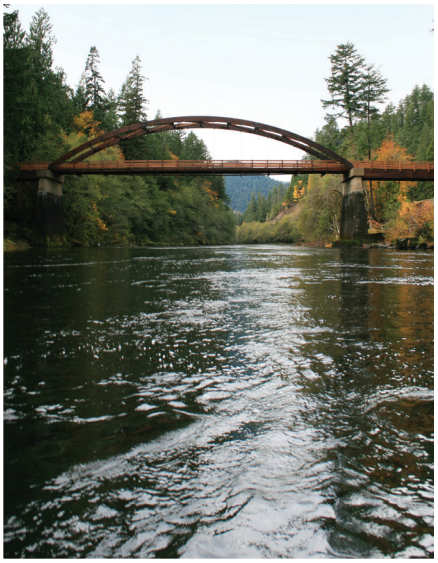
Resource Management Plans for Western Oregon

Bureau of Land Management

Planning Criteria



Salem, Eugene, Roseburg, Coos Bay, Medford, and Klamath Falls Offices

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

Cover photos from top to bottom, left to right: Coos Bay District, BLM photo; Table Rock in Medford District, BLM photo; Northern Spotted Owl, BLM photo; Sandy Ridge Trail System, Salem District, photo courtesy of photo copyright Anna Laxague, Pacific Regional Director, International Mountain Biking Association; Timber sale Salem District, BLM photo; Chemawa Indian School Dance troop, BLM photo; Tioga Bridge in Roseburg District, BLM photo; Coho Salmon, BLM photo; Fire in Southern Oregon, BLM photo.

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Introduction to the Planning Criteria

Sharing this Planning Criteria is the next step as the Bureau of Land Management (BLM) moves forward with the Resource Management Plans (RMP) for Western Oregon. As stewards of 2.5 million acres of BLM-administered land in western Oregon, we at the BLM recognize the importance of dialogue throughout the planning process with members of the public.

We approach the Planning Criteria as an early opportunity to share our thinking with the public and our partners before the draft RMP/draft Environmental Impact Statement (EIS) is published. This is one of our primary tools to continue an open dialogue about the best available options and strategies to manage your lands in western Oregon. Our goal is for you to understand the laws and policies that are shaping the preliminary alternatives being considered and the analytical methodology that will be used. By increasing your understanding of what is shaping this document, it will enhance your feedback, which is essential to this planning effort.

Preliminary alternatives are part of the creative process to develop a framework that covers the spectrum of possibilities within the parameters of the Purpose and Need statement. Planning criteria is our opportunity to explore what we could do with different management approaches. Later in the planning process, we will look at what we should do for a management approach that will provide predictability in a diverse landscape.

Planning Criteria for the RMPs for Western Oregon includes three major elements:

- Legal and policy framework for the RMP;
- Guidance on the development of preliminary alternatives; and,
- Description of the analytical methodology to be used in the analysis of alternatives.

By developing and sharing this level of detail in the Planning Criteria before the analysis phase, it allows us to utilize your feedback to construct an objective and rigorous analysis of the alternatives for the draft RMP/draft EIS. Inviting public comment on the Planning Criteria helps us to identify additional issues needing analysis and improve the analytical methodology. More importantly, it allows us to have ongoing conversation with interested persons as part of our planning process. Accompanying the release of the Planning Criteria, a series of community workshops will be held in conjunction with the public comment period to capture your thoughts and ideas, as well as any concerns you may have.

The public comment period gives a voice to anyone who wants to join us at the planning table. Your engagement is important to the BLM and helps ensure that your perspective is heard and reflected in the draft RMP/draft EIS. Please be part of the planning process by submitting your comments and participating in a workshop near you.

Jerome E. Perez
State Director
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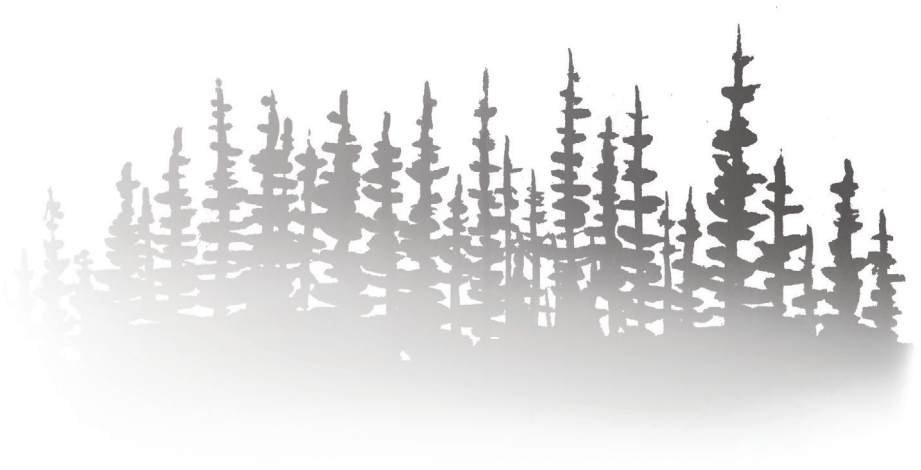
Oregon/Washington

Section A: Introduction



The Coos Bay, Eugene, Medford, Roseburg, and Salem Districts and the Lakeview District's Klamath Falls Field Office of the Bureau of Land Management (BLM) have begun the process of revising their current Resource Management Plans (RMPs; BLM 1995 a, b, c, d, e, f). In 2012, the BLM conducted RMP evaluations in accordance with its planning regulations, which require that RMPs "shall be revised as necessary based on monitoring and evaluation findings, new data, new or revised policy and changes in circumstances affecting the entire plan or major portions of the plan" (43 CFR 1610.5-6). These evaluations concluded that "[a] plan revision is needed to address the changed circumstances and new information that has led to a substantial, long-term departure from the timber management outcomes predicted under the 1995 RMPs" (USDI 2012, p. 12). These evaluations noted new information related to northern spotted owls, including new demographic studies, a new recovery plan and revision of critical habitat by the U.S. Fish and Wildlife Service, and concluded that the analysis supporting the 1995 RMPs contains outdated analysis relative to the development of suitable habitat for the northern spotted owl (USDI 2012, p. 14). These evaluations identified a need to modify or update management direction for most of the other resource management programs due to changed circumstances and new information. The planning criteria are an early step in the process of revising these RMPs.

Purpose of Planning Criteria

The planning criteria lay the groundwork for the formulation of alternatives for consideration in the planning process and guide the analysis of effects. Planning criteria help guarantee that the RMP process is consistent with applicable law, regulation, and policy. The criteria ensure that

1. The planning effort is tailored to the issues previously identified
2. The BLM avoids unnecessary data collection and analyses (43 CFR 1610.4-2(a))

Planning criteria must be made available for public review and comment prior to use (43 CFR 1610.4-2(c)). Some elements of the planning criteria will likely be refined or changed during the planning process as other steps in the process are completed or if new information becomes available.

Planning Area

The planning area includes approximately 2.5 million acres of public land managed by the Coos Bay, Eugene, Medford, Roseburg, and Salem Districts and the Lakeview District's Klamath Falls Field Office (Map 1).

Throughout this document, the term 'planning area' will be used to refer to all lands within the geographic boundary of this planning effort regardless of jurisdiction. However, the BLM will only make decisions on lands that fall under BLM jurisdiction (including subsurface minerals). The term 'decision area' will be used to refer to the lands within the planning area for which the BLM has authority to make land use and management decisions. In general, the BLM has jurisdiction over all BLM-administered lands (surface and subsurface) and over subsurface minerals in areas of split estate (i.e., areas where the BLM administers federal subsurface minerals, but the surface is not owned by the BLM).

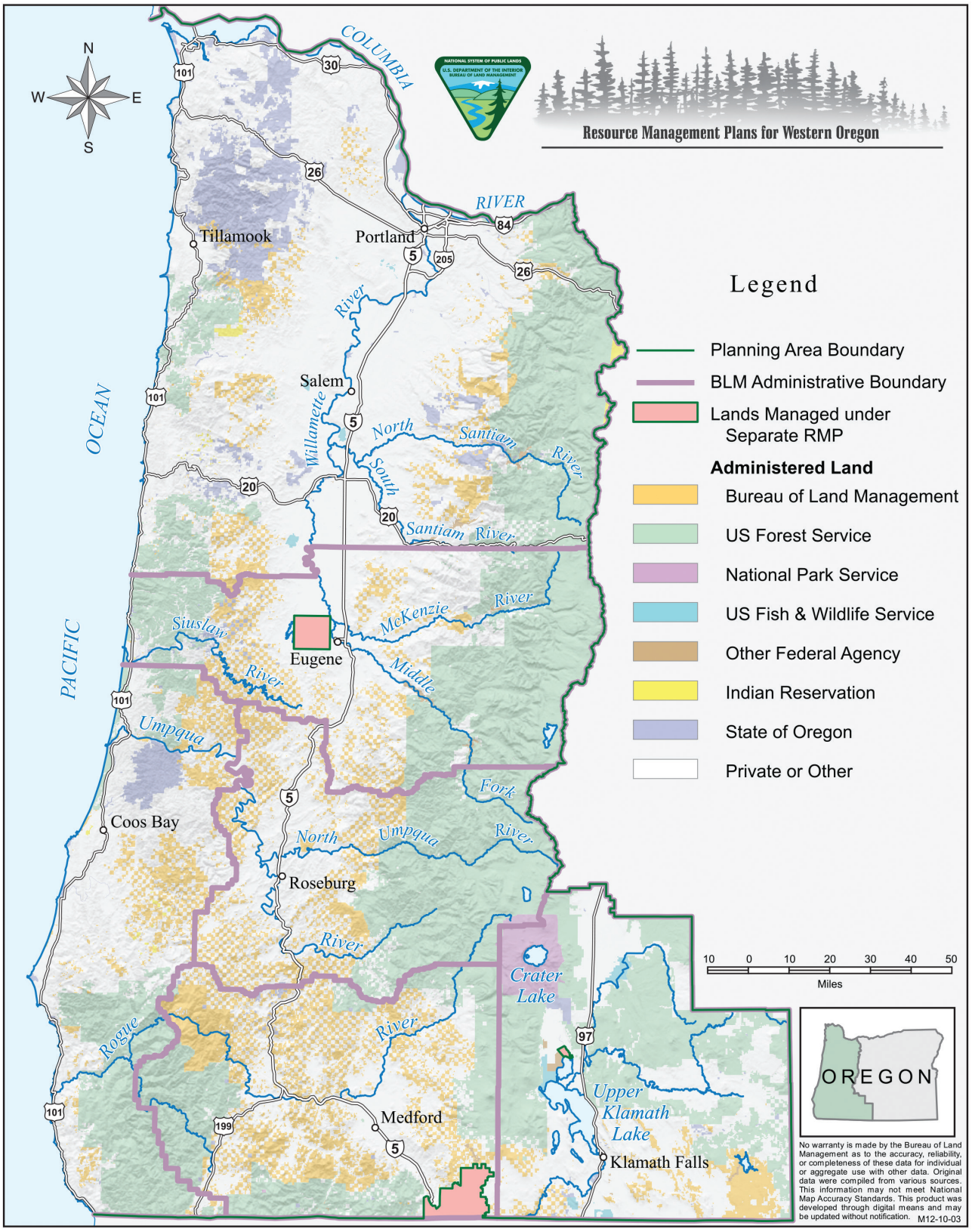
Within the western Oregon districts, three BLM-administered areas are not included in the decision area: the Cascade Siskiyou National Monument (Medford District), the Upper Klamath Basin and Wood River Wetland (Klamath Falls Field Office), and the West Eugene Wetlands (Eugene District). The first two areas have independent RMPs, while the BLM is currently developing an RMP for the West Eugene Wetlands. This revision process will not alter these independent RMPs.

Scale of Planning and Analysis

Planning and analysis may vary spatially (regional, project, or site-specific scale) and temporally (short-term versus long-term), providing a comprehensive basis for implementing resource management actions. Planning and analysis at multiple scales may be necessary to resolve issues for a geographic area that differs from the planning area for the RMP. For example, an issue such as management of the northern spotted owl requires consideration of desired outcomes and management actions in a broader context than the decision area. Information presented at multiple geographic scales helps the BLM to understand issues, analyze cumulative impacts, and tailor decisions to specific needs and circumstances.

In planning and analysis, it is often necessary to consider various temporal scales. Certain natural processes and management actions may occur over a relatively short timeframe, whereas other natural processes and management actions occur over very long timeframes. In cases where management action objectives may not be achieved for decades or more, interim benchmarks or rates of progress may be identified where possible.

Cumulative impacts result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions (40 CFR 1508.7). For analysis in this environmental impact statement (EIS), the existing baseline information is a cumulative result of all past actions; therefore, it is not necessary to analyze past actions individually. For BLM-administered lands, the analysis will assume that the BLM will implement the specific actions described under the various alternatives, and will take the actions necessary to achieve the objectives described for the various alternatives. For lands other than BLM-administered lands within the analysis area, the analysis will assume that landowners will continue their current management strategies, unless the BLM has specific information to the contrary. The analytical assumptions that will be used in the effects analysis are described in more detail later in this document.



MAP 1. PLANNING AREA FOR RMPS FOR WESTERN OREGON

BLM Planning Process and Schedule

Preparing an RMP involves the following nine interrelated actions or steps:

1. Conduct scoping and identify issues
2. Collect inventory data
3. Analyze management situation
4. Develop planning criteria
5. Formulate alternatives
6. Analyze effects of alternatives
7. Select the preferred alternative; issue Draft RMP/Draft EIS
8. Issue Proposed RMP/Final EIS
9. Sign Record of Decision

Formal scoping for the RMPs started with printing of the Notice of Intent in the Federal Register on 9 March 2012. The BLM requested that the public submit comments in response to the Notice of Intent by 5 July 2012. During the scoping period, the BLM held public meetings in Medford, Grants Pass, Roseburg, Klamath Falls, Salem, Coos Bay, Eugene, and Portland. At each of these meetings, the BLM provided a brief overview of the planning process and a list of questions to prompt feedback, and then opened the meeting for discussion. The BLM prepared a scoping report, which summarizes the results of scoping. The scoping report and other scoping documents are available at *http://www.blm.gov/or/plans/rmpswesternoregon/scoping.php*

During the winter of 2013, the BLM initiated a multi-phase outreach strategy to engage the public on recreation management issues. This strategy included an interactive web based survey and a series of regional workshops held in Portland, Eugene, Roseburg, and Medford. The BLM will be using the information to assist with the evaluation of existing and potential recreation management areas and to perform suitability determinations on eligible river segments. A Key Findings Report summarizing the results of this outreach is available for download at *http://www.blm.gov/or/plans/rmpswesternoregon/files/key-findings.pdf*

The Draft RMP/Draft EIS is tentatively scheduled for release in 2014; the Proposed RMP/Final EIS is tentatively scheduled for release in 2015, with the Record of Decision scheduled to follow late in 2015. This schedule is approximate and subject to change.

Vision and Goals

The following vision statement for this RMP revision is carried forward from the 1995 RMPs with minor editing:

The Bureau of Land Management will manage the natural resources under its jurisdiction in western Oregon to contribute to the social well-being of the human population and to help enhance and maintain the ecological health of the environment.

Basic principles that support this vision include:

- Natural resources can be managed to provide for human use and a healthy environment
- Resource management must be focused on ecological principles to reduce the need for single resource or single species management
- The involvement of people working with natural processes is important for successful implementation
- The ability to achieve this vision can be enhanced by cooperation with others and consideration of the ecological, social, and economic role that BLM-administered lands play in the context of adjacent lands
- The results of monitoring and research will be used to make changes or adjustments necessary to achieve this vision

RMP decisions establish goals and objectives for resource management and the management direction needed to achieve these goals and objectives. In the planning process, goals are broad statements of desired outcomes that usually are not quantifiable. In the National Environmental Policy Act (NEPA) process, the 'purposes for the action' describe what the BLM hopes to accomplish in the planning effort (BLM NEPA Handbook, p. 35; USDI 2008). Both the BLM planning regulations and the CEQ NEPA regulations seek to integrate the planning and NEPA processes (43 CFR 1601.0-6; 40 CFR 1500.2(c); 40 CFR 1506.4). With this in mind, and because the nature of 'goals' in the planning process and the nature of the 'purpose for action' in the NEPA process, the two are the same and the goals for this RMP revision are equivalent to the purposes for action, which are described later in this document.

Public Comment Periods

Throughout the planning effort, there will be public comment periods announced along with documents released, as required by NEPA or planning guidance. This document, Planning Criteria, is one of the documents with an associated public comment period. The BLM is interested in public comments and we will make every effort to inform all known interested publics. Public comments are important to the process and help identify reports, studies, information, etc. that the planning team may not be aware of or have considered. Public comment periods also help inform the public about the direction of the planning effort and how the team is doing the analysis. More information is available on our website at *www.blm.gov/or/plans/rmpswesternoregon*.

References

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Section B: Guidance for Formulating Alternatives

One of the primary functions of planning criteria is to provide a structure for the formulation of alternatives. This chapter provides the various pieces of that framework, including legal requirements, a draft of the Purpose and Need for action, and guidance relevant to the formulation of alternatives. As noted in the BLM planning regulations, "Planning criteria will generally be based upon applicable law, Director and State Director guidance, the results of public participation, and coordination with any cooperating agencies and other Federal agencies, State and local governments, and federally recognized Indian tribes" (43 CFR 1610.4-2(b)). This structure is needed to guide the planning process to a lasting solution that will provide predictability and sustainable management of the BLM-administered lands in western Oregon.

Alternative Development

An alternative is a combination of proposed land use allocations, management objectives, and management direction designed to meet the stated purpose and need (i.e., goals) for a planning effort. Alternatives explore the various ways the BLM could manage these lands within the legal and policy framework guiding the planning effort. The Council on Environmental Quality NEPA regulations require an agency to rigorously explore and objectively evaluate all reasonable alternatives (40 CFR 1502.14(a)). A reasonable alternative is one that:

- Responds to the purpose and need
- Is technically and economically feasible
- Is consistent with the basic policy objectives for the management of the area (in this case, see the guidance described later in this section)
- Implementation is not remote or speculative
- Is not substantially similar to another alternative

The Council on Environmental Quality guidance further explains that, when there are potentially a very large number of alternatives, only a reasonable number of examples, covering the full spectrum of alternatives, must be analyzed and compared in the EIS (46 FR 18026).

Preliminary Alternatives

Throughout this document, there will be references to preliminary alternatives that contain concepts identified in external and internal scoping, broad management concepts, and exist within the parameters of the purpose and need statement. These preliminary alternatives are exploratory and are a starting point to the formulation of alternatives.

The O&C Act and FLPMA

On August 28, 1937, Congress enacted the Oregon and California Railroad and Coos Bay Wagon Road Grant Lands Act (O&C Act; 43 U.S.C. §1181a et seq.), which provides the legal authority for the management of O&C lands and Coos Bay Wagon Road lands. Approximately 81 percent of the BLM-administered lands in the planning area are O&C lands, and approximately three percent are Coos Bay Wagon Road lands (Map 2). The provision of the Act that provides the management direction for the O&C lands states, in part, that these lands:

> *"shall be managed except as provided in section 3 hereof, for permanent forest production, and the timber thereon shall be sold, cut, and removed in conformity with the [principle] 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 ..." (43 USC §1181a).*

Based on the language of the O&C Act, the O&C Act's legislative history, and case law, it is clear that sustained-yield timber production is the primary or dominant use of the O&C lands in western Oregon. In managing the O&C lands for that primary or dominant use, the BLM must exercise its discretion to determine how to manage the forest to provide for sustained-yield timber production, including harvest methods, rotation length, silvicultural regimes under which these forests would be managed, or minimum level of harvest. In addition, the BLM must conduct this management "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." Finally, when implementing the O&C Act, BLM must do so in full compliance with a number of subsequent laws that direct how the BLM accomplishes the statutory direction.

The Federal Land Policy and Management Act of 1976 (FLPMA; 43 U.S.C §1701 et seq.) provides the legal authority for the management of public domain lands and acquired lands. These lands and resources are to be managed under the principles of multiple use and sustained yield. Approximately 15 percent of the BLM-administered lands in the planning area are public domain lands, and less than one percent is acquired lands (Map 2). The FLPMA specifically provides that if there is any conflict between its provisions and the O&C Act related to management of timber resources or the disposition of revenues from the O&C lands and resources, the O&C Act prevails (i.e., takes precedence) (43 U.S.C. §1701 note (b)). However, provisions of the FLPMA that do not conflict with the O&C Act related to management of timber resources or the disposition of revenues from the O&C lands are applicable to the O&C lands. Preparation of the RMPs and EIS will conform to these land laws as described in this section and will comply with other Federal laws, including, but not limited to, the Endangered Species Act of 1973 (16 U.S.C. §1531 et seq.), the Clean Water Act of 1970 (33 U.S.C. s/s §1251 et seq., and the National Environmental Policy Act of 1969 (42 U.S.C. §4321 et seq.).

In developing the range of alternatives in this planning process, the BLM will need to apply the direction set forth in the O&C Act to key issues associated with the management of areas or resources that typically arise during land use planning. These areas or resources include:

- Areas of Critical Environmental Concern,
- Lands with wilderness characteristics,
- Visual resources,
- Recreation management areas, and
- Sensitive species.

Areas of Critical Environmental Concern (ACEC):

The FLPMA provides authority for designation of areas of critical environmental concern (43 U.S.C. §1712 [Sec. 202.c.3]). In this planning process, the BLM will evaluate nominated and existing ACECs to determine whether relevant and important values are present and if special management is needed to maintain those values.

For areas that have relevant and important values and need special management to maintain those values, the BLM will designate and manage ACECs on public domain lands and acquired lands. The BLM will also designate and manage ACECs on O&C lands where the special management needed to maintain relevant and important values would not conflict with the planning for sustained-yield timber production for the purposes of the O&C Act. For example, designating and managing ACECs on O&C lands would not conflict with sustained-yield timber production in the following circumstances: on non-forested lands; on O&C lands that would otherwise be allocated to a land use allocation that would preclude sustained-yield timber production; or on lands for which the Timber Productivity Capability Classification category is 'not included in the harvest land base.' In addition, designating and managing ACECs on O&C lands would not conflict with sustained-yield timber production, if the special management needed to maintain relevant and important values is compatible with sustained-yield timber production, even if that special management might condition how sustained-yield timber production would be conducted. Finally, designation and management of Research Natural Areas, which are a type of ACEC, on O&C lands would not conflict with sustained-yield timber production when the scientific value of the research is relevant to sustained-yield timber production.

Lands with Wilderness Characteristics

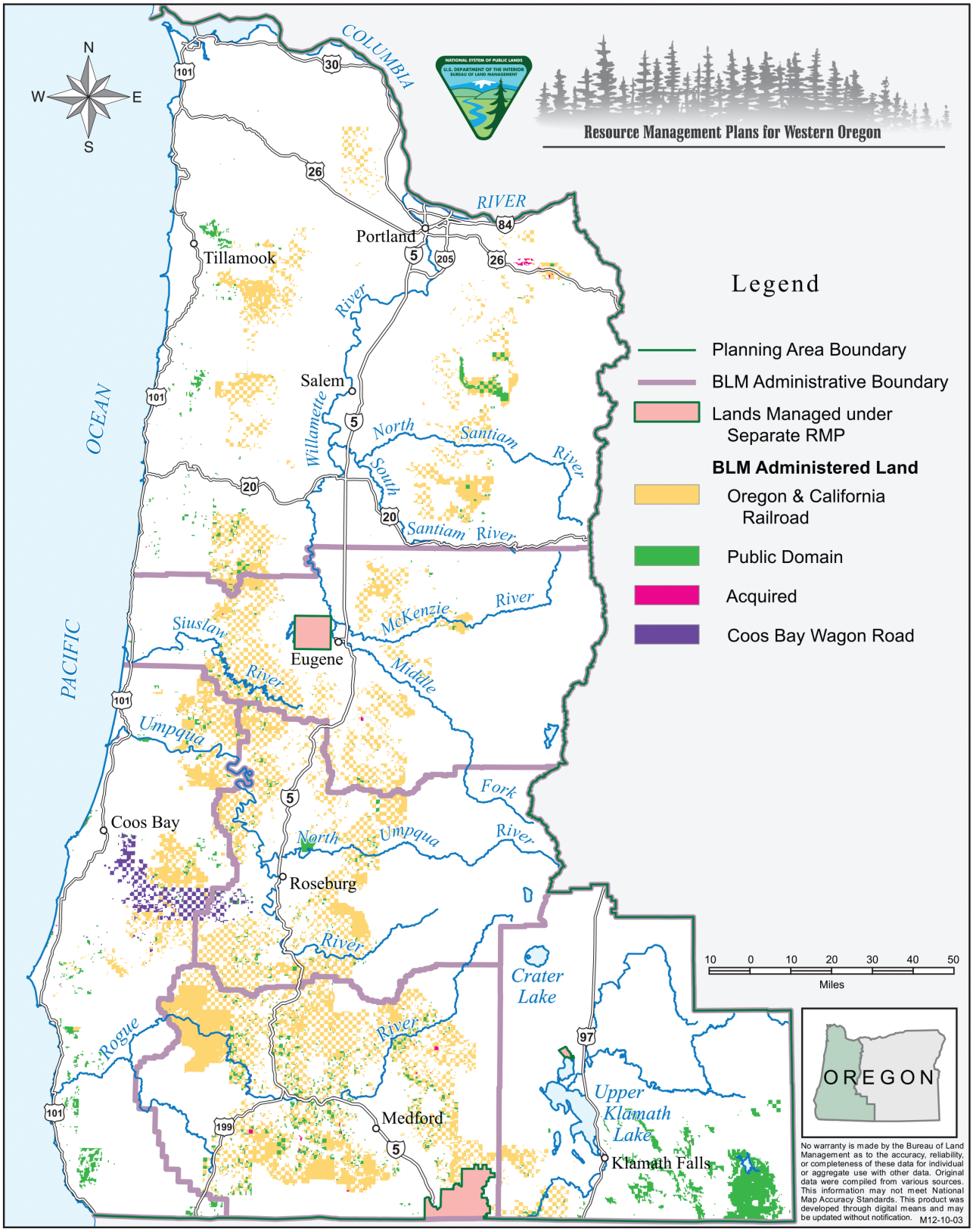
Designated Wilderness Areas will be managed pursuant to the Wilderness Act of 1964 (16 U.S.C. §1131 et seq.), the area's designating statute, the BLM's wilderness regulations at 43 CFR 6300, and BLM Manual 6340 – Management of Designated Wilderness Areas (USDI 2012a). In this planning process, the BLM will consider whether to manage lands outside of designated Wilderness Areas for wilderness characteristics on public domain lands and acquired lands. The BLM will also consider whether to manage lands outside of designated Wilderness Areas for wilderness characteristics on O&C lands where management for wilderness characteristics would not conflict with the planning for sustained-yield timber production for the purposes of the O&C Act. For example, management for wilderness characteristics on O&C lands would not conflict with sustained-yield timber production in the following circumstances: on non-forested lands; on lands that would otherwise be allocated to a land use allocation that would preclude sustained-yield timber production; or on lands for which the Timber Productivity Capability Classification category is 'not included in the harvest land base.'

However, management for wilderness characteristics cannot be compatible with sustained-yield timber production, because the selling, cutting, and removing timber in conformance with the principles of sustained yield would alter such areas to the point of reducing or eliminating their wilderness characteristics. Thus, in developing the range of alternatives for this planning effort, alternatives should not include managing lands outside of designated Wilderness Areas for wilderness characteristics on O&C lands in areas dedicated to sustained-yield timber production.

Visual Resources

The BLM uses Areas of Critical Environmental Concern (ACECs) to designate special management that is required to protect important natural, cultural, and scenic resources, and to identify natural hazards. ACEC designations include Research Natural Areas, Outstanding Natural Areas, and Natural Hazard Areas:

In this planning process, the BLM will designate Visual Resource Management classes that would protect scenic values as identified through a visual resource management inventory where the protection is required as part of the management specified by Congress in legislation, such as the Wild and Scenic Rivers Act of 1968 (16 U.S.C. §1271 et seq.). In this planning process, the BLM will consider designating Visual Resource Management classes that would conflict with sustained-yield timber production to protect scenic values as identified through a visual resource management inventory on public domain lands and acquired lands; on non-forested O&C lands; on O&C lands that



MAP 2. LAND STATUS OF BLM LANDS IN THE PLANNING AREA

would otherwise be allocated to a land use allocation that would preclude sustained-yield timber production; or on O&C lands for which the Timber Productivity Capability Classification category is not included in the harvest land base. Finally, in this planning process, the BLM will consider designating Visual Resource Management classes to protect scenic values as identified through a visual resource management inventory on O&C lands to the extent that the protection of scenic values is compatible with sustained-yield timber production, even if that protection might condition how sustained-yield timber production would be conducted. The O&C Act contemplates that sustained yield forest management can be conducted in a manner to provide for purposes including recreation, and the BLM recognizes that scenery can be an important component of recreation.

Recreation Management Areas

The FLPMA provides authority for management for outdoor recreation (43 U.S.C. §1701 [Sec. 102.a.8]). The O&C Act contemplates that sustained yield timber production can be conducted in a manner to provide for purposes including recreation. Special Recreation Management Area is an administrative unit where the existing recreation opportunities and recreation setting characteristics are recognized for their unique value, importance, and distinctiveness, as compared to other areas used for recreation. Consistent with the BLM Manual 8320 – Planning for Recreation and Visitor Services (USDI 2011), within a Special Recreation Management Area, recreation and visitor services management is recognized as the predominant land use plan focus, where specific recreation opportunities and recreation setting characteristics are managed and protected on a long-term basis.

In this planning process, the BLM will consider designating Special Recreation Management Areas on public domain lands and acquired lands; on non-forested O&C lands; on O&C lands that would otherwise be allocated to a land use allocation that would preclude sustained-yield timber production; or on O&C lands for which the Timber Productivity Capability Classification category is not included in the harvest land base. Finally, in this planning process, the BLM will consider designating Special Recreation Management Areas on O&C lands to the extent that the management for recreation and visitor services would be compatible with planning for sustained-yield timber production for the purposes of the O&C Act, even if that management might condition how sustained-yield timber production would be conducted. However, in developing the range of alternatives for this planning effort, alternatives should not include Special Recreation Management Areas on O&C lands if the management for recreation and visitor services would conflict with planning for sustained-yield timber production for the purposes of the O&C Act.

Extensive Recreation Management Area is an administrative unit that requires specific management consideration in order to address recreation use, demand, or recreation and visitor services program investments. Extensive Recreation Management Areas do not necessarily conflict with sustained-yield timber production. Consistent with the BLM Manual 8320 – Planning for Recreation and Visitor Services, management of Extensive Recreation Management Areas "… is commensurate with the management of other resources and resource uses." Furthermore, the BLM Manual 8320 – Planning for Recreation and Visitor Services explains that land use plan decisions for management of Extensive Recreation Management Areas will be "… compatible with other resource objectives." Because management for recreation values in Extensive Recreation Management Areas is intended to be done in a manner that is compatible with other resource uses, such as sustained-yield timber production, designation of Extensive Recreation Management Areas would not necessarily conflict with sustained-yield timber production. Therefore, the BLM will consider designating Extensive Recreation Management Areas on all lands in the planning area, including O&C lands.

Sensitive Species

The FLPMA provides authority for management for ecological and environmental values and to provide food and habitat for fish and wildlife (43 U.S.C. 1701 [Sec. 102.a.8]). Consistent with the BLM Manual 6840 – Special Status Species (USDI 2008a), the BLM shall designate Bureau sensitive species and implement measures to conserve these species and their habitats. It is in the interest of the BLM to undertake conservation actions for such species before listing under the Endangered Species Act is warranted. By doing so, the BLM will have greater flexibility in

managing the public lands to accomplish native species conservation objectives and other legal mandates. The BLM Manual 6840 also directs that specific protection to species that are listed by the BLM as sensitive on lands governed by the O&C Act must be consistent with timber production as the dominant use of those lands.

In developing the range of alternatives to be considered in this planning process, the BLM will consider providing measures to conserve Bureau sensitive species and their habitats on O&C lands to the extent that the conservation measures are compatible with planning for sustained-yield timber production for the O&C Act purposes. The BLM will consider providing these measures even if the conservation measures might condition how sustained-yield timber production would be conducted. Furthermore, the BLM will consider providing measures to conserve Bureau sensitive species and their habitats on O&C lands to the extent that the conservation measures are necessary to prevent the need to list Bureau sensitive species under the Endangered Species Act. Future listings under the Endangered Species Act could have the effect of limiting the BLM's ability to provide a sustained yield of timber under O&C Act; limiting or avoiding future listings could best ensure a permanency of timber production over the long-term.

Purpose and Need for Action

The purpose and need statement describes why the BLM is revising the RMPs and what outcomes the BLM intends the RMPs to achieve. The purpose and need statement defines the range of alternatives that will be analyzed in the planning process, because alternatives are only considered reasonable if they respond to the purpose and need for action.

The proposed action is to revise the current Resource Management Plans for the Coos Bay District, Eugene District, Medford District, Roseburg District, Salem District, and the Klamath Falls Field Office of the Lakeview District (1995 RMPs; USDI 1995 a, b, c, d, e, f) with land use allocations and management direction that best meet the purpose and need.

This plan revision process takes place against the backdrop of past planning efforts. These previous planning efforts and their supporting analyses, including the 1994 Northwest Forest Plan (USDA/USDI 1994), the 1995 RMPs (the plans currently in effect), and the 2008 RMPs (which are no longer in effect; USDI 2008b), together with the results of the scoping process for this planning effort help to inform the BLM's discretion in determining the purpose and need for this action and to identify the scope of alternatives and impacts that need to be explored in this planning effort.

Need for Action

The BLM conducted plan evaluations in accordance with its planning regulations, which require that RMPs "shall be revised as necessary based on monitoring and evaluation findings, new data, new or revised policy and changes in circumstances affecting the entire plan or major portions of the plan," 43 CFR 1610.5-6. These evaluations concluded that "[a] plan revision is needed to address the changed circumstances and new information that has led to a substantial, long-term departure from the timber management outcomes predicted under the 1995 RMPs" (USDI 2012, p. 12). These evaluations also concluded that the management direction for most of the other resource management programs need to be modified or updated because of changed circumstances and new information. These evaluations concluded that changes are particularly indicated for the fisheries, aquatics, recreation, off-highway vehicle, and fire and fuels programs.

Moreover, the BLM needs to revise existing plans to replace the 1995 RMPs' land use allocations and management direction because of new scientific information and policies related to the northern spotted owl. Since the 1995 RMPs were approved, there have been analyses on the effects of land management on northern spotted owl habitat, demographic studies, and analyses of the effects of barred owls on spotted owls. In addition, since that time, new policies for northern spotted owls have been put in place, including a revised Recovery Plan and a new designation of critical habitat.

Purpose of Action

The purpose of this proposed action is to make land use plan decisions to guide the management of BLM-administered lands as described below.

Several of the purposes of the action are necessary for the BLM to be able to deliver a predictable supply of timber from the BLM-administered lands, based on the BLM's almost two decades of experience implementing the Northwest Forest Plan, new scientific information, and the advice of other federal agencies, as discussed below. Harvesting timber on a sustained yield basis for the O&C Act purposes is required under the O&C Act. Harvesting timber on a sustained yield basis ensures that the BLM will achieve the purposes of the O&C Act, which include continuing to be able to provide, over the long-term, a sustained volume of timber within the management direction in the RMP. Declining populations of species now listed under the Endangered Species Act have caused the greatest reductions and instability in the BLM's supply of timber in the past. Any further population declines of listed species or new species listings would likely lead to additional reductions in timber harvest. Contributing to the conservation and recovery of listed species is essential to delivering a predictable supply of timber. Specifically, the BLM recognizes that providing large, contiguous blocks of late-successional forest and maintaining older and more structurally complex multi-layered conifer forests are necessary components of the conservation and recovery of the northern spotted owl. Providing clean water is essential to the conservation and recovery of listed fish, and a failure to protect water quality would lead to restrictions that would further limit the BLM's ability to provide a predictable supply of timber. Furthermore, the O&C Act recognizes the importance of water quality; the purposes of sustained yield include, among others, "protecting watersheds and regulating stream flow." Finally, in fire-prone ecosystems in southern Oregon, the BLM must manage forests to reduce the likelihood of catastrophic fires and the attendant loss of timber. These purposes require the BLM to exercise its discretion to determine how best to achieve sustained yield timber production over the long term and avoid future limitations on timber production.

Provide a Sustained Yield of Timber

The purpose of the action includes providing a sustained yield of timber. 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 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" (43 U.S.C. §1181a). The O&C Act goes on to state that "[t]he annual productive capacity for such lands shall be determined and declared … [p]rovided, [t]hat timber from said lands … not less than the annual sustained yield capacity … shall be sold annually, or so much thereof as can be sold at reasonable prices on a normal market" (43 U.S.C. §1181a). In meeting the various requirements for managing the O&C lands, the Secretary of the Interior has discretion under the O&C Act to determine how to manage the forest to provide for permanent forest production on a sustained yield basis, including harvest methods, rotation length, silvicultural regimes under which these forests would be managed, or minimum level of harvest. In addition, the Federal Land Policy and Management Act (FLPMA) specifically provides that if there is any conflict between its provisions and the O&C Act related to management of timber resources or the disposition of revenues from the O&C lands and resources, the O&C Act prevails (i.e., takes precedence) (43 U.S.C. §1701). Thus, the multiple-use management direction of the FLPMA does not apply to the O&C lands that are suitable for timber production. The planning process established by the FLPMA is applicable to the O&C lands, because it is not in conflict with the O&C Act's management direction for those lands.

For the public domain lands, the FLPMA requires that public lands be managed "on the basis of multiple use and sustained yield unless otherwise specified by law" (43 CFR 1701 [Sec. 102.a.7]). The FLPMA also requires that "the public lands be managed in a manner which recognizes the Nation's need for domestic sources of minerals, food, timber, and fiber from the public lands" (43 U.S.C. §1701 [Sec. 102.a.12]).

Conservation and Recovery of Threatened and Endangered Species

The purpose of the action includes contributing to the conservation and recovery of threatened and endangered species within the planning area, including the northern spotted owl, marbled murrelet, and threatened and endangered anadromous fish. The Endangered Species Act requires agencies to ensure that their actions are not likely to jeopardize the continued existence of listed species or result in the adverse modification or destruction of critical habitat. Since the adoption of the Northwest Forest Plan, BLM has recognized that additional species listings could have the effect of further limiting the BLM's ability to provide a sustained yield of timber under the O&C Act (Northwest Forest Plan ROD at pp. 49-50). Using its discretion and authority under the O&C Act and the FLPMA, the BLM can direct sustained yield management of the O&C lands and public domain lands in western Oregon in a manner that contributes to the conservation and recovery of listed species and helps limit or avoid future listings, and thereby best ensures a permanency of timber production over the long-term, while, among other benefits of sustained yield, contributing to the economic stability of local communities.

The purpose of contributing to the conservation and recovery of the spotted owl necessarily includes maintaining a network of large blocks of forest to be managed for late-successional forests and maintaining older and more structurally complex multi-layered conifer forests, based on the existing scientific information on the conservation needs of the northern spotted owl and the results of previous analyses as described below.

Large, Contiguous Blocks of Late-Successional Forest

Large, contiguous blocks of late-successional forest have been an element of northern spotted owl conservation strategies for over two decades. Thomas et al. (1990, pp. 23-27) described that a conservation strategy for the northern spotted owl requires large blocks of nesting, roosting, and foraging habitat (i.e., suitable habitat) that support clusters of reproducing owls, distributed across a variety of ecological conditions and spaced so as to facilitate owl movement between the blocks. Courtney et al. (2004, pp. 9-11; 9-15), in the status review for the northern spotted owl, evaluated the conservation needs of the northern spotted owl and concluded that, based on existing knowledge, large contiguous blocks of suitable habitat are still necessary for northern spotted owl conservation. Culminating this confirmation of the scientific information on the conservation needs of the spotted owl, the Spotted Owl Recovery Plan recommends managing for large, contiguous blocks of late-successional forest (USDI 2011, p. III-19).

Based on the results of previous analyses, large contiguous blocks of late-successional forest would not develop in the absence of a land use allocation reserving a network of large blocks of forest. The 1994 Supplemental EIS for the Northwest Forest Plan (USDA/USDI 1994) explicitly required that all alternatives analyzed in detail include the allocation of a network of Late-Successional Reserves (Northwest Forest Plan, p. 2-22). Other previous planning efforts have considered alternatives that would not allocate such a network, including:

- Alternative A in the 1994 RMP/EIS, which would have reserved no late-successional forest outside of special areas and sites occupied by listed species
- Alternative B in the 1994 RMP/EIS, which would have reserved small blocks of late-successional forest
- Alternative 3 in the 2008 RMP/EIS, which would have allocated the majority of the landscape to a General Landscape Area that directed timber harvest on long rotations

For each of those alternatives, the analyses concluded that these alternatives would have resulted in less contribution to spotted owl conservation than alternatives that allocated a network of large blocks of forest. Notably, Alternative 3 in the 2008 RMP/EIS would have resulted in a total acreage of spotted owl habitat comparable to most other action alternatives, but would have failed to meet the conservation needs of the spotted owl because of the arrangement of that habitat. Overall, these previous analyses demonstrated that large, contiguous blocks of late-successional forest would not have developed under these alternatives, further demonstrating that reserving a network of large blocks of forest from programmed timber harvest is a necessary part of the purpose of contributing to the conservation and recovery of the spotted owl.

Older and More Structurally Complex Multi-Layered Conifer Forests

The scientific foundation for the importance of older, more structurally complex multi-layered conifer forests as habitat for the spotted owl has been clearly established. Thomas et al. (1990) described high-quality owl habitat as older, multilayered, structurally complex forests characterized by large-diameter trees, high amounts of canopy cover, numerous large snags, and lots of downed wood and debris. Courtney et al. (2004, pp. 5-18), in the status review for the northern spotted owl, evaluated the existing scientific information on spotted owl habitat and confirmed that nesting, foraging and roosting habitat is associated with older, more structurally complex multi-layered conifer forests in the Pacific Northwest. The 15-year spotted owl monitoring report concluded that the highest stand-level habitat suitability for spotted owls is provided by older, more structurally complex forests (Davis et al. 2011, p. 38).

The Spotted Owl Recovery Plan recommends maintaining older and more structurally complex multi-layered conifer forests. As noted in the Spotted Owl Recovery Plan, the maintenance of older, more structurally complex multi-layered conifer forests has scientific support at several scales: "At the scale of a spotted owl territory, Dugger et al. (in press) found an inverse relationship between the amount of old forest within the core area and spotted owl extinction rates from territories. At the population scale, Forsman et al. (2011) found a positive relationship between recruitment of spotted owls into the overall population and the percent cover of spotted owl NRF [nesting, roosting, and foraging] habitat within study areas" (USDI 2011, p. III-67). The U.S. Fish and Wildlife Service noted that, in dry forest areas, maintaining these older and more structurally complex multi-layered conifer forests may require active management to meet the overlapping goals of spotted owl recovery and restoration of dry forest structure, composition, and processes including fire, insects, and disease.

Previous planning efforts have considered a wide variety of approaches to the management of older, more structurally complex multi-layered conifer forests, including:

- Alternative A in the 1994 RMP/DEIS, which would have reserved no late-successional forest outside of special areas and sites occupied by listed species
- The 1995 RMP, which reserved approximately 83 percent of old-growth forest
- The Proposed RMP in the 2008 RMP/EIS, which would have reserved 81 percent of old-growth forest and would have deferred harvest of any forest older than 160 years old for 15 years
- Alternative E in the 1994 RMP/EIS, which would have reserved all old-growth forest
- A sub-alternative for Alternative 1 in the 2008 RMP/EIS, which would have reserved all forests older than 200 years old
- A sub-alternative for Alternative 1 in the 2008 RMP/EIS, which would have reserved all forests older than 80 years old

None of these alternative approaches defined management direction explicitly in terms of older, more structurally complex, multi-layered conifer forests, but used a variety of different terms, such as older forest, old-growth forest, late-successional forests, or a specific stand age. Nevertheless, these different management approaches would have resulted in the maintenance of differing amount of older and more structurally complex multi-layered conifer forests. Those analyses demonstrated that alternatives that would have maintained more older and more structurally complex multi-layered conifer forests would have maintained more spotted owl habitat and would have provided better conditions for spotted owl movement between large blocks of habitat than alternatives that would have maintained less older and more structurally complex multi-layered conifer forests.

The existing science clearly establishes the importance of older and more structurally complex multi-layered conifer forests as spotted owl habitat; the Spotted Owl Recovery Plan recommends the maintenance of older and more structurally complex multi-layered conifer forests; and the results of previous analyses demonstrate that maintaining older and more structurally complex multi-layered conifer forests would contribute to meeting conservation needs of the spotted owl. Therefore, maintaining older and more structurally complex multi-layered conifer forest is a necessary part of the purpose of contributing to the conservation and recovery of the spotted owl.

To respond to this purpose for the action, alternatives would explore differing approaches to defining older and more structurally complex multi-layered conifer forest, by such criteria as stand age, structure, size, or landscape context. In addition, alternatives would explore differing management approaches to maintaining older and more structurally complex multi-layered conifer forest, such as active management in dry forest areas to reduce fire risk and restore fire resiliency.

The purpose of this action includes maintaining marbled murrelet habitat. The status review of the marbled murrelet prepared for the U.S. Fish and Wildlife Service reviewed the existing scientific information and confirmed the importance of maintaining suitable nesting habitat to the conservation and recovery of the marbled murrelet (McShane et al. 2004, pp. 4-61 – 4-63). Additionally, the Recovery Plan for the Marbled Murrelet (USDI 1997) recommends protecting adequate nesting habitat for marbled murrelets.

The purpose of this action includes protecting existing habitat and restoring degraded habitat for threatened and endangered anadromous fish. The status review of threatened and endangered anadromous fish prepared by the National Marine Fisheries Service reviewed the existing scientific information and confirmed the importance of maintaining existing habitat and restoring degraded habitat to the conservation and recovery of threatened and endangered fish (Good et al. 2005). The National Marine Fisheries Service has prepared several final and draft recovery plans for listed salmonid fish within the planning area, including the Upper Willamette River Conservation and Recovery Plan for Chinook Salmon and Steelhead (ODFW/USDC 2011), which recommend maintaining existing habitat and restoring degraded habitat.

Provide Clean Water in Watersheds

The purpose of the action includes continuing to comply with the Clean Water Act, which directs the restoration and maintenance of the chemical, physical, and biological integrity of the nation's waters. The policy declaration in the FLPMA states that the BLM should manage the public lands in a manner that protects many resources and their values, including the water resource (43 U.S.C. §1701[a][8]). The FLPMA directs that land use plans provide for compliance with applicable State and Federal air, water, noise, or other pollution control laws, standards, or implementation plans (43 U.S.C. §1712[c][8]).

In addition, the O&C Act includes reference to protecting watersheds and regulating stream flows, requiring 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 of sustained yield for the purpose of … protecting watersheds, regulating stream flow, …" (43 U.S.C. §1181a).

Provide for Recreation Opportunities

The purpose of the action includes restoring fire-adapted ecosystems to increase fire resiliency. Previous analyses have shown that active management in the dry forest landscape of southern Oregon can positively influence fire risk and fire resiliency, thereby restoring fire-adapted ecosystems (2008 RMP/EIS). Further, as noted in the Spotted Owl Recovery Plan, natural landscape resilience mechanisms in the dry forest landscape of southern Oregon have been decoupled by fire exclusion and wildfire suppression activities. The Spotted Owl Recovery Plan recommends active management within the dry forest landscape to restore ecosystem resiliency. Additionally, in order to provide for sustained yield of timber from public lands under the O&C Act, BLM management must account for potential loss of this timber to fire. Based on the BLM's authority under the O&C Act, the results of previous analyses showing the benefits of active management in restoring fire-adapted ecosystems, and in light of the recommendations in the Spotted Owl Recovery Plan, the purpose of this action includes restoring fire-adapted ecosystems to increase fire resiliency.

Restore Fire-Adapted Ecosystems

The purpose of the action includes providing for recreation opportunities. The FLPMA requires that, among other uses, "the public lands be managed in a manner that will … provide for outdoor recreation" 43 CFR 1701 [Sec.

102.a.8]. In addition, the O&C Act states that O&C lands shall be managed "… for permanent forest production, and the timber thereon shall be sold, cut, and removed in conformity with the principal of sustained yield for the purpose of … providing recreational facilities" (43 U.S.C. §1181a). Finally, changes in BLM policy since the 1995 RMPs for recreation land use allocations and management objectives necessitate plan revision, as concluded in the BLM plan evaluations (USDI 2012, pp. 28-29).

Coordinate Management of Lands Surrounding the Coquille Forest with the Coquille Tribe

The management of the Coquille Forest is subject by law (25 U.S.C. §715c (d)) to the standards and guidelines of forest plans for adjacent or nearby Federal forest lands. Title V of the Oregon Resource Conservation Act of 1996 (Public Law 104-208) created the Coquille Forest to be held in trust for the benefit of the Coquille Tribe. The Act states that the Coquille Forest shall be managed "under applicable State and Federal forestry and environmental protection laws, and subject to critical habitat designations under the Endangered Species Act and subject to the standards and guidelines of Federal forest plans on adjacent or nearby Federal lands, now and in the future." The Act also requires the Secretary of the Interior to take the Coquille Forest lands into trust for the benefit of the Coquille Tribe. As such, the purpose of the action includes coordinating the management of BLM-administered lands "adjacent or nearby" the Coquille Forest with the Coquille Tribe.

Guidance for Development of All Action Alternatives

All action alternatives will be developed to meet the purposes for the action, described above under 'Purpose and Need for Action.' To be considered reasonable, action alternatives would have to make a substantial and meaningful contribution to meeting each of the purposes, rather than a minimal contribution. The alternatives will explore various ways of contributing to these purposes and meeting the requirements of the management guidance provided in this document.

In developing all action alternatives, the BLM will:

- Review existing ACECs and nominations for new ACECs and do the following:
    - Determine if they meet the Relevance and Importance criteria.
    - Determine, for those on O&C lands that meet Relevance and Importance criteria, if designation would be in conflict with the O&C Act, as detailed above under 'The O&C Act and FLPMA.'
    - Eliminate from further consideration those areas that do not meet criteria for designation as ACECs.
    - Determine if the relevant and important resource values of the remaining nominations can be protected and maintained through other features of the alternatives or if special management attention is needed.
    - Include in development of alternatives those nominations that meet criteria for designation as ACECs.
- Designate areas as Special Recreation Management Areas or Extensive Recreation Management Areas; lands not designated under one of these two categories are Public Lands not Designated for Recreation. Develop a range of recreation management area scenarios in relationship to various land use allocations and management objectives among the alternatives, consistent with the discussion of recreation management areas above under 'The O&C Act and FLPMA.'
- Designate Visual Resource Management classifications for areas. Develop a range of Visual Resource Management classification scenarios in relationship to various land use allocations and management objectives among the alternatives, consistent with the discussion of visual resources above under 'The O&C Act and FLPMA.'

• Evaluate all eligible Wild and Scenic River segments and determine which are suitable or non-suitable per Section 5(d)(1) of the Wild and Scenic Rivers Act of 1968, (16 U.S.C. §1271 et seq.).

• Designate areas as 'open,' limited,' or 'closed' to off-highway vehicle use in accordance with 43 CFR 8342. Develop a range of Travel Management Area scenarios in relationship to various land use allocations and management objectives among the alternatives. Defer implementation level Travel and Transportation Management planning until after completion of the RMP revision process. For those areas designated as 'limited' in the RMP, define interim management objectives and clearly identify the process leading from the interim area designation of 'limited to existing roads, primitive roads and trails' to the development of a designated network of roads, primitive roads and trails, consistent with BLM Handbook 8342.0 (USDI 2012).

• Consider a range of management alternatives for addressing lands with wilderness characteristics.

• Designate areas that are available and have the capacity for planned, sustained-yield timber harvest, and declare an Allowable Sale Quantity of timber that represents the annual productive capacity for sustained-yield timber production.

• Designate lands that are available or not available for livestock grazing. For lands available for livestock grazing, identify the amount of forage available for livestock.

• Designate land tenure zones identifying lands for retention, disposal, or acquisition.

• Designate lands as 'open' or 'closed' to the several forms of mineral entry location, leasing, or sale as appropriate to the type of commodity and land status. Identify areas, if any, recommended for closure to the mining laws for locatable exploration or development (and which would be petitioned for withdrawal).

In developing the action alternatives, the BLM will consider the concepts contained in the Framework to Guide Forest Service and Bureau of Land Management Land Use Plan Revisions and Amendments, dated April 11, 2011 (RIEC, 2011).

The development of alternatives will not be constrained by current or projected BLM budget or staff levels. As long as alternatives are economically feasible, the analysis of the alternatives will assume that BLM budget and staff will be sufficient to implement all alternatives. The analysis of alternatives will include an evaluation of the cost of implementation.

In accordance with national BLM planning policy (USDI 2005, pp. 11-13), the RMP will emphasize management direction for allowable uses and management actions needed to achieve desired resource goals and objectives, rather than administrative process, reviews, or analysis requirements. The BLM will use program guidance issued outside the land use planning process to provide direction on administrative process, reviews, and analysis. Ongoing program guidance provides more flexibility to respond to changing national or state-level BLM administrative process or analysis requirements. Of course, the RMP process itself will be conducted consistent with procedural, review, and analysis requirements necessary to comply with federal law and regulations applicable to planning for BLM-administered lands.

Action alternatives will be developed to provide a high degree of predictability and consistency about implementing land management actions and a high degree of certainty of achieving management objectives (desired outcomes), especially those outcomes related to discrete statutory mandates.

The BLM will develop action alternatives and provide cumulative effects analysis to provide a framework to simplify and facilitate project-level NEPA analysis for management actions implementing the RMP.

The BLM will develop action alternatives to simplify implementation of management actions and reduce the costs of implementation.

Working closely with the U.S. Fish and Wildlife Service and National Marine Fisheries Service, the BLM will develop the action alternatives to provide sufficient detail in the analysis to facilitate RMP-level Endangered Species Act consultation, as well as eventual project-level consultation for management actions implementing the RMP.

Working closely with the Oregon State Department of Environmental Quality, in coordination with the Environmental Protection Agency, the BLM will develop the action alternatives to satisfy state and federal water quality rules and regulations at the RMP level.

Preliminary Alternatives for Development and Analysis

No Action

The Council on Environmental Quality NEPA regulations require that an EIS analyzes a No Action alternative (40 CFR 1502.14(d)). The Council on Environmental Quality guidance explains that for plans, such as this RMP, No Action means there is no change from current management direction or level of management intensity (CEQ 1981). The No Action alternative in this RMP/EIS will be implementation of the 1995 RMPs as written (in contrast to how the BLM has been implementing the 1995 RMPs). It would not be possible to analyze the No Action alternative as continuation of the current practices within the decision area, as opposed to as written in the 1995 RMPs, for two reasons:

- Implementation of the timber management program has departed substantially from the outcomes predicted in the 1995 RMPs, and the manner and intensity of this departure has varied substantially over time and for numerous reasons among districts (USDI 2012, pp. 6-12). There is no apparent basis on which the BLM might select and project into the future continuation of the practices from a specific year (or set of years) since 1995

- The current implementation practices in the timber program are not sustainable at the declared Allowable Sale Quantity level (USDI 2012, pp. 6-12). Continuing to harvest timber at the declared Allowable Sale Quantity level in the future would require changes in the current implementation practices of the timber harvest program. To anticipate and project such changes in future practices would be speculative

Action Alternatives

The preliminary alternatives listed below include proposals that were identified during external and internal scoping. These preliminary alternatives are described here in terms of broad management concepts and major alternative components. These alternatives may be altered based on public comments, cooperator input, internal reviews, or refinements made during development of objectives and management direction. Furthermore, some preliminary alternatives may be eliminated from detailed analysis if further alternative development reveals that the alternative is not reasonable or is substantially similar to another alternative. Also, additional alternatives may yet be developed in response to public comments, cooperator input, or internal reviews.

These preliminary alternatives provide a preview of the ideas that the BLM is exploring in developing alternatives. The eventual alternatives analyzed in the Draft RMP/Draft EIS will present a variety of management approaches designed to meet the purposes for the action. The BLM will use the Draft RMP/Draft EIS as an opportunity to test these different management approaches through analysis, in preparation for constructing a Proposed RMP. While the BLM's regulations (43 CFR 1610.4-7) require it to identify a preferred alternative in its Draft RMP/Draft EIS, it is very likely the BLM's Proposed RMP will draw from a number of the alternatives or include components that are intermediate between alternatives from the Draft RMP/Draft EIS. In the case of this RMP revision, the identification of the BLM preferred alternative would likely be better characterized as the BLM identifying the best alternative to use as a base for modification in the construction of the Proposed RMP.

Each of the preliminary alternatives described below would include land use allocations designed to respond to the purpose and need for action, including a harvest land base that would provide an Allowable Sale Quantity of timber and areas reserved from the harvest land-base for the protection of clean water and the conservation and recovery of threatened and endangered species. The size, location, and management objectives of these land use allocations would vary among the action alternatives, as would the management direction within these land use allocations. The preliminary alternatives only touch on a small handful of the issues the BLM will address in the Draft RMP/ Draft EIS, which will include recreation and fire resilience among other issues. The description of these preliminary alternatives includes four components:

- The design and management approach for a network of large blocks to be managed for late-successional forest
- The protection of older forest
- The width of the riparian management area
- The harvest practices in the harvest land base

Potential Preliminary Alternative A

Large Block Forest Reserves

- The large block forest reserves would have the same boundaries as northern spotted owl and marbled murrelet critical habitat. No commercial removal of timber would take place within the large block reserves in the moist forest. In dry forests in the large block reserves, there would be short-term thinning until stands reach the age of 80, at which point no further thinning would take place.

Protection of Older Forests

- Reserve all forests 120 years old and older.

Riparian Reserves

- Riparian Reserves would encompass lands within one site-potential-tree-height on all streams and would include an inner 'no-thin' buffer of 120 feet on perennial and fish-bearing intermittent streams and 50 feet on non-fish-bearing intermittent streams.

- Only non-commercial thinning would be allowed in the outer zone of the reserves.

Timber Management

- Outside of critical habitat: thinning and regeneration harvest with no retention (clear cuts).

Potential Preliminary Alternative B

Large Block Forest Reserves

- The reserve is designed by modeling the capability of the forest, given current ownership patterns, to form contiguous blocks of northern spotted owl habitat and then reserving the most effective arrangement of lands for spotted owl conservation. Forests within this reserve would be managed for spotted owl and marbled murrelet habitat, as well as for fire resiliency. No treatments would take place in older stands.

Protection of Older Forests

- Reserve all forests 120 years old and older on high productivity sites; 140 years old and older on moderate productivity sites; and 160 years old and older on low productivity sites.

Riparian Reserves

- **Perennial and fish-bearing intermittent streams**: Riparian reserves would encompass lands within one site-potential tree and would have a 60-foot 'no-thin' buffer

- **Debris-flow-prone, non-fish-bearing intermittent streams**: Riparian reserves would encompass lands within 100 feet and would have a 50-foot 'no-thin' buffer

- **Non-debris-flow-prone, non-fish-bearing intermittent streams**: Riparian reserves would encompass lands within 50 feet, all of which would be a 'no-thin' buffer

- Thinning in outer zones could be either commercial or non-commercial

Timber Management

- Inside critical habitat but outside of large block forest reserves: thinning and regeneration harvest with 20-30 percent retention. Higher retention in dry forest

- Outside of critical habitat: thinning and regeneration harvest with 10-20 percent retention. Uneven aged management would be applied in dry forests.

Potential Preliminary Alternative C

Large Block Forest Reserves

- The reserve is designed based on the basic size and spacing requirements for blocks of spotted owl habitat. Forests within this reserve would be managed for spotted owl and marbled murrelet habitat, as well as for fire resiliency. No treatments would take place in older stands.

Protection of Older Forests

- Reserve all forests 160 years old and older.

Riparian Reserves

- **Perennial and fish-bearing intermittent streams**: Riparian reserves would encompass lands within one site-potential tree and would have a 60-foot 'no-thin' buffer

- **Debris-flow-prone, non-fish-bearing intermittent streams**: Riparian reserves would encompass lands within 100 feet and would have a 50-foot 'no-thin' buffer

- **Non-debris-flow-prone, non-fish-bearing intermittent streams**: Riparian reserves would encompass lands within 50 feet, all of which would be a 'no-thin' buffer

- Thinning in outer zones could be either commercial or non-commercial

Timber Management

- All areas outside of reserves (including critical habitat outside of reserves): thinning and regeneration harvest with no retention (clear cuts).

- Uneven aged management would be applied in dry forests.

Potential Preliminary Alternative D

Large Block Forest Reserves

- The large block forest reserves would encompass older stands (as defined under 'protection of older forests' below). Forests within this reserve would be managed for spotted owl and marbled murrelet habitat, as well as for fire resiliency.

