625 -0600 (4)	OAR 629-625-0600-ODF, Road Maintenance DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 079	Stormproof open resource roads receiving infrequent maintenance to reduce road erosion and reduce the risk of washouts by concentrated water flows. Stormproof temporary roads if retained over-winter.	USDI BLM 2008, Appendix I-Water, R 87, p. 282. OAR 629-625-0600 (2)	OAR 629-625-0600-ODF, Road Maintenance DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 080	Suspend stormproofing/ decommissioning operations and cover or otherwise temporarily stabilize all exposed soil if conditions develop that cause a potential for sediment-laden runoff to enter a wetland, floodplain or waters of the State. Resume operations when conditions allow turbidity standards to be met.	USDI BLM 2008, Appendix I-Water, R 88, p. 282.	OAR 629-625-0600-ODF, Road Maintenance DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Road Closure and Decommissioning			
R 081	Inspect closed roads to ensure that	OAR 629-625 -0650 (2)	OAR 629-625-0650-ODF, Vacating Forest

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
	vegetation stabilization measures are operating as planned, drainage structures are operational, and noxious weeds are not providing erosion control. Conduct vegetation treatments and drainage structure maintenance as needed.		Roads DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 082	Fully decommission temporary roads upon completion of use unless there is a foreseeable need for reuse.	USDI BLM 2008, Appendix I-Water, R 90, p. 283.	OAR 629-625-0650-ODF, Vacating Forest Roads DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 083	Prevent use of vehicular traffic utilizing methods such as gates, guard rails, earth/log barricades, to reduce or eliminate erosion and sedimentation due to traffic on roads.	USDI BLM 2008, Appendix I-Water, R 91, p. 283. OAR 629-625 -0650 (2)	OAR 629-625-0650-ODF, Vacating Forest Roads DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 084	Convert existing drainage structures such as ditches and cross drain culverts to a long-term maintenance free drainage configuration such as an outsloped road surface and waterbars.	USDI BLM 2008, Appendix I-Water, R 92, p. 283. OAR 629-625 -0650 (3)	OAR 629-625-0650-ODF, Vacating Forest Roads DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 085	Place and remove temporary stream crossings during the dry season, without overwintering, unless designed to accommodate the 100-year theoretical flood. See also R 049.	OAR 629-625-0430 (5)	OAR 629-625-0430-ODF, Stream Protection DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 086	Place excavated material from removed stream crossings on stable ground outside of wetlands, Riparian Reserves, floodplains, and waters of the State. In some cases, the material could be used for recontouring old road cuts or be spread across roadbed and treated to prevent erosion.	USDI BLM 2008, Appendix I-Water, R 94, p. 284.	OAR 629-625-0650-ODF, Vacating Forest Roads DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 087	Reestablish stream crossings to the natural stream gradient. Excavate sideslopes back to the natural bank profile. Reestablish natural channel width and floodplain.	USDI BLM 2008, Appendix I-Water, R 95, p. 284.	OAR 629-625-0650-ODF, Vacating Forest Roads DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 088	On each side of a stream crossing, construct waterbars or cross ditches that will remain maintenance free.	USDI BLM 2008, Appendix I-Water, R 96, p. 284.	OAR 629-625-0650-ODF, Vacating Forest Roads DEQ-Water Pollution:

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
		OAR 629-625 -0650 (3)	Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 089	Following culvert removal and prior to the wet season, apply erosion control and sediment trapping measures (e.g., seeding, mulching, straw bales, jute netting, and native vegetative cuttings) where sediment can be delivered into wetlands, Riparian Reserves, floodplains, and waters of the State.	USDI BLM 2008, Appendix I-Water, R 97, p. 284. OAR 629-625 -0650 (3)	OAR 629-625-0650-ODF, Vacating Forest Roads DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 090	Implement tillage measures, including ripping or subsoiling to an effective depth. Treat compacted areas including the roadbed, landings, construction areas, and spoils sites.	USDI BLM 2008, Appendix I-Water, R 98, p. 285.	OAR 629-625-0650-ODF, Vacating Forest Roads DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 091	After tilling the road surface, pull back unstable road fill and end-haul or contour to the natural slopes.	USDI BLM 2008, Appendix I-Water, R 99, p. 285.	OAR 629-625-0650-ODF, Vacating Forest Roads DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Wet-Season Road Use			
R 092	On active haul roads, during the wet season, use durable rock surfacing and sufficient rock depth to resist rutting or development of sediment on road surfaces that drain directly to wetlands, floodplains, and waters of the State.	USDI BLM 2008, Appendix I-Water, R 71, p. 280. OAR 629-625-0700 (2)	OAR 629-625-0700-ODF, Wet Weather Road Use DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 093	Prior to winter hauling activities, implement structural road treatments such as: increasing the frequency of cross drains, installing sediment barriers or catch basins, applying gravel lifts or asphalt road surfacing at stream crossing approaches, and armoring ditch lines.	USDI BLM 2008, Appendix I-Water, R 72, p. 280. OAR 629-625-0700 (2)	OAR 629-625-0700-ODF, Wet Weather Road Use DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 094	Suspend commercial use where the road wear surface is deteriorating by vehicular rutting or standing water causing a mud layer, or where turbid runoff from the road is likely to reach waters of the State.	USDI BLM 2008, Appendix I-Water, R 73, p. 280. OAR 629-625-0700 (3)	OAR 629-625-0700-ODF, Wet Weather Road Use DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 095	Remove snow on surfaced roads in a manner that will protect the road and adjacent resources. Retain a minimum layer (4 inches) of compacted snow on the road surface. Provide drainage through the snow bank at periodic	USDI BLM 2008, Appendix I-Water, R 74, p. 280. BLM snow removal letter.	OAR 629-625-0700-ODF, Wet Weather Road Use DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1),

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
	intervals to allow snowmelt to drain off the road surface.		(7) Turbidity OAR 340-041-0036
R 096	Avoid removing snow from unsurfaced roads where runoff drains to waters of the State.		DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 097	Maintain road surface by applying appropriate gradation of aggregate and suitable particle hardness to protect road surfaces from rutting and erosion under active haul where runoff drains to wetlands, Riparian Reserves, floodplains, and waters of the State.	USDI BLM 2008, Appendix I-Water, R 71, p. 280. OAR 629-625-0700 (2)	OAR 629-625-0700-ODF, Wet Weather Road Use DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 098	To reduce sediment tracking from natural surface roads during active haul, provide a gravel approach before entrance onto surfaced roads.		OAR 629-625-0700-ODF, Wet Weather Road Use DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 099	Install temporary culverts and washed rock on top of low water ford to reduce vehicle contact with water during active haul. Remove culverts promptly after use.		OAR 629-625-0700-ODF, Wet Weather Road Use DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036

Timber Harvest Activities

See *Summary of Oregon Water Quality Standards* for additional details about the standards and regulations that are associated with the best management practices.

Table I-2. Best management practices for timber harvest activities.

