Chapter 4 – Environmental Consequences

Chapter 4 of this draft environmental impact statement analyzes the environmental consequences of the alternatives for the six resource management plans of the planning area that are being revised.

In this chapter:

Introduction

Chapter 4 describes the environmental consequences of the alternatives on the affected environment (described in *Chapter 3*) within the planning area (defined in *Chapter 2*). The various resources and programs would be affected to various degrees by each of the four alternatives (the No Action Alternative and the three action alternatives). Also described in this chapter are the analytical assumptions, the key assumptions, the analytical methodology and modeling, and the data that were used in the analyses of this draft environmental impact statement. Finally, this chapter suggests mitigation measures that may be needed for some resources or programs to reduce impacts.

Keep in mind that this draft environmental impact statement describes the generalized management-level actions and not the site-specific implementation-level actions.

Analytical Assumptions

The analytical assumptions that were used in the analysis of the alternatives are based on the science of and the relationships within the natural systems that exist within the planning area. The specific assumptions that were used in this draft environmental impact statement for the analysis of each resource or program are contained within the 2006 *Proposed Planning Criteria and State Director Guidance* document and its subsequent updates (incorporated by reference). In addition, the details about the methodology, including assumptions, that was used to model vegetation, water, large wood source areas, timber valuation, and socioeconomics are included as appendices.

Following are the key assumptions that are common to all four alternatives. The assumptions that are specific to a resource or program are contained within the individual sections of *Chapter 4* for those resources or programs.

Key Assumptions and Information Common to All Four Alternatives

Terminology

The following terms are used in this draft environmental impact statement.

- **Commercial forest lands.** Those lands that are capable of producing 20 cubic feet per year of wood of commercial species. These lands are identified in the timber productivity capability classification (see *Appendix Q – Vegetation Modeling*). These lands are biologically capable of producing a sustained yield of timber.
- **Forested lands**. Those lands that are capable of 10% tree stocking. This excludes roads and such nonforest areas as water, meadows, and rock outcrops, which are identified in the GIS data.

- **Long term.** For the management direction of these resource management plan revisions, long term is considered to be 100 years.
- **Short term.** For the management direction of these resource management plan revisions, short term is considered to be 10 years.

Projection of Forest Conditions

For all four alternatives, the lands that would be available for harvesting in support of the allowable sale quantity and sustained yield management (harvest land base) were mapped. Other lands (nonharvest land base) were also mapped and segregated into those lands where active management could occur and those lands where timber harvesting is prohibited. This mapping allowed the spatial application of the analytical assumptions of the alternatives, including timber harvesting, to model forest conditions over time. These modeled projections of forest conditions were expressed as classifications of habitat for the northern spotted owl, and as structural stages of forests, which were used by the interdisciplinary team in their analyses. See *Appendix B – Ecology* and *Appendix Q – Vegetation Modeling*.

As part of this revision effort, the BLM has modeled timber harvesting and the development of wildlife habitat on BLM-administered lands. See *Appendix Q – Vegetation Modeling*. This modeling allowed projections to be made of the changes to the vegetation over time in the harvest land base. See the *Ecology* section of this chapter.

Information from the Northwest Forest's Plan 10-Year Monitoring Report

Information from the Northwest Forest Plan's 10-year monitoring report was considered in the analyses in this draft environmental impact statement. Some of the general key findings in this monitoring report were that:

- watershed conditions improved,
- late-successional and old-growth forest increased more than was anticipated, and
- less timber harvesting occurred on federal lands than was anticipated.

Specific information used from the report is referenced in the individual sections found in Chapters 3 and 4.

Existing Federal and State Agency Plans

For purposes of analysis, it is assumed that other federal and state agencies would continue the implementation of their current plans as written.

- The U.S. Forest Service would continue to implement their current land and resource management plans, which incorporate the standards and guidelines of the Northwest Forest Plan. The late-successional and riparian reserves would continue to grow into late-successional forest over time. The matrix lands would continue to provide the same overall amount and spatial pattern of vegetation over time.
- State lands and other federal lands would continue to provide the same overall amount and spatial pattern of vegetation over time.

Although changes do occur on particular parcels of land, it is not feasible to project specific changes to millions of acres of land over time. Such a projection would be extremely complex and cost prohibitive to make. In the case of U.S. Forest Service's matrix lands, the assumption that matrix lands would not appreciably change is conservative for species analysis, since forested stands in the matrix would continue to grow until harvested, and in some cases would develop into late-successional habitat.

Private Lands

It is assumed that private lands, including both industrial forest lands and non-industrial lands would continue to provide the same overall amount and spatial pattern of vegetation over time as presently exists.

Industrial forest lands are generally harvested on a short rotation basis, which is approximately every 40 years within the planning area. This means that these lands rotate through vegetative conditions in a regulated fashion from 0 to 40 years. At the landscape level, it is therefore expected that current vegetation patterns would remain approximately the same.

Private, non-industrial lands are owned by a variety of individuals and entities (including private homeowners, local governments, and corporations). It would be cost and time prohibitive to predict the countless scenarios that could occur on these lands. In addition, these lands are less connected to the BLM's management than the intermingled industrial forest lands, state lands, and other federal lands.

Past Effects

As the Council on Environmental Quality in guidance issued on June 24, 2005, points out, the "environmental analysis required under NEPA is forward-looking," and review of past actions is required only "to the extent that this review informs agency decisionmaking regarding the proposed action." Use of information on the effects on past action may be useful in two ways according to the CEQ guidance. One is for consideration of the proposed action's cumulative effects, and secondly as a basis for identifying the proposed action's direct and indirect effects.

The CEQ stated in this guidance that "[g]enerally, agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions." This is because a description of the current state of the environment inherently includes the effects of past actions. The CEQ guidance specifies that the "CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions." Our information on the current environmental condition is more comprehensive and more accurate for establishing a useful starting point for a cumulative effects analysis, than attempting to establish such a starting point by adding up the described effects of individual past actions to some environmental baseline condition in the past that, unlike current conditions, can no longer be verified by direct examination.

The second area in which the CEQ guidance states that information on past actions may be useful is in "illuminating or predicting the direct and indirect effects of a proposed action." Extrapolation of data from largely anecdotal information of past actions is not generally accepted as a reliable predictor of effects. The basis for predicting the direct and indirect effects of this proposed action and its alternatives is published empirical research, the general accumulated experience of the resource professionals in the agency with similar actions, and models that apply current scientific knowledge regarding relationships of our proposed management actions and effects that are generally accepted by the scientific community in the various specialized fields.

Scoping for this project did not identify any need to exhaustively list individual past actions or analyze, compare, or describe the environmental effects of individual past actions in order to complete an analysis which would be useful for illuminating or predicting the effects of the proposed action.

For purposes of analysis, projects designed under the current RMPs proposed prior to October 1, 2005, are assumed completed as proposed. For example, the habitat on acreage included in a timber sale project proposed prior to that date would be displayed and analyzed as harvested, whether or not that harvest has yet been completed in fact.

BLM Budget

It is assumed that all four alternatives would be adequately funded to implement the alternatives as designed..

Administrative Actions

It is assumed that these types of routine transactions and activities (see *Chapter 2* for details) would occur under all four alternatives at approximately the same level as during the past 10 years. The effects of these actions have been generally incorporated into the analysis for each resource or program.

Reasonably Foreseeable Mineral Development

Minerals that can be reasonably foreseeable for development include:

- fluid minerals (from natural gas wells, oil wells, geothermal wells and plants, and coal bed natural gas wells);
- salable minerals (from rock quarries and decorative stone collection); and
- locatable minerals (from dredging and mines).

With the exception of coal bed natural gas, it is assumed that these types of activities would occur at a rate consistent with the past 10 years and would not vary by alternative. Exploration and development of coal bed natural gas is occurring on private lands in the Coos Bay District and exploration on BLM-administered lands is expected to increase in the next 10 years. Development scenarios would not vary by alternative. A detailed description of the reasonably foreseeable development scenario can be found in *Appendix P – Energy and Minerals.* The effects of these actions have been generally incorporated into the analysis for each resource or program. Site-specific analysis would occur during project implementation.

Threatened and Endangered Species

It is assumed that the current listing status for species under the Endangered Species Act would remain in effect.

Several recovery planning efforts and redesignations of critical habitat are currently underway. Information from these efforts was used in formulating the alternatives, management objectives and actions, and effects analyses to the extent practical. As these efforts are updated or completed, they would be considered between the draft and final environmental impact statements. The alternative that is subsequently adopted and implemented will be consistent with the recovery plan and management requirements for redesignated critical habitat.

Analytical Methodologies and Models

The analytical methodologies that were used in assessing the effects of the alternatives are described in detail in the 2006 *Proposed Planning Criteria and State Director Guidance* document. The public was requested to provide comments on the methodologies. Those comments were used to refine the methodologies used in the analysis. The analyses are both qualitative and quantitative in nature. The methodologies consist of procedures or models from experimental forests, scientific papers, previous environmental impact statements, and procedures developed by the BLM's specialists.

Analytical models have been used to assess and compare some of the environmental consequences of the alternatives. These models simplify the complexity of biological, physical, or economic systems. Even though they are limited by current knowledge, they represent a synthesis of the knowledge of BLM staff and other scientists who are familiar with the subjects of concern.

Forest Vegetation and Habitat Modeling

The alternatives outline a range of approaches for managing the BLM forest lands by varying the size and placement of land use allocations and varying the intensity with which the BLM forests are managed. These different management approaches would result in a range of outcomes—forest characteristics, habitat types, and sustainable harvest levels. A model was used to simulate the development of the forest over time under each alternative. The model simulated the application of management practices and forest development assumptions to characterize what the forests would be like in 10, 20, 50, and 100 years into the future. The outputs from this modeling form a quantitative basis for the analysis in this draft environmental impact statement that compares the alternatives.

The OPTIONS model by D.R. Systems was used to model forest vegetation conditions, to model endangered species habitat, and to determine a sustainable harvest level. It is a scenario-based model and not an optimization model. A scenario-based model simulates the intensity of management and the analytical assumptions of the alternatives that produce a solution that satisfies both the objectives of the alternative and a sustainable harvest level. An optimization model seeks to find combinations of the types, timing, and intensity of harvests that increase the value of a forest in terms of its economic value from timber harvesting, as well as its ecological and social value from its composition.

The OPTIONS model is also a spatially explicit model. This allowed for the development of map-based scenarios for the estimation of the environmental consequences of the alternatives within the short term (10 years) and long term (100 years).

The OPTIONS model was applied to the approximately 2.5 million acres of BLM-administered lands within the planning area. The surrounding private, state, and other federal lands comprise approximately 22 million acres. Modeling the non-BLM lands to the same level of detail as the BLM-administered lands was not practical. Context vegetation modeling for the non-BLM lands was done by applying assumptions regarding the future management of non-BLM lands to the Interagency Vegetation Mapping Project satellite image vegetation classification.

The OPTIONS model came with no data and was used only as a modeling tool. The BLM was responsible for the data, assumptions, and rules that were used in formulating the model for analyzing the alternatives. A complete description of the OPTIONS modeling effort can be found in *Appendix Q – Vegetation Modeling*.

The Organon growth and yield model was used to determine the volume outputs for the silviculture regimes of each alternative and was a key input into the OPTIONS model. A complete description of the growth and yield modeling effort can be found in *Appendix Q – Vegetation Modeling*.

The OPTIONS model provided an assessment of the changes to the structural stages of forests and the changes to the habitat of the northern spotted owl over time for each alternative. A detailed description of these vegetation classes may be found in *Appendix B – Ecology*. The OPTIONS model also provided changes to key baseline vegetation conditions and northern spotted owl habitats. These outputs were used by resource specialists to estimate the environmental consequences of the alternatives. Outputs were also used as data inputs for other models (such as the modeling of hydrology and fire).

The harvest treatments that were simulated in the model for the first 10 years were used to develop a first decadal scenario. This first decadal scenario was used for the purpose of estimating short-term change to the forests and the display of the types of treatments that would be applied. It also served as a basis to estimate road construction and harvesting methods. In addition, the first decadal scenario served as a quality control check of the sampled harvest units that were identified by the model. These harvest units were examined for the practicality of implementation. The first decadal scenario was not intended to be a plan for subsequent implementation on the ground. The environmental consequences from subsequent implementation of forest treatments through actual projects will be analyzed and disclosed in project-level environmental analysis. Project-level analysis will examine project level impacts and determine if they are within those already anticipated and described in this Environmental Impact Statement. Additional information about the first decadal scenario can be found in *Appendix D – Timber*.

Geographic Information System Data

To support the western Oregon resource management planning effort in the mid 1980s, the BLM created an automated geospatial database, which is a geographic information system (GIS) database. Ongoing collaborative efforts in data collection, data standards, and data acquisition have resulted in a significant increase in the amount and accuracy of the geospatial data that is available for land use planning.

The quality, quantity, and management of the data that is contained within the GIS database have provided managers and resource professionals with the ability to analyze complex land management issues and scenarios. The western Oregon component of the GIS database includes forest vegetation, management units, roads, hydrology, elevation, ownership, and a wide range of wildlife habitat information (including the location of threatened and endangered species on BLM-administered lands).

Existing data was evaluated for accuracy, reliability, and limitations. Missing, incomplete, or outdated information was identified and updated when practical. Of particular note is an update to the estimated amount of BLM lands that are contained in the riparian reserve land use allocation under the No Action Alternative. Over the past 10 years, the extent of the hydrology network has been more fully mapped and the information regarding the presence of fish has increased. This improved GIS data about hydrology and the presence of fish on BLM lands within the planning area made it possible to model the extent of the riparian reserves to a precision that was not feasible 10 years ago. For the 1995 resource management plans, it was estimated that 22% (522,000 acres) of the western Oregon BLM lands within the planning area were contained in the riparian reserve land use allocation (the portion covering the matrix and adaptive management areas after all other allocations are deducted). This number has been adjusted downward to 15% (364,000 acres) for the No Action Alternative.

Other corrections that resulted from the improved accuracy of the GIS information included a mapping correction. A mapping error during the previous Medford District resource management plan revision resulted in the inaccurate reporting of the district's acres that were open to off-highway vehicle use. The resource management plan showed 391,400 acres were open to off-highway vehicle use when, in fact, only 139,878 acres were open to off-highway vehicle use.

Besides the improved GIS data, another important source of data that was used in the analysis of the alternatives included the recently completed decadal assessment of the Northwest Forest Plan. This decadal assessment generated data that described the condition of the environment across the area of the Northwest Forest Plan.

In general, data that was used in the analysis of the alternatives was summarized at various scales, including the planning area, physiographic provinces, the BLM districts, and fifth-field watersheds. There are 260 fifth-field watersheds, which average 87,000 acres in size, that are located all or partially within the planning area.

Reference Analysis

In addition to analyzing subalternatives, which are variations of an alternative that add, remove, or modify certain management actions, several reference analyses are also analyzed in this draft environmental impact statement. Reference analyses provide additional information that is useful to more fully understand the effects of one or more of the alternatives.

Like the subalternatives, the analysis of the reference analyses is focused and limited to specific analytical questions. Unlike the subalternatives, however, the reference analyses are not selectable during decision making because they do not meet all of the qualifications for being a subalternative.

The two reference analyses for this draft environmental impact statement include:

1 ***Allow no harvesting.*** This reference analysis will provide information about the vegetation condition that would occur naturally without management and the capacity of the BLM-administered lands to provide wildlife habitat.

2. ***Manage most commercial forest lands for timber production.*** This reference analysis will provide information about the vegetation condition and timber production levels that would occur if most of the BLM-administered lands (except the National Landscape Conservation System lands, the administratively withdrawn lands, and lands within 25 ft. of streams) were managed for timber harvesting.

Scope of the Analysis

The Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (NEPA) direct that "NEPA documents must concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail" (40 CFR 1500.1(b)). Issues are "truly significant to the action in question" if they are necessary to make a reasoned choice between alternatives (i.e., the issue relates to how the alternatives respond to the purpose and need). Issues are also "truly significant to the action in question" if they relate to significant direct, indirect, or cumulative impacts resulting from the alternatives. This analysis addresses the environmental consequences that are associated with the issues that are related to the purpose and need (see *Chapter 1*). For example, the analysis of fisheries focuses on the effects on listed fish species to address the issue of "How should the BLM manage federal lands in a manner that is consistent with the Endangered Species Act in order to contribute to the conservation of species." Other fish species occur within the planning area, and some have different habitat requirements and life histories than the listed fish species. However, this analysis does not attempt to analyze the effects of the alternatives on all fish species. Similarly, the analysis of plants and wildlife focus on the effects on species listed under the Endangered Species Act, and analyze effects on special status species to the extent necessary to evaluate changes in populations or habitat that would contribute to a need to list the species under the Endangered Species Act. These sections do not attempt to analyze the effects of the alternatives on all plant and animal species.

Direct and Indirect Effects

The Council on Environmental Quality's regulations for implementing the National Environmental Policy Act requires that both the direct and indirect effects on the quality of the human environment of a proposed action or alternative be disclosed.

- **Direct effects.** Those effects "which are caused by the action and occur at the same time and place."
- **Indirect effects.** Those effects "which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable."

There is no requirement for discussing direct and indirect effects be discussed individually. Also, it can be difficult to distinguish between the two, particularly at the scale of the planning area. Therefore, the terms direct and indirect are not differentiated in the analysis of the effects in this draft environmental impact statement. Effects caused by the actions are identified without attempting to categorize them as direct or indirect.

Cumulative Effects

Cumulative effects result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions (40 CFR 1508.7). Due to the nature of the analysis in this large scale and long-term resource management plan environmental impact statement, all environmental effects described in this environmental impact statement have incremental impacts that result in cumulative effects. Therefore, there is not a discreet and separate section labeled as cumulative effects. The discussion of effects on each resource incorporates the context of incremental effects thus revealing the cumulative effects of the action.

The cumulative effects in this draft environmental impact statement consider past and reasonably foreseeable future actions. The existing baseline information is a result of the aggregation of all past actions; therefore, it is not necessary to analyze past actions individually. For BLM-administered lands, reasonably foreseeable future actions are those actions that would occur as described under the various alternatives. For U.S Forest Service and state of Oregon lands, reasonably foreseeable future actions are those that would occur under their current land use plans. For private lands, reasonably foreseeable actions are those actions that would occur with the continuation of present management.

There are other broad-scale analyses that are currently underway that are relevant to the analyses of these environmental consequences. They include:

- ***Final Supplement to the 2004 Final Supplemental Environmental Impact Statement To Remove or Modify the Survey and Manage Mitigation Measure Standards and Guidelines.*** This supplement provides additional effects analyses in support of the 2004 record of decision to remove the survey and manage standards and guidelines. The U.S. Forest Service and the BLM have reinstated the survey and manage standards and guidelines until this supplement and the subsequent decision have been completed. The SEIS was completed in June, 2007 and the Record of Decision is expected in July, 2007. However, before any decision to remove the Survey and Manage standards and guidelines can be implemented, approval of the U.S. District Court for the District of Western Washington must be obtained. Since it is not certain if that will occur before this revision of the current RMPs is completed, we are assuming for purposes of analysis of the No Action Alternative for this western Oregon Plan Revision that Survey and Manage standards and guidelines consistent with the 2001 SEIS Record of Decision, including changes through the Annual Species Reviews completed through 2003, remain in effect.
- **Westwide Energy Corridor Project.** This project has a programmatic environmental impact statement to designate corridors for oil, gas, and hydrogen pipelines, as well as electricity transmission and distribution facilities on federal lands in 11 western states that is currently underway. The draft programmatic environmental impact statement, which is being coordinated by the Department of Energy, is scheduled for release in the summer of 2007. After the environmental impact statement is completed, the BLM will amend the relevant land use plans, as necessary, to implement corridor designations on the lands it administers. See the *Maps* section at the end of *Chapter 2* for the projected location of the corridor within the planning area. This project was included as a reasonably foreseeable future action for purposes of analyzing cumulative effects.
- **Proposed Jordan Cove Energy (Liquid Natural Gas Terminal) Project and Proposed Pacific Connector Gas Pipeline Project.** These two projects would consist of an onshore liquid natural gas import and storage terminal, which would be located on the bay side of the North Spit of Coos Bay, Oregon, and an approximately 223-mile-long, 36-inch-diameter natural gas pipeline, which would extend from the terminal southeastward across Coos, Douglas, Jackson, and Klamath counties to an interconnection with an existing pipeline near Malin, Oregon.
- The Federal Energy Regulatory Commission will prepare an environmental impact statement to address the environmental consequences of the project. The current schedule calls for completion of the draft environmental impact statement by August 2007 and the final environmental impact statement by December 2007. See the *Maps* section at the end of *Chapter 2* for the projected location of the corridor within the planning area. This project was included as a reasonably foreseeable future action for purposes of analyzing cumulative effects.

Spatial and Temporal Scales of Analysis

Some resources are spread more broadly across the planning area than others. The analysis of the alternatives at multiple spatial scales is necessary to examine those resources for which their geographic area differs from the planning area. For example, the analysis of certain animals or birds may require the consideration of a geographic area that is broader than individual districts. In contrast, the geographic area appropriate for the analysis of a rare plant may be quite limited. Information presented at multiple spatial scales helps the BLM to understand issues, analyze cumulative impacts, and tailor decisions to specific needs and circumstances.

It is also necessary to consider various temporal scales. The Council on Environmental Quality's regulations require a consideration of the relationships between the short-term uses of the human environment and the maintenance and enhancement of long-term productivity. Some natural processes and the implementation of management actions may occur over a relatively short time, whereas other natural processes and implementation of management actions occur over longer periods of time. Therefore, vegetation changes were analyzed at 10, 20, 50, and 100 years. When possible, interim benchmarks and rates of progress or trends have been identified for those management objectives that may not be achieved for decades, a century, or longer.

In general, for these analyses, the short term is considered 10 years and the long term is considered 100 years. In the analysis of certain resources, the definition of short term and long term varies from this general definition. In those instances, the time period for short and long term is specified in the text.

Incomplete or Unavailable Information

As noted in the individual analyses in this environmental impact statement, there are certain relationships for some of the resources that are not fully understood. This is to be expected given the complexities and interrelationships inherent in natural resource management. When encountering a gap in information (incomplete or unavailable information), the Council on Environmental Quality's regulations pose the question as to whether the information is "essential to a reasoned choice among alternatives" (40 CFR 1502.22(a)). While additional information would often add precision, if the basic data and central relationships are sufficiently well-established that new information would not likely reverse or nullify the relationships, or be essential to a reasoned choice among the alternatives, then it is not necessary.

If information that is relevant to reasonably foreseeable significant adverse impacts or that is essential to a reasoned choice among alternatives is unavailable, or if the costs of obtaining the information are exorbitant, an environmental impact statement must include statements to let the public know this and its effect on the ability to predict impacts to a particular resource.

Natural disturbances, salvaging, global climate change, and sudden oak death are areas of incomplete information.

Natural Disturbance and Salvage

This analysis does not include estimates of future natural disturbances, such as wildfires, windstorms, disease, or insect infestations, or subsequent salvaging. These disturbances will occur in the future under all four alternatives; however, the location, timing, severity, and extent of such disturbances are speculative.

Wildfire is the most predictable of these natural disturbances, yet it is still not possible at the scale of the planning area to identify reasonably foreseeable effects related to wildfires, which would be highly dependent on the wildfire location, timing, severity, and extent. Wildfire location, timing, severity, and extent would all be highly dependent upon variables that cannot be reasonably foreseen, such as weather, ignition sources, fuel conditions in the fire location, and the effectiveness of control efforts. For example, the Late Successional/ Old Growth Monitoring Report found that there was high variation among the provinces in the loss of late-successional forest to wildfires in the past 10 years—more than three-quarters of the acres lost to wildfires were the result of a single fire (Moeur et al. 2005, 95). The FSEIS of the Northwest Forest Plan assumed that 2.5% of late-successional forests would be lost to wildfires each decade (NWFP FSEIS, 3&4:42). Most of the planning area had a lower rate of loss in the past decade, but the Klamath province had a much higher loss rate (9.5% for the decade) (Spies 2006, 84; Moeur et al. 2005). It is not possible to accurately predict the total acreage of wildfires at the scale of all federal forests in a province. To predict total acreage of wildfires for BLM-administered lands, which are highly dispersed among other ownerships, would be far more speculative. To attempt to predict wildfire acreage for BLM-administered lands at finer scales, or to predict wildfire severity, timing, or extent, would be so speculative as to be arbitrary.

The alternatives contain management actions related to salvaging of trees killed following disturbances and those management actions vary among the alternatives. Information on the effects of natural disturbances and salvaging (or the absence of salvaging) is incomplete or unavailable. The analysis of the effects of such disturbances prior to their occurrence, and the possible associated salvaging, would require making so many speculative assumptions regarding specific circumstances that the conclusions of the analysis could not be used to make reasonably informed decisions regarding management actions. Such analysis can be addressed at the time of proposed implementation when specific circumstances can be analyzed.

The following describes general information on the effects of natural disturbances and salvaging.

Natural Disturbances

Natural disturbances kill trees, which creates snags and logs. Some disturbances, like wildfires, consume some portion of the trees that are killed, but other disturbances leave the killed trees intact. Disturbances drive the development of forest structure, composition, and process (Franklin et al. 2002). Disturbances have strong controls on the pattern of the landscape, nutrient cycling, hydrology, and habitat (Hutto 2006; Lindenmayer and Noss 2006; Reeves et al. 2006; Beschta et al. 2004; Ice et al. 2004; Karr et al. 2004; Lindenmayer et al. 2004; Robichaud et al. 2000; Perry 1998; Forman 1995). For example:

- **Soil conditions and processes.** The environmental impact statement for the Timbered Rock Fire Salvage and Elk Creek Watershed Restoration Project concluded that these wildfires altered the conditions and processes of the soil, which increased soil erosion and the risk of landslides (Timbered Rock EIS, 3-9 – 3-21). The environmental impact statement for the Biscuit Fire Recovery Project also concluded that that wildfire altered the conditions and processes of the soil, but did not conclude that the wildfire had increased the risk of landslides (Biscuit Fire EIS, III-81 – III-85).
- **Stream flow, sedimentation, and water temperature.** The environmental impact statement for the Timbered Rock Fire Salvage and Elk Creek Watershed Restoration Project and the environmental impact statement for the Biscuit Fire Recovery Project concluded that the wildfires had increased stream flow, sedimentation, and water temperature (Timbered Rock EIS, 3-45 - 3-53; Biscuit Fire EIS, III-206 - III-211).
- **Insect infestations.** The environmental impact statement for the Timbered Rock Fire Salvage and Elk Creek Watershed Restoration Project concluded that that wildfire would lead to only limited and localized subsequent tree mortality from insect infestations (Timbered Rock EIS 3-105 - 3-106). The environmental impact statement for the Biscuit Fire Recovery Project concluded that the extensive insect infestations were possible but impossible to predict (Biscuit Fire EIS, III-143 – III-144).

The environmental impact statement for the Timbered Rock Fire Salvage and Elk Creek Watershed Restoration Project and the environmental impact statement for the Biscuit Fire Recovery Project concluded that the wildfires had removed late-successional forest habitats and created early-successional habitats (Timbered Rock EIS 3-175 – 3-180; Biscuit Fire EIS, III-153 – III-173).

The analyses in these two environmental impact statements are incorporated by reference.

Salvaging

Salvaging after natural disturbances provides opportunities for timber harvesting. Such harvesting, when it would occur in the late-successional management areas, is not included in computing the allowable sale quantity (see the *Timber* section of this chapter), because this harvesting would not be repeated over time. The economic return from harvesting in the late-successional management areas that would not otherwise occur in the absence of a natural disturbance cannot be analyzed because of the speculative nature of the timing and magnitude of the disturbance and the value of the timber that might be killed. When harvesting after natural disturbance occurs in the timber management area or general landscape area, the harvests would be included as part of the allowable sale quantity. Any variations in the allowable sale quantity that is offered for sale in a given year, because of salvaging after a natural disturbance, would be averaged over subsequent years according to the management actions in the alternatives. Because such harvesting in the timber management area and general landscape area would become part of the scheduled allowable sale quantity, there would be no economic benefit beyond that assumed from normal harvesting in these areas.

Salvaging after natural disturbances can potentially reduce the risk of a future high-severity fire by reducing the quantity of large fuels (Biscuit Fire EIS III-37 – III-38, III-58; Timbered Rock EIS, III-162 - III-168; McIver and Starr 2000). The large fuels in a fire release a large amount of energy over a sustained time period. This heat pulse contributes to long-term soil damage (Timbered Rock EIS, III-163 - III-164). All disturbances that kill trees increase the quantity of both fine and large fuels on the ground. Salvage logging reduces the quantity of large fuels, but can increase the quantity of fine fuels. In contrast, Donato et al. (2006) and Beschta et al. (2004) concluded that salvage logging increases fire risk by increasing surface fine fuels, and suggested that leaving snags standing could result in a lower fire hazard. While the potential for reducing future fire severity by reducing large fuels is consistent with existing research on fire effects (Brown et al. 2003), there is little research that directly evaluates the effectiveness of salvage logging in achieving this objective. As noted by Reeves et al. (2006):

> "reburn probability and reburn fire behavior are understood mostly in theory; there is little empirical evidence that would be useful for evaluating risks."

Salvaging after natural disturbances can potentially reduce insect and disease outbreaks (Ice et al. 2004; Sessions et al. 2004; McIver and Starr 2000). For example, windthrow can contribute to increases in Douglas fir bark beetle populations (Furniss and Carolin 1977). However, the effect of salvage logging on future insect and disease outbreaks, like the effect on reburns, is understood mostly in theory and without empirical evidence (Biscuit Fire EIS, III-143 – III-144).

Ground disturbances that are caused by salvage logging can mechanically break up hydrophobic soils, which can result from high-severity fires (McIver and Starr 2000). However, some studies suggest that hydrophobic soils are temporary and would be naturally altered before salvage logging would typically occur, and that the disturbances necessary to break up hydrophobic soils would cause soil compaction and erosion (Reeves et al. 2006; Beschta et al. 2004). The environmental impact statement for the Timbered Rock Fire Salvage and Elk Creek Watershed Restoration Project summarized the research on hydrophobic soils and concluded that they are not considered a major hydrologic concern in the Pacific Northwest, except for granitic soils (BLM Timbered Rock EIS, 3-21).

Salvaging can reduce safety hazards. Natural disturbances create snags and logs that can pose safety hazards to people and infrastructure (roads, trails, and recreation facilities). Salvaging can also reduce safety hazards during wildfire suppression, because large fuels contribute to the difficulty of suppression operations, and snags and logs pose direct safety hazards to firefighters (Biscuit Fire EIS, III-38 - III-41, III-51 – III-53, III-55 – III-56).

Salvage logging can disrupt natural tree regeneration (Donato et al. 2006; McIver and Starr 2000), but can improve access to disturbed sites to allow replanting and future silvicultural treatments (Sessions et al. 2004). Several studies have asserted that salvage logging necessarily causes forest degradation as a result of soil compaction, erosion, sedimentation to streams, and the spread of invasive species (Lindenmayer and Noss 2006; Reeves et al. 2006; Beschta et al. 2004; Karr et al. 2004). These adverse effects are only potential results of salvage logging, not certain results. As with other timber harvesting, proper logging design and implementation can avoid adverse effects on soil and water (Ice et al. 2004; Sessions et al. 2004; Duncan 2002; McIver and Starr 2000)

Salvaging does not directly contribute to the ecological recovery of disturbed forests, and, in some respects, impairs or delays ecological recovery. Salvaging does reduce snag and coarse woody debris levels, which reduces ecological functions and alters future stand development (Lindenmayer and Noss 2006; Noss et al. 2006; Reeves et al. 2006; Franklin et al. 2002). Salvage logging does simplify and homogenize the postdisturbance early-successional forest, and several studies have asserted that structurally complex early-successional forests are becoming increasingly rare and are important sites for many biological and ecological processes (Hutto 2006; Lindemayer and Noss 2006; Spies 2006; Ohmann et al. 2005; Lindemayer et al. 2004; Franklin et al. 2002).

Climate Change

In the past decades, the regional climate has become warmer and wetter with reduced snowpack (Scientific Consensus Statement 2004). Current climate conditions have changed from the climate conditions when the current old-growth stands were developing (Franklin et al. 2006). It is unknown whether these changes in climate have altered fundamental processes about tree regeneration and stand development in a way that changes the likely development of currently young stands.

The analysis assumes no change in climate conditions, because the specific nature of regional climate change over the next decades remains speculative. Although an increase in average annual regional temperatures is likely, changes to the amount and timing of precipitation are too uncertain to predict (U.S. Global Change Research Program 2001; Climate Impacts Group 2004; Scientific Consensus Statement 2004). Changes in the impact analysis as a result of climate change would be highly sensitive to changes in the amount and timing of precipitation. Furthermore, it would be very difficult to apply the results of climate change models to a finer scale than the entire Pacific Northwest, which limits the ability to apply the results of climate change models to the analysis of specific management strategies or actions. This analytical assumption is generally consistent with the recent U.S. Forest Service science consistency review *Addressing Climate Change in Plan Revision* (U.S. Forest Service 2005).

Either higher than previous temperatures or higher than previous atmospheric carbon dioxide levels could increase tree growth rates. However, the overall effects on regional forest growth are uncertain (Smith 2004), especially because of the uncertainty of precipitation changes. Increased summer temperatures combined with reduced summer precipitation could result in reduced tree growth rates and increased losses due to wildfires.

Increased temperatures could also result in changes to hydrologic processes, including reduced snowpacks, earlier snowmelt, shifting of the rain-on-snow zones, higher spring streamflows, and lower summer streamflows. However, as with forest growth, the overall effects on hydrologic processes are uncertain because of the uncertainty of precipitation changes. Increased winter precipitation could mitigate or overwhelm the effects of increased temperatures on snowpack and the changes in the timing of streamflows.

Sudden Oak Death

Sudden oak death is a recently recognized disease that is killing tanoak, oaks, and other plant species in California. The disease is caused by the introduced pathogen known as *Phytophthora ramorum*. The disease causes trunk cankers, which often directly leads to the death or weakening of a tree to the point that fungi or insects kill it (Rizzo et al. 2002). Tree mortality rates vary widely, even in susceptible species. A wide range of other species with visible branch cankers or foliar lesions is infected by the pathogen, but with uncertain effects on the plant. One of the most common oak species within the planning area, Oregon white oak (*Quercus garryana*), appears to be unaffected by the pathogen (Rizzo 2003). The long-term effect of sudden oak death on infected forest ecosystems is unknown.

The disease has been confirmed in one location in Curry County in southwestern Oregon (Kanaskie et al. 2006). Future spread of the disease into Oregon is uncertain. Models identify different levels of risk of sudden oak death spread across the planning area (Kelly et al. 2005). Widespread infections and mortality of tanoak and oak species could alter not only forest composition and structure, but also important forest processes, such as nutrient cycling and wildlife habitat. For example, tanoak and oaks are important in many southwestern Oregon stands in providing cover and food for a wide variety of wildlife species. Widespread infections could affect suitable northern spotted owl habitat in southwestern Oregon through the removal of sub-dominant canopy tree and shrub species; altering habitat structure and prey base numbers. However, because future spread of the disease and subsequent tree mortality in the planning area is speculative, there is no basis on which this analysis can assume future changes to forest composition, structure, and process as a result of Sudden Oak Death.

Irreversible or Irretrievable Commitment of Resources

The irreversible or irretrievable commitment of resources refers to those that cannot be reversed or that are lost for a long period of time. Examples include the extraction of minerals or the commitment of land to permanent roads. Specific irreversible or irretrievable commitments of resources are described in the environmental consequences for each resource.

Adverse Effects That Cannot be Avoided

Under the National Environmental Policy Act (NEPA), an agency does not have to avoid adverse effects. However, an agency must identify adverse effects and disclose them. An agency must also identify the means to mitigate those adverse effects that can be mitigated—not all adverse effects can be mitigated. Adverse effects that cannot be avoided are those that remain after mitigation measures have been applied.

Mitigation

The Council of Environmental Quality's regulations state that mitigation includes avoiding, minimizing, rectifying, reducing, eliminating, or compensating for adverse environmental impacts. Most measures often used in mitigating effects from timber management are already included in the design of the alternatives, and therefore assessed as part of the effects of the alternatives. Those mitigation measures that are not included in the design of the alternatives are identified in the discussions of environmental consequences for individual resources or programs.

Estimated Timber Management Activity for the First 10 Years

See *Table 149 (Estimated annual first decade levels of timber management activity by alternative)* for the assumed levels of timber management activities that were used in the analysis of the environmental consequences.

Table 149. Estimated annual first decade levels of timber management activity by alternative

Timber Management Activity	Unit	Alternative			
		No Action	Alt. 1	Alt. 2	Alt. 3
Regeneration harvesting ASQ	acres	60,500	90,600	143,400	3,900
Partial harvesting ASQ	acres	0	0	0	124,600
Thinning ASQ	acres	36,800	45,400	43,300	160,300
Allowable sale quantity (ASQ)	mmbf	268	456	727	471
Nonharvest land base thinning	acres	63,200	68,000	33,400	0*
Nonharvest land base (NHLB) volume	mmbf	87	81	40	2
Total harvest volume	**mmbf**	**355**	**537**	**767**	**473**
Permanent road construction	miles	360	520	610	550
Temporary road construction	miles	460	310	400	510
Right-of-way area for permanent road construction	acres	1,800	2,800	3,300	3,200
Ground-based yarding	acres	31,100	38,700	36,500	58,500
Cable yarding	acres	100,400	139,100	157,000	187,900
Aerial yarding	acres	29,000	26,200	26,600	42,400
Site preparation:					
Prescribed burning	acres	48,200	71,700	109,300	60,800
Other	acres	14,900	28,500	46,200	20,400
Release/precommercial thinning	acres	54,600	54,600	54,600	54,600
stand conversion	acres	2,100	2,100	2,100	2,100
Planting/unimproved genetics	acres	18,600	29,300	38,600	20,300
Planting/improved genetics	acres	50,800	73,500	115,700	62,400
Fertilization	acres	104,700	129,700	127,200	204,400
stand maintenance/protection	acres	112,500	161,400	259,900	134,400
Pruning	acres	37,600	37,600	37,600	37,600

*Acres round to 0.

Ecology

This analysis describes the abundance and spatial patterns of the forest structural stages that would exist under the alternatives:

- for the BLM-administered lands within the entire planning area by land use allocation and by physiographic province, and
- across all ownerships for the entire planning area by physiographic province.

This analysis compares these abundances and spatial patterns to the average historic conditions.

Key Points

- The abundance of the forest structural stages across all ownerships:
  - would not return to their average historic conditions in 100 years, even if there were no timber harvesting on the BLM-administered lands, and
  - would only shift 1% in 100 years under all four alternatives.
- The abundance of the forest structural stages on the BLM-administered lands:
  - would be consistent with the average historic conditions only under the No Action Alternative, and
  - would decrease the abundance of the young forests and increase the abundance of the mature &structurally complex forests from the current condition under all four alternatives.
- The retention of structural legacies in regeneration harvests, which would occur under the No Action Alternative and Alternative 3, would result in structurally complex forests redeveloping almost twice as fast after harvesting as under Alternatives 1 and 2.
- The alternatives would vary widely in the amount of existing old forest that would be harvested in 100 years—from 14% under the No Action Alternative to 63% under Alternative 3.
- Across all ownerships, the patch size of mature and structurally complex forests would increase under all four alternatives. The No Action Alternative would result in the largest increase and Alternative 3 would result in the smallest increase in all provinces.
- On the BLM-administered lands, the size and connectivity of the patches of the mature&structurally complex forests:
  - would increase from the current condition in most provinces under the No Action Alternative,
  - would decrease in most provinces under Alternatives 1 and 2, and
  - would decrease in all provinces under Alternative 3.

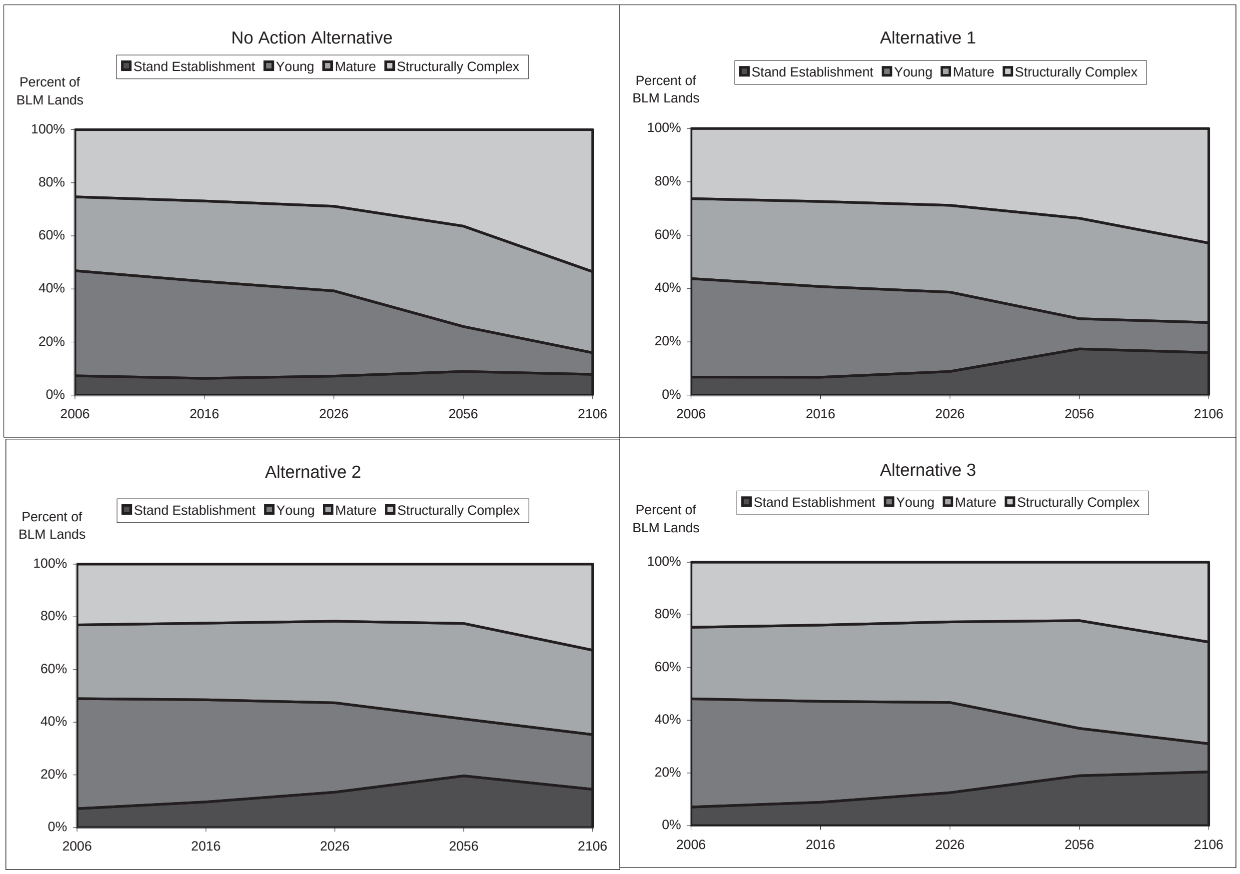
Ecological Conditions of the Conifer Forests on the BLM-Administered Lands across the Planning Area

On the BLM-administered lands in 100 years, the abundance of:

- the stand establishment forests would remain approximately constant under the No Action Alternative, and increase under the three action alternatives;
- the young forests would decrease under all four alternatives;
- the mature forests would increase under all four alternatives; and
- the structurally complex forests would increase under all four alternatives.

See *Figure 142 (Structural stage abundances on the BLM-administered lands by alternative)*.

Figure 142. Structural stage abundances on the BLM-administered lands by alternative[1]



Under the No Action Alternative, the abundance of the forest structural stages on the BLM-administered lands would become roughly consistent with the estimates of the average historic conditions (Nonaka and Spies 2005) within 100 years. Under the three action alternatives, the abundance of the forest structural stages on the BLM-administered lands would move toward the average historic conditions, but would not reach the average historic conditions within 100 years. See *Figure 142*, *Figure 143 (Comparison of the BLM-administered forested lands by 2106 with the average historic conditions and current conditions by alternative)*, and *Table 150 (Structural stage abundances by percentage of the BLM-administered forested lands by alternative)*.

[1] The 2006 forest structural stage abundances differ slightly among the alternatives because of the differences in how the inventory information is assembled for modeling under each alternative and the changes in the identification of nonforest. See the *Ecology* section in *Chapter 3* for the descriptions for Alternative 3 that used the 2006 data.

Figure 143. Comparison of the BLM-administered forested lands by 2106 with the average historic conditions and current conditions by alternative

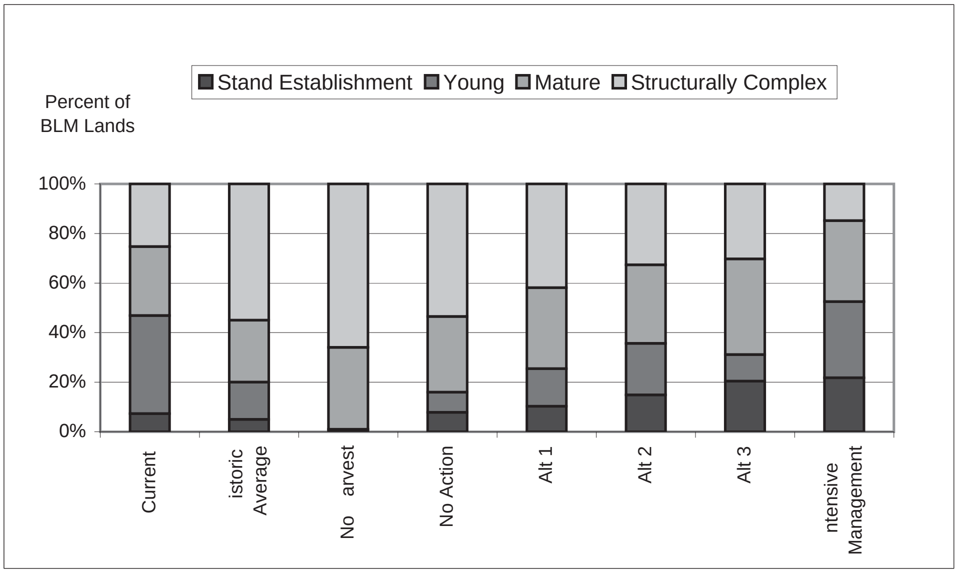


Table 150. Structural stage abundances by percentage of the BLM-administered forested lands by alternative

Year	Stand Establishment (%)	Young (%)	Mature (%)	Structurally Complex (%)
No Action Alternative				
2006	7	41	27	25
2016	6	36	30	27
2026	7	32	32	29
2056	9	17	38	36
2106	8	8	31	53
Historic Averages	5	15	25	55
Alternative 1				
2006	7	41	27	25
2016	7	39	29	25
2026	10	34	31	26
2056	14	19	37	30
2106	10	15	33	42
Historic Averages	5	15	25	55
Alternative 2				
2006	7	41	27	25
2016	10	39	29	22
2026	13	34	31	22
2056	20	22	36	23
2106	15	21	32	33
Historic Averages	5	15	25	55

Year	Stand Establishment (%)	Young (%)	Mature (%)	Structurally Complex (%)
Alternative 3				
2006	7	41	27	25
2016	9	38	29	24
2026	13	34	31	23
2056	19	18	41	22
2106	20	11	39	30
Historic Averages	5	15	25	55

The No Action Alternative would result in the BLM-administered lands being dominated by mature and structurally complex forests. The amount of the structurally complex forests would more than double in 100 years. The increase in structurally complex forests would be accompanied by a comparable decrease in the amount of young forests. The overall result of these changes would be to shift the BLM-administered lands from a condition in which the young forests are the most common to a condition in which the structurally complex forests are the most common. This shift would occur largely as a result of four factors:

- **The large acreage in the nonharvest land base would develop into mature and structurally complex forests.** The nonharvest land base would develop similarly under all four alternatives, but the nonharvest land base would be larger under the No Action Alternative than any other alternative (73% of the forested acres). See *Figure 148 (Structural stage abundances on the forested lands in the nonharvest land base by alternative)* later in this section.
- **The regeneration harvest rate would be too low to increase the amount of stand establishment forests, eventually resulting in a decrease in the young forests.** Regeneration harvesting in the harvest land base would create an average of 6,100 acres of stand establishment forest per year in the first decade, but 8,400 acres of stand establishment forest would develop into young forests across all allocations. Meanwhile, an average of 15,600 acres of young forest would develop into mature forest per year the first decade, which would result in a substantial decrease in the total abundance of young forest.
- **Green tree retention in regeneration harvests would speed the redevelopment of the structurally complex stands after harvesting.** The green tree retention requirements in the harvest land base would result in harvested stands developing into structurally complex forest almost twice as quickly as stands without structural legacies. Stand establishment forests with structural legacies, such as those produced under the No Action Alternative and Alternative 3, would develop into structurally complex forests in approximately 80 years for the most common stand conditions on productive sites. Stand establishment forests without structural legacies, such as those produced under Alternatives 1 and 2, would develop into structurally complex forests in approximately 150 years for common stand conditions on productive sites. See

Figure 144 (The influence of legacy retention on future stand development). This finding is consistent with other studies that concluded that green tree retention would speed the redevelopment of the structurally complex forests (Spies 2006, 94; Zenner 2005; Zenner 2000).

- **The standards and guidelines of the matrix land use allocation would constrain the harvesting of the structurally complex forests.** Several matrix standards and guidelines would contribute to the retention of the structurally complex forest within the harvest land base under the No Action Alternative:
  - the retention of late-successional forests in landscape areas where little late-successional forest persists (15% rule);
  - the maintenance of 25 to 30% of each connectivity/diversity block in late-successional forest;
  - the management of connectivity/diversity blocks on a 150-year area control rotation; and
  - a 120-year minimum regeneration harvest age in the Southern General Forest Management Area (Medford RMP, 72-74).

  The 120-year minimum regeneration harvest age in the Southern General Forest Management Area would contribute to the retention of the structurally complex forest because some forests (7,700 acres in 2006) in the Medford District were identified in the inventory as less than 120 years old, but were classified as structurally complex forest. The green tree retention requirements in regeneration harvesting in the Southern General Forest Management Area would result in harvested stands developing back into structurally complex forests in less than 120 years on some sites, which would result in the retention of the structurally complex forest.