Protection of Older Forests

- Reserve forests 120 years old and older on high productivity sites; 140 years old and older on moderate productivity sites; and 160 years old and older on low productivity sites

Riparian Reserves

- Riparian reserves would encompass lands within one site-potential-tree-height on all streams. The reserves would include an inner 'no-thin' buffer of 120 feet on all streams.

- Thinning in outer zones could be either commercial or non-commercial

Timber Management

- Younger stands in critical habitat: stands would be managed with an uneven-aged management strategy that would combine sustained-yield timber production with maintaining owl habitat.

- Outside of critical habitat: timber would be harvested through thinning and regeneration harvest with 10-20 percent retention. Uneven-aged management would be applied in dry forests.

Existing Decisions

The following existing decisions, which are valid for continued implementation and are supported by an Environmental Impact Statement, will be carried forward into the RMPs. These decisions will be restated or summarized to incorporate them into the RMPs without additional analysis. These decisions will be common to all alternatives and include the following:

- Management plans for congressionally-designated areas such as Wilderness Areas, Wilderness Study Areas, and Wild and Scenic Rivers

- North Bank Habitat Management Area (Roseburg District)

- North Spit Management Area (Coos Bay District)

- Pokegama Herd Management Area Plan (Klamath Falls Field Office)

- Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement

• Record of Decision for Management of Port-Orford-Cedar in Southwest Oregon (Coos Bay, Medford, and Roseburg Districts)

• 2006 Record of Decision for Implementation of a Wind Energy Development Program

• 2008 Record of Decision and Resource Management Plan Amendments for Geothermal Leasing in the Western United States

• 2009 Record of Decision and Resource Management Plan Amendments for Designation of Energy Corridors on BLM-administered lands in the 11 Western States

• 2011 Vegetation Treatments Using Herbicides on BLM Lands in Oregon Record of Decision

• Seed Orchard Records of Decision for Integrated Pest Management

• Greater Sage Grouse Plan Amendments (in process)

The Cascade Siskiyou National Monument (Medford District), and the Upper Klamath Basin and Wood River Wetland (Klamath Falls Field Office), and the West Eugene Wetlands (Eugene District) are not included in the decision area for this RMP revision. This RMP revision will not alter these independent RMP decisions.

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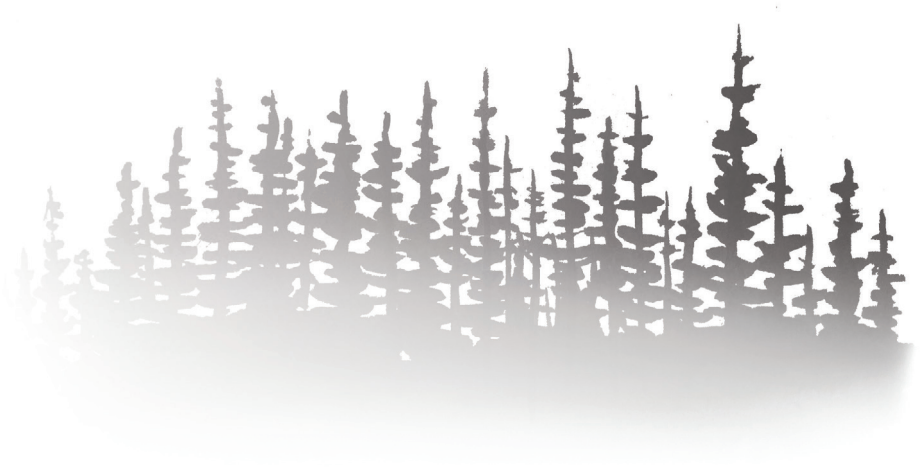
Section C: Analytical Methodology



This chapter guides the effects analyses that will form the basis for most of the discussions of the affected environment and environmental consequences in the environmental impact statement.

This chapter includes an overview of vegetative modeling, which plays a major role in the planning and analysis processes, followed by sections on the following resources and resource uses:

- Air Quality
- Areas of Critical Environmental Concern
- Climate Change
- Cultural and Paleontological Resources
- Fire and Fuels
- Fisheries
- Forest Management
- Grazing
- Hydrology
- Invasive Species Prevention and Control
- Minerals
- Rare Plants and Fungi
- Recreation, Visual Resources Management, and the National Landscape Conservation System
- Roads
- Socioeconomics
- Soil Resources
- Sustainable Energy
- Tribal Interests
- Wild Horses
- Wildlife

For each resource or resource use, this section identifies the issues requiring analysis and a description of how each issue will be analyzed, including analytical assumptions, geographic and temporal scope, units of measure, methods and techniques, conclusions, data needs, data display, and references, as appropriate. Not all of these elements of the analytical approach are applicable to each issue, and in some cases, not all have been determined at this time.

Vegetation Modeling

Introduction

The BLM will use a vegetation model to simulate development of the forested BLM-administered lands over time. The alternatives considered in the plan revisions will outline a range of approaches for managing BLM-administered lands by varying the land allocations and intensity with which the BLM manages these forests. These different approaches will result in a range of outcomes, habitat characteristics, and timber harvest levels. The model will simulate the application of management practices and forest development assumptions to characterize the forest in 10-year increments into the future. Interdisciplinary team members will use model outputs for comparing the effects of the alternatives.

This analysis will use the Woodstock Optimization Platform model (Woodstock), which the Remsoft Corporation developed. When selecting a model, the BLM took into consideration the need to do a strategic plan, rather than a tactical plan. This means that the BLM is primarily interested in understanding the consequences of the alternatives across broad landscapes, rather than making decisions about actions at specific locations. The BLM will need to make projections of endangered species habitat and calculation of a sustainable harvest level under different alternatives. We also need a model that can provide a spatially explicit result for the implementation scenarios that the BLM will develop for each alternative. The model also needs to be capable of modeling complicated management strategies across large areas. We chose Woodstock because of its excellent and flexible reporting capabilities, relatively user-friendly interface, and ability to process complex scenarios quickly.

The BLM considered using other models, but found that they would provide a more tactical rather than strategic outcome, were more expensive, require longer running times, did not provide the same flexibility in developing or reporting model outputs, or would prove difficult for the BLM to use.

The BLM will either run Woodstock as a ‘scenario-based’ model, or as an ‘optimization’ model. A scenario-based model applies the constraints of an alternative along with the management goals and then performs management actions with that framework. The optimization model uses linear programing to specify the outcomes that we are looking for, and then the model figures out the best way to achieve our goals.

Many inputs into the model will be common across all alternatives. The BLM is currently in the process of formulating the alternatives. The BLM will build a separate model for each alternative for each district and then combine them for the analysis. The BLM will build the initial models as a reference analysis in which the forest develops with no future timber harvest, to test the growth curves and develop a habitat suitability index for the northern spotted owl.

Formulating the Model

The Woodstock model provides us with the framework by which the BLM can compare alternatives and provide answers to analytical questions. The reader should view the model as a conceptual framework that attempts to capture the essence of a real system by isolating and retaining its important elements. The BLM is responsible for defining those elements and all of the assumptions that the BLM utilizes in formulating the model for each alternative. The sections below describe the most important elements that the BLM is using in the model.

Land Use Allocations

Land use allocations describe the type of management that can occur in a particular piece of land. The BLM will map the land use allocations for the 1995 RMPs to analyze the effects of the No Action alternative. The action alternatives will describe yet-to-be developed land use allocations that will direct a set of management prescriptions.

The allocation for the No Action alternative and each of the action alternatives will be applied to the current forest conditions for projection into the future. The management of some areas will be modeled the same under all alternatives: for example, designated Wilderness Areas, areas identified as non-forest, and areas described in the Timber Production Capability Classification as not biologically capable of supporting a sustained yield of timber.

Vegetation

The information for BLM forests comes from three sources. The first is the Forest Operations Inventory, which has 72,000+ forest stands mapped in the BLM's geographic information system (GIS; ESRI 1992). The Forest Operations Inventory data is warehoused in the Microstorms database and provides attributes for these stands to describe age, species composition, size classes, stocking classes, and the history of past management treatments.

The second source of vegetation information is the Current Vegetation Survey, which is a systematic, permanent plot grid inventory that has installed one plot every 1.7 miles on forested BLM-administered land. There are approximately 1,300 plots on BLM-administered lands within the planning area. The current vegetation survey was initially installed from 1997-2001. The BLM measured the inventory plots again between 2002 and 2011. This analysis will use data from both measurements as appropriate, to form the basis for empirical growth and yield curve development for existing stands.

The BLM will use the ORGANON growth model (OSU 1987) to simulate the growth of stands through time.

The third source is GIS, the geographic information system. The BLM has updated dozens of GIS layers to use in the Woodstock model. While only the Forest Operations Inventory layer describes forest stand characteristics, other layers describe aspects of the environment that affect where timber harvest could take place. These include the productive capacity of the land, as well as threatened, endangered, and special status plant species.

Use of the Inventory Data in the Modeling

The BLM does not have a unique tree list that describes each individual stand. To facilitate modeling of each stand, the BLM developed categories for both the Forest Operations Inventory data and the Current Vegetation Survey data. There are 1582 unique categories, called 'strata' that were developed by using information on stand age, site class, existing stand condition, and modeling groups. Modelers label each Forest Operations Inventory polygon and Current Vegetation Survey subplot with a unique stratum. The Current Vegetation Survey tree lists for a particular stratum were averaged, and a stand table was developed. All of the Forest Operations Inventories in a particular stratum are modeled using the same stand table. Those strata that represent more BLM acres are derived from more tree lists. If there was at least one available tree list for a strata, than the BLM used it for modeling that strata.

Of the 1582 unique strata, 601 strata had at least one tree list from the Current Vegetation Survey plots. These strata represent 83 percent of the forested BLM acres. The remaining acres were modeled using the 'most similar' Current Vegetation Survey tree list. The BLM used a decision matrix to decide which tree list was most appropriate. In general, the first priority was adjacent age classes, then site classes, then similar species groups.

Prescriptions – Treatment Regimes

Silvicultural prescriptions form the basis of our forest management activities. They tell the model the treatment activities that could occur for an individual stand. For example, a stand in the General Forest Management Area land use allocation in the No Action alternative might be planted with genetically improved stock, fertilized, pre-commercially thinned, and have one or two commercial thinnings, before a final regeneration harvest is accomplished. The alternatives will define and apply different allocation strategies and treatment regimes to the land base.

Stochastic Fire Events

The model will incorporate a scenario for future wildfires in the range of the northern spotted owl for decades ending at years 10, 20, 30, 40, and 50. The wildfire suitability index is the basis for this layer, and the size, intensity, and habitat losses associated with ≥ 1,000-acres wildfires in that area between the years 1970 – 2012 (see Davis et al. 2011). The Woodstock model will implement a set of management regimes depending on the assumptions inherent in the fire polygon.

BLM and Context Modeling

The Woodstock model will be applied to the approximately 2.4 million acres within the planning area of BLM-administered land. On other land ownerships, an estimation of change in forest conditions will occur by applying assumptions to the 2006 version of the gradient nearest neighbor imputation and Landsat time-series data (Ohmann et al. 2012).

The BLM will not use the Woodstock model to model vegetation change on the eastside management lands of the Klamath Falls Field Office. Most of these lands are not in a forested condition. In addition, these BLM-administered lands include no O&C lands and are outside of the range of the northern spotted owl.

Products

The GIS land use allocations will outline which lands the BLM has designated for specific uses, such as Areas of Critical Environmental Concern and recreation sites. The model will project development of the forest under the alternatives for many decades into the future. The model will track the types of treatments over time (short- and long-term), both numerically and spatially. The long-term projection of forest conditions will also illustrate that the management practices for an alternative will provide for sustained yield (non-declining even flow) of timber.

The starting conditions of the forest vegetation (January 2013; analysis year 0) and baselines for northern spotted owl habitat and marbled murrelet habitat will be mapped. The effects analysis will utilize both numeric and spatially explicit displays of development of the forest over time. The BLM will use this to quantify and display conditions of the forest, structural stages, and northern spotted owl and marbled murrelet habitat conditions into the future as described below.

The BLM will describe all BLM-administered land in the planning areas as non-forest, woodland, or forested. The non-forested land includes sagebrush, grassland, water and other areas that are not expected to have forests within the time of the analysis. The woodland includes juniper and Oregon white oak plant associations, and other areas that have trees, but the BLM is not expecting them to maintain a closed forest canopy. The BLM will further define the forested areas in terms of the forest structural stages that they contain.

Forest conditions at the scale of the planning area are discussed in terms of the structural stages of forests. A common definition has been developed that will be used by various interdisciplinary team members in their analysis. The structural stage definitions rely heavily on the structural stage definitions that the BLM developed in the 2008 EIS, with one addition. The 2008 analysis divided the forest structure into four classifications (stand establishment, young, mature, and structurally complex). The forest structure definitions that will be used in this analysis include all of the 2008 definitions, as well as the new category of early successional.

The BLM will define each of the structural stages for ‘moist’ and ‘dry’ forests. The BLM has developed a map that labels all BLM-administered land in the planning area as either moist or dry. The final groupings have incorporated recommendations from the BLM districts, and are similar to, but do not always correspond exactly to mapped plant series, or plant association groupings. In general, the moist forest includes western hemlock, Sitka spruce, Pacific silver fir, Shasta red fir, and tanoak plant associations. The dry forest includes Douglas-fir, Jeffery pine, grand fir,

white fir, and ponderosa pine plant associations. The BLM has developed a map that shows where the moist and dry forests are located and in calculating the structural stages, we will use this map.

The early-successional, stand establishment and young structural stages have further been differentiated by the presence or absence of structural legacies. A structural legacy is a tree that is 20 inches or larger at breast height and is larger and older than other trees in the stand. The reader can find information on the stand establishment, young, mature, and structurally complex structural stages in the 2008 EIS on pages 206-211 and in Appendix B, pages 12-15 (USDI 2008).

The BLM intends the early-successional category to describe forested land that has low canopy cover and younger, shorter trees than the stand establishment stage. The early-successional structural stage has trees that are less than 50 feet tall and less than 30 percent canopy cover. Some combination of shrubs, grasses, and forbs appear visually dominant and are ecologically dominant at the beginning of this stage. The stand establishment structural stage has similar characteristics but has greater than 30 percent canopy cover, such that trees are both visually and ecologically dominant.

The following outline shows the different structural stages that the BLM will use in this analysis:

- Non-forest
- Woodland
- Forest
    - Early Successional
        - With Structural Legacies
        - Without Structural Legacies
    - Stand Establishment
        - With Structural Legacies
        - Without Structural Legacies
    - Young High Density
        - With Structural Legacies
        - Without Structural Legacies
    - Young Low Density
        - With Structural Legacies
        - Without Structural Legacies
    - Mature
        - Single Canopy
        - Multiple Canopy
    - Structurally complex
        - Existing Old Forest
        - Existing Very Old Forest
        - Developed Structurally Complex

The BLM will use the modeling output from this five-tiered structural stage definition to help assess changes in the forested landscape over time, including evaluating habitat conditions for most wildlife species other than the northern spotted owl and marbled murrelet.

The modeling will provide species-specific outputs on habitat conditions for the northern spotted owl and marbled murrelet. Studies published in 2011 on the status and trend of nesting habitat for the marbled murrelet and northern spotted owl (Davis et al. 2011; Raphael et al. 2011) used similar methods to define a habitat suitability index for each species. These habitat suitability indices will be generated using outputs from the Woodstock model as well as gradient nearest neighbor and Landsat data. The gradient nearest neighbor method (Ohmann and Gregory 2002) integrates vegetation measurements from networks of plot data and other sources to characterize vegetation across a region. The habitat suitability indices for the current conditions as well as the projected habitat suitability indices, in 10-year increments into the future, will be the habitat conditions for both species.

Uses for these Products

The vegetation conditions maps and expression of structural stage will provide the basis for assessing the change in vegetation conditions for most resources and programs in the analysis of effects. More specifically, the model will provide an assessment of changes to key baselines, such as older forest, and northern spotted owl and marbled murrelet habitats. The BLM will estimate log quantities and quality for the life of the plan and will provide an estimate of expected payments to the counties that the socioeconomic analysis will use.

The alternatives will explore a variety of management regimes and allocations strategies. The dynamics of how the current forest responds to these strategies in the short and long term can be complex to understand by numbers alone. The spatial display over time of how the forest develops under the alternatives will inform both the agencies and the public. The spatial display of change in habitat conditions at such large scale over time will provide valuable information for consultations under the Endangered Species Act.

The model will simulate a scenario of implementation that reflects the relative magnitude of the types and amounts of land management activities expected from implementing the plans. This can serve as a guide to implementation and a comparison point to monitor compliance with the plans over time.

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Air Quality

Issue 1

How will proposed management actions affect $PM_{2.5}$, PM_{10}, and expected visibility?

Analytical Assumptions

- The dominant source of air pollutants from BLM management activities comes from prescribed burning.
- Prescribed burning emissions will be regulated under and comply with the Oregon Smoke Management Plan (ORS 477.013).
- Adverse impacts from prescribed burning are primarily local in nature.
- Exceedences of daily National Ambient Air Quality Standards (NAAQS; 40 CFR part 50) are unlikely from prescribed burning.
- Prescribed burning trends on other jurisdictions will continue in the current direction.
- Sources of chronic particulate production remain unchanged in number and emissions.
- Emissions factors are:
    - Prescribed fire: 25 lb. PM_{10}/ton consumed and 22 lb. $PM_{2.5}$/ton consumed (Hardy et al. 2001)
    - Wildfire: 30 lb. PM_{10}/ton consumed and 27 lb. $PM_{2.5}$/ton consumed (Hardy et al. 2001)
- Consumption during wildfires by severity class:
    - High severity – Fire consumes 100 percent of needles, standing and down dead wood, live branches to three inches in diameter, litter, and duff. Boles and live branches larger than three inches in diameter remain intact.
    - Mixed severity – Fire consumes 50 percent of needles and live branches up to three inches in diameter and standing dead wood, and 100 percent of downed wood, litter, and duff.
    - Low severity – Fire consumes 100 percent of dead and downed wood and litter and 50 percent of duff.
- Observed trends in annual acres burned and severity class proportions continue.

Analytical Methods and Techniques

- Establish baseline and trend in prescribed fires, wildfires, and wildfire severity, using data from 1990-2011.
- Use standardized fuel loadings by general forest type and silvicultural regimen for projected future.
- Estimate PM_{10} and $PM_{2.5}$ emissions per acre using emissions factors above.

- Estimate expected average and range of prescribed burns for each alternative.

- Potentially, use generalized dispersion models, WindNinja (USDA 2007), or other indicators of seasonal risks for adverse impacts to smoke sensitive areas, NAAQS non-attainment areas, and NAAQS air quality maintenance areas.

Analytical Conclusions

- Determine which alternative is least likely to affect air quality adversely or likely to have the lowest level of adverse impact based on particulate emissions, season of burn, and expected dispersion.

Data Needs

- Prescribed fire acres and consumption for 1990-2011 from the Oregon Department of Forestry (ODF) annual smoke management reports

- Wildfire acres burned for 1987-2011 from national databases and wildfire severity classes for large fires from Monitoring Trends in Burn Severity (USDA/USDI 2005).

- Standardized fuel beds from the Fuels Characteristic Classification System (USDA 2005) or digital fuels photo series by general forest type and structure stage.

- Projected acres to be burned by forest type for each district and alternative.

- Frequency of past smoke intrusions from BLM prescribed burns.

- Frequency of poor air quality from wildfire smoke and conditions associated with poor air quality.

- Trend in visibility in selected mandatory Class I areas as defined by the Clean Air Act.

- $PM_{2.5}$ sources by county

- Number of unhealthy days by county and population type

- Wind data for use in WindNinja or other dispersion indicator.

Geographic and Temporal Scales

- Direct effects of emissions encompass the decision area.

- Indirect effects of emissions encompass the planning area.

- Cumulative effects encompass all lands within the planning area and include effects from both prescribed fire and wildfire.

- 10 years

Units of Measure

- Estimated total annual tons of PM_{10} and $PM_{2.5}$

Data Display

- Graphs or charts depicting analysis results; express those results as some measure of central tendency (mean or median) and variation (standard deviation, confidence interval, or percentiles).

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Areas of Critical Environmental Concern

Issue 1

How will alternatives affect the relevant and important resource values of existing and proposed Areas of Critical Environmental Concern?

Analytical Assumptions

• Areas of Critical Environmental Concern require special management attention to protect or maintain relevant and important resource values.

• Areas of Critical Environmental Concern require no additional management or mitigation outside the special area to protect relevant and important features.

• The BLM might not designate some Areas of Critical Environmental Concern under some alternatives.

• Under some alternatives, mechanisms other than Areas of Critical Environmental Concern designation would protect and maintain relevant and important values.

• Under some alternatives, neither special management attention nor other mechanisms would protect or maintain the relevant and important values.

Analytical Methods and Techniques

• Determine if the management direction of each alternative protects or maintains the important and relevant resource values associated with each existing or potential Area of Critical Environmental Concern.

Step 1 - List and map the locations of existing and potential Areas of Critical Environmental Concern by alternative.

Step 2 - Define special management needed to protect or maintain each Area of Critical Environmental Concern's specific relevant and important resource values by alternative.

Step 3 - Determine if specific management activities or lack of management direction will affect the relevant and important resource values that do not receive special management attention for each alternative.

Analytical Conclusions

- A description of how land use allocations (special area designations) and management direction for each alternative affects relevant and important resource values for each area. Under some alternatives, the BLM may conclude some areas require no special management to protect relevant and important values, and therefore Area of Critical Environmental Concern designation is unnecessary.

Data Needs

- Spatial and attribute data for existing and potential Areas of Critical Environmental Concern.
- Spatial data for each alternative's land use allocations and other special designations.
- Special management attention needed to protect or maintain the relevant and important resource values of individual Areas of Critical Environmental Concern.
- Management direction and action descriptions for land use allocations under each alternative.

Data Display

- A table will show the analyzed Areas of Critical Environmental Concern, their status, acres, and designation by alternative, applicable relevance and importance value categories and management direction if designated.
- A table will contain a more detailed summary of the relevant and important values of each Area of Critical Environmental Concern analyzed.

Climate Change

Issue 1

What are the effects of BLM forest management on long-term carbon storage?

Analytical Assumptions

- No land conversions to another land use, such as residential or agricultural development, will occur; forestland will remain forestland.
- Carbon comprises approximately 50 percent of plant biomass (DOE 2007, Smith et al. 2006).
- Some level of carbon remains stored in forest products, with the life expectancy of that carbon storage varying with the type of forest product (Earles et al. 2012).
- Waste wood products are stored in sanitary landfills where decay rates are very slow.
- There are no net changes in soil carbon stocks, understory vegetation, or litter/duff on BLM-administered lands (Carbon Online Estimator (COLE); Van Deusen and Heath).
- Six board feet equals one cubic foot, accounting for kerf and wastage in the milling process.
- Climate change does not substantially alter carbon storage capability across the analysis area (although carbon storage capability will likely change in the long-term [100 years], we have no way to estimate how that capability will change and at what rate).

Analytical Methods and Techniques

- Estimate the mix of stand structure types at present, in years 10, 20, 30, 50, and 100 of alternative implementation.
- Estimate carbon storage in live trees from tree tables using the following process:
    - Convert standing tree volumes from board feet to cubic feet.
    - Convert tree volume to density (lb. /ft3) using the specific gravity of key species when green and typical moisture content of the heartwood (Simpson 1993, Ross 2010).
    - Biomass for entire live trees (foliage, branches, bark, and roots) equals biomass derived from tree volume multiplied by 1.85.
    - Divide pounds of carbon in live trees by 2200 to calculate tonnes (Megagrams (Mg)) of carbon (C).
- Estimate carbon storage in other forest components using the following process:
    - Assign median age for each stand structure type.
    - Estimate Mg C per acre for snags, understory, dead downed wood, and forest floor in each stand structure type for each forest type based on regional outputs from the COLE, for the following regions:
        - Southwest Oregon (dry forests)
        - Northwest Oregon (moist forests)
    - For estimating Mg C per acre in woodlands, use COLE outputs for age 100 for western juniper and the average for age 100 for California black oak and Oregon white oak.
- Estimate remaining Teragrams (Tg) C stored in wood products from past harvesting.
- Estimate expected Tg C stored in wood products over time from harvesting under each alternative.

Analytical Conclusions

- Determine which alternative results in the highest expected carbon storage over time and the degree of difference between the alternatives based on estimated total above-ground carbon and carbon in live trees stored in years 10, 20, 30, 50, and 100 (expressed as a central tendency and as a range or error bars, if feasible) by alternative.

Data Needs

- Estimates of tree volume for key species in dry and moist forests
- Age used to represent each successional stage in dry and moist forest types
- Estimates of carbon stocks by category (e.g., snags and understory) for the different successional stages
- Estimates of volume used for different product types (lumber and plywood, pulp and paper, biomass for energy or heat production).
- Estimates of life expectancy of carbon in different forest product types

Geographic and Temporal Scales

- The decision area
- Years 10, 20, 30, 50, and 100

Units of Measure

- Teragrams of carbon (Tg C); 1 Tg C = 1,000,000 Mg C.

Data Display

- Graphs of estimated carbon storage by alternative

Issue 2

What is BLM's expected contribution to greenhouse gas emissions (Mg CO_2e) from vegetation management activities such as timber management and hazardous fuels reduction?

Analytical Assumptions

- Emissions from harvesting operations are 0.039 Mg C per 100 ft^3 (Sonne 2006). This accounts for harvest operations, post-harvest site preparation except for prescribed burning, and tree planting.
- Prescribed burning emits 150 Mg CO_2e per acre in wet forests and 85 Mg CO_2e per acre in dry forests (estimate based on First Order Fire Effects Model; Reinhardt 2003).
- Current trends in annual acres burning in wildfires and in proportion of different fire severity types continues (may need to adjust based on level of harvesting by alternative), or acres burned increases by mid-century by percentages described in recent climate change literature.
- For cumulative effects analysis purposes, emissions from other federal lands, state and private lands, and emissions from enteric fermentation of cattle grazing on BLM allotments follow current trends.

Analytical Methods and Techniques

- Use estimates of cubic feet harvested calculated for carbon storage analysis to estimate emissions from harvest operations in years 10, 20, 30, 50, and 100.
- Estimate annual greenhouse gas emissions from prescribed burning in years 10, 20, 30, 50, and 100.
- Estimate annual greenhouse gas emissions from wildfires in years 10, 20, 30, 50, and 100.
- Estimate annual greenhouse gas emissions from enteric fermentation from cattle grazing BLM allotments based on permitted animal unit months (AUMs).

Analytical Conclusions

- Determine which alternative results in the lowest expected greenhouse gas emissions over time and the degree of difference between the alternatives based on the estimated greenhouse gas emissions from harvesting and prescribed burning.

Data Needs

- Cubic foot volume harvested
- Annual prescribed burning acres 1994-2011
- Annual wildfire acres 1987-2011
- Proportion of different wildfire severity classes 1987-2011
- Estimate of permitted AUMs for cattle grazing in BLM allotments

Data Needs

- Graphs of CO_2e (equivalent carbon dioxide) emissions by analyzed timeframes
- Graphs of net C emissions/storage by alternative (combines analyses for Issues 1 and 2)

Issue 3

How might BLM management actions and climate change interact to alter potential outcomes for key natural resources?

Analytical Assumptions

- Climate change analyses using models from both the fourth (IPCC 2007) and fifth (IPCC 2013) assessment reports from the Intergovernmental Panel on Climate Change are equally valid.
- The climate extension in the Forest Vegetation Simulator (FVS; USDA 2013) produces valid results.
- Gradient nearest neighbor (Ohmann and Gregory 2002) analysis can approximate current forest inventory on BLM-managed lands.

Analytical Methods and Techniques

- Use the Forest Vegetation Simulator to analyze potential shifts in species compositions and forest growth and yield. Climate modeling will include a baseline based on multiple global circulation models and a single emissions scenario and examine variability by including multiple additional climate-emissions combinations.
- Use the Forest Planner (Ecotrust 2013) to examine how management prescriptions already included in the Planner and new prescriptions along with different sizes of potential reserves may interact with climate change to affect potential forest yields, northern spotted owl habitat, wildfire risks, certain forest pest risks, and carbon storage.
- Search the NatureServe Climate Change Vulnerability Index (NatureServe 2009) for existing analyses of potential climate change impacts on selected species and habitat important to western Oregon.
- Conduct a literature review of potential climate change interactions with management to determine the potential role of management in exacerbating or mitigating climate change as it pertains to timber yields, habitat, or disturbance risks.

Analytical Conclusions

- Identify what role, if any, alternative management approaches may have in exacerbating or mitigating undesirable climate change impacts on wood production, habitat or species persistence, and disturbance risks.

Data Needs

- Maps of two potential reserve sizes
- Gradient nearest neighbor (Ohmann and Gregory 2002) dataset for western Oregon
- Maps delineating BLM-administered lands within the planning area
- Maps of existing reserves (designated wilderness, wilderness study areas, wild and scenic river corridors, Areas of Critical Environmental Concern, Research Natural Areas, and the Cascade-Siskiyou National Monument)
- Riparian buffer widths by alternative
- BLM-specific management prescriptions including uneven-aged management prescriptions
- Map of northern spotted owl provinces
- Site Class layer

Data Display (potential)

- Maps of bioclimatic envelopes for commercially important tree species
- Graphs, tables, or maps of stocking, timber yields, carbon storage, suitable northern spotted owl habitat, and hazard ratings for wildfire and some forest pests (e.g., mountain pine beetle); results will include mean and variability.

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Cultural/Paleontological Resources

Issue 1

How would the BLM affect cultural and paleontological resources across the planning area under each alternative?

Analytical Assumptions

• The National Historic Preservation Act (NHPA; 16 U.S.C. 470 et seq.) and BLM's protocol agreement (USDI 1998) with the Oregon State Historic Preservation Office (SHPO) provides guidance and direction for federal agencies to preserve and protect cultural resources. The BLM will complete all projects proposed under the RMP in compliance with these directives.

• The Paleontological Resources Protection Act (16 U.S.C. 470aaa et seq.), the National Environmental Policy Act and the Federal Land Policy and Management Act provide guidance and direction for federal agencies to preserve and protect paleontological resources. The BLM will complete all projects proposed under the RMP in compliance with these directives.

• Archaeologists have surveyed a relatively small portion of BLM-administered lands and most surveys are in response to proposed federal projects. This leaves a large percentage of unsurveyed lands in the planning area.

• There has not been a systematic recording of paleontological sites on BLM-managed lands; however, there is existing data and research on paleontological localities in Oregon that the BLM can use for the purposes of analysis.

• Cultural and paleontological resources are unevenly distributed throughout the planning area. Certain types of cultural resources (i.e., mining-related resources) and paleontological localities are associated with discrete geological formations. Other types (i.e., prehistoric sites) occur across the landscape, and it is difficult for archaeologists to predict where they will find unrecorded sites.

• Cultural and paleontological sensitivity also varies by physiographic region. In general, the Coast Range is considered to have low sensitivity for cultural and paleontological resources. The Willamette Valley is considered to have moderate sensitivity. The Eastern and Western Cascades and Klamath Mountains have areas of high sensitivity interspersed with areas of low sensitivity.

• The potential to affect cultural or paleontological resources increases as the total number of acres (or miles) of land management activities increases.

• It is difficult to predict effects to cultural and paleontological resources. Effects vary based on the type of land management activity, where such activities occur, and the level of surface and sub-surface ground disturbance allowed under the alternatives. Therefore, every land management action under the various alternatives (timber harvest, fire suppression, road construction, grazing, etc.) would have a range of effects.

Analytical Methods and Techniques

• The BLM will use an existing GIS model to determine the relative sensitivity of each geographic region in terms of the presence of cultural and paleontological sites.

• The BLM will conduct a review of survey data available in GIS databases and make a comparison with the model of known sites to assist in determining the relative sensitivity of unsurveyed areas. This would allow the BLM to estimate roughly the number of unrecorded sites in the non-surveyed areas.

• The planning area will be stratified by physiographic regions and then into areas of high, medium and low sensitivity. The BLM would add together the numbers of known sites and numbers of extrapolated sites to determine the percentage of sites that land management activities could affect based on acres in each physiographic region.

• An ‘Effects Common to All Alternatives’ section will contain an outline of the types of potential effects to cultural and paleontological resources as they relate to land management activities.

Analytical Conclusions

• The percentage of sites or localities that ground-disturbing activities would affect under each alternative

Data Needs

• GIS data on cultural resource distribution

• GIS data of paleontological localities

• Types of land management activities and the acres or miles of land to be treated (e.g., fire and fuels treatments, timber harvest, road construction)

Geographic Scale

- Divide the planning area into the following distinct physiographic regions:
    - Eastern Cascades
    - Coast Range
    - Willamette Valley
    - Western Cascades
    - Klamath Mountains

Units of Measure

- Acres of land disturbing activities
- Number of extrapolated sites and localities in each physiographic province

Data Display

- A table that displays each physiographic region, types of treatment activities, acres of potential treatment activities and percentage of affected resources. This table will include a narrative section to explain the table as well as the 'common to all' section.

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Fire and Fuels

Issue 1

How will the alternatives affect fire hazard and subsequent risk to firefighter and public safety within the wildland urban interface?

Analytical Assumptions

- Fire hazard refers to the ease of ignition or resistance to control of the fuel complex, defined by the volume and arrangement of several strata including surface, ladder and canopy fuels.
- Stand treatments that reduce flame lengths, help minimize risk to wildland firefighter and public safety, and provide opportunities for suppression resources to engage.
- Treatments will not eliminate fire from the ecosystem.

- Hazardous fuels will continue to increase within unmanaged areas.
- Changes in forest composition and structure will continue to occur in unmanaged areas.
- Full fire suppression will continue.
- Appropriate maintenance of treated acres will continue.
- Broad descriptions of forest vegetation conditions can equate to fire hazard risk. The BLM will assign structural stages in the vegetation modeling different levels of stand-level fire hazard. A panel of professionals will be convened to rank these structural stage classes by dry or moist strata on the merits of their resistance to control.
- A modeled validation of the broad descriptive structural classes will assume a 90th percentile fire weather situation relative to eco-region or forest type and 30 percent slope.
- At this scale of analysis, it is not possible to address the many nuanced site-specific variables that influence fire behavior, such as microclimate, topographic position, detailed crown fuels, and variable surface fuel loading. Therefore, this analysis will address qualitatively the changes in many site-specific and stand-specific factors that affect fire hazard, beyond the forest structural stage classification.
- Forest management actions influence forest composition, structure, fuel loadings, and ecological function.
- Uneven-aged forest management strategies would include the following features:
    - Small patches of group selection would occur that would not retain legacy trees.
    - Legacy trees would be retained under a variable spacing and not clustered around the edges of openings.
    - Legacy trees would be a minimum of 20 inches DBH, where available.
    - There would be a vertical separation between the canopies of the legacy trees and the understory of early successional, stand establishment, and young forest.
    - Understory thinning would occur.
    - Surface fuels would be treated whenever a management action occurs that would increase existing surface fuel loads above a threshold for both dry and moist forests (i.e., five tons/acres in driest forest, 10 tons/acre in dry forest, and 15 tons/acre in moist forest).
- Those hazardous fuel treatments (e.g., maintenance burning in natural fuels, prescribed fire applied as a follow-up hazardous fuel treatment), not associated with reducing fuels directly resulting from timber management activities, would likely not vary among alternatives.

Analytical Methods and Techniques

- Describe changes to fire hazard by alternatives by summing the acres of land by flame length categories and impacts on suppression tactics relative to the Fire Behavior Fire Characteristics Chart (Figure 1 in Andrews and Rothermel 1982) or by fire type (surface, passive, crown fire, and conditional crown fire).
- Determine fire behavior metrics (flame length or fire type) associated with the Woodstock dry and moist forest structural stages under 90th percentile eco-region weather conditions.
- Define eco-regions by dry, driest, and moist forests or major tree species, per the potential vegetation type (PVT) dry forest classification system. Within these analysis areas, review historic 90th percentile weather based on energy release component values. Fire weather inputs include temperature, relative humidity, wind speed, and fuel moisture.

• Assign one of the 40 Standard Fire Behavior Fuel Models (Scott and Burgan 2005) using the LANDFIRE (USDA/USDI 2013) editing process and treatment crosswalk, assuming all hazardous surface fuels have been treated.

• Run the Forest Vegetation Simulator fire and fuels extension (FFE) with year 0 Current Vegetation Survey tree lists that represent all structural stages (10 divisions for both dry and moist forests) to determine fire type and flame length.

• Sum these onetime fire and fuels extension fire metrics associated with structural stages according to the acres of structure stages for each alternative.

• Use fire type or flame length to represent high and low hazard.

Analytical Conclusions

• List alternatives by acres of land with classes of fire hazard (low, moderate, high) over time.

Data Needs

• Map of wildland urban interface (WUI) for west side districts

• Acres of structural stages for moist and dry forests over time by alternative within the WUI boundary

• LANDFIRE Fire Behavior Fuel Model 40 2010 raster data

• LANDFIRE treatment to fuel model crosswalk method

Geographical Scale

• The geographic scale of this analysis will include the wildland urban interface in all districts.

Units of Measure

• Acres in lower fire hazard and acres in higher fire hazard

Data Display

• Table or graph showing the distribution of low and high fire hazard by alternative

Issue 2

How will the alternatives affect fire resiliency in the fire-adapted dry forests?

Analytical Assumptions

• Resilience is the capacity of a system to absorb disturbance and reorganize while undergoing change, while retaining essentially the same function, structure, identity, and feedbacks (Johnson and Franklin 2012).

• It is widely recognized that in dry forests, historic conditions were more fire resilient than current conditions, where influential frequent fire disturbance has been stymied. Current fires in these forests are more apt to result in a higher proportion of severe effects than would have occurred historically (Agee 1998; 2002), essentially altering the resilience of these forests.

• Fire resilient stands have characteristics that limit fire severity and increase the resistance of the forest to mortality. In general, stands with higher fire resiliency have reduced surface fuel loading, lower tree density, large diameter trees of fire-resistant species, and increased height to live crown.

• Fire resiliency can be equated to broad descriptions of forest vegetation conditions. Structural stages in the vegetation modeling can be assigned different levels of stand-level fire resiliency. Convene a panel of professionals to rank these structural stage classes by dry and moist strata on the merits of their fire resilience.

• A modeled validation of the broad descriptive structural classes will assume a 90th percentile fire weather situation relative to eco-region or forest type and 30 percent slope.

• At this scale of analysis, it is not possible to address all of the many nuanced site-specific variables that influence fire behavior, such as microclimate, topographic position, detailed crown fuels, and variable surface fuel loading. Therefore, this analysis will address qualitatively the changes in many site-specific and stand-specific factors that affect fire hazard, beyond the forest structural stage classification.

• Appropriate maintenance of treated acres will continue.

• Uneven-aged forest management strategies would include the following features:

  ◦ Small patches of group selection would occur that would not retain legacy trees.

  ◦ Legacy trees would be retained under a variable spacing and not clustered around the edges of openings.

  ◦ Legacy trees would be a minimum of 20 inches DBH (diameter at breast height).

  ◦ There would be a vertical separation between the canopies of the legacy trees and the understory of early successional, stand establishment, and young forest.

  ◦ Understory thinning would occur.

  ◦ Surface fuels would be treated whenever a management action occurs that would increase existing surface fuel loads to greater than five tons/acre in driest forest and 10 tons/acre in dry forest.

• Leaving and cultivating larger green trees would increase stand-level fire resilience, as large diameter trees (greater than 20 inches DBH) have greater resistance to mortality from bole and crown scorch. A lower probability of tree mortality equates to higher fire resiliency (BLM 2008 pp. 810-811).

• Changes in forest composition and structure will continue to occur in unmanaged areas.

• Those hazardous fuel treatments (maintenance burning in natural fuels, prescribed fire applied as a follow-up hazardous fuel treatment, etc.), not associated with reducing fuels directly resulting from timber management activities, would likely not vary among alternatives.

Analytical Methods and Techniques

• Describe changes to fire resiliency over time by displaying the distribution of acres of land with expected severity under various alternatives to the distribution of severity characteristic of historic conditions in dry forests.

• Determine fire behavior metrics (severity or fire type) for the Woodstock dry forest structural stages under 90th percentile weather conditions by eco-region.

• Define eco-regions by dry and driest forests and/or major tree species, per the potential vegetation type dry forest classification system. Within these analysis areas, review historic 90th percentile weather based on Energy Release component values. Fire weather inputs include temperature, relative humidity, wind speed, and fuel moisture.

• Assign 40 Fire Behavior Fuel Model to treated stands using LANDFIRE editing process or treatment crosswalk, assuming all necessary surface fuels have been treated.

• Run the Forest Vegetation Simulator fire and fuels extension with year 0 Current Vegetation Survey tree lists representing each dry forest Woodstock structural class to determine fire effects to each class under 90th percentile and eco-region weather conditions to determine predicted mortality and fire type (surface, passive, crown, conditional).

• These onetime fire and fuels extension fire metrics associated with structural stages will then be summed according to the acres of structure stages for each alternative.

• Use mortality or fire type (surface, passive, crown, conditional) to equate to low, moderate, and high severity

Analytical Conclusions

• Rank alternatives by acres of land with higher fire resiliency over time (i.e. less high severity) or departure from historic severity distribution by eco-region or weather stratification.

Data Needs

• Acres of dry and driest forest structural stages over time by management action by alternative

• Year 0 Current Vegetation Survey tree list data and associated Plant Association

• LANDFIRE Fire Behavior Fuel Model 40 2010 raster data

• LANDFIRE treatment to fuel model crosswalk method

• LANDFIRE grids of historic distribution of severity classes (i.e., percent low, mixed, and replacement severity fire)

Geographic Scale

• The geographic scope will be limited to the dry forests, including the driest forests across all districts.

Units of Measure

• Relative ranking of alternatives based on how closely the distribution of severity reflects historic distribution.

Data Display

• Table or graph showing the change in acreage of land with higher resiliency over time by alternative

Issue 3

How will the alternatives affect the number of acres in need of surface fuel treatments, due to increased loading associated with management action?

Analytical Assumptions

• Harvest activities will generate fuels in all size classes.

• Surface fuels would be in need of treatment when a management action occurs that would increase existing

surface fuel loads above a threshold for both dry and moist forests (i.e., five tons/acres in driest forest, 10 tons/acre in dry forest, and 15 tons/acre in moist forest).

• Those hazardous fuel treatments (maintenance burning in natural fuels, prescribed fire applied as a follow-up hazardous fuel treatment, etc.), not associated with reducing fuels directly resulting from timber management activities, would likely not vary among alternatives.

Analytical Methods and Techniques

• Determine the relative risk of fuel loading associated with management activities accumulated beyond acceptable thresholds included in assumptions.

• Assign a Fire Behavior Fuel Model 40 to the timber harvest types by using the established LANDFIRE treatment type (mechanical method) to fuel model crosswalk designed for editing National Data based on the treatment history.

Analytical Conclusions

• Acres in need of surface fuel treatment by alternative

Data Needs

• Acres of proposed management actions

Geographic Scale

• The moist and dry forests for the entire planning area

Units of Measure

• Relative ranking of acres in need of surface fuel treatments between alternatives

Data Display

• Table or graph displaying proposed treatment acres by alternative

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Fisheries

Issue 1

How do the alternatives vary in the contribution of small and large functional wood to fish bearing and non-fish-bearing streams?

Analytical Assumptions

• Both large wood pieces (that are stable in the stream for decades) and smaller wood pieces (that are transportable and serve to accumulate into jams) are important in the creation and maintenance of channel form and fish habitat. The size of a stable wood piece is a function of stream width – the wider the stream, the larger in diameter and length the wood piece needs to be (Beechie et al. 2000). For most of the small fish-bearing streams in the planning area, a 20-inch diameter log would be a stable large wood piece (**Table 1**).

TABLE 1. DIAMETER OF FUNCTIONAL WOOD PIECE AS IT RELATES TO WIDTH OF ACTIVE STREAM CHANNEL

Width of Stream (ft.)	Diameter of functional wood (in.)
15	4.5
20	6
30	9
40	12
50	15
>50	>20

From Beechie et al. 2000

• Three major sources of wood to stream include riparian tree fall, channel migration and erosion, and tributary inputs from debris flows.

• Wood accumulation rates vary over time with some episodic input resulting in large accumulations (e.g., landslides after a fire) and other periods of in-channel wood decay and flushing resulting in little wood in the channel. May and Gresswell (2004) estimated a debris flow recurrence interval of up to 357 years for headwater basins in the Oregon Coast Range.

• Trees closer to the stream have a higher probability of falling and interacting with the stream. The further away from the channel a tree is the lower the probability of it ending up in the stream channel however factors like taper and breakage can also affect how much of the tree interacts. Benda et al. (2003) estimated that for a 15-meter wide channel and assuming a 50-meter tall tree, 10 percent of the cumulative length of all trees in a stand intersect the channel and could become instream wood. Johnston et al. (2011) found that while source distances ranged, approximately 90 percent of large wood entered the stream from within 18 meters (60 feet) at 90 percent of the sites in the study.

• Trees on steeper slopes have a higher probability of falling into the stream and in general, trees tend to fall toward the stream channel (Sobota 2006).

• Some small instream wood that is not entrained in a debris jam is flushed from the system during high flows. The remaining large pieces of instream wood are depleted at an average rate of 1.5 percent per year (Murphy and Koski 1989).

- Poage and Tappenier (2002) estimated that riparian stands developed under naturally low densities with little self-thinning – ranging from 40 to 60 trees per acre.

- Therefore, most existing stand densities in previously harvested (second growth) riparian stands are believed to be artificially high (150-300 trees per acre).

- Current stand densities in these areas can be three to four times higher than those likely found there prior to harvest, when the previous stands were of a similar age. This suggests that the available source of small functional wood is currently much higher than what existed in these areas naturally.

- Use of a no-thin inner zone and a thinned outer zone, would still result in residual stand densities that are higher than what was believed to be present in these areas historically.

Analytical Methods and Techniques

- Determine the number and sizes of trees that could potential be delivered to the stream via debris flows

- Determine the number and sizes of trees that could potentially die and fall into the stream from adjacent riparian stands

- Determine tree sizes, and heights within a distance of one site-potential tree-height of streams

- Overlay the slope layer derived from the Digital Elevation Model (DEM) and assign debris flow probability for each cell. The DEM is a representation of continuous elevation values over a topographic surface

- Determine stand density adjacent to streams and use probability function to determine how many die and fall rate

- Using these five parameters, the results would be incorporated into the model used in USDI 2008

Analytical Conclusions

- Relative contribution of wood (number and volume of large and small functional pieces) to fish bearing and non-fish-bearing stream channels (from riparian and debris flow sources

- Ranking of alternatives in the amount of large wood delivered to stream channels

Data Needs

- Forest stand conditions (tree heights, diameters, snag and decay rates and cumulative dead trees)

- Outputs from using DEM data

- Landslide potential

- Tree fall probabilities

Geographic and Temporal Scales

- The planning area

- 100-500 years; debris sources are quite variable in time and may occur on a time scale of hundreds of years. Evaluating input from these sources over the next hundred years may not capture (and hence underestimate) the contribution of wood from these sources

Units of Measure

- Relative and absolute number of large trees and functional pieces of wood per mile recruited to fish and non-fish-bearing stream channels
- Cumulative volume of wood in stream over time

Data Display

- Chart showing the relative contribution of large wood to stream channels from riparian and debris flow sources
- Table ranking the alternatives in the amount and volume of large wood delivered to stream channels

Issue 2

How do the alternatives vary in the contribution of sediment to fish bearing and non-fish-bearing streams?

Analytical Assumptions

- Well-vegetated and non-compacted buffer strips exceeding 35 feet in width adjacent to harvest units are generally sufficient to prevent sediment delivery from adjacent hill slopes that have been clearcut harvested (Rashin et al. 2006). No-treatment buffers that meet or exceed these widths would be sufficient to prevent delivery of harvest-related sediment to the aquatic system.
- Primary sediment sources are road-stream crossings or locations where ditches direct road-runoff into live stream channels. Road surface type and condition may play as an important a role as location. Poorly designed and maintained roads generally affect sediment contribution to a greater degree than roads in good condition.
- Reciprocal right-of-way agreements between the BLM and adjacent private landowners decrease the ability to close or decommission roads that may be chronic sources of sediment delivery.
- Higher volumes of traffic can crush and loosen road material and increase the amount of fine sediment contributed during subsequent precipitation.
- Fine sediment in streams can affect fish habitat by filling interstitial spaces in gravel substrate, reducing oxygen flow to incubating eggs, and physically preventing alevins from emerging. In suspension, fine sediment reduces visibility, reduces foraging ability, and impairs oxygen uptake in gill membranes.

Analytical Methods and Techniques

- Use results from sediment analysis along with fish distribution to assess impacts to listed and sensitive fish

Analytical Conclusions

- Ranking of alternative in the relative contribution of sediment to fish and non-fish-bearing streams

Data Needs

- Sediment inputs to streams from hydrology analysis - locations relative to fish-bearing, designated critical habitat, etc.

Geographic and Temporal Scales

- The planning area
- 10-100 years

Units of measure

- Tons of sediment per year

Data Display

- Chart or graph of ranking of alternatives

Issue 3

How do the alternatives vary in maintaining shade and stream temperatures for fish and non-fish-bearing streams?

Analytical Assumptions

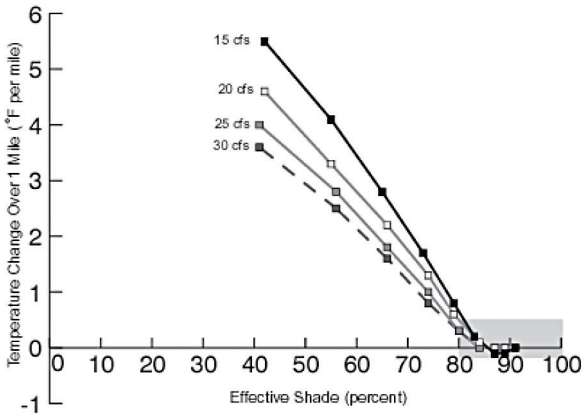
- Salmonids have specific biological temperature requirements for spawning, rearing, and migration. The Oregon Department of Environmental Quality has set standards for determining if streams are achieving these beneficial uses (2011; Table 2).
- Additionally, a Primary Constituent Element for temperature for Bull Trout Critical Habitat is 2-15°C (36-59°F).

TABLE 2. MAXIMUM 7-DAY AVERAGE TEMPERATURE CRITERIA FOR SALMONIDS BENEFICIAL USE

Salmonid Beneficial Use	Criteria
Salmon and Steelhead Spawning	13.0º C or 55.4º F
Core Coldwater Habitat	16.0º C or 60.8º F
Salmon and Trout Rearing and Migration	18.0º C or 64.4º F
Salmon and Steelhead Migration Corridor	20.0º C or 68.0º F
Lahontan Cutthroat Trout or Redband Trout	20.0º C or 68.0º F
Bull Trout Spawning and Juvenile Rearing	12.0º C or 53.6º F

- Where water quality standards are not met, any incremental increase in summer seven day average temperature could have adverse effects on listed or sensitive fish species.
- Where effective shade is greater than 80 percent, significant increases in stream temperature are not expected (Figure 1). The shaded area represents the level of effective shade (greater than 80 percent) that would not result in significant stream temperature change.

FIGURE 1. EFFECTIVE STREAM SHADE AND CHANGE IN STREAM TEMPERATURE



Analytical Methods and Techniques

- See stream shading analysis in the Hydrology section

Analytical Conclusions

- Rank of the alternatives in their ability to maintain effective shade over streams on BLM lands.

Data Needs

- State 303(d) listed streams
- Fish distribution
- Output from stream shading analysis

Geographic and Temporal Scales

- The planning area

Units of measure

- Shade, canopy closure
- Stream temperature

Data Display

- A chart or table that includes the ranking of the alternatives in meeting State of Oregon Salmonid Beneficial Use temperature criteria (**Table 2**)

Issue 4

How would the alternatives vary in changes in peak flow and how would potential changes affect stream channels and fish habitat?

Analytical Assumptions

- Increases in channel-forming peak flows can result in morphological channel changes by increasing scour and bank erosion resulting in additional sediment and can change substrate types available for fish spawning habitat. Increases in peak flows where five-year flows begin to occur at two-year intervals can begin to cause instability and increase stream bank erosion (Harr and Coffin 1992).

- Peak flows that occur earlier in the spring or at a higher magnitude can have an effect on fish survival by scouring eggs incubating in gravel.

Analytical Methods and Techniques

- Determine the percent increase in peak flow for each alternative

Analytical Conclusions

- Ranking of alternatives in the increase in peak flow

Data Needs

- Peak flow analysis from the Hydrology section

Geographic and Temporal Scales

- The planning area

Units of Measure

- Increase in 2-year and 100-year peak flows

Data Display

- Table or chart ranking the alternatives in the increase in peak flow

Issue 5

How will habitat restoration actions affect fish habitat, including access to habitat?

- This issue does not require detailed analysis because the alternatives would not differ substantially in their effect. The 2008 EIS contained an analysis of the effects of several alternatives on watershed restoration across the planning area. The analysis determined that the amount of restoration would increase under all action alternatives relative to the 1995 RMP since habitat and fish passage restoration would focus on areas of high intrinsic potential (HIP; Burnett et al. 2007) for listed fish and not on Key Watersheds as directed in the 1995 RMP. Key Watersheds are not necessarily aligned with HIP habitat for listed fish; therefore, more opportunities would exist if biologists were given the flexibility to prioritize based on HIP.

• Between the action alternatives, there was no difference in the projected amount of restoration planned or accomplished. Grants and partnerships contribute most of the funding for instream habitat restoration and fish passage restoration with a small amount of federally appropriated funds. As such, the opportunities for restoration would remain the same for all of the alternatives, regardless of management direction.

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Forest Management

Issue 1

How will the age classes, structural stages, and inventory of merchantable timber volumes in forest stands change among alternatives between the harvest land base and reserved land use allocations?

Analytical Assumptions

• Current Vegetation Survey plots and the Forest Operations Inventory form the best available data set to construct inventory, standing volume, and yield projections for the planning area.

• Estimation and Woodstock projection of stand level attributes forms the basis for developing structural stage classifications. The structural stage classifications group stands into useful categories, which help us understand how the forest grows, and changes through time by alternative.

• The harvest land base includes all land use allocations dedicated to long-term sustained yield timber production; these are the lands where annual timber harvest contributes to the calculation of the allowable sale quantity (ASQ). Reserved land use allocations do not contribute to long-term sustained yield, although the BLM may extract non-ASQ timber volume as a by-product of forest restoration.

Analytical Methods and Techniques

• Forest Operations Inventory and Current Vegetation Survey data will be used for the starting timber inventory

• To group vegetation stands, individual Current Vegetation Survey plot data will be stratified into ecologically similar conditions

• Modeling will assign Forest Operations Inventory units an Existing Stand Condition (ESC) code to reflect current stand condition and past treatment history, and then a species group to reflect stand composition.

• Starting timber volume [MMbf Scribner short log] will be calculated from Current Vegetation Survey plot data and Forest Operations Inventory acreage, stratified by existing stand condition, species group, age, and site productivity.

• Structural stage classifications will be assigned to stands based on estimated and Woodstock projected stand level attributes (trees per acre ≥ a given size, canopy cover, stand age, coefficient of variation of tree diameters, relative density, etc.) These classifications are the following:

  ◦ Early Successional with Structural Legacies

  ◦ Early Successional without Structural Legacies

  ◦ Stand Establishment with Structural Legacies

  ◦ Stand Establishment without Structural Legacies

  ◦ Young High Density with Structural Legacies

  ◦ Young High Density without Structural Legacies

  ◦ Young Low Density with Structural Legacies

  ◦ Young Low Density without Structural Legacies

  ◦ Mature Single Canopy

- Mature Multi-layered Canopy
- Developed Structurally Complex
- Existing Old Forest
- Existing Very Old Forest

Analytical Conclusions

At years 0, 10, 20, 30, 40, 50, and 100, and broken out between harvest land base and reserved land use allocations:

- Total standing volume, by alternative age class by acres, by alternative, and total merchantable volume within age classes
- Structural stage classification by acres and by alternative

Data Needs

- Output from Woodstock (Remsoft 2012)
- Growth and yield projections

Units of Measure

- Age classes and structural stages by acres
- Timber volume by million board feet (MMbf Scribner short log)

Data Display

- Graph displaying standing volume by alternative over time, at years 0, 10, 20, 30, 40, 50, and 100, broken out between harvest land base and reserved land use allocations
- Tables or graph displaying the distribution of age classes and structural stages, by alternative, by district, and broken out between harvest land base and reserved land use allocations, at years 0, 10, 20, 30, 40, 50, and 100

Issue 2

What is the annual productive capacity of the harvest land base under the various alternatives for each district?

Units of measure

- Timber volume in million board feet (MMbf Scribner short log)

Analytical Assumptions

- Funding for projects and staffing will be available for silvicultural practices and harvest operations
- The allowable sale quantity is the timber yield that a forest can produce continuously under the intensity of management outlined in the RMP from those lands allocated for permanent forest production (the harvest land base)
- The allowable sale quantity will vary, depending on which harvest practices, silvicultural treatments, and land allocations are included within each alternative

Analytical Methods and Techniques

- A suite of available harvest, reforestation, and stand development tools will be developed for each alternative, including but not limited to: silvicultural systems, harvest methods, regeneration, genetic improvement, stand conversion, fertilization, density control, and pruning.

- Growth projection of silvicultural prescriptions, yield curves, and stand structural characteristics (including mortality and coarse woody debris production) will be developed using appropriate versions of the ORGANON growth and yield model (Hann 2011), the CONIFERS young stand simulator (Ritchie 2005); to model young tree lists for input into ORGANON, and the TASS/TIPSY models; to evaluate/compare yield reductions with varying levels of overstory retention (DiLucca 1999), and empirical data from research and local sources.

- Develop growth and yield curves from the Woodstock model for the suite of treatments selected.

- Yield projections will be reduced where appropriate to reflect:

    - Harvest defect and breakage
    - Insect and disease impacts
    - Non-stocked openings
    - Green-tree retention
    - Snag and down woody debris retention
    - Density-independent mortality at older ages in extended rotation scenarios
    - Wildfire

- Timber Productivity Capability Classification will be used in determining the lands capable of supporting the production of forest products on a sustained-yield basis

- Allowable sale quantity will be calculated and declared at the district level.

Analytical Conclusions

- Allowable sale quantity for each district, by alternative

Units of measure

- Silvicultural prescriptions for use as input assumptions to the Woodstock model

Data Display

- Allowable sale quantity, by district

Issue 3

What quantity and mix of timber products will result from the alternatives, what level of harvest methods will be used, and what levels of silvicultural treatments will be applied?

Analytical Assumptions

- Markets will be available for the timber commodity volumes produced, and high quality logs will continue to command a premium, although not necessarily at historical levels (Haynes 2003, Haynes and Fight 2004)

- The BLM will offer an amount of timber equal to the allowable sale quantity each year

- The BLM will offer timber volume each year from reserved land use allocations as a by-product of forest restoration. This volume will not count towards the Allowable sale quantity

Analytical Methods and Techniques

- Ten-year scenario outputs from previous timber harvest analyses (USDI/BLM 2008) will be used to incorporate effects, such as road construction amounts and harvest methods used. Coefficients were generated based on previously completed 10-year scenario analysis, which will be used to estimate ground based, cable, and helicopter yarding acres by district, as well as roadwork miles by type

- The starting inventory, stand yield curves, and silvicultural prescriptions will be used to project the anticipated timber output from harvest actions

- Anticipated log sizes and grades from treatments will be developed using existing data and stand projections

- Units harvested by Woodstock and analyzed by the districts will be summarized by sustained yield unit to project the total mix of volume, acres, log sizes, and log grades harvested by district

- Summarize silvicultural treatments necessary to implement the silvicultural prescriptions in 10-year increments. Anticipated treatments to ensure effective reforestation and desired stand trajectory will be developed from historical experience and modeling.

- Commodity quality and value produced by the various silvicultural systems will be done using BLM appraisal methods

Analytical Conclusions

- Compare the alternatives in terms of the amount of timber outputs, harvest types, and silvicultural treatments

- Compare timber outputs from the harvest land base vs. reserved land use allocations sources over time and by alternative

Data Needs

- Output from Woodstock

Units of measure

- Log sizes and grades

- Acres of harvest actions

- Levels of silvicultural treatments in acres

Data Display

- Display at years 10, 20, 30, 40, 50, and 100, by district, and broken down between the harvest land base and reserves:
    - Acres of harvest types
    - Anticipated timber outputs, including estimates of log sizes and grades
    - Silvicultural treatments by treatment type in acres

Issue 4

How does each alternative affect the availability of special forest products?