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
Cable Yarding			
TH 1	Design yarding corridors to limit canopy loss in Riparian Reserves and to maintain effective shade. Techniques include limiting the number of such corridors, using narrow widths, and using the most perpendicular orientation to the stream feasible.	USDI BLM 2008, Appendix I-Water, TH 2, p. 287.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036 Temperature OAR 340-041-0028
TH 2	Trees felled for yarding corridors in the Riparian Reserve within a tree height distance of a stream channel would be directed toward the stream and left on site.		DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 3	Require full suspension over flowing streams, non- flowing streams with erodible bed and bank, and jurisdictional wetlands.	USDI BLM 2008, Appendix I-Water, TH 3, p. 287.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
TH 4	When logging downhill into Riparian Reserves, design the logging system to prevent converging yarding trails from intersecting the stream network.	USDI BLM 2008, Appendix I-Water, TH 4, p. 287.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 5	Prevent streambank and hillslope disturbance on steep slopes (generally >60%) along stream channels, by yarding across the Riparian Reserve with full suspension or one-end suspension with seasonal restrictions, as needed. Yard the remaining areas across the Riparian Reserve using one-end suspension	USDI BLM 2008, Appendix I-Water, TH 5, p. 287.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 6	Implement erosion control measures such as waterbars, slash placement, and seeding in cable yarding corridors where the potential for erosion and delivery to water bodies, fland seedi and wetlands exists.	USDI BLM 2008, Appendix I-Water, TH 6, p. 288.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
Ground-Based Harvesting			
TH 7	Exclude machinery from the Riparian Reserve inner zone, except for road and temporary skid trail crossings, restoration, and wildfire operational reasons.	USDI BLM 2008, Appendix I-Water, TH 7, p. 288.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036 Temperature OAR 340-041-0028
TH 8	Exclude ground-based equipment on hydric soils, defined by the Timber Productivity Capability Classification (TPCC).	USDI BLM 2008, Appendix I-Water, TH 8, p. 288.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 9	Limit detrimental ground disturbance (soil compaction, organic matter displacement, and alteration of soil structure) to 20% of the harvest unit area. This percentage includes permanent and temporary roads, landings, stockpiles, skid trails, and machinery built burn piles.	Soil Quality Standards USDA FS 1998	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 10	Limit designated skid trails for harvesting to ≤15 percent of the harvest unit area including legacy trails, where there are no other planned detrimental soil disturbances.	Soil Quality Standards USDA FS 1998	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 11	Limit width of skid roads to single width of what is operationally necessary for the equipment. Where multiple machines are used, provide a minimum sized pullout for passing.	USDI BLM 2008, Appendix I-Water, TH 10, p. 288.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 12	Ensure one-end suspension of logs when skidding. Harvesting done with a track or wheel driven type machine must have an extendable and retractable arch and fair lead that is an integral part of the machine and is capable of lifting the leading end clear of the ground.	USDI BLM 2008, Appendix I-Water, TH 11, p. 288.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 13	Restrict skidding and forwarding operations to periods of low soil moisture, frozen ground, or adequate snow cover when soils have the greatest strength to support equipment	USDI BLM 2008, Appendix I-Water, TH 12, p. 288.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
	and increased resistance to compaction and displacement. The soil texture moisture limit, applied at the harvest unit level, would be 25% for clay/clay loam, 20% for loam/silt loam, and 15% for sandy/sandy loam.		
TH 14	Use existing compacted surfaces (e.g. skid trails, landings), where feasible, for ground-based logging equipment, considering proper spacing, skid trail direction and location relative to terrain and stream channel features.	USDI BLM 2008, Appendix I-Water, TH 13, p. 289.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 15	Limit conventional skidders and tracked equipment to slopes less than 35 percent, except when using legacy trails or accessing isolated ground based harvest areas requiring short trails (up to 100 feet) over steeper pitches without causing undue effects to soils.	USDI BLM 2008, Appendix I-Water, TH 14, p. 289.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1)) Turbidity OAR 340-041-0036
TH 16	Monitor use where specialized ground-based mechanized equipment (i.e. low psi tracked or wheeled or self-leveling cabs with oversized tracks or tires) operate on slopes greater than 35%, and restrict where water and sediment could channel in overland flow.	USDI BLM 2008, Appendix I-Water, TH 15, p. 289.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 17	Designate skid trails in locations that channel water from the trail surface away from water bodies, floodplains, and wetlands, or unstable areas adjacent to them.	USDI BLM 2008, Appendix I-Water, TH 16, p. 289.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 18	Directionally fall trees to lead for skidding and skyline yarding to minimize ground disturbance when moving logs to skid trails and skyline corridors.	USDI BLM 2008, Appendix I-Water, TH 17, p. 289.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 19	Apply erosion control measures to skid trails and other disturbed areas with potential for erosion and subsequent sediment delivery to water bodies, floodplains, or wetlands. These practices could include seeding, mulching, water barring, tillage, and woody debris placement. Use guidelines from the road decommissioning section.	USDI BLM 2008, Appendix I-Water, TH 18, p. 289.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 20	Construct waterbars on skid trails using guidelines in Table C-5, where there is potential for soil erosion and delivery to water bodies, floodplains, and wetlands.	USDI BLM 2008, Appendix I-Water, TH 19, p. 289.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 21	Subsoil skid trails, landings, or temporary roads where needed to minimize surface runoff, improve soil structure and water movement through the roadbed. See also R 90.	USDI BLM 2008, Appendix I-Water, R 98, p. 285.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 22	Block skid trails to prevent OHV and other unauthorized use at the end of seasonal use.	USDI BLM 2008, Appendix I-Water, TH 21, p. 290.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1)

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
			Turbidity OAR 340-041-0036
TH 23	Plan one-entry operations, by combining ground-based timber harvesting with pre-commercial thinning, and/or biomass opportunities, or reducing fuel loading.	USDI BLM 2008, Appendix I-Water, TH 22, p. 290.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
Helicopter			
TH 24	Consider the use of helicopter or aerial logging systems to prevent water quality impacts from road construction or ground-based timber yarding, where other BMPs would be more costly or have limited effectiveness.	USDI BLM 2008, Appendix I-Water, TH 23, p. 290.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036 Temperature OAR 340-041-0028
Horse			
TH 25	Within Riparian Reserves, limit horse logging to slopes less than 20 percent.	USDI BLM 2008, Appendix I-Water, TH 24, p. 290.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 26	Construct waterbars on horse skid trails when there is potential for soil erosion and delivery to water bodies, floodplains, and wetlands.	USDI BLM 2008, Appendix I-Water, TH 25, p. 290.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036

Silvicultural Activities

See *Summary of Oregon Water Quality Standards* additional details about the standards and regulations that are associated with the best management practices.

Table I-3. Best management practices for planting, pre-commercial thinning, and fertilization.