More than any other alternative, the No Action Alternative would increase the size and connectivity of mature&structurally complex forest patches compared to the current condition, which would move the spatial patterns in the direction of historic conditions. See *Figure 151 (Change in the mean patch size from the current condition to 2106 by forest structural stage on the BLM-administered lands)* later in this section.
The No Action Alternative is the only alternative that would increase the size and connectivity of the mature&structurally complex forest patches in the Western Cascades and Klamath provinces. None of the alternatives would increase the size and connectivity of the mature&structurally complex forest patches in the Eastern Cascades province.

Figure 144. The influence of legacy retention on future stand development

No Action Alternative and Alternative 3
100-year old stand developed
with structural legacies
(structurally complex forest)

Alternatives 1 and 2
100-year old stand developed
without structural legacies
(mature with single canopy forest)

Under Alternative 1, the overall change in the abundance of the forest structural stages would be similar to the No Action Alternative, in part because the large acreage in the late-successional management areas would be coincident with the mapped late-successional reserves of the No Action Alternative. However, the shift in the forest structural stage abundances would not be as pronounced as under the No Action Alternative, because the total of the riparian management areas would be smaller than the riparian reserves of the No Action Alternative, the absence of green tree retention would slow the redevelopment of the structurally complex forests, and the regeneration harvest rate would be higher in the harvest land base.

Alternative 1 would increase the size and connectivity of the mature&structurally complex forest patches in the Coast Range province compared to the current condition, but less so than under the No Action Alternative. See *Figure 151 (Change in the mean patch size from the current condition by 2106 by forest structural stage on the BLM-administered lands)*. In all other provinces, Alternative 1 would decrease the size and connectivity of the mature&structurally complex forest patches compared to the current condition. Under Alternative 1, the BLM-administered lands would become strongly dichotomous, with the nonharvest land base being dominated by mature& and structurally complex forests and the harvest land base dominated by forests in the stand establishment without structural legacies and young without structural legacies forests. The edges between the harvest land base and nonharvest land base would be abrupt: the adjacent forests would contrast highly in their structure. Strongly dichotomous landscape patterns with abrupt edges would be inconsistent with modeled historic conditions for western Oregon (Nonaka and Spies 2005; Wimberly et al. 2000), and some research has suggested that such a dichotomous landscape would pose a risk to species and ecological processes (Spies 2006; Cissel et al. 1999; Forman 1995). However, little empirical research is available to evaluate the effects of a strongly dichotomous landscape pattern on most species and ecological processes.

In Alternative 2, the overall change in the abundance of the forest structural stages would also be similar to the No Action Alternative. However, the shift in structural stage abundances would be less pronounced than under Alternative 1, because the late-successional management areas and the riparian management area would be smaller than under Alternative 1. Similar to Alternative 1, the regeneration harvest rate under Alternative 2 would be higher in the harvest land base than under the No Action Alternative, and the absence of green tree retention would slow the redevelopment of the structurally complex forests under Alternative 2 compared to the No Action Alternative.

Alternative 2 would decrease the size of the mature&structurally complex forest patches compared to the current condition in all provinces, though less so than Alternative 3. See *Figure 151 (Change in the mean patch size from the current condition by 2106 by forest structural stage on the BLM-administered lands)*. Alternative 2 would decrease the connectivity of the mature&structurally complex forest patches in all provinces, except the Coast Range province where Alternative 2 would result in a smaller increase in connectivity than Alternative 1 or the No Action Alternative. Decreasing the size and connectivity would move the spatial pattern of the mature&structurally complex forests further away from the historic conditions. Alternative 2 would shift the spatial patterns and create a dichotomous landscape on the BLM-administered lands similar to Alternative 1.

Alternative 3 would result in the largest increase in the abundance of stand establishment forests and the smallest increase in the abundance of the structurally complex forest of all four alternatives. The development of the structural stages would be different under Alternative 3 from the other alternatives because of the relatively small acreage in the nonharvest land base. As a result, there would not be a large acreage predictably and inexorably developing into mature&structurally complex forests, as in the other alternatives. Nevertheless, Alternative 3 would have only slightly less mature&structurally complex forest by 2106 than would Alternative 1 and more than would Alternative 2. Alternative 3 would quickly redevelop mature&structurally complex forest after harvesting because of the use of partial harvesting and the retention requirements in both partial and regeneration harvesting.

Alternative 3 would decrease the size and connectivity of the mature&structurally complex forest patches in all provinces more than any other alternative, which would move the spatial pattern of the mature&structurally complex forest away from historic conditions. See *Figure 151 (Change in the mean patch size from the current condition by 2106 by forest structural stage on the BLM-administered lands)*.

The harvest intervals under Alternative 3 are designed to mimic the historic average fire return interval, which might suggest that Alternative 3 would be effective at restoring average historic conditions. However, the conclusion here that the application of the harvesting based on the average fire return interval would not restore average historic conditions in 100 years is consistent with other analyses (Nonaka and Spies 2005; Wallin et al. 1994). The current structural stage abundances and spatial patterns are the result of extensive forest management and human-caused fires in the twentieth century and is strongly inconsistent with the average historic conditions. The application of extensive active forest management—even management mimicking natural disturbances—to the current condition would initially move forests away from the average historic conditions and likely take several centuries to return the BLM-administered lands to the average historic conditions.

The No Action Alternative and Alternative 3 would transform the stand establishment forests on the BLM-administered lands to a structural condition more like naturally-created early-successional forests than the current condition or Alternatives 1 or 2. See *Figure 145 (Stand establishment forests with and without structural legacies by alternative) and Figure 146 (Young forests with and without structural legacies by alternative)*. Under the No Action Alternative and Alternative 3, the stand establishment forests would quickly and completely shift to dominance by stand establishment with structural legacies. This shift would occur because the current stand establishment without structural legacy forests would develop into young forests, and would be replaced by new stand establishment with structural legacy forests because of the green tree retention when regeneration harvesting under the No Action Alternative and Alternative 3.

Alternatives 1 and 2 would create stand establishment forests that would lack the structural complexity of naturally-created early-successional forests. stand establishment with structural legacy forests would almost completely disappear because of the absence of green tree retention when regeneration harvesting. Alternative 2 would create a very small acreage of stand establishment with structural legacy when regeneration harvesting within riparian management areas along intermittent non-fish-bearing streams that are not prone to debris flows and in the management area adjacent to the Coquille Forest, where green tree retention is required.

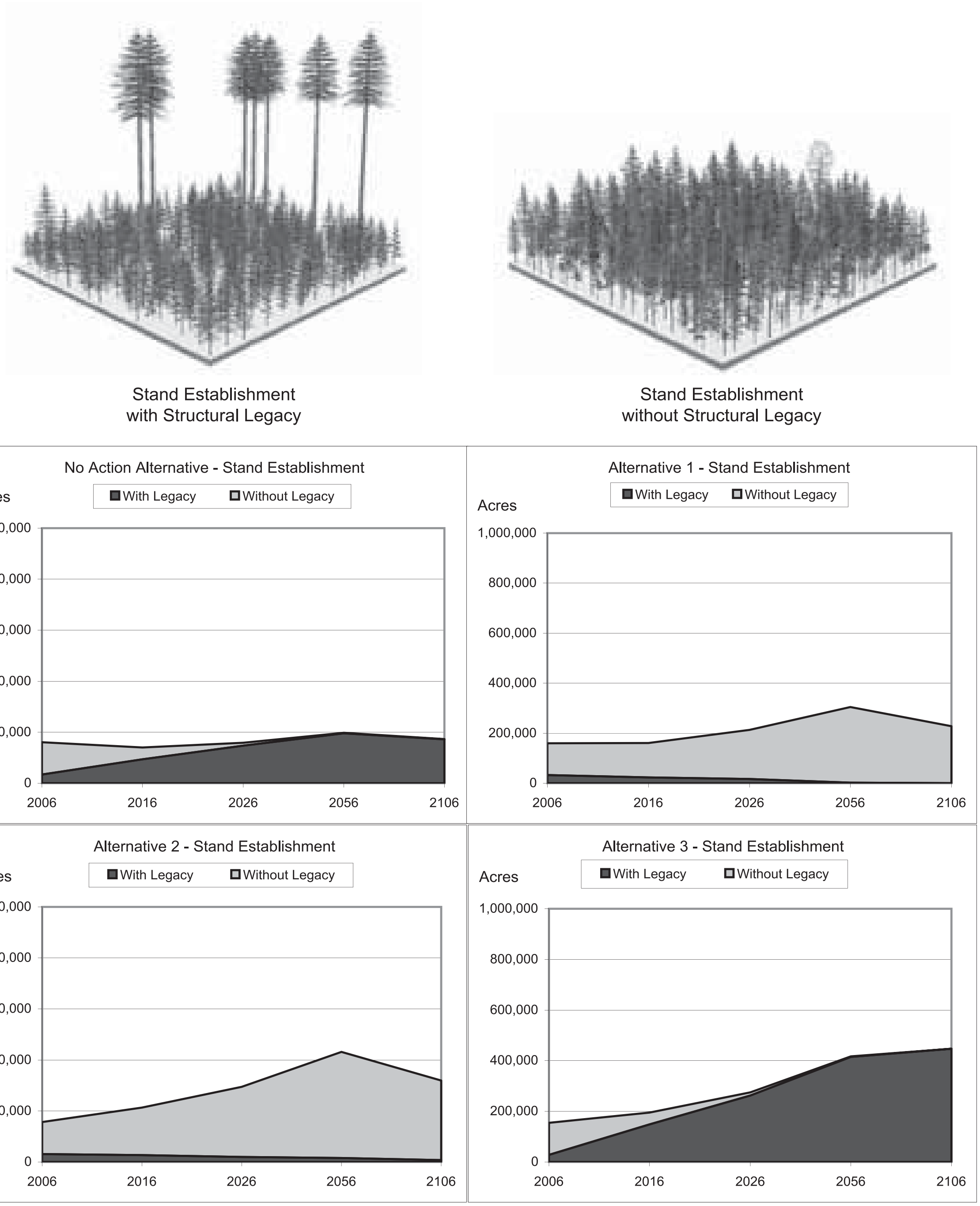
In 100 years, the abundance of stand establishment forest on the BLM-administered lands would be slightly above the average historic conditions under the No Action Alternative, and well above the average historic conditions under the three action alternatives.

The abundance of young forests would drastically decline under all four alternatives. The No Action Alternative and Alternative 3 would slowly shift the remaining young forests to an eventual dominance by young with structural legacy forests. This shift would occur because young forests without structural legacies would develop into mature forests over time and would be replaced by young forests with structural legacies because of the continuous new supply of stand establishment forests with structural legacies under the No Action Alternative and Alternative 3.

Alternatives 1 and 2 would increase the proportion of young without structural legacy forests, because almost all new young forests would develop from stand establishment without structural legacy forests.

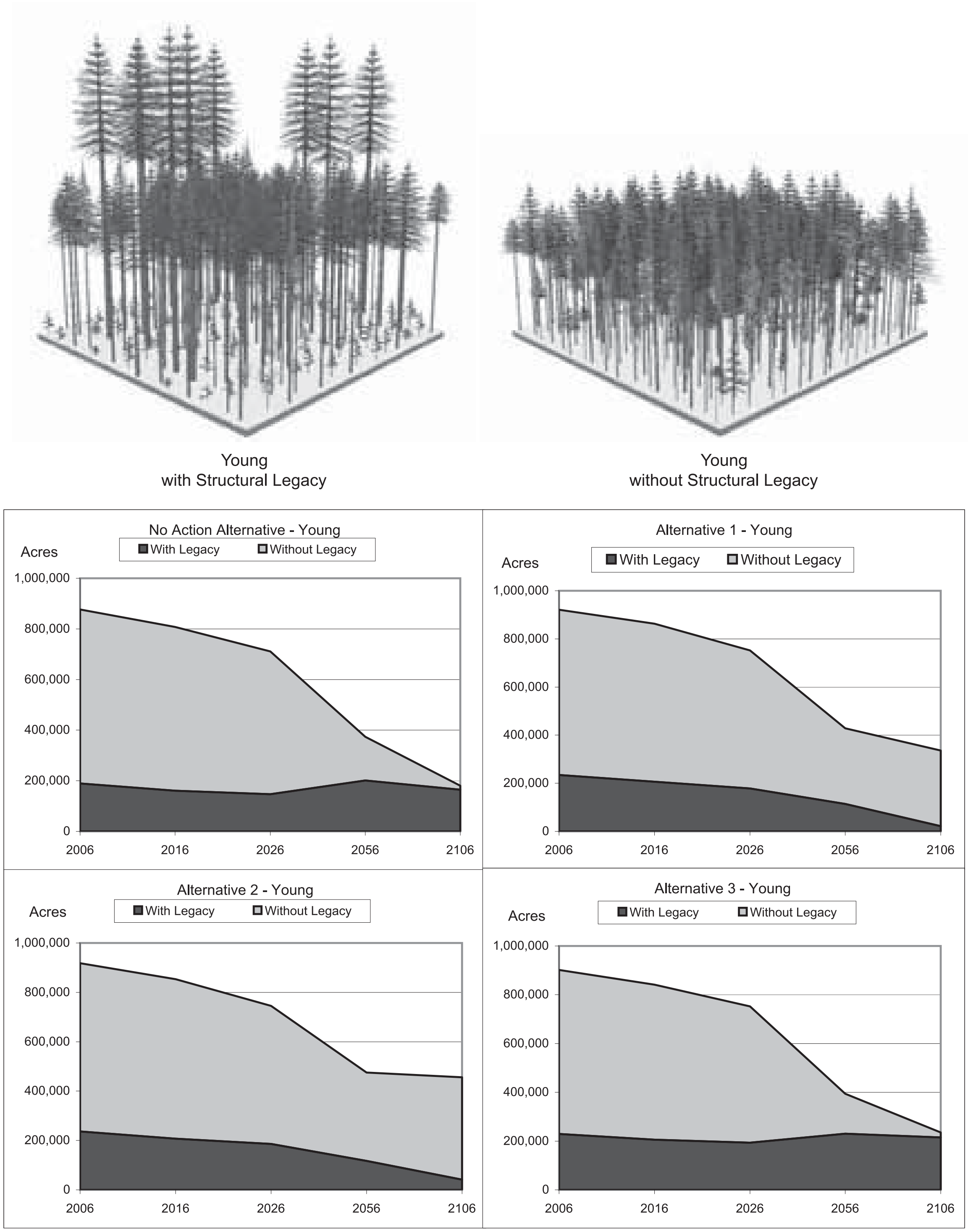
In 100 years, the abundance of young forests on the BLM-administered lands would be slightly below the average historic conditions under the No Action Alternative and Alternative 3; equal to the average historic conditions under Alternative 1, and slightly above the average historic conditions under Alternative 2.

Figure 145. Stand establishment forests with and without structural legacies (e.g., retained green trees) by alternative[2]



[2] This picture displays stand conditions that would develop following regeneration harvesting in No Action (general forest management area) or Alternative 3 (western hemlock retention levels). Partial harvesting under Alternative 3 would also create stand establishment with structural legacy forests, but with more overstory trees than shown here.

Figure 146. Young forests with and without structural legacies (e.g., retained green trees) by alternative[3]



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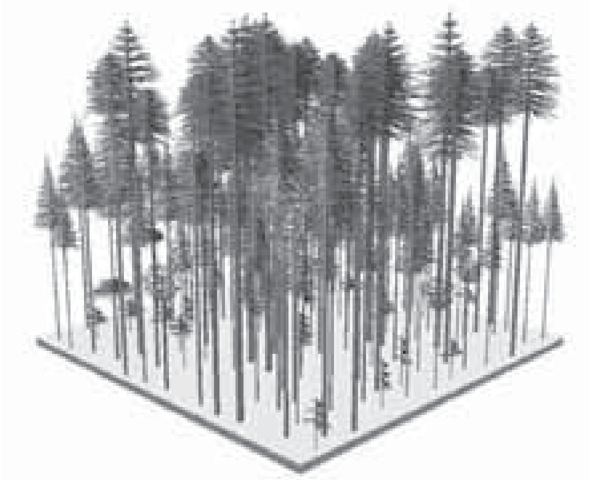
[3] This picture displays stand conditions that would develop following regeneration harvesting in No Action (general forest management area) or Alternative 3 (western hemlock retention levels). Partial harvesting under Alternative 3 would also create young with structural legacy forests, but with more overstory trees than shown here.

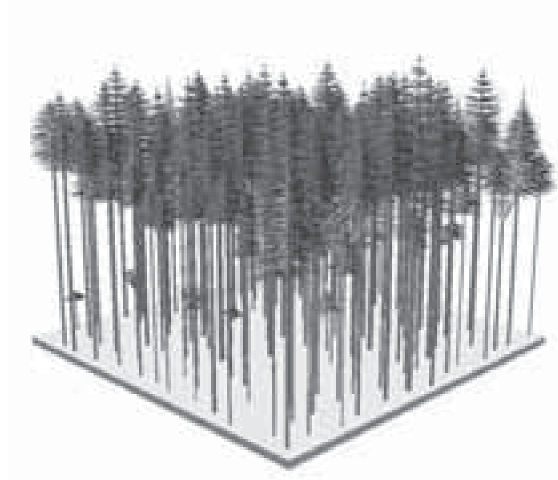
The overall abundance of mature forests would be more consistent among the alternatives than other structural stages. See *Figure 147 (Mature forest with multilayered canopies or single canopies by alternative)*. All four alternatives would result in an overall increase in the abundance of mature forests over the next 50 years (as young forests develop into mature forests), and then a decrease after 50 years. However, the alternatives would differ in the proportion of mature forests with multilayered canopies to mature forests with single canopies. Under the No Action Alternative and Alternative 3, mature forests with multilayered canopies would predominate, because of the eventual influence of green tree retention in timber harvests. Under Alternatives 1 and 2, which have no green tree retention, mature with Single Canopy forest would predominate. The influence of timber harvesting and green tree retention on mature forests is further demonstrated by the benchmark analysis of the no harvesting reference analysis, under which mature forests with single canopies would predominate (similar to Alternatives 1 and 2). The benchmark analysis of the reference analysis for intensive management on most commercial timber lands, which would have no green tree retention, would have the most extreme outcome. There would be 80% of all mature forests that would be mature with single canopies in 100 years.

In 100 years, the amount of mature forests on the BLM-administered lands would be above the average historic conditions under all four alternatives.

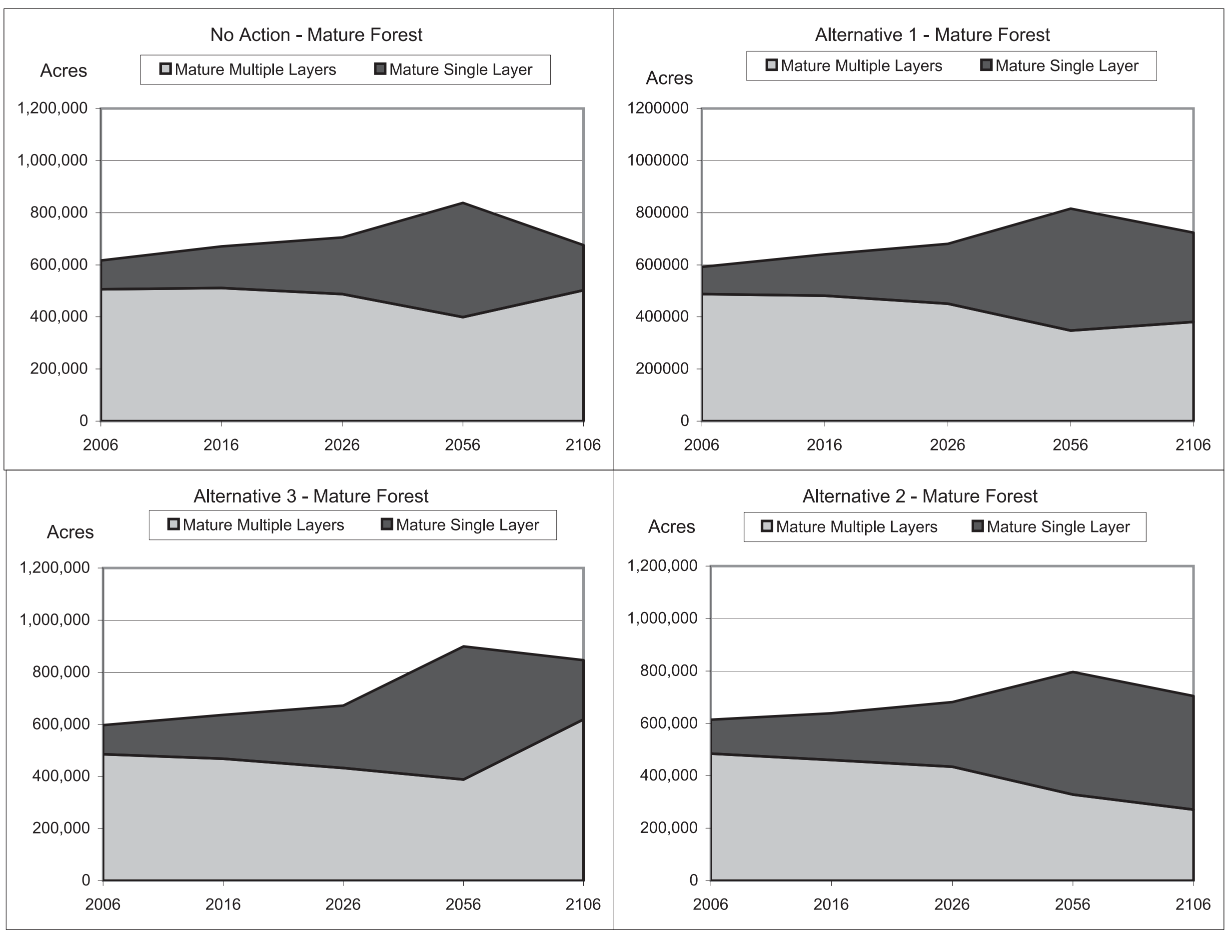
Figure 147. Mature forest with multilayered canopies or single canopies by alternative



Mature
with Multilayered Canopy



Mature
with Single Canopy



Under all four alternatives, the abundance of the structurally complex forests results from the retention of existing structurally complex forests coupled with the future development of additional structurally complex forests. However, the alternatives vary in both the amount of the existing structurally complex forest that is retained and how much additional structurally complex forest develops. Under all four alternatives, the additional structurally complex forest that would develop would initially be at the lower end of forest structural conditions that meet the definition of structurally complex forests, which is generally consistent with the pattern for the implementation of the No Action Alternative for the past decade (Moeur et al. 2005, 100).

The No Action Alternative would result in the largest increase in the abundance of the structurally complex forests of all four alternatives. The No Action Alternative would harvest less existing old forest than any other alternative, because the No Action Alternative has the smallest amount of existing old forest in the harvest land base of all four alternatives, and would harvest the lowest percentage of existing old forest in the harvest land base of all four alternatives. See *Table 151 (Outcome of existing old forest by 2106 by alternative)*. The harvest of existing old forest under the No Action Alternative would be offset by the development of far more additional structurally complex forest. The overall function of the structurally complex forests would improve under the No Action Alternative, because:

- the majority of existing old forest (86%) would remain unharvested and would continue to develop into older structurally complex forests;
- an even greater percentage (90%) of the oldest of these forests (existing very old forest) would remain unharvested and continue to develop;
- approximately 15 times the acreage of existing old forest that would be harvested would develop into new structurally complex forest by 2106; and
- the size and connectivity of the mature&structurally complex forest patches would increase from the current condition in all provinces, except Eastern Cascades. See the *Ecological Conditions on the BLM-administered Lands at the Province Scale* section later in the *Ecology* section of this chapter.

Alternative 1 would increase the abundance of the structurally complex forests more than Alternatives 2 or 3 but less than the No Action Alternative. Under Alternative 1, the structurally complex forests would be almost entirely restricted to the nonharvest land base in 100 years. Alternative 1 would harvest more existing old forest than the No Action Alternative, but less than Alternatives 2 and 3. See *Table 151 (Outcome of existing old forest by 2106 by alternative)*. The harvesting of 88,800 acres of existing old forest under Alternative 1 would be offset by the development of additional structurally complex forest for a net increase of 370,000 acres by 2106. The overall function of the structurally complex forests would improve under Alternative 1 (though less so than the No Action Alternative) because:

- the majority of existing old forest (75%) would remain unharvested and would continue to develop into older structurally complex forests;

- an even greater percentage (90%) of the oldest of these forests (existing very old forest) would remain unharvested and continue to develop;
- approximately six times the acreage of existing old forest that would be harvested would develop into new structurally complex forest by 2106; and
- the size and connectivity of the mature&structurally complex forest patches would increase from the current condition in the Coast Range province. Size and connectivity would decrease in other provinces, but less than under the other action alternatives. See the *Ecological Conditions on the BLM-administered Lands at the Province Scale* section later in the *Ecology* section of this chapter.

Under Alternative 2, the abundance of the structurally complex forests would slightly decrease in the first 50 years and eventually increase in abundance in 100 years. As under Alternative 1, the structurally complex forests would be almost entirely restricted to the nonharvest land base in 100 years. Alternative 2 would harvest more existing old forest than the No Action Alternative or Alternative 1, but less than Alternative 3. See *Table 151 (Outcome of existing old forest by 2106 by alternative)*. Of the existing old forest, 57% would be allocated to the nonharvest land base (compared to 83% for the No Action Alternative, 74% for Alternative 1, and 52% for Alternative 3). The harvesting of 152,400 acres of existing old forest under Alternative 1 would be offset by the development of additional structurally complex forest and the abundance of the structurally complex forest would remain almost constant for the first 50 years with an eventual net increase of 210,100 acres by 2106. The overall function of the structurally complex forests would increase in some aspects under Alternative 2 (though less so than the No Action Alternative and Alternative 1), and decrease in other aspects because:

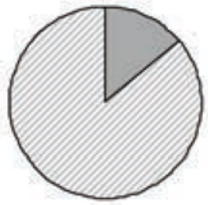
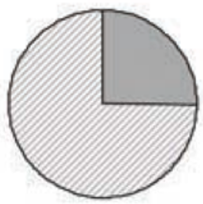
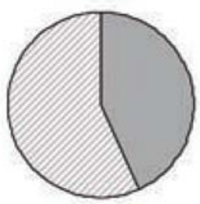
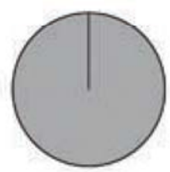
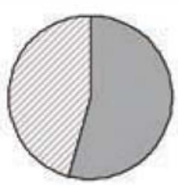
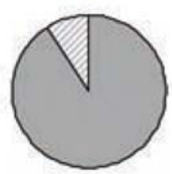
- the majority of existing old forest (57%) would remain unharvested and would continue to develop into older structurally complex forests;
- a greater percentage (76%) of the oldest of these forests (existing very old forest, which are the stands that are 400 years or older in the current inventory) would remain unharvested and continue to develop;
- slightly more acres of the existing old forest that would be harvested would develop into new structurally complex forest by 2106; and
- the size of the mature&structurally complex forest patches would decrease from the current condition in all provinces, and the connectivity of the mature&structurally complex forests would decrease in all provinces, except the Coast Range province. See the *Ecological Conditions on the BLM-administered Lands at the Province Scale* section later in the *Ecology* section of this chapter.

Alternative 3 would result in the lowest acreage of the structurally complex forests of any alternative. Under Alternative 3, the amount of the structurally complex forests would decrease slightly over the first 50 years, and then eventually increase slightly from current levels. The harvesting of the structurally complex forests (including partial harvesting) would be roughly balanced by the development of additional structurally complex forest, which would result in a fluctuating total abundance over time. Alternative 3 would harvest more of the existing old forest than any other alternative. See *Table 151 (Outcome of existing old forest by 2106 by alternative)*. Alternative 3 would allocate the largest amount of the existing old forest to the harvest land base of any alternative. The harvesting of 220,000 acres of existing old forest under Alternative 3 would be offset by the development of additional structurally complex forest, but less so than other alternatives with a net increase of 122,000 acres by 2106. The overall function of the structurally complex forests would decrease from the current condition under Alternative 3, because:

- the majority of existing old forest (63%) would be harvested within 100 years;
- the majority (68%) of the oldest of these forests (existing very old forest, which are stands that are 400 years or older in the current inventory) would be harvested within 100 years;
- the total abundance of the structurally complex forest would decline slightly for the first 50 years; and
- the size and connectivity of the mature&structurally complex forest patches would decrease from the current condition in all provinces. See the *Ecological Conditions on the BLM-administered Lands at the Province Scale* section later in the *Ecology* section of this chapter.

In 100 years, the amount of the structurally complex forest on the BLM-administered lands would be approximately equal to the average historic condition under the No Action Alternative, and below the average historic condition under the three action alternatives.

Table 151. Outcome of existing old forest by 2106 by alternative

	All Land Use Allocations (% of Existing Old Forest harvested)	Harvest Land Base only (% of Existing Old Forest harvested)
No Action	 48,700 acres (14%)	 (83%)
Alternative 1	 88,800 acres (25%)	 (96%)
Alternative 2	 152,400 acres (43%)	 (100%)
Alternative 3	 220,000 acres (63%)	 (91%)
unharvested  harvested		

Note: The harvest Land Base graphs are sized approximately to reflect total acreage.

There is inadequate information to quantify the abundance of hardwood stands. See the *Ecology* section in *Chapter 3*. Furthermore, there is inadequate information about hardwood stand development, especially red alder stands, to model future stand development and transition to mixed or conifer-dominated stands. Some researchers have hypothesized that riparian red alder stands might develop into shrub-dominated areas (especially salmonberry) where conifer tree regeneration is absent (Deal 2006; Harrington 2006; Hibbs and Bower 2001). Empirical evidence for this successional pathway is generally lacking, and this successional development is most likely possible only for small patches rather than entire stands. The likely successional pathway for red alder stands in the Coast Range is to eventually develop into mixed or conifer-dominated stands (western hemlock, western red-cedar, and Douglas fir). This development into conifer stands would be accelerated where hardwood conversion actions would be implemented, but the rate of this successional development is unknown. Therefore, it is most likely that the riparian and upland hardwood stands would develop into mixed or conifer-dominated stands, except:

- where natural disturbances maintain hardwoods,
- where special management in special habitats outside of the harvest land base would be applied to maintain hardwoods, or
- where site conditions preclude succession to a conifer forest.

As a result, hardwood forest abundance would decline under all four alternatives. In addition, none of the alternatives would create additional hardwood stands because of the limited disturbance of the nonharvest land base and the intensive silvicultural practices to reestablish conifers following disturbances in the harvest land base.

Ecological Conditions on the BLM-Administered Lands by Land Use Allocation

Harvest Land Base

In the harvest land base under all four alternatives, the abundance of stand establishment forests and mature forests would increase, and the abundance of young forests and structurally complex forests would decrease. The No Action Alternative and Alternative 3 would maintain 14% of the harvest land base in structurally complex forests in 100 years (compared to the current condition of 19%). Alternatives 1 and 2 would nearly eliminate the structurally complex forests in the harvest land base (compared to the current condition of 2% and 1%, respectively).

The combined abundance of the mature&structurally complex forests in the harvest land base would stay approximately constant under the No Action Alternative, decrease under Alternatives 1 and 2, and increase under Alternative 3. The analysis of terrestrial habitats in the Northwest Forest Plan FSEIS, on which the current RMPs of the No Action Alternative relied, analyzed the abundance and connectivity of late-successional and old-growth forests (which approximates mature&structurally complex forests in this analysis) based on the abundance and future development of forests in the nonharvest land base (FSEIS, 3&4:39-43, 3&4:238-241). That previous analysis did not account for the retention or development of late-successional and old-growth forests in the harvest land base. Nevertheless, the mature&structurally complex forest together would continue to constitute approximately half of the acres (289,000 acres) within the harvest land base over the next 100 years under the No Action Alternative. See *Figure 148 (Structural stage abundances on the forested lands in the harvest land base by alternative)*.

Alternatives 1 and 2 would result in a larger increase in the stand establishment forests and a larger decrease in the structurally complex forests in the harvest land base than the No Action Alternative because of:

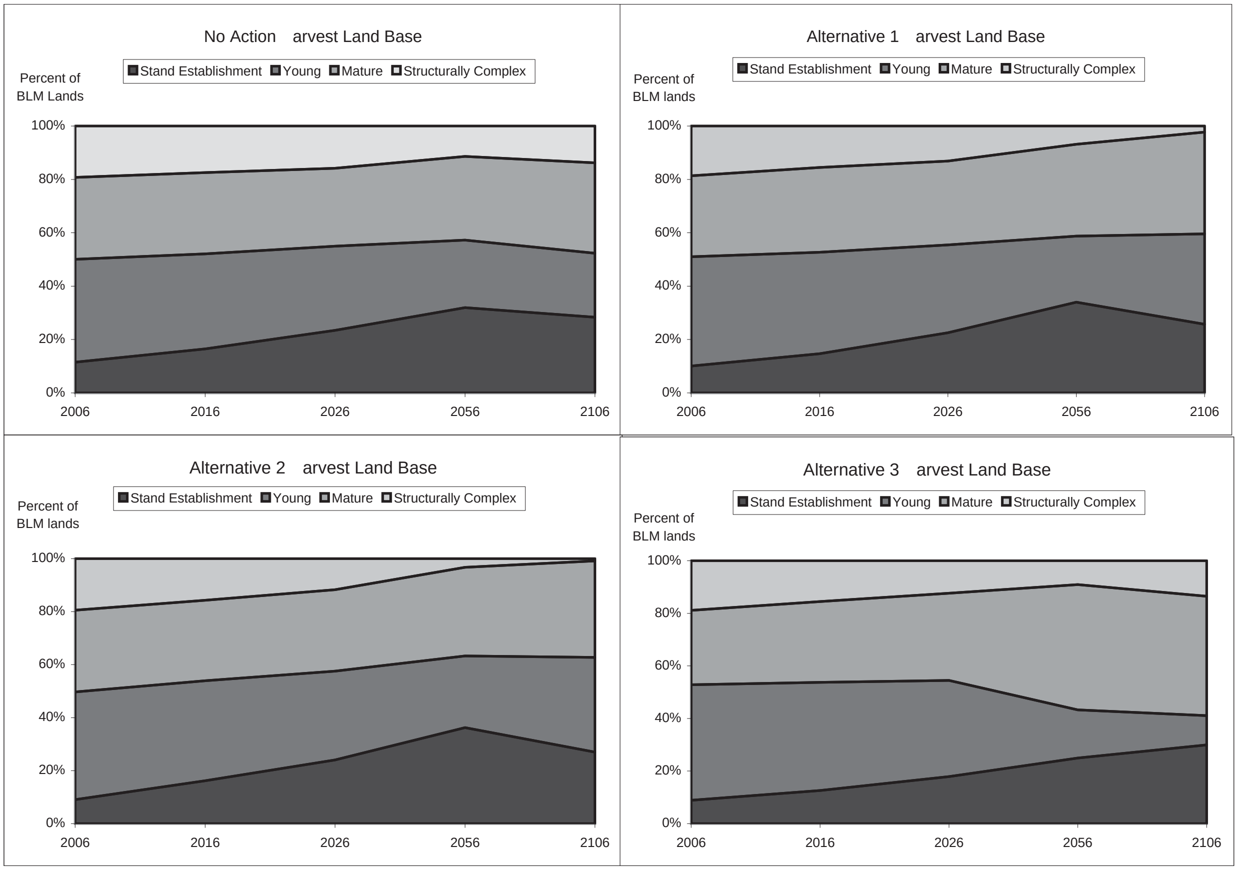
- **the higher regeneration harvest rate in the harvest land base than under the No Action Alternative.** Alternatives 1 and 2 do not have any of the standards and guidelines of the No Action Alternative that would constrain the harvesting of the structurally complex forests in the harvest land base.
- **the absence of green tree retention, which would slow the development of the structurally complex forests after harvesting.** Without green tree retention, stands would take almost twice as long to develop into structurally complex forest after regeneration harvesting.

These two factors would interact to decrease the abundance of the structurally complex forest in the harvest land base. The higher regeneration harvest rate combined with the slower development into structurally complex forests would increase the likelihood that a stand would be harvested before it would have time to develop into structurally complex forest. As a result, structurally complex forest would be almost eliminated from the harvest land base by 2106, even though the total acreage of the structurally complex forests across all land use allocations would increase under Alternatives 1 and 2.

The harvest land base under Alternative 3 would have the most stand establishment forest, the least young forest, and the most mature forest of any alternative. Alternative 3 would maintain the abundance of the structurally complex forest in the harvest land base similar to the No Action Alternative, even though Alternative 3 would harvest the most existing old forest of any alternative.

This analysis does not include estimates of future natural disturbances, but most natural disturbances in the harvest land base would have little effect on the abundance of the structural stages described here. Except in the most severe and extensive disturbances, salvaging of naturally disturbed stands would result in the same eventual effect on the overall structural stage abundances in the harvest land base as scheduled timber harvesting under all four alternatives.

Figure 148. Structural stage abundances on the forested lands in the harvest land base by alternative

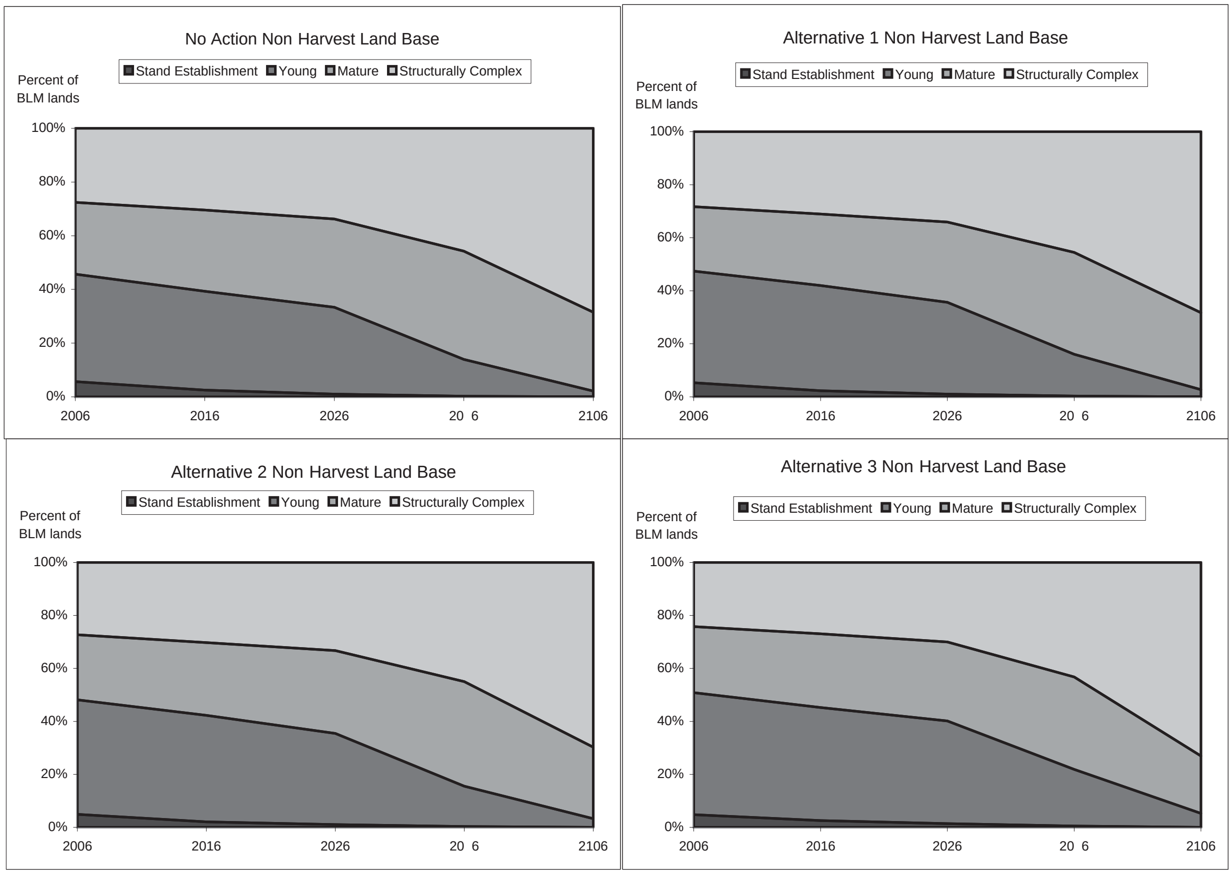


Nonharvest Land Base

The structural stage development within the nonharvest land base would be similar among all four alternatives, although the total acreage in the nonharvest land base would vary. The forest-capable portion of the nonharvest land base would become almost completely dominated by mature and structurally complex forest in 100 years. See *Figure 149 (Structural stage abundances on the forested lands in the nonharvest land base by alternative)*.

This analysis does not include estimates of future natural disturbances, but natural disturbances would increase the amount of stand establishment and young forests from the abundances described here. The Northwest Forest Plan FSEIS assumed that 2.5% of the late-successional forests in the late-successional reserves would be lost to wildfire each decade (NWFP FSEIS, 3&4:42). The rate of disturbance would likely be much lower on the BLM-administered lands because of the land ownership pattern and greater access for fire suppression.

Figure 149. Structural stage abundances on the forested lands in the nonharvest land base by alternative



Ecological Conditions on the BLM-Administered Lands at the Province Scale

The effects of the alternatives on the structural stage abundances and spatial patterns in the Coast Range, Western Cascades, and Klamath provinces generally reflect the structural stage abundances and spatial patterns described for the planning area as a whole. The effects of the alternatives in the Eastern Cascades province differs from the other provinces in many measures of the structural stage abundance and spatial pattern, in part because of the differing ecological conditions and management history. However, these different patterns have little effect on the overall pattern for the planning area, because the Eastern Cascades province makes up only 2% of the BLM-administered forest lands modeled within the planning area.

See *Figure 150*, *Figure 151*, and *Figure 152* on the next several pages.

Figure 150. Comparison of the structural stage abundances on the BLM-administered forested lands by 2106 with the current conditions and the average historic conditions by alternative by province

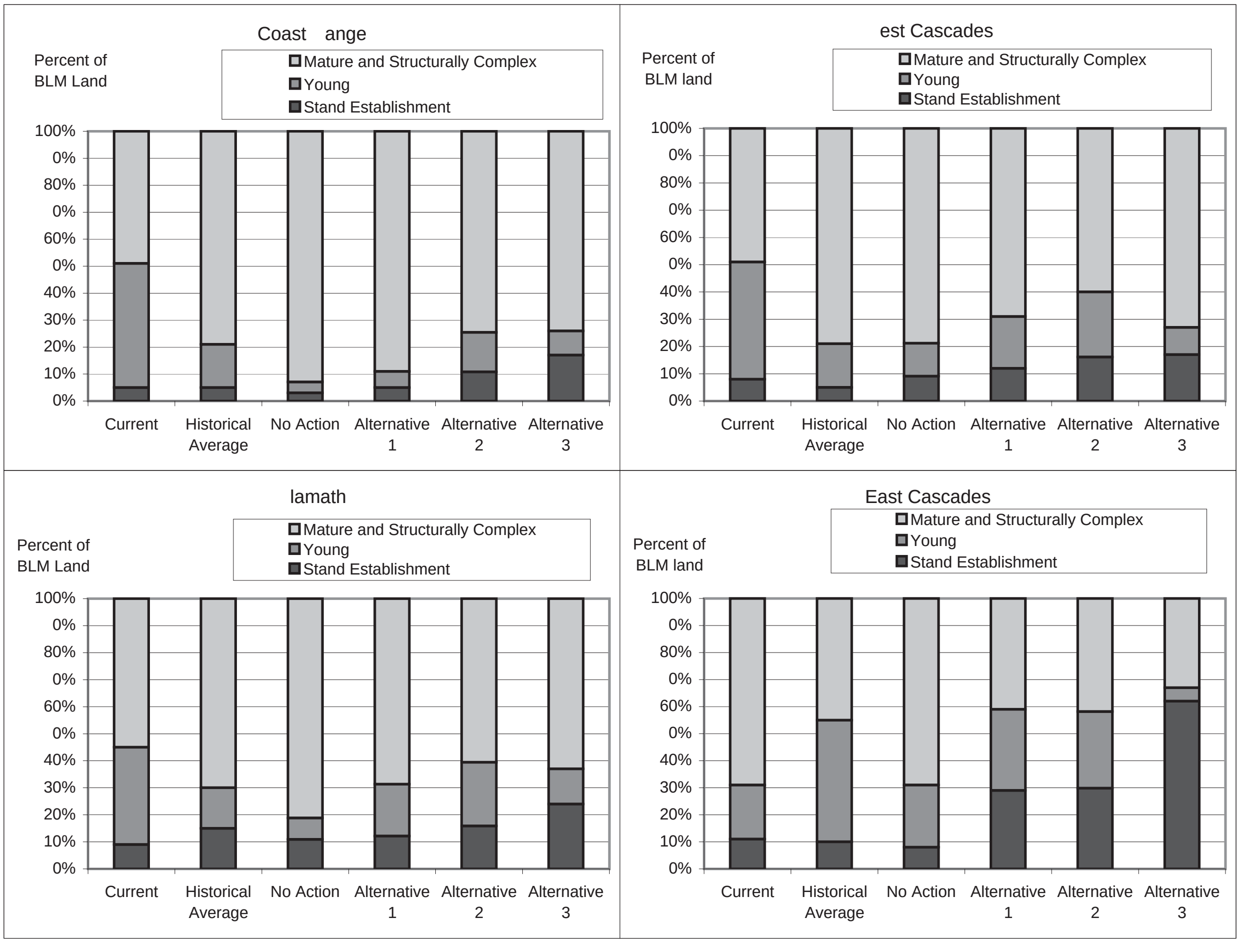


Figure 151. Change in the mean patch size from the current condition by 2106 by forest structural stage on the BLM-administered lands

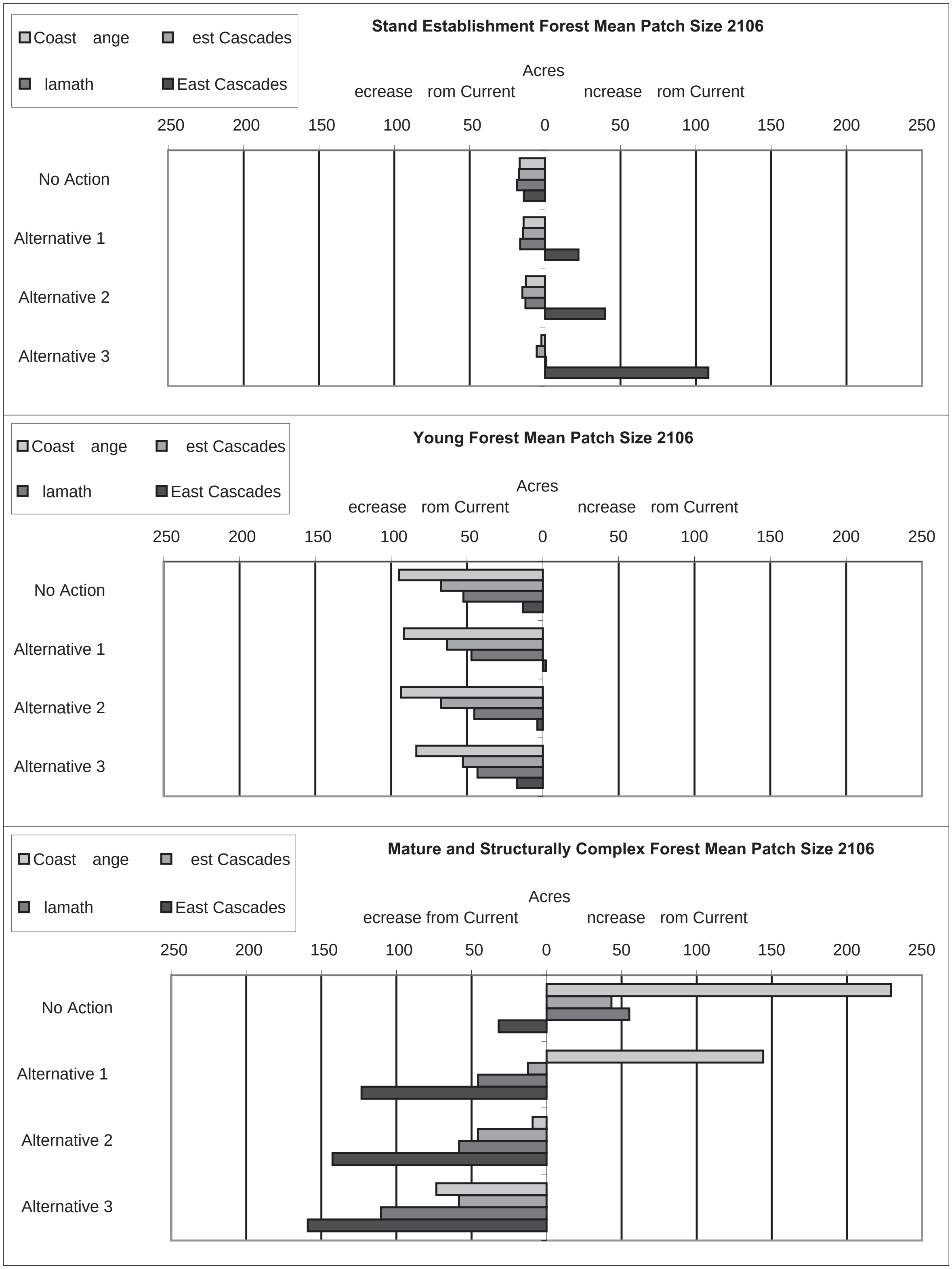
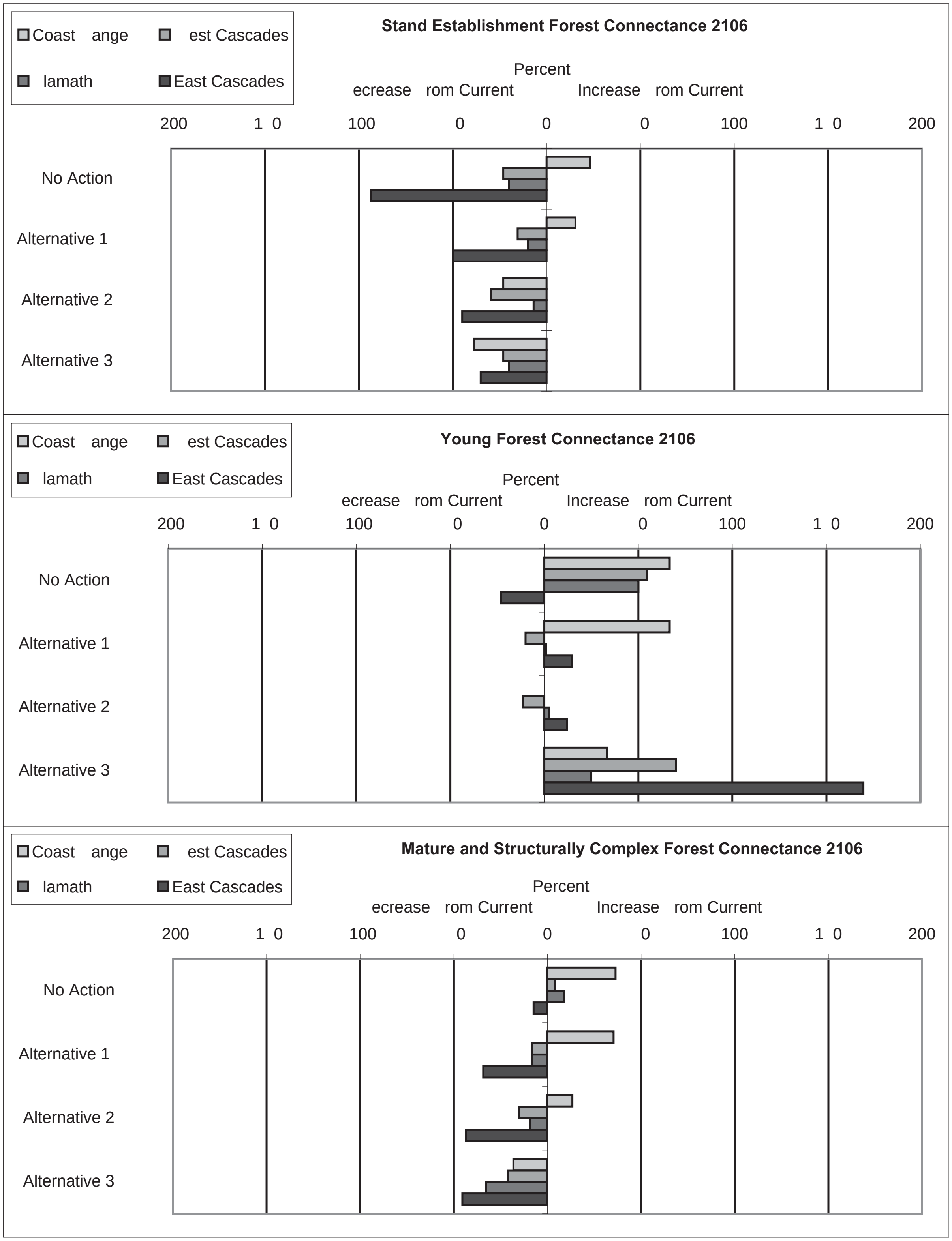


Figure 152. Change in the connectance from the current condition by 2106 by forest structural stage on the BLM-administered lands



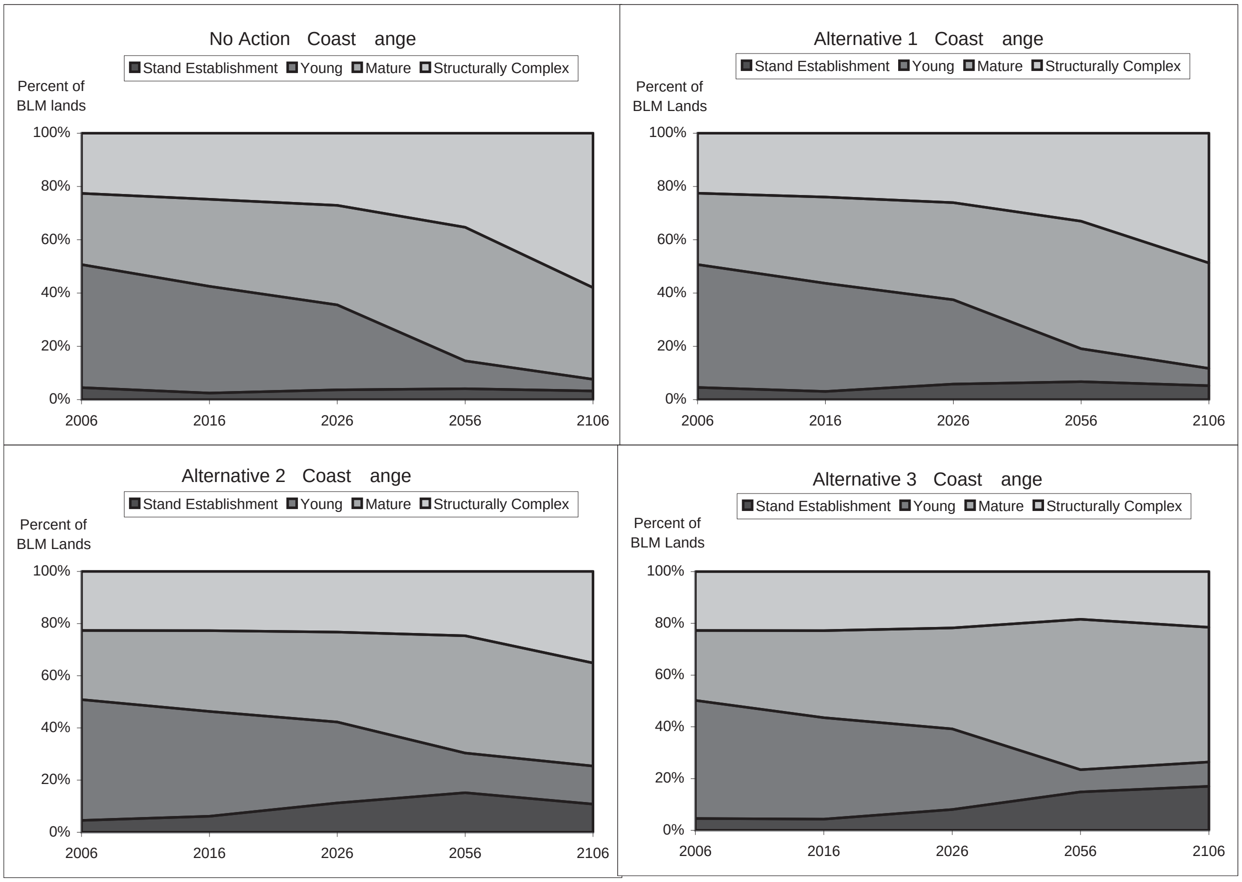
Coast Range Province

Under all four alternatives, the young forests would decrease and the mature forests would increase in abundance in the Coast Range province. See *Figure 153 (Structural stage abundances on the BLM-administered forested lands in the Coast Range province by alternative)*. In the No Action Alternative and Alternative 1, the stand establishment forests would remain approximately constant in abundance and the structurally complex forests would steadily increase to become the most abundant structural stage because of the predominance of the nonharvest land base in the Coast Range. Under the No Action Alternative and Alternative 1, very little of the existing old forest (less than 10% in 100 years) would be harvested in the Coast Range province. Alternative 2 would allocate a larger harvest land base in the Coast Range province than the No Action Alternative or Alternative 1, and consequently would increase the abundance of the stand establishment forests and maintain the abundance of the structurally complex forests approximately constant for the first 50 years. Alternative 3 would allocate an even larger harvest land base in the Coast Range province than Alternative 2, and consequently would increase the abundance of the stand establishment forests more than any other alternative and would slightly decrease the abundance of the structurally complex forests. Alternative 3 would harvest the majority of the existing old forest (69% in 100 years) in the Coast Range province.