Analytical Assumptions

- Special forest products can be represented by two broad categories:
    - Category 1, disturbance-associated special forest products- Christmas trees, wood products, some transplants (manzanita), some edibles and medicinals (huckleberries), some floral and greenery (beargrass), some seeds and seed cones (pine cones), and some mushrooms (morels)
    - Category 2, disturbance-averse special forest products- some transplants (ferns), some edibles and medicinals (wild ginger), some floral and greenery (mosses), some seeds and seed cones (hemlock cones), some mushrooms (chanterelles), coniferous boughs, and burls
- Disturbances like timber harvesting, commercial thinning, prescribed fire, and wildfire produce the right conditions to allow Category 1 species to grow. Less intensive treatments like pre-commercial thinning, fuel reduction, and fertilization do not produce these conditions. The more acres that are disturbed in the planning area, the more acres become available for the harvesting of these products
- Undisturbed areas produce the right conditions to allow Category 2 species to grow The more undisturbed acres that exist in the planning area, the more acres are available for the harvesting of these products
- Areas that have received disturbance in the last 30 years are considered disturbed, while stands that have not been disturbed in the last 30 years are considered to be undisturbed. Vegetation recovers at different rates depending on the plant community, disturbance type, and site productivity. However, on most sites we would expect 30 years to allow tree regeneration and crown expansion and re-vegetation of disturbed soils
- The more acres available to harvest either Category 1 or Category 2 special forest products, the more volume of these categories of special forest products are available
- Annual program summary accomplishment reporting and age class data is sufficient to develop starting conditions for year 0

Analytical Methods and Techniques

- Annual program summary accomplishment reporting coupled with age class data will be used to produce starting conditions for year 0
- Outputs from Woodstock will summarize acres of each harvest type each decade by district and by alternative
- Model outputs of stand disturbance will include commercial thinning, partial cutting, regeneration harvest, prescribed fire, and wildfire. Other less intensive silvicultural treatments will not be considered disturbance
- Disturbed areas will be considered disturbed for three decades before returning to an undisturbed status

Analytical Conclusions

- Comparison and contrast of the available acreage of two broad categories of special forest products, by alternative and district at years 0, 10, 20, 30, 40, 50, and 100

Data Needs

- Output from Woodstock
- Annual program summary accomplishment reporting to determine starting conditions

Units of measure

- Acres available for special forest product harvesting

Data Display

- Table or graph showing predicted number of acres available for special forest products harvesting, broken out by Category 1, disturbance-associated special forest products, and Category 2, disturbance-averse special forest products, by alternative and district at years 0, 10, 20, 30, 40, 50, and 100

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Grazing

Issue 1

How would each of the alternatives affect the attainment of Rangeland Health Standards on those lands allocated for livestock grazing?

Analytical Assumptions

- The 1997 Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands in Oregon and Washington (USDI 1997), which were developed in consultation with Resource Advisory Councils, Provincial Advisory Committees, tribes, and others, provide a measurement of rangeland health.

- Current management direction is to complete rangeland health assessments on all active and vacant allotments. Eighty percent of the allotments within the decision area have currently been assessed. The 80 percent of allotments that have been assessed constitutes a representative sample of all allotments.

- Sixty percent of the total acres assessed are currently meeting rangeland health standards or making significant progress towards meeting the standards.

- Management opportunities to achieve desired conditions may be limited in those areas where rangelands may not have the capability to meet rangeland health standards or make significant progress towards meeting the standards due to causes other than livestock grazing.

- Where allotments are not meeting rangeland health standards and livestock grazing is a causal factor, changes in grazing practices and range improvement projects may result in the allotment meeting rangeland health standards or making significant progress towards meeting the standards.

Analytical Methods and Techniques

- Identify currently assessed allotments that are not currently meeting rangeland health standards where livestock grazing is a causal factor.

- Qualitatively assess changes in grazing practices and range improvement projects under each alternative to evaluate whether changes would result in meeting rangeland health standards or making significant progress towards meeting the standards.

- Calculate percentage of currently assessed allotments that would meet rangeland health standards or make significant progress towards meeting the standards under each alternative.

- Extrapolate percentage of currently assessed allotments to all allotments to derive percentage of all allotments that would meet rangeland health standards or make significant progress towards meeting the standards under each alternative.

Analytical Conclusions

- Rank alternatives by percentage of allotments that would meet rangeland health standards or make significant progress towards meeting the standards.

Data Needs

• Map of lands allocated for livestock grazing

• Rangeland health assessments for allotments that are not meeting rangeland health standards and where livestock grazing is a causal factor

Geographic Scale

• Lands allocated for grazing in the Medford District and Klamath Falls Field Office. Although the Coos Bay District has grazing allotments, those allotments are vacant. There are no grazing allotments in the Salem, Eugene, and Roseburg Districts.

Units of Measure

• Percentage of allotments that are meeting rangeland health standards or making significant progress towards meeting the standards

Data Display

• Table or graph displaying current percentage of allotments that are meeting rangeland health standards or making significant progress towards meeting the standards and percentage of allotments that would meet rangeland health standards or make significant progress towards meeting the standards in the future under each alternative.

Issue 2

How would each of the alternatives affect BLM's ability to provide forage on those lands allocated for livestock grazing?

Analytical Assumptions

• Any adjustments in forage allocations will be based on monitoring and evaluation of site specific information. Forage allocation levels are also based on allotment specific management such as suitability, livestock distribution, and season of use in addition to production.

• Changes in vegetation associated with management actions may increase or decrease forage production in grazing allotments. Open areas provide more forage than forested areas. The structural stages of non-forest, early-successional, and stand establishment provide forage and that the structural stages of young, mature, and structurally complex forest do not provide forage.

• The effects of other actions affecting grazing, such as protection of special areas through exclusion, would affect the livestock grazing allocations to a lesser degree than vegetation management. Such effects from other actions would be immeasurable at the planning area scale and would be unlikely to vary substantially among alternatives.

Analytical Methods and Techniques

• Describe changes to forage available for livestock grazing over time by summing the acres of land in non-forest, early successional, and stand establishment structural stages within grazing allotments over time by alternative.

Analytical Conclusion

- Rank alternatives by the acreage of non-forest, early successional, and stand establishment structural stages over time.

Data Needs

- Map of lands allocated for livestock grazing
- Acres of structural stages within grazing allotments over time by alternative

Geographic Scale

- Lands allocated for grazing in the Medford District and Klamath Falls Field Office. Although the Coos Bay District has grazing allotments, those allotments are vacant. There are no grazing allotments in the Salem, Eugene, and Roseburg Districts.

Units of Measure

- Acres of land in non-forest, early-successional, and stand establishment structural stages

Data Display

- Table or graph showing the change acreage of the structural stages of non-forest, early-successional, and stand establishment over time by alternative

Issue 3

How would each of the alternatives affect the acres of BLM lands allocated for livestock grazing?

Analytical Assumptions

- Management decisions to exclude grazing from certain areas for resource protection or rehabilitation would affect a relatively small acreage. In analyzing this issue, the BLM will consider only the full acreage of an allotment offered for, or closed to, livestock grazing.

Analytical Methods and Techniques

- Provide the total acres of BLM allocated for livestock grazing in each alternative.

Analytical Conclusion

- Rank alternatives by the acreage of BLM-administered land allocated for livestock grazing.

Geographical Scale

- The Medford and Coos Bay Districts and Klamath Falls Field Office will be considered in this analysis. There are no grazing allotments in the Salem, Eugene, and Roseburg Districts.

Units of Measure

- Acres of land allocated for livestock grazing.

Data Needs

- Maps of lands allocated for livestock grazing in each alternative

Data Display

- Table or graph showing the change in acreage of BLM-administered lands allocated for grazing in each alternative.

References

U.S. Department of Interior, Bureau of Land Management. 1997. Standards for rangeland health and guidelines for livestock grazing management for public lands administered by the Bureau of Land Management in the states of Oregon and Washington. *http://www.blm.gov/or/resources/recreation/csnm/files/rangeland_standards.pdf*

Hydrology

Issue 1

To what extent will each alternative maintain effective shade along, streams, lakes, and wetlands?

Analytical Assumptions

- The major source of heat energy to warm streams is solar radiation. Boyd and Sturdevant (1997) showed that direct beam solar radiation is the greatest component of the daily energy balance, and overwhelms bed conduction, longwave, convection, and evaporation fluxes.

- The primary method to block incoming solar radiation and maintain cool stream temperatures in mountainous landscapes during summer day time hours, is streamside shade that is cast from topography and forest vegetation in the path of the sun. Maintaining high levels of forest shade (potential natural shade) is a surrogate for meeting the Oregon Department of Environmental Quality numeric water quality temperature standard.

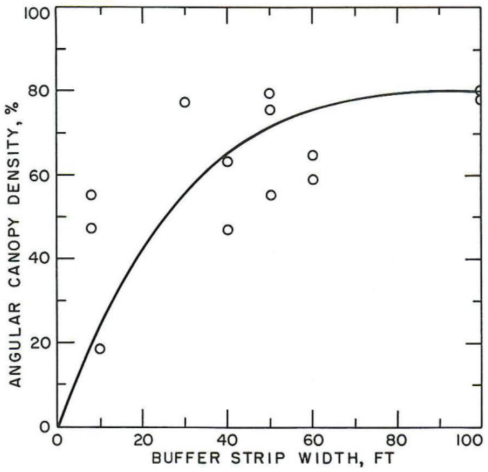
- The total width of a forested riparian area, land steepness, stream orientation and the density of forest vegetation strongly affect the amount of solar radiation reaching a stream. Wider tree spacing and less vertical branches require greater riparian management area widths to achieve the same shade quality as more tightly spaced trees (Brown and Brazier 1972, DeWalle 2010).

- The analysis will use perennial and fish-bearing streams from BLM GIS hydrography data layers are. The majority of the BLM streams are small to medium-sized (10-30 feet active channel width).

- Although important for stream thermal regulation, the BLM will not consider streamflow and groundwater, because of the difficulty of spatial modeling.

• Forest trees near stream channels and dense stands can block solar radiation and cast shadows across the stream. Angular canopy density is the measure of canopy closure as projected in a straight line from the stream surface to the sun, as it varies with the suns path through the day. The angular canopy density value for a given buffer depends on the spacing of forest crowns and vegetation characteristics. As vegetation becomes more open through wider spacing, a greater width of vegetation is needed to achieve the same angular canopy density for the similar vegetation with closer spacing. Lower sun angles and higher canopy density can achieve a higher angular canopy density. **Figure 2** (Brown and Brazier 1972) illustrates that a buffer strip width of 60 feet will result in an angular canopy density of 65 percent, and a buffer width of 100 feet will result in an angular canopy density that reaches a maximum near 80 percent.

FIGURE 2. ANGULAR CANOPY DENSITY AND BUFFER WIDTHS FOR SMALL STREAMS IN WESTERN OREGON



• Effective shade is the total amount of radiant energy prevented from reaching a stream in a solar day (daylight hours). Forest vegetation has different efficiencies in blocking radiation for different times, because sun path and azimuth changes throughout the day, as well as energy input. As seen in **Figure 3** for 43° to 49° N latitude (Boyd 1996), the highest solar radiation intensity occurs between 10:00 a.m. and 2:00 p.m. **Figure 4** illustrates that effective shade cannot be much higher than 80 percent, because corresponding values of angular canopy density above 80 percent are not likely (even under dense shade) due to the structure of forest vegetation where some transmissivity will occur. **Figure 5** demonstrates how effective shade maintains stream temperatures and that significant temperature rises do not occur when effective shade is ≥ 80 percent.

FIGURE 3. SOLAR PATHFINDER

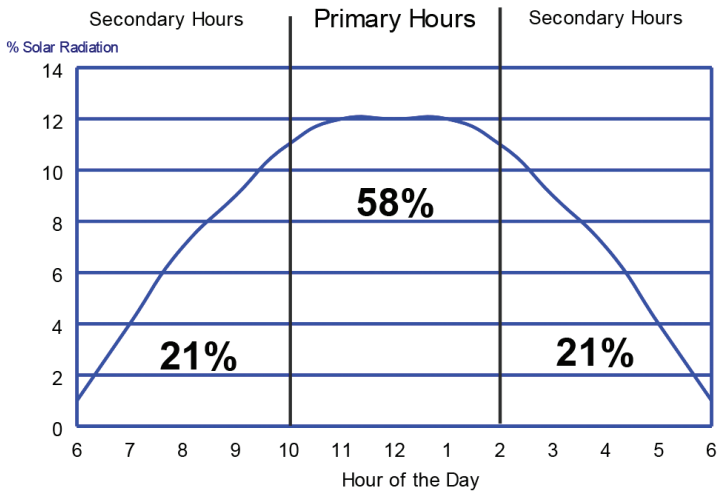


FIGURE 4. ANGULAR CANOPY DENSITY AND STREAM SHADE (PARK 1993)

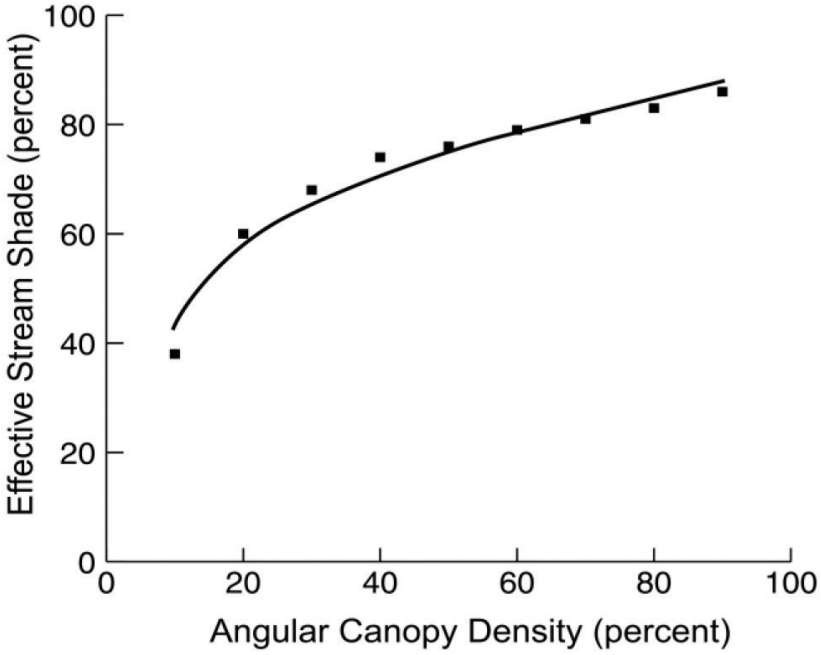
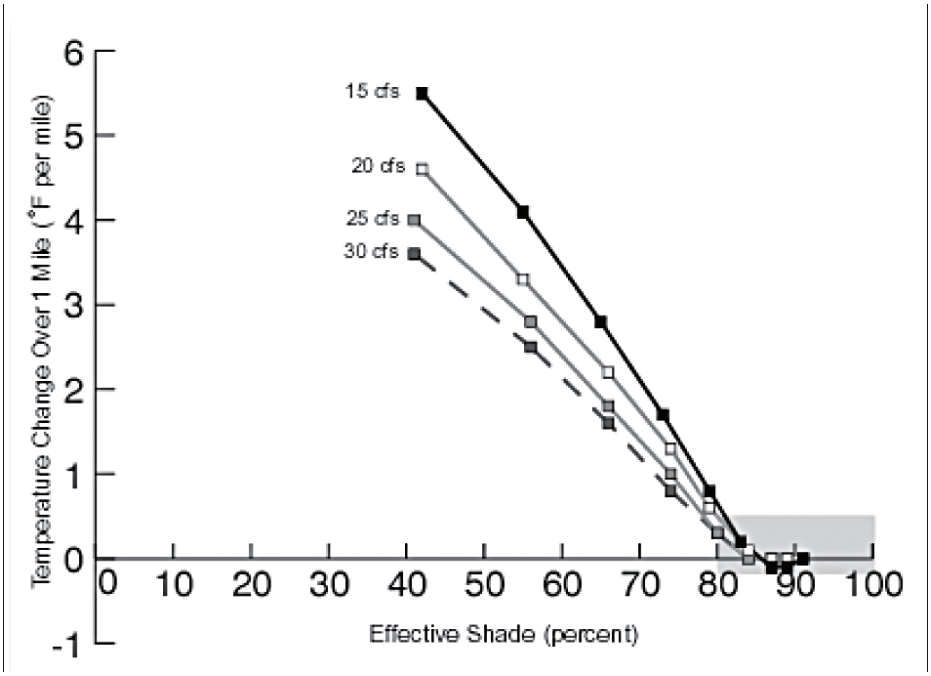


FIGURE 5. EFFECTIVE STREAM SHADE AND CHANGE IN STREAM TEMPERATURE



• For even-aged forest stands with normal stocking, Park (1993) has shown that the width of primary riparian streamside areas will vary as a function of tree height and terrain slope as viewed in **Table 3**. The secondary shade zone is defined as the outer edge of the primary shade zone to 100 feet. There is marginal improvement of angular canopy density past 100 feet width as shown in **Figure 2**.

TABLE 3. PRIMARY SHADE ZONE DISTANCE OF RIPARIAN TREES BASED ON SLOPE AND TREE HEIGHT - WIDTHS MEASURED BY SLOPE DISTANCE

Average Stand Height	Hill Slope < 30% (feet)	Hill Slope 30 - 60% (feet)	Hill Slope > 60% (feet)
< 20 feet	12	14	15
20 to 60 feet	28	33	55
60 to 100 feet	50	55	60
100 to 140 feet	70	75	85

Source: Northwest Forest Plan Temperature Strategies, 2012

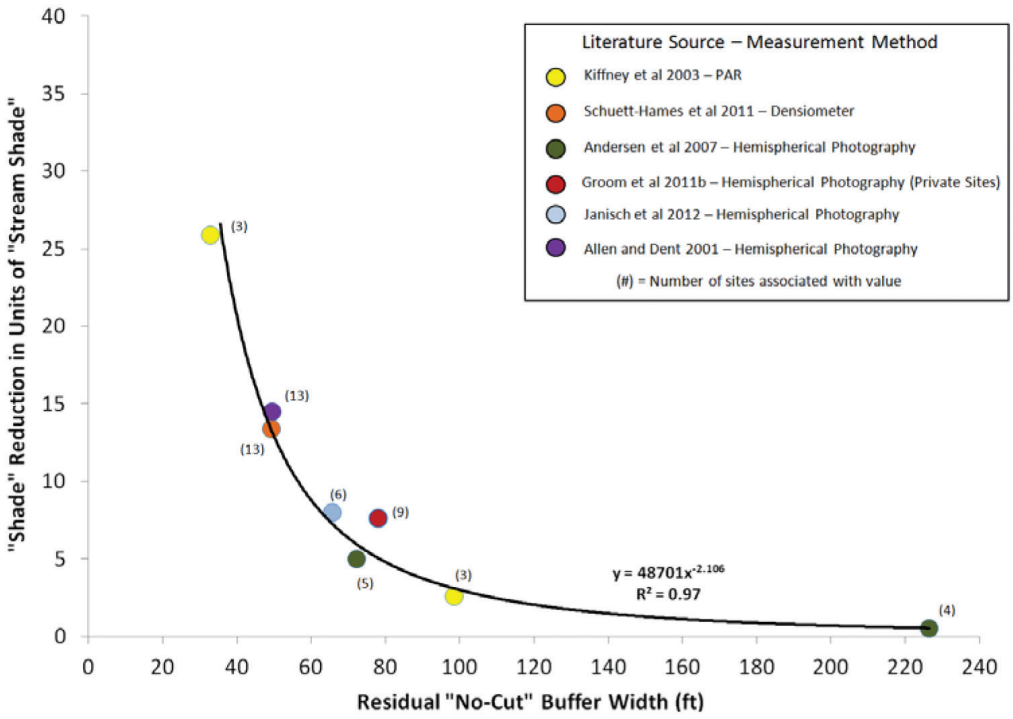
• The analysis will include using **Table 3** to determine the primary shade zone, at an average of 60 feet. The secondary shade zone will be the difference between the primary shade zone and the width of the alternative riparian management area.

Analytical Assumptions for the EPA Methodology

• A study conducted on forests streams in western Oregon (Groom et al. 2011) provides information, to establish a stream shade loss assimilative capacity. Specifically, using a BACI (before-after-control-impact) study on 33 streams exposed to riparian harvest, they observed an increase in stream temperatures pre-harvest to postharvest for sites that exhibited an absolute change in shade of greater than six percent (i.e., shade reducing from 91 percent pre-harvest to 85 percent post-harvest), otherwise the temperature response was variable. The response point of modeling efforts can be set to either (1) a maximum of six units of shade loss or (2) some value less than six units of shade loss. The EPA has proposed to use a maximum value of three units of stream shade loss for the shade loss assimilative capacity, because this adds a margin of safety (EPA 2013).

• A statistical correlation model estimating the association between riparian buffer width reductions resulting from management harvest and resulting stream shade loss is in Figure 6. This correlation model (r2 = 0.97) indicates that shade loss is minimal when the riparian buffer width is 180 ft. to 120 ft., but loss of shade increases dramatically when the buffer is narrowed to less than 100 ft. This indicates that the relatively greater impact riparian vegetation located near the stream has on stream shade conditions, than riparian vegetation located further away. Residual buffer width (X-axis) is defined as the width of the no-harvest riparian buffer left following clear-cut activates, and shade reduction (%; Y-axis) is the amount of shade loss associated with the narrowing of the buffer width due to clearcut harvest activities (e.g., measured 90 percent shade before harvest and 85 percent shade following harvest would be five units of shade loss (90-85=5)).

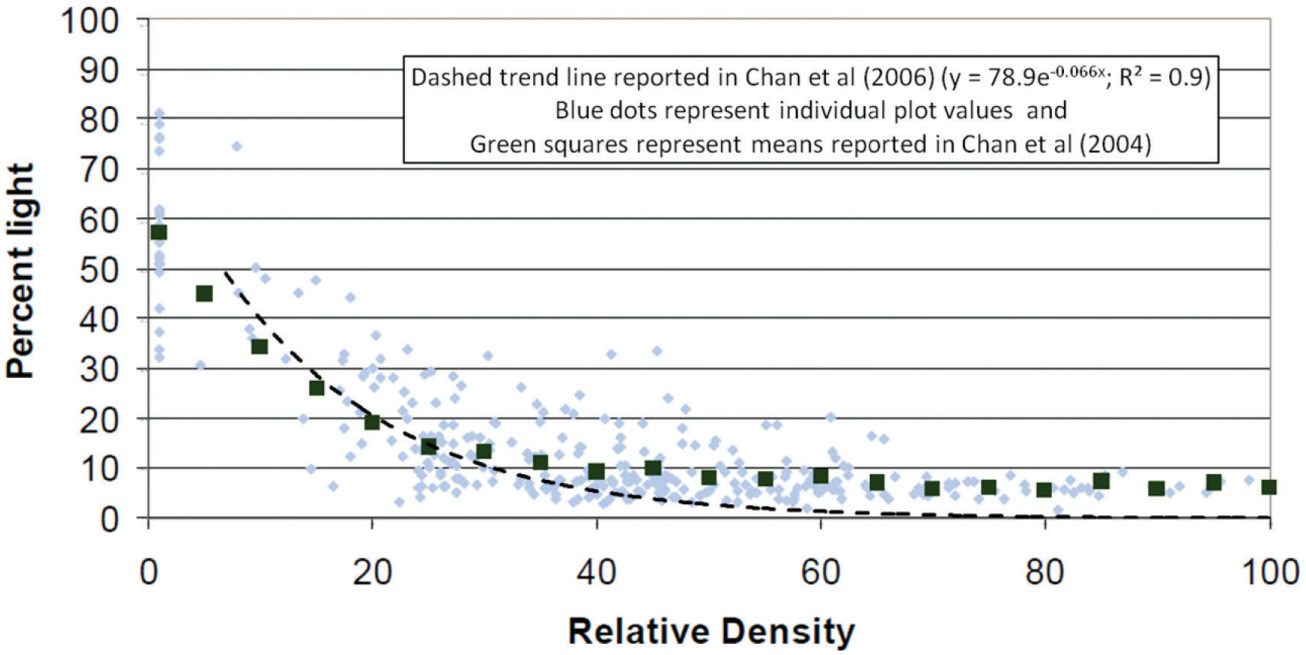
FIGURE 6. MEASURED SHADE LOSS ASSOCIATED WITH VARIOUS "NO-CUT" RIPARIAN BUFFER WIDTHS



• The site-potential tree height of forest trees in the decision area vary generally from 120 to 240 feet. A buffer width of 180 feet, used during the modeling efforts, will provide an average condition response. Although there may be slight effects of using different buffer widths, these effects will be much less than the effects associated with (1) the designation of the inner no-thin buffer width; and (2) the amount of thinning occurring within the outer buffer.

• Field studies have shown that more light penetrates through the stand at lower stocking levels (i.e., residual density levels) as seen in **Figure 7**. However, this relationship is not linear; little change in skylight occurs with changes in residual density within the upper range (i.e., > 40), and large changes of openness occurs with changes in residual density within the lower range (i.e., < 30). Therefore, based on the relationship presented in **Figure 7**, thinning activities are anticipated to increase the amount of light transmitted through the thinned stand, and subsequently increase the amount of stream shade loss.

FIGURE 7. THE ASSOCIATION BETWEEN RELATIVE DENSITY AND PERCENT SKYLIGHT IN FOREST STANDS



• Several inner buffer widths were evaluated with the Oregon Department of Environmental Quality mechanistic shade model: 40, 60, 80, 100, and 120 feet. Tables 4 and 5 show inner buffer widths for a range of alternatives. The 60-foot wide inner no-harvest buffer width scenario results indicate that the shade loss threshold is exceeded for stands with sparse initial stand canopy cover conditions, but it is not exceeded at dense initial stand conditions exposed to light thinning levels. Results indicate that essentially no treatments for the 120-foot inner no-harvest scenario will exceed the shade loss threshold.

TABLE 4. MODELED SHADE LOSS FOR A 180-FOOT WIDE RIPARIAN BUFFER WITH A 60-FOOT INNER NO HARVEST BUFFER AT VARIOUS THINNING INTENSITIES AND INITIAL CANOPY COVER CONDITIONS (EPA 2013)

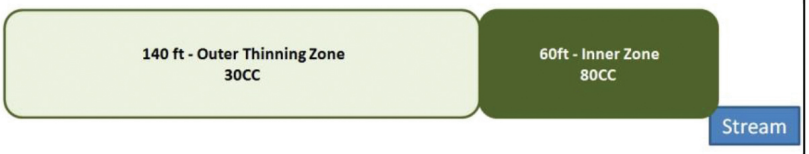
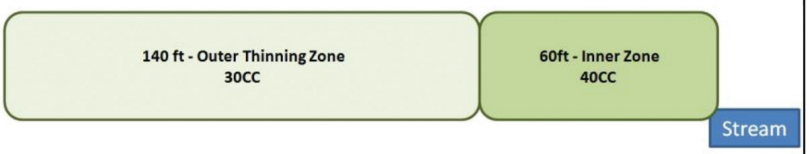
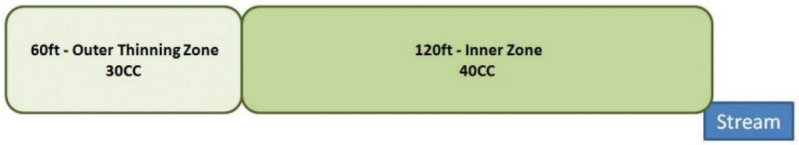
Scenario (Two Sided Treatments)	Stream Aspect			
	North South	NW/SE	East West	Average
Pre-harvest Condition - 80% Canopy Cover				
	1.7	1.6	0.9	1.4
	2.9	2.3	1.3	2.2
	4.5	3.3	1.6	3.1
Pre-harvest Condition - 60% Canopy Cover				
	6.6	6.1	5.6	6.1
	10.1	8.4	6.9	8.4
Pre-harvest Condition - 40% Canopy Cover				
	14.7	13.9	16.2	15.0

TABLE 5. MODELED SHADE LOSS FOR A 180-FOOT WIDE RIPARIAN BUFFER WITH A 120-FOOT INNER NO HARVEST BUFFER AT VARIOUS THINNING INTENSITIES AND INITIAL CANOPY COVER CONDITIONS (EPA 2013)

Scenario (Two Sided Treatments)	Stream Aspect			
	North South	NW/SE	East West	Average
Pre-harvest Condition - 80% Canopy Cover				
	0.1	0.0	0.0	0.0
	0.2	0.1	0.0	0.1
	0.4	0.2	0.0	0.2
Pre-harvest Condition - 60% Canopy Cover				
	0.6	0.4	0.6	0.5
	1.5	0.9	0.6	1.0
Pre-harvest Condition - 40% Canopy Cover				
	2.3	1.8	3.5	2.5

- A description of the Input Parameter Development for the Shade Modeling Effort is provided (EPA 2013).

Analytical Assumptions for the EPA Methodology

The BLM will evaluate effects of the alternatives on stream shading by two different methodologies: Method A, which the BLM has previously used, and Method B, which the EPA has proposed. This use of two methodologies will provide validation of the analytical results.

Method A

Analytical methodology will rely upon previous work in the Final Environmental Impact Statement for the Revision of the Resource Management Plans of the Western Oregon Bureau of Land Management (USDI 2008). This riparian management area strategy includes an inner retention buffer of 60 feet distance and an outer riparian management area of 50 percent canopy closure post-harvest for overstocked stands suitable for thinning along each side of perennial streams. Riparian management strategies in the preliminary alternatives are substantially similar in design to alternatives already analyzed or intermediate between alternatives that had substantially similar effects.

Method B

Step 1 - The EPA-proposed methodology will use the riparian attributes listed in **Table 6**. The analysis is within BLM-administered lands. Spatial GIS analysis will obtain data necessary to inform the EPA shade loss model output **Tables 4 and 5**.6

TABLE 6. RIPARIAN VEGETATION ATTRIBUTES FOR STREAM SHADE (EPA METHODOLOGY)

1. The total width of the riparian buffer management zone, 180 feet
2. The width of the inner no-thin buffer, variable by alternative
3. The density of the vegetation within the inner buffer
4. The pre-harvest vegetation density within the outer thinned buffer
5. The post-harvest vegetation density within the outer buffer

Step 1a- Prepare a total riparian management area width data layer. Buffer the BLM corporate GIS streams data layer to 180 feet along each side of fish-bearing and perennial streams. Determine forest stand canopy cover (%) within the total riparian management area for the No Action alternative and the no-harvest reference analysis time-step projections from the Woodstock model along each side of fish-bearing and perennial streams. Mask and exclude non-forest from the analysis. Overlay and clip the Woodstock model forest stand data layer to the total riparian management area width. Determine an average canopy cover for each HUC 12 (USGS sixth-field Hydrologic Unit Code (HUC 12), 10,000 to 40,000 acres) watershed within the total riparian management area, repeat for each time step, using the no-harvest reference analysis from the Woodstock model.

Step 1b - Prepare an outer riparian management area width data layer. This width is 180 feet distance minus the width of the inner buffer along each side of the riparian management area for each alternative. Repeat Step 1a, except the outer riparian management area becomes the GIS spatial clip cover for the Woodstock model.

Step 2 - From Step 1a, save the No Action and no-harvest reference timeframes projections canopy cover (%) for each HUC 12 watershed into: ≥ 80 percent canopy cover, ≥60 percent canopy cover, and ≥40 percent canopy cover.

Step 3 - From Step 1b, save each alternative canopy cover for each HUC 12 watershed for each alternative scenario and time step for the outer riparian management area along each side of streams. Save categories are ≥30 percent canopy cover, ≥50 percent canopy cover, and ≥70 percent canopy cover.

Step 4 - Using the EPA shade model output shade-loss screens, (1) determine how many HUC 12 watersheds exceed the EPA-recommended threshold for an alternative, and (2) determine how many fish-bearing and perennial stream miles exceed the EPA-recommended threshold for an alternative.

Analytical Conditions

Method A

• Compare the degree that each alternatives riparian management area is substantially similar to an inner retention buffer of 60 feet distance and an outer riparian management area of 50 percent canopy closure. Tabulate the miles of stream not substantially similar.

Method B

• Proportion of HUC 12 watersheds as a percent of total HUC 12 watersheds, involving riparian management areas along each side of fish-bearing and perennial streams for the alternatives and time periods, passing EPA shade loss screens using the results from Step 4, where ≤ 3 units of shade loss (%).

• Proportion of total miles of fish-bearing and perennial streams as a percent of total miles of fish-bearing and perennial streams for the alternatives and timeframes, passing EPA shade loss screens using the results from Step 4, where ≤ 3 units of shade loss (%).

Data Needs

• Selected BLM GIS corporate base layers identified in the steps

• Woodstock model forest stand data with attributes for each alternative

• EPA modeled shade loss tables

Geographic Scale

• The decision area

Data Display

• Method A - Populate tables.

• Method B - Provide data to populate **Table 7** and **Table 8**.

TABLE 7. EPA-OUTPUT SAMPLE TABLE 1 WITH EXAMPLE DATA

HUC 12 Watershed Name and Number	Alternative	Pre-treatment Canopy Cover (%)	Inner RMA Width (ft)	Outer RMA Width (ft)	Inner RMA Canopy Cover (%)	Post-Treatment Outer RMA Canopy Cover (%)	EPA Shade Loss Screen Tables 4 and 5 (Above/Below Threshold)
Big Creek 171003030506	*Current Condition*	81	-	-	90	90	B
	No Action						
	2014	91	-	-	91	91	B
	2024	93	-	-	93	93	B
	2044	95	-	-	95	95	B
	Alternative 1						
	2014	81	60	120	81	30	A
	2024	83	60	120	83	50	B
	2044	85	60	120	85	65	B
	Alternative 2						
	2014	81	120	60	81	30	B
	2024	83	120	60	83	45	B
	2044	85	120	60	85	60	B

TABLE 8. EPA SAMPLE TABLE 2 WITH EXAMPLE DATA

Alternative	HUC 12 Watersheds Above EPA Shade Loss Screen (%)	Fish-bearing and Perennial Streams Above EPA Shade Loss Screen (% of total miles)
Current Condition	96	97
No Action		
2014	96	97
2024	96	98
2044	99	99
Alternative 1		
2014	91	93
2024	95	97
2044	96	97
Alternative 2		
2014		
2024		
2044		

Issue 2

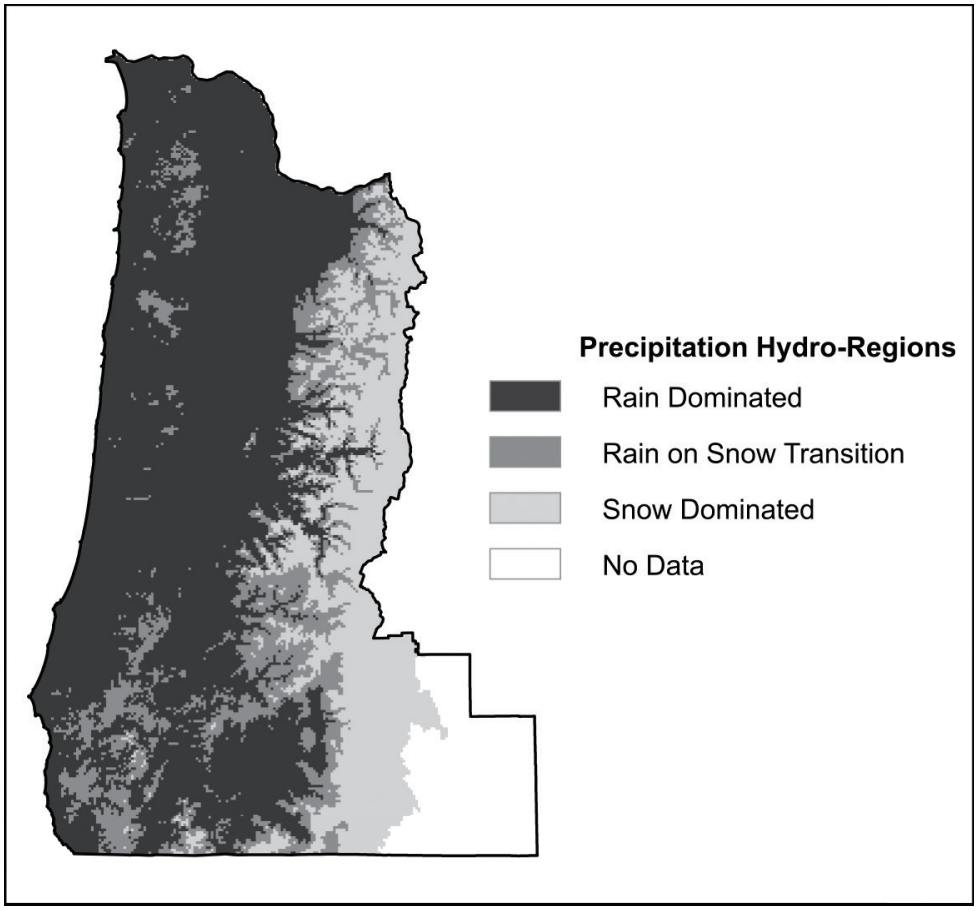
How does timber harvest affect peak flow estimates, under the alternatives, that exceed detection limits within the rain-on-snow dominated hydro-region?

Analytical Assumptions

• Hydro-regions are a physical classification of landscapes based on the form of precipitation with elevation, as predominantly rain, rain-on-snow (or transient snow zone), or snow, as shown in Figure 8 (Precipitation hydro-regions). The rain hydro-region is below approximately 2000 feet in the Coast Range and 1200-3600 feet along the western Cascades from north to south. Rain-on-snow transition areas where shallow snow accumulations can come and go have been reported by Harr (1981) and Harr and Coffin (1992) to be in the elevation range of 1200-3600 feet in western Oregon and from 2500 to 5000 feet in the southern Oregon Cascades (Lindell, pers.com.). The snow hydro-region is generally above 3600 feet and it is centered along the Cascades crest. The BLM will use in this current planning effort, the hydro-region GIS data layer that the BLM developed for the 2008 RMP/EIS (USDI 2008), and classification scheme, following the guidelines noted above, without modification.

• To evaluate the effects of timber harvest upon peak flows and channel response, Grant et al. (2008) prepared a state-of-the-science review of hydrologic studies in the Pacific Northwest, and developed response curves for rain, rain-on-snow, and snow hydro-regions. This information provides a basis for this evaluation criterion, and the BLM will use it to evaluate the No Action and action alternatives, in the rain-on-snow hydro-region. We present rationale why this screening process, to determine the risk of peak flow enhancement, is not applicable in the other hydro-regions.

FIGURE 8. PRECIPITATION HYDRO-REGIONS

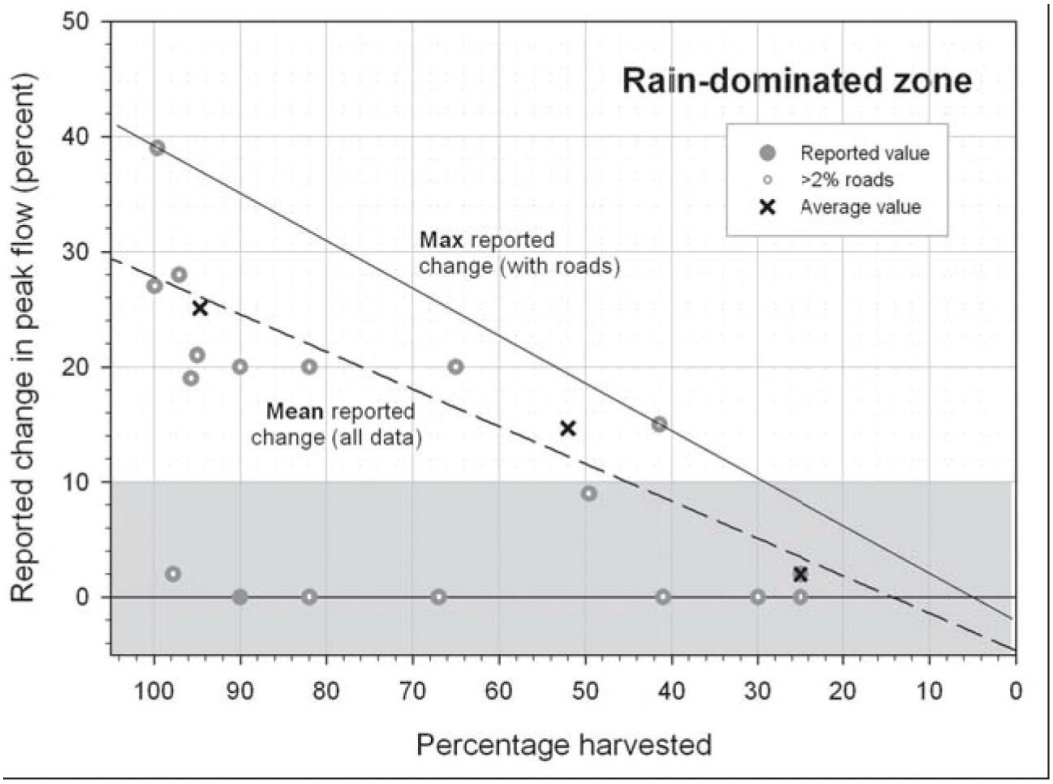


• The subwatershed level (HUC 12) was chosen for the analysis, because it better captures the BLM forested land pattern at closer to a site scale. The HUC 12 watersheds are at a scale that can be compared with Grant et al. (2008) response curves that were developed from small-instrumented watersheds, and will be used as a basis in this procedure. Additionally, smaller watersheds are more sensitive to vegetation and runoff-related changes.

• Within the rain-dominated hydro-region, patch size, stand age, or arrangement is not a factor in explaining greater flow volume or differences in timing, compared to the rain-on-snow hydro-region (Harr and Coffin 1992). Where variable reductions in basal area occur by thinning or partial cuts, the inter-relationships of forest tree size, stocking, distribution and age affect leaf area and evapotranspiration, but the effect on peak flow increase is less clear (Grant et al. 2008). Ziemer (1981; 1998) found a non-statistical increase (four percent) in peak flow for 80-year-old conifer stands that were harvested where 50 percent of the basal area was retained.

• The response curves in Grant et al. (2008) in the rain-dominated hydro-region show that the mean response for watershed area harvested with roads for a reported change in peak flows was 46 percent. Figure 9 shows this. The findings also show that at less than 29 percent of a watershed harvested, there is no data supporting an increasing in peak flows; and further that the first report value occurs at 40 percent. The 2008 RMP/EIS (USDI 2008) hydrologic analysis found; when using this peak flow response envelope at 45 percent for the rain-dominated hydro-region, only two HUC 12 watersheds were susceptible under any alternative and in any analysis year. Further, the two susceptible HUC 12 watersheds were either recently burned in a wildfire or were primarily an oak-savannah community type that should have represented natural conditions and not forest harvest. Based on the available synthesis of studies including the peak flow response curve for the rain-dominated hydro-region and findings from the 2008 RMP/EIS (USDI 2008), it is highly probable that a peak flow response cannot be demonstrated in this region. Therefore, the BLM will not analyze in detail the effect of timber harvest on peak flow estimates in the rain-dominated hydro-region.

FIGURE 9. PEAK FLOW RESPONSE TO HARVEST IN THE RAIN-DOMINATED HYDRO-REGION



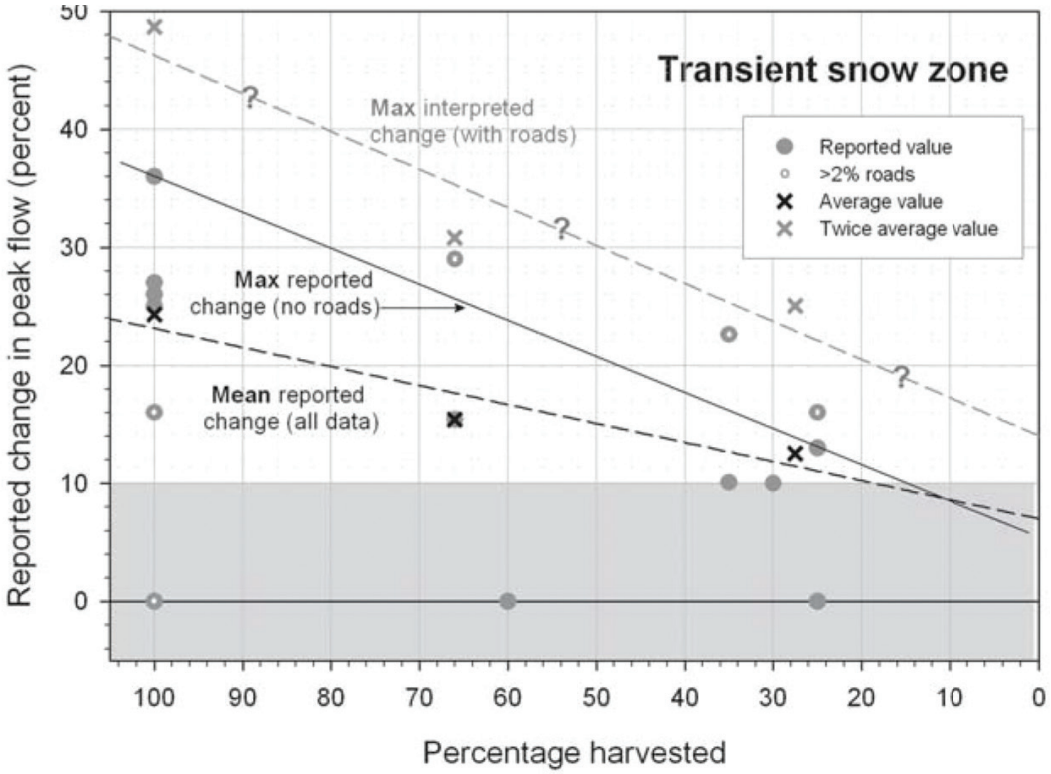
From Grant et. al 2008, used by permission. Solid line represents maximum values reported and includes the influence of roads. Dashed line is a linear fit through the average values and represents the mean reported change for all data. Gray shading around zero indicates limit of detection (+/- 10 percent). Note: the mean line is biased toward higher values as reported zero values are not included in the calculation.

• In the rain-on-snow hydro-region, forest openings commonly receive greater snow accumulation (two to three times more snow water equivalent) than adjacent forests (Harr and Coffin 1992). These openings also receive greater wind speeds and twice the amount of heat during rain-on-snow events, which provides greater melt, compared to the mature forest (Harr 1981; Harr and Coffin 1992; Storck 1997). Regeneration harvest will provide additional melt contributions under rain-on-snow conditions (Harr 1981; Storck 1997).

• Elevated peak flow that can be measured in a managed experimental watershed, when a rain-on-snow event occurs, corresponds with a streamflow return period of two to eight to years where pre-logging and post-logging regressions were significantly different (Harr and Coffin 1992), and one to six years as reported by Grant et al. (2008).

• Response curves for the rain-on-snow hydro-region developed by Grant et al. (2008), as viewed in **Figure 10** indicate that a mean of 20 percent of a watershed area with roads would need to be harvested to detect a change in peak flow response.

FIGURE 10. PEAK FLOW RESPONSE TO HARVEST IN THE RAIN-ON-SNOW HYDRO-REGION



From Grant et. al 2008, used by permission. Solid line represents maximum values reported for basins without roads. Dashed black line is a linear fit through average values and represents the mean reported change for all data. Dashed gray line represents interpreted change with roads and is a linear fit through a doubling of the average values. Gray shading around zero indicates limit of detection (+/- 10 percent). Note: the mean line is biased toward higher values as reported zero values are not included in the calculation.

• In the snow hydro-region, winter mean daily temperatures are too cold to initiate significant melt in forest openings. Therefore, the BLM will not analyze in detail the effect of timber harvest on peak flow estimates in the snow hydro-region.

Analytical Methods and Techniques

Step 1 - Identify rain-on-snow HUC 12 watersheds from the 2008 RMP/EIS (USDI 2008).

Step 2 - On BLM-administered lands within rain-on-snow watersheds, identify areas in early successional forest using early successional without legacies structural stage and non-forest from Woodstock vegetation modeling under each alternative over time.

Step 3 - On non-BLM-administered lands within rain-on-snow watersheds, identify areas in early successional forest (i.e., canopy cover ≤ 30 percent and forest height ≤ 20 feet) and non-forest using the IMAP – LEMMA (Interagency Mapping and Assessment Project – Landscape Ecology, Modeling, Mapping and Analysis) project (USDA, OSU 2012) forest vegetation classified satellite imagery, as a 30-meter cell raster file for the planning area.

Step 4 - For each rain-on-snow watershed, calculate the total acres of early successional for all ownerships as a percentage of the total forested acres in the watershed (total acres minus non-forest acres).

Analytical Conclusions

• Compare to the envelope response curve for the rain-on-snow hydro-region (Grant et al. 1998), and record any rain-on-snow HUC 12 watershed surpassing the 20 percent forest harvest level for the No Action and action alternatives

Data Needs

• Hydro-region GIS data layer from 2008 RMP/EIS (USDI 2008)

• IMAP – LEMMA Project classified forest vegetation satellite imagery for the planning area

• Various GIS corporate base layers identified in the steps

• Woodstock early successional forest vegetation > 10 acres

Geographic Scale

• The decision area

Data Display

- Figure of hydro-regions for the plan area
- Figure showing rain-on-snow watersheds exceeding 20 percent harvested or open area, for the No Action and each action alternative by time period
- Provide data to populate **Table 9** for those rain-on-snow HUC 12 watersheds exceeding 20 percent forest harvest for all ownerships

TABLE 9. RAIN-ON-SNOW WATERSHEDS EXCEEDING 20 PERCENT HARVESTED OR OPEN AREA FOR EACH ALTERNATIVE BY ANALYSIS YEAR (EXAMPLE DATA)

HUC 12 Watershed Name and Number	Alternative	Watershed Forest Harvest (> 20%)	BLM-administered Lands and Alternative Forest Harvest	Other Ownerships Forest Harvest
Big Creek 171003030506	*Current Condition*	22%	7%	15%
	No Action			
	2014			
	2024			
	2044			
	Alternative 1			
	2014			
	2024			
	2044			
	Alternative 2			
	2014			
	2024			
	2044			

Issue 3

How does the relative landslide density that would deliver to stream channels vary under the alternatives and between analysis years within the harvest land base and all BLM-administered lands?

Analytical Assumptions

- Process uses concepts described in "Effects of forest cover, topography, and sampling extent on the measured density of shallow, translational landslides" (Miller and Burnett 2007a).
- Shallow translational landslide initiation, although infrequent, normally require some combination of steep and convergent slopes, shallow soils overlying semi-impervious bedrock, and heavy or prolonged precipitation Area roads and minimal forest cover can elevate susceptibility to landsliding. Extreme storms are highly correlated with increased rates of landsliding on susceptible sites. The 1996 storms in western Oregon fit the extreme category, with recurrence intervals of generally 50->100 years depending on location. Modeling used digital elevation models, topographic variables; roads and forest cover attributes that were calibrated with photography and ground-based landslide inventories, to produce estimates of shallow, translational landslide density (number/unit area). Landslide inventories included the Coast Range, Cascades, and Klamath-Siskiyou provinces (Miller and Burnett 2007a).

• Computer program scripts will be used as developed by Miller and Burnett (2007a) to analyze the differences in relative landslide density. Since it is not known when the few large storms occur, a relative landslide density is determined, based on the observed locations of shallow landslides from extreme storms.

Analytical Methodology and Techniques

Step 1 - A topographic weighting term using ground slope and the degree of convergence will be used, which varies spatially to reflect local topographic influences on landslide locations. Topographic weighting functions are calibrated to landslide inventories for the Coast, Cascades, and Klamath Provinces.

Landslide density, from the effect of vegetative cover, will be calculated using the calibration dataset in **Table 10** *(1996 Siuslaw National Forest extreme storms)*.

TABLE 10. 1996 SIUSLAW NATIONAL FOREST EXTREME STORMS

Forest Age Class, years	Landslide Density, number/mi^2
0-9	21.76
10 -100	8.03
>100	6.47

Roadmask files, 164 feet in width, will be created to indicate proximity to roads. The landslide density for any digital elevation model (DEM) cell within the road mask is multiplied by a factor of 2.2 (Miller and Burnett 2007b).

Step 2 - Report the results for all alternatives for the timeframes

- Report relative landslide density for those susceptible areas that could deliver to stream channels, based on the model calibration described in Miller and Burnett (2007b). All stream reaches will be included up to 12 percent gradient.
- Report results by the Oregon Coast Province, Cascades Province, and Klamath Province. Include the Willamette Province and Klamath Falls Field Office portion of the Basin and Range Province as the Cascades Province for reporting.
- Within provinces, categorize and report on the BLM land base as harvest land base, non-forest, riparian management area, and late-successional management area.
- Report as relative landslide density the numbers of landslides.
- Report the relative landslide densities as weighted averages.

Analytical Conclusions

- Compare the results for each alternative and each time period by province in the harvest land base
- Compare the results for each alternative and each time period for all BLM-administered lands

Data Needs

- GIS topography DEM's for the decision area
- GIS BLM roads data layer for the decision area
- GIS BLM forest inventory vegetation data layer
- BLM Options model structural stages by alternative and years, to partition in forest age classes as shown in a table

Geographic Scale

- The decision area

Data Display

- Show two comparison figures for the Oregon Coast, Cascades, and Klamath Provinces, displaying how the relative landslide density varies over time under the alternatives. Figures will show the harvest land base and all BLM-administered lands (including non-forest, late-successional management area, riparian management area, and the harvest land base). For each figure, show the units of time along the X-axis, and relative landslide density as numbers per square mile along the Y-axis.

Issue 4

How does the pattern and intensity of new BLM road construction, under the alternatives, create disturbance and sources of fine sediment that may deliver to stream channels?

Analytical Assumptions

- This analysis is based on use of a reference road. The analytical technique is an empirical approach patterned from the Washington Road Surface Erosion Model (WARSEM) Manual (Dube et al. 2004). The WARSEM methodology interface with BLM spatial GIS data layers to derive estimates of annual long-term sediment production. The analysis is a screening process to compare and contrast alternatives for existing roads and the expected proportion of new roads.

- Sediment delivery from roads can result from surface erosion, gullying and mass wasting. Occurrences of landslides and gullies are restricted to limited areas on steep slopes, while surface erosion occurs to varying degrees along all roads. Due to limitations of model capability and geospatial processing across the large planning area, this methodology is restricted to surface erosion from roads.

- The WARSEM model characteristics are the reference road in this analytical procedure. The reference road will use the following assumptions: An in-sloped road with a ditch; moderate traffic (pickups, sedans, and haul trucks <50 percent of the time); cut-slope gradient 1:1 (horizontal to vertical) and fill-slope gradient 1.5:1; initial ground cover density of 0 on cut and fill slopes; sustained grade of five to seven percent; and an average cross-drain spacing of 500 feet.

- Proportions of the total long-term average road erosion rates attributed to the components of the standard road prism (Swift 1984, Burroughs and King 1989, Sullivan and Duncan 1980, Megahan unpub.) are:

- Road Tread - 40 percent

- Cutslope and Ditch - 40 percent

- Fillslope - 20 percent

- Roads differ in their inherent erodibility, or erosion potential, due to the geology or parent material on which they are constructed as seen in **Table 11**. Sediment yields from older roads with undisturbed ditches are much smaller than sediment yields from newer roads or roads with disturbed ditches. Maintenance of ditch lines can increase sediment yields.

TABLE 11. BASIC EROSION RATES IN TONS/ACRE OF ROAD PRISM/YEAR

Basic Erosion Rates			
General Category	Geologic Parent Material	Road Age	
		New: 0-2 years	Old: > 2 years
High	Mica Schist Volcanic Ash Highly Weathered Sedimentary	110	60
High/Moderate	Quartzite Course-grained Granite	110	30
Moderate	Fine-grained Granite Moderately Weathered Rock Sedimentary Rock	60	30
Low	Competent Granite Basalt Metamorphic Rock Relatively Un-Weathered Rock	20	10

• Vegetative cover and surface roughness on cut and fills slopes decreases the basic erosion rate for road erodibility. **Table 12** shows reduction factors from the basic erosion rate.

TABLE 12. GROUNDCOVER CORRECTION FACTOR FOR CUT AND FILL SLOPES

Ground Cover Density Factor	Factor
>80%	0.18
50%	0.37
30%	0.53
20%	0.63
10%	0.77
0%	1.00

• Road tread surfacing decreases the basic erosion rate for road erodibility. **Table 13** shows reduction factors based on types of surfacing.

TABLE 13. FACTORS FOR ROAD TREAD SURFACING

Surfacing Material	Factor
Paved	0.03
Gravel, greater than 6 inches deep	0.2
Native soil/rock	1.0

- Road traffic and wet weather haul on natural surface and gravel roads increases the basic erosion rate for road erodibility. **Table 14** shows erodibility increase factors based on precipitation bands and traffic level.

TABLE 14. TRAFFIC AND PRECIPITATION FACTORS

Traffic Use/ Road Category	Annual Precipitation		
	< 47 inches	47 inches – 118 inches	118+ inches
Heavy Traffic/Active Mainline	20	50	120
Moderate Traffic/Active Secondary	2	4	10
Light Traffic/Non Active	1	1	1

Sediment Delivery

- The road drainage system design effects sediment delivery to streams, which includes the road prism shape, proximity of the road to the stream channel, and length of road draining directly into a stream at crossings.

- Sediment delivery to streams by road segment; a road segment does not deliver if the road does not cross a stream channel.

- Sediment delivery to streams by ditches; there will be 100 percent delivery of sediment to streams from the road prism and cutslope before application of factors.

- Sediment delivery to streams by diffuse sources; there will be 10 percent delivery of sediment to streams from the fill slope before application of factors.

- Best Management Practices can substantially reduce sediment delivery from roads.

Sediment Delivery Distance

- Roads near ridges have little direct effect on sediment delivery to streams. Generalized distances for sediment filtration effectiveness occur much sooner (25-100 feet) for diffuse sources of sediment delivery compared to concentrated sources (200 feet), such as road ditch lines draining into the riparian area (CH2MHill 1999).

- Wemple (1998, cited in Jones et al. 2000) found that road segments that have stream connection pathways such as roadside ditches have potential to deliver surface eroded sediment to streams. Road segments not connected to streams by ditch lines or gullies or having more than 25 to 100 feet of filtering forest floor duff and vegetation (depending on slope, soil properties, and surface roughness) between them and a stream are usually not at risk of delivering sediment to streams.

• Below culverts, sediment travel distance in streams decreases with increasing roughness, such as debris and obstructions (Brake et al. 1997).

• The analysis area for concentrated and diffuse sources of sediment delivery will be restricted to within 200 feet of stream channels based on studies of travel distances of sediment downslope of culvert outfalls (Swift 1986; Megahan and Ketcheson 1996; Brake et al.1997). Sediment delivery depends upon water flow volume, slope gradient, and roughness from surfacing, rock content, vegetation and debris or obstructions. Although reported sediment delivery distances vary from 30-550 feet, the tendency is no more than 150 feet in almost all cases. Further, sediment delivery decreases with distance. Megahan and Ketcheson (1996) show that only about 17 percent of the total volume of sediment travels beyond 50 percent of the total travel distance.

Road Traffic

• Frequent heavy truck traffic can grind resistant road surfacing such as gravels into smaller particles that can wash into ditch lines during rainstorms. Material type, and traffic level and rate determine the quantity of sediment available for transport, and the rainfall determines the transport capacity (Reid and Dunne 1984).

• The BLM developed road ratios for the 2008 RMP/EIS (2008) 10-Year Scenario. The 10-Year Scenario was a spatial representation of proposed timber harvest locations, based upon district planners' assessments of road and logging feasibility from Options timber model outputs. Generally, less miles of new road construction are required for regeneration harvest on a timber volume basis (MMbf) and more miles of new road construction are required for thinning or density management. Road ratios will be constructed by district, by road type, by surface type, and by harvest type (See Roads Planning Criteria for more information). Road improvement miles will be added to new permanent construction by harvest type, since the majority of improvement is rocking natural-surfaced roads, where the disturbance is similar to new construction.

Analytical Methods and Techniques

Step 1 - Refer to Steps 1-12 in the 2008 RMP/EIS (2008; Appendix I Water pp. 239-240) for methodology that calculates miles of existing and new permanent BLM road construction by surface type within a 200-foot sediment delivery distance to streams, using selected Washington Road Surface Erosion Model (WARSEM) parameters (formally DNR Reference Road model) and the 2008 RMP/EIS (USDI 2008) 10-Year Scenario.

Step 2 - Using road ratios from the Roads Planning Criteria (Tables 28-31), determine miles of new permanent road construction for natural and aggregate surfaced road by forest treatment type, and projected timber volume by alternative and time period. Populate **Table 15** for each alternative and time period with probable road miles by road surface type. Road ratio road miles per MMbf will be averaged for all districts by harvest type and road surface type. Miles of road improvement will be summed with harvest type and road surface type in the construction of the road ratios.