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
Planting and Pre-Commercial Thinning			
S 1	Limit the crossing of stream channels with motorized support vehicles (e.g., ATV's) and mechanized equipment to existing road crossings.	USDI BLM 2008, Appendix I-Water, S 1, p. 291.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
S 2	Scatter treatment debris on disturbed soils and water bar any equipment access trails that could erode and deposit sediment in water bodies, floodplains, and wetlands.	USDI BLM 2008, Appendix I-Water, S 4, p. 291.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
Fertilization			
S 3	For streams and water bodies that support domestic use, apply fertilizer further than 100 feet from the edge of the active channel or shoreline.	USDI BLM 2008, Appendix I-Water, S 5, p. 291.	EPA 440/5-86-001,-10 mg/L nitrate nitrogen for domestic water supply. DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033
S 4	Locate storage, transfer, and loading sites outside Riparian Reserves and separated from hydrological connections: (e.g., road ditches that are linked to stream channels).	USDI BLM 2008, Appendix I-Water, S 6, p. 291.	EPA 822-R-13-001 2013,-salmonid acute criterion, 17 mg total ammonia nitrogen/L at pH 7 and temperature of 20°C. DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
			Toxic Substances OAR 340-041-0033
S 5	When aerially applying fertilizer, avoid drift of fertilizer into water bodies.	USDI BLM 2008, Appendix I-Water, S 7, p. 291.	EPA 822-R-13-001 2013,-salmonid acute criterion, 17 mg total ammonia nitrogen/L at pH 7 and temperature of 20°C. DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033
S 6	When aerially applying fertilizer, suspend fertilizer application when heavy precipitation is expected at the time of application.	USDI BLM 2008, Appendix I-Water, S 8, p. 292.	EPA 822-R-13-001 2013,-salmonid acute criterion, 17 mg total ammonia nitrogen/L at pH 7 and temperature of 20°C. DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033

Fire and Fuels Management

See *Summary of Oregon Water Quality Standards* for additional details about the standards and regulations that are associated with the best management practices.

Table I-4. Best management practices for fire and fuel management.

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
Underburn, Jackpot Burn, and Broadcast Burn			
F 1	Keep broadcast burns and jackpot burns out of Riparian Reserves inner zone, unless prescribed for restoration purposes, e.g., sudden oak death sanitation, improve species composition, invigorate deciduous trees. Locate ignition lines above large open meadows associated with stream channels, unless prescribed for restoration.	USDI BLM 2008, Appendix I-Water, F 1, p. 293.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036 Temperature OAR 340-041-0028
F 2	Reduce fuel loads by whole tree yarding, and piling material, as necessary, prior to under burning in dry forest types where fuel loads are elevated.	USDI BLM 2008, Appendix I-Water, F 2, p. 293.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036 Temperature OAR 340-041-0028
F 3	Avoid direct ignition or ignition by a backing-in fire of large woody material that is touching the high water mark of a water body or that may be affected by high flows.	USDI BLM 2008, Appendix I-Water, F 3, p. 293.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036 Temperature OAR 340-041-0028
F 4	Avoid delivery of chemical retardant foam or additives to water bodies, and wetlands. Store and dispose of ignition devices/ materials (e.g., flares, plastic spheres, etc.) outside Riparian Reserves or a minimum of 100 feet from water bodies, floodplains, and wetlands. Maintain and refuel equipment (e.g.,	USDI BLM 2008, Appendix I-Water, F 4, p. 293.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
	drip torches, chainsaws) a minimum of 100 feet from water bodies, floodplains, and wetlands. Portable pumps can be refueled on-site within a spill containment system.		
F 5	Limit fire lines inside Riparian Reserves. Construct fire lines by hand on all slopes greater than 35 percent and inside the Riparian Reserve inner zone. Use erosion control techniques such as tilling, waterbarring, or debris placement on fire lines when there is potential for soil erosion and delivery to water bodies, floodplains, and wetlands. Space the waterbars as shown in Table C-5. Avoid placement of any fire line where water would be directed into water bodies, floodplains, wetlands, headwalls, or areas of instability.	USDI BLM 2008, Appendix I-Water, F 5, p. 294.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
Pile and Burn			
F 6	Avoid mechanical or hand piling in the Riparian Reserve inner zone.	USDI BLM 2008, Appendix I-Water, F 6, p. 294.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
Mechanical and Manual Fuel Treatments			
F 7	Prevent mechanical fuel reduction equipment within the Riparian Reserve inner zone, unless prescribed for restoration. Limit mechanical fuel reduction equipment to slopes less than 35 percent. Restrict non- track mechanized equipment, e.g., feller bunchers, horizontal bar masticators, to slopes less than 20 percent.	USDI BLM 2008, Appendix I-Water, F 7, p. 294.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
F 8	Use temporary stream crossings if necessary to access the opposite side with any equipment or vehicles (including ATVs). Follow Temporary Stream Crossing practices under Roads section.	USDI BLM 2008, Appendix I-Water, F 8, p. 294.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
F 9	Place residual slash on severely burned areas, where there is potential for sediment delivery into water bodies, floodplains and wetlands.	USDI BLM 2008, Appendix I-Water, F 9, p. 294.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
Wildfire Suppression			
F 10	Limit firelines inside Riparian Reserves. Where hand constructed firelines are necessary in Riparian Reserves, angle the approach, where feasible, rather than have it perpendicular to the Riparian Reserve. Limit heavy equipment to slopes less than 35 percent.	USDI BLM 2008, Appendix I-Water, F 5, p.294, F 11, p. 295.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
	Locate fire lines to minimize directing water into water bodies, wetlands, headwalls, or areas of instability. Use erosion control techniques such as tilling, waterbarring, or debris placement on fire lines when there is potential for soil erosion and delivery to water bodies, floodplains, and wetlands. Space waterbars as shown in Table C-5. Block dozer lines and roads or landing intersections with an approved barricade and/or scattered slash to preclude OHV use.		
F 11	Prevent cutting of logs or woody material if any portion of that material extends into the stream channel, unless for restoration. Fall snags in the Riparian Reserve towards the stream channel when felling is necessary for safety or fire suppression activities.	USDI BLM 2008, Appendix I-Water, F 12, p. 295.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
F 12	Avoid locating incident bases, camps, helibases, staging areas, constructed helispots, and other centers for incident activities in Riparian Reserves or within 200 feet of any waterbody, floodplain, or wetland. Water drafting sites for engines and tankers would be permitted.	USDI BLM 2008, Appendix I-Water, F 13, p. 295.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1)) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036 Temperature OAR 340-041-0028
F 13	Locate and maintain portable sanitation facilities at incident bases, camps (including spike/ remote camps), helibases, staging areas, constructed helispots, and other centers for incident activities in accordance with state and local regulations.	USDI BLM 2008, Appendix I-Water, F 14, p. 295.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Bacteria OAR 340-041-0009
F 14	Avoid application of chemical retardant, foam, or other chemicals to waterways, maintain a 300 ft. buffer (FA-IM-2008-029), unless the wildfire is deemed a threat to human safety or private property. Apply aerial retardant adjacent to Riparian Reserves by making parallel passes.	USDI BLM 2008, Appendix I-Water, F 15, p. 295.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033
Rehabilitation			
F 15	Implement emergency fire rehabilitation treatments to accomplish erosion control as quickly as possible and before the wet season. Soil and water conservation practices may include, but are not restricted to: Native vegetation for short-term cover development and long-term recovery, unless not available in quantities necessary for the emergency response.	USDI BLM 2008, Appendix I-Water, F 16, p. 296. Interagency Burned Area Emergency Response Guidebook; Interpretation of Department of the Interior 620 DM 3 and USDA Forest Service Manual 2523 For the	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 TurbidityOAR 340-041-0036