In 100 years, the No Action Alternative and Alternative 1 would result in less young forest and more mature&structurally complex forest than the average historic condition[4]. See *Figure 150 (Comparison of the structural stage abundances on the BLM-administered forested lands by 2106 with the current conditions and the average historic conditions by alternative by province)*. Alternative 2 would result in a structural stage abundance that is approximately similar to the average historic condition in the Coast Range province in 100 years with slightly more stand establishment forest and slightly less mature&structurally complex forest. Alternative 3 would result in more stand establishment forest, less young forest, and slightly less mature&structurally complex forest than the average historic condition in the Coast Range province in 100 years.

[4] Note that for this analysis, the mature and structurally complex forests are combined because of the limitations in the description of the average historic conditions.

Figure 153. Structural stage abundances on the BLM-administered forested lands in the Coast Range province by alternative



All four alternatives would result in smaller patches of stand establishment forest and young forest in the Coast Range province as shown in *Figure 151*. The No Action Alternative would result in the most decrease in the size of stand establishment patches, and Alternative 3 would result in the least decrease, which is consistent with the changes in the overall structural stage abundances. All four alternatives would result in mean patch size of stand establishment and young forests that would be far below the average historic condition. Although a direct comparison of these results is problematic (see the *Ecology* section in *Chapter 3*), Nonaka and Spies (2005) reported historic mean patch sizes of stand establishment forest and young forest ranging from 183 to 264 acres, which is 10 to 20 times larger than the alternatives.

The No Action Alternative and Alternative 1 would increase the size and connectivity of the mature&structurally complex forest patches on the BLM-administered lands over the next 100 years in the Coast Range province. See *Figure 151* and *Figure 152*. Over the next 100 years, the No Action Alternative and Alternative 1 would create larger patches of mature&structurally complex forest with more interior habitat than the current condition (see *Appendix B-Ecology*). Alternative 2 would slightly decrease the size of the mature&structurally complex forest patches and increase the connectivity from the current condition in the Coast Range province. Alternative 3 would decrease both the size and connectivity of the mature&structurally complex forest patches. Alternative 3 would move the spatial pattern of the mature&structurally complex forest further away from the historic conditions, which is consistent with the research that concluded that the restoration of historic wildfire would move the Coast Range province further away from the historic range of variability over the next 100 years (Nonaka and Spies 2005).

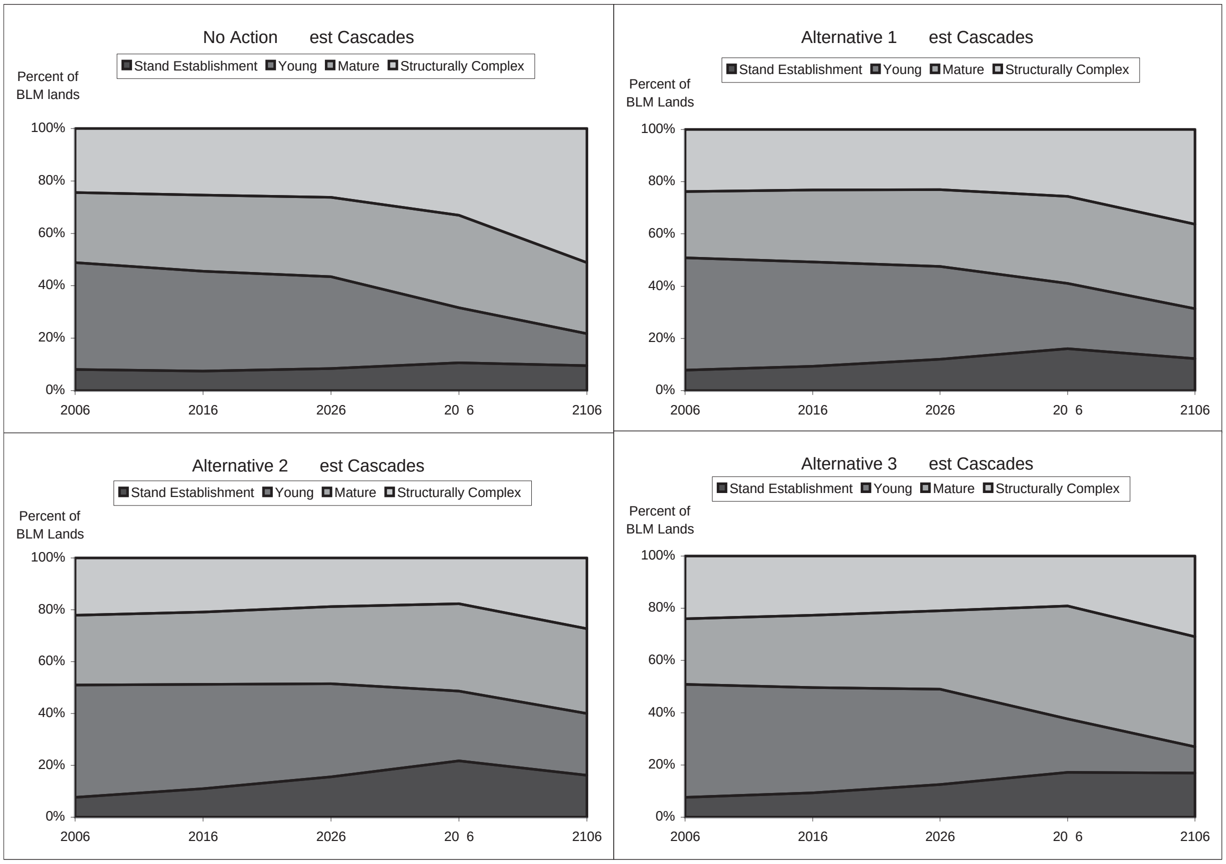
The increase in the mean patch size for the mature&structurally complex forests under the No Action Alternative and Alternative 1 would be comparable to the estimates of the average historic mature forest patch size (Nonaka and Spies 2005). In their modeling of the average historic spatial patterns in the Coast Range province, Nonaka and Spies reported the mean patch size of the mature forests as 272 acres, which is compared to a current mean patch size of 84 acres across all ownerships. From this analysis, the current mean patch size of the mature&structurally complex forest on the BLM-administered lands in the Coast Range province is currently 110.8 acres and would increase to 255.1 acres under Alternative 1 and 340.2 acres under the No Action Alternative.

Western Cascades Province

The structural stage abundance in the Western Cascades province would show the overall changes similar to the Coast Range province. See *Figure 154 (Structural stage abundances on the BLM-administered forested lands in the Western Cascades province by alternative)*. The difference among the alternatives would be less pronounced than in the Coast Range province, because the No Action Alternative and Alternative 1 would allocate a larger portion of the BLM-administered lands in the Western Cascades to the harvest land base than in the Coast Range province.

In 100 years, the No Action Alternative would result in a structural stage abundance that is approximately similar to the average historic condition in the Western Cascades with slightly more stand establishment forest and slightly less young forest. See *Figure 150 (Comparison of the structural stage abundances on the BLM-administered forested lands by 2106 with the current conditions and the average historic conditions by alternative by province)*. Alternatives 1 and 2 would result in more stand establishment forest, more young forest, and less mature&structurally complex forest than the average historic condition in the Western Cascades in 100 years. Alternative 3 would result in more stand establishment forest, less young forest, and less mature&structurally complex forest than the average historic condition in the Western Cascades in 100 years.

Figure 154. Structural stage abundances on the BLM-administered forested lands in the Western Cascades province by alternative



Most of the changes in the spatial patterns in the Western Cascades province under the alternatives would be similar to the changes in the Coast Range province, although the changes from the current condition and the differences among the alternatives would be less pronounced for all measures of spatial pattern. See *Figures 151* and *152*. The No Action Alternative is the only alternative that would increase the size and connectivity of the mature&structurally complex forest patches from the current condition in the Western Cascades province. Alternative 1 would slightly decrease the size and connectivity in the mature&structurally complex forest patches. Alternative 2 would have a larger decrease. And Alternative 3 would have the largest decrease in size and connectivity. There are no detailed studies of the historic spatial pattern in the Western Cascades province comparable to those in the Coast Range province. However, studies of fire frequency and extent suggest that the historic spatial pattern would have been larger and more connected mature&structurally complex forest patches than the current condition (Weisberg and Swanson 2003; Cissel et al. 1999). Therefore, the three action alternatives would move the spatial pattern of the mature&structurally complex forest further away from the historic conditions in the Western Cascades province.

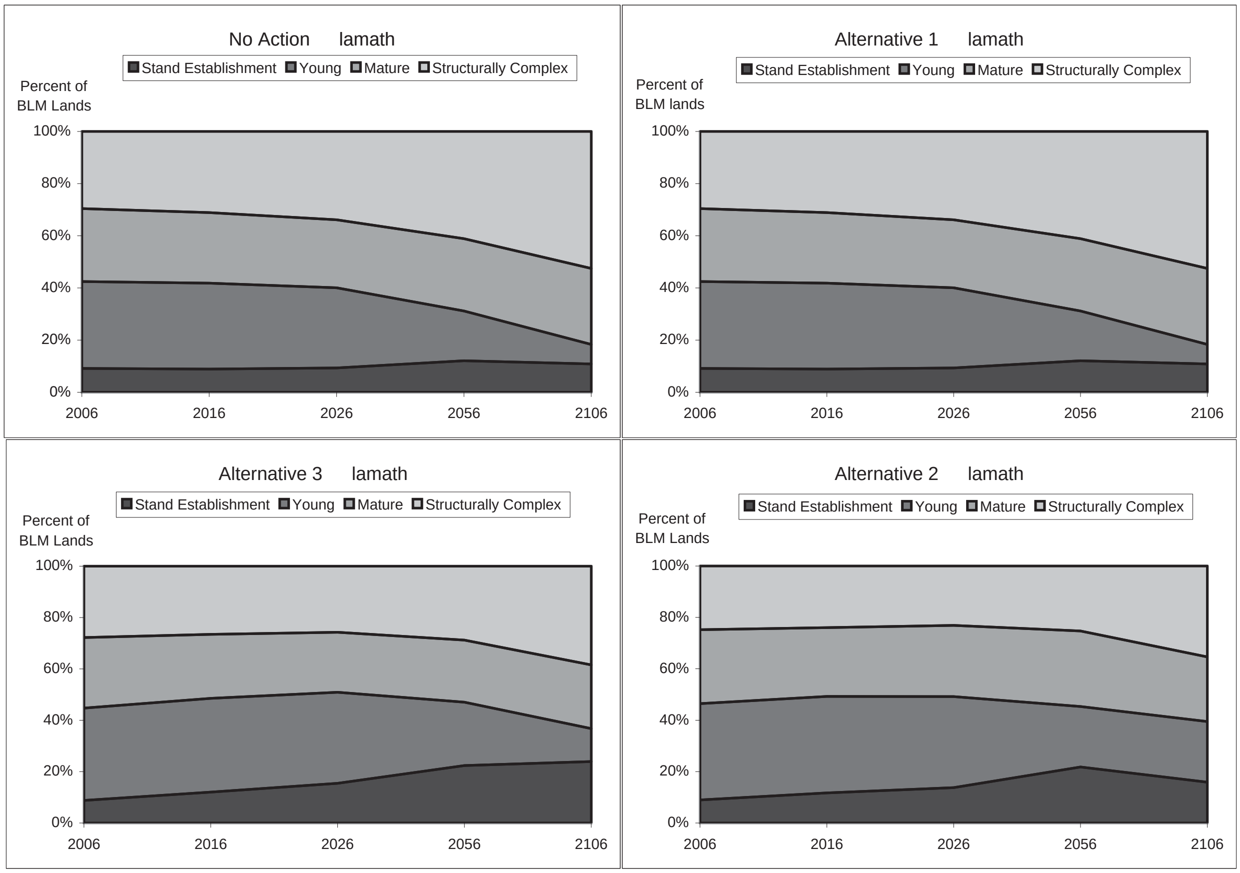
Klamath Province

The structural stage abundance in the Klamath province would show the overall changes similar to the Coast Range and Western Cascades provinces, although the mature forest would remain approximately constant in abundance under the No Action Alternative and decrease slightly under Alternative 3. See *Figure 155 (Structural stage abundances on the BLM-administered forested lands in the Klamath province by alternative)*. The difference among the alternatives in the Klamath province would be less pronounced than in the Coast Range province, because the No Action Alternative and Alternative 1 would allocate a larger portion of the Klamath province to the harvest land base than in the Coast Range province.

In 100 years, the No Action Alternative would result in less stand establishment forest, less young forest, and more mature&structurally complex forest than the average historic condition in the Klamath province. See *Figure 150 (Comparison of the structural stage abundances on the BLM-administered forested lands by 2106 with the current conditions and the average historic conditions by alternative by province)*. Alternative 1 would result in less stand establishment forest and more young forest than the average historic condition in the Klamath province in 100 years. Alternative 2 would result in more young forest and less mature&structurally complex forest than the average historic condition in the Klamath province in 100 years. Alternative 3 would result in more stand establishment forest and less mature&structurally complex forest than the average historic condition in the Klamath province in 100 years.

This analysis does not include the estimates of future natural disturbances, but natural disturbances would be more likely to alter the structural stage abundances in the nonharvest land base in the Klamath province than in the Coast Range or Western Cascades provinces. The predominant high fire frequency regime and the effects of past fire suppression increase the likelihood that wildfires would increase the amount of stand establishment and young forests in the nonharvest land base from the abundances described here. However, there remains inadequate information to estimate the acreage, location, timing, severity, and extent of such disturbances.

Figure 155. Structural stage abundances on the BLM-administered forested lands in the Klamath province by alternative



The No Action Alternative, Alternative 1, and Alternative 2 would result in more smaller patches of stand establishment and young forests in the Klamath province. See *Figure 151 (Change in the mean patch size from the current condition by 2106 by forest structural stage on the BLM-administered lands)*. Alternative 3 would create more stand establishment patches with little change in the mean patch size, which is consistent with the overall increase in the abundance of stand establishment forest. As in the Western Cascades province, the three action alternatives would decrease the size and connectivity of the mature&structurally complex forest patches compared to the current condition—Alternative 1 would result in the least decrease, and Alternative 3 would result in the most decrease. See *Figures 150* and *151*. There are no detailed studies of the historic spatial pattern in the Klamath province to compare these results to. The historic spatial patterns was likely more variable than in the Coast Range or Western Cascades provinces because of the complex interaction of highly variable geology and climate with the highly variable disturbance regimes (Taylor and Skinner 2003; Frost and Sweeney 2000).

Eastern Cascades Province

The structural stage abundances in the Eastern Cascades province would differ from the other provinces and would differ strongly among the alternatives. See *Figure 156 (Structural stage abundances on the BLM-administered forested lands in the Eastern Cascades province by alternative)*.

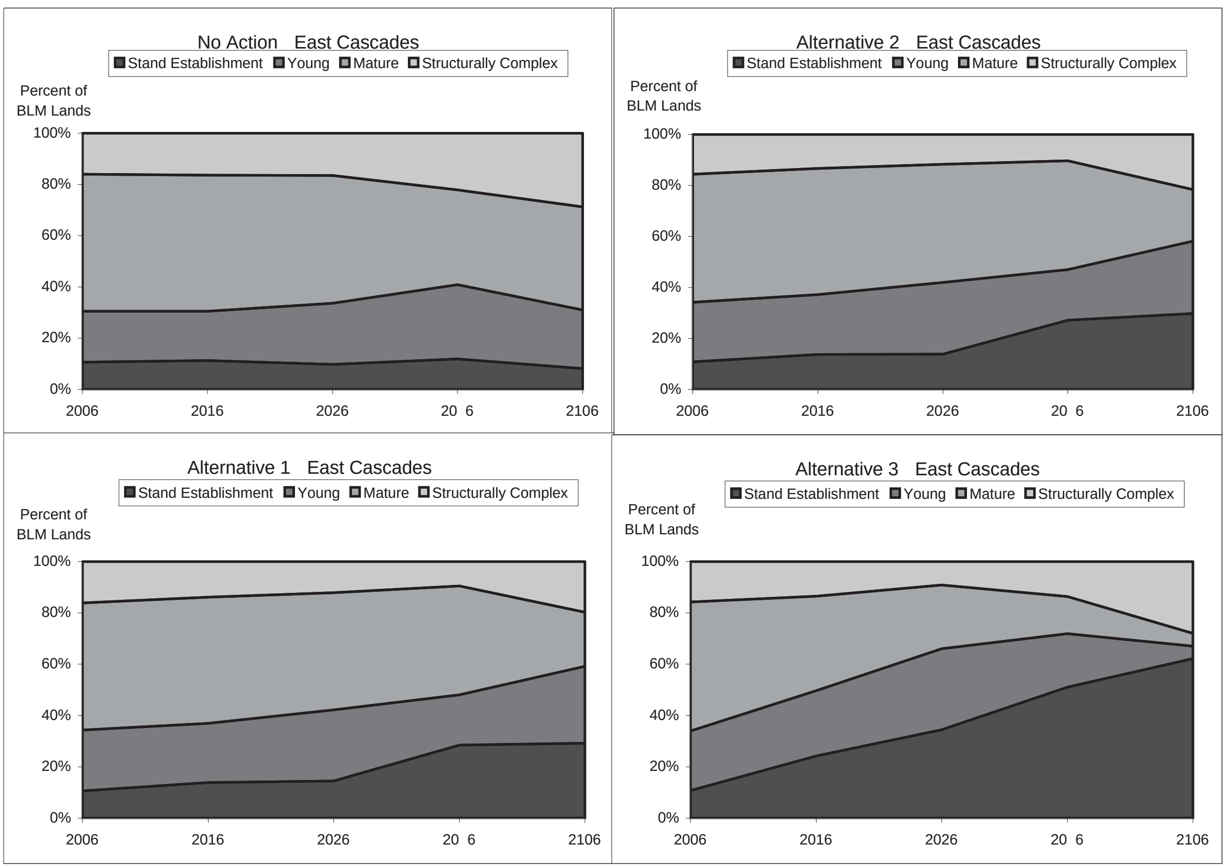
Under the No Action Alternative, the structural stage abundances in the Eastern Cascades province would fluctuate, but remain approximately constant. The patterns in the Eastern Cascades province would differ from the other provinces under the No Action Alternative because of the absence of the late-successional reserves and the small acreage of the riparian reserves in the Eastern Cascades province. The acreage of the riparian reserves in the Eastern Cascades province is small because 69% of the BLM-administered forested acres in the Eastern Cascades province would be in the harvest land base as compared to the planning area average of 26%. Alternatives 1 and 2 would allocate similar acreage amounts to the harvest land base and consequently would show similar structural stage abundance—increasing the stand establishment forests and decreasing the mature forests over the next 100 years. The structural stage abundance under Alternative 3 in the Eastern Cascades would show a pattern different than the other alternatives and different than Alternative 3 in the other provinces—increasing the stand establishment forest to become the most abundant structural stage and decreasing the young forest and mature forest. The uneven-aged management of the Eastern Cascades province under Alternative 3 would repeatedly reset stands to the stand establishment with structural legacies forest structural stage, which would limit or preclude the development into mature forest.

In 100 years, none of the alternatives would result in structural stage abundances that are similar to the average historic condition in the Eastern Cascades. See *Figure 150 (Comparison of the structural stage abundances on the BLM-administered forested lands by 2106 with the current conditions and the average historic conditions by alternative by province)*. The No Action Alternative would result in less young forest and more mature&structurally complex forest than the average historic condition in the Eastern Cascades province in 100 years. Alternatives 1 and 2 would result in more stand establishment forest and less young forest. Alternative 3 would result in a structural stage abundance that would be the most different from the average historic condition of all four alternatives—more stand establishment forest, less young forest, and less mature&structurally complex forest.

The classification of the forest structural stages in the Eastern Cascades province and the characterization of the average historic condition is more challenging than in any other province. The effect of partial harvesting under Alternative 3 would reset stands to stand establishment forest, which likely overestimates the abundance of the stand establishment forests compared to the average historic condition. See the *Ecology* section in *Chapter 3*.

As in the Klamath province, natural disturbances would be more likely to alter the structural stage abundances in the nonharvest land base in the Eastern Cascades province than in the Coast Range or Western Cascades. The predominant high fire frequency regime and the effects of past fire suppression increase the likelihood that wildfires would increase the amount of the stand establishment and young forests in the nonharvest land base from the abundances described here. However, there remains inadequate information to estimate the acreage, location, timing, severity, and extent of such disturbances.

Figure 156. Structural stage abundances on the BLM-administered forested lands in the Eastern Cascades province by alternative



The No Action Alternative would decrease the size of the stand establishment forest patches in the Eastern Cascades province, and the three action alternatives would increase the size of the stand establishment forest patches, which is consistent with the changes in the overall structural stage abundance. See *Figure 151 (Change in the mean patch size from the current condition by 2106 by forest structural stage on the BLM-administered lands)*.

All four alternatives would result in only slight changes in the size of young forest patches compared to the current condition. The No Action Alternative,

Alternative 2, and Alternative 3 would slightly decrease the size of the young forest patches, and Alternatives 1 would slightly increase the size of young forest patches.

All four alternatives would decrease the size and connectivity of the mature&structurally complex forest patches in the Eastern Cascades province. See *Figures 151* and *152.* The No Action Alternative would result in the least decrease, and Alternative 3 would result in the most decrease. There are no studies of historic spatial pattern to compare to these results. However, the historic spatial pattern in the Eastern Cascades likely differed from other provinces within the planning area because of the prevalence of a low-severity/high-frequency fire regime that would have produced a fine-grained mosaic of the forest structural stages (Frost and Sweeney 2000).

Subalternatives and Reference Analyses

Alternative 1 Subalternative: No Harvesting of Stands 80 years of age and older

This subalternative would decrease the amount of the stand establishment and young forests, and increase the amount of mature and structurally complex forests from the current condition. See *Figure 157 (Structural stage abundances of the subalternatives and the reference analyses as a percentage of the BLM-administered forested lands by 2106)* and *Table 152 (Structural stage abundances of the subalternatives and the reference analyses as a percentage of the BLM-administered forested lands by 2106)*. Without the timber harvesting of stands that are 80 years of age and older, the stand establishment and young forests would decline in abundance. Similarly to the no harvest reference analysis, the no harvesting of stands that are 80 years of age and older subalternative would result in the BLM-administered lands almost completely being dominated by the mature and structurally complex forests. The structural stage abundances under this subalternative would be more similar to the no harvesting reference analysis than Alternative 1. Like the no harvesting reference analysis, the no harvesting of stands that are 80 years of age and older subalternative would result in less stand establishment and young forests and more mature&structurally complex forests than the average historic condition.

Alternative 1 Subalternative: No Harvesting of Stands 200 years of age and older

This subalternative would increase the amount of stand establishment forests, decrease the amount of young forests, maintain the amount of mature forests, and increase the amount of the structurally complex forests compared to the current condition. See *Figure 157 (Structural stage abundances of the subalternatives* *and the reference analyses as a percentage of the BLM-administered forested lands by 2106)* and *Table 152 (Structural stage abundances of the subalternatives and the reference analyses as a percentage of the BLM-administered forested lands by 2106)*. The structural stage abundances under this subalternative would be more similar to Alternative 1 than the no harvesting reference analysis or the no harvesting of stands that are 80 years of age and older subalternative. This subalternative would result in more stand establishment forests, less young forests, more mature forests, and less structurally complex forests than the average historic condition.

No Harvesting Reference Analysis

Without any timber harvesting on the BLM-administered lands, the stand establishment forests would completely disappear and the young forests would almost completely disappear from the BLM-administered lands by 2106. See *Figure 157 (Structural stage abundances of the subalternatives and the reference analyses as a percentage of the BLM-administered forested lands by 2106)* and *Table 152 (Structural stage abundances of the subalternatives and the reference analyses as a percentage of the BLM-administered forested lands by 2106)*. The mature and structurally complex forests would increase to occupy almost all the BLM-administered lands. This would result in less stand establishment and young forests and more mature and structurally complex forests on the BLM-administered lands than the average historic condition. Because the mature&structurally complex forests would occupy almost all the BLM-administered lands, the size and connectivity would increase in all provinces and far more than any alternative. See *Appendix B, Ecology*.

This analysis does not include the estimates of future natural disturbances, but natural disturbances would increase the amount of the stand establishment and young forests from the abundances described here. The Northwest Forest Plan FSEIS assumed that 2.5% of the late-successional forests in the late-successional reserves would be lost to wildfires each decade (USDA, USDI 1994b, 3&4:42). The rate of disturbance would likely be much lower on the BLM-administered lands because of the land ownership pattern and the greater access for fire suppression.

Across all ownerships, no timber harvesting on the BLM-administered lands, combined with the effect of the management on other lands, would result in a decrease in the stand establishment forests and young forests from the current condition and an increase in the mature&structurally complex forests, as in all four alternatives and the subalternatives described in this section. These changes would move the landscape in the direction of the historic average conditions. However, the structural stage abundances across all ownerships would not reach the average historic conditions in 100 years. The stand establishment forests would remain above the average historic condition and the mature&structurally complex forests would remain below the average historic condition, as they would in all four alternatives. See *Figure 158 (Comparison of all ownerships by 2106 with average historic conditions and current conditions by alternative)*.

Intensive Management on Most Commercial Timber Lands Reference Analysis

This reference analysis would result in more stand establishment forests, more young forests, and less structurally complex forests than any alternative. The structurally complex forests would be restricted almost entirely to the nonharvest land base, which would comprise 18% of the BLM-administered lands (compared to 40% under Alternative 3, which is the lowest of the alternatives). Although the mature forests would continue to comprise 33% of the BLM-administered lands, the majority (80%) would be mature with single canopy forests (far higher than any other alternative). See *Figure 147 (Mature forest with multilayered canopies or single canopies by alternative)* earlier in this section. This reference analysis would result in more stand establishment forests, more young forests, more mature forests, and less structurally complex forests than the average historic condition.

Figure 157. Structural stage abundances of the subalternatives and the reference analyses as a percentage of the BLM-administered forested lands by 2106

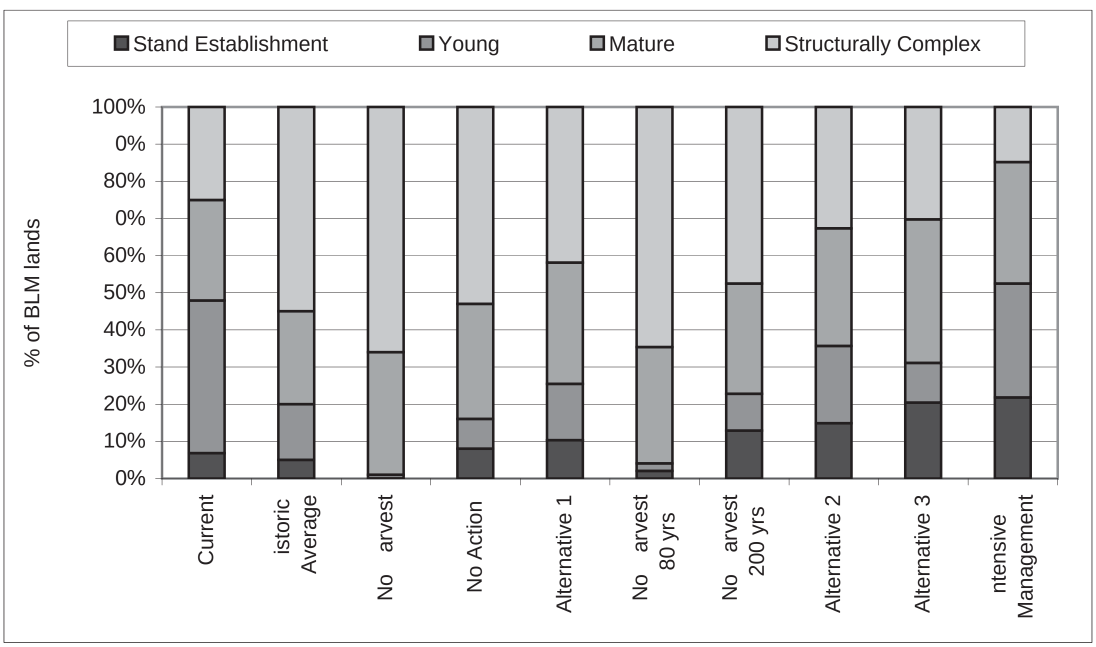


Table 152. Structural stage abundances of the subalternatives and the reference analyses as a percentage of the BLM-administered forested lands by 2106

Alternatives, Subalternatives, and Reference Analyses	Forest Structural Stages			
	Stand Establishment	Young	Mature	Structurally Complex
Average Historic Conditions	**5**	**15**	**25**	**55**
No Action Alternative	8	8	31	53
Alternative 1	10	15	33	42
Alternative 2	15	21	32	33
Alternative 3	20	11	39	30
Alternative 1 Subalternative: No harvesting of stands older than 80 years	2	2	31	64
Alternative 1 Subalternative: No harvesting of stands older than 200 years	13	10	30	48
Reference Analysis: No harvesting	0	1	33	66
Reference Analysis: Intensive management on most commercial timber lands	22	31	33	15

Note: Some percentages do not add up to 100 because of rounding.

Ecological Conditions across All Ownerships

The structural stages for all lands other than the BLM-administered lands were classified using IVMP data (see the *Ecology* section in *Chapter 3*). The IVMP data, however, only describes the current conditions. The BLM-administered lands are classified for both the current and future conditions based on modeling outputs rather than IVMP data. The modeling outputs provide the only available data on the future conditions under the different alternatives. It is not possible to conduct comparable modeling of future conditions on lands other than the BLM-administered lands. Therefore, the analysis relies on simple assumptions about the future conditions on other lands. The analysis assumes that all forest-capable lands in the U.S. Forest Service late-successional reserves, administratively withdrawn, and congressionally reserved lands would develop through the structural stages by the following progression:

- By 2016, all stand establishment forests would become young forests.
- By 2056, all young forests that were young forests by 2006 would become mature&structurally complex forests.
- By 2106, all young forests that were stand establishment forests by 2006 would become mature&structurally complex forests.

The analysis assumes that all other lands would maintain their current abundances and spatial patterns. These broad assumptions are acknowledged to be inaccurate. There is inadequate information, however, to make more accurate assumptions. The assumption about the U.S. Forest Service reserves does not account for natural disturbances (similar to the modeling of the BLM-administered lands) or the slow structural development on poor sites. The assumption on other lands overestimates harvesting on the U.S. Forest Service harvest base lands, does not account for riparian reserves, and overestimates harvesting on state lands. The prediction of harvesting practices on private lands would be complex and largely speculative (Kennedy and Spies 2005; Nonaka and Spies 2005). Nevertheless, the broad assumptions here are sufficient to evaluate the relative effect of the different BLM management actions on the structural stage abundances and spatial patterns across all ownerships.

The value of the analysis across all ownerships is in the relative results that compare the future conditions under the different alternatives. Absolute results from the abundance and spatial analysis should be interpreted with great caution. The measurements of spatial patterns are strongly influenced by:

- the definition of the elements of the analysis (e.g., the landscape boundaries):
- the scale the spatial analysis;
- the definition of patch types; and
- the basis for delineating patches.

In addition, this analysis integrates two different data sources to construct the landscape for the analysis—modeling outputs for the BLM-administered lands and IVMP data for all other lands. These different data sources use slightly different parameters to define the structural stages and are measured at different scales, which influence the spatial pattern results. Therefore, these abundance and spatial pattern results cannot reliably be compared directly to the results from other studies, but should only be used to describe the relative effects of the different alternatives.

All four alternatives, combined with the effect of the management on other lands consistent with the assumptions described above, would contribute to a decrease in the stand establishment forests and young forests from the current condition and an increase in the mature&structurally complex forests. These changes would move the landscape in the direction of the historic average conditions. However, the structural stage abundance across all ownerships would not reach the average historic conditions in 100 years under any alternative. The stand establishment forests would remain above the average historic condition and the mature&structurally complex forests would remain below the average historic condition in all four alternatives. See *Figure 158 (Comparison of all ownerships by 2106 with average historic conditions and current conditions by alternative)*. This conclusion is consistent with the research on the Coast Range landscape conditions that modeled alternative future management scenarios on all ownerships, rather than the broad assumptions described above (Nonaka and Spies 2005).

The structural stage abundances across all ownerships would vary only slightly among the alternatives for two reasons:

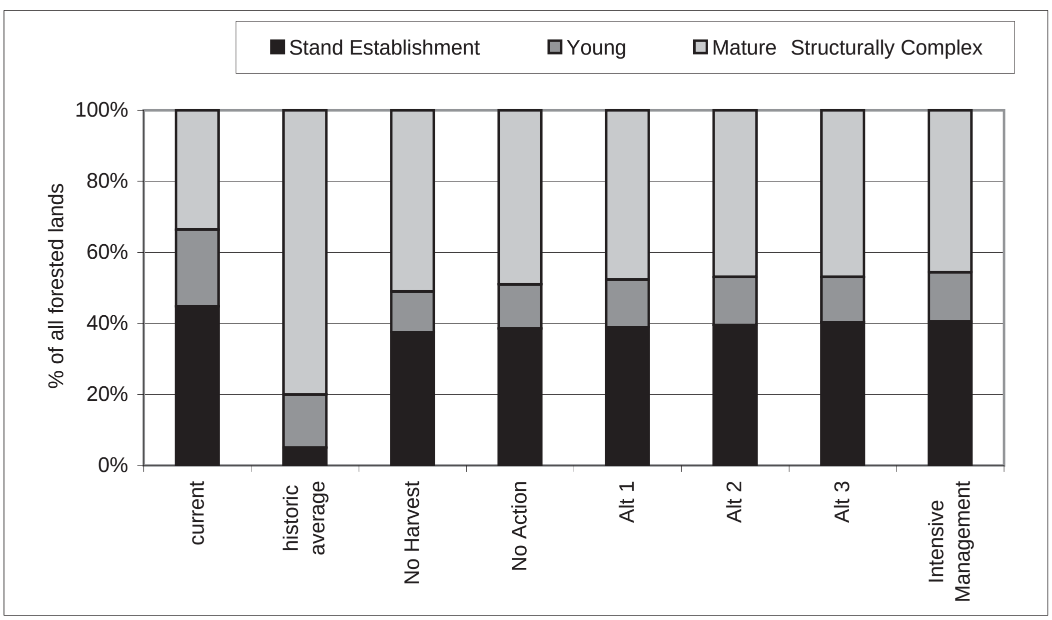
- The BLM-administered lands make up only 16% of all forested land within the planning area, which is too small an area to substantially shift the structural stage abundances across all ownerships.

- The effect of the alternatives on the BLM-administered lands, though quantitatively different, would make similar overall changes to the structural stage abundance—a decrease in the young forests and an increase in the mature&structurally complex forests.

As a result, none of the alternatives would result in more than a 1% shift in the structural stage abundances across all ownerships. Even the reference analyses of no harvesting and intensive management on most commercial timber lands would result in only an additional 1 to 2% shift in the structural stage abundances across all ownerships. There are differences among the alternatives that are masked by grouping all mature and structurally complex forests, together, and these differences are detailed in the analysis of the BLM-administered lands above. But at the broad scale of analysis across all ownerships, the management of the BLM-administered lands does not substantially alter the condition of the entire forested landscape.

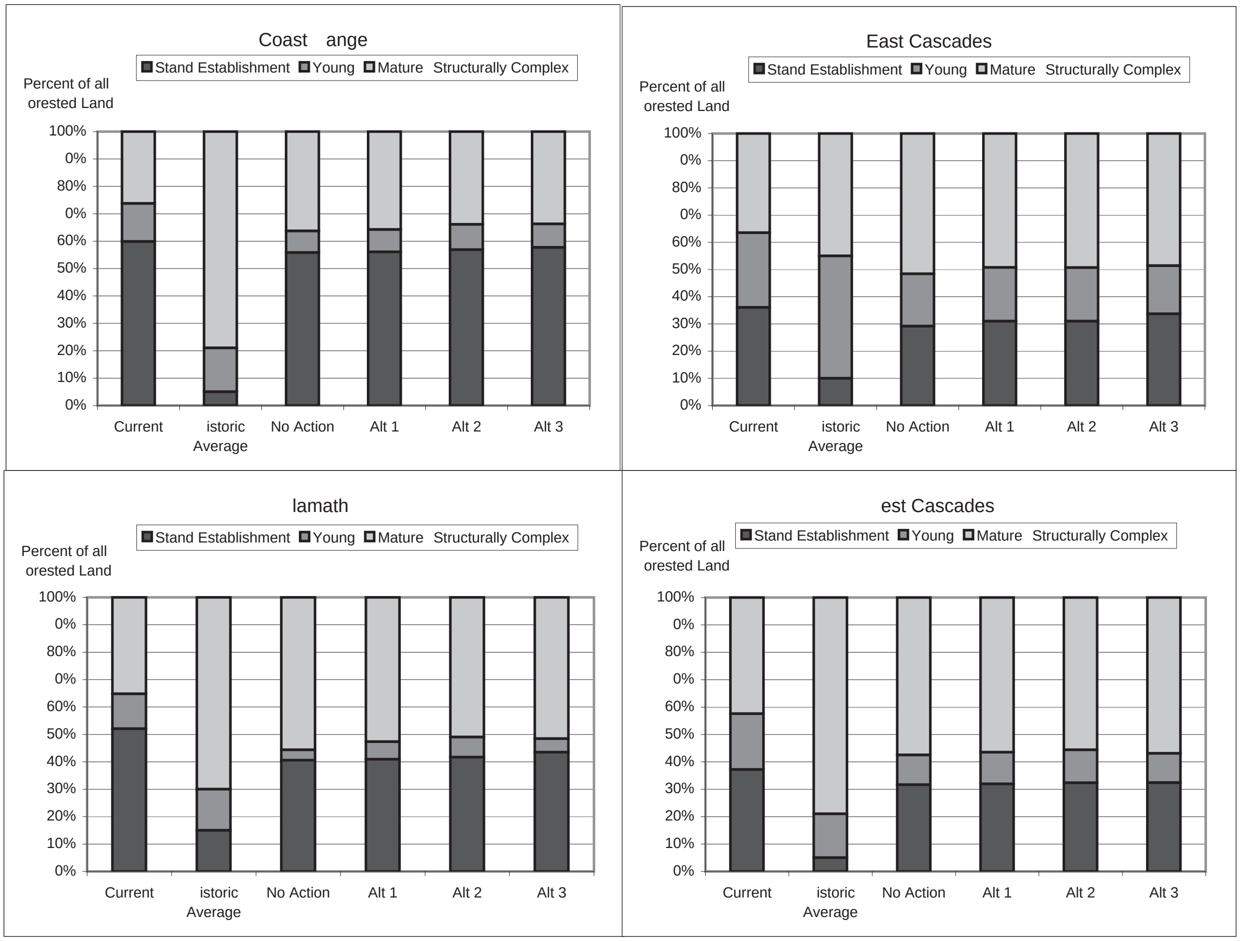
The principal controls on the condition of the entire forested landscape are the development of the U.S. Forest Service reserves into mature&structurally complex forests and the continued intensive management of the nonfederal forests. For example, the No Action Alternative would add an additional 684,000 acres of mature&structurally complex forest on the BLM-administered lands in 100 years, whereas the development of the U.S. Forest Service reserves would add more than twice that amount (1,786,000 acres) of mature&structurally complex forest over the same time period.

Figure 158. Comparison of all ownerships by 2106 with average historic conditions and current conditions by alternative



The abundances of the structural stages over time shows slightly more difference among the alternatives at the province scale than for the entire planning area. Nevertheless, the alternatives still only shift the abundances at the province scale less than 3% in 100 years. See *Figure 159 (Comparison of all ownerships by 2106 with average historic conditions and current conditions by province by alternative)*.

Figure 159. Comparison of all ownerships by 2106 with average historic conditions and current conditions by province by alternative



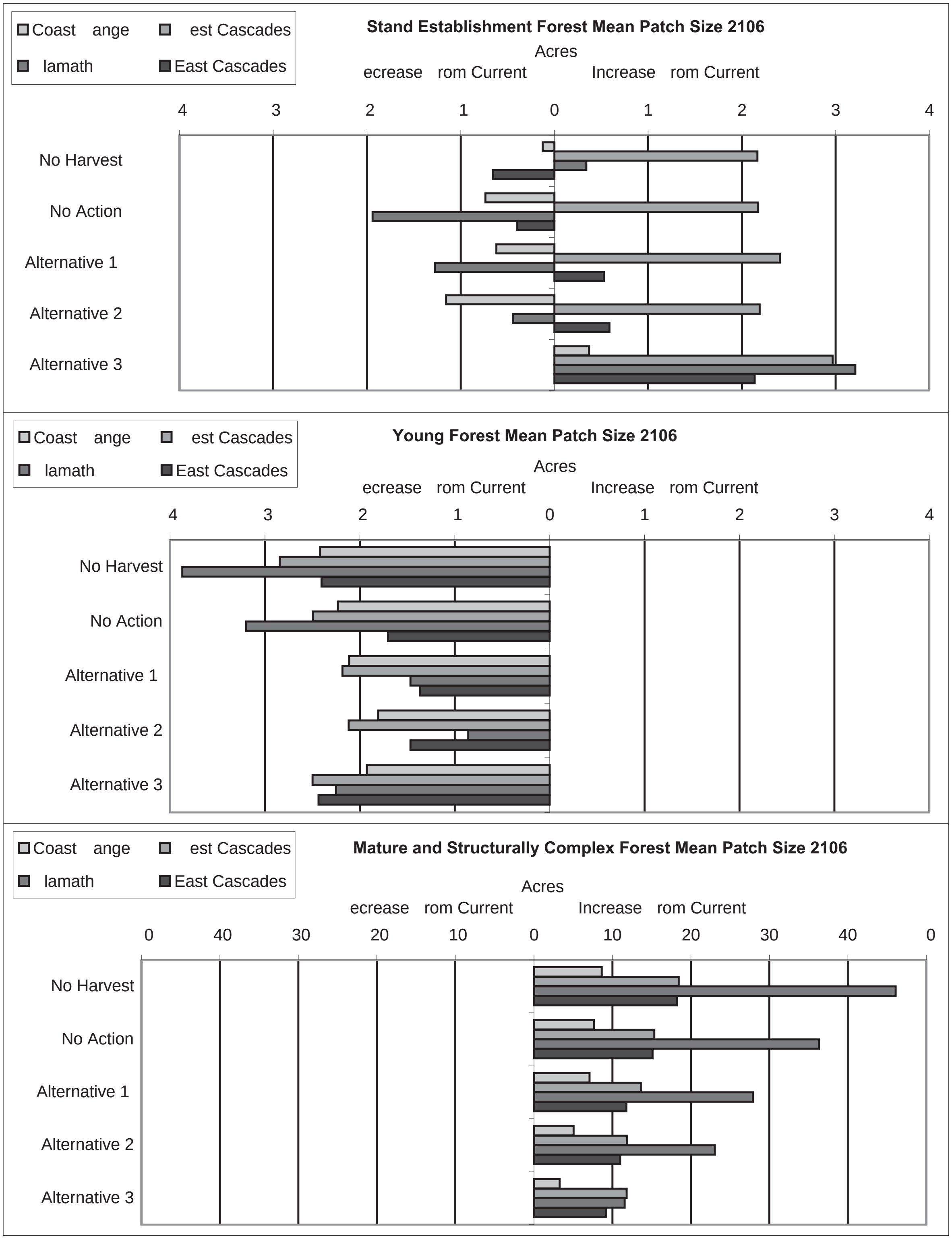
The spatial patterns of the structural stages across all ownerships would reveal more differences among the alternatives than the abundances of the structural stages.