TABLE 15. NEW BLM PERMANENT ROAD CONSTRUCTION BY FOREST TREATMENT TYPE AND TIMBER VOLUME

Forest Treatment type	Road Ratio	No Action			Alternative I			Alternative II		
	Road Miles per MMbf	Road Miles (MMbf × Road Ratios)			Road Miles (MMbf × Road Ratios)			Road Miles (MMbf × Road Ratios)		
		2025	2035	2055	2025	2035	2055	2025	2035	2055
Regeneration Harvest	Natural									
	Aggregate									
Thinning	Natural									
	Aggregate									

Step 3 - **Table 16** (BLM roads within fine sediment delivery distance by surface type), represents the proportion of new permanent roads by alternative that are projected to be within a sediment delivery distance (within 200 feet of streams – from *Step 1*). Multiply road miles for the road surface types, alternatives, and timeframes in *Step 2* by the sediment delivery ratios in **Table 17**.

TABLE 16. BLM ROADS WITHIN FINE SEDIMENT DELIVERY DISTANCE BY SURFACE TYPE

BLM Road Surface Type	Permanent BLM roads within Fine Sediment Delivery Distance	Sediment Delivery Ratio (Sediment Delivery Buffer road miles/14330 total miles)*
Natural	1,738	0.12128
Aggregate	2,590	0.18073
Paved	767	0.05352
Totals	**5,096**	**0.35561**

*Total BLM permanent roads of any surface type - 14,330 miles. 14,273 in 2008 RMP/FEIS

TABLE 17. BLM ROAD MILES WITHIN SEDIMENT DELIVERY DISTANCE BY ALTERNATIVE

Forest Treatment Type	Sediment Delivery Road Ratio (SDR)	No Action			Alternative I			Alternative II		
		Road Miles (SDR × Road Miles) Step 2			Road Miles (SDR × Road Miles) Step 2			Road Miles (SDR × Road Miles) Step 2		
		2025	2035	2055	2025	2035	2055	2025	2035	2055
Regeneration Harvest	Natural 0.12128									
	Aggregate 0.18073									
Thinning	Natural 0.12128									
	Aggregate 0.18073									

Step 4 - Using results from **Table 17** in *Step 3*, calculate potential sediment delivery (tons/year), by alternative, road surface type, and time period. Populate **Table 18**. Calculate total potential fine sediment delivery by alternative by timeframe.

TABLE 18. POTENTIAL FINE SEDIMENT DELIVERY IN TONS/YEAR

Forest Treatment Type	Potential Fine Sediment Delivery	No Action			Alternative I			Alternative II		
		Road miles (SD × SDR road miles) Step 3			Road miles (SD × SDR road miles) Step 3			Road miles (SD × SDR road miles) Step 3		
		2025	2035	2055	2025	2035	2055	2025	2035	2055
Regeneration Harvest	Natural: 28.1									
	Aggregate: 23									
Thinning	Natural: 28.1									
	Aggregate: 23									
	Total Tons/year									

Analytical Conclusions

• An estimate of potential fine sediment delivery (tons/year) from new permanent roads by alternative and projection time period is calculated. The information is compared to the existing permanent roads baseline condition. The magnitude of potential change in sediment delivery can be shown. The relative difference between the alternatives by harvest type, road density, and surface type of roads, leading to differences in sediment delivery may be apparent.

Data Needs

• MMbf of planned timber harvest by district, alternative, and harvest type

• Lands and realty roads planning criteria: by alternative and projection timeframe - miles of new permanent road construction/MMbf by district, road type, surface type, and harvest type

Geographic Scale

• The decision area

Data Display

• Show change in potential fine sediment delivery from roads compared to the existing condition potential fine sediment delivery. Data could be shown in table or in a chart. Repeat the summary information for each alternative projection timeframe.

TABLE 19. EXAMPLE TABLE

BLM Road Surface Type	Existing Permanent Roads Within Fine Sediment Delivery Distance (miles)[1]	Potential Fine Sediment Delivery (tons/year)[1]	No Action tons/year % change		Alternative I tons/year % change		Alternative II tons/year % change	
Natural	1,738	23,050						
Aggregate	2,590	28,938						
Paved	767	8,277						
Totals	**5,096**	**60,265**						

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Invasive Species

Analytical Assumptions Common to All Invasive Species Analyses

- All invasive species have unique strategies for spread and resistance to certain treatment methods. Factors that influence the spread of invasive species include proximity to existing infestations, quality of potential habitat to invade, environmental conditions, speed of discovery and management following introduction, and new introductions over time. Attempting to calculate the spread of all invasive species known within the planning area that are operating independently under a wide variety of environmental conditions is not feasible.

- BLM specialists can characterize the condition of invasive species occurrences on BLM-administered lands in western Oregon by analyzing a few invasive species.

- For the purpose of the invasive species analysis, the geographic area containing an aquatic ecosystem and adjacent areas that directly affect it define riparian areas. This includes floodplains, woodlands, and all areas within a horizontal distance of approximately 100 feet from the normal line of high water of a stream channel or from the shoreline of a standing body of water (USDI 2008).

- The amount of human activity in riparian areas resulting from the implementation of an alternative has a strong correlation with the expected amount of invasive species introduction and spread.

- Alternatives resulting in higher levels of disturbance in and near riparian habitats are more likely to generate riparian infestations than those further removed from riparian habitats.

- More visitors and activities are in the riparian areas within Special Recreation Management Areas than in Extensive Recreation Management Areas or areas not managed for recreation. The least amount of visitors and associated riparian area activities are in the areas not managed for recreation.

- People inadvertently introduce and spread infestations more readily in areas where there is more human activity, such as in wildland urban interface and high recreational use areas.

- Road construction and associated activities in riparian management areas are proportional to the total amount of road construction and associated activities in all land use allocations.

- Disturbance activities located throughout a watershed are more likely to spread invasive species more broadly through the watershed via transportation corridors and stream systems than geographically concentrated disturbance activities.

Issue 1

How would each alternative affect invasive plant introduction and spread?

Analytical Assumptions

• District invasive plant specialists have documented more than 130 invasive plant species within the western Oregon BLM districts.

• The following representative sample of invasive species is used to describe the presence of invasive plants on BLM-administered lands in western Oregon:

- Yellow starthistle
- Knotweeds
- False brome
- Spotted and diffuse knapweeds
- Meadow knapweed
- Scotch and French brooms
- Dyer's woad
- Canada thistle

• Geographic areas that serve as the primary source locations for invasive plants include roads and other travel ways, high recreation use areas, urban areas, and gravel sources.

• The amount of soil disturbance and increase in light conditions resulting from the implementation of an alternative has a strong correlation with the expected opportunity for invasive plant species introduction and spread.

• Most ground-disturbing activities in the planning area are associated with recreational activities, timber harvest and road management.

• Grazing creates ground disturbance.

• There is a gradient of invasive plant introduction opportunities between the different timber harvest methods and intensities. Regeneration harvest activities create higher light levels than density management, commercial thinning, and uneven-aged timber harvest activities. Commercial thinning and uneven-aged timber harvests result in lower light levels than density management harvests.

• Areas designated open to off-highway vehicle use are more likely to have new invasive plant species introductions and more spread than areas designated limited or closed. Areas designated as closed to off-highway vehicle use are least likely to have new introductions and spread of invasive plants associated with off-highway vehicle use.

• Invasive plant infestations associated with streams tend to spread downstream over time as currents carry seeds and vegetative propagules (such as a cutting, seeds, or spores) downstream. Wind and tides carry some infestations upstream in coastal areas.

• Infestations associated with roads and trails tend to spread along those corridors.

• Road management activities involving disturbance to soil and increased light levels contribute to the spread of invasive plant species. These kinds of activities include road construction, weather proofing, ripping, pulling and replacing culverts, cleaning ditches and like activities.

• Infestation spread is likely to be more severe in watersheds where disturbance activities are well distributed.

• Post-timber harvest light levels in areas within 100 feet of the harvest unit's edge would be higher than pre-harvest light levels.

• Post-timber harvest light levels in areas more than 100 feet from the harvest unit's edge would not change because of the timber harvest.

Analytical Methods and Techniques

Step 1- Determine the current invasive plant species distribution category at the fifth-field watershed level:

- GIS specialists will pool representative invasive species occurrence data from BLM corporate sources and iMapInvasives (TNC 2013). The Oregon Biodiversity Information Center works with collaborators to support the Oregon iMapInvasives site, an online, GIS-based invasive species information tool that is the preferred data source for invasive species occurrences on non-BLM ownerships in Oregon.

- BLM's GIS staff will evaluate the collective pool of reported sites to determine representative invasive plant presence for each square mile in a grid applied to the planning area.

- Invasive plant species distribution categories of abundant, limited, and low will be based on the known representative species' distribution in the fifth-field watersheds:

  - Abundant - the representative invasive plant species reported from more than 25 percent of the square miles within the fifth-field watershed.

  - Limited - the representative invasive plant species reported from more than one percent and less than 25 percent of the square miles within the fifth-field watershed.

  - Low - the representative invasive plant species reported in no more than one percent of the square miles in the fifth-field watershed.

Step 2 - Determine the relative risk of introducing invasive plant species into fifth-field watersheds over the first 10 years of plan implementation as an inadvertent result of timber harvest activities for each alternative.

Step 2a - Assign weights of 1 or 5 to the three timber harvest types based on their respective post-harvest light levels. Assign a weight of 5 to regeneration harvests. Assign a weight of 1 to commercial thinning and uneven-aged management activities.

Step 2b - Assign weights of 1, 3, and 5 to logging methods based on their respective levels of soil disturbance. Aerial harvests will be assigned a weight of 1, cable yarding systems will be assigned a weight of 3, and ground-based methods a weight of 5.

Step 2c - Calculate a combined timber harvest activity weighted value by multiplying the weights from *Steps 2a and 2b*.

Step 2d - Generate a set of values to describe the level of susceptibility for invasive plant introduction resulting from probable timber harvest activities by multiplying the timber harvest weighted values by the total acres by harvest category per fifth-field watershed in the first 10 years.

Step 2e - Divide the susceptibility values into three even categories: high, medium and low. Assign a zero value to fifth-field watersheds where there are no BLM-administered lands.

Step 2f - Combine representative invasive plant species presence with susceptibility generated by probable timber harvest activities to determine relative risk of introduction.

- For each alternative, determine the relative risk of invasive species introduction associated with timber harvest activities in the first 10 years for each fifth-field watershed in the planning area by using the matrix in **Table 20**.

TABLE 20. MATRIX TO DETERMINE RELATIVE RISK FOR THE INTRODUCTION OF INVASIVE PLANT SPECIES THAT ARE ASSOCIATED WITH TIMBER HARVEST OVER THE NEXT 10 YEARS

Species Distribution Categories	Susceptibility Categories for Introduction of Invasive Plant Species from Timber Harvesting Activities		
	Low	Moderate	High
Low	Low	Moderately Low	Moderate
Limited	Moderately Low	Moderately High	High
Abundant	Moderate	High	Highest

Step 3 - Determine the relative risk of introducing invasive plant species into riparian habitats over the first 10 years of plan implementation because of timber harvest and associated management activities.

- Use a similar analytical process as the one designed to determine risk associated with timber harvest activities under all alternatives to compare the risk of introducing invasive plants into riparian habitats.

Step 3a - Apply weights to the different riparian management area prescriptions to compare the relative risk of invasive plant introduction into riparian areas as an inadvertent result of timber harvest activities.

- Assume thinning within the riparian reserves would be a constant proportion of the total thinning acres under each alternative.

- Use the total thinning acres under each alternative to determine the relative risk of introducing invasive plants into riparian habitats in the fifth-field watersheds for the first 10 years of plan implementation.

- Consider the relative differences in riparian buffer widths along with the levels and types of timber harvest activities under each of the alternatives to determine the relative differences in light levels in riparian areas adjacent to timber harvest units.

- Should the riparian management area buffer widths associated with intermittent streams be less than 100 feet, assume the post-timber harvest light levels in riparian areas would be higher after timber harvest.

- Should the riparian management areas be wider than 100 feet and free of timber harvest activities, assume surrounding timber harvest activities would have negligible effect on the adjacent riparian habitats' light levels. Therefore, there would be no riparian susceptibility weight assigned to broad riparian management areas under this prescription.

- Use **Table 21** to assign riparian susceptibility weights for invasive plant introduction to riparian habitats associated with timber harvest activities.

TABLE 21. SUSCEPTIBILITY WEIGHTS FOR HARVEST ACTIVITY TYPES FOR INTRODUCTION OF INVASIVE PLANTS INTO RIPARIAN AREAS

Timber Harvest Type	Riparian Susceptibility Weight
Riparian Management Areas at least 100 feet wide with restricted timber harvest activities	0
Thinnings	1
Uneven-aged management	1
Regeneration harvest	2

Step 3b - For each alternative; multiply the weights by the total probable acres for each harvest type in the fifth-field watersheds in the first 10 years, to generate a set of values describing the level of susceptibility for invasive plant introduction into riparian areas.

Step 3c - Likewise, for each alternative, multiply the weights assigned to the logging methods as described in *Step 2b* by total probable acres per fifth-filed watershed for each logging method in the first 10 years to generate a set of values describing the level of riparian susceptibility for invasive plant introduction into riparian areas.

Step 3d - Together, the riparian susceptibility values associated with harvest types and logging methods determine the overall riparian susceptibility to invasion in the first 10 years of plan implementation under each alternative. These two values multiplied together will generate a comprehensive riparian susceptibility value for each fifth-field watershed. Divide these values into three equal categories: high, moderate, and low.

Step 3e - Use the riparian susceptibility category and invasive plant distribution category to determine the relative risk of introducing invasive plants in riparian habitats for the first 10 years of plan implementation using the same methods described for timber harvest activities in *Step 2e* above.

Step 4 - Determine the relative susceptibility of invasive plant introductions as an inadvertent result of off-highway vehicle designation.

Step 4a - Assign off-highway vehicle designation weights, as identified below, to each part of the fifth-field watershed having a different off-highway vehicle designation.

- Off-highway vehicle designation susceptibility weights:
  - Open = 5
  - Limited = 3
  - Closed = 0

Step 4b - Determine the relative susceptibility for introduction of invasive species related to off-highway vehicle use as an inadvertent result of the off-highway vehicle designations.

- For each alternative, multiply the susceptibility weights by total probable acres per watershed for each designation to generate a set of susceptibility values for the fifth-field watersheds. Divide these values into three equal categories: high, medium, and low.

Step 4c - Use the susceptibility category and invasive plant distribution category to determine the relative risk of introducing invasive species as an inadvertent result of off-highway vehicle use, in fifth-field watersheds using the same methods described for timber harvest activities in Step 2e.

Step 5 - Determine the relative susceptibility of invasive plant introductions as an inadvertent result of recreation management designations.

Step 5a - Assign recreation management designation weights, as identified below, to each part of the fifth-field watershed.

- Recreation management area designation susceptibility weights:
  - Special recreation management area = 5
  - Extensive recreation management area = 3
  - No recreation management area = 1

Step 5b - Determine the relative susceptibility for introduction of invasive species related to recreation use as an inadvertent result of the recreation management designations.

- For each alternative, multiply the susceptibility weights by total probable acres per watershed for each designation to generate a set of susceptibility values for the fifth-field watersheds. Divide these values into three equal categories: high, medium, and low.

Step 5c - Use the susceptibility category and invasive plant distribution category to determine the relative risk of introducing invasive species as an inadvertent result of off-highway vehicle use, in fifth-field watersheds using the same methods described for timber harvest activities in *Step 2e*.

Step 6 - Determine the risk to fifth-field watersheds of roadside invasive plant introductions from their invasive plant distribution categories and the relative amounts of new road construction and road related activities by alternative.

Step 6a - For all fifth-field watersheds, determine the range of values for new road construction and road related activities under all of the alternatives. Divide the full range of values into three equal categories, high, moderate, and low.

Step 6b - Use **Table 22** to determine the relative risk categories of invasive plant introduction from the amounts of new road construction and road related activities and species distribution categories from *Step 1*.

TABLE 22. MATRIX TO DETERMINE THE RELATIVE RISK CATEGORIES OF INVASIVE PLANT INTRODUCTION FROM NEW ROAD CONSTRUCTION AND RELATED ACTIVITIES

Species Distribution Categories	Relative Levels of Road Construction and Related Activities		
	Low	Moderate	High
Low	Low	Moderately Low	Moderate
Limited	Moderately Low	Moderately High	High
Abundant	Moderate	High	Highest

Step 7 – Determine the relative susceptibility and risk for introduction of invasive plant species related to grazing as an inadvertent result of grazing allocations.

Analytical Conclusions

- Watersheds with a low distribution of invasive plant species and a low or moderate susceptibility for the introduction of invasive plant species would have the lowest risk of invasion. The greatest risk of invasion would be in fifth-field watersheds where both invasive plant species are abundant and susceptibility would be high. Watersheds with neither reported sites for the sample set of invasive plant species in the analysis nor BLM ownership would not have an assigned risk category.

- Compare the relative ranking of the number and location of high, moderate, and low risk watersheds under each alternative.

- Describe the relative risk of long and short-term invasive plant species introduction and spread, across the alternatives, based on the following factors:

    - Number of the highest and high-risk fifth-field watersheds from timber harvest activities over the next 10 years

    - Number of the highest and high-risk fifth-field watersheds for introduction into riparian habitats from timber harvest activities over the next 10 years

    - Number of fifth-field watersheds assigned risk categories from new road construction associated with timber harvest activities over the next 10 years

    - Number of the highest and high-risk fifth-field watersheds associated with off-highway vehicle use (long- and short-term)

    - Number of the highest and high-risk fifth-field watersheds associated with off-highway vehicle and other recreation use (long- and short-term)

    - Acres of land where grazing is permitted within land use allocations

    - Long-term introduction and spread from timber harvest and associated activities

    - Long-term introduction and spread from grazing activities

    - Long-term introduction and spread along riparian habitats

    - Overall potential to introduce and spread invasive plant species

Data Needs

- Data for the current distribution of invasive species is available from a combination of sources including BLM corporate data and iMapInvasives.

- Despite limited infestation location reporting, a good picture of invasive plant species distribution is available on a species-by-species level in iMapInvasives.

- Fifth-field watershed maps and acre tables for each alternative with the following kinds of information:

    - Timber harvest type and logging method for the first 10 years of implementation generated by the alternative runs from the Woodstock vegetation model and the coefficients developed from the ten-year scenarios in the 2008 RMP/EIS.

    - Off-highway vehicle designations

    - Recreation management area designations

- Mileage tables for new road construction for the first 10 years of implementation

- Occurrence data for the following species on BLM-administered and non-BLM-administered lands in the analysis area: yellow starthistle, knotweeds, false brome, spotted and diffuse knapweeds, meadow knapweed, Scotch and French brooms, dyer's woad, Canada thistle. BLM and either Portland State University's iMapInvasives or Oregon Department of Agriculture's WeedMapper, will be the source of the data for this analysis

- Map of lands allocated for livestock grazing

Geographic and Temporal Scales

• The entire planning area defines the geographic scope of the invasive plant analysis. The analysis will use proposed acres of disturbance from management activities for the first 10 years of implementation to determine the short-term effects. Ten years of implementation is long enough for inadvertent introductions and establishment of invasive plants into watersheds because of management activities. The analysis will use a 10 to 20-year period after the first 10 years of implementation for the discussion of long-term effects. This is a long enough time frame to allow for the establishment and subsequent spread of inadvertent invasive plant infestations as a result of the implementing the alternatives. Variables in effectiveness of prevention practices, treatment effectiveness, and new introductions of invasive plants over time are too uncertain to allow for a useful analysis beyond 30 years.

Data Display

• Display the results of *Step 1* in Chapter 3 as *Distribution categories of invasive plant species for the fifth-field watersheds within the planning area*.

• Display the results of *Step 2e* in Chapter 4 as *Relative susceptibility of fifth-field watersheds to invasive plant species introduction, because of timber harvesting activities over the next 10 years*

• Display the results of *Step 2f* in Chapter 4 as:

- Comparison of the risk by mapped watershed for the introduction of invasive plant species that is associated with timber harvesting activities over the next 10 years.

- Comparison of the risk by watersheds for the introduction of invasive plant species associated with timber harvesting activities over the next 10 years.

- Comparison of the risk for the introduction of invasive plant species associated with timber harvesting in the fifth-field watersheds across the alternatives over the next 10 years.

• Display the results of *Step 3d* in Chapter 4 as:

- Risk comparison for the introduction of invasive plant species into riparian habitats associated with timber harvesting in the fifth-field watersheds across the alternatives over the next 10 years

- Susceptibility comparison for the introduction of invasive plant species into riparian habitats that are associated with timber harvesting over the next 10 years

- Susceptibility comparison for the introduction of invasive plant species into riparian habitats that are associated with timber harvesting in the fifth-field watersheds over the next 10 years

• Display the results of *Step 3e* in Chapter 4 as *Relative risk of introducing invasive plant species in riparian habitats over the next 10 years and Riparian risk category comparison for the introduction of invasive plant species over the next 10 years.*

• Display the products of *Step 4c* in Chapter 4 as *Relative risk for the introduction of invasive plant species that are associated with off- highway vehicle designations and Risk comparison for introduction of invasive plant species that are associated with off-highway vehicle use.*

• Display the products of *Step 5c* in Chapter 4 as *Relative risk for the introduction of invasive plant species that are associated with recreation management area designations and Risk comparison for introduction of invasive plant species that are associated with recreation.*

• Display the products of *Step 6b* in Chapter 4 as *Risk comparison for the introduction of invasive plant species associated with new road construction over the next 10 years and Risk comparison for the introduction of invasive plant species associated with new road construction by fifth-field watershed over the next 10 years.*

• Use *Relative risk of long and short-term introduction and spread of invasive plant species by analysis factor* to summarize the relative ranking of the alternatives concerning invasive plant management.

Issue 2

How would each alternative affect invasive aquatic species introduction and spread?

Analytical Assumptions

• The following representative sample of invasive species is used to describe the condition of aquatic invasive species on BLM-administered lands in western Oregon on BLM-administered lands:

  ◦ Asiatic clam (*Corbicula fluminea*)

  ◦ New Zealand mudsnail (*Potamopyrgus antipodarum*)

  ◦ Bullfrog (*Rana catesbeina*)

  ◦ Nutria (*Myocastor coypus*)

  ◦ Yellow flag iris (*Iris pseudacorus*)

• New Zealand mudsnails and Asiatic clam live in fresh and brackish waters.

• Bullfrogs inhabit river and stream segments with slow moving waters, ponds, lakes, and boggy areas.

• Nutria inhabit riparian areas of still to slow-moving water bodies like marshes, wetlands, ponds, rivers and streams.

• Yellow flag iris invades waterways, marshes, wetlands and the margins of ponds, lakes.

Analytical Methods and Techniques

Use Steps 1 through 6 from the invasive plant analysis.

Step 7 - Determine the current aquatic invasive species distribution category at the fifth-field watershed level using the same methods as in *Step 1*, but with the representative aquatic invasive species.

Step 8 - Determine the relative risk of introducing invasive aquatic species into fifth-field watersheds as an inadvertent result of recreational activity in riparian areas for each alternative.

Step 8a - Same as *Step 5a*

Step 8b - Generate a set of values to describe the level of susceptibility for aquatic invasive species introductions resulting from recreational activities in riparian areas by multiplying the recreation management area weighted values by the riparian management area acres in each recreation management area designation for each fifth-field watershed.

Step 8c - Divide the susceptibility values into three even categories: high, medium and low. Assign a zero value to fifth-field watersheds where there are no BLM-administered lands.

Step 8d - Combine representative aquatic invasive species presence with susceptibility generated by probable recreation use activities in riparian areas to determine relative risk of introduction.

- For each alternative, determine the relative risk of aquatic invasive species introduction associated with recreation activities in riparian areas by using the matrix in **Table 23** for each fifth-field watershed in the planning area.

TABLE 23. MATRIX TO DETERMINE RELATIVE RISK FOR THE INTRODUCTION OF AQUATIC INVASIVE SPECIES THAT ARE ASSOCIATED WITH RECREATION ACTIVITIES IN RIPARIAN AREAS

Species Distribution Categories	Susceptibility Categories for Introduction of Aquatic Invasive Species from Recreation Activities in Riparian Areas		
	Low	Moderate	High
Low	Low	Moderately Low	Moderate
Limited	Moderately Low	Moderately High	High
Abundant	Moderate	High	Highest

Step 9 - Determine the risk to fifth-field watersheds of aquatic invasive species introductions from the aquatic invasive species distribution categories and the relative amounts of new road construction and road related activities by alternative.

Step 9a - For all fifth-field watersheds, determine the range of values for new road construction and road related activities under all of the alternatives. Divide the full range of values into three equal categories, high, moderate, and low. This is the same as *Step 6a*.

Step 9b - Use **Table 24** to determine the relative risk categories of aquatic invasive species introduction from the amounts of new road construction and road related activities and species distribution categories.

TABLE 24. MATRIX TO DETERMINE RELATIVE RISK CATEGORIES OF AQUATIC INVASIVE SPECIES INTRODUCTION FROM NEW ROAD CONSTRUCTION AND RELATED ACTIVITIES

Aquatic Invasive Species Distribution Categories	Relative Levels of Road Construction and Related Activities		
	Low	Moderate	High
Low	Low	Moderately Low	Moderate
Limited	Moderately Low	Moderately High	High
Abundant	Moderate	High	Highest

Analytical Conclusions

• Watersheds with a low distribution of aquatic invasive species and a low or moderate susceptibility for the introduction of aquatic invasive species would have the lowest risk of invasion. The greatest risk of invasion would be in fifth-field watersheds where both aquatic invasive species are abundant and susceptibility high. Watersheds with neither reported sites for the sample set of aquatic invasive species nor BLM ownership would not have an assigned risk category.

• Compare the relative ranking of the number and location of high, moderate, and low risk watersheds under each alternative.

• Describe the relative risk of long and short-term aquatic invasive species introduction and spread, across the alternatives, based on the following factors:

  ◦ Number of the highest and high-risk fifth-field watersheds for introduction into riparian habitats from recreation activities in riparian areas

  ◦ Number of fifth-field watersheds assigned risk categories from new road construction associated activities over the next 10 years

  ◦ Overall potential to introduce and spread aquatic invasive species

Data Needs

• Fifth-field watershed maps and acre tables for each alternative with the following kinds of information:

  ◦ Recreation management area designations

  ◦ Riparian management area acres in Recreation management area designations

  ◦ Mileage tables for new road construction for the first 10 years of implementation

  ◦ Occurrence data for the following species in the analysis area: Asiatic clam, New Zealand mudsnail, bullfrog, nutria, and yellow flag iris. This data would come from the iMapInvasives database.

Geographic and Temporal Scope

• The entire planning area defines the geographic scope of the invasive aquatic animal analysis. Proposed acres of disturbance from management activities for the first 10 years of implementation will be used in the analysis to determine the short-term effects. Ten years of implementation is long enough for aquatic invasive animals to be inadvertently introduced and established into a watershed because of management and recreation activities. Long-term effects will be analyzed for a 10 to 20-year period after the first 10 years of implementation. This is a long enough time frame to allow for the continued introduction, establishment and subsequent spread of inadvertent invasive aquatic animals as a result of the implementing the alternatives. Variables in effectiveness of prevention practices, treatment effectiveness, and new introductions of invasive species over time are too uncertain to allow for a useful analysis beyond 30 years.

Data Display

• Display the results of *Step 7* in *Chapter 3* as *Distribution categories of aquatic invasive species for the fifth-field watersheds within the planning area*.

- Display the results of **Step 8** in *Chapter 4* as:
    - Relative susceptibility of fifth-field watersheds to aquatic invasive species introduction because of recreational activity in riparian areas
    - Relative risk for the introduction of aquatic invasive species that are associated with recreation
    - Risk comparison for introduction of aquatic invasive species that are associated with recreation
- Display the products of Step 9 in Chapter 4 as Risk comparison for the introduction of aquatic invasive species associated with new road construction over the next 10 years and Risk comparison for the introduction of aquatic invasive plant species associated with new road construction by fifth-field watershed over the next 10 years.
- Use Relative risk of long and short-term introduction and spread of aquatic invasive species by analysis factor to summarize the relative ranking of the alternatives concerning aquatic invasive species management.

Issue 3

How would each alternative affect Sudden Oak Death introduction and spread?

Analytical Assumptions

- Factors that influence the spread of *Phytophthora ramorum* (the pathogen that causes sudden oak death) include proximity to an existing infestation, density of host species, environmental conditions, speed of discovery and management following introduction, and new introductions over time.
- Tanoak is the main host of concern for *Phytophthora ramorum*.
- Sudden oak death spread is via natural conditions (movement in moist air) and not from events based on human-assisted transport (new introductions from nursery stock or other infested material). The daily movement of fog and mist carrying *Phytophthora ramorum* (*P. ramorum*) spores up and down the drainages facilitates spread of the disease within stream drainages.
- Under current management direction expansion of the sudden oak death infested area (occurs at the same rate (northward and eastward) for the next two decades as it did from 2001-2013.
- The North American form (NA1) of *P. ramorum* is the only one known to occur in the forests of the planning area and will be the only form considered in this analysis.
- Climate change influences on anticipated sudden oak death spread are negligible.

Analytical Methods and Techniques

Step 1 - Delineate the original (2001) and current (2013) *P. ramorum* infestation areas in a GIS shapefile to establish the current infestation zone and to determine the rate of spread from 2001 through 2013.

Step 2 - Project the rate of sudden oak death infestation expansion for the periods of 2013-2023 and 2023-2033 under the current management strategy of treating all known infestations on BLM-administered lands. Technical experts will use the rate of infestation expansion from 2001-2013 (with Oregon Department of Agriculture's statewide infestation data) and the principles within Václavík et al. (2010) and Hansen (2008) to model the projected rate of disease expansion for the periods of 2013-2023 and 2023-2033. Václavík characterizes the actual and potential distribution of *P. ramorum* in western Oregon by using invasive species distribution models in *Predicting potential and actual distribution of sudden oak death in Oregon: Prioritizing landscape contexts for early detection*

and eradication of disease outbreaks (Václavík et al. 2010.) A team of experts including Ellen Goheen (U.S. Forest Service), Alan Kanaskie (Oregon Department of Forestry), and Everett M. Hansen (Department of Botany and Plant Pathology, Oregon State University) are available to model rate of expansion and infestation zones for the next 10 and 20 years.

Use expert opinion, the proportion of infestation acres on BLM-administered lands in riparian areas compared to total infestation area on BLM-administered lands, and the principles within Václavík et al. (2010) and Hansen (2008) to model the rate of disease expansion for alternatives with direction to treat sudden oak death infestations on BLM-administered lands everywhere except within identified riparian areas.

Step 3 - Project the rate of sudden oak death infestation expansion for the periods of 2013-2023 and 2023-2033 under alternatives with direction to treat all sudden oak death infestations except within riparian areas.

Step 3a - BLM staff will calculate the acres projected for sudden oak death infestation on BLM-administered lands for the period from 2001-2013 which were implemented in the area planned for riparian reserves under one or some alternatives.

Step 3b - BLM staff will calculate the percentage of infested area within planned riparian reserves to the total infestation area on BLM-administered lands.

Step 3c - Technical experts will use the rate of infestation expansion from 2001-2013, percentage of infested area within planned riparian reserves, proportion of riparian reserve area to BLM-administered lands, and the principles within Václavík et al. (2010) and Hansen (2008), to model the projected rate of disease expansion.

Step 4 - Project the rate of sudden oak death infestation expansion for the periods of 2013-2023 and 2023-2033 under alternatives with no direction to treat sudden oak death infestations.

- Technical experts will use current sudden oak death infestation distribution maps, the principles within Václavík et al. (2010) and Hansen (2008) to predict the rate of disease expansion for alternatives with no direction to treat sudden oak death infestations on BLM administered lands.

Step 5 - Technical experts will use the predicted rates of infestation expansion from Steps 3, 4, and 5 to describe the modeled infestation zones for the periods of 2013-2023 and 2023-2033, under each alternative.

Step 6 - Determine the sudden oak death treatment levels for the periods of 2013-2023 and 2023-2033 for each alternative.

Step 6a - BLM staff will use the percentage of acres treated (2001-2013) to total acres of BLM–administered land within the current infestation zone and multiply it by the amount of BLM-administered acres within the expanded infestation zones to estimate decadal treatment acreages under alternatives with direction to treat all infestations.

Step 6b - BLM staff will use the percentage of acres treated (2001-2013) to total acres of BLM–administered land within the current infestation zone and multiply it by the amount of BLM-administered acres for each of the decadal infestation zones for alternatives with direction to limit treatments to areas outside of riparian reserves. These acreages estimate the infestation levels for each decade. Determine decadal treatment levels by multiplying the infestation levels by the percentage of infestation areas expected to occur outside of the riparian reserves.

Analytical Conclusions

- Compare of the relative geographic scope of the modeled sudden oak death infestation zones for the next 10 and 20 years.

• Describe the relative risk of long and short-term introduction and spread, across the alternatives, based on the following factors:

  ◦ Rate of spread and modeled decadal infestation zones for the past and next two decades

  ◦ Estimated acres of infested acres and treatments for the most recent and next two decades

  ◦ Sudden oak death movement within drainages and across the landscape

Data Needs

• Quarantine area and *P. ramorum* in western Oregon distribution GIS shapefiles and attribute data from the Oregon Department of Agriculture

• BLM sudden oak death treatment shapefiles and attribute data 2001-2013 from the Coos Bay District

• BLM ownership and forest operations inventory in corporate GIS data

• Planned riparian reserve GIS data

• GIS data supporting Figure 2. Predicted spread risk map for P. ramorum in western Oregon based on heuristic model of potential distribution from T. Václavík et al. 2010

• Modeled infestation zones shapefile from technical experts

• Expected decadal acres of infestation and treatment by alternative from GIS analysis

Geographic and Temporal Scope

• The geographic scope of the analysis of sudden oak death is the entire planning area, because potential habitat exists throughout. Ten years of *P. ramorum* infestation spread and treatments in the planning area will provide the anticipated spread rate for an additional two decades based on the approach to treatments under the alternatives. Variables in climate change, weather patterns, effectiveness of treatments, and new introductions of *P. ramorum* over time are too uncertain to allow for a useful analysis beyond twenty years.

Data Display

• Display the results of Steps 1 and 5 in Chapter 4 as Sudden Oak Infestation Zones for the next twenty years by alternative.

• Display the results of Step 6 in Chapter 2 as Sudden Oak Death Treatment Levels on BLM-Administered Lands, and in Chapter 4 as Sudden Oak Death Infestation Levels on BLM-Administered Lands and Sudden Oak Death Decadal Infestation and Treatment Levels (Acres) by Alternative.

References

Goheen, E. 2013. Personal Communication. Pathologist. Forest Service. 2606 Old Stage Road. Central Point, OR 97529.

Hansen, E.M. 2008. Alien forest pathogens: Phytophthora species are changing world forests. Boreal Environment Research 13(Suppl A):33-41. *http://www.cfr.washington.edu/classes.esrm.444/Reading%20files/Hansen%202008.pdf*

The Nature Conservancy. 2013. iMapInvasives. *http://www.imapinvasives.org*

Václavík, T.; A. Kanaskie; E.M. Hansen; J.L. Ohrmann; R.K. Meentemeyer. 2010. Predicting potential and actual distribution of sudden oak death in Oregon: prioritizing landscape contexts for early detection and eradication of disease outbreak. Forest Ecology and Management 260(6): 1026 – 1035. *http://www.sciencedirect.com/science/article/pii/S0378112710003580*

Minerals

Issue 1

How will each alternative affect the acres of land: with fluid leasable mineral restrictions, closed to salable mineral entry, petitioned for withdrawal from locatable mineral entry, or with existing BLM rock quarries?

Analytical Assumptions

• There will be no significant impacts associated with mineral leasing of oil, gas, geothermal or Coalbed Natural Gas resources, and the effects of the alternatives on fluid mineral leasing would not vary substantially or meaningfully. All lands not previously closed will remain open to mineral leasing, except public lands within incorporated city limits and designated wilderness areas. In areas open to leasing, site-specific stipulations, such as no surface occupancy or conditional surface uses, can be imposed on each lease as needed to protect other resource values. Because most impacts can typically be mitigated through directional drilling techniques that do not require surface occupancy, there will be no foreseeable significant effects to analyze regarding mineral leasing of oil, gas, geothermal or Coalbed Natural Gas resources.

• The BLM can determine the location of most developed mineral material sites (rock quarries) that are in areas proposed for closure to salable mineral entry using existing data and maps.

• Each alternative will identify acres closed to salable mineral entry and petitioned for withdrawal from locatable mineral entry.

• The BLM will manage existing quarries that are located in areas proposed for closure to salable mineral entry to facilitate reclamation.

• The mineral potential of areas that are petitioned for withdrawal from locatable mineral entry can be estimated with mineral potential maps, publications, mining claim records and geology maps.

• Each alternative will determine acres of land with fluid leasable mineral restrictions (No Surface Occupancy, Conditional Surface Use, and Timing Limitations).

• The BLM will assume that areas petitioned for withdrawal from locatable mineral entry under each alternative to be withdrawn. The analysis will treat the future withdrawal of areas as a reasonably foreseeable action in response to the BLM petition for withdrawal. None of the withdrawals and their impacts would occur if the Secretary of the Interior or Congress does not issue the withdrawals proposed under the alternatives.

Analytical Methods and Techniques

• Determine by alternative the number of existing rock quarries that are located in closed areas.

• Determine by alternative the acres of lands closed to salable mineral entry.

• Determine by alternative the number of proposals and acres of land petitioned for withdrawal from locatable mineral entry.

• Determine by alternative changes of acres of land with fluid leasable mineral restrictions – No Surface Occupancy, Conditional Surface Use, and Timing Limitations.

Analytical Conclusions

• How lands closed to salable development will affect existing quarries

• The number of acres closed to salable mineral entry or petitioned for locatable mineral withdrawal and the effects to the availability of the resource

• The restrictions for each alternative for leasable mineral development and the effects to the economic and logistic viability of developing that resource

Units of Measure

• Acres closed to salable mineral material disposal

• Number of existing quarries in areas proposed for closure to salable mineral

• Each proposal, including acres and the estimated mineral potential, that are being petitioned for withdrawal from locatable mineral entry

• Acres of land with leasable mineral restrictions – No Surface Occupancy, Conditional Surface Use and Timing Limitations

Data Display

• Table or chart method of above information by alternative

Issue 2

How will each alternative affect the acres of lands open or closed to development of repositories for long-term storage of mine waste at abandoned mine sites?

Analytical Assumptions

• A small percentage of abandoned mine sites within the planning area will need a long-term repository for mine waste once screened for environmental contaminants.

• There may be site-specific impacts associated with developing mine waste repositories to store abandoned mine waste and the effects of the alternatives on developing repositories may vary substantially or meaningfully.

• Mine waste repositories will be located near the abandoned mine where the waste was produced.

• The mine waste meets the definition of Solid Wastes which are not Hazardous Wastes as defined in 40 CFR 261.4 (b)(7).

Analytical Methods and Techniques

• Estimate the number of abandoned mines located in closed areas by alternative using existing records in the Abandoned Mine and Site Cleanup Module database (USDI 2013a) and the LR2000 (USDI 2013b) database.

• Estimate the number of sites that may need repositories and that closure would affect under each alternative.

Analytical Conclusions

- A description of how lands closed to development of repositories will affect cleanup of environmental contamination at abandoned mine sites.

- An estimate of how many abandoned mine sites affected by the number of acres closed to repository siting, and the estimated increase in the cost of cleanup.

Data Display

- Table

References

U.S. Department of Interior, Bureau of Land Management. 2013a. Abandoned Mine Site Cleanup Module.

U.S. Department of Interior, Bureau of Land Management. 2013b. Bureau of Land Management's Legacy Rehost System – LR2000. *http://www.blm.gov/lr2000/*

Rare Plants and Fungi

Issue 1

How will management activities (such as timber harvesting, fuels reduction treatments, mineral development, recreation, and grazing) affect special status plant and fungi species, current Survey and Manage species, and special habitats? How will these affects vary by alternative?

Analytical Assumptions

- Botanists have surveyed only a portion of BLM-administered lands within the planning area, and most surveys are associated with previously planned projects (such as timber sales). Rare plant and fungi species are not evenly distributed across the landscape. Some species are specialists and associated with a discrete habitat feature or plant community. Other species have wider amplitude and occur in different plant communities or on different substrates. Even when apparently good potential habitat exists, botanists cannot predict that they will find new sites. Therefore, it is not possible to model or predict where a particular species may or may not occur, and it is difficult to quantify impacts to such a large number of species.

- There are currently 269 special status species in the planning area. In addition, there are 288 species on the Survey and Manage (S&M) list (2001 ROD). Twenty-seven of these Survey and Manage species are included on the BLM Sensitive species list. Botanists have studied some species, such as the federally listed plants, more than other groups of species (e.g., fungi and lichens). Because there are too many species to evaluate individually, the BLM will group species based upon their associated habitat features for analysis purposes (i.e., a functional group). Some species are associated with a specific plant series or ecological feature while others have a broader range of associated habitats. Therefore, some species may occur in more than one functional group.

- BLM special status species include federally listed, proposed, and candidate species; State of Oregon threatened and endangered species; and BLM Sensitive species. The list of special status species changes periodically because of new information (e.g., newly described species, new species records for Oregon, new documented locations of species, and newly described threats to species).

• Plant communities that are less common in the planning area, such as oak woodland and serpentine meadows, generally support a higher density of BLM special status plants than conifer forests. The BLM does not have good spatial data of these less common plant communities.

• Special status species hot spots occur in western Oregon in regions reflecting floristic diversity and habitat quality. Hot spots can occur at fine spatial scales, such as special habitat features (e.g., meadows, wetlands, rock outcrops, and other non-forested areas), and at larger geographic scales where high levels of endemism occur on the broader landscape level.

• Survey and Manage species are generally associated with late-successional conifer forests.

• Reserves will generally provide habitat for species associated with late-successional forests.

• Types of proposed actions most likely to affect special status plant species include timber harvesting, harvest-related activities (e.g., road building), livestock grazing, and recreation.

• Most special status species sites are small and management actions to preserve or enhance them are compatible with timber management objectives. However, indirect impacts, such as the introduction of non-native species could have long-term impacts on the viability of special status species sites.

• Some special status species (such as Gentner's fritillary and Kincaid's lupine) are adapted to frequent natural disturbances, whereas other species are adapted to long periods of stable habitat conditions (many of the special status fungi species). Natural disturbances affect species differently and may create a positive or negative habitat change depending on the type, intensity, and frequency of the disturbances.

• Some management activities (such as density management and fuels reduction treatments) can achieve desired habitat change when carefully designed and implemented.

• Private lands contribute minimally to the conservation of special status species and their habitat because existing federal and state laws provide less protection to plant species on private lands. Section 9 of the federal Endangered Species Act prohibits (1) the removal and collection of endangered plants from lands under federal jurisdiction, and (2) the removal, damage, or destruction of endangered plants[1] on any other area in knowing violation of a state law or regulation, or in the course of any violation of a state criminal trespass law. The Oregon Endangered Species Act restricts take of species listed as threatened or endangered by the state only on state-owned or leased lands. All state-funded entities, such as public schools, public irrigation districts, and publicly owned airports, must consult with the Oregon Department of Agriculture prior to implementation of any ground-disturbing activity. However, these restrictions in state law do not pertain to private lands.

• For vascular species, site data in the BLM regional database (Geographic Biotic Observations (GeoBOB)) is likely to overstate the actual number of occurrences and individuals per population due to the historical age of the data and lack of revisits to the occurrences. Conversely, this database may under-represent occurrences of non-vascular and fungi species because these organisms are difficult to count and map.

• At this planning scale, it is not possible to forecast the location and timing of specific forest management activities and other activities that would affect plant and fungi habitat. Therefore, the analysis of impacts to special status species will look at the relative difference in management activity levels between alternatives.

Analytical Methods and Techniques

• Data sources for analysis include: the BLM Geographic Biological Observations database, Oregon Natural Heritage database, Oregon Flora Project (OSU 1994), Soil Conservation Service soil survey data, U.S. Geological Survey maps, Jepson Manual of Vascular Plants of California (Baldwin et al. 2012), individual species fact sheets

[1]Does not include threatened or candidate species

and conservation strategies available through the Interagency Special Status/Sensitive Species Program (USDA/USDI 2013), the Forest Ecosystem Management Assessment Team (FEMAT, Thomas et al. 1993), and the Northwest Forest Plan (USDA/USDI 1994).

• Sort the special status plant and fungi species into functional groups based upon their associated habitat requirements. Use these functional groups to discuss potential impacts. Within the conifer forest functional group, determine which species are associated with late-successional forest characteristics.

• The analysis will focus on species associated with conifer forest within the harvest land base and on species that are known (or suspected to occur) within specific areas proposed for grazing, intensive recreation, or other habitat-disturbing activities. The invasive species effects analysis will provide the basis for assessing the indirect effects of habitat disturbing actions.

• Review current Geographic Biological Observations tabular data for special status species occurrences, population data, habitat data, and area inventoried. Use spatial data from this database to analyze species distribution and density.

• Review survey data available in the Geographic Biological Observations database and from the districts and compare acres surveyed to the number of documented sites. Determine the number of new sites found in each general habitat type such as riparian, young forest stands, older forest stands, etc. This information will allow us to estimate the number of new sites that surveyors may find with additional project-level surveys.

• Describe the relative degree of change to rare habitats and functional groups by alternative, at watershed-level and regional scales.

Analytical Conclusions

• Describe the habitat characteristics modified by each proposed activity

• Describe anticipated impacts from proposed activities to functional groups

Data Display

• Table showing a list of special status species and each corresponding functional group

• Table showing the relative effect of each alternative on species functional groups

• Table showing rare plant communities and relative change by alternative

References

Baldwin, B.G.; D.H. Goldman; D.J. Keil; R. Patterson; T.J. Rosatti, (Eds.). (2012). The Jepson Manual: Vascular Plants of California. University of California Press. 1568 pp.

Oregon State University, Department of Botany and Plant Pathology. 2013. Oregon Flora Project. *http://www.oregonflora.org/index.php* . OSU Herbarium, Corvallis, OR.

U.S. Department of Agriculture – Forest Service; U.S. Department of the Interior – Bureau of Land Management. 2013. Interagency Special Status / Sensitive Species Program (ISSSSP). *http://www.fs.fed.us/r6/sfpnw/issssp/agency-policy/*

Recreation, Visual Resources Management, and the National Landscape Conservation System

Issue 1

How will alternatives affect the BLM's ability to provide recreation opportunities and manage for beneficial recreation outcomes across western Oregon?

Analytical Assumptions

Recreation Demand

• The BLM's approach to meeting recreation demand encompasses two distinct recreation management area land use allocations: Special Recreation Management Areas (SRMAs) and Extensive Recreation Management Areas (ERMAs). All lands that are not designated as a Special or Extensive Recreation Management Area are referred to as 'public lands not designated for recreation.' The regional distribution of recreation management areas ensures that a range of recreational settings, opportunities, and benefits exists in relative proximity to communities throughout the region. Designation of recreation management areas increases the ability to protect and enhance the targeted activities, experiences, benefits, and desired recreation-setting characteristics on a long-term basis.

• Both the current level of use and the projected future use levels on BLM-administered lands, will define recreation demand across western Oregon. In some instances, the current demand for dispersed recreation opportunities (including motorized and non-motorized trail use and overnight camping), is occurring in areas where there is a lack of appropriate administrative control for the BLM to manage users adequately. The BLM uses recreation monitoring, which we conduct through district staff observations, car counts at popular public access points, and trail counters, to quantify the location and levels of current use.

• Current trends in visitor use levels are the basis for projected demand, with the assumption that these trends will remain constant over the next decade. It is measured by the changes in use levels for thirteen primary categories of recreational activities and by recent demand analysis conducted in the project area. The BLM will measure use levels for these activities by the number of participants, visitors, visitor use hours and visitor days. This analysis will also utilize the Statewide Comprehensive Outdoor Recreation Plan (SCORP) data released in 2013 (OPRD 2013). The thirteen primary categories of recreation activities are:

- Interpretation, education, and nature study (such as wildlife viewing)
- Non-motorized travel (such as hiking, mountain biking, horseback riding)
- Driving for pleasure (such as passenger vehicles on designated roadways)
- Camping and picnicking
- Motorized off-highway vehicle travel
- Hunting (such as big game, upland and migratory game birds)
- Fishing
- Non-motorized boating

- Motorized boating
- Swimming and other water-based activities
- Non-motorized winter activities
- Snowmobile and other motorized winter activities
- Specialized non-motorized activities and events (such as geo-caching, social events, and mountain bike races)

Protection of Recreation Setting Characteristics

• Special Recreation Management Area designation will provide for the protection of recreation setting characteristics (physical, social, and operational). Extensive Recreation Management Area designation provides for the protection of certain recreation setting characteristics where appropriate and commensurate with the management of other resources.

• For public lands not designated for recreation, the BLM will assume that there will be a loss of certain recreation setting characteristics over time. Recreation setting characteristics could be lost due to the need for the management of other resources, or for visitor safety objectives.

Changes in Recreation Planning Guidance

• BLM Instruction Memorandum No. 2011-004 (USDI 2010) and BLM Manual 8320 – Planning for Recreation and Visitor Services (USDI 2011), provide new guidance on applying recreation management area allocations on BLM-administered lands. Prior to the release of this guidance, the BLM allocated areas as Special Recreation Management Areas where the lands in question were experiencing heavy recreation use or where the BLM planned to make large investments in staff, funding, facilities, or time. The BLM identified and managed all remaining lands identified as large, non-specific Extensive Recreation Management Areas. Under the 1995 RMPs (the No Action alternative), all BLM-administered lands in western Oregon would continue to be managed under either a Special or Extensive Recreation Management Area allocation, and unmanaged recreation use would continue to occur across BLM-administered lands in the planning area, primarily within Extensive Recreation Management Areas.

• The guidance issued in 2010 and 2011, refines the application of the Special or Extensive Recreation Management Areas allocations by making them more targeted and allowing for the classification of the remaining BLM-administered lands as public lands not designated for recreation. Under the new guidance, the BLM will no longer manage some BLM-administered lands under a recreation allocation.

Analytical Methods and Techniques

Step 1 - Determine legal access for the public to BLM-administered lands. Since reciprocal right-of-way agreements (and some gating) on BLM and adjacent private lands can prevent visitors from accessing BLM-administered lands for recreation use, an inventory will first be conducted to determine which BLM-administered lands are legally accessible to the public.

Step 2 - Classify land use allocations for recreation management areas by alternative. Recreation management area (i.e., Special or Extensive) allocations will be classified and mapped by alternative for each BLM district (**Table 25**, **Table 26**, and **Figure 11**) Each recreation management area will include a framework that identifies specific outcome objectives, desired recreation setting characteristics, supporting management actions and allowable uses.

FIGURE 11. EVALUATING POTENTIAL RECREATION MANAGEMENT AREAS: RESOURCE MANAGEMENT PLANS FOR WESTERN OREGON

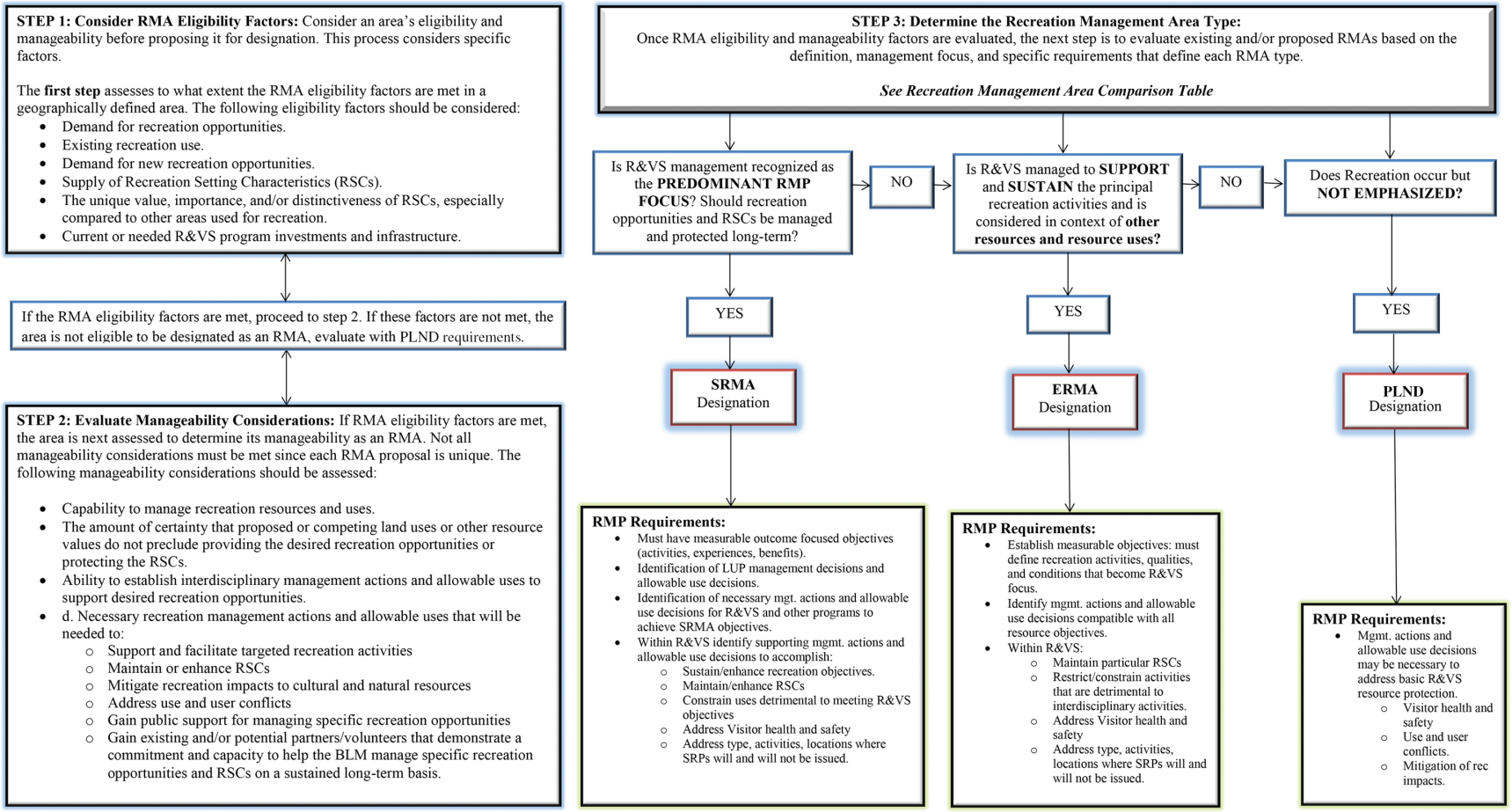

TABLE 25. CLASSIFICATION OF RECREATION MANAGEMENT AREA LAND USE ALLOCATIONS

	Special Recreation Management Area (SRMA)	Extensive Recreation Management Area (ERMA)	Public Lands not Designated for Recreation
Recreation Opportunities	Establishing a Special RMA that is specifically designed and managed for beneficial recreation outcomes would enhance visitor experiences and provide increased recreation opportunities	Establishing an Extensive RMA would ensure continued recreation opportunities for those areas being re-designated from current RMA allocations Designation would support and sustain principal recreation activities	Establishing areas where noRMA will be identified would result in the identification of areas where recreation is not emphasized Decreased recreation opportunities for those areas re-designated from existing SRMA/ERMA allocations would result
User Conflicts	Increasing Special RMA designations would decrease user conflicts within these areas. It may increase user conflicts in areas where no RMA is identified due to lack of recreation program investments and recreation infrastructure	Increasing Extensive RMA designations would decrease user conflicts in certain areas that are managed specifically for identified recreation uses due to the added level of on-site management controls	Increasing the amount of lands where no RMA would be established may result in an increase in user conflicts due to the lack of a structured framework for managing users, and low recreation program and infrastructure investments
Recreation Setting Characteristics	Increasing Special RMA designations would provide for protection of identified recreation setting characteristics	Increasing Extensive RMA designations would provide for the balanced protection of recreation setting characteristics	Increasing areas where no RMA will be identified will provide for zero protection of recreation setting characteristics
Recreation Benefits	Increasing Special RMA designations would provide for maximized personal, social, economic and community benefits	Increasing Extensive RMA designations would provide for a moderate level of personal, social, economic and community benefits	Increasing areas where no RMA will be identified would provide for a low levels of personal, social, economic and community benefits

Step 3 - Characterize land use allocations for recreation use, by BLM district. The framework for characterizing each recreation management area for recreation management and subsequent use will consider recreation opportunities, user conflicts, recreation setting characteristics, and recreation-based benefits (**Table 26**). Part of the evaluation will use this association to determine potential benefits or disadvantages related to each alternative.

TABLE 26. CHARACTERIZATION OF RECREATION MANAGEMENT AREA LAND USE ALLOCATIONS

Type	Definition	Management Focus
Special Recreation Management Area (SRMA)	Administrative units where the existing or proposed recreation opportunities and recreation setting characteristics are recognized for their importance, value, or distinctiveness, especially compared to other areas used for recreation	Managed to protect and enhance a targeted set of activities, experiences, benefits, and desired recreation setting characteristics Within SRMAs, recreation management is recognized as the predominant land use plan focus, where specific recreation opportunities and setting characteristics are managed and protected on a long-term basis
Extensive Recreation Management Area (ERMA)	Administrative units that require specific management consideration in order to address recreation use, demand, or recreation and visitor services program investment	Managed to support and sustain the principal recreation activities and the associated qualities and conditions of the ERMA ERMA management is commensurate and considered in context with the management of other resources and resource uses.
Public Lands not Designated for Recreation	All lands not established as a Special Recreation Management Area or an Extensive Recreation Management Area	Management actions and allowable use decisions may be necessary to address basic recreation and visitor services and resource stewardship needs

Step 4 - Evaluate alternatives. For each alternative, the BLM will quantify the change in the supply of available recreation opportunities by district, measured in acres by recreation management area type. Where possible, the BLM will quantify and evaluate additional metrics such as trail miles by activity type, number of campsites, day use areas, etc.

The BLM will compare the demand for recreation use to opportunities for recreation activities, outcome objectives, associated benefits, and available recreation setting characteristics related to recreation management areas by district, measured in acres. The comparison of recreation demand to the change in recreation supply under each alternative will be made through qualitative narrative.

For each alternative, both the availability of recreation opportunities, quantified by recreation management area type in acres, and changes to recreation-related physical, social, and administrative settings will be used as indicators of impacts. Impacts on settings can either be beneficial due to the achievement of a desired setting or adverse due to the unwanted shift in setting to either a more primitive or urban environment.

Recreation-related physical, social, and operational settings are not specifically managed for, or protected in, public lands not designated for recreation management, (although these areas may still provide intrinsic recreation values and opportunities). The indicator used to describe impacts to these areas is the availability of opportunities described by either acreage restrictions or specific activity prohibitions and the ability to meet anticipated recreation demand by providing adequate opportunities.

Analytical Conclusions

- Ranking of alternatives showing the change in the supply of available recreation opportunities by district, measured in acres

- Alternatives will also be qualitatively compared to recreation demand, discussing the effects that recreation management area allocations (i.e., Special or Extensive Recreation Management Areas) will have on BLM's ability to meet projected demand for activity specific recreation use.

- Ranking of alternatives showing the effects that those recreation management area allocations will have on the protection of recreation setting characteristics (physical, social, administrative).

Data Needs

- GIS coverage - land use allocation polygons for recreation management areas, including acres for existing and proposed areas

- GIS coverage - existing recreation opportunities within the planning area for recreation service providers other than the BLM

- Road and trail networks for areas where designated off-highway vehicle use is occurring

Geographic Scale

- The distribution of land use allocations and the frameworks for recreation management areas for each BLM district within the decision area.

Units of Measurement

- Analysis will examine the satisfaction of recreational demand and the quality of visitor experiences under each alternative as measured by:

    - Availability of recreation opportunities (developed, dispersed, trail-based)

    - Recreation management area distribution, type, location, and acres

    - Acres of protected recreation setting characteristics

    - Allowable uses by type and acres by district

Data Display

- Tables, maps, and recreation management areas frameworks that show existing and re-designated land use allocations (acres) for recreation management areas.

Issue 2

How will alternative affect the BLM's ability to provide trail and travel opportunities in western Oregon?

Analytical Assumptions

• As required by Executive Orders 11644 (1972) and 11989 (1977) – Off-Road Vehicle Management Policies and regulation (43 CFR 8340; 8364), the western Oregon RMPs will classify all BLM-administered lands as open, limited, or closed to motorized travel activities. Designations will be based on the protection of resources, public safety, and minimization of conflicts among various uses.

• The BLM manages motorized access under three possible categories based on BLM land use planning decisions considering natural resource protection, route utility, and public safety. The off-highway vehicle categories are (1) 'open', which allows for unlimited travel, including cross-country, (2) 'limited', where off-highway vehicle use is restricted to meet specific resource management objectives, and (3) 'closed' to motorized use.