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
	Mulch with straw, wood chips, or other suitable material. To avoid introducing noxious weeds when mulching, use certified weed-free straw mulch or rice straw where available. Straw wattles placed on the contour at adequate spacing between each row to capture eroded material without overflowing. Embed to the surface of the soil in slight trench to prevent undermining. Log erosion barriers placed and anchored similarly to straw wattles. Spreading available cut vegetation or slash on bare soils. Placing channel sediment retention or stabilization structures. Placing trash racks for debris above road drainage structures. Installing drainage structures, such as waterbars or drainage dips, on fire lines, fire roads, and other cleared areas according to guidelines in Table 5 (Waterbar spacing by gradient and erosion class). Repairing damaged road drainage facilities such as flattened or ripped culvert ends, burned out plastic pipes or cleaning ditch lines of materials that impede natural flow Blocking or decommissioning roads and trails.	Emergency Stabilization of Federal and Tribal Trust Lands Version 4.0 February 2006	
Post-Fire Road Repair			
F 16	Implement emergency fire rehabilitation treatments to accomplish erosion control as quickly as possible and before the wet season. Soil and water conservation practices may include, but are not restricted to: Reduce road system hydrologic conductivity though proper grading, culvert spacing, and installing drivable dips. Replace culverts to increase peak flow capacity of stream crossing culverts to accommodate the 100-year design flood.	USDI BLM 2008, Appendix I-Water, F 17, p. 297. Interagency Burned Area Emergency Response Guidebook; Interpretation of Department of the Interior 620 DM 3 and USDA Forest Service Manual 2523 For the Emergency Stabilization of Federal and Tribal Trust Lands Version 4.0 February 2006	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
	Prevent culvert plugging. Correct stream diversions.		
Fuel/Retardant Transport			
F 17	If more than 42 gallons of fuel or combined quantity of petroleum product and chemical substances would be transported to a project site, the following precautions would be implemented. 1. Plan a safe route and transfer sites that could contain the transported volume. 2. Plan an active dispatch system that can relay the information to appropriate resources. 3. Ensure a spill containment kit that can absorb and contain 55 gallons of petroleum product and chemical substances is readily available. 4. Provide for immediate notification in the event of a spill. Have a radio equipped vehicle lead the chemical or fuel truck to the project site. 5. Assemble a spill notification list that includes the district hazardous materials coordinator, DEQ, and spill clean-up contractors. 6. Construct a water user contact list with address and phone numbers. 7. When operating within Source Water Watersheds, pre-estimate travel times through the watershed to predict downstream arrival times. 8. Be prepared to sample water and carry sample containers.	USDI BLM 2008, Appendix I-Water, F 18, p. 297.	[40 CFR 112]-Oil Pollution Prevention. Reportable quantity is forty-two U.S. Gallons not involving waterways, a visible sheen where waterways are involved. DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (12) and (13) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033

Table I-5. Water bar spacing by gradient and erosion class.

Gradient	Water Bar Spacing[a] (Feet) Per Erosion Class[b]		
	High Class	Moderate Class	Low Class
2-5%	200	300	400
6-10%	150	200	300
11-15%	100	150	200
16-20%	75	100	150
21-35%	50	75	100
36+%	50	50	50

[a] Spacing is determined by slope distance and is the maximum allowed for the grade.
[b] The erosion classes include the following rock types:
High: Granite, sandstone, andesite porphyry, glacial or alluvial deposits, soft matrix conglomerate, volcanic ash, and pyroclastics.
Moderate: Basalt, andesite, quartzite, hard matrix conglomerate, and rhyolite.
Low: Metasediments, metavolcanics, and hard shale.

Surface Source Water For Drinking Water

See *Summary of Oregon Water Quality Standards* for additional details about the standards and regulations that are associated with the best management practices

Table I-6. Best management practices for surface source water for drinking water protection.

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
SW 1	Sanitary facilities would be planned, located, designed, constructed, operated, inspected, and maintained, to minimize water contamination.	USDI BLM 2008, Appendix I-Water, SW 1, p. 299.	DEQ-Water Pollution: Bacteria OAR 340-041-0009 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (13)
SW 2	Locate contractor camps outside DEQ sensitive zones in drinking water source areas for public water systems. If this is not possible, require self-contained sanitary facilities.	USDI BLM 2008, Appendix I-Water, SW 2, p. 299. DEQ Drinking Water Protection Program http://www.deq.state.or.us/wq/dwp/swcountymap.htm	DEQ-Water Pollution: Bacteria OAR 340-041-0009 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (13)
SW 3	Require self-contained sanitary facilities in surface source water watersheds, when long-term camping (greater than 14 days) is involved with contract implementation.	USDI BLM 2008, Appendix I-Water, SW 3, p. 299.	DEQ-Water Pollution: Bacteria OAR 340-041-0009 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (13)
SW 4	Provide self-contained sanitary facilities when there is high recreational use (almost continuous occupancy) inside DEQ sensitive zones within drinking water source areas for public water systems, known domestic source water watersheds, or Riparian Reserves inner zone.	USDI BLM 2008, Appendix I-Water, SW 4, p. 299. DEQ Drinking Water Protection Program http://www.deq.state.or.us/wq/dwp/swcountymap.htm	DEQ-Water Pollution: Bacteria OAR 340-041-0009 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (13)
SW 5	Locate pack and riding, facilities outside DEQ sensitive zones within drinking water source areas for public water systems, known domestic source water watersheds, or Riparian Reserves inner zone.	USDI BLM 2008, Appendix I-Water, SW 5, p. 299. DEQ Drinking Water Protection Program http://www.deq.state.or.us/wq/dwp/swcountymap.htm	DEQ-Water Pollution: Bacteria OAR 340-041-0009 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (13)
SW 6	Do not allow surface occupancy within 200 feet of a known domestic water source or within DEQ sensitive zones in drinking water source areas for public water systems.	USDI BLM 2008, Appendix I-Water, SW 6, p. 299. DEQ Drinking Water Protection Program http://www.deq.state.or.us/wq/dwp/swcountymap.htm	DEQ-Water Pollution: Bacteria OAR 340-041-0009 Toxic Substances OAR 340-041-0033 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (13)
SW 7	Do not apply sewage sludge as a soil amendment within drinking water source areas for public water systems, known domestic source water watersheds, or Riparian Reserves.	USDI BLM 2008, Appendix I-Water, SW 7, p. 300. DEQ Drinking Water Protection Program http://www.deq.state.or.	DEQ-Water Pollution: Bacteria OAR 340-041-0009 Toxic Substances OAR 340-041-0033 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (13)