The stand establishment forest patch sizes would decrease in some alternatives in some provinces and increase in others. See *Figure 160 (Change in the mean patch sizes from the current condition by 2106 by the forest structural stages on all ownerships)*. Alternative 3 would contribute to an increase in the stand establishment patch size in all provinces. However, these relative shifts represent very slight absolute changes in the Coast Range and Western Cascades provinces, where the differences among the alternatives is less than 4% of the current mean patch size. In the Klamath and Eastern Cascades provinces, the difference among the alternatives would be greater—Alternative 3 would result in stand establishment patch sizes 12% greater than the No Action Alternative in the Klamath province, and 17% greater than the No Action Alternative in the Eastern Cascades province. This is consistent with the overall trend in the abundances across all ownerships, but the differences among the alternatives in mean patch sizes are greater than the differences in the overall abundance.

The young forest patch sizes would decrease in all four alternatives in all provinces consistent with the overall trend in abundances.

The mature&structurally complex forest patch sizes would increase in all four alternatives in all provinces consistent with the overall trend in abundances. The development of the Forest Service reserves into mature&structurally complex forests would produce very large mature&structurally complex forest patches that would contribute to the increase in mean patch size, but there would still be a measurable difference among the alternatives. Among the alternatives, the No Action Alternative would contribute to the most increase in mature&structurally complex forest patch size, and Alternative 3 would contribute to the least increase in all provinces.
The No Harvesting reference analysis would result in more difference in the mature&structurally complex forest patch size than in the overall abundance of the mature&structurally complex forest across all ownerships. The no harvesting reference analysis would result in mature&structurally complex forest mean patch sizes that are much larger than Alternative 3—35% larger in the Coast Range province, 23% larger in the Western Cascades province, 120% larger in the Klamath province, and 32% larger in the Eastern Cascades province. The differences among the alternatives would be greatest in the Klamath province, in part because the BLM-administered lands make up a higher portion of the Klamath province than any other province.

Figure 160. Change in the mean patch sizes from the current condition by 2106 by the forest structural stages on all ownerships



Note the change in scale for the mature&structurally complex forests.

Socioeconomics

This analysis examines the county-level economic impacts in terms of the jobs and income that are associated with the BLM's timber harvests, the BLM's payments to counties, the BLM's budget requirements, and the economic value of the BLM timber program that would result from the alternatives.

Key Points

- None of the alternatives would produce timber receipts that are sufficient to bring payments to the counties to the level provided by the Secure Rural Schools payments of the Secure Rural Schools and Community Self-Determination Act of 2000. Alternative 2 would produce the highest payments to the counties at 94% of the O&C portion of the 2005 Secure Rural Schools payment, while the No Action Alternative would produce the lowest payments at 37% of the O&C portion of the 2005 Secure Rural Schools payment.
- Alternative 2 would have the most favorable impact on local economies and would result in a net increase of 3,442 jobs and $136.5 million of wages. The No Action Alternative would have the least favorable impact on local economies and would result in a next decrease of 3,710 jobs and $125.5 million of wages. Economic impacts would vary by county depending on:
  - the economic structure of the economy,
  - the county's share of the Secure Rural School payments, and
  - the projected changes in the wood products industry.
- The BLM would require an increase in budget to implement all four alternatives. The increase would range from 17% under the No Action Alternative to 60% under Alternative 2.
- The present net value of the BLM timber harvest would range from $46.1 million under Alternative 3 to $962.3 million under Alternative 2.

The management of the BLM timberlands contributes to the economic activity in the western Oregon communities within the planning area. Timber harvesting and the manufacture of wood products create jobs and income in these sectors and also stimulates economic activity in other sectors of the local and regional economies. The BLM's employees and the BLM's management expenditures also contribute to local economies. Approximately 50% of the revenues received from the O&C lands, furthermore, flows directly to the county governments and is used to fund a variety of social services and investments.

The BLM lands contribute to the employment and income in industries other than those that are related to lumber and wood products. Dispersed and developed recreation, commercial fishing, hunting, special forest products, mining, and grazing all contribute to the region's economies and are affected by changes in federal forest management. Estimating the jobs and income that are associated with uses other than the wood products and government sectors is not possible because data for the evaluation of many economic aspects of the alternatives is limited for resources and uses that have no market or transaction costs. In addition, the BLM's receipts from these activities in western Oregon are relatively minor compared to the timber program and vary little between alternatives. For example, receipts from such nontimber sources as recreation ($1.2 million annually), special forest products ($300,000 annually), and grazing receipts ($30,000 to $40,000 annually) are relatively minor and would not vary between the alternatives.

While primary data is not available to measure how the alternatives would differ in economic benefits of recreation opportunities on the BLM, it is important to note that both resident and nonresident tourists contribute to local economies in the form of purchases of goods and services of accommodations, transportation, food and beverage, retail, and commercial recreation services. Outdoor recreation on BLM-administered lands in the planning area yielded an estimated 3,953,400 visitor days in 2004, of these an estimated 24% were tourists who resided more than 50 miles from the recreation site. Using regional tourism studies for western Oregon in combination with national outdoor recreation valuation studies cited by the National Park Service and the BLM produces a conservative estimate of the value of nonresident outdoor recreation spending in the planning area. In 2004, visitors to the BLM's recreation areas spent over $68,300,000 in local communities to support their visit to the public lands. As described in the *Recreation* section of this chapter, all alternatives would continue to meet recreational demand on BLM-administered lands in the planning area with some minor effects on visitor use patterns.

The measures that are used for the comparison of the alternatives are:

- **Employment.** Those full-time equivalent jobs associated with the timber-related economic sectors.
- **Income.** The wages associated with employment.
- **Payments to counties.** The counties' share of the revenues that are paid to the BLM.
- **BLM budget.** The money that is spent for the BLM's personnel, services, equipment, etc.
- **Contract costs.** The money that is spent on contracting certain silvicultural costs.
- **Present net value.** The sum of the discounted revenues and costs associated with the timber sale program.

The volumes and revenues of harvests for this analysis were derived from the OPTIONS model. The Western Oregon Model (Adams and Latta 2007, 8-14) was used to project delivery points for the projected harvest from OPTIONS. Developed at Oregon State University, this model relies on data about processing facilities, market prices, and private inventory to project log flows and production across Western Oregon. County-level input/output models were constructed specifically for this analysis. Data specific to the economy of each county were incorporated into the model, resulting in employment and income projections tuned to the economy found in each county economy. The U.S. Forest Service's Timber Assessment Market Model was used to estimate the stumpage price impact of adding more BLM timber to the market. Revenues, employment, and income reported herein are based on the total harvest volumes including both the harvest land base (lands that contribute to the annual sale quantity) and nonharvest land base. See *Appendix C, Socioeconomics* for a more complete discussion of the analytical process and the assumptions for this analysis.

An increase in the BLM timber harvest would lead to an increase in the total timber harvest in the market area, and an increased activity in the wood processing sectors. Under all four alternatives, as the BLM sells more timber into the log market, log prices would fall and timber harvests from price-sensitive private lands or log imports from Canada and Washington would decline to some degree. Because of this price effect, the increase in the total harvest would be somewhat less than the increment of the BLM's timber. As manufacturing capacity adjusts to absorb the increased volume of the BLM's timber, prices and harvests from other owners would adjust to previous levels. See *Chapter 3* for discussion of the timber market and wood products industry.

The differences in the economic effect of the harvests between the alternatives are due not only to the differences in the volume of timber that would be harvested, but also to the differences in the location and characteristics of the timber that would be harvested. During the first 10 year period after implementation, for example, the harvest volume from Alternative 3 would be mostly from partial harvesting, whereas more regeneration harvesting would occur under Alternatives 1 and 2. Since thinning and partial harvesting costs more than regeneration harvesting, the average net revenue per thousand board feet would be highest under Alternative 2 and lowest under Alternative 3. The differences in the type of timber harvested would result in a difference in log quality. Large, peeler-grade logs, for example, would constitute more of the harvest volume under Alternative 2 than under the No Action Alternative. See *Table 153 (Distribution of harvest by harvesting type and the percentage of large, peeler-grade logs for the first 10 years)*.

Table 153. Distribution of harvest by harvesting type and percentage of large, peeler-grade logs for the first 10 years

Alternatives	Total Annual Harvest (mmbf)	Treatment Type				Percentage of Large, Peeler-Grade Logs
		Regeneration Harvesting	Thinning	Uneven-aged Harvesting	Partial Harvesting	
No Action	355	65%	35%	1%	0%	4.1%
Alternative 1	537	77%	22%	0%	0%	7.7%
Alternative 2	767	89%	11%	0%	0%	8.5%
Alternative 3	473	4%	34%	0%	62%	7.7%

As a result of the differences in the type of harvesting (thinning, partial harvesting, regeneration harvesting, and uneven-aged management) and log quality, there is a difference in the projected average stumpage prices between the alternatives. See *Table 154 (Estimated annual payments to the counties for the first 10 years)*; also see *Figure 186 (Annual stumpage value by alternative over the next 10 years)*, which is in the *Timber* section of this chapter. They show that stumpage prices within the first 10 years would range from $280 per mbf under Alternative 2 to $217 per mbf under Alternative 3.

The differences in the type and quality of logs harvested could also lead to differences in the employment projections. For example, larger and higher-quality logs can produce higher-valued specialty products that often require more labor-intensive milling procedures. Large logs, on the other hand, generally require less logging labor. Due to data limitations, this analysis does not incorporate an employment distinction based on log size or quality.

Payments to the Counties

Currently, the BLM-related revenues provide about 2.5% of the total revenue received by the O&C counties and 9.8% of the discretionary portion of the county budgets (see *Chapter 3*). These figures range from 0.1% of the total funding and 0.2% of the discretionary funding for the large metropolitan counties to 20.5% of the total funding and 70.4% of the discretionary funding for the more rural southwestern Oregon counties. See the *Socioeconomic* section of *Chapter 3*.

Since the Secure Rural Schools funding has expired, this analysis assumes that the BLM payments to the counties would be based on the preexisting formula with which the counties would receive 50% of the BLM stumpage receipts and some minor additional funding, as described in *Chapter 3*. *Table 154 (Estimated annual payments to the counties for the first 10 years)* shows that because Alternative 2 would harvest the most timber at the highest price, it would generate the highest total revenue ($215.8 million) and the highest payment to counties ($108.0 million). That is equivalent to 94% of the 2005 Secure Rural Schools funding that is associated with the BLM lands and 46% of the Secure Rural Schools funding from all federal lands.

The No Action Alternative would have the lowest total annual revenue ($83.9 million) and the lowest payment to Counties ($42.0 million). That is equivalent to 37% of the 2005 Secure Rural Schools funding that is associated with the BLM lands and 18% of the Secure Rural Schools funding from all federal lands.

Table 154. Estimated annual payments to the counties for the first 10 years

Harvests, Revenues, and Payments	Alternatives			
	No Action	Alt. 1	Alt. 2	Alt. 3
Harvest (mmbf) of short logs	355	537	767	473
Adjusted stumpage ($/mbf)	234	254	280	217
Total revenue ($ million)	83.9	137.2	215.8	103.3
Total O&C county payments ($ million)	42.0	68.7	108.0	51.7
% of 2005 BLM payments to the counties	37%	60%	94%	45%
% of 2005 BLM, USFS, and SRS* payments	18%	29%	46%	22%

*SRS (Secure Rural Schools)

Table 155 (Annual payments to the counties for the first 10 years (based on 2005 levels) shows the payments to the counties for the first 10 years. The bulk of the projected payments is based on 50% of the BLM stumpage receipts. That revenue is distributed between the counties based on historic valuation. The distribution of other revenues is fixed at the 2005 level and does not change between alternatives. Since this is a minor amount of revenue, the distribution of the total revenue between the counties on a percentage basis would be nearly identical under any alternative.

Table 155. Annual payments to the counties for the first 10 years (based on 2005 levels)

Counties	SRS[a] Payments ($ million)			Alternatives ($ million)			
	BLM	**USFS**	**Totals[b]**	**No Action**	**Alt. 1**	**Alt. 2**	**Alt. 3**
Benton	3.2	0.5	3.7	1.2	1.9	3.0	1.5
Clackamas	6.3	7.2	13.5	2.3	3.8	6.0	2.9
Columbia	2.3	0.0	2.3	0.9	1.4	2.2	1.1
Coos	7.6	0.8	7.5	2.5	4.1	6.4	3.0
Curry	4.2	5.6	9.8	1.5	2.5	3.9	1.9
Douglas	28.7	22.7	51.2	10.5	17.2	27.0	12.9
Jackson	17.8	6.4	24.3	6.6	10.8	16.9	8.1
Josephine	13.8	3.1	16.8	5.1	8.3	13.0	6.2
Klamath	2.7	17.2	19.9	1.0	1.6	2.6	1.3
Lane	17.4	34.2	51.5	6.4	10.5	16.5	7.9
Lincoln	0.4	5.3	5.7	0.2	0.2	0.4	0.2
Linn	3.0	11.4	14.4	1.1	1.8	2.8	1.4
Marion	1.7	4.3	5.9	0.6	1.0	1.6	0.8
Multnomah	1.2	1.1	2.3	0.5	0.7	1.2	0.6
Polk	2.5	0.0	2.5	0.9	1.5	2.3	1.1
Tillamook	0.6	2.8	3.5	0.2	0.4	0.6	0.3
Washington	0.7	0.0	0.7	0.3	0.4	0.7	0.3
Yamhill	0.8	0.8	1.6	0.3	0.5	0.8	0.4
Totals[b]	**114.9**	**123.3**	**237.1**	**42.0**	**68.7**	**108.0**	**51.7**

[a]SRS (Secure Rural Schools)
[b]Totals do not add precisely due to the rounding of numbers.

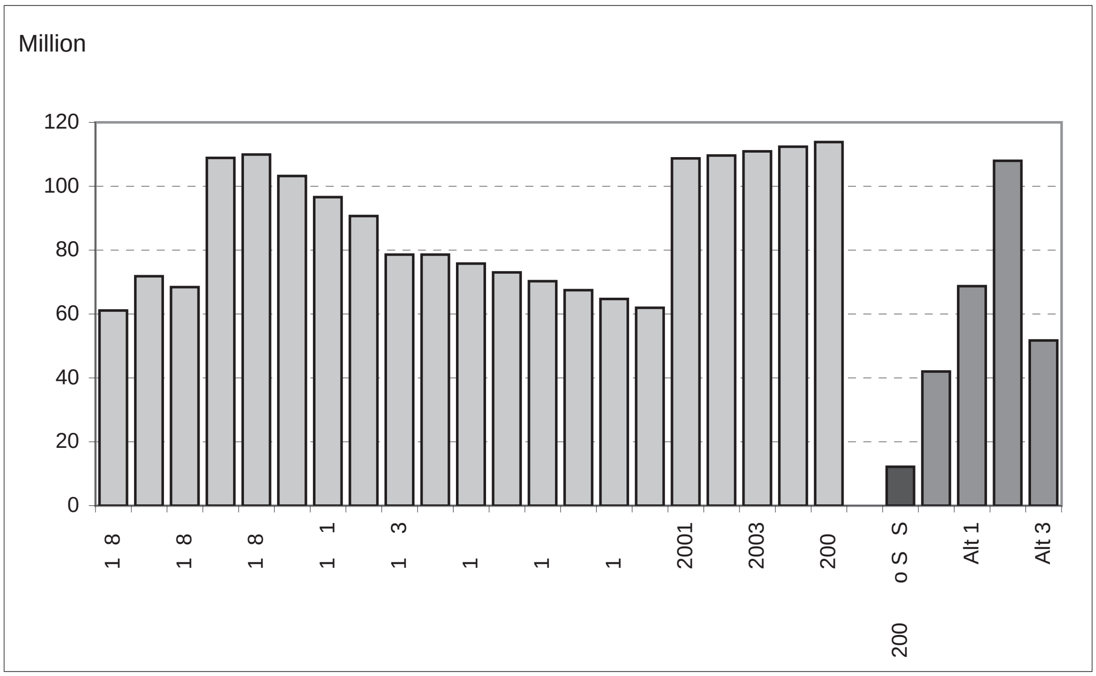
Table 155 also shows that the Secure Rural Schools funding that is associated with the BLM lands accounted for slightly less than half of the total Secure Rural Schools funding with the Secure Rural Schools funding that is associated with the U.S. Forest Service lands accounting for the other half. The distribution of U.S. Forest Service-related Secure Rural Schools funding differs from the distribution of the BLM-related Secure Rural School funding. The analysis of the impacts on jobs and income is based on the assumption that there would no longer be any of the BLM- or U.S. Forest Service-related Secure Rural Schools funding. While this analysis does not include a projection of future U.S. Forest Service payments to counties (25% of timber sale revenue), the amount of the annual payment would have averaged $4.2 million over the period of 2000-2004. Projecting a similar amount of payment into the future would not make any substantive difference in the projection of the effects of the BLM's alternatives.

Assumption

There would no longer be any BLM- or U.S. Forest Service-related Secure Rural Schools funding.

Figure 161 (Historic and projected BLM payments to the counties for the first 10 years) compares the projected BLM payments to counties to the historic BLM payments. The No Action Alternative and Alternative 3 would provide payments less than the lowest year in the 20-year history. Alternative 1 would provide payments in the range seen during the late 1990s. Alternative 2 would provide payments in the range seen in the late 1980s and again after the passage of the Secure Rural Schools legislation, which started in fiscal year 2001.

Figure 161. Historic and projected BLM payments to the counties for the first 10 years



Employment and income

The economic impact estimates for all four alternatives were calculated from county-level input/output models. These models were tailored and field-calibrated to specifically address the types of impacts that are expected from the potential changes in the BLM timber harvest levels.

The economic impacts include the combination of direct effects due to:

- the changes in BLM management and county payments,
- the indirect effects that are associated with inter-industry transactions, and
- the induced effects from payroll spending.

The total effects are described in terms of the changes in employment and earnings. Changes that would result from the alternatives are compared to a 2005 estimated baseline (labeled *current* in the following tables). The term (current) describes the amount of each county's 2005 economy that could be attributed to the combination of the BLM management actions and the Secure Rural Schools payments that are associated with both the BLM and the U.S. Forest Service.

This analysis considers six principal sources of direct economic impacts on the O&C counties, which are:

- the loss of current Secure Rural Schools payments to counties;
- the change in the BLM timber harvesting and associated changes in logging and log hauling under the alternatives;
- the change in administrative expenditures by the BLM offices;
- the changes in sawmill operations in response to changes in timber harvesting;
- the changes in the output of plywood mills; and
- the changes in board and pulp mill operations as more chips and sawmill residuals come on the market.

Each of these changes is considered at the county level. To project economic impacts at the county level, the Western Oregon Model, developed at Oregon State University, was used to project where the BLM timber harvested under each alternative would be manufactured into products (Adams and Latta 2007, 8-14). See *Table 156 (Sources of economic effects by alternative)* for a regional summary of direct effects for each alternative.

Table 156. Sources of economic effects by alternative

Sources of Economic Effects	Current	Changes by Alternatives			
		No Action	Alt. 1	Alt. 2	Alt. 3
Payments to the counties ($ million)	237	**-195**	**-168**	**-129**	**-185**
Timber harvest (mmbf)	117	238	420	650	356
BLM expenditures ($ million)	141	26	55	91	45
Lumber production (mmbf)	6,084	454	720	1,060	656
Plywood production (mmbf 3/8 in.)	2,838	**-441**	**-428**	**-395**	**-433**
Board mill output ($ million)	26	32	53	83	51
Pulp mill output ($ million)	18	38	67	104	60

Notes: Current represents a 2005 estimated baseline.

Two of these effects are dominant sources of economic impacts to the county economies throughout western Oregon. The Western Oregon Model projects a continuing shift in the panel markets away from plywood to less-expensive oriented strand board (OSB). This shift would occur despite increased BLM timber harvests under the alternatives. Plywood production would decline by about 15% by 2009 under any of the alternatives.

Variations in BLM harvest are not a causal factor in the decline of plywood production in that projected declines are due to national market factors. Plywood production declines would occur even under the alternatives that would substantially increase the BLM's timber harvest. The projected decline in plywood production would reduce industry output over $400 million under all four alternatives. In addition, approximately 1,500 to 2,000 plywood and veneer jobs would be lost plus additional job losses from a multiplier effect as a result of the decline in plywood production.

Historically, counties shared in federal timber sales receipts. Western Oregon counties received 25% of U.S. Forest Service receipts and O&C counties received 50% from the BLM's timber sale receipts. Under the Northwest Forest Plan, federal timber sales and shared receipts dropped. The Secure Rural Schools funding that had compensated for lost timber sharing ended in 2006. These annual county payments had ranged from $0.7 million in Washington County to $51.5 million in Lane County.

This analysis assumes that no reauthorization of the Secure Rural Schools and Community Self-Determination Act, or new similar legislation, would occur. The projections of the payments to the counties include shared receipts that are primarily expected from timber sales under the alternatives. All four alternatives would have an off-setting effect to the loss of payments. Western Oregon counties would lose between 2,500 to 3,500 local government jobs from the loss of Secure Rural School payments and multiplier effects would double the total job loss. Losses would be the largest in the timber-dependent counties that have large federal land acreages. For example, under the No Action Alternative, Douglas County would lose over 700 jobs in local government due to changes in county payments and another 350 jobs in plywood manufacturing. Rural county economies typically have a narrower economic base and lower resilience than metropolitan counties.

The increase in the BLM harvests would range between 208% and 560% under the proposed alternatives. These increased harvests would create between 800 and 1,500 jobs in logging, trucking, and additional jobs in the sectors that are linked to logging. Increased BLM harvests, plus the projected increased private harvests (estimated by the Western Oregon Model), would allow sawmills, board mills, and pulp mills to increase output. This increase would not be one-for-one, as some substitution of the additional BLM timber harvest for private timber harvest would occur.

The BLM's land management, coupled with Secure Rural Schools payments, has played a large role in many western Oregon counties (refer to *Sources of economic effects by alternative)*. Together, in 2005, they accounted for 8,948 regional jobs and $319 million in earnings. See *Table 157 (Total economic impacts that are associated with BLM timber harvests by alternative)*. Under all four alternatives, economic losses would be greatest in southwestern Oregon where the O&C lands are concentrated. In Jackson and Douglas counties, revenues that are associated with the BLM's lands currently account for over 3,000 jobs. Timber harvested from the BLM's lands also plays important roles in the Eugene-Springfield, Albany, Medford, Coos Bay, and Grants Pass economies.

Table 157. Total economic impacts that are associated with BLM timber harvests by alternative

Economic impacts	Current	Changes in O&C County Totals by Alternative			
		No Action	Alt. 1	Alt. 2	Alt. 3
Jobs (number of)	8,948	**-3,770**	**-516**	3,442	**-1,275**
Earnings ($ million)	319.4	**-125.5**	**-7.3**	136.5	**-34.7**

Note: Current represents a 2005 estimated baseline.

Under all four alternatives, timber harvesting would increase. There would be an increase in jobs and income along with a multiplier as impacts ripple through other sectors in the affected county economies. The economic effects would vary in proportion to the increased timber harvest volumes. The economic effects would also vary with the amount of a county's concentration of its economy in the wood products sector. Economic activity in other sectors (caused indirectly by multipliers) would be based on the county's economic diversity and its self-sufficiency as a trade center. Under all but Alternative 2, however, the loss of Secure Rural Schools funding, coupled with the reduction in the plywood industry, would be greater than the increased employment and earnings linked to the increased BLM harvest levels. *Table 157* therefore, shows that under the No Action Alternative and Alternatives 1 and 3, there would be a net reduction in jobs and income. The higher harvest level and higher stumpage price for Alternative 2 would more than compensate the economic losses due to changes in the plywood sector and the loss of Secure Rural School funding.

The loss of Secure Rural Schools payments under the No Action Alternative would reduce regional earnings by about one-third. These reductions would be compounded by contraction in the plywood subsector of the wood products industry in Curry, Douglas, Jackson, Josephine, Linn, and Klamath counties.

Under Alternative 1, the increase of the BLM timber harvest by 364% would generate relatively small net economic impacts in western Oregon. Under Alternative 1, the jobs lost in some counties (Coos, Jackson, Lane, Linn, and Marion) would be offset by the jobs created in most other counties. However, Douglas and Klamath counties would have such large losses of jobs and earnings that there would still be a net loss overall in western Oregon.

Under Alternative 2, increased jobs and earnings would offset declines in most counties that would be caused by changes in the wood products industry and loss of Secure Rural Schools payments. Under Alternative 2, about 3,500 new jobs would be created and income would be increased by $137 million across western Oregon. Substantial increases would occur in Clackamas, Coos, Jackson, Lane, Linn, Marion, and Yamhill counties. However, the projected 560% increase in the BLM's harvest under Alternative 2 would still not be sufficient economic stimulus to overcome job losses in Curry, Douglas, Josephine, Klamath, and Lincoln counties. The job losses in these counties would be primarily in local government resulting mostly from losses of payments to the counties and contraction in the plywood sectors unrelated to the BLM's harvests.

For most counties, the economic impacts under Alternative 3 would be similar to those that would occur under Alternative 1. The exception would be Lane County, which would have considerably more jobs created in logging and wood products manufacturing. Under Alternative 3, there would be a net income loss of about $35 million across western Oregon. The most substantial county losses would occur in southwestern Oregon (Curry, Douglas, Josephine, and Klamath counties). For example, Douglas County would lose about $40 million in earnings. In the remaining counties, there would be enough economic increases resulting from the BLM's harvest to generally offset the loss of

Secure Rural School payments. Nevertheless, many individual sectors, particularly those linked to plywood production, would still have income losses.

Only under Alternative 2 would there be sufficient economic gains from increased harvesting to offset the loss of Secure Rural Schools payments and the projected contractions in the plywood sub-sector. In some alternatives, particularly Alternative 2, the increased employment and income that is associated with the increased harvesting would be sufficiently large enough to offset the decreased employment and income that is associated with the loss of Secure Rural Schools funding and the reduction in the plywood industry.

Jobs are an important indicator of the magnitude of the economic impact of the alternatives. A large set of O&C counties would generally show net gains under all four alternatives. See *Table 158 (Counties in which the alternatives would compensate for other job losses)*. Note that under the No Action Alternative, however, harvest increases would be relatively small, so job losses which would result from other factors, would not be offset in Coos and Jackson counties.

Table 158. Counties in which the alternatives would compensate for other job losses

Counties with Net Gains	Current Jobs	Changes in Jobs by Alternative			
		No Action	Alt. 1	Alt. 2	Alt. 3
Benton	118	13	53	132	39
Clackamas	265	51	250	460	211
Columbia	52	77	120	204	88
Coos	410	**-39**	100	358	75
Jackson	1,612	**-351**	211	672	16
Marion	272	**-2**	124	219	95
Polk	54	87	160	139	139
Tillamook	79	6	27	93	43
Washington	22	57	76	112	60
Yamhill	59	54	151	216	106

Harvesting under any of the alternatives would not create sufficient jobs to compensate for job losses caused by the loss of Secure Rural Schools payments and the decline in plywood production in a number of counties. See *Table 159 (Counties in which the alternatives would not compensate for other job losses)*. The group of counties shown in *Table 159* is characterized by large losses in Secure Rural Schools payments and the presence of a large plywood subsector.

Table 159. Counties in which the alternatives would not compensate for other job losses

Counties with Net Losses	Current Jobs	Changes in Jobs by Alternative			
		No Action	Alt. 1	Alt. 2	Alt. 3
Curry	235	**-190**	**-196**	**-30**	**-230**
Douglas	2,204	**-2,012**	**-1,436**	**-494**	**-1,351**
Josephine	470	**- 306**	**-165**	**-4**	**-208**
Klamath	571	**-251**	**-278**	**-237**	**-257**
Lane	1,987	**-766**	184	1,261	**-113**
Lincoln	143	**-115**	**-102**	**-91**	**-105**
Linn	396	**-82**	205	432	117

Douglas County would have the largest economic loss among all the O&C counties, because it would lose large Secure Rural Schools payments ($51.2 million annually from the USFS and BLM) and because it has a large plywood subsector.

A closer look at the estimated job impacts in Douglas County under the No Action Alternative illustrates the importance of considering all of the reasonably foreseeable sources of economic impact. If the economic analysis considered just the impacts of the changes to the harvest levels, the analysis would show that Douglas County employment would increase by 645 jobs simply as a result of increased harvest levels. If the analysis considered just the increased harvest levels and the contraction of the plywood industry, then the analysis would show a net loss of 936 jobs, because the plywood industry is heavily concentrated in Douglas County. If the analysis considered only the changes to the harvest levels and the loss of the Secure Rural Schools payments, then there would be a net increase of 163 jobs, which would result from an increase in the wood products sector offsetting losses in the government sector. When all three factors—the loss of the Secure Rural Schools payments, the contraction of the plywood industry, and the increase in BLM harvest levels—are taken together, there would be a net loss of 2,021 jobs. In other words, the increased employment in the wood products sector, specifically the sawmilling industry, would not be nearly enough to offset losses to the government sector and the plywood industry. Similar relationships would occur in each county under each alternative—the magnitude depending on the unique economic structure of each county and the specific harvest configuration of each alternative.

There would be a spectrum of county economic responses to timber harvest increases under the alternatives. For the purpose of analysis and discussion, counties are clustered into five categories that reflect the sensitivity of individual county economies. A county may fall into one or more of these categories.

Sensitivity Categories of County Economies

Type 1

These counties would receive little or no influence from the alternatives. This is caused by having small Secure Rural School payments, few BLM lands, or having economies with little reliance on the wood products industries. Benton County and Polk County are examples. Clatsop County has so few connections to all of the impact sources that it was not modeled.

Type 2

These counties have large diversified economies. Here, the economic effects of the alternatives would be small relative to the jobs and incomes generated by other sectors. Columbia and Washington counties have positive wood products sector responses, but they are primarily commuter adjuncts to Portland. Marion County is dominated by state and federal government sectors. The Portland metropolitan economy is so large that the Multnomah County model was not used.

Type 3

These are counties in which the effects of the alternatives would be large enough to compensate for the loss of Secure Rural Schools payments—mostly from the higher levels of activity in the sawmill sectors and its multipliers. See *Table 160 (Wood products counties with gains concentrated in sawmills)*. These counties would face internal trade-offs between job and budget losses in their county governments and labor gains as sawmills expand. In some cases, resource-based economies, such as Lincoln and Tillamook counties, are reliant on non-BLM timber sources, so they would be only peripherally affected by the BLM timber harvest changes under the alternatives. The plywood counties (see Type 5) are shown here to indicate that some may have sawmill gains even when plywood jobs are declining.

Table 160. Wood products counties with gains concentrated in sawmills

Counties with Concentrated Sawmill Gains	Current	Changes in Sawmill Sector Industrial Output ($1,000) by Alternative			
		No Action	Alt. 1	Alt. 2	Alt. 3
Clackamas	4,913	14,717	27,702	40,412	25,541
Columbia	339	17,274	21,767	32,962	19,409
Coos	2,638	6,185	11,781	16,782	11,083
Curry	222	3,307	6,386	9,103	5,905
Douglas	12,892	18,895	36,493	56,132	34,257
Jackson	8,305	4,656	8,993	13,162	8,557
Josephine	1,569	1,741	3,363	4,793	3,109
Lane	15,711	30,573	58,205	91,352	55,606
Linn	2,392	13,197	16,790	23,936	14,881
Polk	462	9,160	11,905	16,588	10,504
Tillamook	726	11,854	14,926	23,471	14,311

Type 4

These counties have a large federal forest land base and significant wood products sectors. All counties had some reliance on federal Secure Rural Schools payments. The BLM's harvest revenue sharing would offset losses somewhat under all four alternatives. However, seven of these counties (Clackamas, Douglas, Jackson, Josephine, Klamath, Lane, and Linn) would be at large fiscal risk even considering higher BLM harvests. See *Table 161 (Counties losing more than $10 million per year in Secure Rural Schools payments)*. Job and budget losses would be concentrated in the county government sector and any multipliers tied to that sector.

Table 161. Counties losing more than $10 million per year in Secure Rural Schools (SRS) payments

Counties with Large SRS Funding Losses	Current ($ million)	Changes in Secure Rural Schools Payments ($ million) by Alternative			
		No Action	Alt. 1	Alt. 2	Alt. 3
Clackamas	13.5	**-11.2**	**-9.7**	**-7.5**	**-10.8**
Douglas	51.1	**-40.7**	**-34.0**	**-24.1**	**-39.0**
Jackson	24.3	**-17.7**	**-13.5**	**-7.4**	**-16.7**
Josephine	16.8	**-11.7**	**-8.5**	**-3.8**	**-11.0**
Klamath	19.9	**-18.9**	**-18.3**	**-17.3**	**-18.7**
Lane	51.5	**-45.1**	**-41.1**	**-35.1**	**-44.2**
Linn	14.4	**-13.3**	**-12.6**	**-11.6**	**-13.1**

Counties with large sawmill production value increases (e.g., Clackamas) and relatively small plywood subsectors would be most likely to have a neutral economic effect. Plywood counties have compounded economic losses from losses of payments to counties and adjustments in the wood products industry.

Type 5

These are counties that would have substantial or moderate losses from the alternatives. Three plywood counties (Douglas, Jackson, Lane) would have substantial economic losses. Four other counties (Coos, Curry, Josephine, and Linn) would have moderate economic losses where the plywood industry supplements instead of characterizes the wood products sectors. Large projected reductions in plywood and veneer output values worsen the Secure Rural Schools payment losses. See *Table 162 (County plywood output contraction by alternative)*.

Table 162. County plywood output contraction by alternative

Counties with Plywood Output Contraction	Current Output	Changes in Plywood Output ($ million) by Alternative			
		No Action	Alt. 1	Alt. 2	Alt. 3
Coos	78.5	-12.2	-12.2	-12.2	-12.2
Curry	42.9	-6.6	-5.9	-5.9	-6.6
Douglas	438.7	-68.1	-65.9	-60.4	-67.2
Jackson	271.4	-42.0	-39.8	-37.3	-39.7
Josephine	59.9	-9.3	-9.3	-8.3	-9.3
Lane	211.2	-32.7	-32.7	-29.0	-32.7
Linn	55.6	-8.9	-8.7	-8.1	-8.7

This pattern of economic response would be caused by large compounded economic losses from two sources. The elimination of Secure Rural Schools payments concentrates economic impacts in county government employment and budgets. The plywood contraction projection reduces highly paid jobs and high value-added production. BLM harvests directly increase logging, transportation, sawmill, pulpmill, and board plant jobs only where these subsectors exist. As each of these sectors has different patterns of purchases from other sectors, many of these counties have unique multiplier effects.

A discussion of the overall economic impacts does not capture the subtleties of the impacts within the individual counties or the specific sectors, such as the plywood and sawmill industries. Under all four alternatives, Douglas County would have the most severe economic losses. It would have a sharp decline in plywood production and local government, along with secondary effects in other such sectors as logging and the retail trade. Most of these economic losses would occur in the Roseburg vicinity, where government and plywood manufacturing are concentrated.

Economic losses in Curry County would not be as large as those in the larger Douglas County economy, but would still be substantial. There would be an increase in logging and sawmill operations in Brookings, but these increases would be offset by declines in plywood manufacturing. The loss of government jobs would be most severe in Gold Beach, the county seat. The loss of local governmental services would be particularly difficult for this county because of the high proportion of retirees who need such specialized services as home health care. Only 10 counties in the United States have higher retiree proportions than Curry County (Census 2000, 2006).

Klamath County would also experience substantial economic losses under all four alternatives because of its large losses of Secure Rural Schools payment and small amount of BLM-administered timber lands. Job losses in Klamath County under all four alternatives would range from 237 to 278 jobs. Klamath County is a major producer of plywood, so these job losses would be compounded by job losses resulting in adjustments in the wood products industry.

Josephine County and Jackson County have close economic ties and similarities. Both counties have plywood manufacturing operations that are projected to lose jobs; both counties have a large share of the O&C lands; and both county governments received large Secure Rural Schools payments. Grants Pass would experience economic losses under all four alternatives due to the loss of county payments. Cave Junction would experience improvements in its economy due to increased timber harvests from both the BLM and private forests. The Medford area is a major plywood manufacturing area and would experience large reductions in employment. Some of these economic losses would be offset by increased industry output in sawmills and board mills in White City. Local government services in both counties would shrink. The Medford economy is sufficiently diverse and robust that these job losses would be offset by growth in other economic sectors.

Lincoln County would experience economic losses under all four alternatives. Almost all of these losses would be in local government, which would lose about 100 jobs. Newport would experience the most loss.

Lane and Linn County would experience similar economic losses, but Lane County's economic losses would be mostly the result of the loss of $39.3 million in Secure Rural Schools payments. The logging and sawmill sectors in these counties would grow by 2009, particularly under Alternative 2, with both counties showing large economic gains in that part of the wood products sector but both counties would concurrently experience losses associated with the decline in plywood production. There would be a large economic loss to local government in these two counties, especially in both county seats (Eugene and Albany). These larger, more urban economies, however, are more resilient than the county seats in more rural areas. Plywood mill closures in communities such as Lebanon are more likely to produce long-term localized changes than those caused by changes in the BLM's timber harvesting.

The two other coastal counties, Coos and Tillamook, would experience improvements in their logging and sawmill sectors, particularly under Alternative 2. In Coos County, these economic gains would be partially offset by losses in plywood manufacturing. Coos County has a much larger proportion of federal lands, so increased federal jobs would offset the reduction in local government funding and services resulting in little net government sector change. There would be a proportionally larger economic loss to Coquille compared to other communities because it has both a plywood plant and it is the county seat.

Counties in and near the Portland metropolitan area (Clackamas, Washington, Yamhill, and Columbia) are part of a diversified and rapidly growing economy. None of these counties have a large proportion of federal lands; none are timber dependent; and none are dependent on Secure Rural School funds, even though Clackamas would lose $11.3 million from this source. Economic impacts on these counties would be minimal and almost unrelated to the BLM's timber harvest changes. There are, however, some smaller communities within those counties that do have wood products-based economies. Willamena, Molalla, St. Helens, and Rainier would experience economic gain of varying degrees under all four alternatives.

Central Willamette Valley counties (Benton, Marion, and Polk) would not experience a substantive economic effect as a result of any of the alternatives. They have only lost $2.4 million to $4.6 million each from the termination of Secure Rural Schools payments. These counties are not major wood products processing counties and do not have significant shares of the O&C lands.

Community Well-Being

Donoghue et al. (USDA, U. S. Forest Service 2006c) calculated a socioeconomic well-being index for 433 communities in western Oregon and noted how the index changed between 1990 and 2000 (see the *Socioeconomic* section of *Chapter 3)*. The results suggest those communities with low and or declining socioeconomic well being scores are more typically found in the more rural and more southern counties.

The county-level analysis of jobs and income indicates that the counties with the greatest potential net loss of jobs and income under any alternative are similarly more rural and more southern.

The analysis of the economic impacts of the alternatives describes net changes in county-level jobs and income. Because employees in one sector of an economy often require specialized skills and knowledge, employees may not be able to move easily from a declining sector to a growing sector. While job creation in one sector does not offset all of the social costs of job losses in another sector, a more detailed analysis of these social effects is beyond the scope of this analysis.

The BLM Budget

The BLM's budget requirements would be higher under all four alternatives, due to the administrative costs of implementing higher timber harvest levels. For this analysis, budget requirements for nontimber resource programs and the state office—about 78% of the 2006 fiscal year budget—were held constant between alternatives. See *Table 163 (BLM budget)* for budget requirements at full harvest levels under each alternative. It is assumed that it would take a transition of two years before full harvest level would be achieved under the action alternatives.

All four alternatives would require an increase from the current BLM's budget to implement the increased levels of timber harvesting. Compared to the current level, the BLM budget would increase 17% under the No Action Alternative, 37% under Alternative 1, 60% under Alternative 2, and 29% under Alternative 3.

Table 163. BLM budget

BLM Districts	2006 Fiscal Year	Changes in the BLM Budget by Alternative ($ million)			
		No Action	Alt. 1	Alt. 2	Alt. 3
Salem	16.1	21.3	30.7	38.9	28.5
Eugene	11.9	17.6	27.0	34.2	19.2
Roseburg	14.7	17.9	18.7	25.3	22.3
Coos Bay	12.8	18.2	20.5	30.4	19.1
Medford	33.9	39.6	46.3	50.8	44.2
Lakeview*	13.5	14.2	14.7	14.7	14.5
State Office	51.3	51.3	51.3	51.3	51.3
Totals	**154.2**	**180.2**	**209.1**	**245.6**	**199.1**

*This represents the entire budget for the Lakeview District of which only a part is used for the Klamath Falls Resource Area, which is the only portion of the Lakeview District that is within the planning area.

In addition to the costs above, expenditures (shown in *Table 164*) for contractors to perform silvicultural treatments (planting, fertilization, pruning, etc.) would increase as well. These expenditures vary by alternative based on the types of harvest anticipated under each alternative. Alternative 2 would require the highest expenditure, since it includes the most regeneration harvesting.

Table 164. Annual expenditures for silviculture for the first 10 years by district

BLM Districts	Annual Expenditures for Silviculture by Alternative ($ million) (first 10 years)			
	No Action	Alt. 1	Alt. 2	Alt. 3
Salem	0.5	0.9	1.2	1.0
Eugene	0.8	1.2	1.6	1.1
Roseburg	1.5	1.6	2.3	2.8
Coos Bay	1.2	1.2	2.3	0.6
Medford	3.0	4.1	4.9	3.1
Lakeview*	0.1	0.3	0.3	0.1
Totals	**7.2**	**9.3**	**12.7**	**8.6**

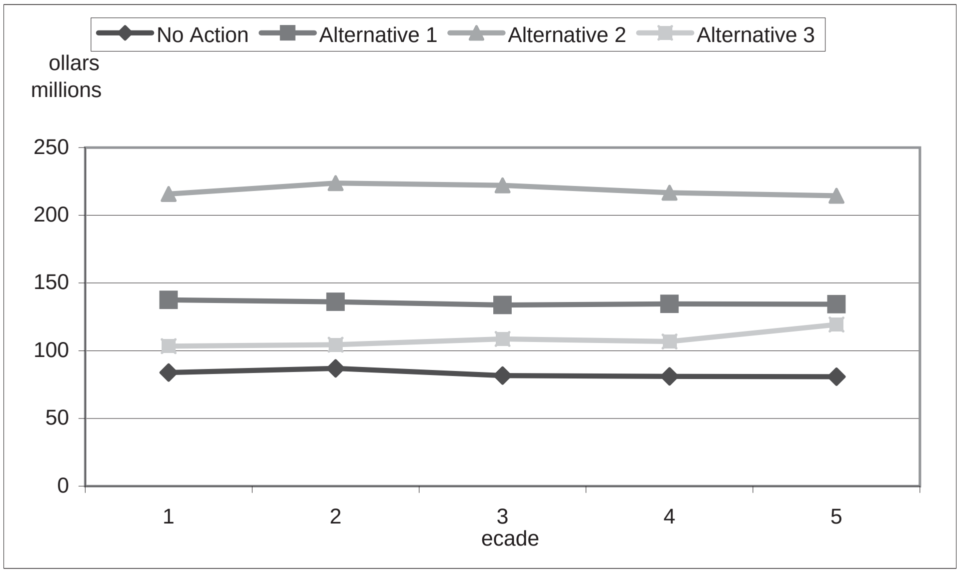
*This represents the expenditures for the entire Lakeview District of which only a part applies to the Klamath Falls Resource Area, which is the only portion of the Lakeview District that is within the planning area.

Present Net Value of the Timber Program

Present net value is a measure of economic return. Future revenues and costs over a 50-year period are discounted back to the present using a 5% discount rate.

Projections of the stumpage revenue for each alternative reflect the amount of timber harvested, the type of harvest (regeneration harvesting, partial harvesting, or thinning), and the age or size of the timber that would be harvested. Stumpage revenues would change over time, reflecting changes in the nature of the sale program under each alternative. See *Figure 162 (Average annual stumpage revenues)*. These revenues include volume from both the harvest land base (from which the annual sale quantity is calculated) and volume from the nonharvest land base during the first five decades after implementation.

Figure 162. Average annual stumpage revenues



For the No Action Alternative, Alternatives 1, and Alternative 2, for example, harvests past the first decade would have less thinning volume from the late-successional management areas, thereby reducing the total volume and value of timber harvests over time. Under Alternatives 1 and 2, higher-valued harvests from the structurally complex forests would drop off after the first couple of decades, and the harvests would shift to more mature and less structurally complex forest types, thereby reducing the average harvest value. Under Alternative 3, harvesting would shift from partial harvesting to regeneration harvesting with an accompanying reduction in costs, resulting in an increase in stumpage revenue.

Revenue projections are based on the 2005 average log price and do not include any future real price increase. Revenues under all four alternatives are based on an assumption that stumpage prices in the market area would fall slightly as the BLM adds more timber into the market. By the second decade, it is assumed that mill capacity would adjust to absorb the additional capacity, and the market adjustment is removed.

Under all four alternatives, the cost of the BLM timber program is estimated to be $200 per mbf. This covers all of the work that is associated with preparing, offering, and administering timber sales. It includes work done by members of a timber sale interdisciplinary Team, National Environmental Policy Act compliance work, overhead, etc. The additional silvicultural costs that are specific to each alternative are also included in the calculation. See *Table 164 (Annual expenditures for silviculture for the first 10 years by district)* in the previous section (*BLM Budget*).

See *Figure 163 (Revenues, costs, and net revenues for the first 10 years)* for a comparison of the revenues, costs, and net revenues for the first 10 years. See *Table 165 (Revenues and costs for the first 10 years and the present net value over 50 years by alternative)* for the present net value calculated over a 50-year period.

Figure 163. Revenues, costs, and net revenues for the first 10 years

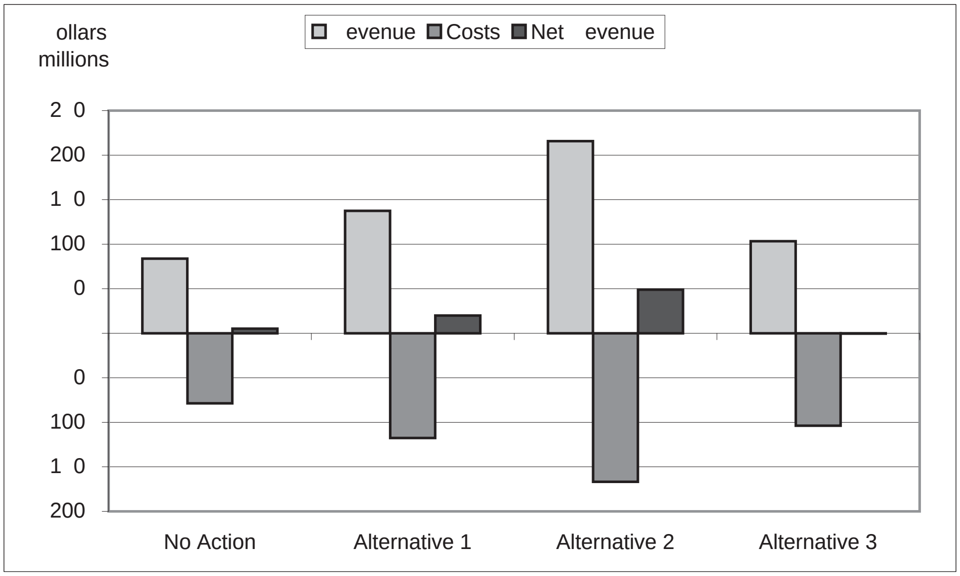


Table 165. Revenues and costs for the first 10 years and the present net value over 50 years by alternative

Alternatives	Decade 1			Present Net Value Over 50 years ($ million)
	Total Revenues ($ million)	Total Costs ($ million)	Net Revenues ($ million)	
No Action	83.9	-78.7	5.2	107.5
Alternative 1	137.5	-117.7	19.8	342.8
Alternative 2	215.8	-166.9	48.9	962.3
Alternative 3	103.3	-103.8	-0.4	46.1

Alternative 2 would have the highest total revenue of all four alternatives because it would have both the highest harvest level and the highest stumpage value. First decade revenues under the No Action Alternative would be the lowest of all four alternatives. This is because even though the No Action Alternative would have an 8% higher average stumpage value than Alternative 3, it would have 33% less harvest volume.

The alternatives are ranked differently with respect to the 50-year present net value calculation. From the highest to lowest present net value, the alternatives would be ranked Alternative 2, Alternative 1, the No Action Alternative, and Alternative 3. Because the average first decadal stumpage price under Alternative 3 is close to the average timber program cost, the net revenue under Alternative 3 would be negative in the first 10 years. Net revenues in subsequent decades would be slightly positive as capacity adjusted to the additional BLM volume and stumpage prices rebounded.

The present net value calculation shown here is based only on the costs and revenue of timber harvests. It does not include the value of the standing inventory, which would increase under all four alternatives. (Growth would exceed harvest because of the amount of lands allocated to the nonharvest land base.) Nor does the present net value include the cash revenues and costs that are associated with nontimber outputs, such as special forest products, nor any economic value associated with other commodity or amenity values.

Environmental Justice

This analysis examines the disproportionate impacts on low-income and minority populations that would result from the alternatives.

Key Points
• No high or adverse human health or environmental effects have been identified for any of the alternatives. • The effects of the alternatives are not expected to fall disproportionately on minority or low income populations.

Federal agencies are required to "identify and address . . . [the] disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States" in accordance with Executive Order 12898 regarding environmental justice.

The guidelines described by the Council on Environmental Quality (CEQ 1997) were used to guide the analysis of the potential environmental justice issues that are associated with the western Oregon resource management plan revisions. The analysis included:

- A determination of the geographic distribution of low-income populations and minority populations within the affected area (i.e., the planning area).
- An assessment of whether the impacts of the alternatives produce impacts that are high and adverse.
- If impacts are high and adverse, a determination as to whether these impacts would disproportionately impact low-income populations or minority populations.

The following Council on Environmental Quality guidelines (CEQ 1997) are used to identify what are minority and low-income populations.

- **Minority population.** A minority population is identified for a geographic unit if the number of minority persons (Hispanic/Latino, Black/African American, American Indian/Alaskan Native, Asian, Native Hawaiian/Other Pacific Islander, or some other race) is:
  - greater than 50% of the total population of that geographic unit, or
  - meaningfully greater than the percentage of the minority population in the reference unit for that geographic unit.

  For this analysis, each county is a geographic unit and the state of Oregon is the reference unit.

  The first part of the Council on Environmental Quality's guidance on minority population provides a numeric measure—the number of minority persons must exceed 50% of the total population for an affected area (i.e., a geographic unit). The remainder of the guidance calls for a judgment in evaluating the potential for environmental justice concerns. It is important to consider the circumstances of any one group that resides within the affected area, in addition to considering the percentage of the affected community that is composed of minority persons (EPA 1998).