• Changing the size and distribution of land use allocations for off-highway vehicle use has a direct effect on motorized use patterns, which influence (1) off-highway vehicle use opportunities, (2) public safety, and (3) user conflicts. The interrelationship between these three primary factors can be attributed to each land use allocation for off-highway vehicle use.

• Travel management affects a variety of travel modes and opportunities for access to public lands. The alternatives will vary in providing motorized as well as non-motorized access.

• The demand to increase travel routes on BLM lands will continue to grow, especially near communities.

• Travel area designations would not affect reciprocal right-of-ways (ROW) holders, permitted uses, country or state roads, or other valid existing rights. Travel closures or limitations apply only to public access.

• The final travel management network of roads and trails will be determined at the implementation level due to the complexity of the planning area and incomplete route inventory data.

Resource Specific Impact Indicators - Trails and Transportation

Impacts to travel management cannot be completely labeled as adverse or beneficial; instead, impacts to travel management represent a given area's travel management focus or priority. To facilitate impact analysis of the various alternatives, the focus is on the impact parameters listed below. Impact indicators will assist with the classification of trail and travel allocations and the application of necessary travel limitations.

• Adverse Impacts

  ◦ Impacts from Cultural and Paleontological Resources: Transportation and access could be limited or denied in areas where recorded sites are located and with the discovery of new cultural or paleontological sites that are found through surveys. The restoration or rerouting of routes would be necessary in limited areas to avoid impacts to these resources.

  ◦ Impacts from listed Fish and Wildlife, and other Special Status Species: Transportation and access would be limited where seasonal closures are applied, and the designation of routes would require careful consideration of the natural systems, which support affected species.

- Impacts from Management of Land with Wilderness Characteristics: Protective management would greatly limit or preclude motorized use in these areas. Identification of existing routes would be evaluated for impacts to resources and either added to the transportation plan for the area or closed for use, limiting or precluding motorized and mechanized use on particular routes. Management of these areas may provide for a very low density of route systems. Motorized travel opportunities could remain available but could decrease in these areas from their current use patterns.

- Impacts from Land Tenure: Land disposals could greatly affect transportation and access. Future release of lands that interface with local communities and are presently appreciated for their open space and used for recreation would affect those communities trying to maintain desirable landscapes. Opportunities for managed off-highway vehicle use, as well as recreation, the protection of open space, and other qualities valued by local communities may be lost.

- Impacts from Land Use Authorizations: Land use authorizations could limit access and opportunities for recreation use when incompatible use within an area is permitted as part of such authorizations.

- Impacts from Recreation: The user conflict between motorized and non-motorized use is increasing the displacement of non-motorized travelers from areas shared by all users. Without recreation management, the availability of maps, and proper facilities such as trailhead signs, designated route identification, and information kiosks to meet needs of users, these conflicts would continue to increase.

- Impacts from Transportation and Access: Decisions to limit or preclude motorized travel in certain areas would cause a reduction in these opportunities and access.

- Impacts from Special Designations: Special designations to protect cultural, paleontological, natural, and aesthetic values are primary reasons that limitations or closures are applied to off-highway vehicle use. Opportunities for off-highway vehicle travel could be lost in certain areas, and be substantially limited in others. Limited areas would be carefully monitored and managed to ensure protection of resource values.

- Beneficial Impacts

  - Impacts from Cultural and Paleontological Resources: As new sites are identified and recorded, improved plans could be adapted for transportation. The survey and identification of cultural sites would aid in the development of transportation planning by providing information used to locate lower impact routes.

  - Impacts from listed Fish and Wildlife, and other Special Status Species: Consideration of wildlife species, habitat, and other natural systems would provide for well-planned travel networks and access opportunities. This provides the BLM with opportunities to manage for conservation and resource protection.

- Impacts from Management of Lands with Wilderness Characteristics: Beneficial impacts to transportation could include better managed and signed route systems that provide trail aces into areas with wilderness and scenic quality. The delineation of routes and opportunities to educate the public could increase understanding of proper use and appreciation for public lands.

- Impacts from Land Tenure: Opportunities exist for the public to take part in the Recreation and Public Purposes Act of 1954 (43 U.S.C. 869 et seq.). The beneficial impact could result in cooperative management strategies (for BLM-administered lands along the urban interface) for off-highway vehicle use and access.

- Impacts from Land Use Authorizations: If the BLM were to acquire new public road easements, access for motorized public travel could increase. Newly acquired routes would be open for administrative use and public travel if designated.

- Impacts from Recreation: Route management categories (open, limited to designated, closed) are applied to BLM-administered lands within the planning area to provide a wide variety of trail-based recreation opportunities such as hiking, equestrian, mountain biking, and off-highway vehicle trails. Travel routes provide safe and legal access for visitors to recreate on public lands Open and designated off-highway vehicle management areas would provide the public with recreational opportunities where concentrated off-highway vehicle use exists. The designation of such areas is part of the National Management Strategy for Motorized OHV Use on Public Lands (USDI-BLM 2001). To meet the recreational demands of the off-highway vehicle community, the BLM would provide managed areas for off-highway vehicle activity.

- Impacts from Transportation and Access: Opportunities for off-highway vehicle use would be enhanced by a definitive network of routes and information available through detailed maps, signage, and access point kiosks

Analytical Methods and Techniques

Step 1 - Classify land use allocations for trail and travel use. Open, limited, and closed area designations will be classified and mapped by alternative for each BLM district.

Step 2 - Characterize land use allocations for off-highway vehicle use. The framework for characterizing each land use allocation for off-highway vehicle use will consider the level of opportunities for off-highway vehicle use, public safety, and user conflicts (**Table 27**). This association will be used as part of the evaluation to determine potential benefits or disadvantages related to each alternative.

TABLE 27. CHARACTERIZATION OF OFF-HIGHWAY VEHICLE LAND USE ALLOCATIONS

	Closed	Limited to Designated Routes	Limited to Existing Routes	Open
Travel Opportunities	Increasing the amount of closed areas excludes OHV opportunities within these areas	Increasing the amount of OHV areas that are limited to designated routes would enhance OHV opportunities in areas that are designated and managed specifically for OHV use	Increasing the amount of OHV areas that are limited to existing routes would ensure continued OHV opportunities for those areas re-designated from open	Open OHV areas that are specifically designed and managed for OHV use would increase OHV opportunities
Public Safety	Increasing the amount of closed areas increases public safety within these areas. It may decrease public safety in open and limited areas due to the displacement of OHV users in those areas	Increasing the amount of OHV areas that are limited to designated routes would increase public safety in areas that are managed specifically for OHV use due to the increase in on-site management controls	Increasing the amount of OHV areas that are limited to existing routes would enhance general public safety for those areas re-designated from open	Increasing the amount of open areas may decrease public safety for non-OHV users. Open OHV areas that are specifically designed and managed for OHV use may increase public safety in other areas not open for OHV use
User Conflicts	Increasing the amount of closed areas decreases user conflicts within these areas. It may increase user conflicts in open and limited areas due to overcrowding of OHV users displaced to those areas	Increasing the amount of OHV areas that are limited to designated routes would decrease user conflicts in certain areas that are managed specifically for OHV use due to the added level of on-site management controls	Increasing the amount of OHV areas that are limited to existing routes would decrease user conflicts for those areas re-designated from open	Increasing the amount of open areas may increase user conflicts for non-OHV users. Open OHV areas that are specifically designed and managed for OHV use may decrease user conflicts in other areas not open for OHV use

Step 3 - Evaluate alternatives. For each alternative, the number of acres, allowable uses, travel limitations and modes of travel designated as open, closed, or limited will be directly compared.

Compare qualitatively the alternatives, discussing the effects that off-highway vehicle allocations (open, closed, limited) will have on resources using the trail and transportation impact indicators.

Analytical Conclusions

- Ranking of alternatives showing the change in the supply of available trail and travel opportunities by district, measured in acres

- Ranking of alternatives showing off-highway vehicle opportunities by vehicle type (Class I, II, III, and IV) and corresponding trail difficulty level

- Alternatives will also be qualitatively compared, discussing the effects on public access and travel that result from implementing management actions and allowable uses to meet resource and resource use objectives for the various programs

- Alternatives will also be qualitatively compared, discussing the effects that off-highway vehicle allocations (open, closed, limited) will have on BLM's ability to meet projected demand for off-highway vehicle specific recreation use

Data Needs

- Land use allocation polygons for off-highway vehicle use, including acres for existing and proposed areas

- Road and trail networks for areas where off-highway vehicle use is limited to designated routes

- Miles of trail by difficulty level and authorized vehicle use (Class I, II, II, and IV)

Geographic Scale

- The geographic scale of the analysis will be the decision area. All BLM-administered lands are allocated as open, limited, or closed to off-highway vehicles. These lands use allocations directly relate to the BLM's ability to help meet projected demand for off-highway vehicle use on BLM-administered lands across the region. The distribution of land use allocations for off-highway vehicle use for each BLM district will be the scale used for the analysis.

Units of Measurement

- Analysis will examine the BLM's ability to contribute to meeting off-highway vehicle use demand under each alternative as measured by off-highway vehicle designations (open, closed, limited), by district, measured in acres.

Data Display

- Tables and maps that show existing and re-designated land use allocations (acres) for off-highway vehicle use areas.

Issue 3

How would the alternatives affect identified Outstandingly Remarkable Values (ORVs), tentative classification, and free flowing characteristics on eligible Wild and Scenic river segments in western Oregon?

Analytical Assumptions

Wild and Scenic River Interim Protection

• All eligible river segments under consideration for inclusion into the National Wild and Scenic River System will be managed under interim protective measures required by the Wild and Scenic River Act and BLM Manual 6400 – Wild and Scenic Rivers Policy, and program Direction for Identification, Evaluation and Management (BLM 2012) until the record of decision for this RMP is adopted. At that time, any eligible segment not found suitable for inclusion into the National Wild and Scenic River System would lose its interim protection.

Primary Factors of the Analysis

• Any potential change to eligible or suitable river values or river segment or corridor area would be the primary factor in analysis. These values include (1) free-flowing nature of the river segment (2) outstanding remarkable values, and (3) tentative classification (wild, scenic, recreational). Recognizing that the analysis of impacts on eligible stream segments includes an evaluation of where the management actions may be inconsistent with these values.

Quantified Wild and Scenic River Impact Indicators

• For effects analysis, the following key resources will be used to determine effects to the outstanding remarkable values:

  ◦ Visual Resource Management: Designation of Class I and II management would protect scenic outstanding remarkable values. This management class would also provide indirect protection for other outstanding remarkable values or tentative classifications by preventing certain types of development that would affect the outstanding remarkable values or tentative classification. Class III and IV management would result in impacts on scenic outstanding remarkable values by allowing development that would directly impair scenic quality. Class III and IV management would also directly affect other outstanding remarkable values or tentative classifications by allowing certain types of development and modification of existing visual landscapes.

  ◦ Off-Highway Vehicle: Establishing open area designations with the ½-mile Wild and Scenic River corridor would result in an effect to several outstanding remarkable values. Closed and limited area designations within the ½-mile Wild and Scenic River corridor would ensure greater protection for several outstanding remarkable values.

  ◦ Recreation Management Area: Designation of Special and Extensive Recreation Management Areas, with the ½-mile Wild and Scenic River corridor, would ensure protection and enhancement of recreation-related outstanding remarkable values. Establishing lands as not designated for recreation within the ½-mile Wild and Scenic River corridor would affect recreation-related outstanding remarkable values.

  ◦ Riparian Management Area: Designation of riparian management area objectives, and the allowable activities that can be performed within these areas, would ensure protection of outstanding remarkable values.

• The BLM will use the following indicators to quantify impacts to outstandingly remarkable values for identified eligible river segments:

  ◦ Controlled Surface Use: Establishing a controlled surface use stipulation would provide a reduced level of protection to outstanding remarkable values and Wild and Scenic River characteristics, as surface-disturbing

activities are allowed, but must be modified or moved so as not to impact the resource. This stipulation does not ensure protection of outstanding remarkable values.

◦ No Surface Occupancy: Establishing a no surface occupancy stipulation would maintain protection of outstanding remarkable values by prohibiting surface occupancy and surface disturbing activities that might degrade or contribute to the degradation of an identified outstanding remarkable value.

◦ Timing Limitation: A timing limitation stipulation provides limited protection of outstanding remarkable values at certain times of the year. These are especially important in protecting aquatic and terrestrial wildlife species and their habitat during critical times. This stipulation does not ensure protection of outstanding remarkable values.

◦ Right-of- Way: Right-of-way exclusion would contribute to maintaining protection of outstanding remarkable values and tentative classification by prohibiting all new rights-of-way within the identified Wild and Scenic River corridor.

◦ Fluid Mineral Leasing: Development associated with fluid mineral leasing would affect outstanding remarkable values and tentative river classifications. Closing eligible river corridors to fluid mineral leasing would contribute to maintaining river related outstanding remarkable values and tentative classifications.

◦ Locatable Mineral Leasing: Withdrawing an area from mineral leasing would contribute to maintaining river related outstanding remarkable values and tentative classifications.

Analytical Methods and Techniques

Step 1 - Identify river segments Suitable for inclusion into the National Wild and Scenic River System. Perform suitability determinations on 51 river segments found eligible during the 1995 RMPs. Determinations will be performed using the following thirteen suitability factors for each river:

1. Characteristics that do, or do not, make the area a worthy addition to the National System. These characteristics (free flow and outstanding remarkable values), are described in the Wild and Scenic Rivers Act and may include additional factors.

2. The status of land ownership and use in the area

3. The reasonably foreseeable potential uses of the land and water that would be enhance, foreclosed, or curtailed if the area were included in the National System

4. The federal agency that will administer the area, should it be added to the National System

5. The extent to which the agency proposes that administration of the river, including the costs thereof, is shared by state and local agencies

6. The estimated cost to the United States of acquiring necessary lands or interests in land within the corridor, as well as the cost of administering the area should it be added to the National System

7. A determination of the extent that other federal agencies and the state or its political subdivisions might participate in the preservation and administration of the river should it be proposed for inclusion in the National System

8. An evaluation of local zoning and other land use controls in protecting the river's outstandingly remarkable values and preventing incompatible development

9. The state or local government's capacity to manage and protect the outstanding remarkable values on non-Federal lands. This factor requires an evaluation of the river protection mechanisms available through the

authority of state and local governments. Such mechanisms may include, for example, statewide programs related to population growth management, vegetation management, water quantity or quality, or protection of river related values such as open space and historic areas.

10. The existing support or opposition of designation. Assessment of this factor will define the political context. The interest in designation or no designation by federal agencies; state, local, and tribal governments; national and local publics; and the state's congressional delegation should be considered.

11. The consistency of designations with other agency plans, programs, and policies in meeting regional objectives. Designations may help or impede the goals of tribal governments or other Federal, state, or local agencies. For example, designation of a river may contribute to state or regional protection objectives for fish and wildlife resources. Similarly, adding a river that includes a scarce recreation activity or setting to the National System may help meet statewide recreation goals.

12. The potential for water resources development. Identify any proposed water resource projects that may be foregone, as designation may limit development of water resources projects as diverse as irrigation and flood control measures, hydropower facilities, dredging, diversions, bridge construction, and channelization. The location of segments found 'Suitable' for potential inclusion into the National System will be listed and mapped by alternative.

13. The contribution to river system or basin integrity. This factor reflects the benefits of a "systems" approach (e.g., expanding the designated portion of a river in the National System or developing a legislative proposal for an entire river system-headwaters to mouth-or watershed). Numerous benefits may result from managing an entire river or watershed, including the ability to design a holistic protection strategy in partnership with other agencies and the public.

Step 2 - Evaluate impacts to eligible river segments. The identified impact indicators will be used to measure the impact that each alternative would have on the protection of eligible river values, tentative classification, and free flowing characteristics. Each alternative will be displayed by river segment across the range of selected impact indicators identified in the analytical assumptions section.

Analytical Conclusions

- Alternatives will be ranked to show the effects to river characteristics as a result of determining a river or river segment suitable for potential inclusion into the National Wild and Scenic River System.

Data Needs

- Map of termini for all eligible wild and scenic river segments within the planning area.
- Map of termini for all suitable wild and scenic river segments within the planning area.
- Stand-alone Wild and Scenic River Suitability report for all rivers and river segments within the planning area.

Geographic Scale

- The geographic scale of analysis is all BLM-administered eligible river segments in each BLM district within the planning area. Eligible river segments identified in the 1995 RMPs will be evaluated to assess whether or not they would be suitable for inclusion in the National Wild and Scenic River System.

Units of Measurement

- Miles of rivers with outstanding remarkable values maintained or degraded

Data Display

• Tables, maps and suitability reports that show river related impacts, by impact indicators (acres) across the range of alternatives

Issue 4

How would varying types and intensities of forestry management and other resource uses affect visual resource quality on BLM-administered lands?

Analytical Assumptions

Changing Visual Character in Western Oregon

• Over the past two decades, BLM-administered lands in western Oregon have experienced population growth and development, and these lands have been increasingly used for outdoor recreation and tourism. Because of these recent changes, the BLM has identified the need to complete updated Visual Resource Inventories (VRI).

• Visual Resource Inventories classes form the basis for analysis. These classes use the same numerical scale (I through IV) as Visual Resource Management (VRM) classes. They are the categories the BLM uses to classify the current visual character of the landscape and are a way to communicate the degree of visual value in an area. Impacts to visual resources are those that contrast with the existing environment when viewed by the casual observer from any key observation point. Contrast can be with form, line, texture, or color.

• Designating an area to a visual resource management class lower than the inventoried visual resource class will result in an adverse effect to visual resources. Conversely, designating an area to a visual resource management class higher than the inventoried visual resource class may result in a beneficial effect to visual resources over time.

• Visitors to BLM-administered lands, or residents living near BLM-administered lands, are sensitive receptors for impacts of visual quality.

• Activities that cause the most contrast and are the most noticeable to the viewer and the public would be considered to have the greatest effect on scenic quality and greatest magnitude of perceived impact on sensitive landscapes.

• The BLM would implement Visual Resource design techniques to mitigate potentially harmful impacts.

• The magnitude (or dominance) of a visual effect depends on a variety of factors, including the size of a project (i.e., area disturbed, physical size of structures), the location and design of roads and trails, and the overall visibility of disturbed areas.

• The more protection that is associated with the management of other resources and special designations, the greater the benefit to visual resources of the surrounding viewsheds.

Analytical Methods and Techniques

Step 1 - Perform a Visual Resource Inventory Update. All BLM-administered lands within the planning area will have an updated Visual Resource Inventory. This will involve the identification of the visual resources of an area and assign them to inventory classes using the BLM's visual resource inventory process. All BLM-administered lands are required to be designated as Visual Resource Management Class I, II, III, or IV. The Class I objective is to preserve the existing character of the landscape. The Class IV objective is to provide for management activities that may involve major modification of the existing character of the landscape. Class II, III, and IV objectives provide partial modifications across a uniform continuum.

Step 2 - Establish resource uses that would potentially affect Visuals. Establish and identify the resources and resource uses that would potentially impacts visuals based on the implementation of specific actions. Examples include impacts from forestry and woodland products, recreation, trails and travel management, renewable energy, wildlife and special status species management, and those that would have little or no impacts on visual resources.

Step 3 - Establish criteria for analysis. The criteria for analysis will be the number of acres proposed for designation under the Visual Resource Management classes, and the level of impacts and surface disturbances permitted and anticipated under each class. Analyses of the impacts on visual resources are discussed in terms of the number of acres in each Visual Resource Management category and reasonably foreseeable actions in those categories because the proposed RMP management actions would be required to comply with (i.e., not exceed) the approved Visual Resource Management class objectives.

Step 4 - Assess impacts to Visual Resources through resource uses. To evaluate the impact of the proposed alternatives on visual resources the quantitative measure of the acres of Visual Inventory Classes that are prescribed to specific Visual Resource Management Class objectives will be used to disclose the anticipated loss or protection of visual quality (scenic quality, sensitivity level and distance zones) in the existing environment. To provide a comparative analysis between the acres of inventory class versus the acres of Visual Resource Management classes, each alternative will be displayed by Visual Resource Inventory and Management class.

Analytical Conclusions

- Ranking of alternatives showing effects between Visual Resource Inventories acres and Visual Resource Management acres. To facilitate impact analysis, Visual Resource Management classes represent allowable levels of impacts described above and the inventory classes represent the general existing condition of the landscape or baseline. The management of other resources and resource uses, and how those actions might affect scenic resources, will also be examined and explained in narrative format.

Data Needs

- Updated Visual Resource Inventory for all BLM-administered lands within the planning area; Inventory will be mapped by individual visual resource components and resulting Visual Resource Inventory classes

- Visual Resource Management allocations by alternative

Geographic Scale

- The decision area

Units of Measurement

- Visual Resource Inventory Class (Acres)

- Visual Resource Management Class (Acres)

Data Display

- Tables and maps that show inventoried Visual Resource Inventory classes and proposed Visual Resource Management classes across the range of action alternatives

Issue 5

How will the alternatives affect BLM-administered lands with identified wilderness characteristics?

Analytical Assumptions

Lands with Wilderness Characteristics

• Lands with wilderness characteristics inventories identify BLM-administered lands, outside of wilderness areas, wilderness study areas, and instant study areas, that possess the following wilderness characteristics: sufficient size, naturalness, and outstanding opportunities either for solitude or for primitive and unconfined recreation. Management decisions can affect identified lands with wilderness characteristics.

• Where management action seeks to maintain or enhance naturalness (e.g., protection of biological or visual resources), the associated wilderness characteristics are beneficially impacted. Where management action seeks to maintain or enhance opportunities for solitude or primitive, unconfined recreation, (e.g., establishing permit systems or closing an area to motorized or mechanized use), the associated wilderness characteristics are beneficially impacted.

• Where management direction would allow for surface disturbance or development, wilderness characteristics can be adversely impacted.

Designated Wilderness and Wilderness Study Areas (WSAs)

• Designated Wilderness will continue to be managed under the Wilderness Act of 1964, the specific designating legislation, BLM's Wilderness Management Regulations at 43 CFR 6300, and BLM's 6340 Wilderness Manual (BLM 2012a). Wilderness study areas (WSAs) will be managed under the BLM's 6330 WSA Management Manual (BLM 2012b) until Congress either designates or releases all portions of WSAs from further consideration for wilderness.

Lands with Wilderness Characteristic Impact Indicators

• The wilderness characteristics (i.e., size, naturalness, and either outstanding opportunities for solitude or primitive and unconfined recreation) will be used as the indicators for impacts. Analysis will assume the following management actions would, over time, result in impairment of wilderness characteristics:

  ◦ Sustained-yield timber production: The special management to maintain wilderness characteristics would not apply to portions of inventoried units that would be managed for sustained-yield timber production

  ◦ Recreation Management Area designation: Designating a Special or Extensive Recreation Management Area for motorized or mechanized trail use

  ◦ Travel Management Area designation: Designating an area as open motorized travel management

  ◦ Fire Management: Designating an area for Wildland urban interface fire treatment

Analytical Methods and Techniques

Step 1 - Perform Lands with Wilderness Characteristics Inventories (LWCI). Perform these inventories on all BLM-administered lands in western Oregon to identify those lands that possess the sufficient size, naturalness, and either outstanding opportunities for solitude or for primitive and unconfined recreation.

Step 2 - Establish Indicators for Lands with Wilderness Characteristics Impacts. The wilderness characteristics (i.e., size, naturalness, either outstanding opportunities for solitude or primitive and unconfined recreation) will be used as the indicators for impacts.

Step 3 - Evaluate impacts to lands with wilderness characteristics. For each area identified as having wilderness characteristics, evaluate whether wilderness character elements would be maintained or not, based on the land use allocation, management objectives, and management direction in each alternative.

Analytical Conclusions

- Ranking of alternatives showing the percentage of BLM-administered Lands with Wilderness Characteristics that will be maintained by alternative. The analysis will include a narrative discussing Lands with Wilderness Characteristics that will be impacted by other resource uses across the range of alternatives

Data Needs

- Polygons identifying lands with wilderness characteristics as updated in the 2012 inventory.

Geographic Scale

- The geographic scale of the analysis will be the inventoried lands with wilderness characteristics within the decision area

Units of Measure

- Acres of lands with wilderness characteristics

Data Display

Maps

- Wilderness characteristics as updated in the 2012 inventory
- Wilderness characteristics maintained across range of alternatives

Tables

- District, unit name, and acres where wilderness characteristics will be protected or not protected with special management under each alternative

References

Oregon Parks and Recreation Department. 2013. Statewide Comprehensive Outdoor Recreation Plan. *http://www.oregon.gov/OPRD/PLANS/Pages/SCORP.aspx*

U.S. Department of the Interior, Bureau of Land Management. 2010. Transmittal of revised recreation and visitors services land use planning guidance, updated checklist, and three land use planning templates. Instruction Memorandum no. 2011-004. *http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/2011/IM_2011-004.html*

-- . 2011. Revised Planning for Recreation and Visitor Services Manual. Release 8-81, 29 March 2011 *http://www.blm.gov/pgdata/etc/medialib/blm/wo/Information_Resources_Management/policy/blm_manual.Par.82237.File.dat/8320.pdf*

Roads

Issue 1

How will the alternatives affect the use, maintenance, and condition of BLM's transportation system?

Analytical Assumptions

- Timber harvest operations will require construction of additional permanent and temporary roads.
- Existing roads needed for timber sale use would be renovated, improved, or maintained to design standards, thus supporting anticipated use, providing for safety, and preventing degradation to adjacent lands and resources
- During the past two decades, timber harvest levels have been lower than previous decades, resulting in decreased commercial utilization of the existing road network. This has led to a significant gap between annual maintenance need and actual expenditure, thus creating a large deferred maintenance backlog.
- The new construction road ratios (feet/Mbf), developed for the ten-year scenarios in the 2008 RMP/EIS, are a reasonable approximation of expected future new road construction. These road ratios were developed by using a volume weighted average of the road ratios developed for each of the five alternatives analyzed. Harvest types, methods, and volumes, as well as landing locations and road types, will be similar to and bracketed by the 2008 RMP/EIS alternatives using these road ratios for all our new alternatives is justified.
- The BLM will estimate future renovation, improvement, and closure of existing BLM roads based on recent timber sale experiences.
- Renovation expenditures reduce the deferred maintenance backlog.

Analytical Methods and Techniques

- The road ratios (feet/Mbf) developed for the 2008 RMP/EIS will be used to estimate miles of new road construction required for the No Action alternative and all the action alternatives (harvest type, road type, and surface type) as shown in the following example (for each district):
    - Total length of roads required for regeneration harvest = (road ratio of feet/Mbf for regeneration harvest type) × (total volume of regeneration harvest).
    - Rocked permanent road length, for regeneration harvests = (Total road length) × (percentage of permanent rocked for regeneration harvest).
- Road ratios and road type, surface type percentages are shown in **Tables 28**, **29**, **30**, and **31**.

TABLE 28. ROAD RATIOS BY HARVEST TYPE (FT/MBF)

District / Field Office	Regeneration	Thinning	Partial Cut
Coos Bay	0.6029	1.5019	0.6379
Eugene	0.3966	1.7201	0.6032
Klamath Falls – West	0.2075	0.8757	0.0978
Klamath Falls – East	3.0834	4.6251	0.0000
Medford	1.1673	3.8330	1.7741
Roseburg	0.7513	2.0818	0.9681
Salem	0.4087	1.5191	0.3531

TABLE 29. ROAD PERCENTAGES FOR REGENERATION HARVESTS BY ROAD TYPE AND SURFACE TYPE

District/Field Office	Temporary Rock	Temporary Natural	Permanent Rock	Permanent Natural
Coos Bay	19.16	28.66	48.20	3.98
Eugene	8.75	5.13	84.37	1.74
Klamath Falls – West	0.00	0.00	0.00	100.00
Klamath Falls – East	0.00	0.00	0.00	100.00
Medford	3.62	31.06	42.50	22.83
Roseburg	1.82	36.12	61.91	0.15
Salem	10.08	52.32	28.05	9.55

TABLE 30. ROAD PERCENTAGES FOR THINNING BY ROAD TYPE AND SURFACE TYPE

District/Field Office	Temporary Rock	Temporary Natural	Permanent Rock	Permanent Natural
Coos Bay	38.39	37.05	15.27	9.30
Eugene	37.81	31.18	30.14	0.87
Klamath Falls – West	0.00	0.00	0.00	100.00
Klamath Falls – East	0.00	0.00	0.00	100.00
Medford	4.70	13.96	30.12	51.22
Roseburg	1.06	64.73	33.06	1.14
Salem	14.65	21.58	24.63	39.13

TABLE 31. ROAD PERCENTAGES FOR PARTIAL CUT HARVEST BY ROAD TYPE AND SURFACE TYPE

District/Field Office	Temporary Rock	Temporary Natural	Permanent Rock	Permanent Natural
Coos Bay	35.43	21.66	42.91	0.00
Eugene	9.44	3.61	86.95	0.00
Klamath Falls – West	0.00	0.00	0.00	100.00
Klamath Falls – East	0.00	0.00	0.00	0.00
Medford	13.52	20.59	42.69	23.20
Roseburg	0.00	43.11	56.22	0.67
Salem	9.04	69.20	9.87	11.89

- Six years (FY2007-FY2012) of harvest volume sold data and timber sale contract data will be used to compute ratios of miles of renovation and improvement to MMbf sold. The BLM will then use these ratios to project miles of renovation and improvement for all the alternatives.

- Six years (FY2007-FY2012) of harvest volume sold data, timber sale contract data, and restoration and deferred maintenance contract data will be used to compute ratios of miles of road closure to MMbf sold, closure type, and surface type. These ratios will then be used to project miles of road closure for all the alternatives, by closure type and surface type. Road closure mileages will also be projected on a per year basis since road closure mileage may not be sensitive to harvest levels given that most BLM-administered lands are encumbered by reciprocal right-of-way agreements.

• BLM tracks logging hauls over BLM roads in western Oregon. Eight years (CY2005-CY2012) of BLM timber sale contract haul data have been used to calculate road use ratios (miles/MMbf and Mbf-miles/MMbf) by surface type, at the scale of western Oregon, as shown in **Table 32**.

TABLE 32. ROAD USE BY SURFACE TYPE PER DECADE

Surface type	Miles/MMbf	Mbf-Miles /MMbf
Aggregate	1.03	1,353
Bituminous Surface Treatment (BST)	0.67	2,977

• These ratios will be used to project total miles of the road network utilized by surface type for each alternative; utilization rates will also be computed by surface type. Road maintenance fee collections by surface type will be projected using current maintenance fee rates (assuming purchaser maintenance equivalent to fee collection). Finally, maintenance fee collections will be compared to the annual maintenance need for roads as reported in the Facility Asset Management System (BLM's constructed asset inventory).

• Six years (FY2007-FY2012) of harvest volume sold data and timber sale contract data will be used to compute ratios of the average value of timber sale purchaser road renovation to MMbf sold, by district. These ratios will then be used to project renovation values for all the alternatives, by district. Renovation values will be compared to the deferred maintenance backlog for roads as reported in the Facility Asset Management System.

Analytical Conclusions

• Miles of new permanent and temporary road construction by district, surface type, and harvest type

• Miles of road renovation and improvement by district and surface type

• Miles of both permanent and short- and long-term road closure by district and surface type; also by district, surface type, and year

• Change in road network mileage by district, surface type, and closure status

• Miles of existing road network utilized by surface type; utilization percentages

• Road maintenance fee collections by surface type; compare to annual maintenance need

• Value of timber sale purchaser renovation; compare to deferred maintenance backlog

Data Needs

• Current Facility Asset Management System road inventory data:

  ◦ Functional classification (miles)

  ◦ Ownership (miles)

  ◦ Surface type (miles)

  ◦ Condition class (miles)

  ◦ Annual maintenance need ($)

• Deferred maintenance backlog ($)

• MMbf of planned timber harvest by district and harvest type for each alternative

- Harvest volume sold, by district (FY2007-FY2012 data)
- Miles of renovation or improvement, by district and surface type (FY2007-FY2012 timber sale data)
- Miles of permanent road closure by district, by surface type and by year (FY2007-FY2012 timber sale data)
- Miles of long- and short-term closure by district, by surface type and by year (FY2007-FY2012 timber sale data)
- Current road maintenance fee rate by surface type (Road Maintenance Fee Schedule)
- Average value of timber sale purchaser road renovation by district by surface type (FY2007-FY2012 timber sale data)

Data Display

- Tables showing for each district by alternative:
  - Miles of permanent and temporary new road construction by surface type and harvest type
  - Miles of permanent and short- and long-term road closure by surface type; and by surface type per year
  - Miles of road renovation and improvement by surface type
- Tables showing:
  - Miles of the existing road network utilized and utilization percentage by surface type
  - Maintenance fees collected and percentage of annual maintenance need
  - Value of purchaser renovation and percentage of deferred maintenance backlog

References

U.S. Department of the Interior, Bureau of Land Management. 2008. Final Environmental Impact Statement for the Revision of the Resource Management Plans of the Western Oregon Bureau of Land Management Districts. Portland, OR. Vol. I-IV. *http://www.blm.gov/or/plans/wopr/final_eis/index.php*

Socioeconomics

Issue 1

How will the alternatives affect the supply, demand, and value of goods and services derived from BLM-administered lands?

BLM-administered lands produce a wide range of goods and services that people value. Some goods and services are valuable after they are harvested or otherwise extracted from the landscape (e.g., timber products). Other goods and services are valuable in situ, as part of the ecosystem (e.g., recreational opportunities). Natural resources often have the capacity to provide market-based values as well as non-market based values. This section describes the analytical framework the BLM will use to estimate or describe the total economic value of each good or service. The analysis will assign value to some goods and services based on their market prices (e.g., timber). For other goods and services, the analysis will rely on both market and non-market information to estimate or describe their value (e.g., recreation). The analysis can value some goods and services only using non-market valuation techniques. **Table 33** shows the goods and services anticipated to be included in the analysis and shows whether they will be valued using a market or non-market approach.

The general approach to analyzing the goods and services is described below. Details may vary somewhat for each good or service depending on data availability.

TABLE 33. SUMMARY OF ANALYTICAL APPROACH FOR GOODS AND SERVICES INCLUDED IN THE SOCIOECONOMIC ANALYSIS

Good or Service[1]	General Analytical Approach		Data Inputs	
	Market[2]	Non-Market	Biophysical Data from Other Resource/Program Areas	Demand and Value
Timber	X		Million board feet (MMbf) by species type	BLM and non-BLM market revenue
Non-Timber Forest Products	X	X	*Forest Management:* Quantity of products and permits, (e.g., firewood, berries, mushrooms)	Price of permits; participation in production; market prices where available; Non-market value of production
Recreation and Tourism	X	X	*Fisheries/Aquatic:* Effects on aquatic habitat and fish populations *Wildlife:* Effects on terrestrial habitat and wildlife populations *Recreation/Visual Resources Management:* Supply and characteristics of recreation activity on BLM land (e.g., number of visitors; number of permits; number of trips; trail miles; access points)	Utilize census population data combined with state, BLM, and USFS recreation demand survey data. Draw from BLM and non-BLM revenue data (e.g., permits and fees, etc.) Utilize USFS, USFWS, and other values from the literature for activity-specific expenditures and willingness-to-pay values
Energy Production	X		*Energy:* Quantity of biofuels, coal bed natural gas (CBNG) development opportunities, geothermal, and other types of energy production and transmission as relevant	Coordinate with BLM staff on prices for permits; Market prices for energy produced.
Grazing	X		*Range*: Quantity of Animal Unit Months	Coordinate with BLM staff on prices for permits; Market value of range production.
Minerals	X		*Minerals/Geology:* Quantity of saleable minerals (no expected substantial quantity of locatable or leasable).	Coordinate with BLM staff on market prices for saleable minerals and permit values.
Carbon Storage		X	*Air Quality/GHG/Carbon Storage:* Tons of carbon stored.	Value of climate change mitigation from carbon storage, (commonly referred to as the social cost of carbon), which represents a scaling of projected costs to society per ton of increased atmospheric carbon. The latest estimate for this value is based on the federal interagency work group assigned with generating an estimate for use in setting federal policy (Interagency Working Group on Social Cost of Carbon, United States Government. 2013.)
Source Water Protection	X	X	*Hydrology/Riparian:* Changes in quantity and quality of water used for drinking, irrigation, etc.	Quantity of users, uses; Values from literature regarding avoided costs of services, value of increased reliability, and reduced risk of contamination, including, as appropriate, information from markets for water quality and water quantity
Biodiversity and Sensitive Species		X	*Wildlife:* Effects on species of concern *Plants:* Effects on biodiversity and species of concern	Existence value of protection of sensitive species and areas *(Use values incorporated into Non-Timber Forest Products and Recreation)*
Scenic Amenities	X	X	*Air Quality/GHG/Carbon Storage:* Changes in visibility *Recreation/VRM:* Changes in visual resources	Qualitative discussion: demand for scenic amenities, economic importance of changes in quality, including information for markets for land conservation and other information revealed through property values
Cultural Meaning		X	*Cultural*: Description of historic uses and cultural meaning	Qualitative discussion: demand for cultural services, indicators of socioeconomic importance

1 This list of goods and services is subject to revision as the analysis progresses. It is dependent in part on sufficient data availability and findings of the biophysical analyses. For example, if a biophysical analysis finds no impact from the management alternatives on the supply or quality of a particular good or service, or finds no meaningful variation across alternatives, it may not be appropriate to include in the socioeconomic analysis.

2 This means the analysis will rely on prices revealed through markets to illustrate or quantify values associated with goods and services derived from BLM-administered lands. It does not necessarily imply that goods and services derived from BLM-administered lands are or will be traded on markets, though for some goods and services, e.g., timber, this is true.

Analytical Assumptions

• Rely on information produced by BLM resource or program area staff to describe changes in the supply of goods and services by alternative. Changes in timber supply will come from vegetation-modeling work. BLM sources will also be the basis, to the extent possible, for information describing demand and prices for goods and services.

• Consider in detail only those goods and services for which the alternatives will generate a meaningful and substantial change in supply from baseline conditions. For those goods and services that Resource or Program specialists determine will not vary meaningfully by alternative, the analysis will describe the finding but not include them in subsequent analyses.

• Include a description of the value of goods and services in terms of their supply and sources of demand, both from inside and outside the planning area. For example, the analysis will include a description of the value of recreational opportunities on BLM-administered lands in terms of the quantity and quality of the supply on BLM-administered lands, but also the availability of substitutes on non-BLM-administered lands within the same area. There will also be a description of the demand for those opportunities from nearby residents within the planning area, and from visitors traveling from outside the state.

• Use official guidance from the BLM (USDI 2013) to estimate the value of goods and services valued through non-market methods.

Analytical Methods and Techniques

• Describe the supply, demand, and value for all goods and services shown in **Table 33** using market data, non-market data, or both. The analysis will follow current guidelines for economic analyses, including those described by the BLM (USDI 2005, 2013), the Council on Environmental Quality (2013), and the EPA (2010). Major analytical steps include:

Step 1 - Identify and describe affected goods and services. In this case, 'affected' refers to goods and services that the alternatives would affect, in terms of either quantity or quality, particularly where this impact would vary among alternatives.

Step 2 - Analysis of the No Action alternative. This step requires the analysis of the effects of implementing the current RMPs as written on the goods and services selected in Step 1. As with the other alternatives, the starting point for this analysis will be the affected environment section of the DEIS, which describes the existing conditions for each good or service, including trends and status.

Step 3 - Describe changes in supply of goods and services by action alternative, using information from other resource or program areas and presented in other sections in the EIS and relative to the No Action and the action alternatives. When the data will not allow quantification, describe the changes qualitatively, which may include describing the relative scarcity of the good or service at issue. The analysis will seek to isolate changes attributable to the action alternative, distinct from changes based on other forces, such as changing demographic and market conditions.

Step 4 - Estimate the changes in value of each good or service arising from changes in supply across alternatives. This will be based upon demand data, in terms of quantity and price or willingness-to-pay, specific to each good or service. When the data do not allow quantifying changes in values, the analysis will describe economic value qualitatively. This analysis will take into account economic forces and trends that affect demand, supply, and economic values of goods and services. Where the analysis estimates a flow of values over time, it will report both per-year values and the present discounted value over the period using a discount rate consistent with BLM and other federal guidance.

Step 5 - Identify beneficiaries of each good or service and describe the distribution of values across beneficiaries, geography, and time. This step will be coordinated with other analyses as appropriate including economic activity, economic stability, and capacity and resiliency of different types of communities.

Step 6 - Describe risks and uncertainties that affect the analysis. These risks and uncertainties include factors that arise from biophysical sources of uncertainty (e.g., climate change effects on the supply of ecosystem goods and services) and socioeconomic sources of uncertainty (e.g., trends in market conditions that affect demand for goods and services, or supplies of substitute goods and services). Both factors have the potential to affect values, and should be recognized at a minimum, qualitatively and quantitatively, through the sensitivity analyses (if data allow) (EPA 2010).

Analytical Conclusions

- The analysis will describe the effect of each alternative on the value of each good or service. The description will include the direction, general or specific magnitude, timing, and duration of the effect. For some goods and services, the analysis will be able to provide a monetary value of the effect, either per year or as a present value discounted over a specific period. For other goods and services, it will describe the change in value qualitatively, providing as much information as possible to distinguish effects across alternatives.

Data Needs

- **Table 33** shows the data inputs anticipated for each good or service. For each good or service, the general analytical approach requires identifying data to describe
    - Quantity (supply) by alternative
    - Value per quantity. This may be a price for goods traded in markets or other indicators of value, (e.g., willingness-to-pay for goods and services not traded in markets)
- The analysis will seek information from the BLM resource or program areas to describe the quantity or supply of each good or service. Specific data expected, based on preliminary conversations with each resource or program area's lead specialist is shown in the left column of the Data Inputs section of **Table 33**.
- The analysis will also describe the demand and value for each good or service. **Table 33** illustrates the types of data and general analytical approach for each good or service in the right column of the Data Inputs section (Demand and Value). For each type of data, to the extent available, the analysis will present historical records and future forecasts to show trends over time.
- **Table 33** does not identify all data sources for values at this time, as the analysis will only compile and analyze value data once alternatives have been defined, and areas of variation among alternatives identified. As noted above, only a subset of goods and services will have identifiable and quantifiable variation appropriate for valuation.

Geographic and Temporal Scales

- The geographic market for each good or service will likely vary by good or service. For some goods and services, the relevant market will correspond to BLM districts. For some, the geography could be smaller (e.g., counties) or larger (e.g., the State of Oregon, the Pacific Northwest).
- The number of future years in the analysis will depend on data output from resource or program areas. In general, the timeframe will be selected to capture the substantial costs and benefits of a specific action or policy within an alternative.

Units of Measure

- Units of measure for change in supply will vary by type of market good or service (see **Table 33** and the Data section below). Because most of the information to describe the supply of goods and services will come from other research or program areas, the analysis will rely on the units of measure used in those analyses. Where multiple units may be used to quantify supply in biophysical terms, selection of a unit of measure will be coordinated among specialists to ensure that the selected unit is compatible with the economic information available from market transactions or in the non-market literature.

- When the available data support quantification, the analysis will value the change in supply of goods or services in 2012 dollars (consistent with the other economic analyses used for this effort). When the data do not support quantification in either physical or monetary terms, the analysis will describe the economic significance qualitatively.

Data Display

- For each good or service a narrative description of the analysis will include:
    - Description of the goods or services
    - How the alternatives affect supply
    - Sources of demand, value
    - How the management alternatives affect value
    - Beneficiaries of the good or service and distribution of effects on value
    - Relevant economic forces, trends, and sources of uncertainty affecting the results

- Where possible, display changes in supply, demand, and values over time for each good or service using graphs and tables. The analysis will provide results describing the value of goods and services disaggregated to the extent possible by: (1) revenue that would accrue directly to BLM, (2) revenue that would directly accrue to other entities, such as counties, and (3) other measures and descriptions of the remainder of the total economic value for that particular good or service (e.g., consumer surplus associated with recreation). **Table 34** provides a possible results table structure.

TABLE 34. EXAMPLE SUMMARY OF VALUE RESULTS STRUCTURE

Good or Service	Metric	BLM Revenue	Non-BLM Revenue	Other Value
Timber	Species-specific board feet	$	$	$, non-monetary measures, descriptions
Recreation	User-days by activity type	$	$	$, non-monetary measures, descriptions
Carbon	Tons of carbon sequestered	N/A	N/A	$, value of carbon sequestration, as defined by federal guidance on the social cost of carbon

Issue 2

How will the alternatives affect economic activity in the planning area derived from BLM-administered lands?

Analytical Assumptions

• Two distinct triggers of economic effects result from BLM management: resource programs and federal payments. Effects resulting from program outputs and expenditures will be calculated separately from those resulting from federal payments. Program outputs will include timber, special forest products, recreation (including wildlife and fish-based), minerals, and grazing. Program expenditures will include all operational expenses (personnel, facilities, and overhead), plus resource-specific expenses such as watershed restoration, fuels reduction, and transportation management. Federal payments will include all funds paid to either the state of Oregon or its counties, such as Payments in Lieu of Taxes (PILT), mineral royalties, and O&C payments or their replacement (Secure Rural Schools).

• Economic models will reflect conditions in 2012, the most recent year for which all economic data are available. While prices used for resource allocation purposes may reflect averages over certain timeframes, prices used to estimate economic activity must match the model year.

Analytical Methods and Techniques

Two sets of economic models will be developed. The first set will be multi-county models organized around BLM districts to estimate the effects of BLM resource programs and expenditures. The multi-county areas will include a substantial share of commuting to capture a functional economic area and such that spending effects by local households will be captured. The second set will be single county models that focus on effects by federal payment spending by local governments.

Resource programs and agency expenditures

Step 1 - Delineate multi-county model areas. Counties will be grouped around each BLM district based primarily on the economic centers that are most responsive to either resource program outputs or expenditures. Inclusion of a county in one group will be based on the economic connections to resource processing, visitor spending, and agency expenditures rather than acreage of BLM-administered land.

Step 2 - Develop economic models. The IMPLAN® modeling system will be used to create and run all economic models. Multi-county models will be created, initially using IMPLAN® data for 2012. The forest product sectors will be customized using industry data available from federal, state, and private sources. State and local government sectors will be customized using data available from local governments. Finished models will provide economic information for the Affected Environment section of the EIS.

Step 3 - Collect resource program outputs, values, and expenditures. Resource specialists will estimate quantities of resource production and use for which there are sales in the local economies. Historic log flows will be used to allocate timber products harvested in each district to particular processing centers, some of which may not be located in the same model area. Current (2012) market prices or production relationships for each resource will be applied to resource quantities in order to estimate total sales. Agency expenditures (2012) will be collected from BLM fiscal records. Agency employment will be collected from BLM personnel records. A variety of tools will be used to organize sales and expenditure information, including the Forest Economic Assessment Spreadsheet Tool (FEAST). Resource and expenditure information will be averages expected during the first decade of each alternative.

Step 4 - Estimate economic effects. Sales and expenditure data developed in Step 3 will be run through the appropriate IMPLAN® models to generate economic effects. A variety of tools, including the Forest Economic Assessment Spreadsheet Tool, will be used to generate and summarize effects.

Federal payments

Step 1 - Develop single county models. The IMPLAN® modeling system will be used to create individual models for each county in the planning area that receives federal payments associated with BLM-administered lands. Each model will be created using IMPLAN® data for 2012. State and local government sectors will be customized using data available from local governments.

Step 2 - Collect federal payment data. Data will include payments received in 2012 by the State of Oregon and distributed to local governments, as well as payments received in 2012 directly by local governments. Federal payments include Payments in Lieu of Taxes, payments from O&C timber receipts (or Secure Rural Schools payments as a replacement), and payments from Federal mineral royalties.

Step 3 - Estimate economic effects. Federal payment data developed in *Step 2* will be run through each single-county IMPLAN® model to generate economic effects. Average spending patterns for state and local governments nationally are available from IMPLAN® and will be used to estimate economic effects.

Analytical Conclusions

- Rank alternatives based on the magnitude of economic effects (employment and earnings) by sector and district.
- Effects summary will include results for both resource programs and federal payments.
- The narrative will include explanations for the magnitude of different impacts

Data Needs

- IMPLAN® 2012 data set for Oregon
- Forest industry employment, production, payrolls in 2012 by sector by multi-county model area
- Local government employment and payrolls in 2012 by county, separating education from other government operations
- BLM resource program outputs and expenditures (as defined above) in 2012 by District and during the midpoint of the first decade by alternative by district
- Historic log flows for Oregon by timber product and sector
- Current (2012) market values for timber, forage, minerals, and special forest products
- Current spending data for recreation visitors

Geographic and Temporal Scales

- County, district, planning area
- Average of first decade in planning period

Units of Measure

- Employment (annual average jobs)
- Earnings (1,000s in 2012 dollars)

Data Display

- Resource programs and agency expenditures; tables of employment and earnings by multi-county model area and planning area
- Federal payments; tables by employment and earnings by county and planning area
- Summary of both; tables of employment and earnings by multi-county model area and by planning area

Issue 3

What will be the effect of alternatives on payments distributed to counties from activities on BLM-administered lands?

Timber harvested from BLM-administered lands generates revenue that the federal government and the counties with O&C lands divide. The 1937 O&C Act first stipulated this basic revenue-sharing agreement, and though the payment formula has evolved over the years, counties continue to use these payments to help support local public services. Variation across alternatives in the location, amount, and timing of timber harvested from BLM-administered lands has the potential to affect the amount of revenue counties receive each year relative to the No Action alternative.

Analytical Assumptions

- Management alternatives generate marginal (measurable) changes in the amounts of activities that contribute to county payments. If changes do not produce measurable results, that outcome will be described.
- Analysis will be based on payments to counties under the O&C Act formula plus Payments in Lieu of Taxes (Tuchmann and Davis 2013).

Analytical Methods and Techniques

Step 1 - Analysis of the No Action alternative with respect to payments to counties; this involves describing the past, current, and expected future conditions under continued implementation of the 1995 RMPs. This approach reflects that conditions today are not necessarily representative of future conditions.

Step 2 - Describe changes in variables relevant to the payment formula, by management alternative. These will include, for example, timber harvests and values, output from the vegetation model regarding changes in timber harvests and values by alternative, by county.

Step 3 - Calculate O&C funding by county. Using the formula(s) identified in the assumptions, the analysis will estimate the amount of payment per year to each county in the planning area.

Step 4 - Describe risks and uncertainties that affect the analysis. The analysis will put into historical context and assess potential changes in risk (e.g., climate change and fire) on the stability of payments under each management alternative. Given the uncertainty regarding federal timber payments and the uncertainty underlying the variables used to calculate payment levels (e.g., timber harvest levels), this part of the analysis will be particularly relevant.

Analytical Conclusions

- Describe change in federal payments tied to BLM-administered lands by management alternative, relative to the No Action alternative

Data Needs

- Timber harvest volumes and sales by county

Geographic and Temporal Scale

- The analysis will describe payments to counties within the planning area at the county level

- The analysis will describe payments to counties over a period that is consistent with policy developments and timber forecasts; up to 10 years from the beginning of management activities

Units of Measure

- Dollar amounts of payments to counties, by year

Data Display

- Narrative text, tables, charts, graphs, diagrams of changes in O&C payments by county, by alternative

Issue 4

How will the alternatives contribute to economic stability in the planning area?

While Issue 2 focuses on how the alternatives will affect economic activity (growth) in the planning area, Issue 4 focuses on economic stability[2]. Economic stability and growth are both needed to foster sustainable communities; one without the other leads to an unbalanced situation.

Analytical Assumptions

- In economic development studies, both economic stability and economic growth are viewed as desirable but competing characteristics of regional economies. In a recent study by the Federal Reserve Bank of Kansas City (Felix 2012), volatility – the converse of stability – and growth were analyzed jointly over a 30-year period. The author studied the volatility of annual employment and wage growth rates across the 10th District of the Federal Reserve, which covers seven states. The study's unique approach to viewing the relationship between stability and growth can be extended to the western Oregon planning area as a way to gauge current and projected economic consequences of planning alternatives.

- Annual employment and earnings growth rates will be examined across model areas in western Oregon to assess historic economic stability in the planning area. The same examination will be performed across industries nationally. National industries, rather than Oregon industries, serve as a better measure of inherent stability characteristics by removing the influence of historic federal public land management in the western Oregon planning area. Federal management of public lands can influence local industrial volatility for reasons not associated with normal business cycles, including such effects as resource-based constraints on timber management activities. Because the recession starting in December 2007 was so large and recovery has been so slow, the federal study did not and this assessment will not include data from 2008 forward for calculating historic growth rates and their volatility.

- Each alternative will be evaluated for economic volatility based on the magnitude of its contribution to local industries and to the model areas (BLM districts). Industries will include primarily those associated with forest products and recreation/tourism. A comparison of the historic growth and stability of these industries to growth and

2 This means the analysis will rely on prices revealed through markets to illustrate or quantify values associated with goods and services derived from BLM-administered lands. It does not necessarily imply that goods and services derived from BLM-administered lands are or will be traded on markets, though for some goods and services, e.g., timber, this is true.

stability of each model area will indicate whether the alternative is likely to enhance or diminish local economic stability. Where industries affected by the alternative have demonstrated historic volatility metrics lower than historic rates in the affected model area, the assumption will be that the alternative has the potential to enhance long-term stability. Where historic volatility metrics by industry are greater than historic rates in the affected model area, the assumption will be that the alternative has the potential to diminish long-term stability.

- The coefficient of variation is a well-established metric for volatility in financial and economic disciplines. This statistical measure will be used to gauge the volatility of employment and earnings growth rates for both industries and model areas. To facilitate understanding of volatility across model areas, the measure will be converted to a relative index within the planning area. The least volatile – or most stable – model area will provide a benchmark index of 1.0. All other model areas will therefore be greater than 1.0. The consequences of each alternative will suggest index movement to indicate potentials for less stability, more stability, or unchanged stability in model area employment and earnings growth rates.

Analytical Methods and Techniques

Step 1 - Collect data and compute metrics by industry. Obtain employment and earnings data for all U.S. industries (Tables SA05 and SA25) from the United States Bureau of Economic Analysis (BEA; USDC 2008). These data cover six business cycles defined by the National Bureau of Economic Research, Inc. (1969-2007). Calculate annual growth rates for employment and earnings. Calculate the mean, standard deviation, and coefficient of variation of growth rates for all industries.

Step 2 - Collect data and compute metrics by model area. The same methods described in Step 1 will be applied to total employment and earnings for each model area using data from the Bureau of economic Analysis (USDC 2008; Table CA04). They will also be applied to the State of Oregon and the United States for comparison benchmarks.

Step 3 - Present metrics by industry and model area. The analysis will:

- Present results for resource-based industries as well as summaries for each model area in the Affected Environment.
- Identify industries and model areas as having high-average-low growth rates and high-average-low stability.
- Index the results to compare historic conditions across model areas and with state and national averages.

Step 4 - Estimate contributions to economic stability. Using the results from Issue 2, the analysis will identify the magnitude of economic effects (employment and earnings) by industry for each model area by alternative. The analysis will calculate a weighted average of historic growth rate volatility of affected industries in each model area and compare it with the historic volatility of that model area. Where the weighted average of industrial volatility exceeds model area volatility, reduced economic stability can be expected in the end. Where industrial volatility is less than model area volatility, greater economic instability can be expected in the long term[3].

Analytical Conclusion

- Rank alternatives based on potentials to enhance, no change, or diminish economic stability for each model area in the long term.

Data Needs

- Employment and earnings for all industries (Tables SA05 and SA25) from 1969-2007 for the United States (USDC 2008)

3 The analysis is based on characteristics across multiple business cycles, each of which varies in length. As a result the period of anticipated effects cannot be specified. The analytical reference period is approximately 40 years (1969 to 2007) and the effects period may be similar.

- Employment and earnings (by place of work) totals (Tables CA04) from 1969-2007 for each model area, the State of Oregon, and the United States (USDC 2008)

- Economic effects by alternative identified above in Issue 3

Geographic and Temporal Scale

- District (economic model areas)

- The temporal scale is long-term; several decades, predicated on future business cycles. The length of future business cycles cannot be forecast with specificity. However, the historical business cycle reference period for the analysis (1969 to 2007) is approximately 40 years, and, for purposes of this analytical question, it is assumed that conclusions regarding the duration of stability or instability effects to the planning area will be comparable.

Units of Measure

- An index (based on the coefficient of variation) of annual growth rates for employment and earnings

Data Display

- Tables of historic growth rates and their volatility (stability) for employment and earnings by selected industries

- Tables of historic growth rates and their volatility (stability) for employment and earnings by model area, the State of Oregon, and the United States

- Tables of the economic effects by alternative and their alignment with historic growth rates and volatility (stability) by industry, and potential stability effects on model areas

Issue 5

How will the alternatives affect the capacity and resiliency of different types of communities in the planning area?

This question focuses on the potential effects of the alternatives on selected communities of place in the planning area, small and mid-size cities, and tribal communities.

Analytical Assumptions

- Definitions; these current working definitions will be refined throughout the RMP/EIS drafting process:

    - Community of place: a distinct geographic area within which residents or tribal members would generally associate themselves with a single location. For purposes of this analysis, this location would be a city or tribal land.

    - Community Capacity: a community's ability to face changes; respond to external and internal stresses, create and take advantage of opportunities, and meet its needs

    - Community Resiliency: a community’s ability to adapt to change over time

- There are 161 cities (incorporated places) in the planning area. A small number of cities (approximately 13 or 10 percent) will be selected at random for analysis from approximately 134 of the 161, excluding 27 very small and large cities from the sample. These 134 cities are widely dispersed and house close to 30 percent of the planning area

population. While every city is unique, the assumption is that insights from the analysis of the cities in the sample will have relevance to the broader set of 134 cities.

The 16 very small cities have populations below 500 and the 11 large cities have populations over 40,000. They would not be included for the following reasons:

- Very small cities represent a very small share of the planning area population (less than one percent) and data may be difficult to obtain.
- Large cities tend to mirror or contribute significantly to the socioeconomic characteristics of the counties in which they are located. Other planning criteria analytical questions will be focused on counties so that including large cities would be somewhat duplicative and reduce the desired focus on communities below the county level.

• The 13-city sample would be stratified such that there would at least one or two cities from each BLM district. Further, there would be at least three rural cities drawn from the Salem District, since there are many urban cities in the Portland metropolitan area that, if sampled, would reveal little regarding the potential impacts of the RMPs. For the Lakeview District, which has only four cities, Klamath Falls would be selected.

• There are seven federally recognized tribes with both interest and land in the planning area. They will be included as separate communities of place, as they are acknowledged to be sovereign nations and retain inherent powers of self-government. The analysis will not be limited to residents of these lands but will also consider other tribal members.

- Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians (Coos County)
- Coquille Indian Tribe (Coos County)
- Cow Creek Band of Umpqua Tribe of Indians (Douglas County)
- Confederated Tribes of the Grand Ronde Community of Oregon (Yamhill County)
- Confederated Tribes of Warm Springs Reservation of Oregon (Clackamas and Marion Counties)
- Klamath Tribes (Klamath County)
- Confederated Tribes of the Siletz Indians (Lincoln and Polk Counties)

• Quantitative measures of resiliency and capacity can be difficult to identify; “community capacity and community resiliency are fundamentally about dynamic processes that involve the actions of community leaders and residents” (Donoghue, Sutton, and Haynes 2006).

A community capacity or resiliency baseline will be developed for each community based on selected social and economic indicators such as population, housing, income, wealth, and health (see below for complete list).

An extensive literature on the topic exists, and indicator systems have been developed. One example is the Resilience Capacity Index (Building Resilient Regions, 2013) which uses 12 indicators in three broad areas: economic capacity, socio-demographic capacity, and community connectivity capacity. For analytic efficiency purposes in the western Oregon analysis, community capacity/resiliency will be reflected by a small number of key indicators (approximately ten).

• The baseline will be supplemented by interviews with city and tribal officials, with the intent of gaining insights into the community's capacity and resiliency based on its unique conditions, history and culture, and specifically relating to any effects that forest planning including by BLM has had on the community. It is anticipated that these interviews will shed light on effects felt by communities since the Northwest Forest Plan (1994). Communities are all different based on factors such as their size, location, history, economy, and culture, and it is anticipated that each interview will be different.

• There is some overlap between the concepts of capacity and resiliency. The concepts may be merged if distinguishing between the two proves to not serve useful analytical purposes.

• For each community, the analysis will assess the potential effects of the alternatives on the indicators of community capacity or resiliency.

• For quantitative indicators, the analysis will measure or estimate changes caused by each alternative, based on outputs from other analytical questions or from analysis specific to this question. For example, the alternatives are expected to have different effects on payments to counties that, in turn will affect communities. These effects will be evaluated for counties separately under Issue 3, but in this Issue, the analysis will assess the results to different types of place community.

• The assessment of effects for some indicators may be qualitative rather than quantitative.

Analytical Methods and Techniques

Step 1 - Select the sample of the universe of cities. **Table 35** shows the proposed 134 cities by BLM district with populations between 500 and 40,000.