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
		us/wq/dwp/swcountymap.htm	
SW 8	Avoid loading, or storing chemical, fuel, or fertilizer in DEQ sensitive zones within drinking water source areas for public water systems, known domestic source water watersheds, or Riparian Reserves inner zone.	USDI BLM 2008, Appendix I-Water, SW 8, p. 300. DEQ Drinking Water Protection Program http://www.deq.state.or.us/wq/dwp/swcountymap.htm	DEQ-Water Pollution: Toxic Substances OAR 340-041-0033 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (13)
SW 9	Conduct equipment maintenance outside DEQ sensitive zones within drinking water source areas for public water systems, known domestic source water watersheds, or Riparian Reserves inner zone.	USDI BLM 2008, Appendix I-Water, SW 9, p. 300. DEQ Drinking Water Protection Program http://www.deq.state.or.us/wq/dwp/swcountymap.htm	DEQ-Water Pollution: Toxic Substances OAR 340-041-0033 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (13)
SW 10	Use non-oil-based dust suppressants within surface source water watersheds.	USDI BLM 2008, Appendix I-Water, SW 10, p. 300.	DEQ-Water Pollution: Toxic Substances OAR 340-041-0033 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (13)
SW 11	Use fire retardant and surfactants as a last resort in fire suppression activities within surface source water watersheds.	USDI BLM 2008, Appendix I-Water, SW 11, p. 300.	DEQ-Water Pollution: Toxic Substances OAR 340-041-0033 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (13)

Recreation

See *Summary of Oregon Water Quality Standards* for additional details about the standards and regulations that are associated with the best management practices.

Table I-7. Best management practices for recreation management

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
All Recreation Facilities			
REC 1	Implement erosion control measures at recreation sites to stabilize exposed soils where water flows or sediment, may reach water bodies.	USDI BLM 2008, Appendix I-Water, REC 1, p. 301.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
REC 2	Locate new recreational facilities, developed and dispersed sites, outside of the water influence area. Low impact uses, such as hiking trails, picnic sites, or water dependent facilities (e.g., boat ramps or docks), are excluded.	USDI BLM 2008, Appendix I-Water, REC 2, p. 301.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Bacteria OAR 340-041-0009 Turbidity OAR 340-041-0036 Temperature OAR 340-041-0028
Developed Recreation Sites			
REC 3	Self-contained sanitary facilities would be used at all developed recreational facilities, unless a sewage system and drain field is approved by the Department of Environmental Quality.	USDI BLM 2008, Appendix I-Water, REC 3, p. 301.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Bacteria OAR 340-041-0009
REC 4	When conducting recreation site maintenance, do not cut portions of	USDI BLM 2008, Appendix I-Water,	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1)

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
	logs or coarse woody debris that fall across the active stream channel. Keep adequate lengths of material on the banks to anchor it in place. If not possible to make the log stable, it may be removed.	REC 5, p. 301.	Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
Water Dependent Facilities			
REC 5	Construct boat ramps and approaches with hardened surfaces.	USDI BLM 2008, Appendix I-Water, REC 6, p. 301.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
Off-Highway Vehicle (OHV) Trails			
REC 6	Use existing stream crossings to the extent possible when constructing trails through Riparian Reserves.	USDI BLM 2008, Appendix I-Water, REC 7, p. 301.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
REC 7	When constructing or maintaining trails within Riparian Reserves, do not cut the portion of logs or coarse woody debris that extend into the active stream channel. Provide for adequate stabilization of the logs if not doing so would create a safety hazard.	USDI BLM 2008, Appendix I-Water, REC 8, p. 302.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
REC 8	Stream crossings would be designed to accommodate active channel width, bed load, and fish passage and exceeding capacity for the 100-year flood event.	USDI BLM 2008, Appendix I-Water, REC 10, p. 302.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
REC 9	Suspend construction or maintenance of trails, where erosion and runoff into water bodies would occur.	USDI BLM 2008, Appendix I-Water, REC 11, p. 302.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
REC 10	Locate staging areas outside Riparian Reserves. Design or upgrade staging areas to prevent sediment/pollutant delivery to wetlands, floodplains, and water bodies, e.g., rocking or hardening, drainage through grading or shaping.	USDI BLM 2008, Appendix I-Water, REC 12, p. 302.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (12) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
REC 11	Harden trail approaches to stream crossings using materials such as geotextile fabric and rock aggregate.	USDI BLM 2008, Appendix I-Water, REC 13, p. 302.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
REC 12	Drain dips or drainage features would be installed on approaches to stream crossings as needed to divert runoff and reinforced with rock for longevity.	USDI BLM 2008, Appendix I-Water, REC 14, p. 302.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
REC 13	When constructing bridges or walkways over streams or water bodies, avoid use of chemically treated materials at water level contact points, where leachate or solids may enter soil or water.	USDI BLM 2008, Appendix I-Water, REC 15, p. 302.	DEQ-Water Pollution: Toxic Substances OAR 340-041-0033 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (10)
REC 14	Use a temporary flow diversion bypass to minimize downstream turbidity, when constructing perennial stream	USDI BLM 2008, Appendix I-Water, REC 16, p. 302.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1)

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
	crossings (See Roads Section for Stream Crossing BMPs.).		Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
REC 15	Prevent vehicle access to nearby wetlands by using suitable barriers.	USDI BLM 2008, Appendix I-Water, REC 17, p. 303.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (12) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033 Turbidity OAR 340-041-0036
REC 16	Where trails intersect road ditches, provide erosion resistant crossings. Divert water from the trail to keep from reaching wetlands, floodplains, and water bodies.	USDI BLM 2008, Appendix I-Water, REC 18, p. 303.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
REC 17	If trail width is too wide for the designated use (such as old roads converted to trails), consider tilling one side of the trail, covering with brush, and seeding or planting.	USDI BLM 2008, Appendix I-Water, REC 19, p. 303.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
REC 18	Repair rills and gullies to keep sediment from reaching wetlands, floodplains, and water bodies.	USDI BLM 2008, Appendix I-Water, REC 20, p. 303.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
REC 19	Water bars, drain dips, and lead off ditches will be constructed or repaired as needed. These features may need rock reinforcement to promote longevity. Self-maintaining drain dips or lead-off features are the preferred design.	USDI BLM 2008, Appendix I-Water, REC 21, p. 303.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
REC 20	Drain dips or lead off ditches would be constructed on steeper gradient trails and approaches to stream crossings.	USDI BLM 2008, Appendix I-Water, REC 22, p. 303.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
Trails (Hiking)			
REC 21	When constructing or maintaining trails within Riparian Reserves, do not cut any portion of logs or coarse woody debris that extend into the active stream channel. Use alternative passage options, such as earthen ramps, small notch steps, or slight trail realignments, to facilitate maintenance of intact logs. Cut and stabilize if necessary for safe passage and safety.	USDI BLM 2008, Appendix I-Water, REC 23, p. 303.	DEQ-Water Pollution: Antidegradation OAR 340-041-004(1) Biocriteria OAR 340-041-0011 Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
Trail Closure			
REC 22	Remove existing stream crossings or bridges (See Road Decommissioning. BMPs).	USDI BLM 2008, Appendix I-Water, REC 24, p. 303.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (8) Turbidity OAR 340-041-0036
REC 23	Position fill or waste material in a location that would avoid direct or indirect sediment discharge to streams or wetlands.	USDI BLM 2008, Appendix I-Water, REC 25, p. 304.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
REC 24	Restored stream banks would be planted with native vegetation, mulched, and then planted with water-tolerant species where appropriate.	USDI BLM 2008, Appendix I-Water, REC 26, p. 304.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
REC 25	Barricade and allow nearby vegetation to grow into closed trails.	USDI BLM 2008, Appendix I-Water, REC 27, p. 304.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
Dispersed Recreation			
REC 26	Site camps for permitted group overnight camping would be greater than 100 feet from surface water.	USDI BLM 2008, Appendix I-Water, REC 28, p. 304.	DEQ-Water Pollution: Bacteria OAR 340-041-0009 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (13)

Range Management

See *Summary of Oregon Water Quality Standards* for additional details about the standards and regulations that are associated with the best management practices.