- **Low-income population.** Low-income individuals are defined as individuals who fall below the poverty line. The poverty line takes into account the size of the family and the age of individuals in the family. In 1999, for example, the poverty line for a family of five with three children below the age of 18 was $19,882. For any given family below the poverty line, all family members are considered as being below the poverty line for the purposes of analysis (Proctor and Dalaker 2002).

  While there are no quantitative guidelines by the Council on Environmental Quality regarding the percentages of low-income populations in reference to larger populations, the Council on Environmental Quality does suggest a screen to determine if low-income populations are unevenly distributed in an affected area compared to the larger population.

See *Table 166 (Current composition of minority and low-income populations of the counties within the planning area compared to the state of Oregon)* for the current composition of the minority and low-income populations for each of the 18 counties within the planning area and the state of Oregon based on 2000 census data and the Council on Environmental Quality's guidelines. Counties that exceed the state-wide averages for minority or low-income populations are highlighted.

According to *Table 166*:

- For minority populations:
  - None of the minority populations in the counties exceeds 50% of the total population of the county.
  - There are three counties that exceed the state average for the percentage of minorities. The percentage of minority individuals in these three counties exceeds the state average by 6 to 7 percentage points.
  - These three counties are within large metropolitan areas with diverse economies (Portland and Salem). For these three counties, the BLM lands constitute less than 3% of the county area.
- For low-income populations:
  - There are 12 counties that exceed the state average for the percentage of low-income populations. They exceed the state average by 0.1 to 5.4 percentage points.
  - One of the 12 counties (Klamath County) is more than 5 percentage points above the state average. Approximately 7% of the lands within Klamath County are the BLM lands. These BLM lands are largely public domain lands east of the Cascade Mountains and are close to unincorporated populations. Low-income populations are not expected to be unevenly distributed in relationship to the BLM lands.

No high or adverse human health or environmental effects have been identified for any of the alternatives and effects are not expected to fall disproportionately on minority or low-income populations.

Table 166. Current composition of minority and low-income populations of the counties within the planning area compared to the state of Oregon

Counties within the Planning Area	Total Populations	White	Hispanic/ Latino	Black/ African American	American Indian/ Alaskan Native	Asian	Native Hawaiian/ Other Pacific Islander	Some other race	2+ Races	Total Minority	Percent Minority	Total Low-Income	Percent Low-Income
Benton	78,153	67,816	3,645	637	556	3,493	175	173	1,658	10,337	13.2	10,655	14.6
Clackamas	338,391	301,548	16,744	2,056	2,090	8,216	521	317	6,899	36,843	10.9	21,969	6.6
Columbia	43,560	40,576	1,093	97	540	246	39	43	926	2,984	6.9	3,910	9.1
Coos	62,779	56,616	2,133	169	1,412	553	99	66	1,731	6,163	9.8	9,257	15.0
Curry	21,137	19,206	761	31	408	144	21	29	537	1,931	9.1	2,554	12.2
Douglas	100,399	92,302	3,283	165	1,446	601	83	86	2,433	8,097	8.1	12,999	13.1
Jackson	181,269	160,795	12,126	674	1,782	1,583	291	198	3,820	20,474	11.3	22,269	12.5
Josephine	75,726	69,233	3,229	192	844	460	78	52	1,638	6,493	8.6	11,193	15.0
Klamath	63,775	53,659	4,961	362	2,443	482	72	96	1,700	10,116	15.9	10,515	16.8
Lane	322,959	286,075	14,874	2,391	3,268	6,390	562	534	8,865	36,884	11.4	45,423	14.4
Lincoln	44,479	39,260	2,119	113	1,296	412	66	31	1,182	5,219	11.7	6,084	13.9
Linn	103,069	94,012	4,514	285	1,192	789	125	92	2,060	9,057	8.8	11,618	11.4
Marion	284,834	217,880	48,714	2,274	3,326	4,905	967	337	6,431	66,954	23.5	37,104	13.5
Multnomah	660,486	505,492	49,607	35,592	5,754	37,344	2,206	1,216	22,275	154,994	23.5	81,711	12.7
Polk	62,380	53,394	5,480	229	1,078	671	152	57	1,319	8,986	14.4	6,943	11.5
Tillamook	24,262	22,086	1,244	42	273	154	50	9	404	2,176	9.0	2,718	11.2
Washington	445,342	346,251	49,735	4,778	2,335	29,552	1,249	650	10,792	99,091	22.3	32,575	7.4
Yamhill	84,992	71,684	9.017	592	1,134	889	91	76	1,509	13,308	15.7	7,336	9.2
Oregon	3,421,399	2,857,656	275,314	53,325	40,130	100,333	7,398	4,550	82,733	563,743	16.5	388,740	11.4

Source: U.S. BLM of the Census (2000)

Timber

This analysis examines timber harvest levels, the size of the harvest land base, the value of the harvest, the acres of harvest activities, and changes to the forest inventory and forest stand conditions that would result from the alternatives.

Key Points
• The annual allowable sale quantity would range from a high of 727 mmbf under Alternative 2 to a low of 268 mmbf under the No Action Alternative. • Prohibiting harvesting in certain types of stands or changing the intensity of management would all have substantial effects on the allowable sale quantity. • Over the next 10 years, volume from thinnings in the nonharvest land base would range from a high of 87 mmbf under the No Action Alternative to virtually no volume under Alternative 3. • The harvest land base varies between the alternatives from a high of 1.4 million acres, which is 65% of the forested acres, under Alternative 3 to a low of 608,000 acres, which is 27% of the forested acres, under the No Action Alternative. • The estimated sale price of timber sold during the first 10 years after implementation would range from a high of $2.16 billion under Alternative 2 to a low of $839 million under the No Action Alternative. • The annual timber harvest acres of all harvest types would range from approximately 16,000 acres for the No Action Alternative to 29,000 acres for Alternative 3.

The annual productive capacity of the sustained yield units is determined by the productivity of the land, the quantity of acres in the harvest land base, and the management intensity. The O&C Act requires the determination and declaration of an annual productive capacity. It also requires the sale annually of an amount equal to this level, which is the allowable sale quantity. The term allowable sale quantity is used to describe the annual level of sustainable harvest under each alternative. See *Chapter 3* for a discussion of forest inventory. As areas are removed from or added to the harvest land base under the alternatives, the quantity, location, and the productivity of the harvest land base would vary.

Timber Harvest Levels

Allowable Sale Quantity

Variation in the acres of different age classes within the harvest land base affects the allowable sale quantity. Harvest scheduling by treatment type also affects the allowable sale quantity. See *Appendix Q – Vegetation Modeling* for detailed information on how harvests were modeled.

Alternative 3 would restrict regeneration harvesting until landscape thresholds are met. Since the long-term allowable sale quantity is based upon the eventual harvest of all the areas that are within the harvest land base, this landscape threshold would temporarily suppress the allowable sale quantity. The allowable sale quantity shown below in the following figures and table for Alternative 3 is the initial reduced level.

The No Action Alternative would also restrict harvest levels. For example, connectivity/diversity blocks would limit the level of harvest within a decade. Regeneration harvesting of older forest would be deferred within watersheds in which federal forest lands are comprised of 15% or less of late-successional forest.

Requirements for the retention of green trees in regeneration harvests would affect the productivity of forest stands. Retention trees would reduce the available volume and thus the allowable sale quantity. These retention trees would reduce the growth of the subsequent stand. This reduction varies by stand type, site quality, retention levels, and other factors but is expected to be in the range of 10 to 25%. The No Action Alternative and Alternative 3 contain green tree retention requirements

The allowable sale quantity for the planning area is shown in *Figure 164 (Total allowable sale quantity by alternative for the planning area)*. The allowable sale quantity by district is shown in *Figure 165 (Allowable sale quantity by district and alternative)*. See *Table 167 (Allowable sale quantity by district and alternative)* for the allowable sale quantity by district and alternative.

The eastern management lands of the Klamath Falls resource area do not have an allowable sale quantity because these lands are not covered by the O&C act. Any harvest would occur only to meet forest stand health needs. Under all alternatives, the annual harvest to meet forest health needs would not exceed the modeled annual productive capacity of 2 MMBF/year. With the exception of the maximum allowable annual volume that may be harvested, and the expected miles of road constructed, these eastern management lands are not shown in the subsequent analysis of ASQ.

Figure 164. Total allowable sale quantity by alternative for the planning area

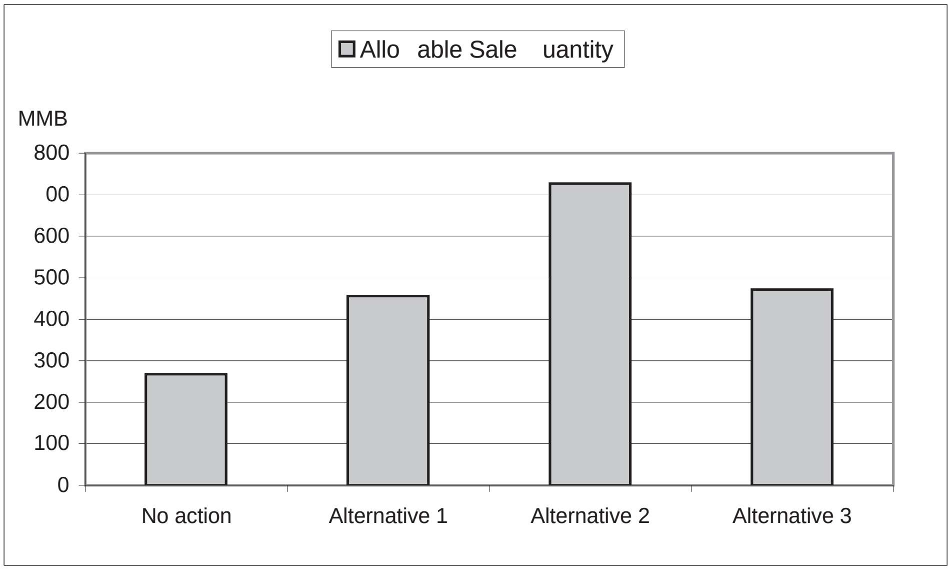


Figure 165. Allowable sale quantity by district and alternative

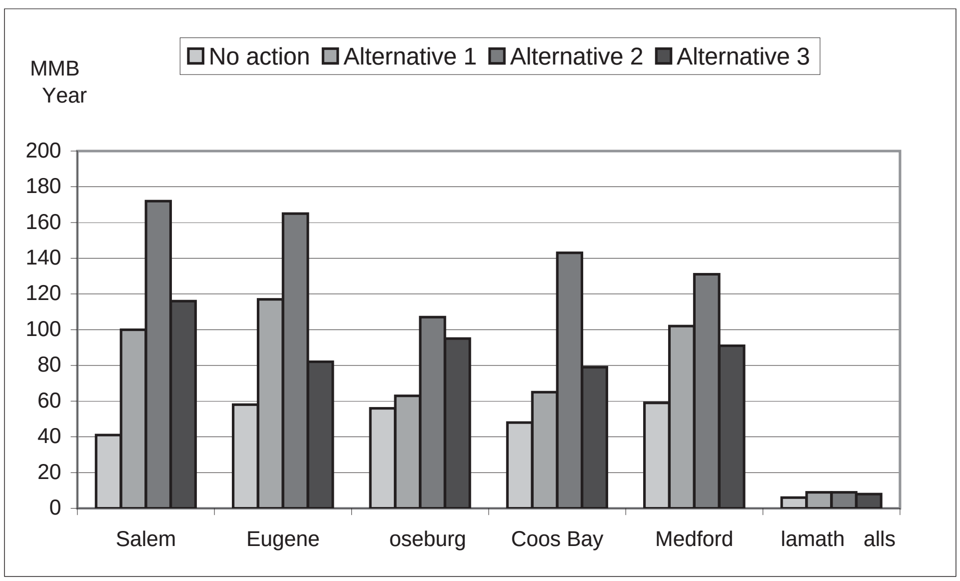


Table 167. Allowable sale quantity by district by alternative

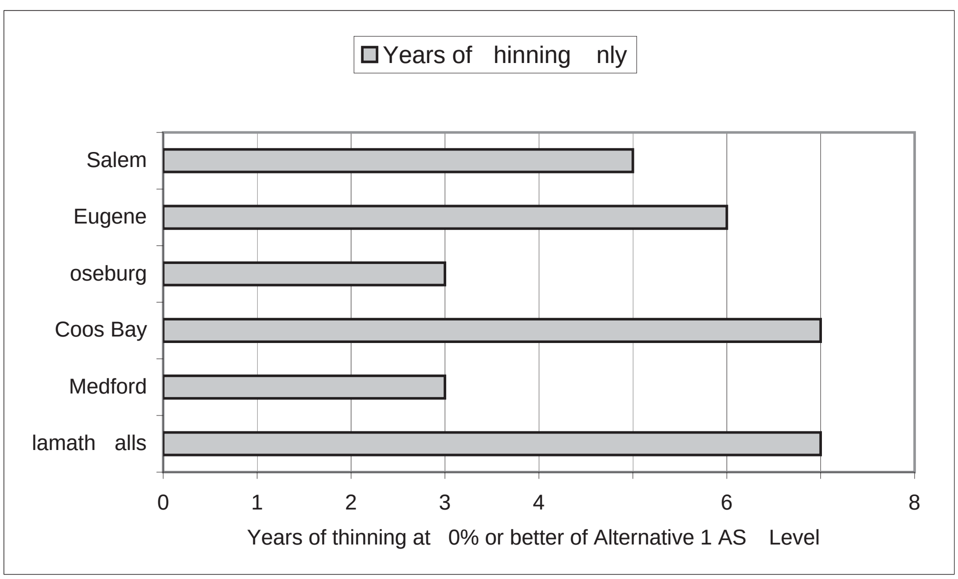
BLM Districts	Allowable Sale Quantity by Alternative (mmbf/year)			
	No Action	**Alt. 1**	**Alt. 2**	**Alt. 3**
Salem	41	100	172	116
Eugene	58	117	165	82
Roseburg	56	63	107	95
Coos Bay	48	65	143	79
Medford	59	102	131	91
Klamath Falls Resource Area (Lakeview District)	6	9	9	8

Subalternatives to Alternative 1 address four questions of how the allowable sale quantity would change in response to variations in available stands and harvest method. Subalternatives were also analyzed for Alternatives 2 and 3.

Alternative 1: Subalternative 1

The first of these subalternatives examined how long a harvest level similar to Alternative 1 would be maintained by only thinning stands that were of an appropriate age and density. A minimum thinning harvest level of 90% of the Alternative 1 allowable sale quantity level was used as a threshold. The results are shown below in *Figure 166 (Alternative 1, Subalternative 1: Allow no regeneration harvesting until thinning opportunities are exhausted)*.

Figure 166. Alternative 1, Subalternative 1: Allow no regeneration harvesting until thinning opportunities are exhausted

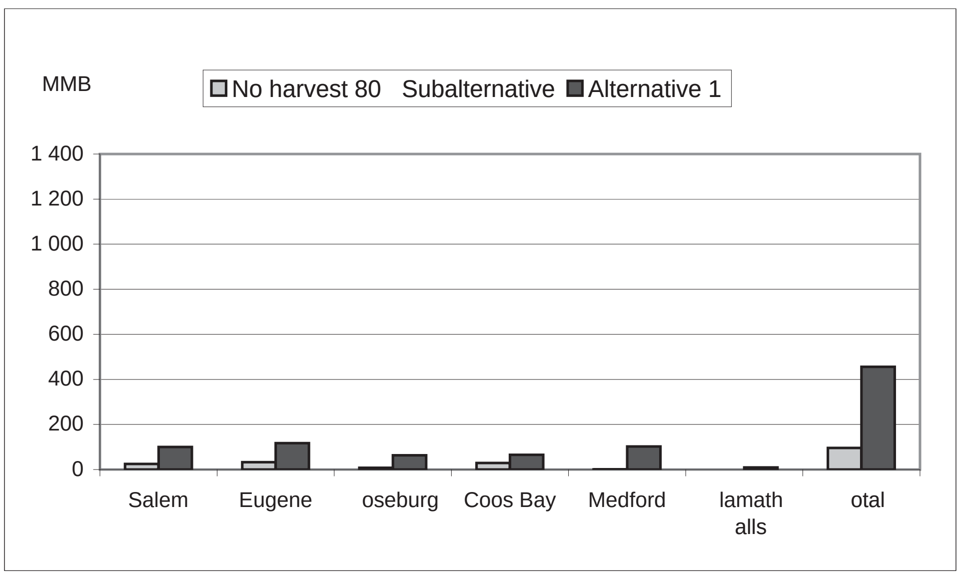


In less than a decade, thinning would no longer be maintained at 90% of the allowable sale quantity. This subalternative demonstrates that high levels of thinning cannot be maintained for extended periods to sustain an allowable sale quantity level.

Alternative 1: Subalternative 2

The second subalternative analyzed for Alternative 1 addressed the effect on the allowable sale quantity if stands currently 80 years of age and older were reserved from harvesting. The sustainable levels of allowable sale quantity are shown below in *Figure 167 (Alternative 1, Subalternative 2: Allow no harvesting of stands that are 80 years of age and older)*.

Figure 167. Alternative 1, Subalternative 2: Allow no harvesting of stands that are 80 years of age and older



The substantial decline in the allowable sale quantity in all districts indicates that the harvest of stands over 80 years of age would be essential to attain the Alternative 1 level of volume harvested. If stands currently over 80 years of age were reserved from harvesting, the allowable sale quantity for the planning area would fall to 96 mmbf per year, which would be 21% of Alternative 1's allowable sale quantity. Specifically:

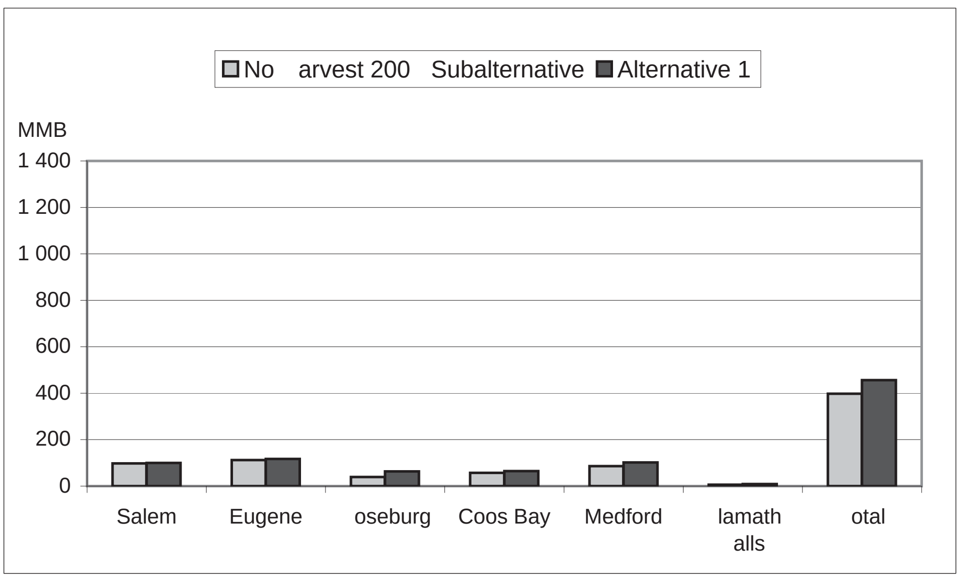
- The effects would vary by district with the highest harvest level being in the Eugene District at 33 mmbf per year.
- The highest percentage level would be in the Coos Bay District where the allowable sale quantity would be 29 mmbf per year, which would be 45% of Alternative 1's allowable sale quantity.

- The Roseburg and Medford districts would be greatly affected with the allowable sale quantity in the Roseburg District dropping to 8 mmbf per year, which would be 13% of Alternative 1's allowable sale quantity.
- The allowable sale quantity in the Medford District would drop to 1 mmbf per year, which would be less than 1% of Alternative 1's allowable sale quantity.

Alternative 1: Subalternative 3

The third subalternative analyzed for Alternative 1 addressed the effect on the allowable sale quantity if stands currently 200 years of age and older were reserved from harvesting. The allowable sale quantity is shown in *Figure 168 (Alternative 1, Subalternative 3: Allow no harvesting of stands that are 200 years of age and older)*.

Figure 168. Alternative 1, Subalternative 3: Allow no harvesting of stands that are 200 years of age and older



Under this subalternative, the allowable sale quantity for the planning area would drop to 398 mmbf per year, which is 87% of Alternative 1's allowable sale quantity. Specifically:

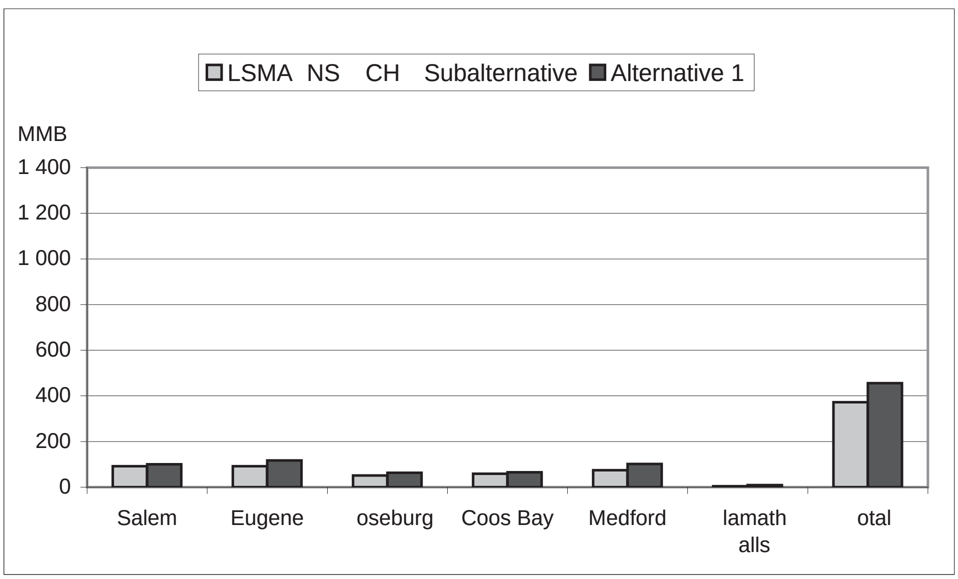
- The Salem District's allowable sale quantity would be the least affected as a percentage by retaining 98 mmbf per year, which would be 98% of Alternative 1's allowable sale quantity, because the Salem District has a substantial acreage of stands between 80 and 200 years of age.
- The Roseburg District would have the greatest percentage drop in allowable sale quantity with the allowable sale quantity dropping to 39 mmbf per year, which is 61% of Alternative 1's allowable sale quantity.

- The Medford District allowable sale quantity would not be as greatly reduced because the Medford District has a substantial acreage of stands between 80 and 200 years of age that could be harvested. Harvest in the Medford District would only drop to 86 mmbf per year, which would be 84% of Alternative 1's allowable sale quantity.

Alternative 1: Subalternative 4

The fourth subalternative examined the consequences of adding the acres of the northern spotted owl critical habitat units that are not already within the late-successional management area to the late-successional management area under Alternative 1. This would reduce the harvest land base acres. The allowable sale quantity for this subalternative is shown in *Figure 169 (Alternative 1, Subalternative 4: Increase the size of the late-successional management area to include all critical habitat of the northern spotted owl).*

Figure 169. Alternative 1, Subalternative 4: Increase the size of the late-successional management area to include all critical habitat of the northern spotted owl



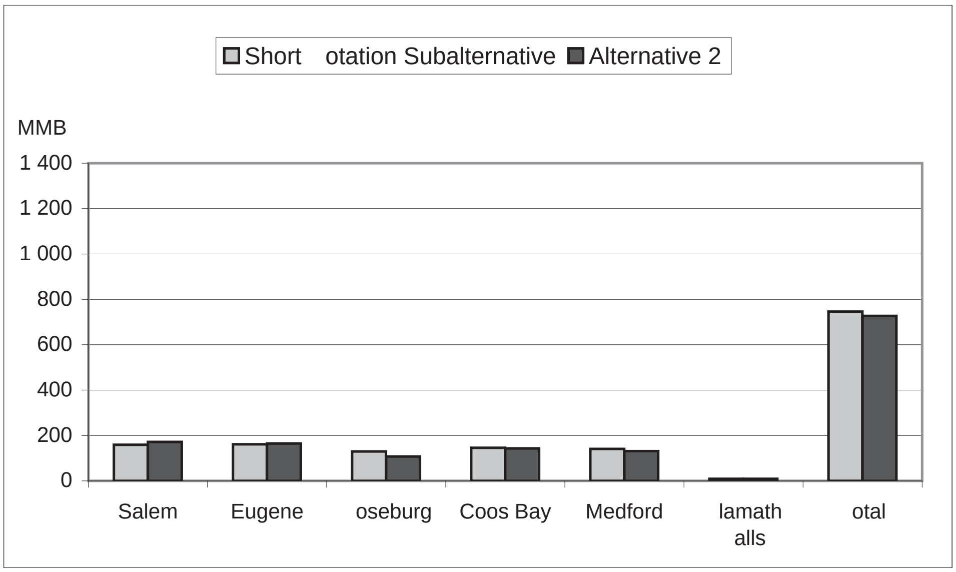
Under this subalternative, the allowable sale quantity for planning area would be reduced to 372 mmbf per year, which would be 82% of Alternative 1's allowable sale quantity. Specifically:

- The Klamath Falls Resource Area would be the most affected with a harvest level of 4 mmbf, which would be 44% of Alternative 1's allowable sale quantity.
- The Salem District would be the least affected with a harvest level of 92 MMBF per year, which would be 92% of Alternative 1's allowable sale quantity.

Alternative 2: Subalternative 1

This subalternative examined the consequences under Alternative 2 of reducing the minimum harvest age to more closely resemble current industrial forest management and removing commercial thinning. The allowable sale quantity of this subalternative is shown in *Figure 170 (Alternative 2, Subalternative 1: Change the rotation to emulate the timber industry's short rotation)*.

Figure 170. Alternative 2, Subalternative 1: Change the rotation to emulate the timber industry's short rotation



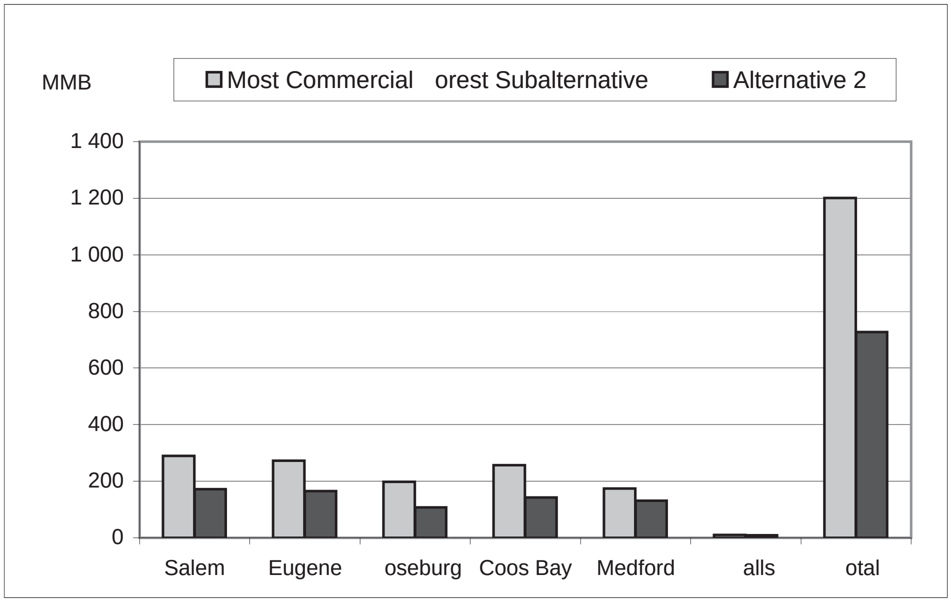
This subalternative would increase the allowable sale quantity to 746 mmbf per year, which would be 103% of Alternative 2's allowable sale quantity. However, the consequences would be different for different districts with the Salem and Eugene districts decreasing in allowable sale quantity, and the Roseburg, Coos Bay, and Medford districts increasing. The existing stand age class distributions of the districts respond differently in this subalternative.

Reference Analysis

A reference analysis of managing most commercial forest lands for timber production was completed.

The results that would occur are shown in *Figure 171 (Reference Analysis: Manage most commercial forest lands for timber production)*.

Figure 171. Reference Analysis: Manage most commercial forest lands for timber production



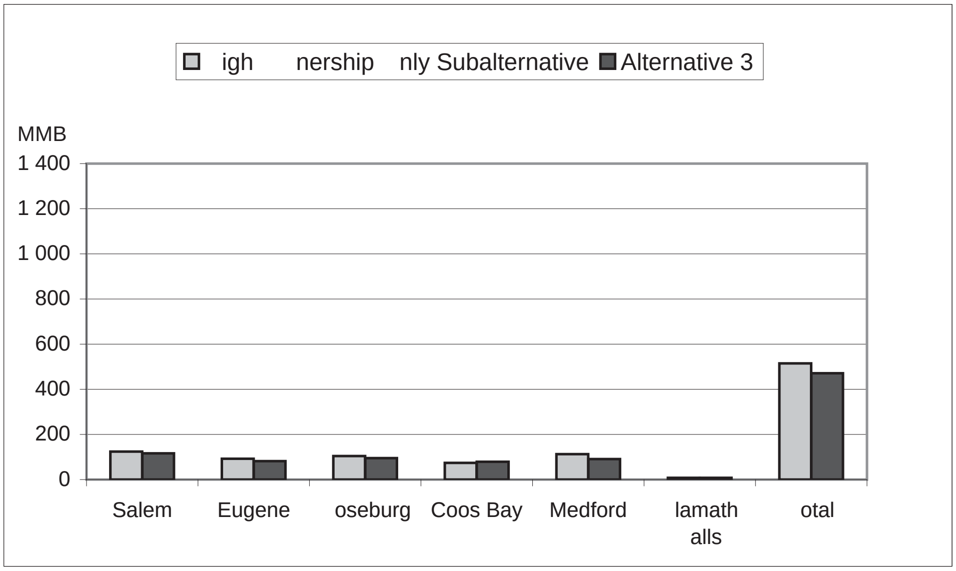
The allowable sale quantity under all of the alternatives is substantially lower than the reference analysis of managing most commercial forest lands for timber production. The total for the planning area would be 1,201 mmbf per year, which would be 165% of Alternative 2's allowable sale quantity. That would be an increase of 474 mmbf per year.

The allowable sale quantities for all four alternatives would be 22%, 38%, 61%, and 39% of the allowable sale quantity of the manage most lands for commercial timber production for the No Action Alternative, Alternative 1, Alternative 2, and Alternative 3, respectively.

Alternative 3: Subalternative 1

This subalternative examined the consequences under Alternative 3 of using landscape thresholds for regeneration harvests, but only in the areas of high BLM ownership. The results are shown in *Figure 172 (Alternative 3, Subalternative 1: Apply the landscape target of 50% in late-successional habitat condition to only those areas where the government land is half or more of the total ownership).*

Figure 172. Alternative 3, Subalternative 1: Apply the landscape target of 50% in late successional habitat condition to only those areas where the government land ownership is half or more of the total ownership



This subalternative increases the allowable sale quantity from Alternative 3 to 515 mmbf per year, which would be 109% of Alternative 3's allowable sale quantity. That would be an increase of 44 mmbf per year.

Changes from 1995 Harvest Land Base and ASQ

The alternatives would vary the portion of the forest allocated to the harvest land base, which has a direct effect on the harvest level by increasing or decreasing the acreage of lands available for sustained harvest.

In 1995, it was estimated that the riparian reserves contained approximately 522,000 acres. Improved riparian reserve estimations, which were completed for these plan revisions, have shown that riparian reserves under the No Action Alternative contain 364,000 acres. Over the past 10 years, the extent of the hydrology network has been more fully mapped and the information regarding fish presence has increased. This improved data of the BLM lands allowed for GIS modeling of the extent of riparian reserves that was not feasible 10 years ago. See *Geographic Information System Data* in the *Introduction* to this chapter.

The allowable sale quantity for the planning area is based on the improved GIS mapping of allocations, new inventory data, and revised growth and yield information. Given the low level of harvests in the last decade, the total standing volume has increased since the 1995 estimations. Therefore, the allowable sale quantity for the No Action Alternative would be 268 mmbf per year, which would be 32% greater than the 203 mmbf per year that was declared as the allowable sale quantity in the 1995 resource management plans.

Nonharvest Land Base Volume

Under the alternatives, timber would be offered each year as allowable sale quantity. In addition, volume from the nonharvest land base would be added to the allowable sale quantity and offered for sale each year. The nonharvest land base volume would result from applying thinning treatments in young stands to accelerate the development of mature and structurally complex forest for stands not in the harvest land base (see the *Introduction* section of this chapter). These thinning harvests would not be sustainable and would decline over time as the young stands in the nonharvest land base become too old for treatment. Under the alternatives, thinnings treatments would occur in:

- the late-successional reserves and riparian reserves under the No Action Alternative,
- the late-successional management areas and riparian management areas under Alternatives 1 and 2, and
- the riparian management areas under Alternative 3.

For some areas in the nonharvest land base, such as National Landscape Conservation System lands, or lands not suitable for sustained timber harvesting, no thinning harvesting is planned. See *Figure 173 (Nonharvest land base volume over time)* for the volume and duration of harvest from the nonharvest land base for all four alternatives.

Figure 173. Nonharvest land base volume over time

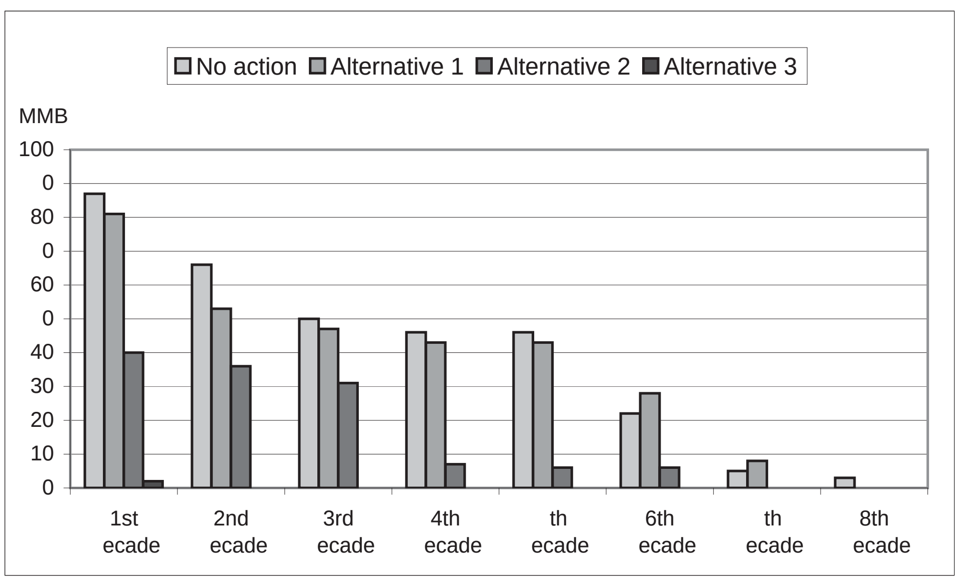


Figure 173 shows that for all four alternatives, the nonharvest land base harvest volume would decline over the entire planning area and would cease by the end of the eighth decade.

See Table 168 (*Nonharvest land base volume over the next 10 years)* for the first decade level of nonharvest land base volume that would occur for the alternatives.

Table 168. Nonharvest land base volume over the next 10 years

BLM Districts	First Decadal Nonharvest Land Base Volume (mmbf)			
	No Action	**Alt. 1**	**Alt. 2**	**Alt. 3**
Salem	32	32	12	2
Eugene	14	14	12	0
Roseburg	12	9	7	0
Coos Bay	26	24	8	0
Medford	3	2	1	0
Klamath Falls Resource Area	0	0	0	0
Totals	**87**	**81**	**40**	**2**

Volume harvested from the nonharvest land base volume is added to the computed allowable sale quantity to determine the total volume that would be annually harvested under the alternatives.

The No Action Alternative would thin more timber volume from the nonharvest land base than the other alternatives because the No Action Alternative would have the largest acreage in the nonharvest land base of all four alternatives. The additional volume from these lands outside the harvest land base would be an additional 32% of the allowable sale quantity for the No Action Alternative. The No Action Alternative would restrict thinning to stands less than 80 years of age (except for the North Coast Adaptive Management Area, where the limit would be 110 years). Alternatives 1, 2, and 3 would not restrict nonharvest land base thinning by stand age. Through thinning, Alternative 1 would generate an additional 18% above the allowable sale quantity. The level of Alternative 2 would be 5% and Alternative 3 would be less than 1%.

In addition to the allowable sale quantity and nonharvest land base volume, the eastern management lands of the Klamath Falls Resource Area would add an additional 2 mmbf under all four alternatives.

Total Harvest Volume Level

The allowable sale quantity, the nonharvest base volume, and the eastern management land volume comprise the total harvest volume level. This level is shown below by district and alternative for the first decade in *Figure 174 (Total annual volume level by alternative over the next 10 years),* and in *Table 169 (Total annual volume by district over the next 10 years).*

Figure 174. Total annual volume level by alternative over the next 10 years

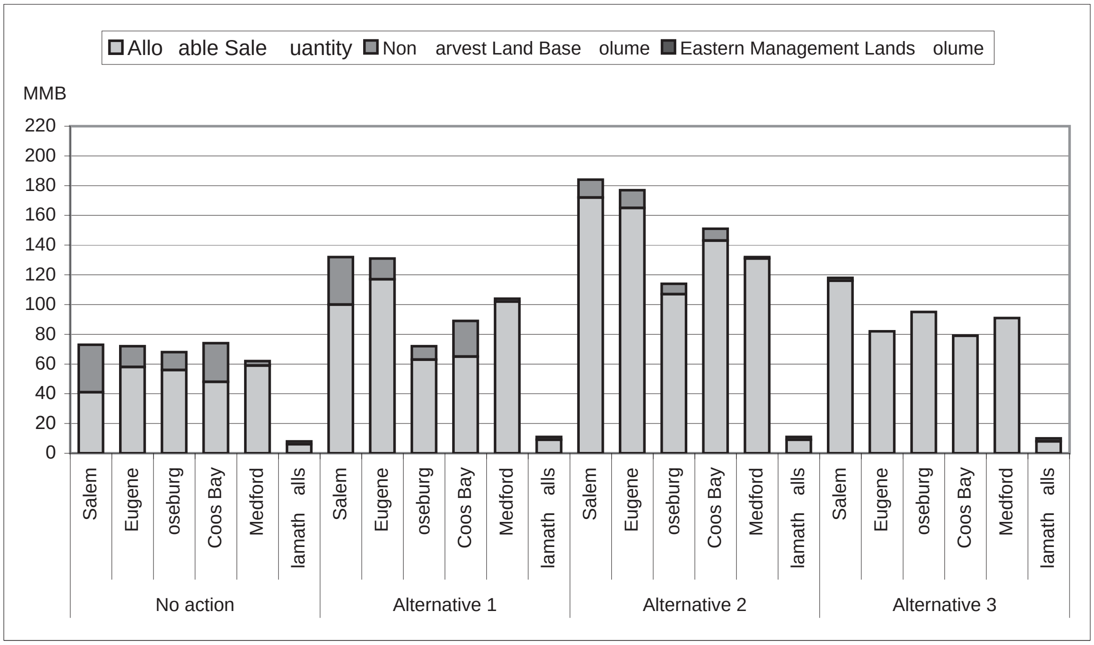
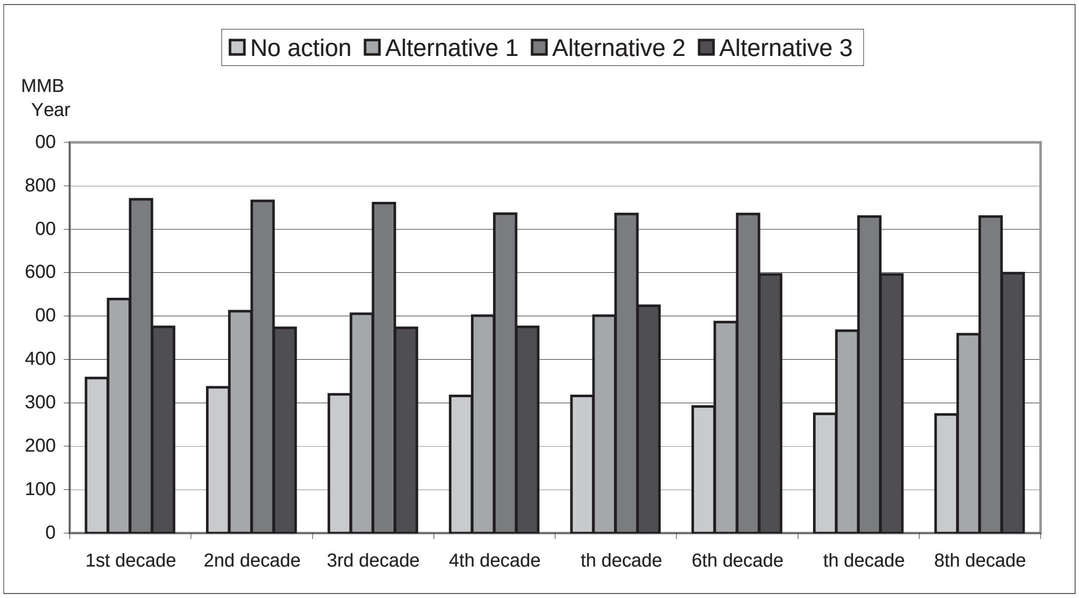


Table 169. Total annual volume by district over the next 10 years

Alternatives	First Decadal Annual Harvested Volume by BLM District (mmbf)						Totals
	Salem	Eugene	Roseburg	Coos Bay	Medford	Klamath Falls	
No Action	73	72	68	74	62	8	357
Alternative 1	132	131	72	89	104	11	539
Alternative 2	184	177	114	151	132	11	769
Alternative 3	118	82	95	79	91	10	475

As a result of the declining nonharvest land base volume, the total volume harvested would decrease over the first eight decades, except for Alternative 3 where the attainment of landscape objectives would permit the sustainable allowable sale quantity to increase. The volume harvested by decade is shown in *Figure 175 (Total harvest volume by decade and alternative)*.

Figure 175. Total harvest volume by decade and alternative



Age of Stands Harvested

The ages of the stands that would be harvested vary by alternative. The No Action Alternative would harvest proportionally less mature and structurally complex forest and a higher amount of younger forest than the action alternatives. Specifically:

- Under the No Action Alternative, the allowable sale quantity harvest volume from forests older than 200 years during the first decade would be 19 mmbf per year, which would be 7% of the allowable sale quantity harvest volume.
- Under Alternatives 1, 2, and 3, the allowable sale quantity from forests older than 200 years during the first decade would be 98 mmbf per year (21 %), 175 mmbf per year (24%), and 99 mmbf per year (21%), respectively.

The following four figures (*Figures 176* through *Figure 179*) show the volumes that would be harvested by age class by alternative during the first decade. These figures include both allowable sale quantity and nonharvest land base volumes.

Figure 176. Timber volume harvest by age class under the No Action Alternative over the next 10 years

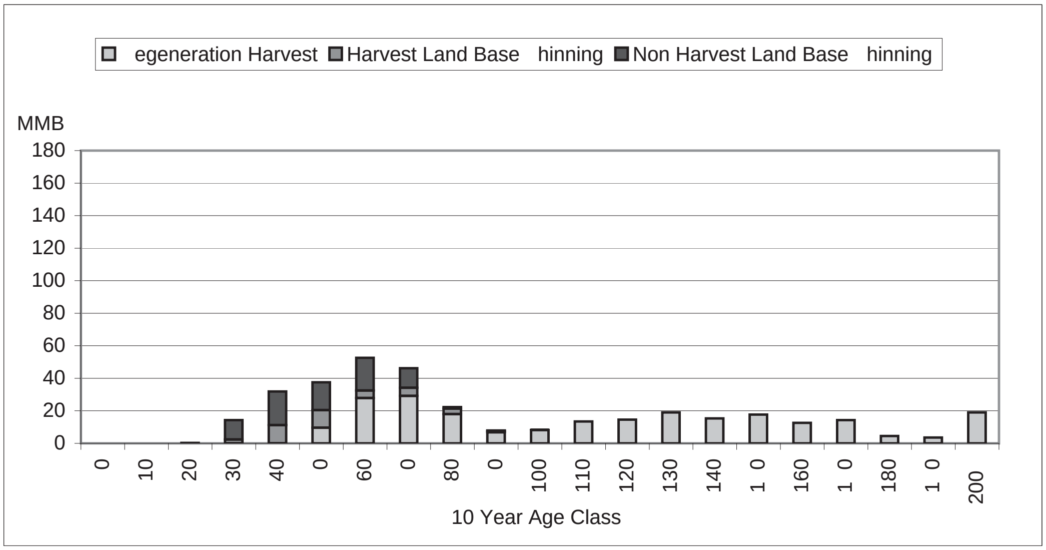


Figure 177. Timber volume harvest by age class under Alternative 1 over the next 10 years

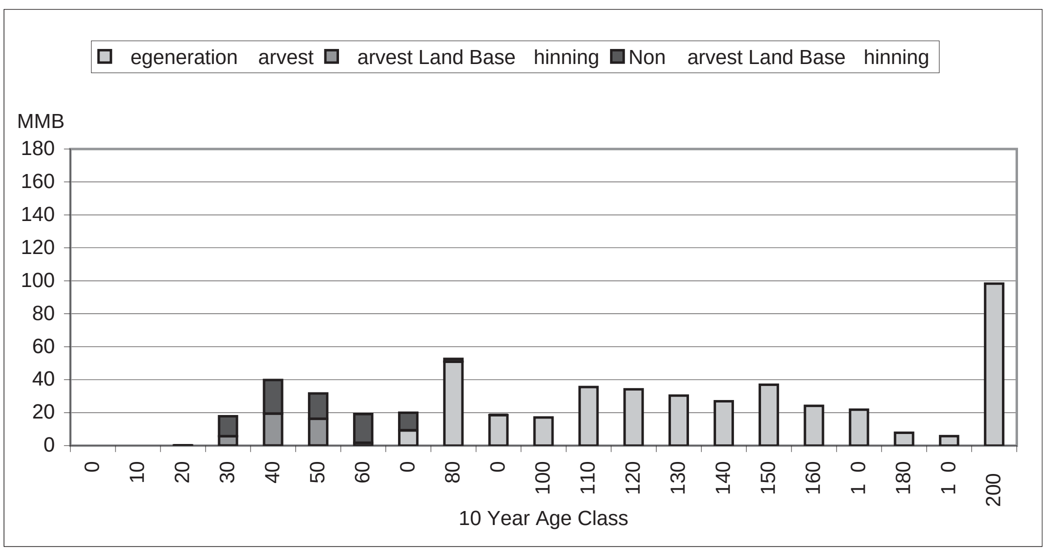


Figure 178. Timber volume harvest by age class under Alternative 2 over the next 10 years

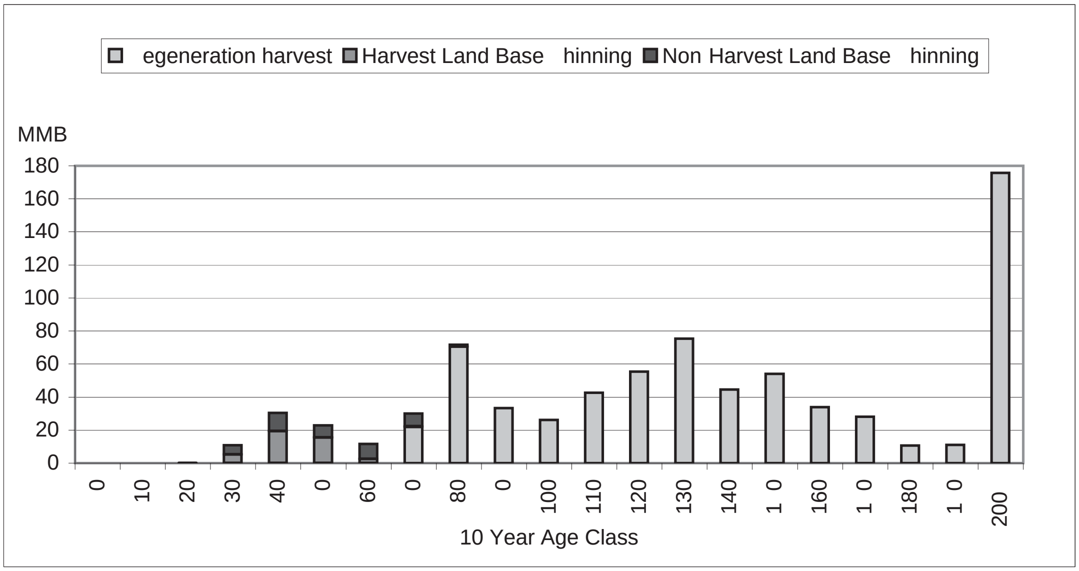
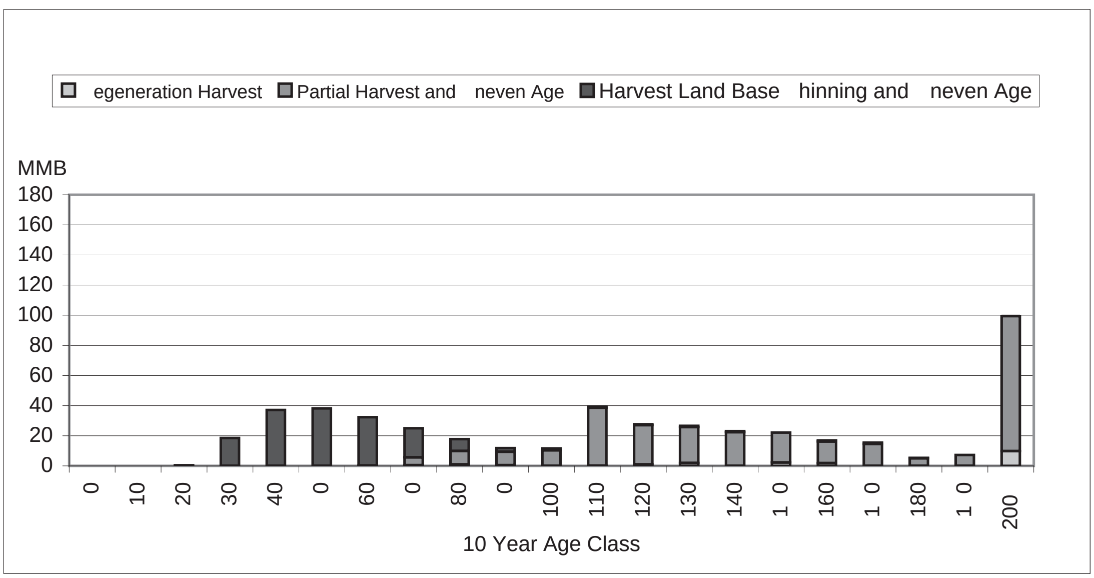


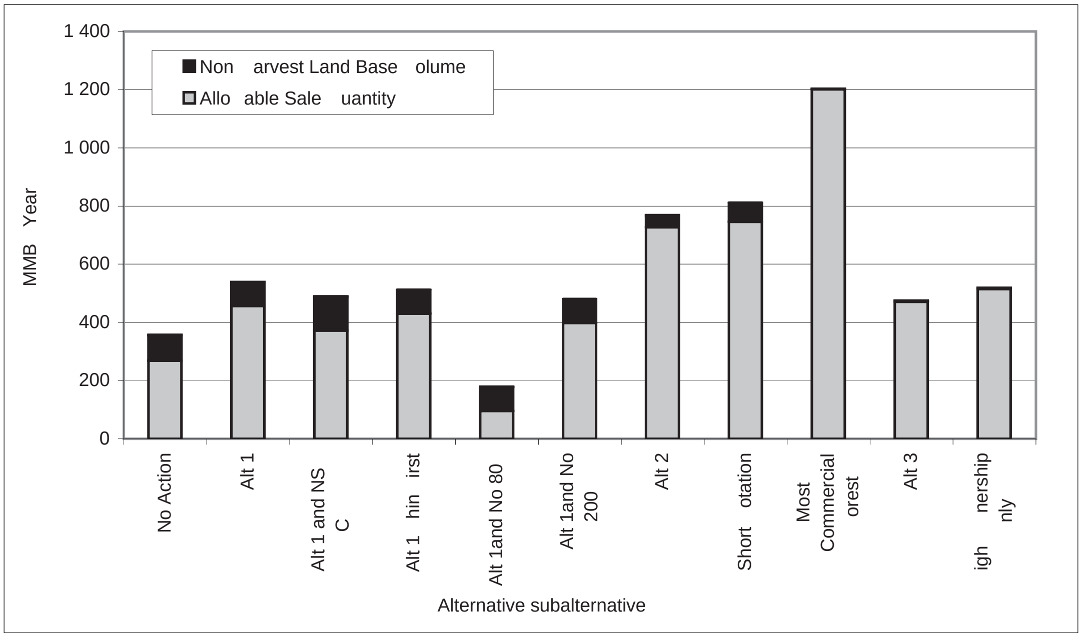
Figure 179. Timber volume harvest by age class under Alternative 3 over the next 10 years



Summary of Timber Harvest levels

The total volume harvested annually would vary substantially between the subalternatives and alternatives. Subalternatives change not only in the allowable sale quantity but also the amount on nonharvest base volume that would be produced. The total volume for the alternatives and subalternatives is shown in *Figure 180 (Total volume harvested for all four alternatives and subalternatives).*

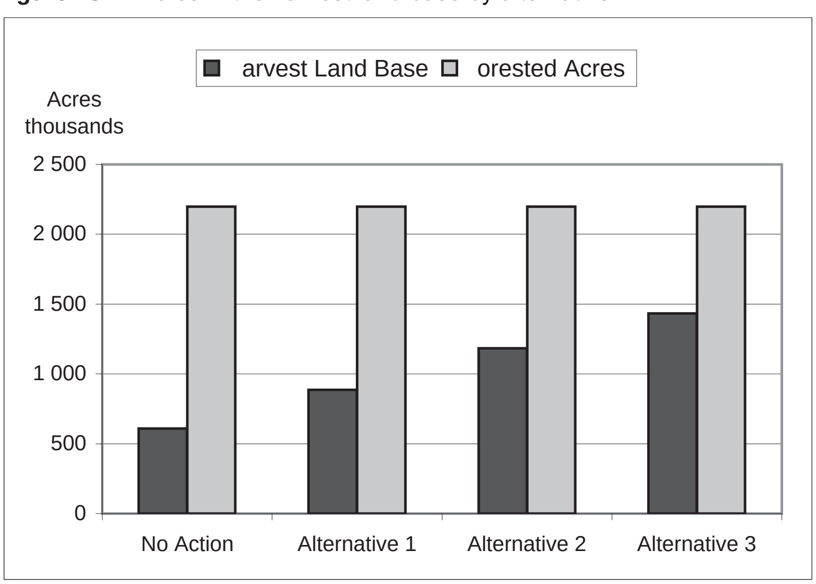
Figure 180. Total volume harvested for all four alternatives and subalternatives



Harvest Land Base

The harvest land base varies by alternative. The No Action Alternative has the lowest number of acres within the harvest land base. This alternative has 27% of the forested acres contained within the harvest land base (nearly 608,000 acres). Alternative 3 has the highest amount with 65% of the forested acres being contained within the harvest land base (1.4 million acres). *Figure 181 (Acres in the harvest land base by alternative)* displays the acres for the alternatives contrasted with the total forested acres.