TABLE 35. CITIES IN THE PLANNING AREA WITH POPULATIONS BETWEEN 500 AND 40,000

Coos Bay	**47,218**	**Salem**	**661,130**	**Salem**	
Powers	689	Johnson City	566	Lafayette	3,742
Port Orford	1,133	Manzanita	598	Wood Village	3,878
Lakeside	1,699	Monroe	617	Philomath	4,584
Gold Beach	2,253	Gaston	637	Tillamook	4,935
Myrtle Point	2,514	Yachats	690	Warrenton	4,989
Bandon	3,066	Maywood Park	752	Sheridan	6,127
Coquille	3,866	Garibaldi	779	Seaside	6,477
Brookings	6,336	Scio	838	Scappoose	6,592
North Bend	9,695	Adair Village	840	Stayton	7,644
Coos Bay	15,967	Halsey	904	Lincoln City	7,930
Eugene	**39,724**	Aurora	918	Molalla	8,108
Coburg	1,035	Falls City	947	Independence	8,590
Lowell	1,045	Donald	979	Fairview	8,920
Dunes City	1,303	Yamhill	1,024	Sweet Home	8,925
Oakridge	3,205	Lyons	1,161	Silverton	9,222
Veneta	4,561	Tangent	1,164	Astoria	9,477
Creswell	5,031	Siletz	1,212	Monmouth	9,534
Junction City	5,392	Bay City	1,286	Sandy	9,570
Florence	8,466	Rockaway Beach	1,312	Newport	9,989
Cottage Grove	9,686	Millersburg	1,329	Damascus	10,539
Lakeview	**23,223**	Durham	1,351	Gladstone	11,497
Chiloquin	734	Depoe Bay	1,398	Cornelius	11,869
Malin	805	Gearhart	1,462	St. Helens	12,883
Merrill	844	Amity	1,614	Happy Valley	13,903
Klamath Falls	20,840	Brownsville	1,668	Dallas	14,583
Medford	**101,776**	Cannon Beach	1,690	Lebanon	15,518
Gold Hill	1,220	Clatskanie	1,737	Canby	15,829
Cave Junction	1,883	Banks	1,777	Troutdale	15,962
Rogue River	2,131	Turner	1,854	Sherwood	18,194
Jacksonville	2,785	Mill City	1,855	Wilsonville	19,509
Shady Cove	2,904	Rainier	1,895	Milwaukie	20,291
Phoenix	4,538	Columbia City	1,946	Forest Grove	21,083
Talent	6,066	North Plains	1,947	Newberg	22,068
Eagle Point	8,469	Carlton	2,007	Woodburn	24,080
Central Point	17,169	Willamina	2,025	West Linn	25,109
Ashland	20,078	Waldport	2,033	Tualatin	26,054
Grants Pass	34,533	Vernonia	2,151	Oregon City	31,859
Roseburg	**49,031**	Gervais	2,464	McMinnville	32,187
Glendale	874	Dayton	2,534	Keizer	36,478
Oakland	927	Sublimity	2,681	Lake Oswego	36,619
Yoncalla	1,047	Estacada	2,695		
Drain	1,151	Jefferson	3,098		
Riddle	1,185	King City	3,111		
Canyonville	1,884	Dundee	3,162		
Myrtle Creek	3,439	Hubbard	3,173		
Reedsport	4,154	Mount Angel	3,286		
Winston	5,379	Toledo	3,465		
Sutherlin	7,810	Harrisburg	3,567		
Roseburg	21,181	Aumsville	3,584	**Grand Total**	**922,102**

Step 2 - Select the cities to be sampled pursuant to the stratification recommendations in the analytical assumptions. **Table 36** shows what the sample would be based on the share of population in each district (column 5), and how this would be adjusted to ensure that the sample would be representative of communities across the planning area geography (column 6).

TABLE 36. RECOMMENDED SAMPLE OF COMMUNITIES

District	Total Population	# of Cities between 500 and 40,000	% District Population in Planning Area	10% Proportional Sample of Cities Based on District Population (13)	Adjusted Sample (at least 1 or 2 per district)	Tribes
Salem	2,490,892	89	74%	10	4	3
Eugene	351,715	10	10%	1	2	
Roseburg	107,667	11	3%	0	2	1
Coos Bay	85,407	10	3%	0	2	2
Medford	285,919	10	8%	1	2	
Lakeview	66,380	4	2%	0	1	1
Total	3,387,980	134	100%	13	13	7

Step 3 - Develop the community capacity or resiliency baseline. Collect data from various sources to develop a baseline for the selected communities. **Table 37** shows the data sets that would be used and how they relate to community capacity and resiliency. The BLM selected these data sets in consultation with the Cooperative Agencies Advisory Group's Socioeconomics Working Group.

Interviews with city and tribal officials as described in the analytical assumptions will supplement the baseline data. These interviews will help "tell the story" of each community.

Results will be summarized to rank communities on a relative capacity or resiliency scale (i.e., more or less capacity or resiliency). The scale will be developed based on the data collected for the baseline.

TABLE 37. COMMUNITY CAPACITY/RESILIENCY BASELINE INPUTS

Data set	What does this tell us?	Community Base Data Availability	
		County	Sub County
Population 2010, 2012	Size, generally = more community capacity	Y	Y
Population change 2000 to 2010/2012	Growing pop, generally = more capacity	Y	Y
Employment / Unemployment, 2012	High employment/ low unemployment, generally = more capacity	Y	Y
Employment volatility (diversity) current at place empt by industry (possibly including change over time)	More employment, employment access = more capacity More diversity in disconnected industries (not all in one sector) = more resiliency	Y	Y
Household income 2010 or most recent from American Community Survey (number of households) Median household income or share in plus 3 to 5 $ income brackets ($20-34, 35 to 50 etc.)	Higher incomes, generally = more capacity, more resiliency	Y	Y
Poverty rate	Lower poverty = more capacity	Y	Y
Education (% population with High School certificate; with a 4 year degree	Higher = more capacity more resiliency.	Y	Y
Community Health Population with health insurance (available from census)	Healthy Communities have more capacity, more resiliency	Y	Y
Community wealth: Assessable tax base? (needs to be expressed in relative terms (e.g., per capita)	More wealth = more capacity. more resiliency	Y	If available
Recreation indicator? Recreation demand/scarcity? (per Rec Planning Criteria)	Lower scarcity = more capacity	Y - specifics To be determined	If available

Step 4 - Assess the effects of RMP/EIS alternatives on the capacity and resiliency of different types of communities. Not all resources affect communities. **Table 38** shows the resource areas that affect community capacity and resiliency and that would be included in the analysis and how they will affect communities. The BLM developed this table in consultation with the Cooperative Agencies Advisory Group's Socioeconomics Working Group. Some other resources such as fire ecology affect communities and will be included if the alternatives would affect communities in different ways.

Where possible, the assessment will be made quantitatively though the assessment of effects of some resources will be qualitative.

TABLE 38. RESOURCES AFFECTING COMMUNITIES

Resource/Subject	Effects on Community Capacity and Resiliency
Timber and Silviculture	See socioeconomic effects
Recreation	Changes in the availability of recreational facilities and lands, including active and passive recreation, hunting, and fishing Investment in Recreation Management Areas spending, jobs, community well-being
Transportation	Roads can have an economic impact. County roads provide access to BLM lands through the checkerboard. Road closures could affect communities
Cultural Resources	Disturbance to cultural sites could affect community resiliency. Arguably would affect tribal communities largely than non-tribal, but impacts to non-tribal communities would be considered.
Socioeconomic	IMPLAN and other economic modeling showing changes in employment, earnings, and public revenues (taxes and fees) In addition to timber, this includes (depending on availability) economic activity related to non-timber forest products, subsistence (hunting, fishing, gathering), recreation, and other activities.
Socioeconomic	Changes in federal payments to counties
Socioeconomic	Changes to public safety and other public spending because of direct economic impacts
Socioeconomic	Other economic findings that indirectly relate to minerals, soils, land, and sustainable energy, with a focus on the economic aspect of these activities
Sustainable Energy	Potentially a job creator, depending on what the alternatives will include

Analytical Conclusions

• Analytical conclusions would be by community, by community type (e.g., small, large), by district and overall within the planning area. The conclusions would be drawn from the analysis of individual resources in **Table 38**, and summarized by community type, by district and overall by alternative. The results will be used the draw conclusions regarding the following:

  ◦ Identify communities where BLM alternatives would most effectively support or improve community capacity and resiliency

  ◦ Identify communities where BLM alternatives could have negative effects or adversely affect community capacity and resiliency

  ◦ Identify which BLM alternatives would most effectively support or improve community capacity and resiliency

  ◦ Rank alternatives based on the magnitude of effects on community capacity and resiliency

Data Needs

• Data to describe baseline indicators for communities. Data will come from various sources (e.g., Bureau of the Census, decennial census, American Community Survey, county and local budgets, assessment data)

• Interviews with community leaders, for baseline development

• Outputs from economic analyses for alternatives, such as IMPLAN, and other analyses to evaluate the effects of alternatives on communities

Geographic and Temporal Scales

• The geographic unit would be communities, small to mid-sized cities and tribal communities.

• The temporal scale is long-term; several decades. Conclusions from this analytical question will be drawn from outputs from several resource areas (such as recreation and socioeconomics). The temporal scale for these outputs is expected to vary. Some will be shorter term (e.g., first decade of the planning period); others will be longer term (e.g., several decades for the output from Issue 2). For purposes of this issue, the outputs of different durations will be combined (using an average or weighted average) to generate a single value scale of anticipated capacity or resiliency effects over the long term (approximately 40 years).

Units of Measure

• The final unit will be an eight-measure scale of effects to communities ranging from strong to moderate to minor to no effect, positive or negative.

• Feeding into the scale will be a series of quantitative and qualitative measures including, for example, dollar amounts of payments communities, change in earnings (1,000s in 2012 dollars), and increase or decrease in visitation for recreation.

Data Display

- Tables and narrative text summarizing community capacity or resiliency baseline by community
- Data tables showing the potential impacts of alternatives on communities (see sample tables below – **Table 39**)
- Narrative text discussing changes in capacity and resiliency under each alternative, and summarizing overall impacts

TABLE 39. POTENTIAL IMPACTS OF ALTERNATIVES ON CAPACITY AND RESILIENCY OF COMMUNITIES

Resource	Proposed RMP	Alternative 1	Alternative 2
Timber and Silviculture			
Community 1	+++	+	No effect
Community 2	+	++	No effect
Community 3	---	---	---
Recreation			
Community 1	+++	+	No effect
Community 2	+	++	No effect
Community 3	---	---	---
Summary of Effects			
Community 1	+++	+	+
Community 2	+	+	++
Community 3	---	-	---
Summary of Effects			
Small cities	+++	+	+
Mid-sized cities	+	+	++
Tribes	---	-	---

Legend	
+++ = Strong benefit	--- = Strong negative impact
++ = Moderate benefit	-- = Moderate negative impact
+ = Minor benefit	- = Minor negative impact
No effect	

Issue 6

Will the alternatives result in environmental justice impacts (disproportionately high and adverse effects on minority, low-income, or tribal populations or communities)?

Analytical Assumptions

• While the RMPs are expected to affect some specific places, as management plans affect large geographies, the associated EIS is more programmatic than project or place specific. As a result, the BLM must analyze the potential environmental justice effects of the alternatives at a broad geographic scale that is at the county or census 'place' scale rather than at the census tract or block group scale.

• Potential environmental justice populations will be identified using statistical data but also with input from scoping and from other public input. Such populations will be reviewed to determine whether they could be affected by the alternatives and whether statistical data exist to allow for an environmental justice analysis. BLM district managers and members of the Cooperative Agencies Advisory Group's Socioeconomics Working Group were asked to identify potential environmental justice populations or communities. In addition to the seven federally recognized tribes with lands in the planning area, the only other population that was identified was the Shasta Indian Nation.

• Current EPA guidance (2010) states that the "assessment of whether the action involves disproportionate impacts may include qualitative and/or quantitative elements." CEQ guidance provides the following thresholds for identifying potential environmental justice populations:

  ◦ The minority population of the affected area exceeds 50 percent or the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis (CEQ 1997).

  ◦ That definition aside, the guidance does not include quantitative definitions determining whether the effects of a project or action are 'disproportionately high,' nor does the guidance further define the term 'meaningfully greater' (as cited above from CEQ 1997). Instead, the guidance largely refers back to the "significance" threshold generally employed throughout NEPA.

  ◦ The analysis is expected to define the term meaningfully greater for use in the EIS as "at least 25 percent greater (for poverty and nonwhite population) or 25 percent less (median income) than the state value." However, 25 percent is not an absolute value. Based on review of the baseline data, the thresholds for meaningfully greater could be adjusted up or down, if this would reflect Oregon's unique demographics and improve the analysis. For example, if the baseline data show a large cluster of places with a poverty rate between 20 and 25 percent greater than the state value, the analysis will consider using 20 percent as the threshold (versus 25 percent). The rationale would be (1) that the difference between 20 and 25 percent is not great, and (2) that if 25 percent were used as the threshold, the analysis would unnecessarily exclude from consideration a large cluster of places with environmental justice populations. However, the analysis will not use 10 or 15 percent difference from the state value as the threshold, as this would not be meaningfully greater.

• There is some overlap between the question addressed in Issue 5, (capacity and resiliency of different types of communities) and this Issue 6. As a result, some of the analytical conclusions from Issue 5 may also be relevant to the environmental justice analysis and will be included.

Analytical Methods and Techniques

Step 1 - Identify geographies for analysis. These will include 19 counties, the 258 incorporated places and census designated places, and the lands of seven federally recognized tribes. **Table 40** lists these geographies.

(see next page for Table 40)

TABLE 40. COUNTIES, PLACES, AND TRIBES IN THE PLANNING AREA

Benton County	**Coos County**	**Jackson County**	**Linn County**	**Marion County, Polk County**	**Washington County**
Adair Village city	Bandon city	Ashland city	Brownsville city	Salem city	Aloha CDP
Alpine CDP	Barview CDP	Butte Falls town	Cascadia CDP	**Multnomah County**	Banks city
Alsea CDP	Bunker Hill CDP	Central Point city	Crabtree CDP	Fairview city	Beaverton city
Bellfountain CDP	Coos Bay city	Eagle Point city	Crawfordsville CDP	Gresham city	Bethany CDP
Blodgett CDP	Coquille city	Foots Creek CDP	Halsey city	Maywood Park city	Bull Mountain CDP
Corvallis city	Glasgow CDP	Gold Hill city	Harrisburg city	Troutdale city	Cedar Hills CDP
Kings Valley CDP	Lakeside city	Jacksonville city	Holley CDP	Wood Village city	Cornelius city
Monroe city	Myrtle Point city	Medford city	Lacomb CDP	**Multnomah County, Washington County**	Durham city
Philomath city	North Bend city	Phoenix city	Lebanon city	Cedar Mill CDP	Forest Grove city
Summit CDP	Powers city	Prospect CDP	Lyons city	West Haven-Sylvan CDP	Garden Home-Whitford CDP
Benton County, Linn County	**Curry County**	Rogue River city	Millersburg city	**Polk County**	Hillsboro city
Albany city	Brookings city	Ruch CDP	Peoria CDP	Dallas city	King City city
Clackamas County	Gold Beach city	Shady Cove city	Scio city	Eola CDP	Metzger CDP
Barlow city	Harbor CDP	Talent city	Shedd CDP	Falls City city	North Plains city
Beavercreek CDP	Langlois CDP	Trail CDP	Sodaville city	Independence city	Oak Hills CDP
Canby city	Nesika Beach CDP	White City CDP	South Lebanon CDP	Monmouth city	Raleigh Hills CDP
Damascus city	Pistol River CDP	Wimer CDP	Sweet Home city	Rickreall CDP	Rockcreek CDP
Estacada city	Port Orford city	**Josephine County**	Tangent city	**Polk County, Yamhill County**	Sherwood city
Gladstone city	**Douglas County**	Cave Junction city	Waterloo town	Fort Hill CDP	Tigard city
Government Camp CDP	Canyonville city	Fruitdale CDP	West Scio CDP	Grand Ronde CDP	West Slope CDP
Happy Valley city	Days Creek CDP	Grants Pass city	**Linn County, Marion County**	Willamina city	**Washington County, Yamhill County**
Jennings Lodge CDP	Dillard CDP	Kerby CDP	Gates city	**Tillamook County**	Gaston city
Johnson City city	Drain city	Merlin CDP	Idanha city	Bay City city	**Yamhill County**
Molalla city	Elkton city	New Hope CDP	Mill City city	Bayside Gardens CDP	Amity city
Mount Hood Village CDP	Fair Oaks CDP	O'Brien CDP	**Marion County**	Beaver CDP	Carlton city
Mulino CDP	Gardiner CDP	Redwood CDP	Aumsville city	Cape Meares CDP	Dayton city
Oak Grove CDP	Glendale city	Selma CDP	Aurora city	Cloverdale CDP	Dundee city
Oatfield CDP	Glide CDP	Takilma CDP	Brooks CDP	Garibaldi city	Lafayette city
Oregon City city	Green CDP	Williams CDP	Butteville CDP	Hebo CDP	McMinnville city
Sandy city	Lookingglass CDP	**Klamath County**	Detroit city	Idaville CDP	Newberg city
Stafford CDP	Melrose CDP	Altamont CDP	Donald city	Manzanita city	Sheridan city
West Linn city	Myrtle Creek city	Bonanza town	Four Corners CDP	Neahkahnie CDP	Yamhill city
Clackamas County, Multnomah County	Oakland city	Chiloquin city	Gervais city	Nehalem city	
Milwaukie city	Reedsport city	Klamath Falls city	Hayesville CDP	Neskowin CDP	
Clackamas County, Multnomah County, Washington County	Riddle city	Malin city	Hubbard city	Netarts CDP	
Lake Oswego city	Roseburg city	Merrill city	Jefferson city	Oceanside CDP	
Portland city	Roseburg North CDP	**Lane County**	Keizer city	Pacific City CDP	
Clackamas County, Washington County	Sutherlin city	Coburg city	Labish Village CDP	Rockaway Beach city	
Rivergrove city	Tri-City CDP	Cottage Grove city	Marion CDP	Tillamook city	
Tualatin city	Winchester Bay CDP	Creswell city	Mehama CDP	Wheeler city	
Wilsonville city	Winston city	Dunes City city	Mount Angel city		
Clatsop County	Yoncalla city	Eugene city	Scotts Mills city		
Astoria city	Oakland city	Florence city	Silverton city		
Cannon Beach city	Reedsport city	Junction City city	St. Paul city		
Gearhart city	Riddle city	Lowell city	Stayton city		
Jeffers Gardens CDP	Roseburg city	Oakridge city	Sublimity city		
Seaside city	Roseburg North CDP	Springfield city	Turner city		
Warrenton city	Sutherlin city	Veneta city	Woodburn city		
Westport CDP	Tri-City CDP	Westfir city			
Columbia County	Winchester Bay CDP	**Lincoln County**	**Federally recognized tribes with lands**		
Clatskanie city	Winston city	Depoe Bay city	Confederated Tribes of the Coos, Lower Umpqua, and Siuslaw Indians of Oregon (Coos County)		
Columbia City city	Yoncalla city	Lincoln Beach CDP	Coquille Tribe of Oregon (Coos County)		
Deer Island CDP		Lincoln City city	Cow Creek Band of Umpqua Indians of Oregon (Douglas County)		
Prescott city		Newport city	Confederated Tribes of Grand Ronde Community of Oregon (Yamhill County)		
Rainier city		Rose Lodge CDP	Confederated Tribes of Warm Springs Reservation of Oregon[2]		
Scappoose city		Siletz city	Klamath Tribes, Oregon (Klamath County)		
St. Helens city		Toledo city	Confederated Tribes of the Siletz Reservation (Lincoln and Polk Counties)		
Vernonia city		Waldport city			
Warren CDP		Yachats city			

Step 2 - Collect environmental justice data. Census data will be collected for all selected geographies in the planning area as well as for the state of Oregon overall (for comparison purposes). Specifically, pursuant to Executive Order 12898 and guidance from the Council on Environmental Quality (CEQ) and EPA, the following data would be collected:

- Racial makeup of the population
- Percentage of the population meeting the federal criteria for low or very low income (based on median household income)
- Percentage of residents in poverty

Step 3 - Evaluate environmental justice data and identify environmental justice populations. The analysis will compare county and place-level data for the three criteria described above to the data for the state overall. Instances where local-level data are meaningfully different from the state-level reference data will be noted and categorized as locations with environmental justice populations where the RMP alternatives could potentially have disproportionately high or adverse impacts.

Step 4 - Evaluate the potential impacts of the RMP alternatives on environmental justice populations. The analysis will review the analytical conclusions from other resources such as socioeconomics (jobs gain or loss, changes to county payments), recreation (increase or decrease in visitation), and cultural resources (effects to cultural properties).

The analysis would note potential adverse impacts, if any, and then compare the geographic area of impact to the environmental justice population's geography identified in Step 3. The analysis would then determine whether, among the impacts, there is potential for disproportionately high and adverse effects to environmental justice populations to occur. For example, if losses of jobs were expected to occur, but the losses would be higher than average in a county or in a district with a proportionately large number of places with meaningfully greater low-income populations, then the analysis would conclude that there is potential for disproportionately high and adverse effects to those places.

As part of this evaluation, the BLM will consult the Cooperating Agencies Advisory Group, especially the member tribes, to help identify any adverse impacts, and especially those that could be disproportionately high and adverse.

Step 5 - Mitigation. Should the analysis identify the potential for disproportionately high and adverse effects, it would then identify opportunities to avoid or mitigate those impacts.

Analytical Conclusions

- A listing of geographies with environmental justice populations that the alternatives would disproportionally, highly and adversely affect, along with any measures that could avoid or mitigate for these effects.

Data Needs

- State, county, place-level, and tribal lands data from the U.S. Census Bureau related to race, income, and poverty
- Data from the tribes, supplementary to census data, will also be considered
- Analytical outputs from other resource areas regarding the alternatives such as impacts to employment and earnings from the socioeconomic analyses, changes in visitation from the recreation analysis.

Geographic and Temporal Scales

- Geographic scale: county; incorporated places (cities and towns); census designated places, and lands of federally recognized tribes
- Temporal scale: first decade of the planning period

Units of Measure

- The unit of measure is potential adverse disproportionality to environmental justice populations. The unit will be expressed as a simple yes or no, or modified using terms such as high or low potential
- Inputs for determining potential adverse disproportionality will the analytical outputs from the analyses from other resources such as socioeconomics (jobs gain or loss) and recreation (increase or decrease in visitation)

Data Display

- Tables showing all baseline data including potential environmental justice populations
- Summary tables or maps for the EIS affected environment section showing environmental justice populations
- Summary tables and maps for the EIS environmental consequences section showing environmental justice populations potentially disproportionately highly and adversely affected by the alternatives
- Narrative to describe methods and results

Issue 7

What will be the cost to the BLM to implement the alternatives?

Analytical Assumptions

- The reference year for the BLM budget will be 2012, consistent with economic analysis for Issue 2 above.
- Budget requirements for non-timber resource programs and the State Office will be held constant across alternatives.
- Changes to the BLM budget for timber will be estimated using a unit cost associated with timber harvest. Costs will be calculated in the year of assumed full harvest levels. The fixed rate will be a cost per million board feet (Mbf), and based on historic budget information.
- Contractor costs will be based on the amount and type of harvest specified by the Woodstock model.
- The present net value calculation will be based on the stumpage values derived from the Woodstock model for five decades, and the estimated cost of the BLM timber program. Future revenues and costs over a 50-year period will be discounted back to the present using a discount rate.

Analytical Methods and Techniques

Step 1 - Obtain reference year budget for BLM districts and the State Office. The analysis assumes the reference year will be 2012.

Step 2 - Determine budget requirements for timber resources. This will include a cost per million board feet and contractor costs under different harvest alternatives.

Step 3 - Determine budget requirements for non-timber resource programs. Hold costs constant across alternatives based on the share of these programs in the 2012 budget.

Step 4 - Determine the present net value of the timber program. This will include deciding an appropriate discount rate, most likely four or five percent.

Analytical Conclusions

- Dollar costs of effects of the alternatives to BLM budgets and expenditures and revenues

Data Needs

- BLM budget for reference year, by district and for the State Office
- Outputs from Woodstock model

Geographic and Temporal Scale

- BLM districts and the State Office
- One year of planning period, at full harvest levels, in relation to a recent reference year (FY 2012)
- First 10 years of planning period, for annual expenditures for contractors to perform silvicultural treatments

Units of Measure

- Dollars; Present net value calculations will be presented to show future economic costs and returns in reference year (FY 2012) dollars

Data Display

- Tables and graphs displaying results:
    - BLM budget, by district and the State Office by alternative
    - Annual expenditures for silviculture for the first 10 years by district and alternative
    - Revenues and costs for the first 10 years and the present net value over 50 years by alternative
- Narrative summarizing and explaining key drivers and conclusions

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Soil Resources

Analytical Assumptions Common to All Soils Analyses

• Soil quality is the *capacity of a soil to function*, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality and to support human health and habitation. The capacity of soil to function responds to changes in soil properties that vary due to management.

• Management practices can reduce soil productivity through declines in site organic matter and soil physical properties (Powers et al. 1990). The three physical soil-based indicators that are used to varying extent by the Forest Service and others to assess soil compaction include changes in soil bulk density, soil porosity, and soil strength (Powers et al. 1998, USDA 2010). Due to the inability to measure each of the physical indicators at the scale of the decision area, this analysis will use a surrogate based on detrimental soil disturbance acres.

• Detrimental soil disturbance is the limit where the innate soil properties change and the inherent capacity to sustain growth of vegetation is reduced (Powers et al. 1998). Detrimental soil disturbance generally represents unacceptable levels of erosion: loss of organic matter, soil compaction, soil displacement, or some combination. For the Pacific Northwest Region, when the combined extent of all types of detrimental soil conditions exceeds 15 percent of the action area (e.g., harvest unit), the overall soil productivity will be considered negatively impacted

• Soil resiliency is the capacity of the soil to recover from degradation, which means the ability to restore functional and structural integrity after a disturbance (NRCS 2013)

Issue 1

What are the effects of timber harvest on soil quality?

Analytical Assumptions

• During a timber harvest, impacts to soil quality most often result from soil disturbance (displacement of surface material) and soil compaction. The extent of these processes will be contained within the harvest unit (road construction is addressed in Issue 2). The impacts of timber harvesting on soil quality vary with the type of harvest system. The following detrimental disturbance levels (Heilman et al. 1981; Fleming et al. 2006; Froehlich 1976; Han et al. 2009; Miller et al. 1989) are based on the following harvest systems without mitigation:

  ◦ Ground-based – 35 percent (includes rubber tired skidder and tracked dozer equipment but also the more recent cut-to-length harvesters and multi-wheeled forwarders).

  ◦ Cable skyline – 12 percent (cable systems capable of either one-end or full suspension of the log on inhaul)

  ◦ Aerial – six percent (helicopter systems)

Analytical Methods and Techniques

• Calculate amount of detrimental soil disturbance due to type of timber harvest system by multiplying the areal extent of the yarding method by the assumed percentages for the planning area: acres of type of harvest system × percentage disturbance levels = acres of detrimental soil disturbance

Analytical Conclusions

• Alternatives ranked for acres of detrimental soil disturbance

Units of Measure

- Acres of detrimental soil disturbance

Data Needs

- Acres harvested by type of harvest system (ground-based, skyline, or aerial) from the Woodstock model across the decision area.

Data Display

- Compare each alternative using a side-by-side stacked chart to display the total number of detrimental soil acres for the alternative.

Issue 2

What is the effect of building permanent roads and landings in terms of soil not being available for plant growth?

Analytical Assumptions

- Permanent roads and landings will be necessary to harvest and provide future management accessibility to some areas where no access currently exists. Harvest actions may also construct some temporary spurs and landings

- Permanent roads and landings by definition reduce the soil functions necessary for plant growth to zero

- Road widths range from multi-lane to single-use narrow tracks. This analysis assumes a width of 40 feet from upper cutbank to lower toe of fill (pers. comm., Brian Thauland, BLM, July 2013)

Analytical Methods and Techniques

- Estimate the acreage of new permanent roads and landing by alternative based on harvest ratios (miles/MMbf) across the decision area. Calculate the reduction of acreage encompassed by the length and width of the road and adding it to the acres of new landings.

- [(Length of road in feet × 40 feet)/43,560 square feet/ acre] + acres of new landings = acres of detrimental soil disturbance.

Analytical Conclusion

- Alternatives ranked for the number of acres unavailable for plant growth due to permanent roads and landings.

Data Needs

- The estimated length of any new permanent roads by alternative.

- The acreage of landings by alternative.

- Miles were calculated in 2008 RMP/EIS and ratios have been determined (see Roads section); these ratios provide a mile-to-acres comparison.

Units of Measure

- Acres of detrimental soil disturbance.

Data Display

- Compare each alternative using a pie chart to display the total number of acres of detrimental soil disturbance.

Issue 3

What are the effects of prescribed fire on soil quality?

Analytical Assumptions

- For analysis, site preparation for regeneration harvest and hardwood conversion will average for each alternative:
    - No-treatment of slash – 27 percent
    - Hand piling – 13 percent
    - Machine piling – 17 percent
    - Broadcast burning – 47 percent

These are based on collective averages from Coos Bay, Eugene, and Roseburg Districts Fuel Specialists for site preparation acres after regeneration timber harvest.

- Piling and burning of slash causes a detrimental change in soil properties due to the localized heating and the duration of the burn (Busse, Shestack, and Hubbert, 2013). Soil directly beneath a burning pile experiences detrimental soil damage due to deep burning from intensive heat.

- There will be no detrimental soil disturbance from piling and burning of slash in thinning harvest actions, because slash disposal would typically be smaller in amount and size, and piles would be constructed on roads or landings.

- Regeneration harvest, hardwood conversion, and uneven-aged harvest actions will result in creating excess slash and require various types of piling and burning for site preparation. This will cause some level of detrimental soil disturbance.

- The burning of hand-piled slash in regeneration harvest or hardwood conversion areas would not result in detrimental soil disturbance. The soil heat pulse at the center did not increase significantly for slash piles ranging from 2 to 7 m in diameter (Busse, Shestack and Hubbert, 2013).

- Machine piles are larger and contain larger diameter wood than hand piles, resulting in a longer time of exposure and deeper penetration of the heating under the pile (Busse, Shestack and Hubbert, 2013). For this analysis, the center of the pile (one-half the pile size) will produce detrimental soil temperatures.

- In general, for regeneration harvesting and hardwood conversion the machine piling occurs after completion of the harvest, increasing detrimental soil disturbance. For uneven-aged harvesting, the piling is done concurrently with harvesting, adding little additional detrimental soil disturbance.

- In regeneration harvest or hardwood conversion areas with ground-based harvesting, the burning of machine-piled slash would result in detrimental soil disturbance on 25 percent of any harvested acre. This figure also includes the compaction of the surrounding soil from the equipment when the piles are constructed. For the purposes of this analysis, all ground-based harvested units will include machine piling from skid trails (pers. comm., E. Johnson, BLM Eugene District, December 2013). The following methodology was used to calculate the 25 percent detrimental soil disturbance per acre of treatment by alternative for regeneration harvest using machine piling for each sq. acre:

    - An excavator with a 30-foot boom would travel in a one pass strip method, building piles on either side of the strip in only one traverse.

    - Slash would be collected within 20 feet from each side of the strip edge and 10 feet on both sides of the equipment.

    - By traversing a one-acre block in two U-shaped arcs, using the two previous factors, equipment would need 800 ft. in travel distance to complete piling of each acre (i.e., 43,560 sq. ft.).

    - This would result in 8,000 ft. of compaction from the equipment (800 ft. length × 10 ft. width) and would result in 18 percent compaction (8,000 sq. ft. of 43,560 sq. ft.) per acre.

    - Each pile area will have 50 percent detrimental soil disturbance when burned (Busse, Shestack, and Hubbert 2013).

    - With an average pile size of 200 sq. ft. (approximately 16 feet in diameter), there will be 100 sq. ft. of detrimental soil disturbance per pile when burned.

    - Approximately 28 piles would be constructed of larger slash material from an area approximately 25 ft. × 35 ft. This will total 2,800 sq. ft. (100 sq. ft. × 28 piles) of detrimental soil disturbance from pile burning.

    - For each harvested acre (43,560 sq. ft.), the 8,000 sq. ft. disturbance from compaction plus the 2,800 sq. ft. disturbance from burning would result in 10,800 sq. ft. or 25 percent (10,800 sq. ft. of 43,560 sq. ft.) detrimental soil disturbance.

- In uneven-aged harvest areas with ground-based harvesting, the burning of machine-piled slash would result in detrimental soil disturbance on 2 percent of any harvested acre. As stated above, compaction from equipment will be included in the harvest calculations as the piling occurs concurrently with the harvest. Detrimental soil disturbance from piling with machines in uneven-aged harvest areas would be less than in regeneration harvest areas because less of the stand is harvested (i.e., removal of only 25-50 percent of the stand occurs leaving less slash). In addition, piles would be smaller and more scattered across a given acre. Soil impacts from burning would be similar to machine pile burning (center half of pile producing detrimental soil damage. The following methodology was used to calculate the 25 percent detrimental soil disturbance per acre of treatment by alternative for regeneration harvest using machine piling:

    - Mechanical equipment is that which harvested the area, or is smaller and operated from existing harvest skid trails.

    - Each pile area will have 50 percent detrimental soil disturbance when burned (Busse, Shestack, and Hubbert 2013)

    - With an average pile size of 200 sq. ft. (approximately 16 feet in diameter), there will be 100 sq. ft. of detrimental soil disturbance per pile when burned

- Based on harvest area size, uneven-aged harvest areas will have approximately 35 percent of the 28 machine piles per acre in regeneration harvest, or 10 piles.

- This average of 10 piles per acre, with 100 square feet of detrimental soil per pile, equals 1,000 sq. ft. (100 sq. ft. × 10 piles) of detrimental soil disturbance from pile burning

- For each harvested acre (43,560 sq. ft.), the 1,000 sq. ft. from burning results in two percent (1,000 sq. ft. of 43,560 sq. ft.) detrimental soil disturbance

• Broadcast burning will have detrimental soil disturbance on five percent of the acres treated (pers. comm., J. Lawrence, B. Hogge, July 2013; Dyrness and Youngberg, 1957).

Analytical Methods and Techniques

• Calculate the total acreage of detrimental soil disturbance by adding the acres of detrimental soil disturbance from machine piling and broadcast burning. Use the following equations:

- Acres of regeneration timber harvest × 0.17 × 0.25 = Acres of detrimental soil disturbance from machine pile burning.

- Acres of uneven-aged timber harvest × 0.02 = Acres of detrimental soil disturbance from machine pile burning.

- Acres of regeneration timber harvest × 0.47 × 0.05 = Acres of detrimental soil disturbance from broadcast burning.

Analytical Conclusions

• Alternatives ranked by potential for detrimental soil disturbance, based on the sum total of number of acres of each kind of prescribed fire treatment.

Data Needs

• Acres harvested by silvicultural method (regeneration or uneven-aged) from the Woodstock model across the decision area

Units of Measure

• Acres of detrimental soil disturbance

Data Display

• Compare each alternative using a pie chart to display the total number of detrimental acres burned for the type of treatments

Issue 4

What are the effects of fuel reduction on soil quality in the moist or dry forest ecosystem in the decision area?

Analytical Assumptions

• Detrimental soil disturbance reduces soil quality when ground-based mechanical fuel reduction techniques (including slash-busting and grinding, mowing and mastication, or crushing) exceed the normal limits of compaction

or displacement, produce excessive green carbon-laden buildup, expose bare soils, or include burning as part of the reduction strategy.

• The detrimental soil disturbance level in the southern portion of the plan area is 35 percent of a unit due to the higher use of ground-based harvesting methods. In addition, there is a larger proportion of grinding or mastication of unmerchantable timber material during treatments.

• On average, 37 percent of fuel reduction treatments are accomplished by manual means (e.g., chainsaw use, manual piling, and mobile chippers); 63 percent of treatments are accomplished by ground-based equipment (e.g., feller-bunchers or masticators) or are accomplished in association with biomass removal. This is based on completed fuel reduction treatment data from the BLM corporate GIS database from 1963 to 2013.

• Grinding or mastication occurs with various machines. Machines with a rotary head attached to a boom can treat more area with less compaction than a machine that has the rotary mechanism attached directly to the machine. The boom-mounted masticator can reach areas such as deep ditches and steep embankments (Ryans and Cormier 1994). In addition, tracked machines are often used to work on steeper slopes and on softer soils compared to wheeled machines.

• Fuel reduction by any method is temporary in nature as materials regrow and need retreatment in 5 to 15 years.

• On dry sites, material may remain for a decade or more. Adding a dense layer of woody material to the forest floor is unlikely to tie up soil nitrogen unless the material is thoroughly mixed into the soil (Bennett and Fitzgerald, 2008).

• There is no detrimental soil disturbance when fuel reduction employs lop and scatter methods. This involves grinding of slash material with equipment located on existing forest roads and spreading the reduced material out in a reasonable mulch layer (two or three inches).

Analytical Methods and Techniques

• Calculate the amount of detrimental soil disturbance due to ground-based mechanical fuel reduction methods for each alternative by multiplying the areal extent times the assumed percentage.

• Acres of ground-based mechanical fuel risk reduction treatments × 0.63 × 0.35 = Acres of detrimental soil disturbance.

Analytical Conclusions

• Alternatives ranked for detrimental soil disturbance based on the anticipated acres of mechanical fuel reduction and the level of disturbance by one or the other method employed.

Data Needs

• Acres treated for fuel reduction by mechanical means, traditional removal of material offsite, and any acres where in-place reduction through processing occurs.

• Acres totaled by alternative.

Units of Measure

• Acres of detrimental soil disturbance

Geographic Scope

• The Medford and Roseburg Districts and the Klamath Falls Field Office; fuel reduction treatments may vary by alternative.

Data Display

• Compare each alternative using a bar chart to display the total number of acres mechanically treated by alternative, with each bar representing the total number of acres of detrimental soil disturbance.

Issue 5

What are the effects of off-highway vehicle use on soil quality in terms of detrimental soil disturbance?

Analytical Assumptions

• Soil disturbance from off-highway vehicle use includes compaction, displacement, and bared soils. Bare soils lead to erosion and the ability to reduce soil quality of lands not encompassed in the trail itself.

• Areas designated as 'limited' will experience detrimental soil disturbance from off-highway vehicle use. The BLM will assume that off-highway vehicle use in a designated area will adhere to proper and legal use, and trails are properly built and maintained. Soil disturbance from off-highway vehicle use is generally limited to an area slightly greater than the width between two tires. An average of five feet will be the assumed width of the designated trails for analysis purposes. Roads that make up the transportation network will not be considered as part of the impacted area, because they are removed from the managed land base as infrastructure.

• Areas designated as 'open' will experience detrimental soil disturbance. Impacts will be concentrated on designated trails. The BLM cannot quantify the impacts from off-highway vehicles that leave designated trails.

• Areas designated as 'closed' will not experience detrimental soil disturbance, because off-highway vehicle use will not be permitted in a 'closed' designation.

Analytical Methods and Techniques

• Describe off-highway vehicle use in 'limited' areas as the number of acres for each alternative. For designated trails, five feet/foot of trail provides total square feet of trail area. Divide that result by 43,560 square feet/acre to get total acres of the areal effect of this activity.

• Describe off-highway vehicle use in open areas as the number of acres in open areas for each alternative.

Analytical Conclusions

• Rank alternatives by the acres of detrimental soil disturbance from off-highway vehicle use.

Data Needs

• Length of trails in limited areas, by alternative, from corporate GIS data

• Acres of open areas by alternative

Units of Measure

- Acres of detrimental soil disturbance

Data Display

- Compare alternatives using a bar chart to display the total number of acres available for 'open' and 'limited' off-highway vehicle use and the acres of detrimental soil disturbance from off-highway vehicle use for each alternative.

Issue 6

What are the effects of livestock grazing on soil quality in terms of rangeland health?

Analytical Assumptions

- Grazing will follow the current Rangeland Health Standards with current assessments

- Grazing impacts to soil resources can include compaction, erosion, and bare soils, which can be extensive and long-term when animal unit month (AUM) numbers equal the heavy use level (1.7 AUM/acre; Donkor et al. 2002; Evans et al. 201; Naeth et al. 1990; Roberson 1996; Sharrow 2007)

- All acres under high grazing management (greater than 1.7 AUM/acre) will be considered to have detrimental soil disturbance

- There is no BLM grazing allotment that has more than 0.2 AUM/acre

- Because all allotments within the decision area are below the analytical threshold levels that would result in detrimental soil disturbance, the analysis would not be able to detect any meaningful effect of grazing on soil quality with the information available at this scale of analysis. Therefore, the RMP/EIS will not analyze this issue in detail. Allotment-specific or site-specific analyses for implementation actions may address the effects of livestock grazing on soil quality, as appropriate, where specific information may be available.

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Sustainable Energy

Issue 1

How will management alternatives for forest treatment affect the availability of slash as a biomass energy source?

Analytical Assumptions

- The amount of slash available as a biomass energy source from timber harvesting is 450 green tons/million board-feet harvested (GT/MMbf), based on calculations from (USDA 2007) As defined in the Desk Guide, biomass includes value added products such as firewood
- Biomass resource can be used for energy production, but is also needed for other resources such as soil nutrients

Analytical Methods and Techniques

- Multiply the volume of timber harvested by 450 green tons/MMbf to determine the amount of slash available by district
- Comparison of best use with competing resources, such as soil nutrients

Analytical Conclusion

- A description of how management direction for each forest treatment alternative affects availability of slash as a biomass energy resource.

Data Needs

- Harvest volumes per district within the decision area
- Carbon storage modeling to document plus or loss of biomass storage potential

Units of Measure

- Green tons of slash

Data Display

- A table show annual biomass available as slash by district by alternative

Issue 2

How will reserve land use allocations for the conservation and recovery of threatened and endangered species affect the potential siting of wind energy developments and energy corridor designations?

Units of Measure

- Acres of reserve land that overlap land with high wind energy potential
- Miles of existing and potential Energy Corridor Right of Ways (ROW)

Analytical Assumptions

• Locations of high wind energy resource potential in the decision area are identified in the 2005 Wind Energy Programmatic EIS, and existing and potential Energy Corridor ROWs.

• Existing and Potential Energy Corridor ROWs analysis will crossover and be in cooperation with Lands and Realty Sections as well as Fluid Minerals. Energy Corridors will include Sustainable Energy such as electricity transmission as well as Conventional Energy such as Natural Gas Pipelines.

Analytical Methods and Techniques

• Determine reserve land use allocations within the decision area designated for the conservation and recovery of threatened and endangered species.

• Determine locations of high potential wind energy resources and ROW corridors in the decision area.

• Determine the overlap between ESA reserve land use allocations and high potential wind energy resource and existing and potential Energy Corridor ROW locations.

Step 1 - List and map all existing and potential reserve land use allocations for the conservation and recovery of threatened and endangered species.

Step 2 - List and map high potential wind energy resource and existing and potential Energy Corridor ROW locations in the decision area.

Analytical Conclusion

• A description of how reserve land use allocations for conservation and recovery of threatened and endangered species has the potential for affecting the availability of land for wind energy development

Data Needs

• Spatial and attribute data on reserve land use allocations for the conservation and recovery of threatened and endangered species

• Spatial data for high potential wind energy and existing and potential Energy Corridor ROW locations in the decision area

Data Display

• A table will show the overlap between areas of high potential wind energy resources, existing and potential Energy Corridor ROWs, and reserve land use allocations.

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Tribal Interests

Issue 1

How would land management actions affect tribal plant collection, management, and use?

Analytical Assumptions

- Impacts to culturally important plants include removal of desired plants from accessible collection areas, removal of plants habitat, or use of herbicides on or near plants that are collected.

- The number of culturally important plants to the tribes within the planning area is greater than can be accurately summarized here.

- In the absence of data on specific plants and their locations on the landscape, a quantified analysis of the effects on plant collection, management and use is not possible as part of the RMP process. The effects of the alternatives on tribal plant collection, management, and use will be discussed qualitatively. Early consultation with tribes during project implementation will identify those plants that are important for traditional uses and can reduce or eliminate negative impacts to these resources. Identifying plant-gathering locations can also reduce or eliminate adverse impacts by project redesign or mitigation.

Issue 2

How would land management actions affect tribal resource collection of obsidian, chert, and other rocks and minerals for noncommercial purposes?

Analytical Assumptions

- There are no identified locations within the decision area for obsidian collection; therefore, analysis of effects is not possible.

- Chert and other rocks and minerals (including obsidian) are allowed to be collected anywhere within the decision area, except developed recreation areas or where it is otherwise prohibited and posted per CFR 8365.1-5. In the absence of specific locations identified for collection, an analysis of effects is not possible.

Issue 3

How would land management actions affect lamprey, fish, and fish passages?

Analytical Assumptions

- Large wood, stream temperature, sediment and water flow have the greatest influence on aquatic habitat and the ability of aquatic habitat to support fish populations

- Analysis of the effects to fish and their habitat are addressed in the Fisheries section covering the four factors stated above

- Additional analysis of BLM actions contributing to sediment delivery to stream channels is covered in the Hydrology section addressing BLM road construction

- The alternatives are not likely to have significant effects on fish passages, because 97 percent of large culverts that serve as fish passages on BLM-administered lands are in good condition, and the majority of fish passage barriers within the planning area are on private lands

• Lampreys are a traditional cultural food for various tribes with interests in the planning area, and their population decline is a concern for those tribe

• Lamprey have similar habitat needs as other salmonids, therefore the analyses in the Fisheries section regarding habitat for salmonids also applies to lamprey. Analysis of this issue will be addressed by the Fisheries and Hydrology analyses

Issue 4

How would land management actions affect migrating mule deer?

Analytical Assumptions

• Mule deer occupy the same or similar habitats as other early-successional structural stage species

• Effects to mule deer can be drawn from the analysis in the wildlife section that covers species that occupy early-successional structural stage habitats

• Analysis of this issue will be addressed by the Wildlife analysis

Issue 5

How would land management actions affect sacred sites and places of traditional religious and cultural importance?

Analytical Assumptions

• Sacred sites and places of traditional religious and cultural importance are not distributed evenly across the landscape, and their locations are largely unknown to the BLM.

• The inherent value of these sites is not necessarily in any physical remnants at a location but due to their association with cultural practices and beliefs that are (1) rooted in the history of a community, and (2) are important to maintaining the continuity of that community's traditional beliefs and practices.

• It is not possible for the BLM alone to identify sacred site locations across the decision area as part of the RMP process. Early consultation with tribes during project implementation to identify site locations can reduce or eliminate impacts to these sites by allowing time to redesign a project or implement mitigation.

• Analysis of effects to these sites is not possible as part of the RMP process, because the BLM does not have information on site locations. Analysis of effects to these sites should take place at the project level because their identification and the values that would be affected can only be identified through consultation with tribes and site-specific protections would be applied.

Issue 6

How would land management actions affect historic trail routes?

Analytical Assumptions

• Historic trails are linear features on the landscape that are identified, evaluated and protected the same as archaeological and historic sites on federal lands.

• The analysis of effects to archaeological and historic sites, which includes historic trail routes, is covered in the Cultural Resources section of the document. Early consultation with tribes during project implementation to identify

trail locations can reduce or eliminate impacts to historic trails by allowing time to redesign a project or implement mitigation.

Issue 7

How would land management actions affect neighboring tribally managed lands?

Analytical Assumptions

- The analysis of environmental effects to the resources on BLM-administered lands apply to the Coquille Forest, because the Coquille Forest, managed by the Coquille Tribe, is "subject to the standards and guidelines of Federal forest plans on adjacent or nearby Federal lands, now and in the future" (Coquille Forest Act, 1996)
- All other tribally managed lands adjacent to BLM-administered lands are subject to their own management direction
- Designating right-of-way exclusion areas can prevent access to tribal lands via BLM-administered lands
- BLM road maintenance can affect access to tribally owned lands
- BLM actions have the potential to affect water quality on tribal lands. Analysis of water quality will be addressed in the Hydrology analysis
- The "Tribal Forest Protection Act" allows for tribes to propose projects on federal lands adjacent to tribal lands that would reduce or eliminate threats (disease or fire for example) to tribal lands
- Effects of the alternatives on the management of the Coquille Forest will be addressed in the various resource and program analyses as part of the RMP process

Issue 8

What are the social and economic effects of land management actions on tribal communities?

Analytical Assumptions

- Tribes comprise distinct communities within the planning area.
- Analysis of this issue will be addressed by the Socio-economic analysis. Effects to tribal communities will be analyzed in the sections of the socio-economic analysis that focus on economic stability, capacity and resiliency of communities and environmental justice

Issue 9

How would land management actions affect water quality?

Analytical Assumptions

- Tribal interest in clean water has been explicitly expressed regarding the Klamath watershed
- Tribal interest in clean water extends throughout the planning area and relates to communities access to clean water as well as for the health of fish and other aquatic species
- Some tribes have water codes that can be used to analyze the effects of BLM actions upstream on water course of tribal interest
- Analysis of this issue will be addressed by the Hydrology analysis

Data Needs

- Tribal water codes

Issue 10

How would land management actions affect the visibility of the historic Siletz reservation boundary?

Analytical Assumptions

- Creating a visible boundary of the historic Siletz reservation on BLM-administered lands can be accomplished by leaving trees along the boundary line during harvest activities

- A "leave tree" boundary can be accomplished under all types of forest management other than clear-cuts

Analytical Methods and Techniques

- For each alternative calculate: Total linear miles of BLM-administered lands touching the historic reservation boundary – (minus) total number of linear miles of those same BLM-administered lands that are in land use allocations allowing clear-cutting = total number of miles of BLM-administered lands available to retain a visible boundary of the historic Siletz reservation (by alternative).

Analytical Conclusion

- Alternatives can be ranked from most to least miles of available BLM-administered lands for retaining a visible boundary.

Data Needs

- Linear miles of BLM-administered land touching the historic reservation boundary

- Linear miles of BLM-administered land in each land use allocation that touches the historic reservation boundary

Data Display

- Map of planning area surrounding the historic reservation with the historic reservation boundary. Distinctly show the BLM-administered lands that touch the historic reservation boundary

- Graph of linear miles of BLM-administered land touching the historic reservation boundary by land use allocation by alternative

Issue 11

How would land management actions affect cultural harvest activities within riparian areas?

Analytical Assumptions

- Cultural harvest activities refer to bark, lichen and other plants and plant products. It does not refer to timber harvest

- Riparian strategies may reduce or eliminate the ability to harvest certain plants in riparian areas.

- Cultural harvest activities may have positive or negative effects in relation to the goals of particular riparian strategies

Wild Horses

Issue 1

How would the alternatives affect BLM's ability to maintain the Appropriate Management Level of 30 to 50 wild horses within the Pokegama Herd Management Area?

Analytical Assumptions

- The only management actions that will affect the wild horse herd are those occurring within the Pokegama Herd Management Area.
- The acreage within the Pokegama Herd Management Area supports the Appropriate Management Level of 30 to 50 wild horses, which need 150 animal unit months.
- Fencing intended to protect or restore habitat would exclude wild horses from certain traditional watering or foraging areas. These exclusion areas would be so limited in number and so scattered geographically that the fencing would not appreciably limit overall watering or foraging areas or change herd movement and distribution.
- Grazing authorizations within the Pokegama Herd Management Area would remain at current levels.
- Changes in vegetation associated with management actions may increase or decrease forage production in the herd management area. Open areas provide more forage than forested areas. The analysis will assume that the structural stages of non-forest, early successional, and stand establishment provide forage and that the structural stages of young, mature, and structurally complex forest do not provide forage.

Analytical Methods and Techniques

- Describe changes to forage available to the wild horse herd over time by summing the acres of the structural stages of non-forest, early successional, and stand establishment within the Pokegama Herd Management Area over time by alternative.

Analytical Conclusion

- Rank alternatives by the acreage in non-forest, early-successional, and stand establishment structural stages over time

Data Needs

- Map of the Pokegama Herd Management Area with public and private lands overlain showing site-specific land use allocations or designations
- Acres of structural stages within the Pokegama Herd Management Area over time by alternative

Geographic Scale

- The analysis will be limited to the Pokegama Herd Management Area, which encompasses a total of 80,885 acres, of which 67,869 acres are federal, private, and state land within the planning area.

Units of Measure

- Acres of land in non-forest, early-successional, and stand establishment structural stages.

Data Display

• Table or graph showing the change in acreage in non-forest, early-successional, and stand establishment structural stages over time by alternative.

Wildlife

Northern Spotted Owl

Framework for Evaluating Effects to the Northern Spotted Owl

The analyses are designed to determine if the BLM would contribute to a western Oregon landscape that meets the four conservation needs of the northern spotted owl, and if the management of BLM-administered lands in western Oregon would be consistent with Recovery Actions 6, 10, 12 and 32 of the Revised Recovery Plan for the Northern Spotted Owl (Revised Recovery Plan; USDI 2011). The planning decisions in the RMPs for Western Oregon potentially would affect the accomplishment of only these four Recovery Actions.

Conservation Needs

Thomas et al. (1990, pp. 23-27) determined that northern spotted owl conservation requires:

• **Conservation Need 1**: Large blocks of nesting, roosting and foraging habitat that support clusters of reproducing owls, are distributed across a variety of ecological conditions, and are spaced to facilitate owl movement between the blocks

• **Conservation Need 2**: Habitat conditions within and surrounding large blocks of nesting, roosting and foraging habitat that facilitate owl movement between the blocks and ensure the survival of dispersing owls

Fourteen years after Thomas et al. (1990), Courtney et al. (2004, Chapter 9) concluded that, although subsequent northern spotted owl research had refined these conservation needs, they remained valid. The U.S. Fish and Wildlife Service (the Service) reaffirmed these conservation needs (77 FR 71908-71910) in its 2012 final rule on spotted owl critical habitat (Final Rule).

After 2004, the Service began identifying two additional habitat-specific conservation needs in its biological opinions:[4]

• **Conservation Need 3**: A coordinated, adaptive management effort to reduce the loss of habitat due to catastrophic wildfire throughout the northern spotted owl's range, and a monitoring program to clarify whether these risk reduction methods are effective and to determine how owls use habitat treated to reduce fuels

• **Conservation Need 4**: In areas of significant population decline, sustain the full range of survival and recovery options for this species in light of significant uncertainty

The Service added these conservation needs because of findings that the range-wide loss of habitat to wildfire, especially in southern Oregon, posed a greater threat to northern spotted owl conservation than previously thought (Courtney et al. 2004, Chapter 6) and because of observed declines in the spotted owl population (Anthony et al. 2006). The fourth conservation need has become increasingly important with continued populations declines (Forsman et al. 2011) and recent findings on competitive interactions between spotted owls and barred owls (e.g., Van Lanen et al. 2011; Dugger et al. 2011; Wiens 2012).

4 The Service, in its biological opinions, also identified "habitat-independent" conservation needs: A coordinated research and adaptive management effort to better understand and manage competitive interactions between spotted and barred owls, and monitoring to better understand the risk of West Nile virus and sudden oak death pose to spotted owl populations. This analysis does not address these conservation needs because, as habitat-independent, BLM management in the planning area would not influence them.

Pertinent Recovery Actions

In 2011, the Service issued its Revised Recovery Plan (USDI 2011), which recommended four Recovery Actions that are pertinent to the RMP planning effort (i.e., the success of Recovery Action implementation on BLM-administered lands would be affected by RMP planning decisions):

- **Recovery Action 6**: "In moist forests managed for spotted owl habitat, land managers should implement silvicultural techniques in plantations, overstocked stands and modified younger stands to accelerate the development of structural complexity and biological diversity that will benefit spotted owl recovery" (p. III-19).

- **Recovery Action 10**: "Conserve spotted owl sites and high value spotted owl habitat to provide additional demographic support to the spotted owl population" (p. III-43).

- **Recovery Action 12**: "In lands where management is focused on development of spotted owl habitat, post-fire silvicultural activities should concentrate on conserving and restoring habitat elements that take a long time to develop (e.g., large trees, medium and large snags, downed wood" (p. III-49).

- **Recovery Action 32**: "Because spotted owl recovery requires well distributed, older and more structurally complex multi-layered conifer forests on Federal and non-federal lands across its range, land managers should work with the Service as described below to maintain and restore such habitat while allowing for other threats, such as fire and insects, to be addressed by restoration management actions. These high-quality spotted owl habitat stands are characterized as having large diameter trees, high amounts of canopy cover, and decadence components such as broken-topped live trees, mistletoe, cavities, large snags, and fallen trees" (p. III-67).

Issue 1

Conservation Need 1: Would the BLM alternative contribute to a landscape in western Oregon that creates large blocks of nesting, roosting and foraging habitat that is capable of supporting clusters of reproducing owls, are distributed across a variety of ecological conditions, and are spaced to facilitate owl movement between the blocks?

Analytical Assumptions

- Large blocks of spotted owl nesting and roosting habitat that support clusters of reproducing owls that are distributed across a variety of ecological conditions, and are spaced to facilitate owl movement between the blocks, will provide nesting habitat sufficient for spotted owl recovery.

- Although Conservation Need 1 is a range-wide requirement, the BLM confines this analysis to western Oregon because that is the landscape affected by this planning effort.

- Therefore, to meet Conservation Need 1, the BLM alternative would contribute to a western Oregon landscape that:

    - Is capable of supporting at least one large habitat block during each decadal increment (years 10, 20, 30, 40 and 50), in each of the Oregon Western Cascades, Oregon Eastern Cascades, Oregon Coast Range, and Oregon Klamath provinces.

    - Within 50 years, supports a network of large and small blocks that are properly spaced within and between the Oregon Western Cascades, Oregon Eastern Cascades, Oregon Coast Range, and Oregon Klamath provinces.

    - Except for proper spacing in areas where BLM ownership patterns preclude the BLM from contributing to proper spacing; the analyses that informed the 2008 RMPs suggest that the BLM cannot help ensure proper

north-south spacing in the north half of the Oregon Coast Range Province, or proper east-west spacing through the Oregon Willamette Valley Province (USDI 2008 pp. 4–645-661).

• The habitat layers for all lands will incorporate ingrowth, wildfire, and change due to treatments, including restoration and timber harvest.

• Conclusions are based on block development, regardless of their occupancy by nesting spotted owls (Spotted owl population response is addressed by Issue #4, below.)

• A potential nest territory is a 500-acre circle with ≥ 50 percent nesting and roosting habitat, centered within a provincial home range circle with ≥ 50 percent nesting and roosting habitat[5]. These values accord to USDI 2008 (pp. 3–287-289). Provincial home range size (USDI 2008, Table 3-25, p. 3-288) is determined by the location of its center point. When both the 500-acre and provincial home range circles support ≥ 50 percent nesting and roosting habitat, the provincial home range circle delineates a habitat block.

• Overlapping habitat blocks aggregate.

• A large habitat block is capable of supporting ≥ 25 spotted owl nesting pairs (Thomas et al. 1990, p. 24; p. 320 for formula; Lamberson et al. 1994; Marcot et al. 2013, pp.196-200). A small habitat block is capable of supporting 1 – 24 spotted owl nesting pairs (Thomas et al. 1990, pp. 318-319).

• The Northwest Forest Plan physiographic provinces, in this case the Oregon Western Cascades, Oregon Eastern Cascades, Oregon Coast Range, and Oregon Klamath provinces (USDA/USDI 1994, p. A-3) represent the "variety of ecological conditions."

• To facilitate spotted owl movement between blocks, large habitat blocks are to be spaced ≤ 12 miles from other large habitat blocks; small habitat blocks are to be spaced ≤ 7 miles from other large and small habitat blocks (Thomas et al. 1990, p. 28; Marcot et al. 2013, pp. 196-200).

Analytical Methods and Techniques

• See USDI 2008 (pp. 3–287-290) for general methods; methods are updated to incorporate new data and models, as warranted. Habitat layers include decadal changes due to in-growth, treatment, wildfire and the effect of climate change on wildfire.

Conclusion

• Pass/fail: Either the resultant western Oregon landscape meets Conservation Need 1 (with stated exceptions), or it does not.

Data Needs

• Geospatial representations of spotted owl nesting and roosting habitat on all lands in western Oregon at years 0, 10, 20, 30, 40, and 50

Geospatial and Temporal Scales

• All western Oregon, except those areas where BLM ownership patterns preclude the BLM from contributing to habitat blocks, as demonstrated by the no-harvest reference analysis (no-harvest is a hypothetical forecast of forest

5 These standards apply to nesting and roosting habitat (instead of nesting, roosting, and foraging habitat) because each large habitat block is intended to support nesting spotted owls (Thomas et al. 1990, p. 24) and biologists determined that these standards would accord to a functional nest territory (BLM 2008, pp. 3-287-289).

ingrowth and wildfire on BLM-administered lands in the absence of forest treatments such as restoration and timber harvest; i.e., it shows maximum forest development on BLM-administered lands in the absence of treatment).