Table I-8. Best management practices for grazing.

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
G 1	Fence water developments, including springs and seeps, unless other methods are available. Pipe overflow away from the developed source area.	USDI BLM 2008, Appendix I-Water, G 1, p. 305.	DEQ-Water Pollution: Antidegradation OAR 340-04l-0004 Statewide Narrative OAR 340-041-0007(1) Bacteria OAR 340-041-0009 Biocriteria OAR 340-041-0011 Dissolved Oxygen OAR 340-041-0016 Temperature OAR 340-041-0028 Turbidity OAR 340-041-0036
G 2	Do not locate salting areas within ¼ mile of permanent water sources or Riparian Reserves.	USDI BLM 2008, Appendix I-Water, G 2, p. 305.	DEQ-Water Pollution: Antidegradation OAR 340-04l-0004 Statewide Narrative OAR 340-041-0007(1) Bacteria OAR 340-041-0009 Biocriteria OAR 340-041-0011 Dissolved Oxygen OAR 340-041-0016 Temperature OAR 340-041-0028 Turbidity OAR 340-041-0036
G 3	Locate new permanent livestock handling or management facilities (corrals, pens, or holding pastures) outside Riparian Reserves or 200 feet from water bodies and on level ground where drainage would not enter surface waters. Make changes as necessary to existing facilities within Riparian Reserves to meet water quality standards and regulations.	USDI BLM 2008, Appendix I-Water, G 3, p. 305.	DEQ-Water Pollution: Antidegradation OAR 340-04l-0004 Statewide Narrative OAR 340-041-0007(1) Bacteria OAR 340-041-0009 Biocriteria OAR 340-041-0011 Dissolved Oxygen OAR 340-041-0016 Temperature OAR 340-041-0028 Turbidity OAR 340-041-0036
G 4	Apply specific grazing strategies for riparian wetland areas, including timing, intensity, or exclusion for maintenance of proper functioning condition. Use one or more of the following features: Inclusion of the water bodies, floodplains, and wetlands within a	USDI BLM 2008, Appendix I-Water, G 4, p. 306.	DEQ-Water Pollution: Antidegradation OAR 340-04l-0004 Statewide Narrative OAR 340-041-0007(1) Bacteria OAR 340-041-0009 Biocriteria OAR 340-041-0011 Dissolved Oxygen OAR 340-041-0016 Temperature OAR 340-041-0028 Turbidity OAR 340-041-0036

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
	separate pasture. Fence or herd livestock out of water bodies, floodplains, and wetlands for as long as necessary to allow vegetation to recover. Control the timing and intensity of grazing to keep livestock off stream banks when they are most vulnerable to damage and to coincide with the physiological needs of target plant species. Add more rest to the grazing cycle to increase plant vigor, allow stream banks to revegetate, or encourage more desirable plant species composition. Limit grazing intensity to a level that will maintain desired species composition and vigor. Permanently exclude livestock from those water bodies, floodplains, and wetlands areas that are at high risk and have poor recovery potential, and when there is no practical way to protect them while grazing adjacent uplands.		
G 5	Recover degraded water bodies through adjustments to forage utilization levels, improved livestock distribution, and management through fencing, vegetation treatments, water source developments, or changes in season of use or livestock numbers.	USDI BLM 2008, Appendix I-Water, G 5, p. 306.	DEQ-Water Pollution: Antidegradation OAR 340-04l-0004 Statewide Narrative OAR 340-041-0007(1) Bacteria OAR 340-041-0009 Biocriteria OAR 340-041-0011 Dissolved Oxygen OAR 340-041-0016 Temperature OAR 340-041-0028 Turbidity OAR 340-041-0036

Minerals (Salable)

See *Summary of Oregon Water Quality Standards* for additional details about the standards and regulations that are associated with the best management practices.

Table I-9. Best management practices for minerals (salable).

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
Salable Minerals			
M 1	Locate stockpile sites on stable ground where the material would not move into water bodies, floodplains, and wetlands.	USDI BLM 2008, Appendix I-Water, M 18, p. 309.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
M 2	Stabilize and control erosion of overburden and stockpiles. Separate and windrow or stockpile topsoil for use in reclamation.	USDI BLM 2008, Appendix I-Water, M 10, p. 308.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
M 3	Locate, design, and construct salable mineral sites to control runoff and prevent or minimize sediment delivery	USDI BLM 2008, Appendix I-Water, M 18, p. 309.	OAR 629-625-0500-ODF, Rock Pits and Quarries

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
	to streams. Prevent overburden, solid wastes, drainage water or petroleum products from entering wetlands, Riparian Reserves, flood plains and waters of the State.	OAR 629-625-0500 1-5	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
M 5	Outslope quarry floors to provide for adequate drainage of the floor and away from stream channels.		DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
M 6	Locate, design, and maintain settling ponds to contain sediment discharges.	USDI BLM 2008, Appendix I-Water, M 1, p. 309.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
M 7	When a quarry or rock pit is depleted or vacated, stabilize cutbanks, headwalls, and other surfaces to prevent surface erosion and landslides. Close roads, excavations, and crusher pads in accordance with Roads and Landings section. Remove all potential pollutants to prevent their entry into wetlands, Riparian Reserves, floodplains, and waters of the State.	OAR 629-625-0500 DEQ 2005 NS - 6	OAR 629-625-0500-ODF, Rock Pits and Quarries DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
M 8	Use erosion-reduction practices, such as seeding, mulching, silt fences, and woody debris placement, to limit erosion and transport of sediment to streams from quarries. Provide drainage from stockpiles and mineral sites, dispersed over stable vegetated areas rather than directly into stream channels. Grade all material sites, where practicable to conform with the surrounding topography prior to closure. Utilized topsoil as a medium to for successful revegetation. Reseed and plant trees, where needed.	USDI BLM 2008, Appendix I-Water, M 22, p. 309.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036

Spill Prevention and Abatement

See *Summary of Oregon Water Quality Standards* for additional details about the standards and regulations that are associated with the best management practices.

Table I-10. Best management practices for spill prevention and abatement.