Figure 181. Acres in the harvest land base by alternative



Value of the Harvest

Log Quality

The differences in the ages of the stands and the species composition of those stands that would be harvested under the alternatives would result in different types and grades of logs being removed. The structural stage classification described in the *Ecology* section of *Chapter 3* is used as one basis for determining the log quality and the value resulting from these harvests. The differences in species that occur in each district would also affect the value of the harvests for each alternative. Historical sales data has been used to estimate the percentage of harvest volume by species or groups of species. Individual species have been consolidated into groupings that are typical of those quoted for prices, such as true firs and hemlock being grouped into whitewoods. Historical sales data has also been used to estimate the amount of different log grades that would result from harvesting each structural stage. See *Appendix D – Timber* for further discussion on the methodology to value the timber that would be produced under each alternative.

The percentages of volume by structural stage that would be harvested are shown in *Figure 182 (Percent volume by structural stage)* as the average annual level for the first 10-year period. Volume is from both the harvest land base and nonharvest land base. The volumes of harvest by structural stage are shown in *Figure 183 (Volume by structural stage and alternative).*

Figure 182. Percent volume by structural stage

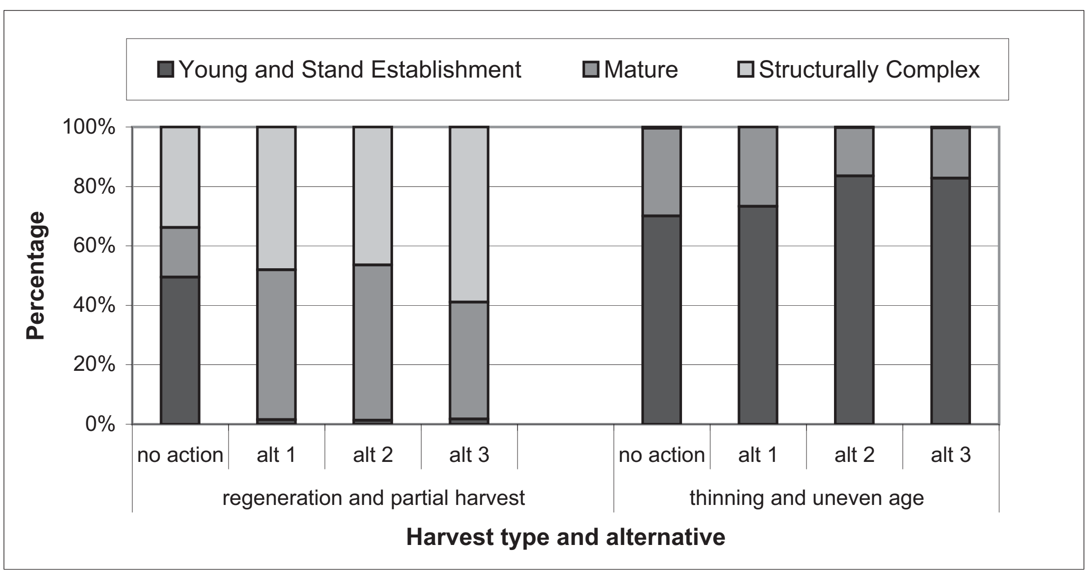
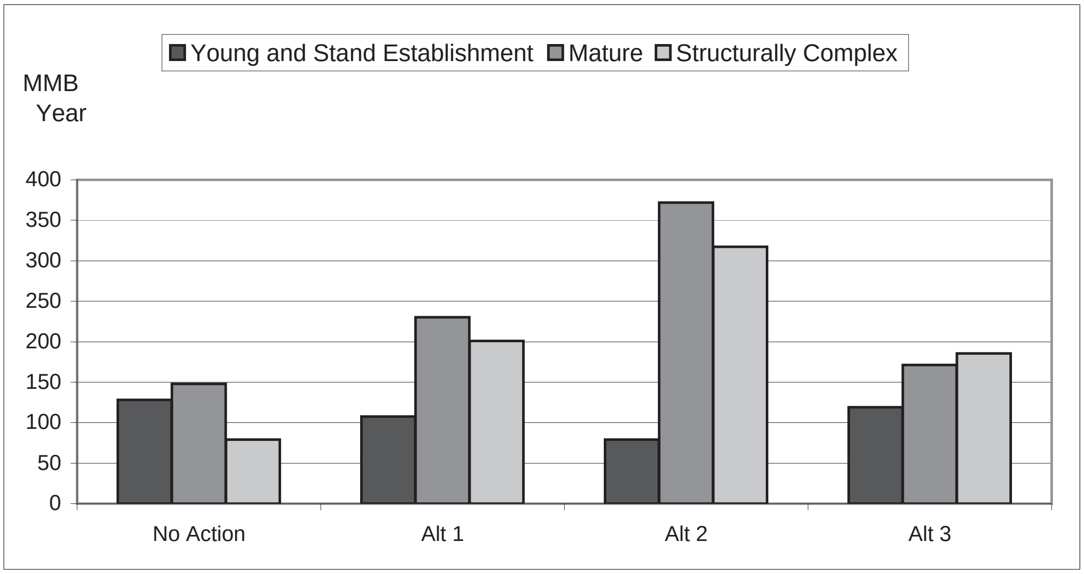


Figure 183. Volume by structural stage and alternative



Both as a percentage and in quantity, the No Action Alternative would harvest less structurally complex forest than the action alternatives. Under the No Action Alternative, there would be substantially more regeneration harvesting of young forest than for the action alternatives.

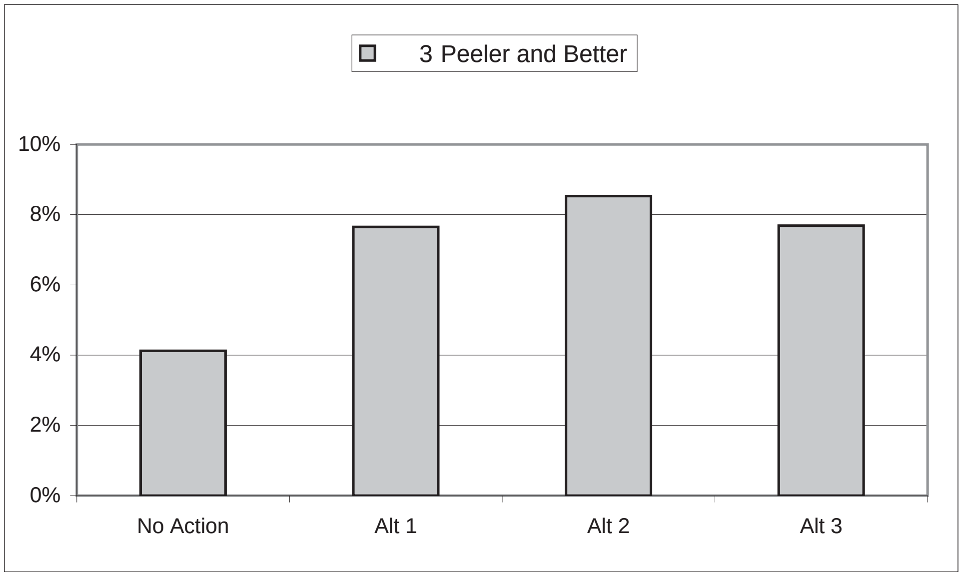
The action alternatives would all have similar percentage levels of harvest from structurally complex forest, but would vary in quantity. As a result, the percentage levels of higher-grade logs (number 3, peeler-grade and better Douglas fir) would be higher under the action alternatives than the No Action Alternative. The action alternatives would harvest similar percentages of peeler grade Douglas fir logs in the first decade.

Log quality for the first 10 year period is determined only for Douglas fir due to the dominance of Douglas fir in all districts. Historically, except for the Klamath Falls Resource Area, Douglas fir has been approximately 80% of the volume of timber sold. Two log grade groups are used for log quality analysis:

- number 3, peeler-grade and better
- sawlog grade

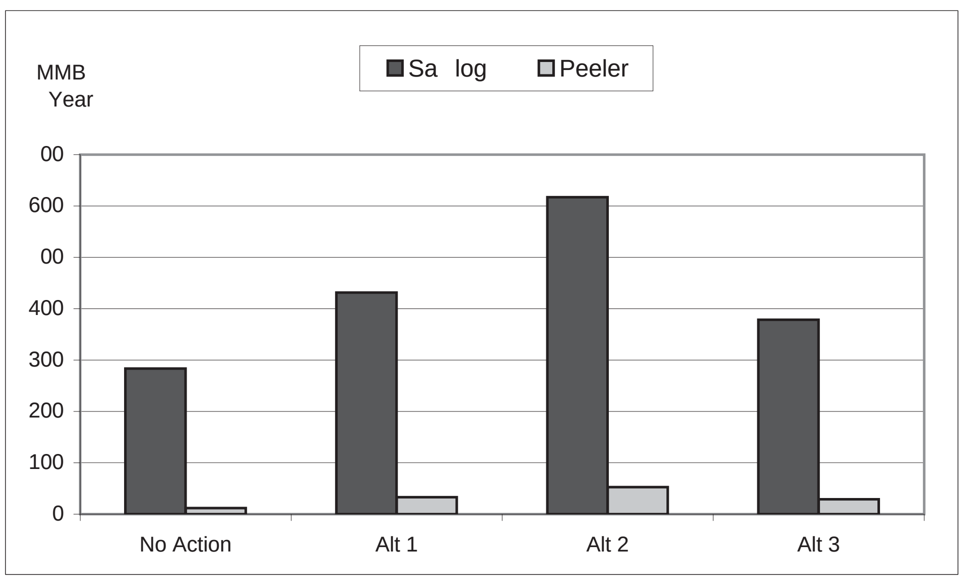
The percentage level of Douglas fir volume by peeler grade that would be harvested by alternative is shown in *Figure 184 (Percentage of number 3, peeler-grade and better Douglas fir logs by alternative).*

Figure 184. Percentage of number 3, peeler-grade and better Douglas fir logs by alternative



Under the alternatives, there are differing levels of harvest volume. The quantities of peeler-grade logs compared to sawlog-grade logs are shown in *Figure 185 (Douglas fir log volumes by peeler grade and sawlog grade by alternative)*.

Figure 185. Douglas fir log volumes by peeler grade and sawlog grade by alternative



Under the No Action Alternative, there would be a reduced level in the quality of logs as a percentage and in the quantity harvested compared to the action alternatives because of the higher proportion of thinning and the lower proportion of the structurally complex forest that would be harvested compared to the action alternatives.

Stumpage Value

The value of the timber harvests for each alternative is the product of the harvest levels and the anticipated stumpage price.

The anticipated stumpage price is influenced by the pond value and the cost associated with harvesting.

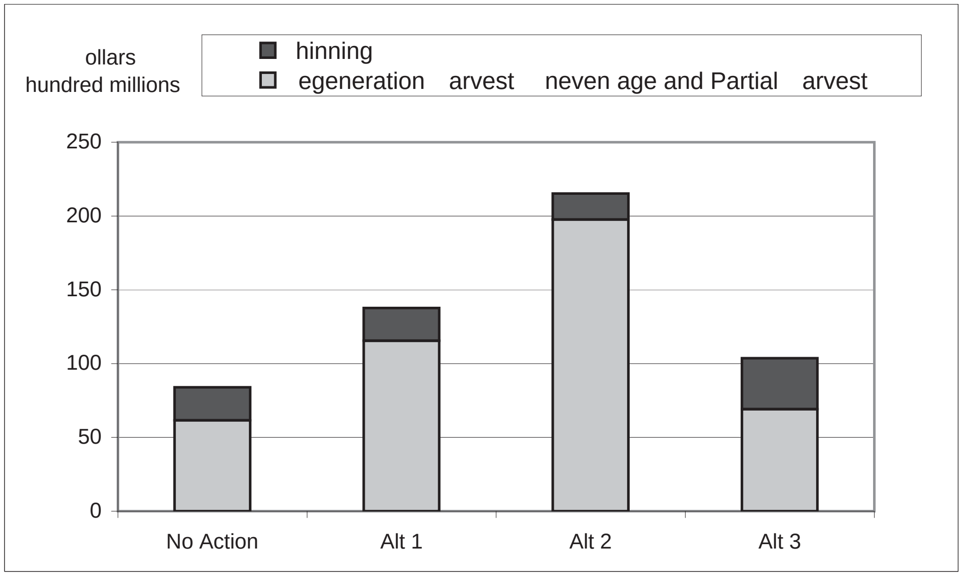
The pond value is the market value of the logs at a processing facility. The pond value is affected by the quality and species of harvested logs. Douglas fir is the primary commercial species within the planning area. In the Medford District and Klamath Falls Resource Area, ponderosa pine, white fir, and sugar pine are also important. Only these species have been divided by grade as a part of valuation. Other species have not been split by grade because of low occurrence, or because they are typically purchased as “camp run” where one price is quoted for all sizes and grades. Historical information indicates that other than the four above species, the level of higher grade logs was low relative to the total volume of other species.

The costs associated with harvesting, such as falling, logging, transportation, and road construction, reduce the price received for timber that would be sold. Stumpage is the residual value after the costs to get the log from the standing tree in the forest to where it is manufactured are subtracted from the pond value. The costs of such requirements as road construction that is needed to access timber have been estimated using costs from actual sales with a base period of 1995 through 2006. See *Appendix D – Timber* for further information.

The stumpage value of the harvests over the first 10 years is the product of the volumes for each type of harvest (i.e., thinning, partial harvesting, regeneration harvesting, and uneven-aged management) and structural stage (i.e., stand establishment, young, mature, and structurally complex) multiplied by the expected stumpage price for each harvest type. Stumpage prices for each harvest type are developed from historical costs and log prices.

The values shown in *Figure 186 (Annual stumpage value by alternative over the next 10 years)* are calculated using 2005 log prices. Values are in 2005 dollars without adjustment for inflation.

Figure 186. Annual stumpage value by alternative over the next 10 years

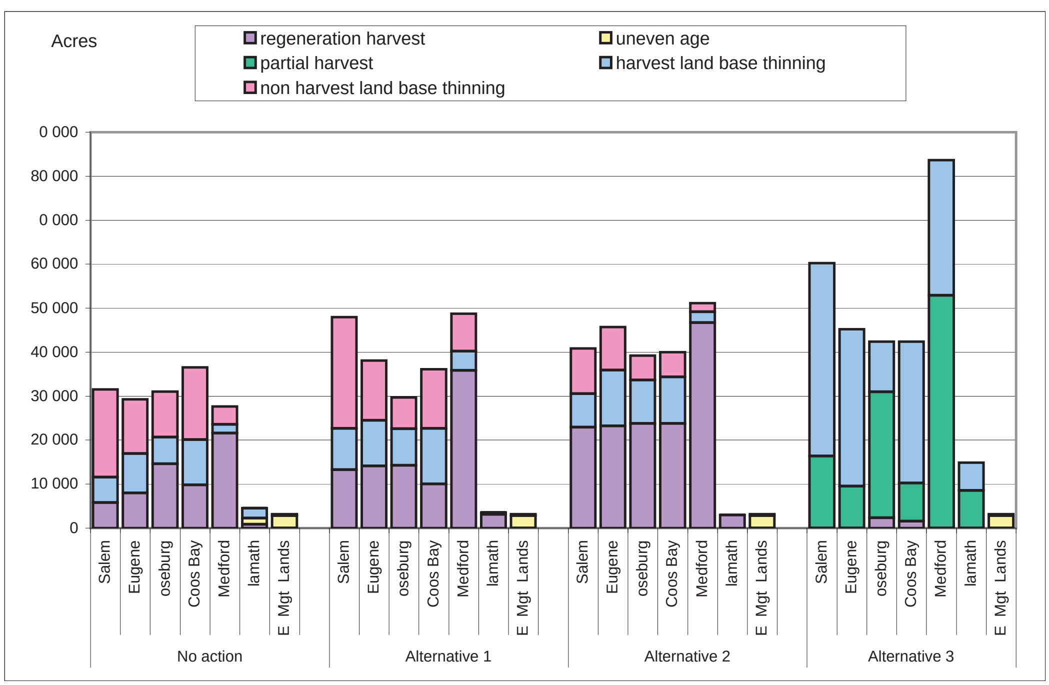


Type of Harvest

The different types of harvest that occur under the alternatives include thinning, uneven-aged management, partial harvesting, and regeneration harvest. Thinning can occur in both the harvest land base and the nonharvest land base.

The harvest levels by harvest type under each alternative over the next 10 years are shown in *Figure 187 (Harvest acres by harvest type over the next 10 years)*.

Figure 187. Harvest acres by harvest type over the next 10 years



The different alternatives would vary in the age classes that receive regeneration harvesting, partial harvesting, uneven-aged management, or thinning. The acres harvested over the next 10 years by age class are shown in the next four figures (*Figure 188* through *Figure 191*) and the next four tables (*Table 170* through *Table 173*).

During the first decade under the No Action Alternative, approximately 10% of the harvest land base would be regeneration harvested, which is 2.7% of the total forested acres within the planning area. Harvest land base thinning would occur on 6% of the harvested land base with both types of thinning (harvest land base and nonharvest land base) occurring on 4.6% of the forested acres. See *Figure 188* and *Table 170*.

Figure 188. Harvest acres by age class under the No Action Alternative

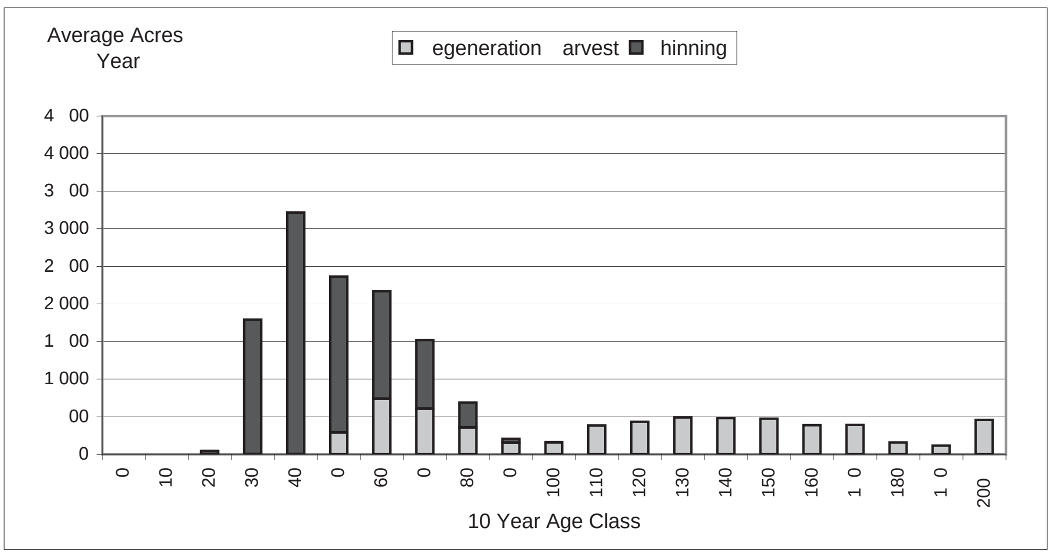


Table 170. Acres harvested by age group compared with the size of the total harvest land base under the No Action Alternative

No Action Alternative		First Decade Harvest		
		Harvest Land Base		Nonharvest Land Base
Age Group (years)	Total Harvest Land Base (acres)	Regeneration Harvesting (acres)	Thinning (acres)	Thinning (acres)
0 to 30	151,800	0	3,200	15,100
40 to 70	190,900	16,300	28,900	47,500
80 to 110	101,000	10,400	3,700	600
120 to 150	71,800	18,700	400	0
160 to 190	33,300	10,500	100	0
200+	58,800	4,600	500	0
Totals	**607,600**	**60,500**	**36,800**	**63,200**

During the first decade under Alternative 1, approximately 10% of the harvest land base would be regeneration harvested, which is 4.1% of the total forested acres within the planning area. Harvest land base thinning would occur on 5% of the harvested land base with both types of thinning (harvest land base and nonharvest land base) occurring on 5.1% of the forested acres. See *Figure 189* and *Table 171*.

Figure 189. Harvest acres by age class under Alternative 1

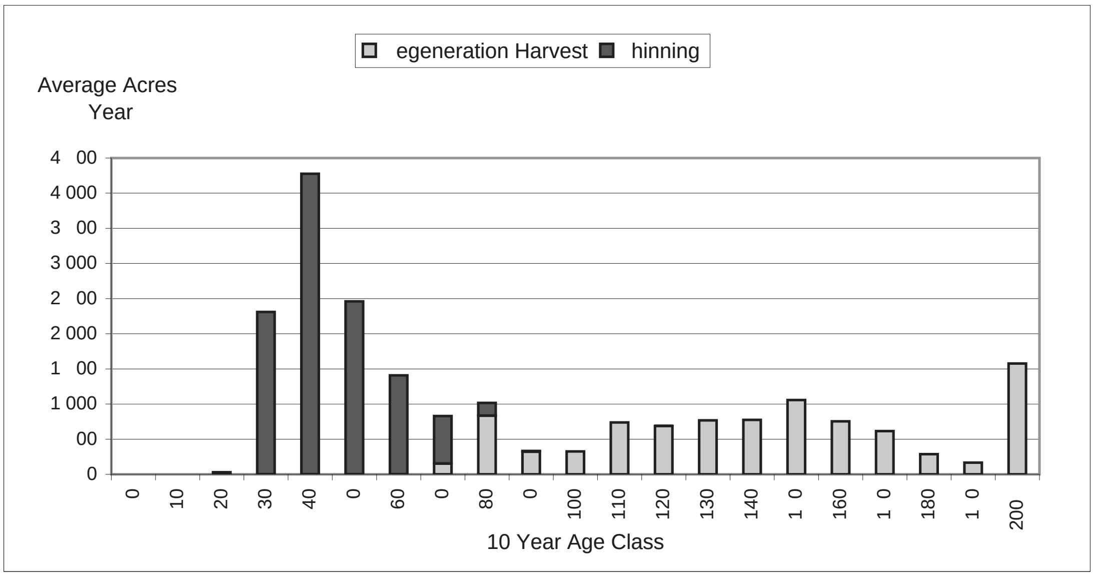


Table 171. Acres harvested by age group compared with the size of the total harvest land base under Alternative 1

Alternative 1		First Decade Harvest		
Age Group (years)	**Total Harvest Land Base (acres)**	**Harvest Land Base**		**Nonharvest Land Base**
		Regeneration Harvesting (acres)	**Thinning (acres)**	**Thinning (acres)**
0 to 30	204,600	0	7,400	16,000
40 to 70	282,400	1,500	37,500	50,600
80 to 110	144,100	22,200	500	1,400
120 to 150	109,500	32,900	0	0
160 to 190	53,100	18,200	0	0
200+	92,100	15,800	0	0
Totals	**885,800**	**90,600**	**45,400**	**68,000**

During the first decade under Alternative 2, approximately 12% of the harvest land base would be regeneration harvested, which is 6.5% of the total forested acres in the planning area. Harvest land base thinning would occur on 3.6% of the harvested land base with both types of thinning (harvest land base and nonharvest land base) occurring on 3.5% of the forested acres. See *Figure 190* and *Table 172*.

Figure 190. Harvest acres by age class under Alternative 2

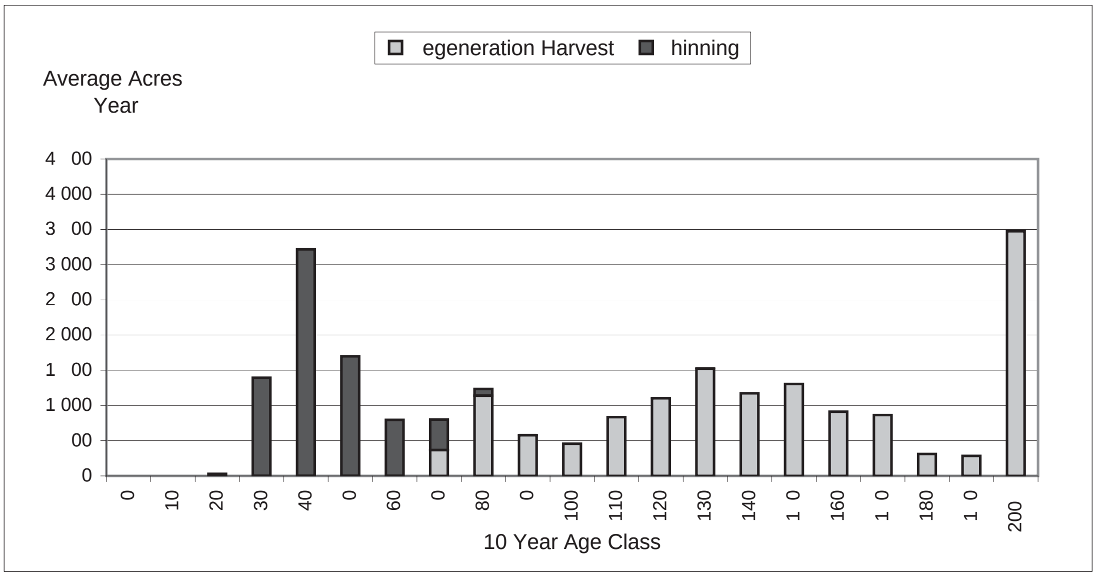


Table 172. Acres harvested by age group compared with the size of the total harvest land base under Alternative 2

Alternative 2		First Decade Harvest		
		Harvest Land Base		Nonharvest Land Base
Age Group (years)	Total Harvest Land Base (acres)	Regeneration Harvesting (acres)	Thinning (acres)	Thinning (acres)
0 to 30	279,000	0	6,800	7,400
40 to 70	346,600	3,700	36,300	25,200
80 to 110	169,300	30,100	200	800
120 to 150	163,600	51,100	0	0
160 to 190	72,100	23,700	0	0
200+	152,400	34,800	0	0
Totals	**1,183,000**	**143,400**	**43,300**	**33,400**

During the first decade under Alternative 3, approximately 0.3% of the harvest land base would be regeneration harvested, which is 0.2% of the total forested acres within the planning area. Partial harvesting would occur on 8.7% of the harvest land base, which is 5.7% of the forested acres. And harvest land base thinning would occur on 11% of the harvest land base, which is 7.3% of the forested acres. See *Figure 191* and *Table 173*.

Figure 191. Harvest acres by age class under Alternative 3

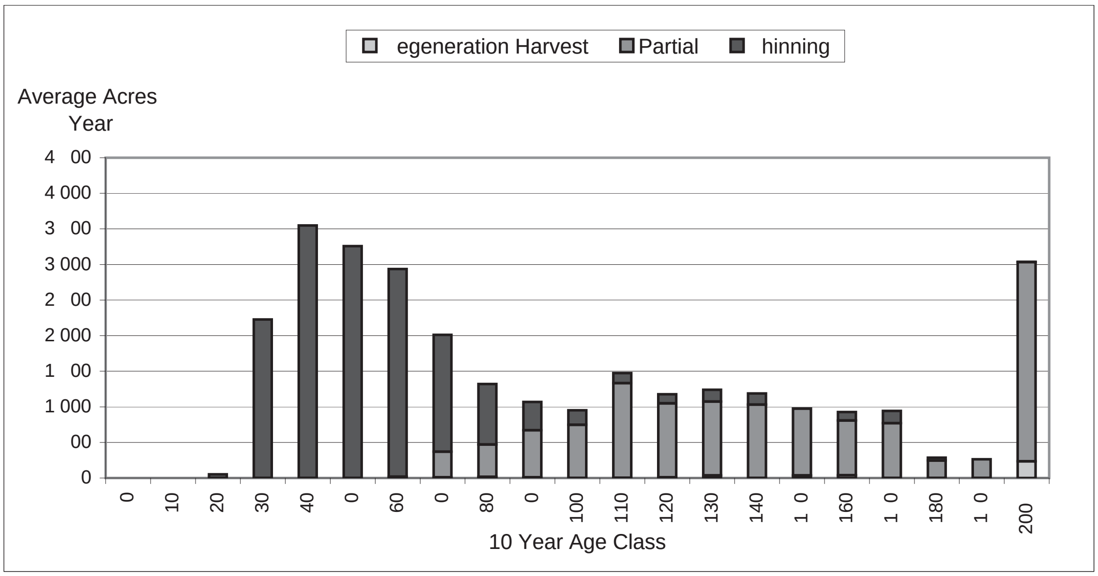


Table 173. Acres harvested by age group compared with the size of the total harvest land base under Alternative 3

Alternative 3		First Decade Harvest		
		Harvest Land Base		Nonharvest Land Base
Age Group (years)	Total Harvest Land Base (acres)	Regeneration Harvesting (acres)	Thinning (acres)	Thinning (acres)
0 to 30	377,100	0	22,800	0
40 to 70	445,700	100	117,500	0
80 to 110	201,400	300	47,800	0
120 to 150	160,100	800	44,900	0
160 to 190	83,200	400	23,800	0
200+	166,700	2,300	28,100	0
Totals	1,434,200	3,900	284,900	0

Under all four alternatives, the acres harvested would decline over time as the nonharvest land base thinning declines and as harvesting begins to shift to managed stands with higher expected yields. See *Figures 192* through *Figure 195* for the average annual harvested acres by harvest type over the next 100 years for each alternative.

Figure 192. No Action Alternative, average annual harvested acres by harvest type over the next 100 years

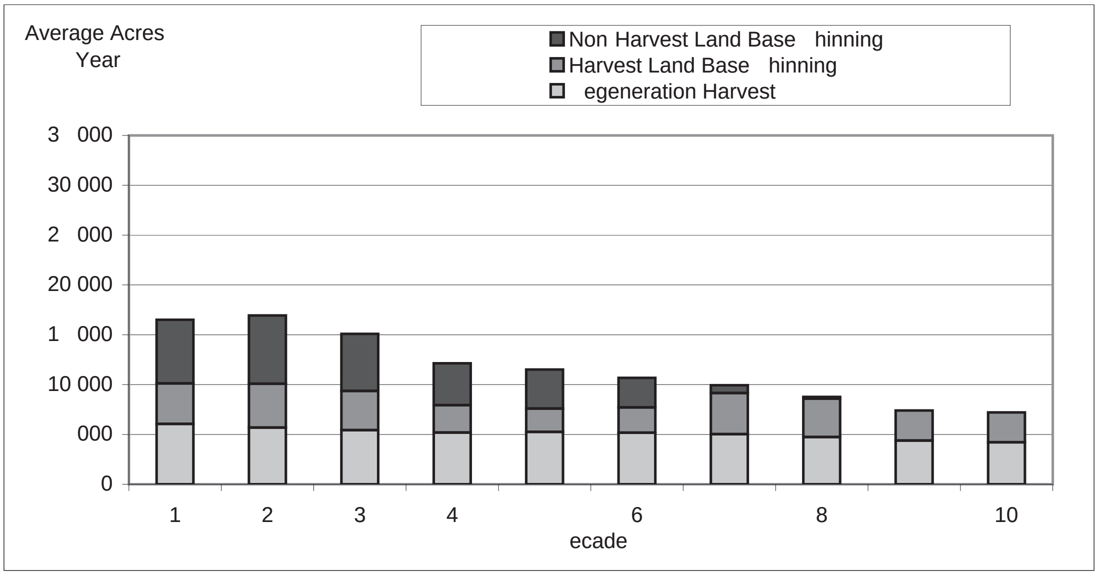


Figure 193. Alternative 1, annual average harvested acres by harvest type over the next 100 years

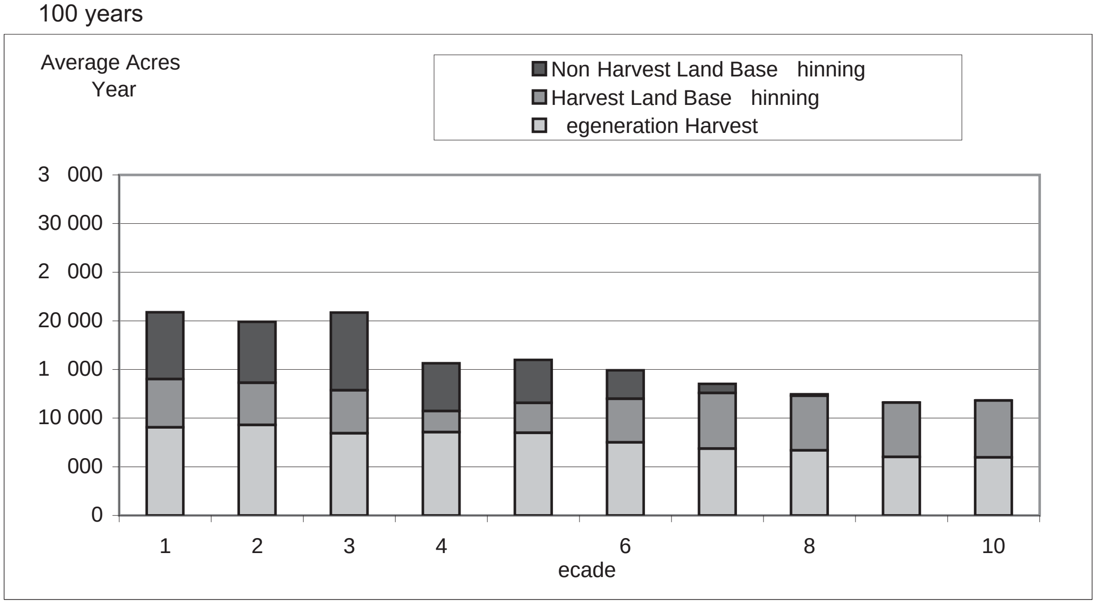


Figure 194. Alternative 2, average annual harvested acres by harvest type over the next 100 years

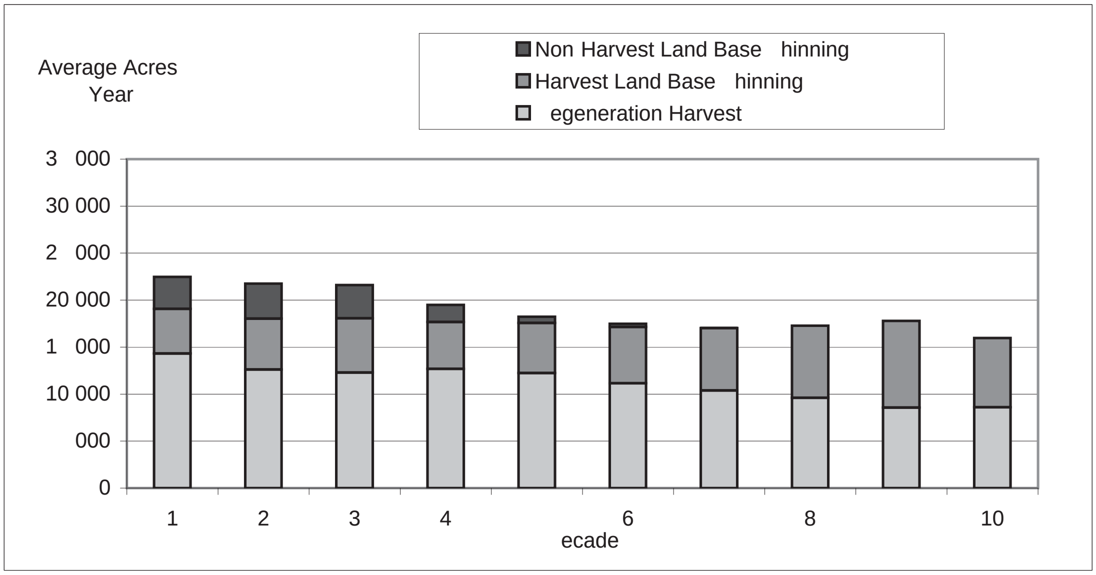
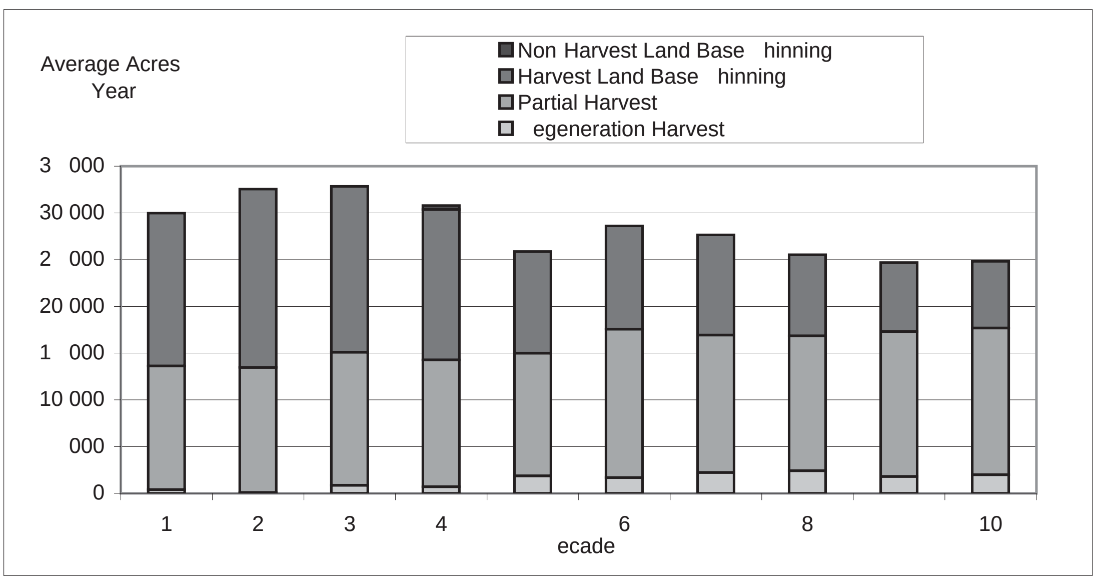


Figure 195. Alternative 3, average annual harvested acres by harvest type over the next 100 years



Under all four alternatives, some forest land would be converted to roads and landings in order to implement timber management activities. New permanent road construction under the alternatives over the next 10 years are shown in *Figures 196 (Miles of new permanent road construction under each alternative)* and *Figure 197 (Acres of new permanent road construction under each alternative)*.

Figure 196. Miles of new permanent road construction under each alternative

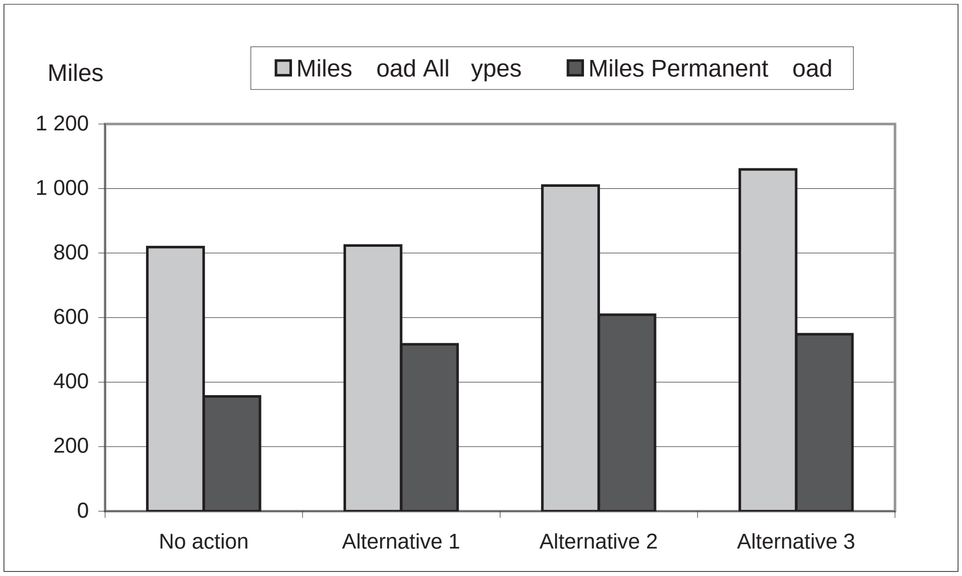
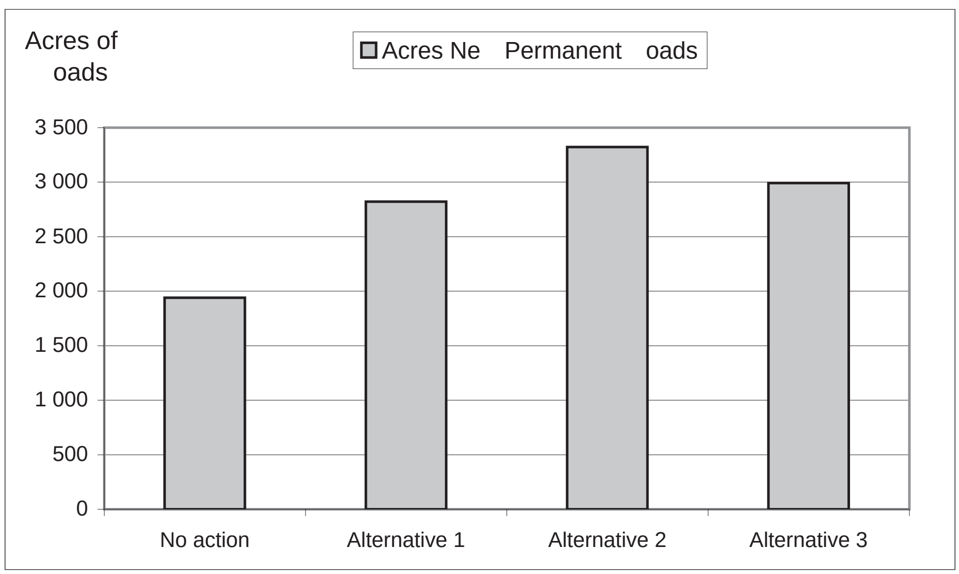


Figure 197. Acres of new permanent road construction under each alternative



Note: Acres are calculated using an average road construction and disturbance width of 45 feet.

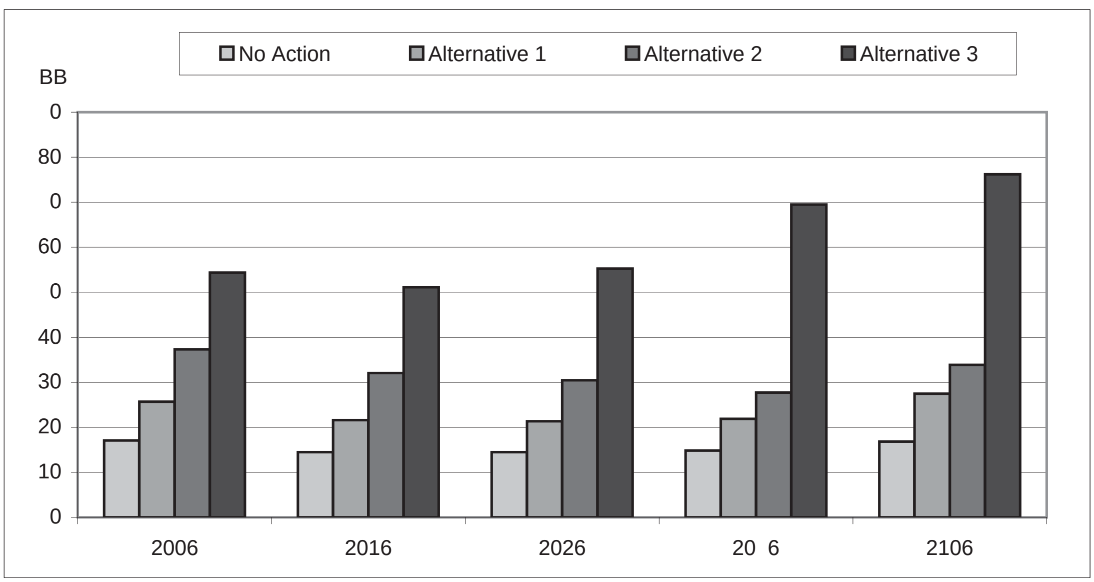
Forest Inventory and Forest stand Conditions

In the past 10 years, the amount of older forest on the BLM-administered lands within the planning area has been increasing. Under all four alternatives, this trend would continue (see the *Ecology* section in this chapter). Under all four alternatives, the aging of the nonharvest land base would cause the overall age class distribution on the BLM-administered lands to get older. Generally, the harvest land base would move towards a regulated condition.

To estimate the future growth and yield at the time of harvest, the initial volume for each forest operations inventory (FOI) unit is projected over time using the ORGANON and OPTIONS models. See *Appendix Q. Vegetation Modeling* for further explanation of this methodology.

For the entire planning area (all land use allocations), standing volume would increase under all four alternatives. This is primarily due to the stands within the nonharvest land base increasing in age. Under all four alternatives, the volume on the harvest land base would drop initially, then recover and increase as the harvest land base moves towards a regulated condition with approximately even levels of age classes below the anticipated harvest age. The trend of the standing volume for the planning area by alternative is shown in *Figure 198 (Inventory on the harvest land base by alternative over the next 100 years)*.

Figure 198. Inventory on the harvest land base by alternative over the next 100 years



The standing volume for the different alternatives varies due to the different sizes of harvest land base for the alternatives. Under all four alternatives, the standing volume in the harvest land base would dip and then recover as mature and structurally complex stands are harvested and replaced with rapidly growing stand establishment and young stands, while the standing volume in the nonharvest land base would increase. By 2106, Alternatives 1 and 3 would exceed the starting condition, the No Action Alternative will have nearly reached the starting standing volume, and Alternative 2 would not have yet recovered to the starting standing volume level.

The growth rates for stands would change in the harvest land base over time. mature and structurally complex stands would be harvested and replaced with more rapidly growing stand establishment and young stands. As young stands progress in age within the nonharvest land base, the growth on these stands would change as a result of increasing age and response to thinning.

The standing volume on the nonharvest land base indicates that the 100 year analytical period is not long enough to reach the time when the nonharvest land base growth rate would be expected to slow due to advancing age. Nonharvest land base areas, such as the late successional management areas, contain acres of stand establishment and young stands that have not yet reached culmination of mean annual increment. The growth rates on these stand establishment and young stands would remain high beyond 100 years.