- 50 years[6]

Units of Measure

- Size, number, spacing, and provincial distribution of block of habitat

Data Display

- Maps, by decade and alternative, of large and small habitat blocks on all lands in western Oregon, with 12-mile spacing lines around large blocks and seven-mile spacing lines around small blocks

Issue 2

Conservation Need 2: Would the BLM alternative contribute to a landscape in western Oregon that creates habitat conditions within and surrounding large blocks of nesting, roosting, and foraging habitat that facilitate owl movement between the blocks and ensure the survival of dispersing owls?

Analytical Assumptions

- Habitat conditions within and surrounding large blocks of spotted owl nesting and roosting habitat, that facilitate owl movement between the blocks and ensure the survival of dispersing owls, will provide dispersal and survival habitat sufficient for spotted owl recovery.

- Although Conservation Need 2 is a range-wide requirement, the BLM confines this analysis to western Oregon because that is the landscape affected by this planning effort.

- Therefore, to meet Conservation Need 2, the BLM would contribute to a western Oregon landscape that either:

    - Supports spotted owl movement and survival conditions between and through all habitat blocks at each decadal increment (years 10, 20, 30, 40 and 50)

    - Or, if that standard is not possible due to current habitat conditions, maintains current spotted owl movement and survival conditions at decadal increments 10 and 20, and supports spotted owl movement and survival conditions between and through all habitat blocks at decadal increments 30, 40 and 50

This is except for the north-south movement and survival conditions in the northern half of the Oregon Coast Range Province, and east-west movement and survival conditions in the Oregon Willamette Valley Province (see Davis et al. 2011, p. 51), or as defined by the no-harvest reference analysis.

- Dispersal habitat was defined by Thomas et al. (1990, p. 27), and refined by Miller et al. (1997) and Forsman et al. (2002)

- With respect to the quantity of dispersal habitat necessary to support spotted owl movement between and through habitat blocks, Davis et al. (2011, p. 40), based on research findings, determined that ≥ 40 percent dispersal

6 We chose a 50-year analytical timeframe mindful that the Revised Recovery Plan identifies a 30-year timeframe for the recovery of the northern spotted owl (USDI 2011, p. viii). However, this 30-year timeframe is unchanged from that of the 2008 Northern Spotted Owl Recovery Plan (USDI 2008) which the Service issued before the most recent meta-analysis of northern spotted owl demography (Forsman et al. 2011) and recent findings on competitive interactions between northern spotted owls and barred owls (e.g., Van Lanen et al. 2011, Dugger et al. 2011 and Wiens 2012). In addition, on 3 April 2013, the assistant directors for Regions 1 and 2 of the U.S. Fish and Wildlife Service, which include the planned area, issued internal agency guidance on implementation of the Final Rule on 2013 northern spotted owl critical habitat, in which they stated a conservation timeframe of al least 50 years.

habitat within a 15.5-mile radius circle (moving window analysis) would accommodate 90 percent of known owl movements. Therefore, this quantity of dispersal habitat is sufficient to meet Conservation Need 2.

• With respect to the quantity of dispersal habitat necessary to support spotted owl survival, the HexSim model (see Issue #4) will simulate spotted owl demographic responses to each alternative. This response is based, in part, on spotted owl survival.

Analytical Methods and Techniques

• Geospatial: See Davis et al. 2011, pp. 40-43; 49-52 for methods

• HexSim: See Issue #4

• Evaluate decadal maps of dispersal function, based on habitat condition, to verify that habitat conditions support owl movement between and through habitat blocks.

• Overlay these maps with associated maps of spotted owl survival, dispersal flux, based on simulated spotted owl movements, to evaluate potential population sinks and dispersal barriers or filters not evident from habitat condition.

Analytical Conclusions

• Pass/fail: Either the resultant western Oregon landscape meets Conservation Need 2 (with stated exceptions), or it does not.

Data Needs

• Geospatial representations of spotted owl dispersal habitat on all lands in western Oregon at years 0, 10, 20, 30, 40, and 50

• HexSim-generated maps at the same timeframes of spotted owl survival, dispersal flux (the number of NSO movements through each hexagon) based on simulated owl movement, to evaluate dispersal function, and to identify population sources and sinks, and dispersal barriers or filters (See Issue #4 for information on the HexSim analyses).

Geospatial and Temporal Scales

• All of western Oregon except those areas where BLM ownership patterns preclude the BLM from contributing to habitat blocks, as demonstrated by the no-harvest reference analysis.

• 50 years

Units of Measure

• Dispersal function between and through large blocks based on (1) habitat suitability and (2) simulated spotted owl movement.

• Movement and survival patterns between and through large blocks based on spotted owl movement and population as simulated by HexSim

Data Display

• Maps, by decade and alternative, of lands that support spotted owl movement and survival in western Oregon, overlaid with the associated large and small habitat blocks

Issue 3

Conservation Need 3: Would the BLM alternative contribute to a coordinated, adaptive management effort to reduce the loss of habitat due to catastrophic wildfire throughout the northern spotted owl's range?

Analytical Assumptions

• Conservation Need 3 includes "a monitoring program to clarify whether these risk reduction methods are effective and to determine how owls use habitat treated to reduce fuels." However, the creation of such a monitoring program is not a BLM responsibility and will not be included in the BLM evaluation.

• Wildfire is relevant to northern spotted owl conservation only because of its effects to northern spotted owl habitat and demography, which Conservation Need 1, 2, and 4 address.

• The relative habitat suitability data layers the BLM developed to address Conservation Needs 1, 2, and 4, include forecasts of habitat change from wildfire.

• Thus, the BLM's evaluations of Conservation Needs 1, 2 and 4, also address Conservation Need 3.

• No additional analysis is needed

Issue 4

Conservation Need 4: In areas of significant population decline, would the BLM alternative contribute to a landscape that sustains the full range of survival and recovery options for the spotted owl in light of significant uncertainty?

Analytical Assumptions

• To meet Conservation Need 4, the BLM must contribute to a landscape that maintains spotted owl population viability in all western Oregon modeling regions (USDI 2011, pp. C–7-13) for 50 years, or 30 years if the no-harvest reference analysis indicates that 50 years is not possible.

• "Areas of significant population decline" include all of western Oregon (Forsman et al. 2011).

• Barred owls occupy the entire range of the spotted owl and all spotted owl habitats, compete with spotted owls for all spotted owl prey species, displace spotted owls from nest territories, inhibit spotted owl establishment of new territories, and are contributing to observed, range-wide spotted owl population declines (Van Lanen et. al. 2011, Dugger et al. 2011, Wiens 2012).

• Although BLM-administered lands play a key role in northern spotted owl conservation in some portions of the planning area, recent research provides no evidence that the BLM can manage individual forest stands in a manner that provides northern spotted owls with a competitive advantage over barred owls (Dugger et al. 2011; Wiens 2012). The Revised Recovery Plan identifies a 30-year recovery timeframe (USDI 2011, p. viii). Thomas et al. (1990, p. 318) developed the original conservation plan for the spotted owl to maintain owl population viability to 50 years. In addition, on 3 April 2013, the assistant directors for Regions 1 and 2 of the U.S. Fish and Wildlife Service, which include the planning area, issued internal agency guidance on implementation of the Final Rule on 2012 northern spotted owl critical habitat in which they stated a conservation timeframe of at least 50 years.

• The HexSim Spotted Owl Scenario model, used by the Service to inform its delineation of spotted owl critical habitat (USDI 2011, pp. C-54 – C-85 and 2012), augmented by new habitat change data in western Oregon (e.g., Woodstock and ORGANON) and modified to incorporate parameters that meet the 'reasonably foreseeable' standard of NEPA and the 'reasonably certain to occur' standard of the ESA, can forecast approximate spotted owl demographic responses in each modeling region.

• Although the HexSim model used by the BLM cannot forecast true spotted owl demographic responses (due to model and data limitations), the responses will be sufficiently accurate to help inform BLM planning decisions and will be comparative among alternatives.

• BLM's contribution to "the full range of survival and recovery options for the spotted owl" is demonstrated by owl demographic persistence in all western Oregon modeling regions to 50 or 30 years.

• BLM-administered lands are capable of contributing to spotted owl persistence in all modeling regions for 50 or 30 years.

Analytical Methods and Techniques

• See USDI 2011 (Appendix C) and USDI 2012 for methods.

Analytical Conclusions

• Persistence probabilities in each western Oregon modeling region based on the number of replicates occurring above the persistence threshold at years 50 and 30.

Data Needs

• The Service's HexSim Spotted Owl Scenario model - except for the following specific modifications:

• Use the same decadal habitat layers (habitat quality and change or stochasticity) used to address Issue #1.

• Beginning at year 0, use population estimates, by modeling region, based on Forsman et al. (2011, Table 22) with scientist recommendation (for example, see USDI 2011 (pp. C– 71-74).

• Establish a pseudo-extirpation risk threshold[7] for each modeling region[8].

• Allow spotted owls to move through and establish nest territories in all habitat gradients.

• Beginning at year 0, use observed barred owl encounter rates (see USDI 2011, p. C-66, Table C-25).

• Simulate 50 years from year 0.

Geospatial and Temporal Scales

• The modeling regions in western Oregon delineated by the Service to inform its delineation of spotted owl critical habitat (USDI 2011:C-7 – C-13)

• 50 years; 30 years if 50 years is not possible

Units of Measure

• Spotted owl extirpation risk (i.e., the relative risk that spotted owls would vanish from, or become reproductively unstable in, a modeling region) based on simulated spotted owl numbers and distributions in each modeling region at 50 years, or 30 years if needed.

7 A pseudo-extinction threshold is an area-specific population level derived from empirical evidence or expert opinion. It is the level at which small population processes, such as the diminished ability of individuals to find mates when the species becomes rare on the landscape, would be expected to affect species persistence in an area. With respect to the northern spotted owl, the BLM will use pseudo-extinction thresholds to calculate the probabilities of small population processes affecting species persistence under different planning alternatives.

8 HexSim models "female" owls, only (USDI 2011, p. C-56), which "reproduce" probabilistically (i.e. pseudo nesting pairs). Therefore, we need a population and distribution threshold for each modeling region to evaluate the risk of species extirpation in that region.

Data Display

- Forecasts of spotted owl demographic response in each modeling region for years 30 and 50
- Determinations of extirpation risk in each modeling region at year 50, and then year 30
- Spatial delineations of population sources and sinks by decade

Issue 5

Recovery Action 6: Would the BLM alternative delineate at least one reserved land use allocation in the moist forest that would be managed for structural complexity and biological diversity beneficial to the spotted owl?

Analytical Assumptions

- Recovery Action 6 states, "In moist forests managed for spotted owl habitat, land managers should implement silvicultural techniques in plantations, overstocked stands and modified younger stands to accelerate the development of structural complexity and biological diversity that will benefit spotted owl recovery" (USDI 2011, p.III-19). The analysis will compile information on implementation of silvicultural techniques relevant to Recovery Action 6 for reserved land use allocations and spotted owl critical habitat in the moist forest.

Analytical Conclusions

- With respect to a reserved land use allocation, the purpose and need for action includes maintaining a network of large blocks of forest to be managed for late-successional forests to contribute to the conservation and recovery of the spotted owl. All alternatives will include a network of large blocks of forest that the BLM will manage for late-successional forest. The BLM would provide data specific to reserved land use allocations and spotted owl critical habitat to the Service for review and evaluation regarding consistency with Recovery Action 6.

Issue 6

Recovery Action 10: Would the BLM alternative conserve spotted owl sites and high value spotted owl habitat to provide additional demographic support to the spotted owl population?

Analytical Assumptions

- The Revised Recovery Plan anticipates some loss of spotted owl sites, but does not define an anticipated limit to such loss (USDI 2011, pp. III – 44-46).

- "Conserve spotted owl sites" (i.e., are we conserving or losing individual sites) may be determined using the rationale and thresholds of Thrailkill (pers. com. 2005). By these thresholds, a nest site is lost when a nest territory has less than 50 percent nesting-roosting habitat within the 500-acre core circle, or less than 40 percent nesting-roosting habitat within the mean provincial home range circle, that surround the nest site.

- The Revised Recovery Plan defines high value spotted owl habitat as including older, multi-layered structurally-complex forests (i.e., forest stands addressed by Recovery Action 32) "but also areas with current and historic use by spotted owls" (USDI 2011, p. G-2). In other words, Recovery Actions 10 and 32 address high-value habitat.

- Recovery Action 10 anticipates neither that all high value habitats will be conserved nor defines an amount of loss that would be consistent with Recovery Action 10 (USDI 2011, p. III-45). Instead, the Revised Recovery Plan states, "The intent of this recovery action is to protect, enhance and develop habitat in the quantity and distribution necessary to provide for the long-term recovery of spotted owls" (ibid.: III-44).

- Thus, Issues 1, 2 and 4 address the standard "Conserve…high value spotted owl habitat."

Analytical Methods and Techniques

• The loss of a spotted owl site, with respect to the ability of the surrounding habitat to support nesting, is determined by any loss of nesting and roosting habitat in which the quantity of nesting and roosting habitat, post-change (i.e., regardless of extant conditions), within the associated 500-acre core is < 50 percent of the core area, or within the associated provincial home range is < 40 percent of the provincial home range area (USDI 2011)

• As a no-loss bookend, prohibit simulated treatments that would drop the amount of nesting and roosting habitat below 50 percent in the 500-acre core or below 40 percent in the provincial home range, regardless of extant conditions

Analytical Conclusions

• Numbers of extant spotted owl sites on BLM-administered lands 'conserved' and 'lost' at years 10, 20, 30, 40, and 50

Data Needs

• Spotted owl sites on BLM-administered lands in western Oregon with 500-acre core area and provincial home range

• Geospatial representations of spotted owl nesting and roosting habitat on all lands in western Oregon at years 0, 10, 20, 30, 40, and 50

Geospatial and Temporal Scales

• BLM-administered lands in western Oregon

• 50 years

Units of Measure

• Number of spotted owl sites

Data Display

• Table showing the number of spotted owl sites on BLM-administered lands above and below thresholds, and 'conserved' and 'lost', by decade

Issue 7

Recovery Action 12: In lands where management is focused on the development of spotted owl habitat, would the BLM alternative concentrate post-fire silvicultural activities on conserving and restoring habitat elements that take a long time to develop (e.g., large trees, medium and large snags, downed wood)?

Analytical Assumptions

• Lands that are managed for the development of spotted owl habitat include reserved land use allocations and designated critical habitat.

• The BLM will forecast the locations, footprints, and intensities of wildfires.

• The management of post-fire silvicultural activities on these lands will vary by planning alternative.

Analytical Methods and Techniques

- Qualitatively describe how the management of post-fire silvicultural activities varies by alternative.
- Quantify for each alternative the acres of reserved land use allocations and critical habitat affected by wildfire each decade.

Analytical Conclusions

- Quantitative comparisons by alternatives of the acres of burned areas in which habitat elements that take a long time to developed are conserved or restored.

Data Needs

- Acres or reserved land use allocations and critical habitat modified, by decade, by wildfire.
- Changes in spotted owl relative habitat suitability values in each area modified by wildfire.

Geospatial and Temporal Scales

- BLM-administered lands in western Oregon
- 50 years

Unit of Measure

- Acres by land use allocation and critical habitat subunit.

Data Display

- Table showing the acres of wildfire by decade and, for each alternative, the portions of those acres in which the BLM would conserve or restore habitat elements that take a long time to develop

Issue 8

Recovery Action 32: Would the BLM alternative maintain and restore well-distributed, older and more structurally complex multi-layered conifer forests on BLM-administered lands in western Oregon while allowing for other threats, such as fire and insects, to be addressed by restoration management actions?

Analytical Assumptions

- The definition of "older and more structurally complex multi-layered conifer forests" will vary by alternative
- Using tabular and spatial data, the Service will determine if BLM management is consistent with Recovery Action 32

Analytical Methods and Techniques

- Map and tabulate the occurrences of such habitat in the Oregon Western Cascades, Oregon Eastern Cascades, Oregon Coast Range, and Oregon Klamath provinces, at decadal increments 0, 10, 20, 30, 40, and 50.

Analytical Conclusions

• Acres of extant, older and more structurally complex multi-layered conifer forest maintained in the Oregon Western Cascades, Oregon Eastern Cascades, Oregon Coast Range, and Oregon Klamath provinces, at decadal increments 0, 10, 20, 30, 40, and 50.

• Total acres of older and more structurally complex multi-layered conifer forest maintained and restored (including forest ingrowth) in the Oregon Western Cascades, Oregon Eastern Cascades, Oregon Coast Range, and Oregon Klamath provinces, at decadal increments 0, 10, 20, 30, 40, and 50.

Data Needs

• Geospatial representations of older and more structurally complex multi-layered conifer forests on BLM-administered lands in western Oregon at years 0, 10, 20, 30, 40, and 50 years.

Geospatial and Temporal Scales

• BLM-administered lands in western Oregon

• 50 years

Data Display

• Tabular and geospatial representations of older and more structurally complex multi-layered conifer forest maintained and restored in the Oregon Western Cascades, Oregon Eastern Cascades, Oregon Coast Range, and Oregon Klamath provinces, at decadal increments 0, 10, 20, 30, 40, and 50

Critical Habitat

Framework for Evaluating Effects to Northern Spotted Owl Critical Habitat

ESA sec. 3(5)(A)(i) defines critical habitat as having "those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection." The Final Rule includes four "special management considerations or protections" for critical habitat in the western Cascades and Coast Range of Oregon, and eight for the eastern Cascades of Oregon (77 FR 71908 – 71910). These same "special management considerations or protections" also apply to the Klamath Basin of southwestern Oregon depending on site-specific moist and dry forest conditions (77 FR 71910; 71911).

• Oregon Western Cascades and Coast Range:

"(1) Conserve older stands that contain the conditions to support northern spotted owl occupancy or high-value northern spotted owl habitat as described in Recovery Actions 10 and 32 (USFWS 2011, pp. III–43, III–67). On federal lands, this recommendation applies to all land-use allocations (see also Thomas et al. 2006, pp. 284–285).

"(2) Management emphasis needs to be placed on meeting northern spotted owl recovery goals and long-term ecosystem restoration and conservation. When there is a conflict between these goals, actions that would disturb or remove the essential physical or biological features of northern spotted owl critical habitat need to be minimized and reconciled with long-term ecosystem restoration goals.

"(3) Continue to manage for large, continuous [sic] blocks of late-successional forest.

"(4) In areas that are not currently late seral forest or high-value habitat and where more traditional forest management might be conducted (e.g. matrix), these activities should consider applying ecological forestry prescriptions. Some examples that could be utilized include Franklin et al. (2002, pp. 417–421; 2007, entire), Kerr (2012), Drever et al. (2006, entire), Johnson and Franklin (2009, pp. 39–41), Swanson et al. (2010, entire), and others cited in the Revised Recovery Plan for the Northern Spotted Owl (USFWS 2011, pp. III–14, III–17 to III–19)."

- Oregon Eastern Cascades:

"(1) Conserve older stands that contain the conditions to support northern spotted owl occupancy or high-value northern spotted owl habitat as described in Recovery Actions 10 and 32 (USFWS 2011, pp. III–43, III–67). On federal lands this recommendation applies to all land use allocations (see also Thomas et al. 2006, pp. 284–285).

"(2) Emphasize vegetation management treatments outside of northern spotted owl territories or highly suitable habitat;

"(3) Design and implement restoration treatments at the landscape level;

"(4) Retain and restore key structural components, including large and old trees, large snags, and downed logs;

"(5) Retain and restore heterogeneity within stands;

"(6) Retain and restore heterogeneity among stands;

"(7) Manage roads to address fire risk; and

"(8) Consider vegetation management objectives when managing wildfires, where appropriate."

Issue 1

Does the BLM conserve older stands that contain the conditions to support northern spotted owl occupancy or high-value northern spotted owl habitat as described in recovery actions 10 and 32?

Analytical Assumptions

- "Conditions to support northern spotted owl occupancy" are addressed by Northern Spotted Owl issues 1 – 4 and 6
- "High-value northern spotted owl habitat," as addressed by Recovery Actions 10 and 32 of the Revised Recovery Plan, are addressed by northern spotted owl Issues 6 and 7
- No additional analysis is needed

Issue 2

In the western Cascades, Coast Range and Klamath Basin, does BLM management emphasize meeting northern spotted owl recovery goals and long-term ecosystem restoration and conservation?

Analytical Assumptions

- The BLM's contribution to the conservation needs of the spotted owl is addressed by Northern Spotted Owl issues 1 – 4
- Determining if the BLM would contribute to a landscape in western Oregon that meets the conservation needs of the spotted owl also would determine if the BLM would

"emphasize meeting northern spotted owl recovery goals and long-term ecosystem restoration and conservation."

- No additional analysis is needed

Issue 3

In the western Cascades, Coast Range and Klamath Basin, does the BLM continue to manage for large, contiguous blocks of late-successional forest?

Analytical Assumptions

- The BLM's contribution to "large, contiguous blocks of late-successional forest" is addressed by northern spotted owl Issue 1

- No additional analysis is needed

Issue 4

In the western Cascades, Coast Range and Klamath Basin, and in areas that are not currently late seral forest or high-value habitat and where more traditional forest management might be conducted, does the BLM consider applying ecological forestry prescriptions?

Analytical Assumptions

- The Final Rule does not define "areas that are not currently late seral forest or high-value habitat." Because the Final Rule addresses them, they are a subset of critical habitat.

- As verified by the articles cited by the Service, ecological forestry is open to broad interpretation.

- The Final Rule acknowledges the site-specific nature of ecological forestry: "Specifically prescribing such management is beyond the scope or purpose of this document, and should instead be developed by the appropriate land management agency at the appropriate land management scale (e.g., National Forest or Bureau of Land Management District)… through the land managing agencies' planning processes and with technical assistance from the Service, as appropriate" (77 FR 71881).

- Some suggested components of ecological forestry, such as increasing forest edge, depend on site-specific conditions (i.e., they are too site-specific or fine-scaled to be analyzed during a resource management planning process; 30 m × 30 m pixel-scale).

- The standard "should consider applying ecological forestry prescriptions" is advisory.

- Therefore, this standard cannot meaningfully be modeled during resource management planning because the Final Rule provides no analytical link between "ecological forestry" and "those physical and biological features" that are essential to spotted owl conservation, and that can be evaluated across the planning area.

- Instead, this standard must be addressed qualitatively: Does the BLM intend to apply management standards in land use allocations that accord to ecological forestry?

- Analysis of this question will not be needed to compare the effects of the alternatives on the EIS, but this question will be addressed in the biological assessment of the proposed RMPs.

Issue 5

In the eastern Cascades and Klamath Basin of Oregon, does BLM management emphasize vegetation management treatments outside of northern spotted owl territories or highly suitable habitat, design and implement restoration treatments at the landscape level, retain and restore key structural components, including large and old trees, large snags, and downed logs, retain and restore heterogeneity within stands, retain and restore heterogeneity among stands, manage roads to address fire risk, and consider vegetation management objectives when managing wildfires, where appropriate?

Analytical Assumptions

- Northern spotted owl Issues 6 and 7 examine how the BLM would address vegetation management inside northern spotted owl territories and highly suitable habitat. Evidence from these analyses (that the BLM would maintain such habitat while pursuing vegetation treatments) indicates if "BLM management emphasizes vegetation management treatments outside of northern spotted owl territories or highly suitable habitat."

- The BLM's emphasis on the "design and implement[ion of] restoration treatments at the landscape level" is addressed by northern spotted owl Issues 1, 2 and 4

- The BLM's emphasis on "vegetation management objectives when managing wildfires" is addressed by northern spotted owl Issue 3

- The remaining standards are too subjective or too fine-scale for analysis by the resource management planning effort for western Oregon. Since the intent of the Final Rule is to protect habitat that is essential to species conservation, these standards are addressed by northern spotted owl Issues 1 – 7

- No additional analysis is needed

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Marbled Murrelet

Issue 1

What levels of marbled murrelet habitat will be available under each alternative?

Analytical Assumptions

- The marbled murrelet habitat suitability index presented in Raphael et al. (2011) will serve as the basis for developing habitat relationships.

- Not all federal lands within the range of the marbled murrelet are capable of developing into habitat; either the lands are not capable of growing forests (e.g., rock outcrops or barren lands), or the forests that grow are not capable of developing into habitat usable by the murrelet (e.g., serpentine soils or in high elevations).

- Higher amounts of habitat, greater patch cohesion, and larger mean patch size are indicative of better habitat conditions for the marbled murrelet at a landscape-scale.

Analytical Methods and Techniques

- MaxEnt (Phillips et al. 2004) analysis of stand data, based on the marbled murrelet habitat suitability model published in Raphael et al. (2011) or using data from BLM sources. The published marbled murrelet habitat suitability model included nine covariates in Oregon (Table 41).

- The primary output from the MaxEnt model is a logistic probability for each 30-meter pixel in the model region. The logistic probability can be interpreted as the relative likelihood of murrelet presence at that pixel given the set of environmental covariates at that pixel (Raphael et al. 2011, p. 16).

- Habitat suitability will be categorized into 'lower suitability' and 'higher suitability' based on 10 replicated model runs as described in Raphael et al. 2011 (pp. 16-19).

- Lower suitability: where the ratio of predicted probability of marbled murrelet presence versus expected probability of presence (P/E) < 1.0 (i.e., where the predicted frequency of test sites is less than the expected frequency of test sites).

- Higher suitability: where the ratio of predicted probability of marbled murrelet presence versus expected probability of presence (P/E) > 1.0 (i.e., where the predicted frequency of test sites is greater than the expected frequency of test sites).

- Calculate various indices to describe the distribution and connectedness of 'patches' of habitat using models such as either FRAGSTATS (McGarigal et al. 2002) or GUIDOS (2013) morphological spatial pattern analysis. Measure connectivity by connectance and patch cohesion indices (McGarigal et al. 2002; Schumaker 1996) as well as patch metrics regarding patch size (e.g., minimum, maximum, mean ± stand deviation).

TABLE 41. MARBLED MURRELET MAXENT COVARIATES FOR OREGON

Covariate	Description	Data Source
PLATFORMS*	Platforms per acre by tree species and tree diameter at breast height	Derived from CVS† plot data with extrapolations based on data from Raphael et al. 2011
CANCOV_CON	Canopy cover of all conifers	Woodstock output
CANCOV_HDW	Canopy cover of all hardwoods	Woodstock output
MNDBHBA_CON*	Basal-area weighted mean diameter of all live conifers	Derived from Woodstock output
MULTISTORY_50	Percentage of 50 hectare (124 acre) circular area where GNN† number of tree canopy layers present equal 3	Derived from GNN
PCTMATURE_50*	Percentage of 50 hectare (124 acre) circular area where GNN VEGCLASS equals 10 (large conifer, moderate to closed canopy) or 11 (giant conifer, moderate to closed canopy)	Derived from GNN
SLOPE_PCT	Slope	BLM corporate data
BRIGHTNESS*	Tasseled cap transformation of Landsat thematic mapper data measuring overall reflectance. Differentiates dry from wet soils	LandTrendr†
GREENNESS	Tasseled cap transformation of Landsat thematic mapper data measuring presence and density of green vegetation	LandTrendr

* Covariates that were the strongest contributors to the habitat suitability model in Oregon (Raphael et al. 2011; pg. 20).
† CVS – Current Vegetation Survey; GNN – Gradient Nearest Neighbor; LandTrender – Landsat based detection of trends in disturbance and recovery (OSU 2013)

Analytical Conclusions

- Rank alternatives by the amount of marbled murrelet high suitability habitat
- Rank alternatives by the patch diversity and connectivity of marbled murrelet high suitability habitat

Data needs

- Woodstock/Forest Operations Inventory output – to model stand attributes in MaxEnt
- Current Vegetation Survey platform data – to model platforms as the primary covariate in MaxEnt
- Platform data from Raphael et al. (2011) – to refine the platform covariate where the number of platforms > 10 in the Current Vegetation Survey data
- Occupied marbled murrelet sites in Oregon (Geographic Biotic Observations database; GeoBOB) – to train the MaxEnt model and develop habitat relationships
- Marbled murrelet management Zones 1 and 2 (USDI 1997) to define the analysis area

Geographic and Temporal Scales

- Geographic scale will be marbled murrelet management Zones 1 and 2 for Salem, Eugene, Roseburg, and the northern portion of Coos Bay; and Zones A and B in Medford and the southern portion of Coos Bay (approximately a 6.5-mile buffer of the western hemlock type).
- Temporal scale for habitat modeling will be years 0, 10, 20, 30, 40, 50, and 100.

Units of Measure

- Acres of high suitability habitat
- Acres of low suitability habitat

Data Display

- Tables, line graphs, and maps of habitat acreage (higher and lower suitability) by years 0, 10, 20, 30, 40, 50, and 100 years by marbled murrelet management zone (Zones 1 and 2) and by land use allocation for each alternative (i.e., marbled murrelet habitat trends within the planning area).
- Tables, line graphs, and maps of habitat acreage (higher and lower suitability) by years 0, 10, 20, 30, 40, 50, and 100 years) by marbled murrelet management zone (Zones 1 and 2) within critical habitat for each alternative (i.e., marbled murrelet habitat trends within designated critical habitat).
- Table(s) displaying habitat patch diversity and connectivity indices as well as patch metrics (e.g., minimum, maximum, mean ± stand deviation) by alternative.

Issue 2

How will the alternatives affect future occupied marbled murrelet sites?

Analytical Assumptions

- For the current condition (year 0), the management of occupied marbled murrelet sites will be based on the sites as currently mapped: 321 sites encompassing 47,078 acres.
- If pre-disturbance surveys are not conducted, marbled murrelet sites will not be found. If undetected marbled murrelet sites are located within the harvest land base, they will be lost.
- The effective area surveyed by each survey station will be 30 acres based on Mack et al. (2003).
- The estimated number of occupied marbled murrelet sites that would not be found will not be spatially explicit (i.e., no prediction of which particular stand will be occupied).
- In the Roseburg District, marbled murrelets use five major streams and rivers as travel corridors to establish occupied sites in Zone 2 more frequently than expected (USDI 2005). These travel corridors follow the main stem of the Umpqua River, Elk Creek, Middle Fork of the Coquille River, Berry Creek, and Olalla Creek. There are no such travel corridors in Zone 2 documented in other Districts.

Analytical Methods and Techniques

- Calculate detection rates of past surveys to estimate the amount of future, occupied marbled murrelet sites that either will or will not be discovered (contingent on whether or not surveys are conducted under the alternative).

• Calculate detection rates based on the amount of survey effort (e.g., number of stations surveyed) and survey results (i.e., occupancy detection) within the following hierarchical strata:

  - By district
  - By proximity to the Pacific Ocean (Zone 1, Zone 2),
  - By stand condition at the time of survey (e.g. using stand age at time of survey as a proxy for habitat conditions for marbled murrelets).

• Base the number and locations of survey stations and occupancy detections on BLM-administered lands on the data available in the GeoBOB marbled murrelet station and marbled murrelet site data layers respectively.

• Express detection rate as the percentage of stations surveyed that resulted in ≥ 1 occupancy detection.

• Calculate detection rates by district and by marbled murrelet management zone. In the Roseburg District, detection rates within the Zone 2 travel corridor will also be calculated.

• Calculate detection rates calculated by stand age. Strata used to stratify marbled murrelet detection rates include: < 80 years, 80-119 years, 120-159 years, and ≥ 160 years.

• The acreage modeled in the harvest scenarios within Zone 1 or Zone 2, combined with the effective station area and the calculated detection rates, will provide an estimate of how many occupied detections would not be observed in the absence of surveys.

• Each detection that would not be observed would represent an occupied marbled murrelet site that would not be found in the absence of surveys.

Analytical Conclusions

• The number of future, occupied marbled murrelet sites will provide an estimate of the number, acreage, and distribution of occupied marbled murrelet sites on the landscape.

• Rank alternatives by number of future, occupied marbled murrelet sites lost.

Data Needs

• Occupied marbled murrelet sites in Oregon – to determine extent of occupied sites at year 0.

• Marbled murrelet occupancy detections in Oregon from GeoBOB– to determine extent of occupied sites under alternative strategies

• Marbled murrelet survey stations and survey polygons from GeoBOB – to calculate detection rates of marbled murrelets

• Marbled murrelet management Zones 1 and 2 – to define the analysis area and determine detection rates

• Forest Operations Inventory data – to refine detection rates by age class of stand(s) surveyed.

• Hydrology data – to refine detection rates within the travel corridors in the Roseburg District.

• Harvest scenario polygons – to help describe future sites.

Geographic and Temporal Scales

• The planning area within the inland range of the marbled murrelet (i.e., within 50 miles of the Pacific Ocean - within Zone 1 and Zone 2 collectively)

• Habitat modeling will be at years 0, 10, 20, 30, 40, 50, and 100.

Units of Measure

• Number of future, occupied marbled murrelet sites that will be lost in the absence of surveys.

• Number of future, occupied marbled murrelet sites that will be discovered in the presence of surveys.

Data Display

• Tables of occupied marbled murrelet sites lost (number of sites and acreage) by years 0, 10, 20, 30, 40, 50, and 100 years, by marbled murrelet management zone (Zones 1 and 2), by district for each alternative.

Fisher

Issue 1

What levels of fisher habitat will be available under each alternative?

Analytical Assumptions

• Habitat for the fisher will be divided into three categories (Lofroth et al. 2010). :

◦ Denning habitat: habitat that fishers use for reproduction, denning, and rearing of young. Cavities in live or dead trees are a key characteristic of denning habitat for fisher. The mean diameter of trees (live or dead) used for denning in Oregon was 91 cm (36 inches).

◦ Resting habitat: habitat that fishers use for resting (thermal regulation, security, proximity to prey). High canopy cover, an abundance of large trees, and incidence of mistletoe or rust brooms are characteristic of resting habitat. In Oregon, the average canopy cover of fisher resting habitat was 82-84 percent and mean diameter of live trees used for resting was 76 cm (30 inches).

◦ Foraging habitat: habitat that fishers use for locating and capturing prey. Fishers are more active in areas where there is greater structural complexity (vertically and at the ground level) and greater amounts of dead woody structure compared to random locations.

• The following structural stages will represent the three categories of fisher habitat:

◦ Denning habitat: structurally complex

◦ Resting habitat: structurally complex and mature, multi-layered canopy

◦ Foraging habitat: structurally complex, mature, multi-layered canopy, and young with structural legacies

• The structural stages representing fisher habitat will be verified and refined, as necessary, based on information from Current Vegetation Survey plot data for down woody material and snags associated with each stage relative to the habitat needs of fisher

• Fishers do not exhibit selection for particular seral conditions at the home range, but are associated with specific forest structural elements (tree cavities, logs, snags, live hardwood trees, and shrubs) (Raley et al., 2012) and moderate to dense forest canopy (Lofroth et al., 2010; Raley et al., 2012). Fishers rarely use early-successional stages (Lofroth et al., 2010; Raley et al., 2012) and select home ranges with ≥ 30 percent canopy cover and show positive correlations with canopy cover up to 60 percent (Raley et al., 2012)

• Higher amounts of habitat and higher degrees of connectivity, greater patch cohesion, and large mean patch size will be indicative of better habitat conditions for the fisher at a landscape scale

• The distribution of fisher in Oregon is limited to the Klamath Mountains and the southern portion of the Cascade Range (Lofroth et al. 2010)

• Fisher habitat will be limited to those sub-basins where there is a reliable, documented observation of the species in the GeoBOB database. Reliable observations include those that are noted as "excellent" (high confidence that the identification is correct). Sub-basins that will represent the extent of fisher habitat in the planning area include Applegate, Chetco, Illinois, Middle Rogue, Upper Klamath, Upper Klamath Lake, and Upper Rogue.

Analytical Methods and Techniques

• Utilizing structural stages and habitat relationships (as defined above) the amount and location of habitat for fisher will be calculated in GIS and exported to pivot tables

• Calculate various indices that will help to describe the distribution and connectedness of 'patches' of habitat using models such as either FRAGSTATS (McGarigal et al. 2002) or GUIDOS (2013) morphological spatial pattern analysis. Measure connectivity by connectance and patch cohesion indices (McGarigal et al. 2002; Schumaker 1996) as well as patch metrics regarding patch size (e.g., minimum, maximum, mean ± stand deviation)

Analytical Conclusions

• Rank alternatives by the amount of fisher habitat

• Rank alternatives by the patch diversity and connectivity of fisher habitat

Data Needs

• Woodstock/Forest Operations Inventory output – to model habitat attributes by structural stage

• Structural stages – to develop habitat relationship

• Physiographic provinces – to define analysis area (e.g., Klamath, Coast Range, Cascades East, and Cascades West)

• Sub-basins – to define analysis area

• Harvest scenario polygons – to help describe known sites

Geographic and Temporal Scales

• Sub-basins with documented fisher sightings with an excellent reliability rating in GeoBOB

• Habitat modeling will be at years 0, 10, 20, 30, 40, 50, and 100

Units of Measure

• Acres of denning, resting, and foraging habitat

Data Display

- Table, line graph, and map of habitat acreage by years 0, 10, 20, 30, 40, 50, and 100 by district for each alternative to show fisher habitat trends within the planning area
- Table(s) displaying habitat patch diversity and connectivity indices as well as patch metrics (e.g., minimum, maximum, mean ± stand deviation) by alternative.

Red Tree Vole

Issue 1

What levels of habitat for the North Oregon Coast Distinct Population Segment of the red tree vole will be available under each alternative?

Analytical Assumptions

- Based on Huff et al. (2012), the following structural stages represent habitat for the North Oregon Coast Distinct Population Segment (DPS) of the red tree vole population:
    - Mature, single and multi-layered canopy
    - Structurally complex
- Higher amounts of habitat and higher degrees of connectivity, greater patch cohesion, and larger mean patch size will be indicative of better habitat conditions for the North Oregon Coast DPS of the red tree vole at a landscape scale

Geographic and Temporal Scales

- The defined range of the North Oregon Coast DPS of the red tree vole within the planning area
- Habitat modeling will be at years 0, 10, 20, 30, 40, 50, and 100

Units of Measure

- Acres of habitat

Data Needs

- Woodstock/Forest Operations Inventory output – to model habitat development
- Structural stages – to develop habitat relationship
- Range of the North Oregon Coast DPS of the red tree vole – to define analysis area
- Survey zones for the red tree vole – to define the analysis area (i.e., Northern Mesic and Mesic Zones)
- 10th field watershed boundaries – to define the 16 watersheds exempted from surveys in Matrix and Adaptive Management Areas (Huff et al. 2012)
- Harvest scenario polygons – to help describe known sites

Analytical Methods and Techniques

• Utilizing the habitat relationships defined in Huff et al. (2012), the amount and location of habitat for the North Oregon Coast DPS of the red tree vole will be calculated in GIS and exported to pivot tables

• Calculate various indices to describe the distribution and connectedness of 'patches' of habitat using models such as either FRAGSTATS (McGarigal et al. 2002) or GUIDOS morphological spatial pattern analysis. Measure connectivity by connectance and patch cohesion indices (McGarigal et al. 2002; Schumaker 1996) as well as patch metrics regarding patch size (e.g., minimum, maximum, mean ± stand deviation)

Analytical Conclusions

• Rank alternatives by the amount of habitat for the North Oregon Coast DPS of the red tree vole

• Rank alternatives by the patch diversity and connectivity of habitat for the North Oregon Coast DPS of the red tree vole

Data Display

• Table, line graph, and map of habitat acreage by years 0, 10, 20, 30, 40, 50, and 100 by District for each alternative to show habitat trends within the planning area

• Table(s) displaying habitat patch diversity and connectivity indices as well as patch metrics (e.g., minimum, maximum, mean ± stand deviation) by alternative

Special Status Species; Survey and Manage Species

Issue 1

How will the alternatives affect the levels of habitat for Bureau Sensitive, Bureau Strategic, and Survey & Manage wildlife species?

Analytical Assumptions

• Bureau Sensitive, Bureau Strategic, and Survey and Manage species will be assigned into analytical groups based on similarity of ecology and use of similar structural stages and/or vegetative conditions (**Table 42**[9]). Species will then be further assigned into taxonomic groups. The use of these groups may facilitate the discussion and presentation of results

• Similar analytical groups are also included in the Woodstock harvest modeling.

• A 'primary habitat attribute' for each species will be identified that will serve as an indicator of habitat conditions for that species (**Table 42**)

• Landscape habitat targets were used to assign which structural stage(s) will represent habitat for a given species in the analysis (**Table 42**). Quantified landscape habitat targets were used where available and qualitative targets were used elsewhere. It is assumed that for this analysis the structural stage(s) adequately represent habitat for a given species as described by the landscape habitat targets (**Table 42**)

• The structural stage(s) that represent habitat for a given species in the analysis will be a simplification of the habitat needs for the species and habitat conditions and as a result will likely overestimate the amount of habitat available (i.e., it is not feasible to model and analyze conditions and features at scales within individual stands).

9 Tables 42, 43, and 44 are located at the end of the Wildlife section due to their large size.

However, the analysis will provide a means to compare relative differences in habitat development among alternatives despite the overestimation in absolute quantities of habitat

- The analysis will consider five Bureau Sensitive species individually because they are a proposed or candidate species under the Endangered Species Act or there is explicit direction to do so (**Table 42**)

- The Bureau Sensitive, Bureau Strategic, or Survey and Manage wildlife species that are associated with special habitats (or where associated habitat is unknown) will not be analyzed in detail and are identified in **Table 43**

- The Bureau Sensitive, Bureau Strategic, or Survey and Manage wildlife species that will either be modeled and analyzed individually, considered but not analyzed in detail, or another portion of the analysis will meet the analytical needs for the species (e.g., landbird focal species analysis) are identified in **Table 44**

- Higher amounts of habitat are indicative of better habitat conditions at a landscape scale for the Bureau Sensitive, Bureau Strategic, or Survey and Manage wildlife species considered.

Analytical Methods and Techniques

- Utilizing analytical groups and their habitat relationships (as defined above), the amount and location of habitat for each group will be calculated in GIS and exported to pivot tables

- The amount of habitat for each species will be calculated for the District(s) on which they are documented or suspected to occur using the State Director's Special Status Species List

- The number of known sites by land use allocation and harvest scenario will be calculated in GIS and exported to pivot tables

Analytical Conclusions

- Rank alternatives by the amount of habitat for a given analytical group over time.

Data Needs

- Woodstock/ Forest Operations Inventory output – to model habitat attributes

- Structural stages – to develop habitat relationship

- GeoBOB fauna observations – to help describe known sites

- Land use allocations under each alternative – to help describe known sites

- Harvest scenario polygons – to help describe known sites

Geographic and Temporal Scales

- The planning area

- Habitat modeling will be at years 0, 10, 20, 30, 40, 50, and 100

Units of Measure

- Acres of habitat;

- Number of known sites

Data Display

- Table and line graph of habitat for each analytical group by years 0, 10, 20, 30, 40, 50, and 100 by district for each alternative to show habitat trends within the planning area
- Tables of known sites by species, land use allocation, district and within harvest scenario will be displayed

Bald Eagles

Issue 1

What levels of bald eagle habitat will be available under each alternative?

Analytical Assumptions

- Nesting habitat for the bald eagle consists of mature, multi-layered canopy and structurally complex forest stands within two miles of large water bodies (reservoirs or lakes > 10 acres or streams > 7th order). Bald eagles nest in large diameter trees within two miles of large, permanent water bodies (Isaacs and Anthony 2011)
- The role of private lands in contributing bald eagle habitat will be assumed to remain constant throughout the analysis period. Current Oregon Forest Practice Rules and Statutes (ORS 629.665.0220-0240) require protection of all known bald eagle nests, roost areas, and foraging perches
- Higher amounts of habitat will be indicative of better habitat conditions for bald eagles at a landscape scale

Analytical Methods and Techniques

- Utilizing the habitat relationship (as defined above), the amount and location of habitat for bald eagles will be calculated in GIS and exported to pivot tables
- The number of known bald eagle nest sites and communal/winter roosts by land use allocation, bald eagle management area, and harvest scenario will be calculated in GIS and exported to pivot tables

Analytical Conclusions

- Rank alternatives by amount of bald eagle habitat over time

Data Needs

- Structural stages – to develop habitat relationship
- Hydrology data (lakes, reservoirs, and streams) – to define habitat relationship
- GeoBOB fauna observations – to help describe known sites
- Land use allocations under each alternative – to help describe known sites.
- Harvest scenario polygons – to help describe known sites
- Bald Eagle Management Area polygons – to help describe known sites under the No Action alternative

Geographic and Temporal Scale

- The planning area
- Habitat modeling will be at years 0, 10, 20, 30, 40, 50, and 100

Units of Measure

- Acres of habitat
- Number of known sites

Data Display

- Table, line graph, and map of habitat acreage by years 0, 10, 20, 30, 40, 50, and 100 by district for each alternative to show habitat trends within the planning area
- Tables of known sites by land use allocation by district and within harvest scenario will be displayed

Golden Eagles

Issue 1

What levels of golden eagle habitat will be available under each alternative?

Analytical Assumptions

- The following structural stages represent nesting habitat for the golden eagle:
    - Mature, multi-layered canopy
    - Structurally complex within four miles of broad expanses (patches ≥ 100 acres) of 'open' structural stages:
        - Non-forest vegetation series: sagebrush and grassland
        - Woodland: juniper and early-successional
- Golden eagles nest in open and semi-open habitat and they may also nest in coniferous habitat when open space is available (e.g., fire breaks, clear-cuts, burned areas, pasture-land) (Pagel et al. 2010) or there are "broad expanses of open country" available for foraging (Johnsgard 1990)
- Golden eagles nest on cliffs, the largest trees in forested stands, or artificial structures (Pagel et al. 2010)
- Over 98 percent of golden eagle observations are within 4 miles of the center of their territory center (McGrady et al. 2002). Golden eagle nesting habitat will be limited to those counties where there are historical breeding areas: Klamath, Douglas, Jackson, Curry, Clackamas, Coos, Josephine, Lane, and Linn Counties (Isaacs 2011) in the planning area
- Higher amounts of habitat will be indicative of better habitat conditions for golden eagles at a landscape scale

Geographic and Temporal Scale

- Klamath, Douglas, Jackson, Curry, Clackamas, Coos, Josephine, Lane, and Linn Counties in the planning area
- Habitat modeling will be at years 0, 10, 20, 30, 40, 50, and 100

Units of Measure

- Acres of habitat

Data Needs

- Woodstock/ Forest Operations Inventory output – to model habitat attributes by structural stage
- Structural stages – to develop habitat relationship
- Harvest scenario polygons – to help describe known sites

Analytical Methods and Techniques

- Utilizing structural stages and habitat relationships (as defined above) the amount and location of habitat for golden eagles will be calculated in GIS and exported to pivot tables

Analytical Conclusions

- Rank alternatives by amount of golden eagle habitat over time

Data Display

- Table, line graph, and map of habitat acreage in years 0, 10, 20, 30, 40, 50, and 100 by district for each alternative to show golden eagle habitat trends within the planning area

Landbirds

Issue 1

What levels of landbird habitat will be available under each alternative?

Analytical Assumptions

- The collective needs of a suite of focal species represent the range of desired habitat conditions for birds in the habitat should also address the habitat needs of most, if not all, of the other bird species occurring in that habitat type (Altman and Alexander 2012).
- Habitat attributes will be adapted from those described for the focal species of landbirds based on the three conservation plans pertinent to the planning area:
    - Habitat Conservation for Landbirds in the Coniferous Forests of Western Oregon and Washington (August 2012) – 25 focal species and habitat attributes (Altman and Alexander 2012),
    - Conservation Strategy for Landbirds in Lowlands and Valleys of Western Oregon and Washington (March 2000) – 34 focal species and habitat attributes (Altman 2000a)
    - Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington (June 2000) – 12 focal species and habitat attributes (Altman 2000b).
- The analysis will assume that the structural stage(s) used in the RMP analysis that best correspond to the landscape habitat objectives described in the landbird conservation plans for individual focal species will be considered habitat (**Table 42**)

- For focal species that have snags or coarse woody material as a habitat attribute or as part of their landscape habitat targets, the structural stages in **Table 42** will be verified and refined, as necessary, based on information for these attributes from the Current Vegetation Survey plot data
- Higher amounts of habitat will be indicative of better habitat conditions for landbirds at a landscape scale

Analytical Methods and Techniques

- Utilizing focal species and their relationships with habitat attributes (as defined in **Table 42**), the amount and location of habitat for each focal species will be calculated in GIS and exported to pivot tables

Analytical Conclusions

- Rank alternatives by the amount of habitat for a given focal species over time

Data Needs

- Structural Stage Definitions – to develop habitat relationships
- Woodstock/ Forest Operations Inventory output – to model habitat attributes
- Current Vegetation Survey snag and coarse woody material data – to develop habitat relationships

Geographic and Temporal Scales

- The planning area
- Habitat modeling will be at years 0, 10, 20, 30, 40, 50, and 100

Units of Measure

- Acres of habitat

Data Display

- Table and line graph of habitat for each focal species by time-step (0, 10, 20, 30, 40, 50, and 100 years) by district for each alternative (i.e., habitat trends within the planning area)

Other Species not Analyzed in Detail

Effects on the following species will not be analyzed in detail because the alternatives are not likely to significantly affect the species; the alternatives are not likely to differ in their effects on the species; or effects cannot be meaningfully analyzed at the RMP level. The rationale and analytical assumptions for those species which will not be analyzed in detail are described below.

Special Habitats:

- For this analysis, "special habitats" are non-forested types of habitat, which do not have a defined structural stage and will not be modeled through time in Woodstock
- Naturally occurring special habitats will be managed to maintain their ecological function under all alternatives:
    - Seeps, springs, wetlands, natural ponds, vernal pools/ponds, streams, natural meadows, rock outcrops, caves, cliffs, talus slopes, mineral licks, oak savannah/woodlands, sand dunes, and marine habitats

- Human-made special habitats will be managed as special habitats when compatible with their engineered function:
    - Bridges, buildings, quarries, pump chances/heliponds, abandoned mines, and reservoirs.

- The effects of BLM management on special habitats, and the species that use them, will not differ amongst the alternatives. The species that are associated with special habitats for this analysis are identified in **Table 43**.

Columbian White-tailed Deer (Columbia River Population):

- Riparian areas (within 200 meters [650 feet] of streams or rivers) and oak woodlands are habitat for the Columbian white-tailed deer (68 FR 43647; USDI 2013a).

- Distance to stream is more important than the vegetative condition in determining habitat for Columbian white-tailed deer (68 FR 43647).

- Columbian white-tailed deer habitat is limited to Douglas, Clatsop, Columbia, and Multnomah counties within the planning area – corresponding with the location of the distinct population segments for the species (ibid.).

- Because vegetation condition is less important than distance to streams or rivers in defining habitat for the Columbian white-tailed deer, management direction under the alternatives will not lead to meaningful differences in the amount of habitat (i.e., amount of habitat < 200 meters from streams will not change based on management direction).

Fender's Blue Butterfly:

- There are 2,180 acres of designated critical habitat for Fender's blue butterfly within the planning area (71 FR 63861). However, none of this designated critical habitat is within the decision area, and management direction under the alternatives will not affect critical habitat for Fender's blue butterfly.

Oregon Silverspot Butterfly:

- Habitat for the Oregon silverspot butterfly is restricted to the immediate coast, centered around salt-spray meadows, or within a few miles of the coastline in similar meadow-type habitat (USDI 2013b).

- There are 368 acres of designated critical habitat for the Oregon silverspot butterfly within the planning area but none occurs within the decision area (66 FR 59807).

- Given the narrow range of habitat-type and limited spatial extent of habitat, management direction on BLM-administered lands is unlikely to affect the species or its habitat.

Steller Sea Lion (Western Distinct Population Segment) and Sea Otter:

- Given their marine habitat, management direction on BLM-administered lands are unlikely to affect Steller sea lion (Western Distinct Population Segment), sea otter, or habitat for either species.

Vernal Pool Fairy Shrimp:

- There are 7,354 acres of designated critical habitat for the vernal pool fairy shrimp within the planning area; six percent of which (422 acres) is within the decision area (68 FR 46684).

- Given the narrow range of habitat (e.g. temporary ponds and vernal pools) and limited spatial extent of habitat on BLM-administered lands, management direction under the alternatives is unlikely to affect the vernal pool fairy shrimp or its habitat.

Western Snowy Plover (Pacific Coast Population):

• Western snowy plover nest primarily on coastal beaches, sand spits, and open areas around estuaries and river mouths (58 FR 12864).

• There are 2,279 acres of designated critical habitat for the snowy plover within the planning area; 17 percent of which (385 acres) is within the decision area (77 FR 36728).

• Given the narrow range of habitat-type and limited spatial extent of habitat on BLM-administered lands, management direction under the alternatives is unlikely to affect snowy plovers or its beach habitat.

Streaked Horned Lark:

• Foraging and nesting habitats for the streaked horned lark include topographically flat areas with bare ground and low-lying vegetation such as grasslands, prairies, coastal dunes, agricultural fields, and shoulders of lightly travelled roads (78 FR 61505).

• Sites used by streaked horned larks are also generally treeless and > 300 acres in size (ibid.).

• Within the planning area, the historical range of the streaked horned lark habitat is limited to the Willamette Valley, Oregon Coast, Umpqua River Basin, and the Rogue River Basin (ibid.).

• Given the narrow range of habitat (flat, treeless areas > 300 acres) and limited availability of this habitat within the historical range of the species on BLM-administered lands in the decision area, management direction under the alternatives is unlikely to affect streaked horned larks or its habitat.

Taylor's Checkerspot Butterfly:

• Habitat for Taylor's checkerspot butterfly is coastal grasslands or open areas dominated by grassland within the Willamette Valley (78 FR 61455; USDI 2013c).

• Given the narrow range of habitat-type and limited spatial extent of habitat on BLM-administered lands, management direction under the alternatives is unlikely to affect the species or its habitat.

Wolverine:

• Wolverine habitat is dependent on high-elevation areas that are cold and receive enough winter precipitation to maintain snow late into the spring, and wolverines are dependent on that spring snow cover for successful reproduction (78 FR 7867).

• Wolverine habitat does not appear to be restricted to specific vegetation or other structural characteristics (ibid.).

• Wolverine habitat is limited to the crest of the Cascade Mountains and scattered mountaintops in the planning area (≥ 4,592 feet elevation). Mean seasonal elevations used by wolverines in the northern Rocky Mountains and North Cascades vary between 1,400 and 2,600 meters (4,592 and 8,528 feet; ibid.). The amount of habitat for wolverines will not change amongst the alternatives since elevation is a constant; however, the amount of timber harvest activity and disturbance within wolverine habitat may vary amongst the alternatives.

• Human use and disturbance may have an impact on wolverine behavior (ibid.). Dispersed recreational activities, infrastructure development, transportation corridors, and land management activities (e.g., forestry) may reduce the wolverine's ability to complete essential life-history activities, such as foraging, breeding, maternal care, routine travel, and dispersal. However, little is known about the behavioral responses of individual wolverines to human presence, or about the species' ability to tolerate and adapt to repeated human disturbance (ibid.).

• The U.S. Fish and Wildlife Service does not consider stressors such as recreation, infrastructure development, or transportation corridors to pose a threat to wolverines. There is no evidence to suggest that land management activities are a threat to the conservation of the wolverine (ibid.).

• Future climate change is the only projected threat to wolverine habitat and its range due to reduced snowpack, earlier spring thaw, and warmer summer temperatures. These changing conditions reduce wolverine habitat and increase fragmentation of remaining habitat (ibid.).

• Since land management activities are not considered a threat to wolverine habitat, management direction under the alternatives will not affect wolverine habitat.

Greater Sage-grouse:

• There is no currently recognized habitat for the greater sage-grouse within the decision area. BLM developed a preliminary priority habitat and preliminary general habitat map jointly with the Oregon Department of Fish and Wildlife and the BLM National Operations Center. The result of this preliminary mapping effort does not include any priority or general habitat for the greater sage-grouse within the decision area.

  ◦ Preliminary Priority Habitat includes those areas that have been identified as having the highest conservation value to maintaining sustainable greater sage-grouse populations. These areas would include breeding, late brood-rearing, and winter concentration areas. These areas have been identified by the BLM in coordination with respective state wildlife agencies (BLM Instruction Memorandum No. 2012-044; USDI 2011).

  ◦ Preliminary General Habitat includes those areas of occupied seasonal or year-round habitat outside of priority habitat. These areas have been/are being identified by the BLM in coordination with respective state wildlife agencies (ibid.).

• In addition, mapping efforts of greater sage-grouse breeding density do not appear to include lands within the decision area (Doherty et al. 2010)

Oregon Spotted Frog:

• Oregon spotted frog habitat includes perennial bodies of warm water such as ponds, reservoirs, wetlands, and irrigation canals. They are documented in wetland sites from 2.5 acres in size up to 4,900 acres; although, it is theorized that only sites > 9 acres in size are necessary to support stable, local populations (USDI 2011)

• Wetland sites that could support Oregon spotted frogs will be included within some form of riparian protection areas under the alternatives, so management direction under the alternatives is unlikely to affect the species or its habitat

Black-tailed Deer, Mule Deer, and Elk:

• Habitat development of black-tailed deer, mule deer, and Roosevelt elk (i.e., deer and elk) was raised as a question in the scoping comments.

• Habitat for deer and elk will be assumed as the early-successional structural stage.

  ◦ Summer forage and nutritional quality can influence elk reproduction and survival within a population but one of the main threats to elk populations is the lack of early-successional habitats, particularly on federal lands (Cook et al. 2013a)

  ◦ Early-successional habitat is required to maintain productive ungulate populations (ibid.)

- Nutritional models from Southwest Oregon suggest that forest management that reduces overstory canopy cover will improve the nutritional value of forest lands for elk (Cook et al. 2013b)

- Deciduous shrubs and shade intolerant forbs are more nutritious and palatable to elk than evergreen shrubs and other shade tolerant species that grow under closed canopy conditions (ibid.)

- Black-tailed deer populations are dependent on the native food sources found in early-successional stages of the forest (ODFW 2008). On federal lands, the reduction in harvest volumes beginning in the 1980s reduced the availability of early seral habitats typically preferred by black-tailed deer on a significant portion of their range in western Oregon (ibid.)