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
Operations Near Water bodies			
SP 1	Take precautions to prevent leaks or spills of petroleum products, e.g., fuel, motor oil, and hydraulic fluid, from entering the waters of the State.	[40 CFR 112] OAR 629-620-0100(2)	[40 CFR 112]-Oil Pollution Prevention. Reportable quantity is a visible sheen where waterways are involved. OAR 629-620-0100-ODF, Chemical and Other Petroleum Product Rules DEQ-Water Pollution:

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
			Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (12) and (13) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033
SP 2	Take immediate action to stop and contain leaks or spills of chemicals and other petroleum products. Notify the Oregon Emergency Response System, through the District Hazard Materials specialist, of any spill that enters the waters of the State.	[40 CFR 112] OAR 629-620-0100(3), (4)	[40 CFR 112]-Oil Pollution Prevention. Reportable quantity is a visible sheen where waterways are involved. OAR 629-620-0100-ODF, Chemical and Other Petroleum Product Rules DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (12) and (13) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
SP 3	Inspect and clean heavy equipment as necessary prior to moving on to the project site, in order to remove oil and grease, noxious weeds, and excessive soil. Inspect hydraulic fluid and fuel lines on heavy-mechanized equipment for proper working condition. Where possible, maintain and refuel equipment a minimum of 100 feet away from streams and other water bodies , except small equipment e.g. chainsaws or water pumps. Refuel small equipment from no more than 5-gallon containers. Use absorbent material or a containment system to prevent spills when re-fueling small equipment within the stream margins or near the edge of water bodies. In the event of a spill or release, all reasonable and safe actions to contain the material will be taken. Specific actions are dependent on the nature of the material spilled. Use spill containment booms or as required by DEQ. Have access to booms and other absorbent containment materials. Immediately remove waste or spilled hazardous materials (including but not limited to diesel, oil, hydraulic fluid) and contaminated soils near any stream or other water body, and dispose of it/them in accordance with the applicable regulatory standard. Notify Oregon Emergency Response System of any spill over the material reportable quantities, and any spill not totally cleaned up after 24 hours. Store equipment containing Reportable Quantities of toxic fluids outside of Riparian Reserves.	USDI BLM 2008, Appendix I-Water, SP 1, p. 311.	[40 CFR 112]-Oil Pollution Prevention. Reportable quantity is forty-two U.S. Gallons not involving waterways, a visible sheen where waterways are involved. DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (12) and (13) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
SP 4	If more than 42 gallons of fuel or combined quantity of petroleum product and chemical substances, as project materials, would be transported to a project site, the following precautions will be implemented. 1. Plan a safe route and material transfer sites so that all spilled material will be contained easily at that designated location. 2. Plan an active dispatch system that can relay the information to appropriate resources. 3. Ensure a spill containment kit that can absorb and contain 55 gallons of petroleum product and chemical substances is readily available. 4. Provide for immediate notification to OERS in the event of a spill. Have a radio-equipped vehicle lead the chemical or fuel truck to the project site. 5. Assemble a spill notification list that includes the district hazardous materials coordinator, DEQ, and spill clean-up contractors. 6. Construct a downstream water user contact list with addresses and phone numbers. 7. When operating within Source Water watersheds, pre-estimate water flow travel times through the watershed to predict downstream arrival times. 8. Be prepared to sample water and carry sample containers. Be prepared to assist OSP and ODFW to assess wildlife impacts of any material spilled.	USDI BLM 2008, Appendix I-Water, SP 2, p. 312.	[40 CFR 112]-Oil Pollution Prevention. Reportable quantity is forty-two U.S. Gallons not involving waterways, a visible sheen where waterways are involved. DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (12) and (13) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033
Spill Abatement			
SP 5	Spill Prevention, Control, and Countermeasure Plan (SPCC): All operators shall develop a modified SPCC plan prior to initiating project work if there is a potential risk of chemical or petroleum spills near water bodies. The SPCC plan will include the appropriate containers and design of the material transfer locations. No interim fuel depot or storage location other than a manned transport vehicle would be used	USDI BLM 2008, Appendix I-Water, SP 3, p. 312.	[40 CFR 112]-Oil Pollution Prevention. Reportable quantity is forty-two U.S. Gallons not involving waterways, a visible sheen where waterways are involved. OAR-340-142-0030-DEQ, Oil and Hazardous Materials Emergency Response Requirements
SP 6	Spill Containment Kit (SCK): All operators shall have a SCK as described in the SPCC plan on-site during any operation with potential for run-off to adjacent water bodies. The SCK will be appropriate in size and type for the oil or hazardous material carried by the operator.	USDI BLM 2008, Appendix I-Water, SP 4, p. 313.	OAR-340-142-0030-DEQ, Oil and Hazardous Materials Emergency Response Requirements

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
SP 7	Operators shall be responsible for the clean-up, removal, and proper disposal of contaminated materials from the site.	USDI BLM 2008, Appendix I-Water, SP 5, p. 313.	OAR-340-102-DEQ, Standards Applicable to Generators of Hazardous Waste OAR-340-122-DEQ, Hazardous Substance Remedial Action Rules

Restoration

See *Summary of Oregon Water Quality Standards* for additional details about the standards and regulations that are associated with the best management practices.

Table I-11. Best management practices for restoration activities

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
RST 1	Confine work in the stream channels to the low flow period unless a waiver is obtained from the permitting agencies.	USDI BLM 2008, Appendix I-Water, RST 1, p. 314.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
RST 2	In stream channels that are sensitive to disturbance (e.g., meadow streams), do not drive heavy equipment in flowing channels and floodplains.	USDI BLM 2008, Appendix I-Water, RST 2, p. 314.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
RST 3	In well-armored channels that are resistant to damage (e.g., bedrock, small boulder, or cobble dominated), consider conducting the majority of heavy-equipment work from within the channel, during low streamflow, to minimize damage to sensitive riparian areas.	USDI BLM 2008, Appendix I-Water, RST 3, p. 314.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036 Temperature OAR 340-041-0028
RST 4	Design access routes for individual work sites to reduce exposure of bare soil and extensive stream bank shaping.	USDI BLM 2008, Appendix I-Water, RST 4, p. 314.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
RST 5	Limit the number and length of equipment access points through Riparian Reserves.	USDI BLM 2008, Appendix I-Water, RST 5, p. 314.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036 Temperature OAR 340-041-0028
RST 6	Limit the amount of stream bank excavation to the minimum necessary to ensure stability of enhancement structures. Provide isolation from flowing water during excavation. Place excavated material above the flood prone area and cover or place a berm to avoid its reentry into the stream during high flow events.	USDI BLM 2008, Appendix I-Water, RST 6, p. 314.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036 Temperature OAR 340-041-0028
RST 7	Inspect all mechanized equipment daily for leaks and clean as necessary to ensure that toxic materials, such as fuel and hydraulic fluid, do not enter the stream.	USDI BLM 2008, Appendix I-Water, RST 7, p. 314.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (12) Biocriteria OAR 340-041-0011