Under all four alternatives, the harvest land base would move towards, but not reach, a regulated condition. The requirement to maintain a nondeclining even flow of harvest volume reduces the ability to rapidly achieve regulation. The age classes of the harvest land base in 2006 and by 2106 under the alternatives are shown in the next four figures (*Figure 199* through *Figure 202*).

Figure 199. Harvest land base distribution under the No Action Alternative over the next 100 years

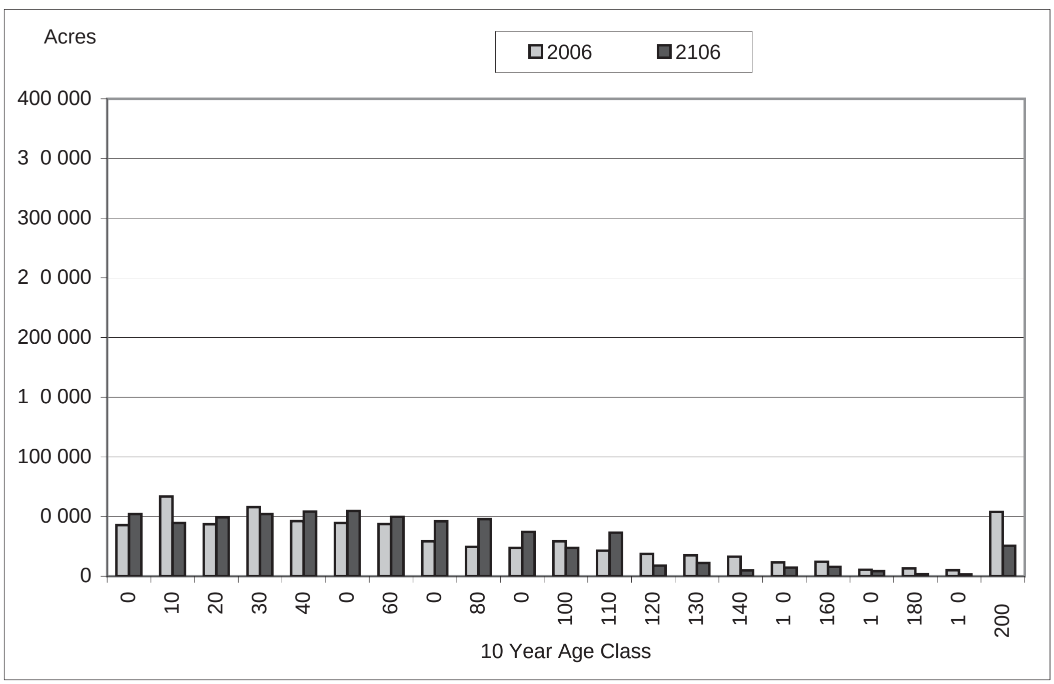


Figure 200. Harvest land base distribution under Alternative 1 over the next 100 years

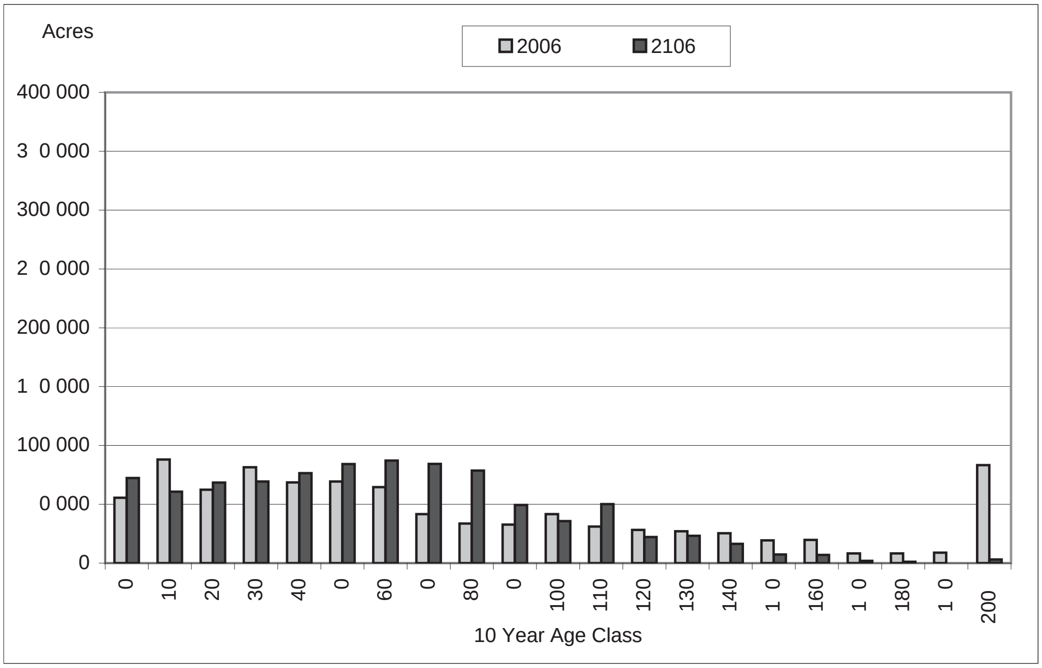


Figure 201. Harvest land base distribution under Alternative 2 over the next 100 years

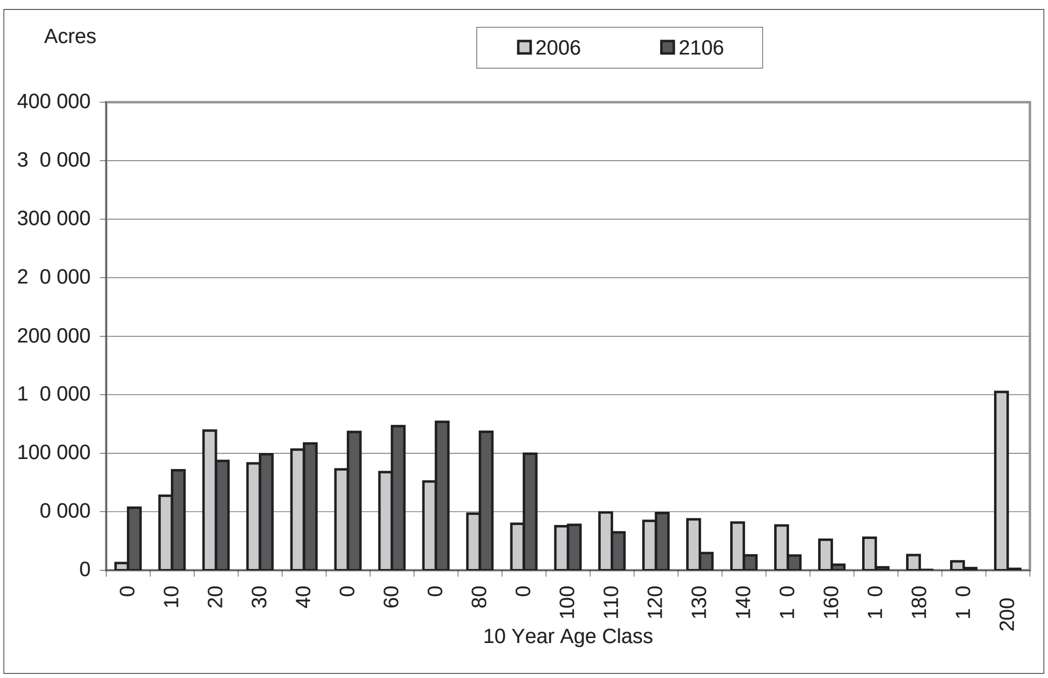
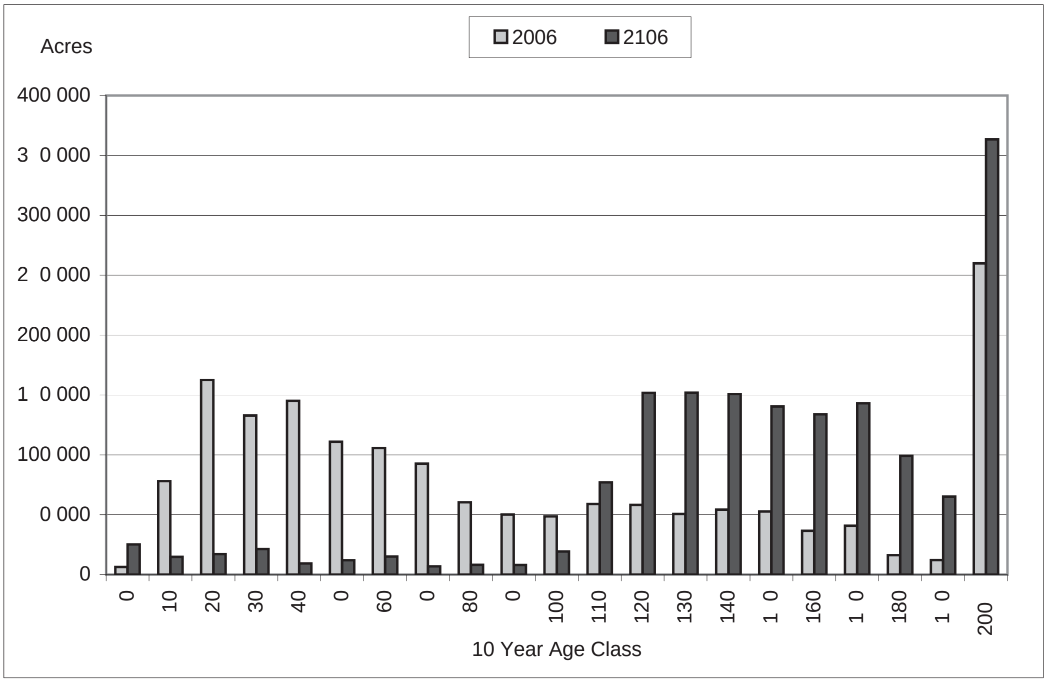


Figure 202. Harvest land base distribution under Alternative 3 over the next 100 years



Under the No Action Alternative, the age class distribution shows a substantial level of stands 200 years of age and older that would remain after 100 years in the harvest land base.

Alternative 1 would harvest more of the stands that are 200 years of age and older within the 100 year analytical period.

Alternative 2 would also harvest most of the 200+ year old stands in the harvest land base in the 100 year analytical period.

Under Alternative 3, age should be used with caution when describing stands that would develop. This is because the application of a silvicultural system consisting of partial harvests causes stand age to be a less applicable measurement of stand condition. As partial harvesting is applied to stands, they would increase in variability in age with different cohort ages included within the stands. They would develop into multistoried stands. Although stands harvested using partial harvesting have their ages adjusted to provide a blended age, age is a useful metric only for those stands that are regeneration harvested.

Under all four alternatives, the age class distribution in the districts would respond in two distinct manners. In the Salem, Eugene, and Coos Bay districts, and the Klamath Falls Resource Area of the Lakeview District, the harvest land base is currently approaching a regulated state, and the age class distribution of these districts would remain relatively stable. The Roseburg and Medford districts currently have proportionally more mature and structurally complex forests stands, which would be harvested over the next 100 years, and have variation in their acres by age class that would persist.

The alternatives would produce a variety of allowable sale quantities, a range of values for those timber products, and occur on a varying amount of acres, but all would move the harvest land base toward even amounts of acres in age classes that are less than the average harvest age.

Special Forest Products

This analysis examines the availability, quantity, and abundance of special forest products relative to their demand that would result from the alternatives.

Key Points
• All four alternatives would maintain similar levels of availability and quantity of special forest products. • Under all four alternatives, special forest products would generally be abundant relative to demand over the long term.

Under all four alternatives, the harvest locations of specific special forest products would change over time as forest management activities occur in different locations. For example, the harvesting of firewood, fungi, floral, and greenery would shift either into or away from where regeneration timber harvesting occurs. Collectors focus harvesting efforts in locations where special forest products of commercial or personal value are abundant, easy, and economical to harvest. In general, it is expected that, similar to past activity, special forest products would be harvested from common and abundant plant or fungi species. Special forest products would be generally abundant under all four alternatives in relation to the overall demand. See the *Special Forest Products* section in *Chapter 3*.

All four alternatives would accommodate and respond to normal market fluctuations, conditions, and public demand, and provide reasonable opportunities for new special forest products. New road construction on the BLM-administered lands would occur under all four alternatives and would provide access to new harvest areas for special forest products. The additional access that results from new roads, however, would likely be offset by restrictions on public access that would be implemented for administrative purposes, and by the decommissioning of roads.

Timber harvesting would be distributed across the harvest land base over time and would result in an increase for some special forest products and a decrease for others. Regeneration and thinning harvests modify the condition of conifer forest stands and stand components (such as substrates and species that support mats of mosses), disturb the forest ground floor, and remove conifer host species that support mushrooms. See the *Special Forest Products* section in *Chapter 3*.

Silvicultural treatments (e.g., stand maintenance and precommercial thinning) retard the development of some special forest products (such as mushrooms and floral and greenery), while improving the quality and quantity of others (such as Christmas trees and boughs). The development of commercial mushroom products is delayed because silviculture treatments target host species and slash debris prevents access. The amount of precommercial thinning would be similar under all four alternatives.

Fuels reduction treatments, livestock grazing, recreation, watershed restoration, road construction and maintenance, and wildfire suppression activities would be similar under all four alternatives and would not affect the availability, quantity, and abundance of special forest products relative to their demand. Fuels reduction treatments normally target small diameter wood products and chip or cut unwanted fuels, but would not affect the overall availability and quantity of special forest wood products.

The availability and quantity of special forest products that are associated with the stand establishment structural stage would vary with the amount of regeneration harvesting and partial harvesting that would occur under the alternative.

The availability and quantity of special forest products that are associated with older forests would vary with the amount of forest in the mature and structurally complex structural stages that would exist under the alternatives.

Thinning would disturb the forest floor but would retain conifer host species and allow mushrooms to recover and fruit within approximately 5 to 10 years after harvesting (Pilz et al. 2006). Floral and greenery products would generally respond to the new growing conditions that would result from the increased light and decreased competition even though thinning activities would initially disturb the forest floor and the commercial floral and greenery special forest products.

Under all four alternatives, the relative availability and quantity of mushrooms, mosses, and floral and greenery are associated with the amount of stands that are in the mature and structurally complex structural stage.

The relative availability of Christmas trees is associated with the amount of regeneration harvesting. The relative availability and quantity of firewood and other wood products, which are byproducts of regeneration and thinning harvesting, would also coincide with the amount of regeneration harvesting.

Timber harvesting under all four alternatives would not alter the overall availability, quantity, and sustainability of special forest products, although availability would vary on individual harvest units in the short term. Although overall availability and quantity would be maintained because of the abundance of special forest products, a small variation in availability and quantity would occur as a result of varying amounts of regeneration harvesting and thinning of the structurally complex forests under all four alternatives. See *Table 174 (Acres of forest management activity and mature&structurally complex forest by alternative in the year 2016)*.

Table 174. Acres of forest management activity and mature&structurally complex forest by alternative in the year 2016

Forest Management Activity and Forest Type	Special Forest Product Response*	Response (as acres increase)	No Action (acres)	Alternative 1 (acres)	Alternative 2 (acres)	Alternative 3 (acres)
Regeneration harvesting or partial harvesting	Floral/ greenery	decreases	60,500	90,600	143,400	128,500
	Mosses	decreases				
	Mushrooms	decreases				
	Wood products	increases				
	Christmas trees	increases				
Thinning harvesting (includes both harvest land base and nonharvest land base)	Floral/ greenery	increases	100,000	113,400	76,700	160,300
	Mosses	decreases				
	Mushrooms	decreases				
	Wood products	increases				
Silvicultural treatments (stand maintenance/ protection)	Floral/ greenery	decreases	112,500	161,400	259,900	134,400
	Mushrooms	decreases				
	Christmas trees	increases				
mature&structurally complex forest	Floral/ greenery	increases	1,266,000	1,190,000	1,131,000	1,161,000
	Mosses	increases				
	Mushrooms	increases				

Under all four alternatives, the availability and quantity of five special forest product categories (transplants, seeds and seed cones, edibles and medicinals, burls and miscellaneous, and boughs-coniferous) would be similar to past levels. Differing levels of timber harvesting and silviculture activities, based on the amount of acres treated, would not increase or decrease the quantity or availability of these forest products from the current level. These forest products are generally abundant relative to their demand throughout the region or within the vegetative community where they occur. In general, an extensive amount of acres of forest habitat exists for these special forest products over the planning area, combined with relatively low commercial demand.

Natural disturbances, such as wildfires and wind storms, which shape the types and availability of special forest products, are unpredictable in time and location, but are expected to occur as in the past across the landscape. Natural disturbances change local conditions for special forest products. In general, most special forest products would be lost in wildfires, although the availability of firewood and mushrooms, which respond to fire, would increase. Windstorms that blow down large amounts of trees would reduce the quality of special forest products and would limit the access for harvesting. Natural disturbances would have a substantive effect on the availability and quantity of special forest products only at the local level. Availability, quantity, and abundance relative to the demand of special forest products would not be substantially affected at the planning area scale.

Botany

This analysis examines the effects of timber management, fuels treatments, road construction, grazing, and areas of critical environmental concern on plant populations including BLM sensitive and assessment species, and species listed under the Endangered Species Act.

Key Points

- Under all alternatives the populations and habitat of species listed under the Endangered Species Act and state listed species where the BLM has entered into a cooperative management agreement for a species would be maintained or increased and recovery activities implemented.
- Under all alternatives on BLM-administered lands, there would be little risk of loss of populations of BLM sensitive and assessments species in eight of nine habitat groups.
- Under the action alternatives, some populations of BLM sensitive and assessment species in the conifer habitat group on O&C lands in the harvest land base would be lost. There would be low to moderate risk of local extirpation for some species in the conifer forest habitat group, but little risk of extirpation from the planning area or extinction. The ranking of alternatives is as follows:

No Action	Alternative 1	Alternative 2	Alternative 3
Lower Risk -->.Moderate Risk			

Federally Listed Plant Species and those state listed species where the BLM has entered into a cooperative management agreement

The species shown in *Table 175* (*Federally listed and candidate plant species in the planning areas*) are listed as threatened or endangered or are candidates for listing under the Endangered Species Act.

Table 175. Federally listed and candidate plant species in the planning area

Status	Species	Common Name
FTO	Sidalcea nelsoniana	Nelson's Checker-mallow
FTO	Castilleja levisecta	Golden Paintbrush
FTO	Howellia aquatilis	Water Howellia
FTO	Lupinus sulphureus ssp. kincaidii	Kincaid's Lupine
FEO	Lilium occidentale	Western Lily
FEO	Astragalus applegatei	Applegate's Milk-Vetch
FEO	Lomatium cookii	Cook's Lomatium
FEO	Fritillaria gentneri	Gentner's Fritillary
FEO	Limnanthes floccosa ssp. grandiflora	Large-Flowered Wooly Meadowfoam
FEO	Arabis macdonaldiana	MacDonald's Rock-Cress
FEO	Plagiobothrys hirtus	Rough Popcorn Flower

FEO	Erigeron decumbens var. decumbens	Willamette Valley Daisy
FEO	Lomatium bradshawii	Bradshaw's Desert Parsley
FCO	Calochortus persistens	Siskiyou Mariposa lily

FTO = Federally Threatened Oregon FEO = Federally Endangered Oregon FTO = Federal Candidate Oregon

Under all four alternatives, no damage or loss of occupied habitat, individual plants, or populations would occur as a result of management activities on BLM-administered lands. This is because species recovery measures would be applied. These measures are required by recovery plans, biological opinions, or conservation agreements and would maintain or reduce the risk of extinction to species. Occasionally, emergency operations such as wildfire suppression would result in the damage or loss of occupied habitat or populations. When these occasional situations occur, conservation measures would be applied to the extent possible to minimize damage or loss of populations or habitat.

The number of populations of federally listed and candidate species on BLM-administered lands varies by species and the BLM's contribution to the recovery of the species also varies accordingly. The number of populations by species found on BLM-administered lands ranges from over 100 populations of Gentner's fritillary to only three known populations of Nelson's checker-mallow.

Populations of federally listed and candidate species also occur on private lands. For analysis purposes, it is assumed that these populations would not contribute to recovery of the species (USDI, USFWS 2006b; USDI, USFWS 2003b; USDI, USFWS). This is because no protection of plant species is provided by state or federal laws on private lands.

Recovery activities would be implemented consistent with plans and conservation agreements for each federally listed plant species. Recovery activities are described individually in each recovery plan (see *Appendix E, Botany*). Occupied habitat and populations of federally listed and candidate species would be maintained or increased on BLM-administered lands as a result of these conservation activities.

State Listed Species where the BLM has not entered into a conservation agreement and BLM Sensitive and Assessment Species

Most plant and fungi species are considered common and are of no conservation concern (see the *Botany* section of *Chapter 3*). This analysis focuses on the BLM's sensitive and assessment species which include State-listed species where the BLM has not entered into a conservation agreement. Species are grouped according to habitat associations (see the *Botany* section of *Chapter 3*) to facilitate the analysis of large number of species. *Table 176* shows the habitat groups and the physiographic provinces and land allocations in which they occur.

Table 176. Habitat groups, physiographic provinces, and land use allocations

Habitat Groups	Physiographic Provinces	Land Use Allocations
Upland Meadows/ Grasslands areas	Klamath and Willamette Valley	• Non timber management area • National Landscape Conservation System
Shrub Communities	Klamath	• Non timber management area • National Landscape Conservation System
Oak and Hardwood Woodlands	Klamath and Willamette Valley	• Timber management area • Non timber management area • National Landscape Conservation System
Conifer and Mixed Evergreen Forests	All	• Late-successional management area • Riparian management area • Timber management area • Areas of critical environmental concern and research natural areas • National Landscape Conservation System
Seasonal Wetlands Fens/Vernal Pools	All	• Riparian management area • Areas of critical environmental concern and research natural areas
Riparian and Aquatic	All	• Riparian management area
Serpentine Areas	Klamath	• Timber management area • Non timber management
Rocky Areas Outcrops/ Scree	All	• Non timber management
Maritime Zone	Coast and Klamath	• Late-successional management area • Riparian management area • Timber management area • Areas of critical environmental concern and research natural areas • National Landscape Conservation System

Introduction

Under the No Action Alternative, conservation measures would be applied to all habitat groups under the BLM Special Status Species Policy and Survey and Manage on all BLM-administered lands in the planning area. Habitat characteristics would be managed for the specific requirements of each species. Conservation measures provide protection from management activities that modify or degrade occupied habitat, compact or displace soil, or trample or damage individual plants or populations. The types of conservation measures are numerous and affect the area, extent, or timing of the activity, the type of operation, and the degree of disturbance to a population. Typically conservation measures are implemented as seasonal or operational restrictions and changes, treatment changes, or protection buffers.

Under the action alternatives, conservation measures from the BLM Special Status Species Policy would be applied on Public Domain lands and O&C lands that are not in the harvest land base. With the exception of the conifer habitat group, all other habitat groups occur primarily on Public Domain and O&C lands not in the harvest land base. Conservation measures would not be applied to populations of species in the conifer habitat group that occur within the O&C harvest land base unless 20 or fewer populations of a species are known to exist.

Timber harvest including silviculture treatments in young stands, hazardous fuels treatments, and road construction, are major activities that would affect populations in the conifer habitat group. The level of these activities that would occur under the alternatives is shown in *Table 177* (*Forest management activities that affect plant populations over the next 10 years)*.

Table 177. Forest management activities that affect plant populations over the next 10 years

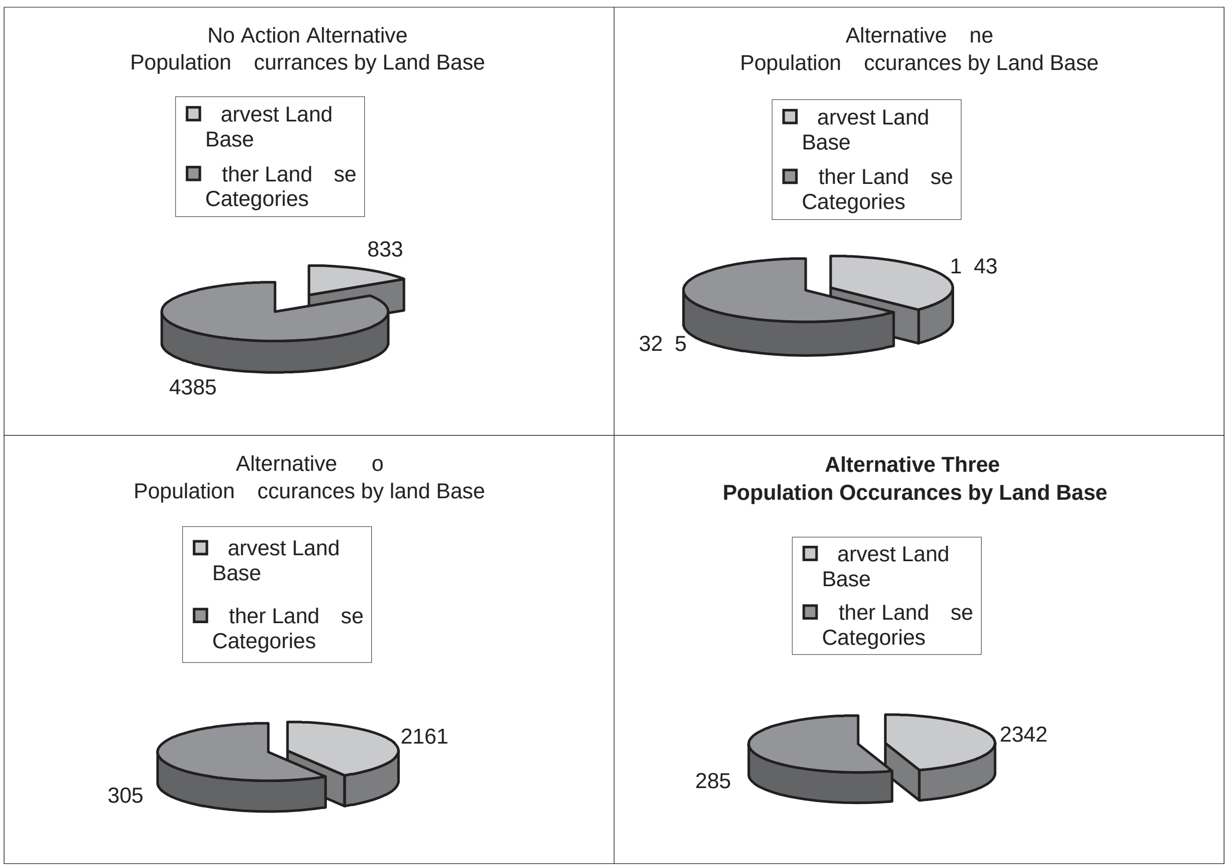
Activity	No Action (acres)	Alt 1 (acres)	Alt 2 (acres)	Alt 3 (acres)
Regeneration Harvest	60,500	90,600	143,400	3,900
Partial Harvest	0	0	0	124,600
Thinning (HLB and Non-HLB)	100,000	113,400	76,700	160,300
Hazardous Fuels Treatments	110,000	110,000	110,000	110,000
Road Construction	4,100	4,100	5,000	5,300

Timber Harvest

Under all action alternatives, the acres subject to timber harvest with known populations would increase. *Figure 203* (*Distribution of populations of BLM sensitive and assessment botany species subject to timber harvest)* shows that when all known populations of BLM sensitive and assessment species are aggregated and compared between alternatives, the most notable pattern is the increase in the number of populations that occur in the harvest land base under the action alternatives compared to the No Action Alternative.

Approximately 5,000 known populations of BLM sensitive and assessment species occur on BLM-administered lands. The percentage of known populations in the conifer habitat group that would occur within the harvest land base is 16%, 37%, 41% and 45% under the No Action Alternative and Alternatives 1, 2, and 3, respectively. The known populations of species in the conifer habitat group located in the harvest land base would be subject to greater risk of population and habitat losses through management actions.

Figure 203. Distribution of populations of BLM sensitive and assessment botany species subject to timber harvest



Harvest methods include ground based, cable, and helicopter logging. Timber harvesting modifies forest stand vegetation, species composition, stand density and structure, canopy, snags, and large down wood which serve as substrate, hosts, and environmental conditions associated with species in the conifer habitat group. Thinning modifies forest stand structure and conditions less than regeneration harvests or partial harvests and stands recover quicker from disturbance. After harvest, slash disposal treatments reduce fuel loads.

Silvicultural treatments on new stands reduce vegetative competition to conifer species and would occur on the same areas where regeneration harvest and thinning would take place over a 3 to 20 year period of time after harvest.

Typically, more timber harvest units receive fuels and silviculture treatments in the Klamath province than the other provinces where more populations occur. Few populations that occur in these areas would survive the combination of treatments without the application of conservation measures. However, post treatment monitoring has shown that occasional populations have survived the combination of treatments, and populations of some species respond with increased vigor.

For some species and populations, the affects of the physical disturbance of the harvest method would have more consequence than the modification of the habitat itself. For example, the amount of physical disturbance of the site from regeneration harvest can vary widely depending upon factors such as terrain, access, type of equipment, and skills of the operator. These factors contribute to the total area disturbed and the survival of any population occurring in the area.

Under the alternatives, the amount of regeneration harvest acres as a portion of total harvest acres is 38% under the No Action Alternative and 44%, 65% and 44% under Alternatives 1, 2 and 3, respectively. Partial harvests under Alternative 3 would create forests in the stands establishment structural stage classification resulting in a change in forest habitat similar to that of regeneration harvest. Under the action alternatives, in regeneration harvests and partial harvests on O&C harvest base lands, few populations of species in the conifer forest habitat group would survive because of multiple fuels and silvicultural treatments associated with treating forests in the stand establishment structural stage classification within a 3 to 20 year period of time. This would also occur because no conservation measures under BLM special status species policy would be applied, except where populations of species are 20 or fewer. The amount of timber harvest, hazardous fuels treatments and road construction as a portion of the total amount of forested acres is estimated to be 12% under the No Action Alternative, and 14%, 15%, and 18% under Alternatives 1, 2, and 3 respectively over the next 10 years.

Under all alternatives, fuel reduction treatments would reduce slash from timber harvest and silviculture activities. The Medford District and Klamath Falls Resource Area would treat the slash on 90% of harvest units while the other districts would treat approximately 50% of harvest units.

These treatments include slash piling and burning or broadcast burning. Hand-piling and burning reduces slash and live vegetation. Approximately 10% to 25% of the treated area would be piled and burned. Excavator-piling crushes vegetation as well as displaces and compacts soil. Approximately 5,000 acres over the past 10 years has been treated and 2,500 acres would be projected to be treated for the next 10 years. Piling and burning occurs primarily in southern

Oregon. Broadcast burning occurs after harvest and consumes logging debris and other live vegetation on approximately 75% of the treated timber harvest areas.

Under all four alternatives, silvicultural treatments within the harvest land base would modify young stands through thinning, stand conversion, fertilization, cutting brush, and scalping vegetation. Treatments would result in young stands that are generally even-aged with reduced species diversity, reduced stand structures, and reduced amounts of small micro-habitat patches where less disturbance occurred during harvest and where species in the conifer habitat group are more like to persist. The amount of silviculture treatments within the harvest land base would be tied directly to the amount of regeneration and partial harvest acres as shown in *Table 177* (*Forest management activities that affect plant populations over the next 10 years).*

A few species in the conifer habitat group occur in forests in the stand establishment and young forest structural stage classification. As long as populations weren't completely lost during timber harvest, they would benefit from more frequent habitat disturbances. Post-harvest monitoring has shown that species such as Tall bugbane and Wayside aster respond positively by increasing growth, flowering, and fruiting from more open conditions (e.g., *Cimicifuga elata,* Kaye and Kirkland, 1994, *Eucephalus vialis,* Thorpe and Kaye, 2006*)*. Other populations of species in the conifer habitat group have survived the combination of treatments in the past but do not appear to benefit with increased growth and reproduction *(Cypripedium fasciculatum,* Knorr and Martin, 2003). These are considered relic populations that have survived the activity and habitat disturbance in micro-habitat patches but do not appear to benefit with increased growth and reproduction.

Hazardous Fuels Treatments

Under all four alternatives, hazardous fuel reduction treatments (outside of timber harvest units) would occur on approximately 110,000 acres over the next 10 years in the Wildland Urban Interface. A majority of the acres that would be treated would occur in the Klamath province. The operational methods and habitat disturbance would be similar to fuel reduction treatments from timber harvest slash, except that these fuels reduction treatments would retain more of the original forest stand and vegetation conditions than treatments of slash from timber harvest.

These treatments would affect species in the conifer and mixed evergreen forests, shrub communities, and oak and hardwood woodlands habitat groups. Generally, the species in these habitat groups are shade intolerant and respond to increased light and reduction in plant competition with increased growth, flowering and fruiting (Kaye and Thorpe 2006; USDA,USDI 2004b;USDA and USDI, BLM and NPS 2004; USDI, USFWS 2005; USDI, USFWS 2006b). However, disturbance from fuel reduction treatments would create exposed soil and increased light that would result in the introduction and spread of invasive plants into occupied habitat. Invasive plant species would reduce population vigor, expansion, and migration (See the *Invasive Plants* section of *Chapter 4*) of the BLM's sensitive and assessment species. Impacts would vary depending on several factors. Variations in site characteristics, the type and growth habit of the invasive species, and rare plant species vigor and growth would determine the growth or decline of a population. Actions to control invasive plants species would benefit the growth and survival of rare plant populations. Additionally, species with larger populations would be more likely to survive the disturbance than species with small populations.

The overall risk to species populations from these hazardous fuel treatments is low because the species in these habitat groups are generally shade intolerant and respond with increased growth to increased light and less competition.

Road Construction

Under all alternatives, road construction would occur in areas where all nine habitat groups are found. However, the majority of road construction activities would occur in the conifer habitat group. Roads built in the Klamath province are most likely to cross habitat types such as meadows or serpentine with rare plant populations. This is because such habitats and populations occur more commonly in the Klamath Province than other provinces. The estimated amount of new road construction over the next 10 years on the Medford District, primarily the Klamath province, would range from 158 miles under the No Action Alternative to 330 miles under Alternative 3. This would equate to 795 acres or 0.1% of BLM-administered lands in Medford District under the No Action to 1650 acres or about 0.2% of BLM-administered lands under Alternative 3. New road construction in the Klamath province has the potential to affect more BLM sensitive and assessment plant species relative to other provinces because of the higher density of such plant populations in this province.

New roads would increase the introduction and spread of invasive plants (See the *Invasive Plants* section of this chapter). Actions to control invasive plants would be applied in order to reduce competition to the BLM's sensitive and assessment plant populations and occupied habitat. Conservation measures would be applied to populations and occupied habitat in the path of road construction of all nine habitat groups in areas outside of the harvest land base. Populations in the conifer habitat group which occurred in the path of road construction would likely not survive in areas within the harvest land base management. However, it is assumed that conservation measures would be applied to species with 20 or fewer populations.

Other Management Activities

Under all alternatives, wildfire suppression activities would occur in all habitat groups. Plant species in the planning area evolved in ecosystems which included periodic natural fires but not wildfire suppression activities. The most wildfire suppression activity would occur in the Klamath province and in the southern part of the Western Cascades province. Wildfire suppression activities that involve bull-dozing such as fireline access and construction, safety zone construction, and staging centers often make more fundamental and longer lasting changes to habitat than the wildfire itself, although on a much smaller area. On the recent Timber Rock wildfire, only 27 of 27,100 acres (0.1%) were disturbed by fire lines (USDI, BLM 2004). The acres of wildfire suppression activity are low relative to other management activities, but where they occur, populations of the BLM's sensitive and assessment species would likely be lost.

Under all alternatives, mining operations would occur primarily in areas occupied by the rocky areas/outcrops/scree, serpentine, conifer, and riparian and aquatic habitat groups. According to the BLM's records, mining operations occur primarily in the Klamath province where more rare plant populations occur. Approximately 230 mining notices would be issued over the next 10 years on approximately 280 acres. The number of acres is very low, but mining notices would require processing during a biological window when field reviews would not be suitable. Conservation measures would not be applied in most cases and some populations would be lost.

Approximately 17 mining plans that total 250 acres would be anticipated over the next 10 years. The total amount of acres is small and mining plans would provide for conservation measures associated with the application of the BLM's Special Status Species Policy in most cases. A mining plan currently occurs on portions of the French Flat area of critical environmental concern where seven of the BLM's sensitive and assessment species are found.

Quarry operations would also occur in areas occupied by the rocky areas/outcrops/scree, serpentine, conifer, and riparian and aquatic habitat groups. The amount of quarry operation activity would be associated with the level of road construction under each alternative. There would be approximately 300 quarries located on 600 acres. This would affect a relatively small percentage of the planning area and would intersect with a small number of plant populations. The overall risk of population losses in these four habitat groups from quarry activities is low under all alternatives. This is because most quarries have been surveyed and few populations discovered. Additionally, populations and occupied habitat would receive conservation measures in most cases.

Under all alternatives invasive plants would increase and alter the existing plant community for all habitat groups (see the *Invasive Plants* section of this chapter). Invasive plants occur throughout the planning area, but are less prominent on serpentine soils in the Klamath province. Invasive plants are well documented on habitat occupied by the BLM's sensitive and assessment Species. Invasive plant species reduce vigor, flowering and fruiting and limit the expansion and migration of populations of the BLM's sensitive and assessment species. Under all action alternatives, rare plant populations forced to compete with invasive plants would decrease in vigor and the likelihood of survival would be reduced.

Under all alternatives, livestock grazing would occur in areas occupied by five habitat groups including upland meadows/grasslands, oak and hardwood woodlands, conifer, seasonal wetlands fens/vernal pools, and riparian and aquatic. Under the No Action Alternative, approximately 560,000 acres would be authorized for grazing. Under all action alternatives, the number of grazing allotment acres would be reduced by 141,000 acres to 420,000 acres. Since these 141,000 acres of allotments are currently vacant (no cattle grazing occurring), there would be no change in the effects to the 1,126 known populations of the BLM's sensitive and assessment species in this area. Allotments that would be authorized for grazing contain approximately 1,300 known populations.

Livestock graze and trample vegetation including the BLM's sensitive and assessment species. Species assessments and monitoring of rangeland conditions and trends indicate that few populations of species are lost due to grazing. However, livestock graze on vegetation and trample and damage plants (USDA, USDI 1996a; Oregon Department of Agriculture 2001; Kaye, 2002). Not all populations in grazing allotments are affected by grazing or trampling because they occur in inaccessible locations, areas of low forage, or where grazing and trampling is low. A few annual species such as bellinger's meadow-foam, disappearing monkeyflower, and sculptured allocarya tolerate light to moderate levels of trampling and grazing as long as they can produce seed and maintain stable germination and occupancy levels (Whiteaker, pers. com. 2007).

Generally, the areas of higher grazing utilization occur in close proximity to abundant forage, grassland meadows, water sources, and flat ground. Areas of higher disturbance from trampling occur around holding pens, watering areas and salt blocks. These high disturbance areas allow invasive plants to establish and increase occupancy. Populations of BLM sensitive and assessment species occur in areas of high utilization and high disturbance. While populations would normally withstand low to moderate amounts of grazing and trampling damage, high levels of disturbance repeated over multiple years would reduce plant vigor, prevent reproduction, and damage individual plants and populations. This would cause the loss of populations (Menke and Kaye 2006).

Populations and occupied habitat of most the BLM's sensitive and assessment species that occur in these five habitat groups would be protected from grazing and trampling through conservation measures associated with the application of the BLM's Special Status Species Policy under all alternatives.

Under the No Action Alternative, off-highway vehicle activities would occur on BLM-administered lands designated as open to off-highway vehicle use where species in all nine habitat groups are found. A total of 330,000 acres is currently designated as open in the Salem, Medford, and Klamath Falls districts. A majority of these open areas are located on steep, densely-forested terrain, which is not conducive to cross-country motor vehicle travel. However, where cross country travel would occur, vehicles would crush vegetation, displace soils and create trails that degrade occupied habitat and damage populations scattered throughout the area.

High concentrations of off-highway vehicle activities occur around campgrounds, recreation areas, existing trails, and adjacent to private lands and fan outwards for hundreds of acres. Off-highway vehicle activities occur across a wide area including 140,000 acres in the Klamath province where the highest species' population densities are found.

Under all action alternatives, off-highway vehicle activity would be designated as limited to designated roads and trails on most of the 330,000 acres currently designated as open to off-highway vehicles under the No Action Alternative. A total of 77 acres are designated as open under the action alternatives. This would result in a reduction to the amount of damage to occupied habitat and populations for all habitat groups compared to the No Action Alternative.

Areas of critical environmental concern are designated where special management attention is required to maintain and protect relevant and important values. Under the No Action Alternative, 70 potential and existing areas of critical environmental concern would provide special management attention resulting in the conservation of approximately 700 known populations of the BLM's sensitive and assessment plant species. These species occur in a wide range of habitats throughout the planning area and over 540 populations occur in the Klamath province. More populations are likely to occur in existing areas of critical environmental concern because of the unique nature of the habitat.

Under the action alternatives, nine areas of critical environmental concern that contain special status species as a relevant and important value would not be designated under one or more alternatives. These areas contain 127 known populations. There are 14 additional areas of critical environmental concern with the BLM's sensitive and assessment species that would be reduced in size under one or more alternatives. Populations of species in the conifer habitat group would be subject to forest management activities. Since these species' populations would not receive special management attention (except for those species with 20 or fewer populations), populations would be lost. One of these species, *Cupressus bakeri,* is one of eight populations in Oregon and is found in the Baker Cypress area of critical environmental concern. It is the only population on BLM-administered lands and is the northern most population of cypress in North America.

Biological Factors and Risk to Species from Management

There is incomplete information available to determine the effects of the loss of one or more populations to a BLM sensitive and assessment plant or fungi species. The species in the habitat groups are diverse and respond differently to habitat change and disturbance. Each species' unique biological requirements and threats shape the number of individuals, patch size, and distribution. Biological factors interact with environmental factors to determine population and species rarity and trends ((Gurevitch et al. 2006, Kaye et al, 1997). Several studies discuss specific factors that influence population trends and they include plant life-form and life history, breeding systems and effective breeding populations, seed dormancy, recruitment, clonal growth, colonization, genetic factors, and models of extinction risks and disturbance (Lennartsson 2002, Menges 2000, Ellestrand and Elam 1993, Schemske et. al, 1994). Any population losses from management activities to species with 20 or fewer populations would contribute to the trend toward local extirpation or extinction of the species within the planning area (Ellstrand and Elam, 1993; USF&WS, 2003; Kaye, pers.com., 2007, Freidman, 2007, pers. com). A minimum population threshold of 20 is selected to ensure survival of species and therefore no additional population losses would be allowed as a result of management actions. The threshold is based on biological and environmental factors and is consistent with species rankings in Oregon Natural Heritage Plan (2004) and NatureServe (2006).

Under all alternatives, there would be little risk of population losses of the BLM's sensitive and assessment species in the nine habitat groups on O&C lands in areas outside of the harvest land base and on Public Domain lands. This is because conservation measures associated with the BLM Special Status Species Policy would be applied.

Under all action alternatives, populations of species in the conifer habitat group on O&C lands in the harvest land base would be subject to forest management activities. This would include regeneration harvest, partial harvest, thinning harvest, slash treatment, silviculture treatments, and road construction. The following percentages of the area would be affected by management activities over the next 10 years:

- No Action Alternative: 12%
- Alternative 1: 14%
- Alternative 2: 15%
- Alternative 3: 18 %

The specific location of management activities that would take place under the alternatives is unknown in relation to the specific locations of populations of the BLM's sensitive and assessment species. Therefore, the specific number of populations in the conifer habitat group that would be lost is uncertain.

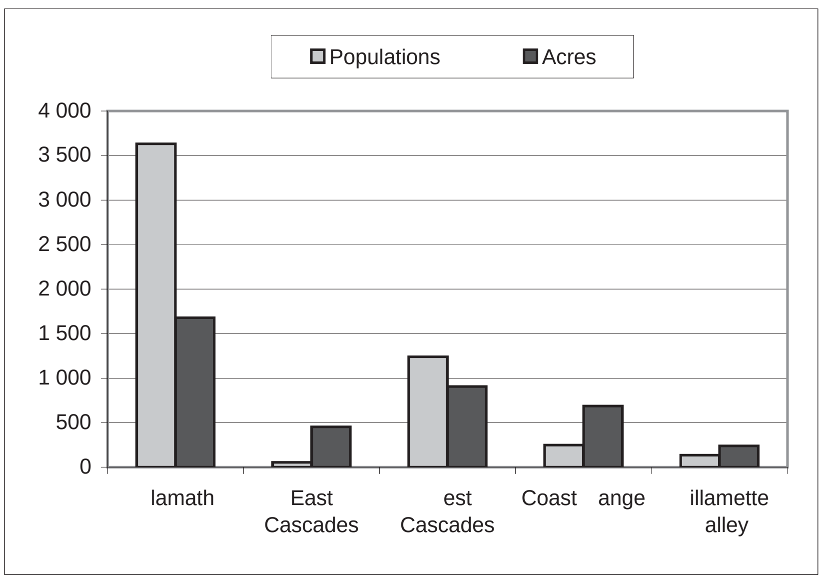
However, the risk of local extirpation to species in the conifer habitat group would increase under the action alternatives compared to the No Action Alternative. Populations would be lost under all action alternatives. Few populations would survive in areas of regeneration harvest that occur in the path of direct operational activities. However, conservation measures would be applied for species with from 20 or fewer known populations. The number of populations that would be lost would increase with the amount of acres of forest management activities. The combined amount of partial harvest and thinning under Alternative 3 would modify more conifer forest habitat than the other action alternatives even though partial harvest would leave small patches of habitat. The increase in the amount of thinning acres under Alternative 3 offsets any small habitat benefits to populations.

The factors used in determining these outcomes included:

- distribution and the number of known populations and occupied habitat on BLM-administered lands, particularly within the harvest land base, and
- the types and amount of activities anticipated over the next ten years.

As shown in *Figure 204* (*Number of populations and occupied habitat by province*), under all action alternatives, the Klamath province has the highest risk of losses of populations and the highest risk of local extirpation due to forest management activities. This is because the number of the BLM's sensitive and assessment species populations is the highest and the average patch size is the smallest compared to the other provinces. In the other provinces, there are fewer sites, but the patch size is larger.

Figure 204. Number of populations and occupied habitat acres by province



Under all alternatives, there would be 53 of the BLM's sensitive and assessment species with 20 or fewer known populations and containing at least one population on BLM-administered lands (excluding species in the Cascade Siskiyou National Monument and West Eugene Wetlands). There are 11 of these species that occur entirely on BLM-administered lands[5]. Specifically:

- There are 18 of the 53 species that have 1 to 5 known populations.
- There are 35 of the 53 species that have 6 to 20 known populations.

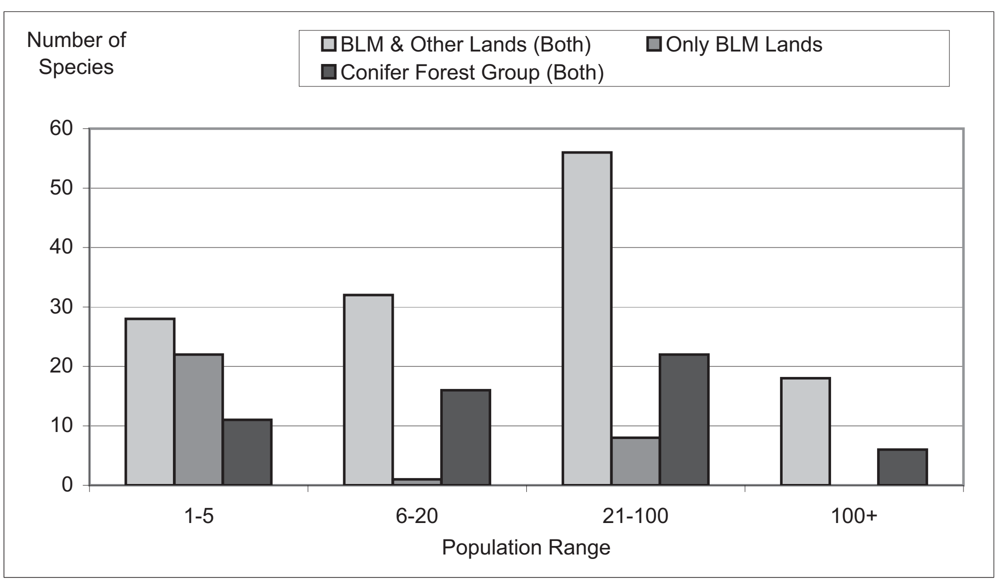
The conifer habitat group, where forest management activities would occur, includes 23 of the 53 species as shown in *Figure 205* (*Species in the conifer habitat group by ownership and number of currently known populations*).
Of these:

- There are 5 species with 1 to 5 known populations.
- There are 18 species with 6 to 20 known populations.

Any population losses from management activities would be critical for species with fewer than 20 populations (Ellstrand and Elam, 1993; USDI, USFWS 2003c; Kaye, pers.com., 2007). Conservation measures would be applied to species with 20 or fewer populations to prevent extirpation in the planning area.

There are another 53 species that are known from between 21 to 100 populations. There are 5 of these that occur entirely on BLM-administered lands and 21 of these that occur in the conifer habitat group.

Figure 205. Species in the conifer habitat group by ownership and number of currently known populations



[5] There is some uncertainty when combining records from 2 data sets related to double counting and undercounting. Geobob was the primary data source for BLM and other Federal Lands and Heritage data was the source for state, private and other lands.

For species with 21 to 100 known populations in the conifer habitat group, risk of extirpation from population losses would increase. Any population losses would contribute to a trend toward extirpation within the planning area. However, if populations drop to 20 or fewer known sites, conservation measures would be applied to prevent extirpation.

It is assumed that no protection of the BLM's sensitive and assessment species would occur on private lands. These populations are at high risk of population loss. Populations of these species have been damaged and lost on private lands, including federally listed lands (USDI, USFWS 2003b; Brock and Callagan, 2006, USDI, USFWS 2006b) and the loss of habitat is documented in recovery plans for federally listed plant species (USDI, USFWS 1998c; USDI, USFWS 2000; UDDI, USFWS 2003a; USDI, USFWS 2003b). These sites would not be considered when determining which species have 20 or fewer known sites on federal lands.