- Federal forestlands in Western Oregon are lacking in adequate forage conditions due to drastic reductions in timber harvest under the Northwest Forest Plan (ODFW 2003)

- Individual species-specific analysis of habitat development will not be performed for these deer and elk species because:

  - Analysis of species is limited to special status species (Federally listed, candidate, or proposed species under the Endangered Species Act; Bureau Sensitive, or Bureau Strategic; Survey and Manage specie; or those with explicit direction to do so (landbirds, bald eagle, and golden eagle)

  - A deer- and elk-specific analysis will not yield results substantially different from the analysis for other wildlife species associated with the early-successional structural stage (Table 2). The analysis of early successional habitat will also provide an assessment of deer and elk habitat development under the alternatives

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TABLE 42. BUREAU SENSITIVE, BUREAU STRATEGIC, SURVEY & MANAGE WILDLIFE, SPECIES AND LANDBIRD FOCAL SPECIES WITH DEFINED STRUCTURAL STAGES FOR ANALYSIS

Analytical Group*	Taxonomic Group	Species	SSSp Status **	S&M (Y/N)	Landbird Focal Species (Y/N)	Habitat Attribute	Landscape Habitat Target	Structural Stage(s) for Habitat Analysis
Early Successional	Birds: Landbird Focal Species	Black-throated Gray Warbler	-	N	Y[1]	Deciduous canopy trees	> 30% watershed is young/pole forest (> 20% canopy cover deciduous trees)	Stand Establishment
Early Successional	Birds: Landbird Focal Species	Blue (Sooty) Grouse	-	N	Y[1]	Landscape mosaic forest	Maintain interspersion of 20-50% tree cover, 10-40% shrub cover, and 30-60% herbaceous cover within 0.5 mile radius	Early-successional, Stand Establishment, or Young Low Density
Early Successional	Birds: Landbird Focal Species	Chipping Sparrow	-	N	Y[3]	Open understory with regenerating pines	10-30% canopy cover; 20-60% shrub cover with > 20% sapling cover – especially pines	Early-successional
Early Successional	Birds: Landbird Focal Species	Common Nighthawk	-	N	Y[2]	Short grass, bare or sparsely vegetated ground	20-50% bare or sparsely vegetated; grass height < 12in	Early-successional or non-forest vegetation series: Grasslands
Early Successional	Birds: Landbird Focal Species	Fox Sparrow	-	N	Y[1]	Montane brushfields	> 60% shrub cover within forest with < 30% canopy cover	Early-successional
Early Successional	Birds: Landbird Focal Species	Grasshopper Sparrow	BS	N	Y[2]	Moderate Grass	Grass height 6-24in; > 90% herb cover; < 5% shrub cover	Early-successional or non-forest vegetation series: grasslands
Early Successional	Birds: Landbird Focal Species	Lark Sparrow	-	N	Y[2]	Scattered shrubs or bunchgrass	Shrub cover 5-15%; grass height < 18in	Early-successional or non-forest vegetation series: grasslands
Early Successional	Birds: Landbird Focal Species	Lazuli Bunting	-	N	Y[1]	Post-fire	< 20% live tree cover with 30-70% shrub-herbaceous cover and 30-70% bare ground	Early-successional or non-forest vegetation series: grasslands
Early Successional	Birds: Landbird Focal Species	Nashville Warbler	-	N	Y[1]	Dense shrub understory	> 40% understory shrub cover in wetter sites	Early-successional, stand establishment, or young low density within the Klamath Province
Early Successional	Birds: Landbird Focal Species	Nashville Warbler	-	N	Y[3]	Early successional; dense understory with regeneration	>40% native shrub cover interspersed with grassy openings with scattered trees; < 30% canopy closure	Early-successional, stand establishment, or young low density within the Klamath Province

Analytical Group*	Taxonomic Group	Species	SSSp Status **	S&M (Y/N)	Landbird Focal Species (Y/N)	Habitat Attribute	Landscape Habitat Target	Structural Stage(s) for Habitat Analysis
Early Successional	Birds: Landbird Focal Species	Olive-sided Flycatcher	-	N	Y[3]	Edge and openings created by wildfire	>2% of landscape as post-fire habitat; > 40% post-fire habitat unsalvaged; in salvage retain trees and snags > 20 in. DBH and 50% of those 12-20 in. DBH	Early Successional with Structural Legacies or Stand Establishment
Early Successional	Birds: Landbird Focal Species	Orange Crowned Warbler	-	N	Y[1]	Deciduous vegetation	> 30% watershed is early successional forest with > 30% deciduous shrub cover or trees < 15ft tall	Early Successional
Early Successional	Birds: Landbird Focal Species	Oregon Vesper Sparrow	BS	N	Y[2]	Scattered shrubs or bunchgrass	Shrub cover 5-15%; grass height < 18in	Early-successional or non-forest vegetation series: grasslands
Early Successional	Birds: Landbird Focal Species	Rufous Hummingbird	-	N	Y[1]	Nectar-producing plants	≥ 20% shrub/herbaceous cover is nectar producing plants (e.g., salmonberry, rhododendron, currant)	Early Successional, Stand Establishment, or Young Low Density
Early Successional	Birds: Landbird Focal Species	Streaked Horned Lark	FP	N	Y[2]	Short grass, bare or sparsely vegetated ground	20-50% bare or sparsely vegetated; grass height < 12in	Early Successional or Non-Forest Vegetation Series: Grasslands; *Also Considered under Species Not Analyzed in Detail*
Early Successional	Birds: Landbird Focal Species	Western Meadowlark	-	N	Y[2]	Large patches grassland	Shrub-tree over < 10%; grass height < 30in	Early-successional or non-forest vegetation series: grasslands
Early Successional	Birds: Landbird Focal Species	Western Tanager	-	N	Y[1]	Forest canopy edges	40-70% dispersed or patchy forest canopy cover	Stand Establishment or Young Low Density
Early Successional	Insects: Terrestrial	*Chloealtis aspasma* (Siskiyou Short-horned Grasshopper)	BS	N	N	Grassland or herbaceous habitats	Host plant is blue elderberry (*Sambucus caerulea*); maintain open habitat to support host plant	Early Successional
Forest Floor	Amphibians: Terrestrial	Black Salamander	BS	N	N	Talus Slopes or Down Woody Material	9.4-11.8% down wood cover for various salamander species	Young High Density with Structural Legacies, Mature, or Structurally Complex
Forest Floor	Amphibians: Terrestrial	California Slender Salamander	BS	N	N	Down Woody Material	9.4-11.8% down wood cover for various salamander species	Young High Density with Structural Legacies, Mature, or Structurally Complex

Analytical Group*	Taxonomic Group	Species	SSSp Status **	S&M (Y/N)	Landbird Focal Species (Y/N)	Habitat Attribute	Landscape Habitat Target	Structural Stage(s) for Habitat Analysis
Forest Floor	Amphibians: Terrestrial	Larch Mountain Salamander	-	Y	N	Down Woody Material	9.4-11.8% down wood cover for various salamander species	Young High Density with Structural Legacies, Mature, or Structurally Complex
Forest Floor	Amphibians: Terrestrial	Van Dyke's Salamander	-	Y	N	Down Woody Material	9.4-11.8% down wood cover for various salamander species	Young High Density with Structural Legacies, Mature, or Structurally Complex
Forest Floor	Insects: Terrestrial	*Malezonotus obrieni* (Obrien's Seed Bug)	BStr	N	N	Conifer litter	Poorly understood but appears to be associated with accumulations of Douglas-fir/conifer litter and seeds	Mature and Structurally Complex
Forest Floor	Insects: Terrestrial	*Pterostichus rothi* (Roth's Blind Ground Beetle)	BS	N	N	Downed woody material	Under rocks and logs in cool, moist, closed-canopy coniferous forests with well-drained, deep soils	Mature and Structurally Complex
Forest Floor	Mollusks: Terrestrial	*Carinacauda stormi* (Cascades Axetail Slug)	BS	N	N	Mixed coniferous-hardwood forest	Uncertain but appears associated witth riparian and/or mature forests	Mature and Structurally Complex
Forest Floor	Mollusks: Terrestrial	*Cryptomastix devia* (Puget Oregonian)	BS	Y	N	Mixed coniferous-hardwood forest	Maintain cool, moist conditions in mature or old-growth habitat; maintain canopy cover > 50-60%	Mature and Structurally Complex
Forest Floor	Mollusks: Terrestrial	*Hemphillia glandulosa* (Warty Jumping-slug)	-	Y	N	Coniferous Forest with heavy ground cover and/or prevalent woody debris	Maintain cool, moist conditions (> 50% canopy cover) and conserve down woody debris	Young High Density with Structural Legacies, Mature, or Structurally Complex
Forest Floor	Mollusks: Terrestrial	*Hemphillia malonei* (Malone Jumping-slug)	-	Y	N	Coniferous Forest with heavy ground cover and/or prevalent woody debris	Maintain cool, moist conditions (> 50% canopy cover) and conserve down woody debris	Young High Density with Structural Legacies, Mature, or Structurally Complex

Analytical Group*	Taxonomic Group	Species	SSSp Status **	S&M (Y/N)	Landbird Focal Species (Y/N)	Habitat Attribute	Landscape Habitat Target	Structural Stage(s) for Habitat Analysis
Forest Floor	Mollusks: Terrestrial	*Megomphix hemphilli* (Oregon Megomphix)	-	Y	N	Mature or late-seral mixed coniferous-hardwood forest	Maintain cool, moist conditions with sufficient canopy cover and conserve deciduous understory	Mature and Structurally Complex
Forest Floor	Mollusks: Terrestrial	*Monadenia churchi* (Klamath Sideband)	-	Y	N	Late-successional forest with woody debris or rock/talus	Maintain cool, moist conditions and undisturbed woody debris and talus deposits	Mature and Structurally Complex
Forest Floor	Mollusks: Terrestrial	*Monadenia fidelis beryllica* (Green Sideband)	BS	N	N	Mixed coniferous-hardwood forest	Maintain cool, moist conditions	Young High Density with Structural Legacies, Mature, or Structurally Complex
Forest Floor	Mollusks: Terrestrial	*Pristiloma johnsoni* (Broadwhorl Tightcoil)	BStr	N	N	Mixed coniferous-hardwood forest	Associated with exceptionally moist sites with diverse and abundant ground cover; old-growth in the Cascades Province	Mature and Structurally Complex
Forest Floor	Mollusks: Terrestrial	*Pristiloma pilsbryi* (Crowned Tightcoil)	BS	N	N	Mixed coniferous-hardwood forest	Associated with riparian or old-growth forests with abundant moisture	Mature and Structurally Complex
Forest Floor	Mollusks: Terrestrial	*Prophysaon coeruleum* (Blue-grey Taildropper)	-	Y	N	Mixed coniferous-hardwood forest	Maintain cool, moist conditions where canopy cover is > 50-70%	Young High Density with Structural Legacies, Mature, or Structurally Complex
Forest Floor	Mollusks: Terrestrial	*Prophysaon sp. nov.* (Klamath Taildropper)	BStr	N	N	Mixed coniferous-hardwood forest	Maintain cool, moist conditions where canopy cover is > 50-70%	Young High Density with Structural Legacies, Mature, or Structurally Complex
Forest Floor	Mollusks: Terrestrial	*Vertigo sp. nov.* (Hoko Vertigo)	-	Y	N	Deciduous trees/shrubs within 200m of streams, seeps, or springs	Maintain deciduous vegetation under high canopy cover; attain late-successional forest conditions	Mature and Structurally Complex
Legacy Features	Bats	Fringed Myotis	BS	N	N	Snags; caves, and mine adits	15 snags/acre ≥ 20 in. DBH for bat Roost Sites	Young with Structural Legacies, Mature, and Structurally Complex

Analytical Group*	Taxonomic Group	Species	SSSp Status **	S&M (Y/N)	Landbird Focal Species (Y/N)	Habitat Attribute	Landscape Habitat Target	Structural Stage(s) for Habitat Analysis
Legacy Features	Bats	Pallid Bat	BS	N	N	Snags; arid areas with rocky outcrops	15 snags/acre ≥ 20 in DBH for bat Roost Sites	Young with Structural Legacies, Mature, and Structurally Complex
Legacy Features	Bats	Spotted Bat	BS	N	N	Snags	15 snags/acre ≥ 20 in DBH for bat Roost Sites	Young with Structural Legacies, Mature, and Structurally Complex
Legacy Features	Birds: Landbird Focal Species	Lewis' Woodpecker	BS	N	Y[2, 3]	Large conifer trees/snags	Trees > 24in DBH; 1 snag/ac > 12in DBH; 10-40% tree canopy cover >2% of landscape as post-fire old forest; >50% post-fire landscape unsalvaged; in salvage retain all trees/snags > 20 in. DBH and > 50% of those 12-20 in. DBH; salvage < 50% of dead and down wood; in old forest > 13% shrub cover and ~ 24 snags/ac > 9 in. DBH Oaks > 33ft tall or > 22in DBH; > 1 ponderosa pine snag/ac > 40ft tall > 30in DBH; > 75% of snags with < 50% bark remaining; canopy closure < 40%	Early Successional with Structural Legacies or Woodland: Oregon White Oak
Legacy Features	Birds: Landbird Focal Species	Northern Flicker	-	N	Y[1]	Snags	> 30% watershed is early successional forest with: 1 snag/ac > 24in DBH and > 40ft tall; > 3 snags/ac 16-24in DBH and > 40ft tall; and > 10 snags/ac 4-12 in DBH	Early Successional with Structural Legacies or Stand Establishment with Structural Legacies
Legacy Features	Birds: Landbird Focal Species	Olive-sided Flycatcher	-	N	Y[1]	Residual tree canopy	> 30% watershed is early successional forest with 1-2 tpa > 40ft tall and aggregate clumps > 2.5ac with 4-12 tpa > 40ft tall	Early Successional with Structural Legacies or Stand Establishment
Legacy Features	Birds: Landbird Focal Species	Vaux's Swift	-	N	Y[1]	Large hollow snags	≥ 5 broken top or defect trees per square mile (up to 20% can be snags; > 27in DBH > 82ft tall in forest patches ≥ 60% canopy closure)	Young High Density with Structural Legacy, Mature Multi-layered Canopy, or Structurally Complex

Analytical Group*	Taxonomic Group	Species	SSSp Status **	S&M (Y/N)	Landbird Focal Species (Y/N)	Habitat Attribute	Landscape Habitat Target	Structural Stage(s) for Habitat Analysis
Legacy Features	Birds: Landbird Focal Species	White-Headed Woodpecker	BS	N	Y[3]	Large patches of old forest with large trees and snags	>10 tpa > 21in DBH and > 2 tpa 31in DBH; 10-40% canopy closure; > 1.4 snags/ac > 8in DBH and 50% > 25in DBH; patches > 350ac (	Early Successional with Structural Legacies or Woodland: Oregon White Oak
Legacy Features	Birds: Landbird Focal Species	Williamson's Sapsucker	-	N	Y[3]	Large snags	>1 snag/ac > 12in DBH (except ponderosa pine > 18in DBH); canopy cover 25-70%	Early Successional with Structural Legacies, Stand Establishment with Structural Legacies, or Young Low Density with Structural Legacies
Legacy Features	Birds: Landbird Focal Species	Winter Wren	-	N	Y[1]	Forest floor complexity	≥ 2 blocks > 75ac (or one block > 150ac) per square mile that is: > 60yrs old; avg. 4 logs/acre > 24in diameter in decay class 3-5; shrub cover > 60%; avg. DBH 16in	Young with Structural Legacies, Mature, or Structurally Complex
Mature/Structurally Complex Forest	Birds: Landbird Focal Species	Brown Creeper	-	N	Y[1]	Large trees	≥ 3 blocks > 75ac (or one block > 210ac) per square mile that is: > 60yrs old; ≥ 6 tpa > 20in DBH; ≥ 1.2 tpa > 24in DBH	Mature or Structurally Complex
Mature/Structurally Complex Forest	Birds: Landbird Focal Species	Brown Creeper	-	N	Y[3]	Large trees	>4 tpa > 18in DBH with at least 2 trees > 24in DBH; patches > 75ac	Mature or Structurally Complex
Mature/Structurally Complex Forest	Birds: Landbird Focal Species	Hermit Thrush	-	N	Y[3]	Multi-layered, dense canopy	Patches of forest with multi-layered structure and a dense understory shrub layer	Mature Multi-layered Canopy or Structurally Complex
Mature/Structurally Complex Forest	Birds: Landbird Focal Species	Pacific-slope Flycatcher	-	N	Y[1]	Deciduous canopy trees	Within landscapes > 2,500ac maintain 90% as late-successional coniferous forest intermingled with patches (2-10% of area) where deciduous canopy cover > 20% (particularly in wet or riparian zones)	Mature or Structurally Complex
Mature/Structurally Complex Forest	Birds: Landbird Focal Species	Pileated Woodpecker	-	N	Y[1]	Large snags	> 40% watershed is nesting habitat (forest > 60yrs old with ≥ 0.7 snags per acre > 32in DBH)	Mature Multi-layered Canopy or Structurally Complex
Mature/Structurally Complex Forest	Birds: Landbird Focal Species	Pygmy Nuthatch	-	N	Y[3]	Large trees	>10 tpa > 21in DBH and > 2tpa 31in DBH; > 1.4 snags/ac > 8in DBH and >50% > 25in DBH	Mature Multi-layered Canopy or Structurally Complex

Analytical Group*	Taxonomic Group	Species	SSSp Status **	S&M (Y/N)	Landbird Focal Species (Y/N)	Habitat Attribute	Landscape Habitat Target	Structural Stage(s) for Habitat Analysis
Mature/Structurally Complex Forest	Birds: Landbird Focal Species	Varied Thrush	-	N	Y[1]	Mid-story canopy trees	≥ 3 blocks > 75ac (or one block > 210ac) per square mile that is: > 60yrs old; multiple tree layers and species; berry-producing species; > 70% canopy closure; > 30% deciduous cover	Mature Multi-layered Canopy or Structurally Complex
Mature/Structurally Complex Forest	Insects: Terrestrial	Johnson's Hairstreak	BS	N	N	Variety of Flowering Plants	Provide an array of flowering plant food/host species	Mature or Structurally Complex
Mature/Structurally Complex Forest	Red Tree Vole	Red Tree Vole	-	Y	N	Mature/Old-growth Douglas-fir forest	Northern Mesic or Xeric Zones: mature or old-growth conifer forest with stand QMD ≥ 16 in. Mesic Zone: mature or old-growth conifer forest with stand QMD ≥ 18 in.	Mature or Structurally Complex
Young/Mature Forest	Birds: Landbird Focal Species	Hammond's Flycatcher	-	N	Y[1]	Open mid-story	Within landscapes > 2,500ac maintain unfragmented coniferous forest (80-90% of area > 80% canopy cover, 10-20% in early-successional habitat, and < 1% in deciduous forest in drier upland habitats)	Young High Density or Mature
Young/Mature Forest	Birds: Landbird Focal Species	Hermit Thrush	-	N	Y[1]	Shrub-herbaceous interspersion	Within 2,500ac blocks provide: > 90% forest cover ≥ 20 ac patch size; > 80% forest cover ≥ 64 ac patch size; > 70% forest cover ≥ 163 ac patch size; > 60% forest cover ≥ 385 ac patch size; > 50% forest cover ≥ 873 ac patch size	Young High Density or Mature within the Klamath Province
Young/Mature Forest	Birds: Landbird Focal Species	Hermit Warbler Townsend's Warbler	-	N	Y[1]	Closed canopy	> 55% watershed is nesting habitat (forest > 40yrs old; avg. DBH > 12in; > 90% canopy closure) and > 25% watershed is young forest (20-50yrs old)	Young High Density or Mature

Analytical Group*	Taxonomic Group	Species	SSSp Status **	S&M (Y/N)	Landbird Focal Species (Y/N)	Habitat Attribute	Landscape Habitat Target	Structural Stage(s) for Habitat Analysis
Young/Mature Forest	Birds: Landbird Focal Species	Purple Finch	-	N	Y[1]	Pine-oak canopy/subcanopy trees	> 60% canopy/subcanopy closure especially where pine and oak are present; > 25% canopy cover of pine and oak trees	Young High Density, Mature Multi-layered Canopy, or Structurally Complex within the Klamath Province
Young/Mature Forest	Birds: Landbird Focal Species	Wilson's Warbler	-	N	Y[1]	Deciduous understory	Within landscapes > 2,500ac maintain complex heterogeneity (> 60% area contiguous deciduous or mixed conifer-deciduous forest and > 4% area early successional forest in corridors or complex shapes)	Young or Mature
Young/Mature Forest	Great Gray Owl	Great Gray Owl	-	Y	N	Natural Meadows near Nesting Structure	Western Cascades, Willamette Valley Provinces: nest trees ≥ 38in dbh < 650 feet from natural meadows or openings ≥ 10 acres in size Eastern Cascades, Klamath, Coast Range Provinces: nest trees ≥ 23in dbh < 650 feet from natural meadows or openings ≥ 10 acres in size	Young High Density with Structural Legacies, Mature, or Structurally Complex that is < 650 feet from natural meadows or openings ≥ 10 acres in size

*Species are categorized into broad Analytical Groups for organizational purposes. Additional details about which structural stage(s) will be modeled as habitat for the species is provided in Structural Stage(s) for Habitat Analysis.

**SSSp Status (Special Status Species status):
BS = Bureau Sensitive
BStr = Bureau Strategic
FP = Federal Proposed (also Bureau Sensitive)
FC = Federal Candidate (also Bureau Sensitive)

1 = Habitat Conservation for Landbirds in the Coniferous Forests of Western Oregon and Washington, Version 2 (Altman and Alexander, 2012; pgs. iv, 29-56).
2 = Conservation Strategy for Landbirds in Lowlands and Valleys of Western Oregon and Washington, Version 1.0 (Altman, 2000a; pgs. 133-138).
3 = Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington, Version 1.0 (Altman, 2000b; pgs. 118-121).

TABLE 43. BUREAU SENSITIVE, BUREAU STRATEGIC, SURVEY & MANAGE WILDLIFE, SPECIES AND LANDBIRD FOCAL SPECIES ASSOCIATED WITH SPECIAL HABITATS OR UNKNOWN HABITAT ASSOCIATIONS THAT DO NOT HAVE DEFINED STRUCTURAL STAGES FOR ANALYSIS

Analytical Group*	Taxonomic Group	Species	SSSp Status **	S&M (Y/N)	Landbird Focal Species (Y/N)	Habitat Attribute	Landscape Habitat Target	Structural Stage(s) for Habitat Analysis
Special Habitat: Caves/Mines	Bats	Townsend's Big-eared Bat	BS	N	N	Caves and mine adits	Caves and abandoned mine adits	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Cliffs	Peregrine Falcon	Peregrine Falcon	BS	N	N	Cliffs	Maintain areas near cliffs for nesting habitat	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Grassland/Meadow	Birds: Landbird Focal Species	American Pipit	-	N	Y[1]	Alpine grasslands	Restrict domestic grazing from alpine grasslands < 25ac in size an limit timing or area of domestic grazing in alpine grasslands > 25ac in size	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Grassland/Meadow	Birds: Landbird Focal Species	Burrowing Owl	-	N	Y[2]	Burrows	> 40% ground cover; < 40% grass cover	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Grassland/Meadow	Birds: Landbird Focal Species	Northern Harrier	-	N	Y[2]	Wet prairie/grassland	Adjacency of wetlands (within 400ft) to prairie/grassland habitat	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Grassland/Meadow	Insects: Terrestrial	American Grass Bug	BStr	N	N	Wet native grasslands	Wet native grasslands	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Grassland/Meadow	Insects: Terrestrial	*Bombus franklini* (Franklin's Bumblebee)	BS	N	N	Variety of flowering plants; grassland	Abundant flowering plants and requires clumps of grass or rodent burrows for nesting; may need undisturbed grassland	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Grassland/Meadow	Insects: Terrestrial	*Bombus occidentalis* (Western Bumblebee)	BS	N	N	Variety of flowering plants	Generalist pollinator; uses rodent burrows or bird nests to overwinter; threats to habitat include urbanization, agriculture, and grazing	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Grassland/Meadow	Insects: Terrestrial	Coronis Fritilary	BS	N	N	*Viola spp.* flowering plants	Provide an array of flowering plant food/host species (*Viola spp.*)	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Grassland/Meadow	Insects: Terrestrial	*Derephysia foliacea* (Foliaceous Lace Bug)	BStr	N	N	Meadows	Mountain meadows or grassy balds; 3,937-4,921 ft. elevation in Oregon	*No defined structural stage available for analysis that will differ among alternatives*

Analytical Group*	Taxonomic Group	Species	SSSp Status **	S&M (Y/N)	Landbird Focal Species (Y/N)	Habitat Attribute	Landscape Habitat Target	Structural Stage(s) for Habitat Analysis
Special Habitat: Grassland/Meadow	Insects: Terrestrial	Gray Blue Butterfly	BS	N	N	Sub-Alpine wet meadows	High elevation (5,100-6,500ft) wet, montane meadows; *Dodecatheon alpinum* or *D. jeffreyi*as larval host plant species	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Grassland/Meadow	Insects: Terrestrial	*Polites mardon* (Mardon Skipper)	FC	N	N	Grassland or meadows	Grassland or meadows with large graminoid species for host plants (*Danthonia unispicata, Festuca idahoensis* and *Poa pratensis*)	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Grassland/Meadow	Insects: Terrestrial	*Polites Sonora siris* (Dog Star Skipper)	BStr	N	N	Grassland or meadow	Associated with native prairies, grasslands, and alpine meadows; woodland edges, stream banks and springs	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Grassland/Meadow	Insects: Terrestrial	*Vanuzeeina borealis californica* (California Shield-backed Bug)	BS	N	N	Grassland or Meadows	Associated with tall grass prairies; natural balds or meadows	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Grassland/Meadow	Mollusks: Terrestrial	*Vespericula sp. nov.* (Bald Hesperian)	BStr	N	N	Native prairie and wetlands	Associated with native prairies/wetland habitat	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Grassland/Meadow	Pygmy Rabbit	Pygmy Rabbit	BS	N	N	Sagebrush	Maintain sagebrush vegetation	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Grassland/Meadow	White-tailed Kite	White-tailed Kite	BS	N	N	Wetlands, grasslands, or agricultural fields	Maintain herbaceous wetlands	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Grassland/Meadows	Insects: Terrestrial	*Acalypta lillianis* (Lillian's Lace Bug)	BStr	N	N	Boreal meadows	Cold, dry, rocky ridges and boreal meadows at high elevation (e.g., 4,921ft) where moss occurs	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Maritime/Coastal	Birds: Aquatic	Franklin's Gull	BS	N	N	Wetlands, estuarine, or riparian	Maintain clean water	*No defined structural stage available for analysis that will differ among alternatives*

Analytical Group*	Taxonomic Group	Species	SSSp Status **	S&M (Y/N)	Landbird Focal Species (Y/N)	Habitat Attribute	Landscape Habitat Target	Structural Stage(s) for Habitat Analysis
Special Habitat: Maritime/Coastal	Birds: Aquatic	Rhinoceros Auklet	BStr	N	N	Wetlands, estuarine, or riparian	Maintain clean water	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Maritime/Coastal	Birds: Aquatic	Tufted Puffin	BS	N	N	Wetlands, estuarine, or riparian	Maintain clean water	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Maritime/Coastal	Insects: Terrestrial	*Callophrys polios maritima* (Hoary Elfin)	BS	N	N	Coastal sand dunes	Coastal sand dunes where kinnickinnick (larval host plant) is abundant	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Maritime/Coastal	Insects: Terrestrial	*Cicindela hirticollis siuslawensis* (Siuslaw Sand Tiger Beetle)	BS	N	N	Coastal sand dunes	Sandy edge of river mouths on beaches of the Pacific Ocean	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Maritime/Coastal	Insects: Terrestrial	*Lygus oregonae* (Oregon Plant Bug)	BS	N	N	Coastal sand dunes	Coastal sand dunes with either of the two known host plants (*Abronia latifolia* or *Ambrosia chamissonis*)	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Maritime/Coastal	Insects: Terrestrial	*Plebejus saepiolus littoralis* (Insular Blue Butterfly)	BS	N	N	Coastal sand dunes	Coastal sand dunes where clover-related plants (larval host plant) are abundant	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Maritime/Coastal	Insects: Terrestrial	*Saldula villosa* (Hairy Shore Bug)	BS	N	N	Salt marsh	Salt marshes; may be inundated by high tide	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Amphibians: Stream	Cope's Giant Salamander	BS	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Amphibians: Stream	Foothill Yellow-legged Frog	BS	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Birds: Aquatic	Aleutian Canada Goose	BS	N	N	Wetlands, estuarine, or riparian	Maintain clean water	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Birds: Aquatic	American White Pelican	BS	N	N	Wetlands, estuarine, or riparian	Maintain clean water	*No defined structural stage available for analysis that will differ among alternatives*

Analytical Group*	Taxonomic Group	Species	SSSp Status **	S&M (Y/N)	Landbird Focal Species (Y/N)	Habitat Attribute	Landscape Habitat Target	Structural Stage(s) for Habitat Analysis
Special Habitat: Riparian Areas	Birds: Aquatic	Bufflehead	BS	N	N	Wetlands, estuarine, or riparian	Maintain clean water	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Birds: Aquatic	California Brown Pelican	BS	N	N	Wetlands, estuarine, or riparian	Maintain clean water	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Birds: Aquatic	Canadian Sandhill Crane	BStr	N	N	Wetlands, estuarine, or riparian	Maintain clean water	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Birds: Aquatic	Dusky Canada Goose	BS	N	N	Wetlands, estuarine, or riparian	Maintain clean water	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Birds: Aquatic	Harlequin Duck	BS	N	N	Wetlands, estuarine, or riparian	Maintain clean water	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Birds: Aquatic	Horned Grebe	BS	N	N	Wetlands, estuarine, or riparian	Maintain clean water	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Birds: Aquatic	Red-necked Grebe	BS	N	N	Wetlands, estuarine, or riparian	Maintain clean water	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Birds: Aquatic	Snowy Egret	BS	N	N	Wetlands, estuarine, or riparian	Maintain clean water	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Birds: Aquatic	Trumpeter Swan	BS	N	N	Wetlands, estuarine, or riparian	Maintain clean water	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Birds: Aquatic	Tule White-fronted Goose	BS	N	N	Wetlands, estuarine, or riparian	Maintain clean water	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Birds: Aquatic	Western Least Bittern	BStr	N	N	Wetlands, estuarine, or riparian	Maintain clean water	*No defined structural stage available for analysis that will differ among alternatives*

Analytical Group*	Taxonomic Group	Species	SSSp Status **	S&M (Y/N)	Landbird Focal Species (Y/N)	Habitat Attribute	Landscape Habitat Target	Structural Stage(s) for Habitat Analysis
Special Habitat: Riparian Areas	Birds: Aquatic	Yellow Rail	BS	N	N	Wetlands, estuarine, or riparian	Maintain clean water	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Birds: Landbird Focal Species	Band-tailed Pigeon	-	N	Y[1]	Mineral springs/seeps	Maintain 5 acre no-harvest buffer around all mineral springs/seeps	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Birds: Landbird Focal Species	Black Swift	BS	N	Y[1]	Waterfalls	Maintain 0.17 mile no-harvest buffer around known nesting waterfalls	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Birds: Landbird Focal Species	Lincoln's Sparrow	-	N	Y[1]	Montane wet meadows	Maintain 0.17 mile no-harvest buffer around montane wet meadows	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Insects: Aquatic	Caddisfly (*Lepania cascada*)	BStr	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Insects: Aquatic	Caddisfly (*Moselyana comosa*)	BStr	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Insects: Aquatic	Caddisfly (*Namamyia plutonis*)	BS	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Insects: Aquatic	Caddisfly (*Rhyacophila chandleri*)	BS	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Insects: Aquatic	Caddisfly (*Rhyacophilia leechi*)	BS	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Insects: Aquatic	Denning's Agapetus Caddisfly	BStr	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Insects: Aquatic	Green Springs Mountain Farulan Caddisfly	BStr	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Insects: Aquatic	Haddock's Rhyacophillan Caddisfly	BS	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*

Analytical Group*	Taxonomic Group	Species	SSSp Status **	S&M (Y/N)	Landbird Focal Species (Y/N)	Habitat Attribute	Landscape Habitat Target	Structural Stage(s) for Habitat Analysis
Special Habitat: Riparian Areas	Insects: Aquatic	Martin's Water-Measurer	BStr	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Insects: Aquatic	Mulsant's Water Treader	BStr	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Insects: Aquatic	O'Brien Rhyacophilan Caddisfly	BStr	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Insects: Aquatic	One-Spot Rhyacophilan Caddisfly	BStr	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Insects: Aquatic	Schuh's Homoplectran Caddisfly	BStr	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Insects: Aquatic	Scott's Apatanian Caddisfly	BS	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Insects: Aquatic	Tombstone Prarie Caddisfly	BStr	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Insects: Terrestrial	*Acupalpus punctulatus* (Marsh Ground Beetle)	BStr	N	N	Wetlands	Seasonal wetlands, temporary ponds, and valley-bottom wetlands; perhaps associated with tufted hairgrass (*Deschampsia caespitosa*)	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Insects: Terrestrial	*Ochlodes Yuma* (Yuma Skipper)	BS	N	N	Wetlands	Reed beds in and around freshwater marshes, streams, ponds, seeps, sloughs, springs, and canals	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Flumincola* n. sp. 1	-	Y	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Flumincola* n. sp. 11	-	Y	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Flumincola* n. sp. 14	-	Y	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Flumincola* n. sp. 15	-	Y	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*

Analytical Group*	Taxonomic Group	Species	SSSp Status **	S&M (Y/N)	Landbird Focal Species (Y/N)	Habitat Attribute	Landscape Habitat Target	Structural Stage(s) for Habitat Analysis
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Flumincola* n. sp. 16	-	Y	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Flumincola* n. sp. 17	-	Y	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Flumincola* n. sp. 18	-	Y	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Flumincola* n. sp. 19	-	Y	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Flumincola* n. sp. 2	-	Y	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Flumincola* n. sp. 20	-	Y	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Flumincola* n. sp. 3	-	Y	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Flumincolaseminalis*	-	Y	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Flumincola sp. nov.* (Casebeer)	BStr	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Flumincola sp. nov.* (Dimunitive)	BStr	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Flumincola sp. nov.* (Fall Creek)	BStr	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Flumincola sp. nov.* (Fredenburg)	BStr	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Flumincola sp. nov.* (Keene Creek)	BStr	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Flumincola sp. nov.* (Klamath Rim)	BStr	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Flumincola sp. nov.* (Klamath)	BStr	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*

Analytical Group*	Taxonomic Group	Species	SSSp Status **	S&M (Y/N)	Landbird Focal Species (Y/N)	Habitat Attribute	Landscape Habitat Target	Structural Stage(s) for Habitat Analysis
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Flumincola sp. nov.* (Toothed)	BStr	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Helisoma newbwerryi* (Great Basin Rams-horn)	BS	N	N	Large lakes and rivers	Large lakes and slow rivers, including large springs and spring-fed creeks	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Highcap Lanx*	BS	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Juga* (O) n. sp. 2	-	Y	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Juga* (O) n. sp. 3	-	Y	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Lined Ramshorn*	BS	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Lyogyrus* n. sp. 1	-	Y	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Lyogyrus* n. sp. 2	-	Y	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Lyogyrus* n. sp. 3	-	Y	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Lyogyrus sp. nov.* (Columbia)	BStr	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Montane Peaclam*	BS	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Necomb's Littorne Snail*	BS	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Pacific Walker*	BS	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Pomatiopsis chacei*	BStr	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Pristinicola hemphilli*	BStr	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*

Analytical Group*	Taxonomic Group	Species	SSSp Status **	S&M (Y/N)	Landbird Focal Species (Y/N)	Habitat Attribute	Landscape Habitat Target	Structural Stage(s) for Habitat Analysis
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Robust Walker*	BS	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Rotund Lanx*	BS	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Scale Lanx*	BS	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Vorticifex klamathensis sinitsini*	-	Y	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Vorticifex* n. sp.	-	Y	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Aquatic	*Western Ridgemussel*	BS	N	N	Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Terrestrial	Crater Lake Tightcoil *(Pristiloma articum crateris)*	BS	Y	N	Spring or seeps	Within 10m of perennially wet areas (springs, seeps, wetlands) in mature conifer forest	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Terrestrial	*Cryptomastix hendersoni* (Columbia Oregonian)	-	Y	N	Within 100m of riparian areas	Maintain cool, moist conditions within 100m of riparian areas	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Terrestrial	*Pristiloma wascoense* (Shiny Tightcoil)	BStr	N	N	Mixed coniferous-hardwood forest	Associated with moderate to high elevation ponderosa-pine or Douglas-fir forest; perhaps associated with riparian or rock outcrops	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Mollusks: Terrestrial	*Vespericula sierranus* (Siskiyou Hesperian)	BS	N	N	Mixed coniferous-hardwood forest	Associated with perennially moist areas; near springs or stream banks	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Riparian Areas	Reptiles	Pacific Pond Turtle	BS	N	N	Ponds, Reservoirs, or Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*

Analytical Group*	Taxonomic Group	Species	SSSp Status **	S&M (Y/N)	Landbird Focal Species (Y/N)	Habitat Attribute	Landscape Habitat Target	Structural Stage(s) for Habitat Analysis
Special Habitat: Riparian Areas	Reptiles	Painted Turtle	BS	N	N	Ponds, Reservoirs, or Streams	Maintain clean water and temperature regimes	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Subterranean	Fossorial	Gold Beach Pocket Gopher	BStr	N	N	Subterranean, loose soils	-	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Subterranean	Fossorial	Oregon Giant Earthworm	BStr	N	N	Subterranean, loose soils	Fine, clay soils that are well-drained within the Willamette Valley with deep hardwood/conifer litter accumulations	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Subterranean	Fossorial	Pistol River Pocket Gopher	BStr	N	N	Subterranean, loose soils	-	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Talus Deposits	Amphibians: Terrestrial	Del Norte Salamander	-	Y	N	Talus Slopes	9.4-11.8% down wood cover for various salamander species	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Talus Deposits	Amphibians: Terrestrial	Shasta Salamander	-	Y	N	Talus Slopes	9.4-11.8% down wood cover for various salamander species	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Talus Deposits	Amphibians: Terrestrial	Siskiyou Mountains Salamander	BS	Y	N	Talus Slopes	9.4-11.8% down wood cover for various salamander species	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Talus Deposits	Mollusks: Terrestrial	*Monadenia chaceana* (Chace Sideband)	BS	Y	N	Rocky areas, talus deposits, or large woody debris	Rocky areas or talus in the Klamath Province; conifer forest with large woody debris in the Cascades Province Maintain cool, moist conditions and undisturbed talus	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Talus Deposits	Mollusks: Terrestrial	*Monadenia fidelis celeuthia* (Travelling Sideband)	BS	N	N	Associated with dry, open (pine) forest with rock/talus features	Maintain undisturbed talus deposits and avoid grazing within known sites	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Talus Deposits	Mollusks: Terrestrial	*Monadenia fidelis minor* (Dalles Sideband)	-	Y	N	Talus deposits within 200m of streams, springs, or seeps	Talus deposits within 200 m of streams, springs, or seeps. Maintain cool, moist conditions and undisturbed talus	*No defined structural stage available for analysis that will differ among alternatives*

Analytical Group*	Taxonomic Group	Species	SSSp Status **	S&M (Y/N)	Landbird Focal Species (Y/N)	Habitat Attribute	Landscape Habitat Target	Structural Stage(s) for Habitat Analysis
Special Habitat: Talus Deposits	Mollusks: Terrestrial	*Monadenia fidelis ssp. nov.* (Modoc Rim Sideband)	BS	N	N	Rocky areas, talus deposits, or large woody debris	Maintain undisturbed talus deposits	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Talus Deposits	Mollusks: Terrestrial	Oregon Shoulderband *(Helminthoglypta hertleini)*	BS	Y	N	Rocky areas, talus slopes and outcrops	Maintain cool, moist conditions and undisturbed talus	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Talus Deposits	Mollusks: Terrestrial	*Trilobopsis tehamana* (Tehama Chaparral)	-	Y	N	Deciduous trees; occasionally talus deposits	Maintain cool, moist conditions and undisturbed talus deposits	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Woodland	Birds: Landbird Focal Species	American Kestrel Western Screech Owl	-	N	Y[2]	Large oaks with cavities	Oaks > 24in DBH with cavities; 10-30% tree canopy cover; < 30% shrub cover	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Woodland	Birds: Landbird Focal Species	Ash-throated Flycatcher	-	N	Y[3]	Large oaks with cavities	Oaks > 14in DBH	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Woodland	Birds: Landbird Focal Species	Flammulated Owl	-	N	Y[3]	Interspersed grassy openings and dense thickets	>10 snags/100 ac > 12in DBH and 6ft tall; > 8 tpa > 21in DBH; at least one dense brushy thicket and one grassy opening	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Woodland	Insects: Terrestrial	*Dendrocoris arizonensis* (Arizona Stink Bug)	BStr	N	N	Oak Woodlands	Associated with oaks and oak woodland habitat in Oregon	*No defined structural stage available for analysis that will differ among alternatives*
Special Habitat: Woodland	Insects: Terrestrial	*Macrotylus essigi* (Essig's Plant Bug)	BStr	N	N	Oak woodlands	Apparently associated with oak woodlands; host plant is *Rhamnus crocea*	*No defined structural stage available for analysis that will differ among alternatives*
Unknown	Insects: Terrestrial	*Acalypta cooleyi* (Cooley's Lace Bug)	BStr	N	N	Unknown	Unknown	Unknown

Analytical Group*	Taxonomic Group	Species	SSSp Status **	S&M (Y/N)	Landbird Focal Species (Y/N)	Habitat Attribute	Landscape Habitat Target	Structural Stage(s) for Habitat Analysis
Unknown	Insects: Terrestrial	*Atrazonotus umbrosus* (Umbrose Plant Bug)	BStr	N	N	Unknown	Unknown	Unknown
Unknown	Insects: Terrestrial	*Boreostolus americanus* (American Unique-Headed Bug)	BStr	N	N	Unknown	Unknown	Unknown
Unknown	Insects: Terrestrial	*Criocoris saliens* (Salien Plant Bug)	BStr	N	N	Unknown	Unknown	Unknown
Unknown	Insects: Terrestrial	*Hoplistoscelis heidemanni* (Heidemann's Damsel Bug)	BStr	N	N	Unknown	Unknown	Unknown
Unknown	Insects: Terrestrial	*Nabicula propinqua* (Marsh Damsel Bug)	BStr	N	N	Unknown	Unknown	Unknown
Unknown	Insects: Terrestrial	*Pinalitus solivagus* (True Fir Plant Bug)	BStr	N	N	Unknown	Unknown	Unknown
Unknown	Insects: Terrestrial	*Platylygus pseudotsugae* (Douglas-fir Plan Bug)	BStr	N	N	Unknown	Unknown	Unknown
Unknown	Mollusks: Terrestrial	*Deroceras hesperium* (Evening Fieldslug)	-	Y	N	Unknown	Unknown	Unknown
Unknown	Mollusks: Terrestrial	*Hochbergellus hirsutus* (Sisters Hesperian)	BStr	N	N	Unknown	Unknown	Unknown

Analytical Group*	Taxonomic Group	Species	SSSp Status **	S&M (Y/N)	Landbird Focal Species (Y/N)	Habitat Attribute	Landscape Habitat Target	Structural Stage(s) for Habitat Analysis
Unknown	Mollusks: Terrestrial	*Monadenia fidelis columbiana* (Columbia Sideband)	BStr	N	N	Unknown	Unknown	Unknown

*Species are categorized into broad Analytical Groups for organizational purposes. Additional details about which structural stage(s) will be modeled as habitat for the species is provided in Structural Stage(s) for Habitat Analysis.

**SSSp Status (Special Status Species status):
BS = Bureau Sensitive
BStr = Bureau Strategic
FP = Federal Proposed (also Bureau Sensitive)
FC = Federal Candidate (also Bureau Sensitive)

1 = Habitat Conservation for Landbirds in the Coniferous Forests of Western Oregon and Washington, Version 2 (Altman and Alexander, 2012; pgs. iv, 29-56).
2 = Conservation Strategy for Landbirds in Lowlands and Valleys of Western Oregon and Washington, Version 1.0 (Altman, 2000a; pgs. 133-138).
3 = Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington, Version 1.0 (Altman, 2000b; pgs. 118-121).

TABLE 44. BUREAU SENSITIVE, BUREAU STRATEGIC, SURVEY & MANAGE WILDLIFE, SPECIES AND LANDBIRD FOCAL SPECIES THAT ARE ADDRESSED ELSEWHERE IN THE ANALYSIS

Analytical Group*	Taxonomic Group	Species	SSSp Status **	S&M (Y/N)	Landbird Focal Species (Y/N)	Habitat Attribute	Landscape Habitat Target	Structural Stage(s) for Habitat Analysis
Addressed Elsewhere in Analysis	Amphibians: Terrestrial	Oregon Spotted Frog	FC	N	N	-	-	Considered under Species Not Analyzed in Detail
Addressed Elsewhere in Analysis	Bald Eagle	Bald Eagle	BS	N	N	-	-	Analyzed individually
Addressed Elsewhere in Analysis	Birds: Upland	Merlin	BStr	N	N	-	-	Habitat analysis provided for under Landbird Focal Species analysis.
Addressed Elsewhere in Analysis	Birds: Upland	Purple Martin	BS	N	N	-	-	Habitat analysis provided for under Landbird Focal Species analysis.
Addressed Elsewhere in Analysis	Birds: Upland	Tricolored Blackbird	BS	N	N	-	-	Habitat analysis provided for under Landbird Focal Species analysis.
Addressed Elsewhere in Analysis	Columbian White-tailed Deer	Columbian White-tailed Deer	FE	N	N	-	-	Considered under Species Not Analyzed in Detail
Addressed Elsewhere in Analysis	North Oregon Coast DPS of the Red Tree Vole	North Oregon Coast DPS of the Red Tree Vole	FC	Y	N	-	-	Analyzed individually
Addressed Elsewhere in Analysis	Fisher	Fisher	FC	N	N	-	-	Analyzed individually
Addressed Elsewhere in Analysis	Greater Sage-grouse	Greater Sage-grouse	FC	N	N	-	-	Considered under Species Not Analyzed in Detail
Addressed Elsewhere in Analysis	Sea Otter	Sea Otter	BStr	N	N	-	-	Consider under Species Not Analyzed in Detail

Analytical Group*	Taxonomic Group	Species	SSSp Status **	S&M (Y/N)	Landbird Focal Species (Y/N)	Habitat Attribute	Landscape Habitat Target	Structural Stage(s) for Habitat Analysis
Addressed Elsewhere in Analysis	Taylor's Checkerspot Butterfly	Taylor's Checkerspot Butterfly	FP	N	N	-	-	Consider under Species Not Analyzed in Detail
Addressed Elsewhere in Analysis	Wolverine	Wolverine	FP	N	N	-	-	Consider under Species Not Analyzed in Detail

*Species are categorized into broad Analytical Groups for organizational purposes. Additional details about which structural stage(s) will be modeled as habitat for the species is provided in Structural Stage(s) for Habitat Analysis. The species in this table will be modeled and analyzed individually, considered but not analyzed in detail, or another portion of the analysis will meet the analytical needs for the species (e.g., landbird focal species analysis).

**SSSp Status (Special Status Species status):
BS = Bureau Sensitive
BStr = Bureau Strategic
FP = Federal Proposed (also Bureau Sensitive)
FC = Federal Candidate (also Bureau Sensitive)

Glossary

Allowable Sale Quantity - The gross amount of timber volume, including salvage, which may be sold annually from a specified area over a stated period in accordance with the resource management plan.

Anadromous fish - Fish that are born and reared in freshwater, move to the ocean to grow and mature, and return to freshwater to reproduce.

Animal Unit Month (AUM) - The amount of forage necessary for the sustenance of one cow or its equivalent for 1 month.

Aquatic habitat - Habitat that occurs in free water.

Area of Critical Environmental Concern (ACEC) - Lands where special management attention is needed to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish, and wildlife resources or other natural systems or processes or to protect life and provide safety from natural hazards.

Beneficial use - In water use law, reasonable use of water for a purpose consistent with the laws and best interest of the people of the state. Such uses include, but are not limited to, the following: instream, out of stream, and ground water uses, domestic, municipal, industrial water supply, mining, irrigation, livestock watering, fish and aquatic life, wildlife, fishing, water contact recreation, aesthetics and scenic attraction, hydropower, and commercial navigation.

Best Management Practices (BMPs) - Methods, measures, or practices designed to prevent or reduce water pollution. Usually, BMPs are applied as a system of practices rather than a single practice.

Bioclimatic envelope - the range of climatic conditions in which a species can survive and reproduce.

Biological Opinion (ESA) -The document resulting from formal consultation that states the opinion of the U.S. Fish and Wildlife Service or National Marine Fisheries Service as to whether or not a federal action is likely to jeopardize the continued existence of listed species or results in destruction or adverse modification of critical habitat.

Biomass - A renewable source of energy derived from plant materials.

Board foot (BF) - Lumber or timber measurement term. The amount of wood contained in an unfinished board 1 inch thick, 12 inches long, and 12 inches wide.

Breeding, nesting, roosting, foraging habitat - The vegetation with the age class, species composition, structure, sufficient area, and adequate food source to meet some or all of the life needs of specific species.

Bureau Sensitive Species - Plant or animals species eligible for federal listed, federal candidate, state listed, or state candidate (plant) status, or on list 1 in the Oregon Natural Heritage Data Base, or approved for this category by the BLM State Director. Species included under agency species conservation policies.

Canopy cover - A measure of the percentage of ground covered by a vertical projection of the tree canopy.

Canopy closure - The proportion of the sky hemisphere obscured by vegetation when viewed by a single point.

Checkerboard ownership - A land ownership pattern in which every other section (square mile) is in federal ownership because of federal land grants to early western railroad companies.

Closed canopy - The degree to which the canopy (forest layers above one's head) blocks sunlight or obscures the sky. It can only be accurately determined from measurements taken under the canopy to account for openings in the branches and crowns.

Coarse woody debris/downed woody debris - Portion of a tree that has fallen or been cut and left in the woods. Usually refers to pieces at least 20 inches in diameter.

Commercial thinning - Removal of generally merchantable trees from an even-aged stand, usually to encourage growth of the remaining trees.

Conservation Strategy - A management plan for a species, group of species, or ecosystem that prescribes standards and guidelines that if implemented provide a high likelihood that the species, groups of species, or ecosystem, with its full complement of species and processes, will continue to exist well-distributed throughout a planning area.

Consultation - A formal interaction between the U.S. Fish and Wildlife Service and another federal agency when it is determined that the agency's action may affect a species that has been listed as threatened or endangered or its critical habitat.

Convection - Transfer of heat by the automatic circulation of fluids.

Coos Bay Wagon Road (CBWR) Lands - Public lands granted to the Southern Oregon Company and subsequently reconveyed to the United States.

Critical Habitat - Under the Endangered Species Act, critical habitat is defined as: (1) the specific areas within the geographic area occupied by a federally listed species on which are found physical and biological features essential to the conservation of the species, and that may require special management considerations or protection; and (2) specific areas outside the geographic area occupied by a listed species, when it is determined that such areas are essential for the conservation of the species.

Crown - Upper part of a tree or other woody plant that carries the main system of branches and the foliage.

Cubic foot - A unit of solid wood, one foot square and one foot thick.

Cumulative effect - The impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time.

Debris flow - A rapid moving mass of rock fragments, soil, and mud, with more than half of the particles being larger than sand size.

Decision area - The lands within the planning area of this RMP revisions for which the BLM has authority to make land use and management decisions. In general, the BLM has jurisdiction over all BLM-administered lands (surface and subsurface) and over subsurface minerals in areas of split estate (i.e., areas where the BLM administers federal subsurface minerals, but the surface is not owned by the BLM).

Density management - The cutting of trees for the primary purpose of widening their spacing so that growth of remaining trees can be accelerated. Density management may be designed to improve forest health, to open the forest canopy, or to accelerate the attainment of late-successional forest structural characteristics.

Detrimental soil disturbance - The limit where the innate soil properties change and the inherent capacity to sustain growth of vegetation is reduced. Detrimental soil disturbance generally represents unacceptable levels of erosion, loss of organic matter, soil compaction, or soil displacement.

Dispersal habitat (northern spotted owl) - Forest stands with average tree diameters of greater than 11 inches, and conifer overstory trees having closed canopies (greater than 40 percent canopy closure) with open space beneath the canopy to allow owls to fly.

Disturbance (natural) - A force that causes significant change in structure and/or composition through natural events such as fire, flood, wind, or earthquake, mortality caused by insect or disease outbreaks, or by human-caused events such as the harvest of forest products.

Endangered species - Any species of plant or animal defined through the Endangered Species Act as being in danger of extinction throughout all or a significant portion of its range, and published in the Federal Register.

Fire hazard - A fuel complex, defined by volume, type condition, arrangement, and location, that determines the degree of ease of ignition and of resistance to control.

Fire resilient forest - A forest having characteristics that limit fire severity and increase the resistance of the forest to mortality.

Fifth-field watershed - Individual watershed within a Hydrologic Unit as defined by the U.S. Geological Survey; it typically averages 87,000 acres in size.

Floodplain - Level lowland bordering a stream or river onto which the flow spreads at flood stage.

Forage - All browse and herbaceous foods available to grazing animals, including wildlife and domestic livestock.

Forest canopy - The more or less continuous cover of branches and foliage formed collectively by crowns of adjacent trees and other woody growth.

Forest Operations Inventory (FOI) - An intensive inventory that provides managers with information regarding age, species, stand location, size, silvicultural needs, and recommended treatment based on individual stand conditions and productivity.

Gradient Nearest Neighbor - A method to characterize forest vegetation across a region that integrates vegetation measurements from regional networks of field plots, mapped environmental data, and Landsat TM data. The method applies direct gradient analysis (canonical correspondence analysis) and nearest-neighbor imputation to ascribe detailed ground attributes of vegetation to each patch in a regional landscape.

Gravel interstitial space - The pockets between pieces of gravel.

Ground-based harvest system - Harvesting timber using mechanical equipment that moves along the ground.

Growth and yield modeling - Estimates of timber volumes expected to be produced under a certain set of conditions.

Harvest land base - Those lands on which the determination and declaration of the Annual Productive Capacity / Allowable Sale Quantity (ASQ) is based. The ASQ is based on implementing a set of programmed timber management activities that assumes those practices will be repeated over time and results in a sustainable harvest level.

Helicopter logging - Use of helicopters to transport logs from where they are felled to a landing.

Herbaceous vegetation - Seed-producing annual, biennial, or perennial vegetation that does not develop persistent woody tissue, but dies down at the end of a growing season.

Intermittent stream - A stream that flows most of the time, but occasionally is dry or reduced to pools.

Intrinsic potential (stream) - A stream's inherent ability to provide high quality habitat for salmonids.

Invasive species – A non-native species whose introduction does, or is likely to, cause economic or environmental harm or harm to human health.

Key Watershed - A land use allocation used in the Northwest Forest Plan. A watershed containing: (1) habitat for potentially threatened species or stocks of anadromous salmonids or other potentially threatened fish, or (2) greater than 6 square miles with high-quality water and fish habitat.

Ladder fuel - Material on or near the ground that will carry fire to the crown of a tree.

Landscape - A heterogeneous land area with interacting ecosystems that are repeated in similar form throughout.

Land use allocation - Uses that are allowed, restricted, or prohibited for a particular area of land. A type of decision in a land use plan.

Leasable minerals - Minerals generally found in bedded deposits and include oil, gas, coal, chlorides, sulfates, carbonates, borates, silicates, and nitrates of potassium (potash) or sodium and related products; sulfur; phosphate and its associated and related minerals; asphalt; and gilsonite.

Locatable minerals - Metallic minerals (gold, silver, lead, copper, zinc, nickel, etc.) and nonmetallic minerals (fluorspar, mica, certain limestone and gypsum, tantalum, heavy minerals in placer form and gemstones) in land belonging to the United States that are open to citizens of the United States for exploration, discovery, and location which conveys the exclusive right to extract the locatable minerals upon receiving all required authorizations in accordance with regulations at 43 CFR 3802 for lands in wilderness review and 3809 for other public lands.

Mass wasting - The downslope movement of earth materials caused by gravity. This all-inclusive term includes, but is not limited to, landslides, rock falls, debris avalanches, and creep. However, it does not include surface erosion by running water.

Monitoring - The review on a sample basis, of management practices to determine how well objectives are being met, as well as the effects of those management practices on the land and environment.

National Landscape Conservation System - Special Congressional or Presidential land use designations such as National Monuments, Wild and Scenic Rivers, and Wilderness Areas.

O&C lands - Public lands granted to the Oregon and California Railroad Company and subsequently revested to the United States.

Off-Highway Vehicle (OHV) - Any motorized track or wheeled vehicle designed for cross-country travel over any type of natural terrain.

Off-highway vehicle designation - Designation of lands made in a land use plan for use of off-highway vehicles:

- Open: All types of vehicle use is permitted at all times, anywhere in the area subject to certain operating regulations and vehicle standards.
- Limited: Restricted at certain times, in certain areas, and/or to certain vehicular use.
- Closed: Off-road vehicle use is prohibited.

Paleontological resource - Remnants of life from past geological ages as seen in fossil plants and animals.

Particulate matter (PM) - A complex mixture consisting of varying combinations of dry solid fragments, solid cores with liquid coatings, and small droplets of liquid, typically measured in micrometers (e.g., $PM_{2.5}$ – particular matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers).

Peak flow - The highest amount of stream or river flow occurring in a year, or from a single storm event.

Perennial stream - A stream that typically has running water on a year-round basis.

Physiographic province - A geographic area having a similar set of biophysical characteristics and processes due to effects of climate and geology, which result in patterns of soils and broad-scale plant communities. Habitat patterns, wildlife distributions, and historical land use patterns may differ significantly from those of adjacent provinces.

Planning area - All lands within the geographic boundary of this RMP revision regardless of jurisdiction.

Plant Association Group - A vegetation classification including five to ten closely related plant associations, or groupings of plants that occur together in similar environments, typically defined by their climates (temperature and moisture), soils, and history of natural disturbances, such as wildfires, diseases and insect outbreaks.

Pre-commercial thinning - An action taken in a nonmerchantable stand of immature trees to control density and growing space, so that growth is concentrated on potential crop trees.

Preferred Alternative - Term used in the Council on Environmental Quality's implementing regulations of the National Environmental Policy Act (NEPA) and BLM planning regulations. Guidance from the Council on Environmental Quality explains that the preferred alternative is the alternative that the agency believes would fulfill its statutory mission and responsibilities, considering economic, environmental, technical, and other factors.

Prescribed fire - A fire burning under specified conditions that will accomplish certain planned objectives. The fire may result from planned or unplanned ignitions.

Present net value - A traditional economic valuation method. Determines the present value in "today's dollars" of the future net cash flow of a project.

Public domain lands - Original holdings of the United States never granted or conveyed to other jurisdictions, or reacquired by exchange for other public domain lands.

Recovery plan - A plan for the conservation and survival of an endangered species or a threatened species listed under the Endangered Species Act, for improving the status of the species to the point where listing is no longer required.

Regeneration harvest - Timber harvest conducted with the partial objective of opening a forest stand to the point where favored tree species will be reestablished.

Relevant and Important Resource Value - Criteria used to evaluate nominated Areas of Critical Environmental Concern.

Resource Management Plan (RMP) - A land use plan as described by the Federal Land Policy and Management Act.

Right-of-Way - A permit or an easement that authorizes use of public lands for certain specified purposes, commonly for pipelines, roads, telephone lines, electric lines, reservoirs, and so on; also, the lands covered by such an easement or permit.

Riparian area - A geographic area containing an aquatic ecosystem and adjacent upland areas that directly affect it.

Rotation age - The age of a stand when harvested at the end of a rotation.

Saleable minerals - Minerals including but not limited to: petrified wood and common varieties of sand, stone, gravel, pumice, pumicite, cinder, clay, and rock.

Seral Stages - The series of relatively transitory plant communities that develop during ecological succession from bare ground to the climax stage.

Silvicultural practices (or treatments or system) - The set of field techniques and general methods used to modify and manage a forest stand over time to meet desires conditions and objectives.

Silvicultural prescription - A plan for controlling the establishment, composition, constitution, and growth of forests.

Site Class - A forest management term denoting site productivity and measured in productivity classes (example: Site Class I - highest productivity).

Skyline cable system - Harvesting timber using a machine that reaches out a long distance to lift logs off the ground and move them via a cable to a landing where they are hauled away.

Slash - The branches, bark, tops, cull logs, and broken or uprooted trees left on the ground after logging has been completed.

Slope stability - The resistance of a natural or artificial slope, or other inclined surface, to failure by landsliding (mass movement).

Snag - Any standing dead, partially-dead, or defective (cull) tree at least 10 inches in diameter at breast height and at least 6 feet tall. A hard snag is composed primarily of sound wood, generally merchantable. A soft snag is composed primarily of wood in advanced stages of decay and deterioration, generally not merchantable.

Soil compaction - An increase in bulk density (weight per unit volume) and a decrease in porosity (particularly macropores) resulting from applied loads, vibration or pressure.

Soil productivity - Capacity or suitability of a soil, for establishment and growth specified crop or plant species.

Soil quality - The capacity of a soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality and to support human health and habitation.

Special status species - Plant or animal species in any of the following categories:

- Threatened or endangered species
- Proposed threatened or endangered species
- Candidate species
- State-listed species
- Bureau sensitive species

Stand conversion - Converting one type of timbered stand to another type of timbered stand. Typically refers to converting hardwood stands to conifer stands.

State-Listed Species - Plant or animal species listed by the State of Oregon as threatened or endangered pursuant to ORS 496.004, ORS 498.026, or ORS 564.040.

Statewide Comprehensive Outdoor Recreation Plan (SCORP) - A plan that describes and analyzes the organization and function of the outdoor recreation system of the State. Prepared by the State, the plan provides an analysis of the roles and responsibilities of major outdoor recreation suppliers; an analysis of demand, supply, and needs; issue discussions; an action program to address the issues; and a project selection process.

Stream reach - An individual first order stream or a segment of another stream that has beginning and ending points at a stream confluence. Reach end points are normally designated where a tributary confluence changes the channel character or order. Although reaches identified by BLM are variable in length, they normally have a range of 0.5 mile to 1.5 miles in length unless channel character, confluence distribution, or management considerations dictate variance.

Stumpage price - The value of standing timber.

Sustained yield - The volume of timber that a forest can produce continuously (i.e., at a non-declining, even flow of timber volume) at a given intensity of management.

Timber production capability classification (TPCC) - The process of partitioning forest land into major classes indicating relative suitability to produce timber on a sustained yield basis.

Timber volume - Amount of timber contained in a log, a stand, or a forest, typically measured in board feet or cubic feet.

Threatened species - Those plant or animal species likely to become endangered species throughout all or a significant portion of their range within the near future. A plant or animal identified and defined in accordance with the 1973 Endangered Species Act and published in the Federal Register.

Visual resource management (VRM) - The inventory and planning actions to identify values and establish objectives for managing those values and the management actions to achieve those objectives.

Visual resource management classes - Categories assigned to public lands based on scenic quality, sensitivity level, and distance zones. There are four classes. Each class has an objective that prescribes the amount of change allowed in the characteristic landscape.

Water quality - The chemical, physical, and biological characteristics of water with respect to its suitability for a particular use.

Watershed - An area in which all surface waters flow to a common point.

Wildland urban interface (WUI) - Areas where communities are expanding into traditional forest and other resource lands.

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