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
			Toxic Substances OAR 340-041-0033
RST 8	Locate equipment storage areas at least 100-feet from any water feature, including machinery used in stream channels for more than one day.	USDI BLM 2008, Appendix I-Water, RST 8, p. 315.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (12) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033
RST 9	When using heavy equipment in or adjacent to stream channels during restoration activities, develop and implement an approved spill containment plan that includes having a spill containment kit on-site and at previously identified containment locations.	USDI BLM 2008, Appendix I-Water, RST 9, p. 315.	DEQ Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (12) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033
RST 10	Refuel equipment, including chainsaws and other hand power tools, at least 100 feet from water bodies (or as far as possible from the water body where local site conditions do not allow a 100-foot setback) to prevent direct delivery of contaminants into a water body.	USDI BLM 2008, Appendix I-Water, RST 10, p. 315.	DEQ Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (12) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033
RST 11	Use waterbars, barricades, seeding, and mulching to stabilize bare soil areas along project access routes prior to the wet season.	USDI BLM 2008, Appendix I-Water, RST 11, p. 315.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
RST 12	Prior to the wet season, rehabilitate and stabilize disturbed areas where soil will support seed growth by seeding and planting with native seed mixes or plants, or using erosion control matting.	USDI BLM 2008, Appendix I-Water, RST 12, p. 315.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
RST 13	When replacing culverts design placement location, crossing type, and installation depth to avoid excessive scour through the site, consider installation of grade control structures e.g., boulder vortex weirs or boulder step weirs	USDI BLM 2008, Appendix I-Water, RST 13, p. 315.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
RST 14	Rehabilitate headcuts and gullies.	USDI BLM 2008, Appendix I-Water, RST 14, p. 315.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
RST 15	Implement measures to control turbidity. Measures may include installation of turbidity control structures (e.g., isolation, diversion, or silt curtains) immediately downstream of in-stream restoration work areas. Remove these structures following completion of turbidity generating activities.	USDI BLM 2008, Appendix I-Water, RST 15, p. 315.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036

Dry Forest Specific BMPs

See *Summary of Oregon Water Quality Standards* for additional details about the standards and regulations that are associated with the best management practices.

Soils of concern in the dry forest area include those with a high potential for severe surface erosion, soil creep, periodic slumping (even when not overly saturated), and low nutrient potential. These soils weathered from granite, schist, and pyroclastic materials. They are predominately located in the Medford District but also found in the southern end of the Roseburg District and the Klamath Falls Field Office. On the Medford District, concentrations of these vulnerable soils occur in Evans, Snow, Sugar, and Meadow Creeks, upper portions of Williams Creek and headwaters of Birdseye Creek. These soils are mapped as fragile soils within the decision area. Limiting disturbance is key to keeping these soils in place; particularly from ground-based operations.

The Timber Production Capability Classification (TPCC) and Handbook (5251-1) involves mapping, with discrete mapping units and interpretations of timbered lands. The classification uses geology, landform, topographic position, climate (especially precipitation), soil properties, and vegetation. Lands with the capacity to erode excessively or prone to movement, e.g., creep or slump, are denoted with either a fragile code of FM (surface erosion potential) or FP (mass movement potential). Sites could have varying severity of either of these conditions. Management activities and restrictions would be scaled to reflect the differences in erosion or mass movement potential.

Table I-12. Timber Production Capability Classification soil categories of concern.

Category	Description of Soil Categories
Surface Erosion FM	These sites have soil surface horizons that are highly erodible, easily detached and subject to bouncing or sliding downhill (dry ravel), even if partially vegetated. The soils overlay intrusive volcanic bedrock, e.g., granite, diorite, or schist. The Natural Resources Conservation Service (NRCS) provides a Revised Universal Soil Loss Equation soil loss tolerance factor, known as T factor. It ranges from a low of 1 on shallow soils, 1-10 inches depth, to a 5 on soils deeper than 60 inches. This factor describes the maximum rate of annual soil loss in tons/acre that can be lost and still permit crop productivity to sustain economically and indefinitely. Disturbances from harvesting or burning create increased dry raveling of soil, losses of soil nutrients, and burying of newly planted seedlings. Classification coding may be FMR for suitable lands or FMNW for non-suitable lands.
Mass Movement FP	These sites range from gentle to moderately steep slopes, ten to sixty percent, where the rate of sliding is slow enough to permit forest management, but with some loss in wood quality in certain areas. Sites may have an impervious clay pan overlaying pyroclastic bedrock, e.g., volcanic tuffs, breccia, and are subject to movement. Tree roots providing strength and certain landforms act as resisting forces, while gravity and soil moisture may initiate non-uniform spatial and temporal rates of movement. Slow deep seated, slump or earth flow types of mass movements may occur, forming an undulating topography. Classification coding may be FPR for suitable lands or FPNW for non-suitable lands.

Table I-13. Additional dry forest best management practices (refer to **Table X**[C-12] for category type).

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
Roads and Landings: General Construction, Maintenance Timber Harvest: Cable Yarding			
DF 01	Use full suspension whenever possible on TPCC soils identified as prone to surface erosion, category FM in Table C-12. Use one-end suspension on these soils if full suspension is not practicable. Restrict yarding to the dry season, generally from June to end of September.	USDI BLM 2008, Appendix I-Water, MFO 1, p. 317.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
	Use one-end suspension on TPCC soils identified as prone to mass movement, category FP in Table C-12. Restrict yarding to the dry season.		
Timber Harvest: Ground-Based			
DF 02	Limit ground-based yarding equipment to slopes less than 20% on TPCC soils identified as category FM or FP in Table C-12, where soils include less than 20% clay. Limit ground-based yarding equipment to slopes less than 35%, on TPCC soils identified as category FM or FP in Table C-12, where soils include greater than 20% clay. Avoid tilling on TPCC soils identified as category FM or FP in Table C-12, unless adequate ground cover is present to arrest potential sediment transport.	USDI BLM 2008, Appendix I-Water, MFO 2, p. 317.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Fire and Fuels Management			
DF 03	Avoid mechanical piling to limit severe surface disturbance and displacement on TPCC soils identified as category FM or FP in Table C-12.	USDI BLM 2008, Appendix I-Water, MFO 3, p. 318.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
DF 04	Allow ground-based equipment on TPCC soils identified as category FM or FP in Table C-12, where slopes are less than 20% and clay content is less than 20%. Limit ground-based equipment to slopes less than 35%, where clay contents are greater than 20%.	USDI BLM 2008, Appendix I-Water, MFO 4, p. 318.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Wildfire: Suppression			
DF 05	Limit the use of track driven heavy machinery and other major surface-disturbing activities to slopes of 20% or less on TPCC soils identified as category FM or FP in Table C-12.	USDI BLM 2008, Appendix I-Water, MFO 5, p. 318.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Rights-of-Way			
DF 06	Avoid facility construction on soils identified on TPCC soils identified as the FM category in Table C-12, unless water quality would be maintained. Locate rights-of-ways to minimize surface disturbance on TPCC soils identified as category FM or FP in Table C-12.	USDI BLM 2008, Appendix I-Water, MFO 6, p. 318.	DEQ-Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036

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