Projected Populations

A quantitative analysis was conducted to calculate the number of populations of the BLM's sensitive and assessment species that would be expected to occur on unsurveyed BLM-administered lands. The analysis allows a comparison of the total number of populations and occupied habitat on BLM-administered lands under the alternatives. There is incomplete information on the distribution of the BLM's sensitive and assessment plant and fungi species in the planning area as well as the specific location of future management actions that could affect these populations. This information is useful in estimating the number of populations and occupied habitat expected to occur and the potential intersect of populations and management activities. The analysis derives estimated populations and occupied habitat based on a single linear projection using existing survey and population data for BLM-administered lands in the harvest land base (a subset of the total land base). The acres in the harvest land base ranges from 14%, 15% and 18% for Alternatives 1, 2, and 3, respectively. The number of known populations within the harvest land base ranges from 37%, 41% and 45 under Alternatives 1, 2, and 3, respectively.

The following information was used to determine outcomes:

- There have been 433,000 acres surveyed on BLM-administered lands in the planning area over the past 6 years. This is 17% of the total BLM land base (2,555,000 acres) in the planning area. Surveyed acres occur in the range of habitat types where future activities on BLM-administered lands would occur.
- There are 5000 total known populations of the BLM's special status species that occur on BLM-administered lands in the planning area.[6]

[6] These species and populations are based on the 2006 BLM special status species list and the records in GeoBob on 3-28-2006. It is anticipated that species on the BLM special status species list would change in the final EIS, as well as the number of populations which would change the results of this analysis.

- Acres of timber harvest and fuels reduction treatments were projected for each action alternative.
- Data sets of surveyed acres and known populations were analyzed for each BLM district.

A ratio of the total number of known populations to the total number of acres surveyed was calculated and applied across all BLM-administered lands. The following caveats apply to the projection of populations and occupied habitat:

- BLM sensitive and assessment species are not homogenously distributed throughout the planning area, and tend to have a clumpy or patchy distribution. They are often associated with poorly understood biotic, edaphic and climatic patterns.
- The pattern that results from the acres surveyed, populations found, and acres of occupied habitat cannot be used to predict the location of BLM sensitive and assessment species. The analysis is limited to broad-scale estimates of the aggregate of all populations and occupied habitat and is not applicable to any specific species.
- The pattern of distribution is based on the survey information and provides only a broad approximation of the number of populations and the pattern of occupied habitat at the planning area scale.

The results of the analysis, including the number and percentage of projected populations that would be affected by forest management activities under the alternatives is shown in *Table 178* (*Projected populations that would be affected by forest management over the next 10 Years)*. It is assumed for purposes of analysis that the percentage of projected populations that would be affected under the alternatives is directly proportional to the amount of acres subject to forest management. If forest management occurred on 12 percent of the planning area, then 12 percent of projected populations would be affected. There is no assumed propensity for management activities to occur where populations are scarce or dense.

The percentage of projected populations that would be affected by management activities under the alternatives ranges from 12 to 16 percent. The projected populations that occur in the harvest land base (not all populations), would intersect with forest management activities over many decades and be lost or harmed unless the species is known from 20 or fewer populations. In this case, populations would be protected by conservation measures under the BLM Special Status Species policy. The percentage of populations affected also does not equate to the percentage of risk that a specific population or species would be lost. Populations are not assumed to be affected under the No Action Alternative due to the application of conservation measures under the BLM Special Status Species policy.

Table 178. Projected Populations that would be affected by Forest Management over the next 10 Years

Alternative	Planning Area BLM acres	Number of Projected Populations	Acres of Timber Harvest & Fuels treatments	Number of Projected Populations Affected	Percent of Projected Populations Affected
Alt 1	2,557,800	31,400	314,000	3,850	12
Alt 2	2,557,800	31,400	330,100	4,050	13
Alt 3	2,557,800	31,400	398,800	4,950	16

The average occupied habitat size per population, or patch size, of BLM sensitive and assessment species varies widely between districts. Based on current survey data and known populations, the average patch size ranges from 0.5 acres per population in the Salem and Medford districts to approximately 5 acres in the Coos Bay District, and 10 acres in the Klamath Falls Resource Area. The Klamath Falls Resource Area has only 20 known populations. The differences in patch size are largely dependant on the species and characteristics of the population, including size, density, and the habitat type.

The ratio of known occupied habitat and known populations as a fraction of surveyed acres, when calculated for each BLM district and projected over each district's entire land base, provides a comparison of projected occupied habitat and populations between districts. The lowest percent of projected occupied habitat occurs in the Salem District (0.2%) and the Klamath Falls Resource Area (0.4%). The Medford, Roseburg, Coos Bay, and Eugene districts increase this ratio incrementally from 1.0 to 2.4 percent as shown in *Table 179* (*Projected BLM sensitive and assessment species populations and occupied habitat by district).*

The Medford District would have the most occupied habitat, and includes most of the Klamath province. The amount of projected populations in the Medford District is nearly 4 times greater than the next nearest district.

Under all action alternatives the risk of damage and loss of populations of the BLM's sensitive and assessment species changes by district relative to the number of populations and the patch size. In districts where few populations are found, the likelihood of activities occurring where populations occur is lower. In districts where more populations are found, the likelihood of activities occurring where populations occur is higher. Where the patch size per population is smaller, such as in the Medford and Salem districts, the risk of population loss would be higher when activities occur is areas where populations are found.

Table 179. Projected BLM sensitive and assessment species populations and occupied habitat by district

Total Area (acres)	Planning Area	Salem	Eugene	Roseburg	Coos Bay	Medford	Klamath Falls
	2,557,800	403,000	315,000	426,300	322,600	865,800	51,300
Projected Occupied (acres)	23,000	940	7,500	6,200	6,700	8,600	190
Land Base (%)	0.9	0.2	2.4	1.4	2.1	1.0	0.4
Projected Populations (#)	31,000	1,800	4,800	3,350	1,250	18,500	20

Mitigation Measures

Mitigation Measures could be applied to reduce the risks of extirpation to populations and species under the action alternatives. This would involve the application of conservation measures similar to the BLM special status species policy to species at risk of local extirpation in the conifer forest habitat group that have an Oregon Natural Heritage ranking of S1 and S2 in Oregon.

Invasive Plants

This analysis examines timber harvesting, road management activities, and off-highway vehicle use for the potential to introduce and spread invasive plant species that would result from the alternatives.

Key Points
• The risk of introducing invasive plant species would be greater under Alternative 2 than the No Action Alternative and Alternatives 1 and 3. • Invasive plant species would have a greater risk of spreading more broadly under Alternative 3 than under the No Action Alternative and Alternatives 1 and 2. • The BLM's influence on invasive plant species introduction and spread is limited by the relative amount of BLM-administered land within the planning area compared to other ownerships.

Timber harvesting, road management activities, and off-highway vehicle use create susceptibility for invasive plant species introduction and spread. Infestations are introduced and spread more readily in areas that have more human activity (e.g., high recreational use areas).

Introducing Invasive Plant Species

The factors that were considered in the analysis of the relative levels of risk for the inadvertent introduction of invasive plant species on the BLM-administered lands include:

- the distribution and abundance of species,
- the types and methods of timber harvesting,
- the proximity of harvesting activity to streams,
- the intensity and distribution of management activities, and
- the designations for off-highway vehicle use.

Species group distributions are categorized and displayed in maps as abundant, limited, or low by fifth-field watershed (see *the Invasive Plant* section in *Chapter 3)*. For analysis purposes, species groups are combined to represent invasive plant species.

Risk of Introduction

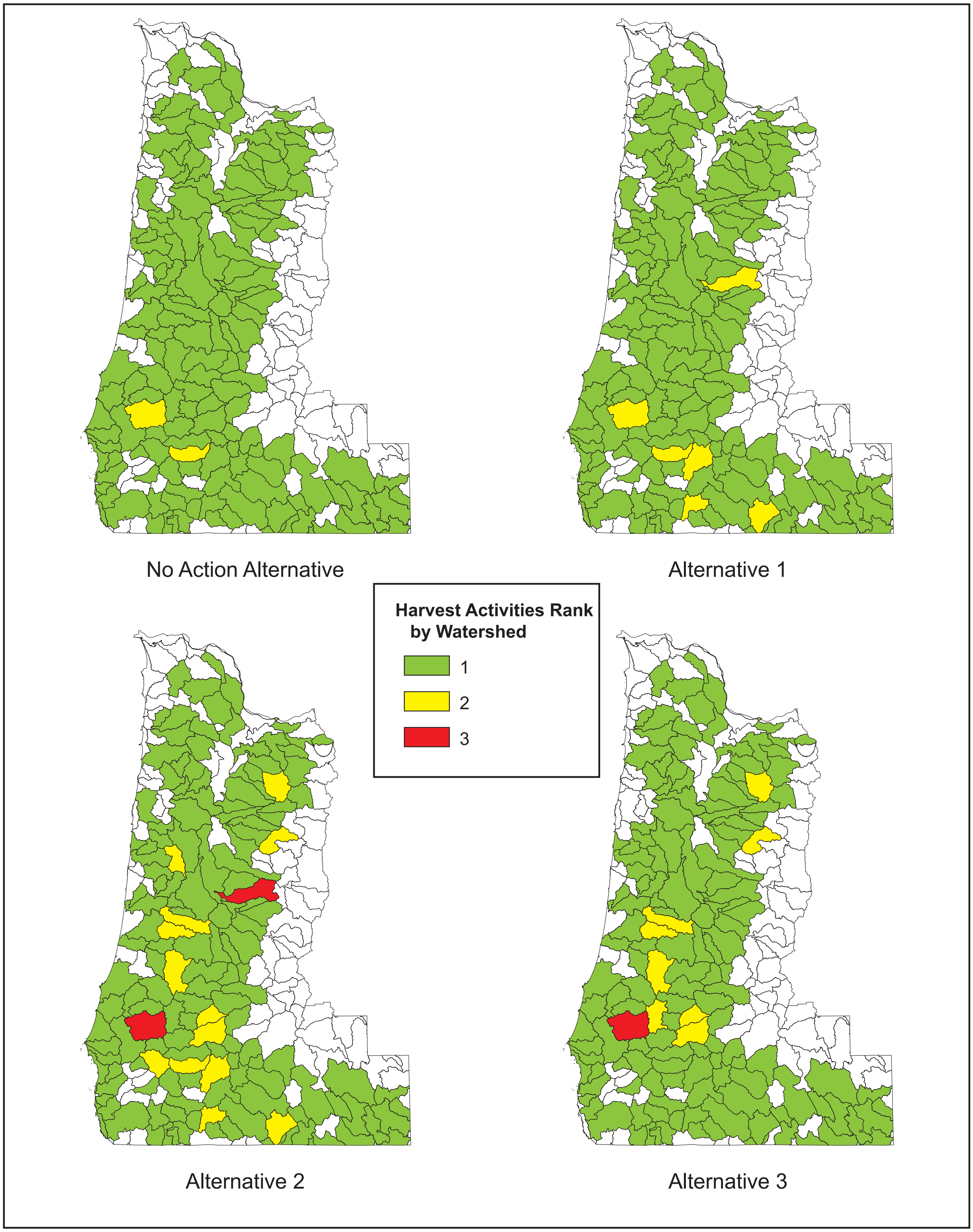
The relative risk of invasive plant species being introduced over the next 10 years as an inadvertent by-product of timber harvesting activities varies by alternative. The differences are based on the distribution of invasive plant species, the acres of the different timber harvesting types (thinning, partial harvesting, regeneration harvesting, and uneven-aged management), and the methods of logging used.

Timber harvesting types and logging methods alter the conditions that affect the introduction and spread of invasive weeds. For example:

- Regeneration harvests under all four alternatives and partial harvests under Alternative 3 create higher light levels than commercial thinning and uneven-aged management.
- Soil is disturbed more by ground-based logging methods, less by skyline cable systems, and least by aerial logging systems.

The watersheds that would generate the most and the least postharvest light and soil disturbance from timber harvesting activities are shown in *Figure 206 (Relative susceptibility of fifth-field watersheds to invasive plant species introduction as a result of timber harvesting activities over the next 10 years)*.

Figure 206. Relative susceptibility of fifth-field watersheds to invasive plant species introduction as a result of timber harvesting activities over the next 10 years



A comparison of the relative susceptibility between the alternatives can be seen in *Figure 207 and Table 180 (Susceptibility comparison for the introduction of invasive plant species that are associated with timber harvesting activities over the next 10 years)*. Watersheds with no potential for timber harvesting activities in the first 10 years after implementation, or which have no BLM-administered lands, have no assigned susceptibility category.

Figure 207. Susceptibility comparison for the introduction of invasive plant species that are associated with timber harvesting activities over the next 10 years

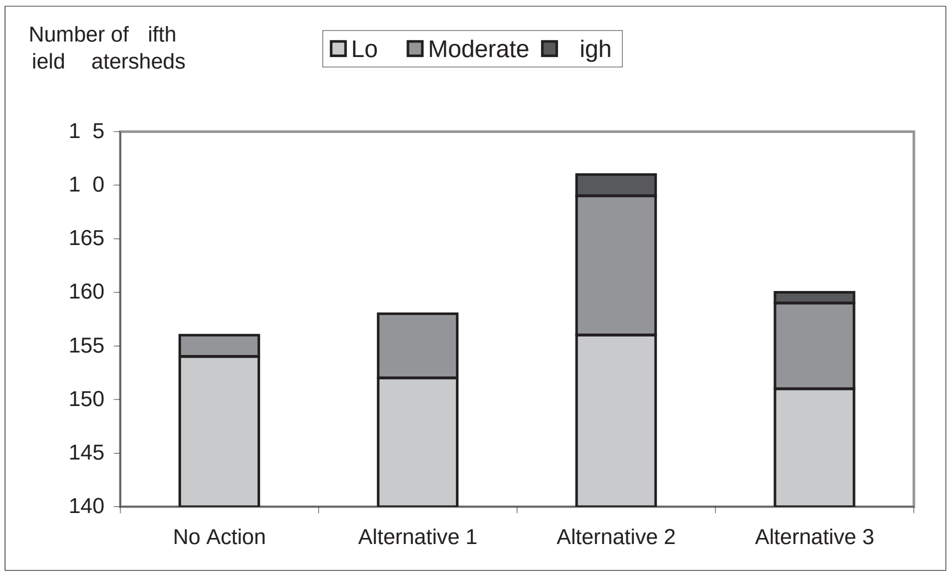


Table 180. Susceptibility comparison for the introduction of invasive plant species that are associated with timber harvesting in the fifth-field watersheds across the alternatives over the next 10 years

Susceptibility Ranking	No Action	Alternative 1	Alternative 2	Alternative 3
High	0	0	2	1
Moderate	2	6	13	8
Low	154	152	156	151
Total Susceptible	**156**	**158**	**171**	**160**
Total Not Susceptible	**104**	**102**	**89**	**100**
Total Watersheds	**260**	**260**	**260**	**260**

Susceptibility to the introduction of invasive plant species would be greatest under Alternative 2 with 171 watersheds having some level of susceptibility that is associated with timber harvesting activities over the next 10 years compared to the 156 watersheds under the No Action Alternative and 158 and 160 watersheds with susceptibility rankings under Alternatives 1 and 3.

Under Alternative 2, two fifth-field watersheds would be in the highest susceptibility category and 13 would be in the moderately susceptible category. Under Alternative 2, the highly susceptible watersheds would be in the Eugene, Roseburg, and Coos Bay districts. Watersheds of moderate and low susceptibility would be in all of the districts within the planning area.

Alternative 3 would be the second most susceptible to invasion with one fifth-field watershed in the highest category and eight in the moderately susceptible category. Under Alternative 3, the highly susceptible watershed would in the Roseburg and Coos Bay districts. The moderately susceptible watersheds would be in the Salem, Eugene, and Roseburg districts.

Alternative 1 and the No Action Alternative would have the lowest overall susceptibility to the introduction of invasive plant species that are associated with timber harvesting activities over the next 10 years. For both of these alternatives, no fifth-field watersheds would be in the highest susceptibility category.

Under Alternative 1, six fifth-field watersheds would be in the moderately susceptible category. The moderately susceptible watersheds would be in all of the districts within the planning area, except the Salem District.

The No Action Alternative would have two fifth-field watersheds in the moderately susceptible category and they would be in the Roseburg, Coos Bay, and Medford districts. All of the other watersheds would be in the lowest susceptibility category.

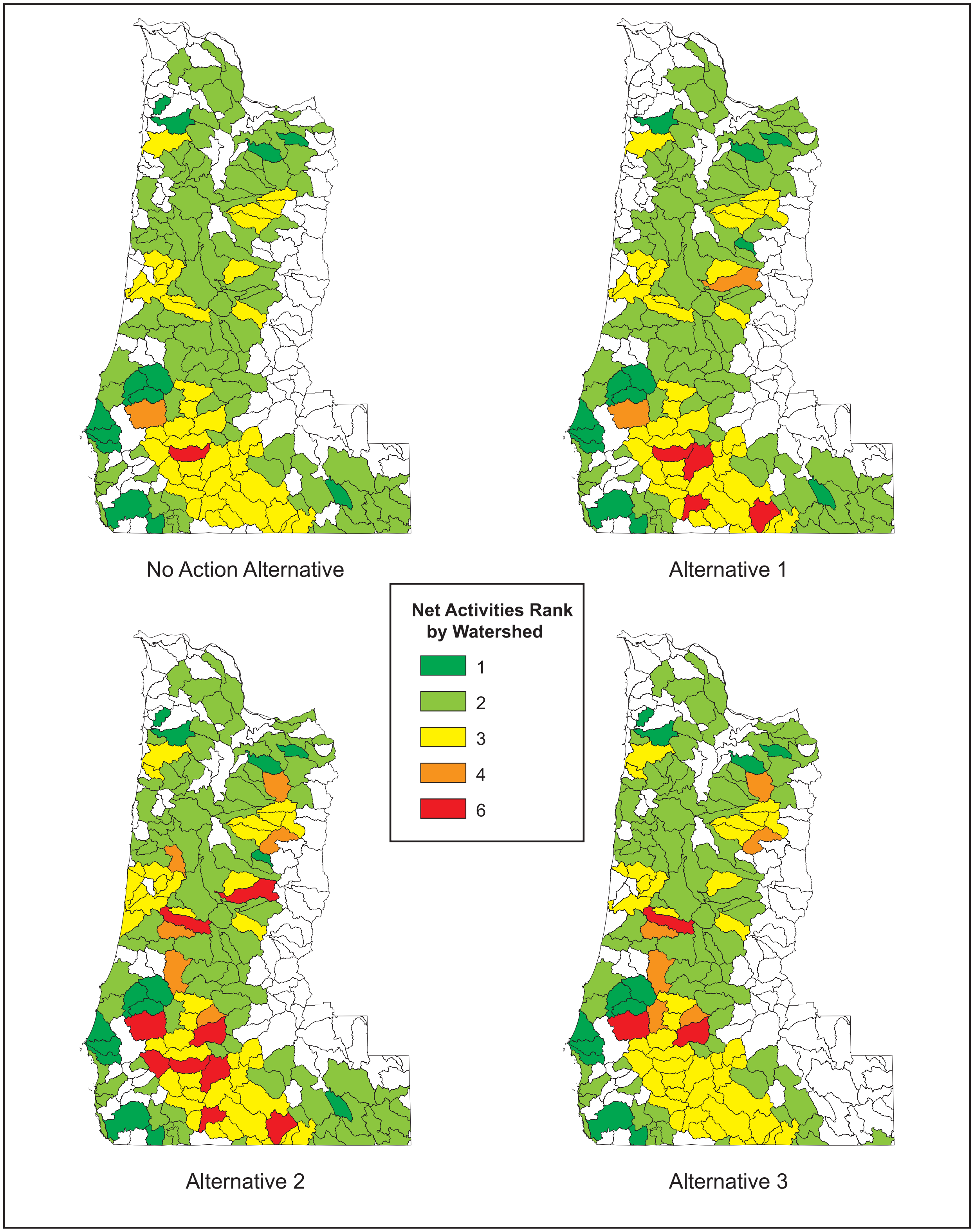
The risk of invasion is determined by both the susceptibility of a watershed to invasion from timber harvesting activities in the first 10 years of implementation and the presence of invasive plant species.

The process used to determine the risk of invasive plant species introduction by fifth-field watershed is shown in *Table 181 (Matrix to determine the relative risk for the introduction of invasive plant species that are associated with timber harvesting activities over the next 10 years)* and displayed in *Figure 208 (Comparison of the risk by mapped watershed for the introduction of invasive plant species that are associated with timber harvesting activities over the next 10 years)*. Within this table, categories for the distribution of invasive plant species distribution categories and the categories for the susceptibility of introduction from timber harvesting activities are used to determine the relative risk categories for the inadvertent introduction of invasive plant species.

Table 181. Matrix to determine the relative risk for the introduction of invasive plant species that are associated with timber harvesting activities over the next 10 years

Species distribution categories	Susceptibility categories for the 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

Figure 208. Comparison of the risk by mapped watershed for the introduction of invasive plant species that are associated with timber harvesting activities over the next 10 years



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 watershed where both invasive plant species are abundant and susceptibility would be high. Watersheds with either no reported sites for the sample set of invasive plant species in the analysis or with no BLM ownership have no assigned risk category.

See *Figure 209 (Comparison of the risk by watersheds for the introduction of invasive plant species associated with timber harvesting activities over the next 10 years)* and *Table 182 (Risk comparison for the introduction of invasive plant species associated with timber harvesting in the fifth-field watersheds across the alternatives over the next 10 years)* for the relative risk for the introduction of invasive plant species that are associated with timber harvesting activities over the next 10 years across the alternatives.

Figure 209. Comparison of the risk by watersheds for the introduction of invasive plant species associated with timber harvesting activities over the next 10 years

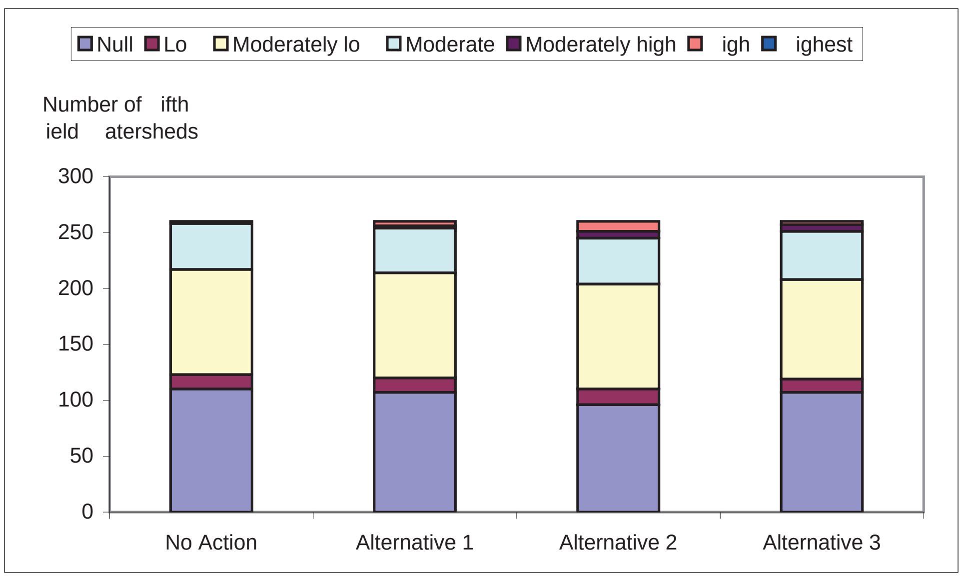


Table 182. Risk comparison for the introduction of invasive plant species associated with timber harvesting in the fifth-field watersheds across the alternatives over the next 10 years

Risk Ranking	No Action	Alternative 1	Alternative 2	Alternative 3
High	1	4	9	3
Moderately high	1	2	6	6
Low	148	147	149	144
Total Susceptible	**150**	**153**	**164**	**153**
Total Not Susceptible	**110**	**107**	**96**	**107**
Total Watersheds	**260**	**260**	**260**	**260**

The relative levels of risk of invasive plant species introduction associated with timber harvesting activities over the next 10 years under the alternatives follow the same pattern as the relative levels of susceptibility. Alternative 2 would have 164 watersheds with some level of risk compared to 150 watersheds under the No Action Alternative and 153 watersheds under both Alternatives 1 and 3.

Alternative 2 would have the most watersheds in the high and moderately high risk categories for invasive plant species introduction associated with timber harvesting activities over the next 10 years. Under Alternative 2, nine of the fifth-field watersheds would have a high risk of invasion and another six watersheds would have a moderately high risk of invasion. High risk watersheds are from all of the districts within the planning area, except the Salem District. Moderately high risk watersheds would be in the Salem, Roseburg, and Coos Bay districts.

Under the No Action Alternative, one of the fifth-field watersheds would be in both the high risk and moderately high risk categories. The high risk watershed would be in the Medford District. The moderately high risk watershed would be shared between the Roseburg and Coos Bay districts.

Alternative 1 would have four fifth-field watersheds in the high risk category and two watersheds in the moderately high risk category. The high risk watersheds would be all in the Medford District and one would be shared between the Medford District and the Klamath Falls Resource Area in the Lakeview District. The moderately high risk watersheds would be in the Eugene and Coos Bay districts.

Alternative 3 would have three fifth-field watersheds in the high risk category and six watersheds would be in the moderately high risk category. The high risk watersheds would be in the Eugene, Roseburg, and Coos Bay districts. The moderately high risk watersheds would be in the Salem, Roseburg, Coos Bay, and Medford districts.

Invasive Plant Species Introduction into Riparian Areas

The introduction of invasive plant species into riparian habitats provides a corridor for introduction (see the *Invasive Plants* section in *Chapter 3*). The risk of invasive plant species being introduced into riparian habitats as an inadvertent by-product of timber harvesting activities and associated new road construction varies with the widths, prescriptions, and levels of timber harvesting activities within riparian reserves and riparian management areas. The lower the shade levels, the higher the risk for the introduction of invasive plant species (see the *Invasive Plants* section in *Chapter 3*).

Under the No Action Alternative and Alternative 1, the post-thinning shade levels are the highest because of the broader widths of the riparian reserves or riparian management areas for all streams (perennial and intermittent).

- Post-thinning shade levels in the riparian management areas for perennial streams under Alternatives 2 and 3 would be lower than those under

Alternative 1 and the No Action Alternative since the widths of the riparian management areas are narrower.

- The widths of the riparian management areas are 25 feet for all intermittent streams under Alternative 2, except for debris-flow prone intermittent streams, and for all intermittent streams under Alternative 3. This would result in the lowest post-harvest shade levels along these streams.

The analytical assumption for the risk for the introduction of invasive plant species in intermittent streams under Alternative 2 and 3 is that the shade levels for the riparian habitats that are associated with these streams would mimic the levels in the surrounding timber harvest units. The intermittent riparian habitat post-harvest shade levels would be lower under Alternatives 2 and 3 than under the No Action Alternative and Alternative 1.

See *Figure 210 (Susceptibility comparison for the introduction of invasive plants species into riparian habitats associated with timber harvesting activities over the next 10 years)* and *Table 183 (Susceptibility comparison for the introduction of invasive plant species into riparian habitats that are associated with timber harvesting activities in the fifth-field watersheds over the next 10 years)* for a comparison of the relative susceptibility between the alternatives.

Figure 210. Susceptibility comparison for the introduction of invasive plant species into riparian habitats associated with timber harvesting activities over the next 10 years

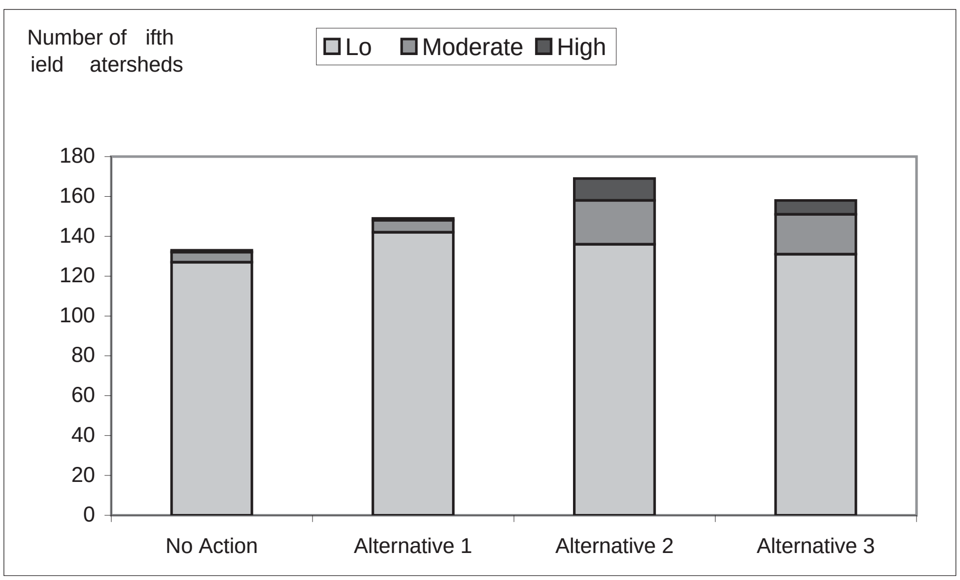


Table 183. Susceptibility comparison for the introduction of invasive plant species into riparian habitats that are associated with timber harvesting in the fifth-field watersheds over the next 10 years

Susceptibility	No Action	Alternative 1	Alternative 2	Alternative 3
Post-thinning shade levels	highest	highest	lower	lower
Widths of riparian reserves or riparian management areas	broader	broader	narrower	narrower
Overall susceptibility	moderate	moderate	highest	next highest
High	1	1	11	7
Moderate	5	6	22	20
Low	127	142	136	131
Total Susceptible	**133**	**149**	**169**	**158**
Total Not Susceptible	**127**	**111**	**91**	**102**
Total Watersheds	**260**	**260**	**260**	**260**

Alternative 2 would have 169 fifth-field watersheds with assigned susceptibility categories. Alternative 3 would have 158 with assigned susceptibility categories. The No Action Alternative and Alternative 1 would have 133 and 149 fifth-field watersheds, respectively, with assigned susceptibility categories.

The relative distribution of the fifth-field watersheds that were assigned susceptibility categories for invasive plant species introduction into riparian habitats for each alternative can be seen in *Appendix F, Invasive Plants*.

Over the next 10 years, Alternative 2 would have the most fifth-field watersheds in the highest susceptibility category for the introduction of invasive plant species into riparian habitats that are associated with timber harvesting activities. There are 11 watersheds that would be the most susceptible to introductions and they would be in the Salem, Eugene, Roseburg, and Medford districts. Another 22 watersheds would be in the moderately susceptible category and they would be in all of the districts within the planning area, except for the Klamath Falls Resource Area of the Lakeview District.

Over the next 10 years, Alternative 3 would have the second highest overall susceptibility for the introduction of invasive plant species into riparian habitats that are associated with timber harvesting activities. There are seven watersheds that would be the most susceptible to introductions and they would be in the Klamath Falls Resource Area of the Lakeview District and the Medford District. There are 20 fifth-field watersheds that would be moderately susceptible to invasive plant species introductions and they would be in all of the districts within the planning area.

Over the next 10 years, Alternative 1 and the No Action Alternative would be similar in their relative level of susceptibility for the introduction of invasive plant species into riparian habitats that are associated with timber harvesting activities. Both alternatives would have a single fifth-field watershed in the highest susceptibility category and it would be shared between the Roseburg and Coos Bay districts. There are five and six fifth-field watersheds under the No Action Alternative and Alternative 1, respectively, which would be in the moderately susceptible category. Under the No Action Alternative, the moderately susceptible fifth-field watersheds would be in the Eugene, Roseburg, and Coos Bay districts. Under Alternative 1, all of the districts within the planning area, except the Klamath Falls Resource Area of the Lakeview District, would have moderately susceptible fifth-field watersheds.

The risk of introducing invasive plant species into riparian habitats is shown in *Figure 211 (Relative risk of introducing invasive plant species in riparian habitats over the next 10 years)* and based on riparian susceptibility values and invasive plant species distribution. The risk comparison for invasion into riparian habitats between the alternatives is presented in *Figure 212 (Riparian risk category comparison for the introduction of invasive plant species over the next 10 years)* and *Table 184 (Risk comparison for the introduction of invasive plant species into riparian habitats associated with timber harvesting in the fifth-field watersheds over the next 10 years).*

Figure 211. Relative risk of introducing invasive plant species in riparian habitats over the next 10 years

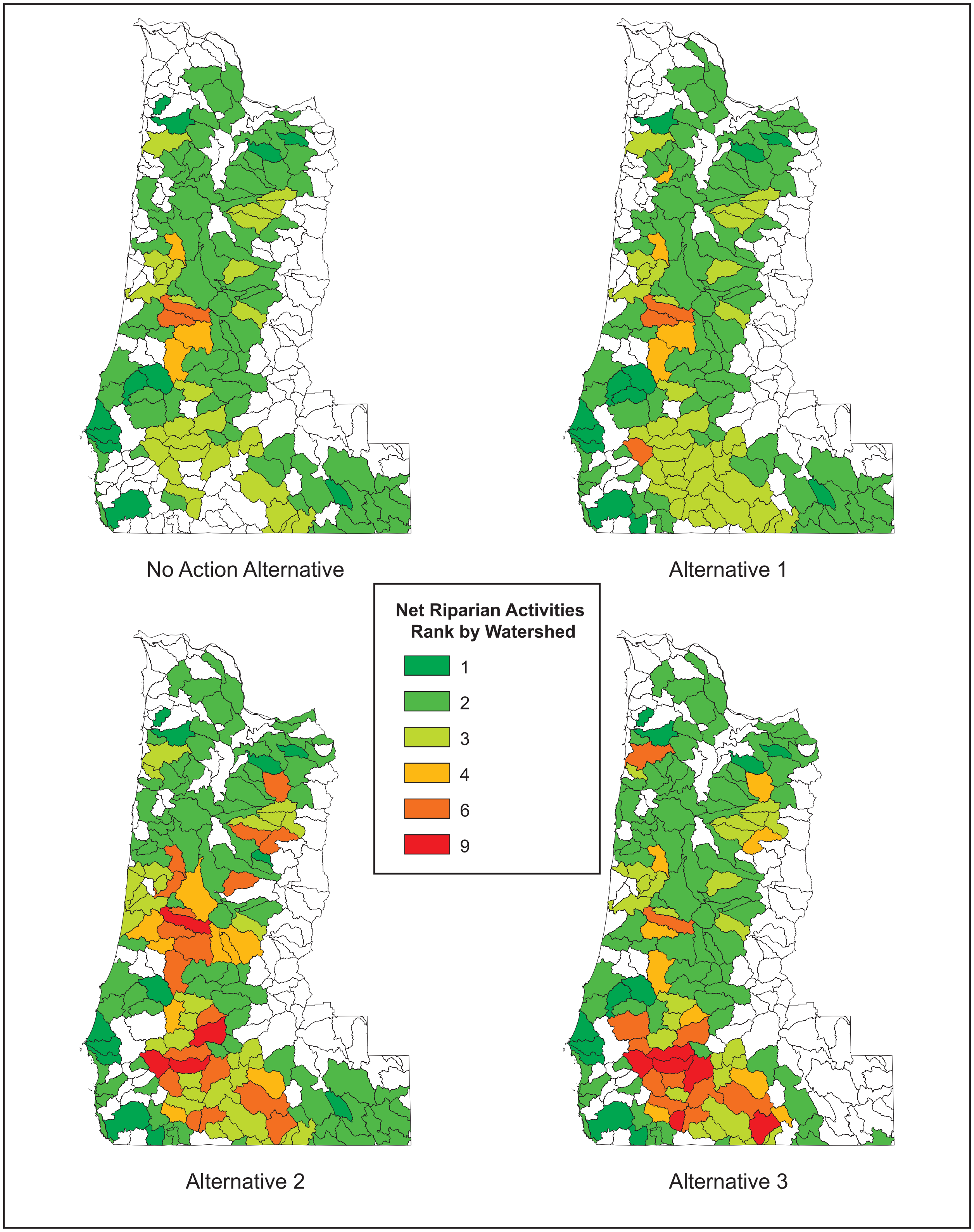


Figure 212. Riparian risk category comparison for the introduction of invasive plant species over the next 10 years

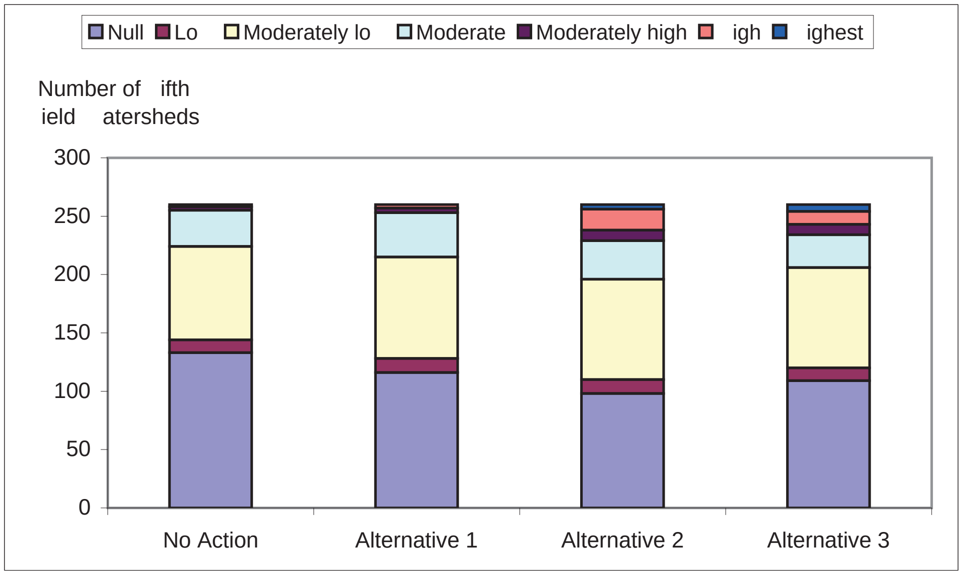


Table 184. Risk comparison for the introduction of invasive plant species into riparian habitats associated with timber harvesting in the fifth-field watersheds across the alternatives over the next 10 years

Risk Ranking	No Action	Alternative 1	Alternative 2	Alternative 3
Highest	0	0	4	6
High	2	3	18	11
Moderately high or lower	125	141	140	134
Total Susceptible	**127**	**144**	**162**	**151**
Total Not Susceptible	**133**	**116**	**98**	**109**
Total Watersheds	**260**	**260**	**260**	**260**

Alternative 2 would create the greatest risk of introducing invasive plant species into riparian habitats. The least amount of risk would occur under the No Action Alternative with its broader riparian management areas on both perennial and intermittent streams. Alternative 2 would have 162 fifth-field watersheds with risk for the introduction of invasive plant species into riparian habitats that are associated with timber harvesting activities. Alternative 3 would have 151 fifth-field watersheds with a risk for introduction. The No Action Alternative and Alternative 1 would have 127 and 144 fifth-field watersheds, respectively, with a risk for introduction. Over the next 10 years, watersheds with either no harvesting activities or no documented invasive plant species were determined to have no risk of introduction into riparian habitats that are associated with timber harvesting activities. These watersheds are represented in the null category in *Figure 212*.

Alternative 3 would have the most fifth-field watersheds in the highest risk category for the introduction of invasive plant species into riparian habitats that are associated with timber harvesting activities over the next 10 years. There are six watersheds that would be in the highest risk category and they would be in the Klamath Falls Resource Area of the Lakeview District and the Medford District. Another 11 watersheds would be in the high risk category and they would be in all of the districts within the planning area.

Over the next 10 years, Alternative 2 would have the second highest amount of fifth-field watersheds in the highest risk category for the introduction of invasive plant species into riparian habitats that are associated with timber harvesting activities. There are four fifth-field watersheds that would be in the highest risk category and they would be in the Eugene, Roseburg, and Medford districts. There are 18 fifth-field watersheds that would be in the high risk category and they would be in all of the districts within the planning area, except the Coos Bay District.

Over the next 10 years, Alternative 1 and the No Action Alternative would be similar in their relative level of risk for the introduction of invasive plant species into riparian habitats that are associated with timber harvesting activities. Alternative 1 and the No Action Alternative would have a relatively low risk of invasive plant species introduction into riparian areas compared to the risk levels under Alternatives 2 and 3.

Alternative 1 and the No Action Alternative would have no fifth-field watersheds in the highest risk category. Under the No Action Alternative there would be two fifth-field watersheds in the high risk category and they would be in the Eugene, Roseburg, and Coos Bay districts. Under Alternative 1, the three fifth-field watersheds in the high risk category would be in the Eugene, Roseburg, Coos Bay, and Medford districts.

An increase in timber harvesting activities indirectly increases the amount of road construction and maintenance that is needed to support the preparation, harvesting, and reforestation of the timber harvesting. Typical road management activities involve some level of soil disturbance and reduction in shade. For the relationship of timber harvesting and roads to the runoff into streams, see the *Water* section in this chapter.

See *Figure 213 and Table 185 (Risk comparison for the introduction of invasive plant species associated with new road construction over the next 10 years)* for the risk comparison for the introduction of invasive plant species into fifth-field watersheds as a result of new road construction activities between the alternatives.

Figure 213. Risk comparison for the introduction of invasive plant species associated with new road construction over the next 10 years

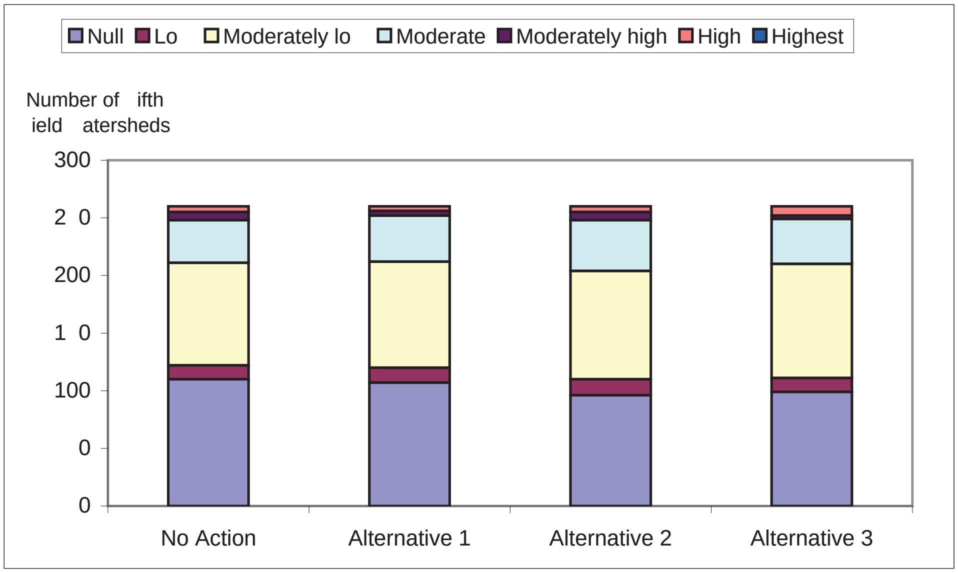


Table 185. Risk comparison for the introduction of invasive plant species associated with new road construction by fifth-field watershed over the next 10 years

Risk Ranking	No Action	Alternative 1	Alternative 2	Alternative 3
High	5	4	5	8
Moderately high	7	4	7	3
Moderate or lower	138	145	152	150
Total Susceptible	**150**	**153**	**164**	**161**
Total Not Susceptible	**110**	**107**	**96**	**99**
Total Watersheds	**260**	**260**	**260**	**260**

The greatest relative risk of inadvertent invasive plant species introduction that is associated with new road construction activities would occur under Alternative 2 and would be the lowest under the No Action Alternative. Alternative 2 would have 164 fifth-field watersheds with assigned risk categories. Alternative 3 would have 161 fifth-field watersheds with assigned risk categories. The No Action Alternative and Alternative 1 would have 150 and 153 fifth-field watersheds, respectively, with assigned risk categories.

Over the next 10 years, Alternative 3 would have the most fifth-field watersheds in the high risk category for the introduction of invasive plant species that are associated with new road construction activities. There are eight fifth-field watersheds from the Eugene, Coos Bay, and Medford districts that would be in the high risk category. Another three fifth-field watersheds from the Salem, Roseburg, and Coos Bay districts would be in the moderately high risk category.

Alternative 2 and the No Action Alternative would have the same amount of fifth-field watersheds in the high and moderately high risk categories, but the high risk watersheds would come from four of the districts within the planning area under Alternative 2 compared to two districts under the No Action Alternative.

Over the next 10 years, Alternative 2 would have five fifth-field watersheds in the high risk category for the introduction of invasive plant species that are associated with new road construction activities and they would be in the Eugene, Roseburg, Coos Bay, and Medford districts. Another seven fifth-field watersheds from the Salem, Eugene, Roseburg, and Coos Bay districts would be in the moderately high risk category.

Over the next 10 years, the No Action Alternative would have five fifth-field watersheds in the high risk category for the introduction of invasive plant species that are associated with new road construction activities and they would be in the Eugene and Medford districts. Another seven fifth-field watersheds from the Salem, Eugene, Roseburg, and Coos Bay districts would be in the moderately high risk category.

Over the next 10 years, Alternative 1 would have four fifth-field watersheds in the high risk category for the introduction of invasive plant species that are associated with new road construction activities and they would be in the Medford District. Another four fifth-field watersheds from the Roseburg and Coos Bay districts would be in the moderately high risk category.

Areas that are designated as open to off-highway vehicle use would not be substantially more susceptible to having new introductions of invasive plant species and more spread than areas that are designated as limited or closed because a majority of the open areas are located on steep, densely-forested terrain, which is not conducive to cross-country motor vehicle travel. Areas that are designated closed to off-highway vehicle use would not be susceptible to having new introductions and spread of invasive plant species due to off-highway vehicle activity.

Emphasis areas for off-highway vehicle use would be more susceptible to having new introductions than other areas under the limited designation. This higher level of susceptibility is due primarily to the use of larger numbers of off-highway vehicles in the emphasis areas. The analytical assumption is that with additional off-highway vehicle use there is a corresponding chance of introducing infestations.

Under the No Action Alternative, 330,000 acres are designated as open and 84,600 acres are designated as closed, and the remaining acres are designated as limited. In contrast, under the three action alternatives, 77 acres are designated as open in the three action alternatives and 98,800 acres are designated as closed. Most of the acres that were designated as open under the No Action Alternative would be designated as limited under the three action alternatives. Therefore, the BLM-administered lands would be somewhat less susceptible to the introduction of invasive plant species by off-highway vehicle use under the three action alternatives than under the No Action Alternative. The designation of off-highway vehicle emphasis areas under Alternative 2 would raise the relative risk of invasive plant species introduction from off-highway vehicle use (in affected watersheds) above the risk levels under Alternatives 1 and 3.

A relative risk comparison between the alternatives for the introduction of invasive plant species into fifth-field watersheds that are associated with the off-highway vehicle designations is shown in Figure 214 (R*elative risk for the introduction of invasive plant species that are associated with off-highway vehicle designations)* and Figure 215 (*Risk comparison for introduction of invasive plant species that are associated with off-highway vehicle use)*.

Figure 214. Relative risk for the introduction of invasive plant species that are associated with off-highway vehicle designations

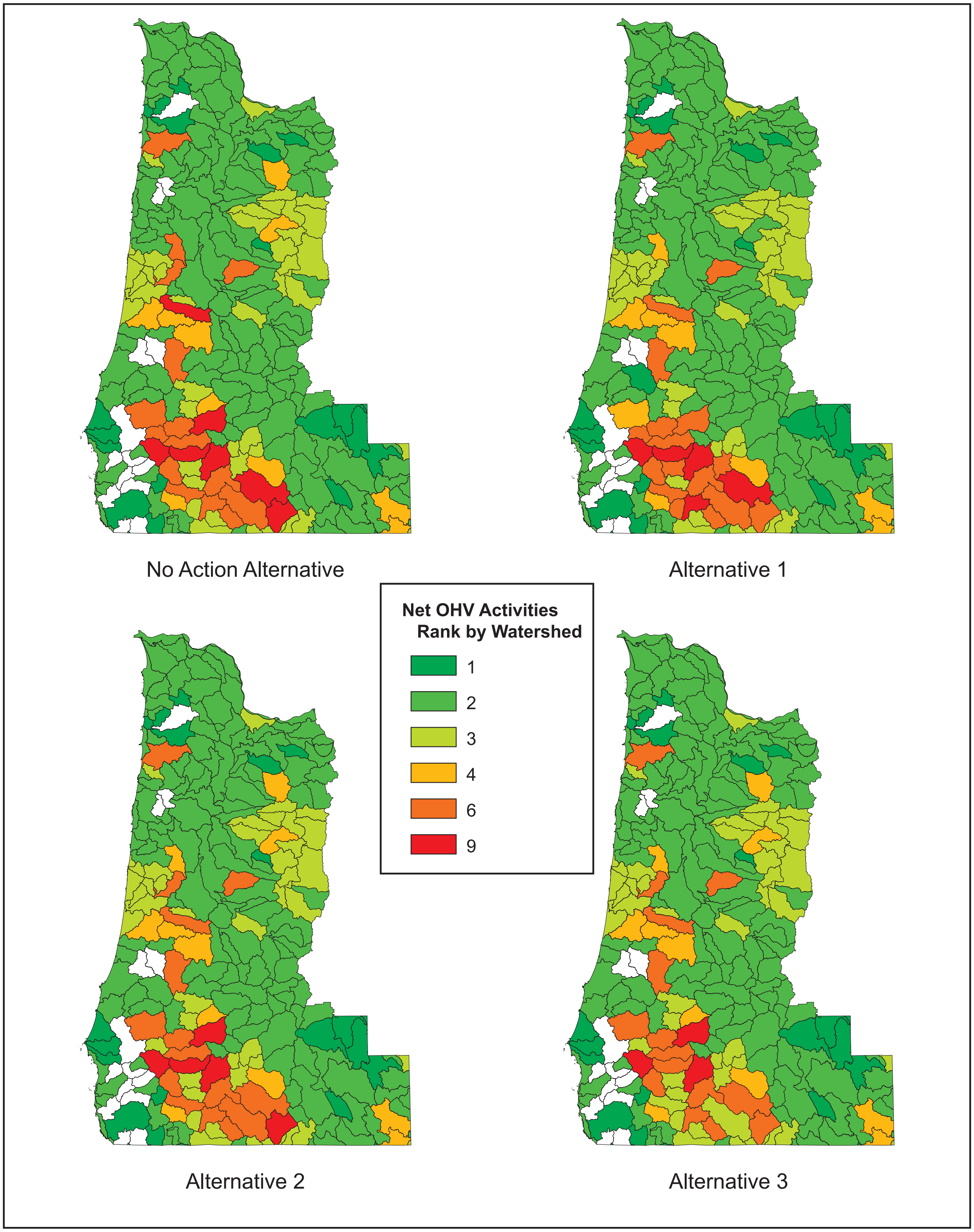
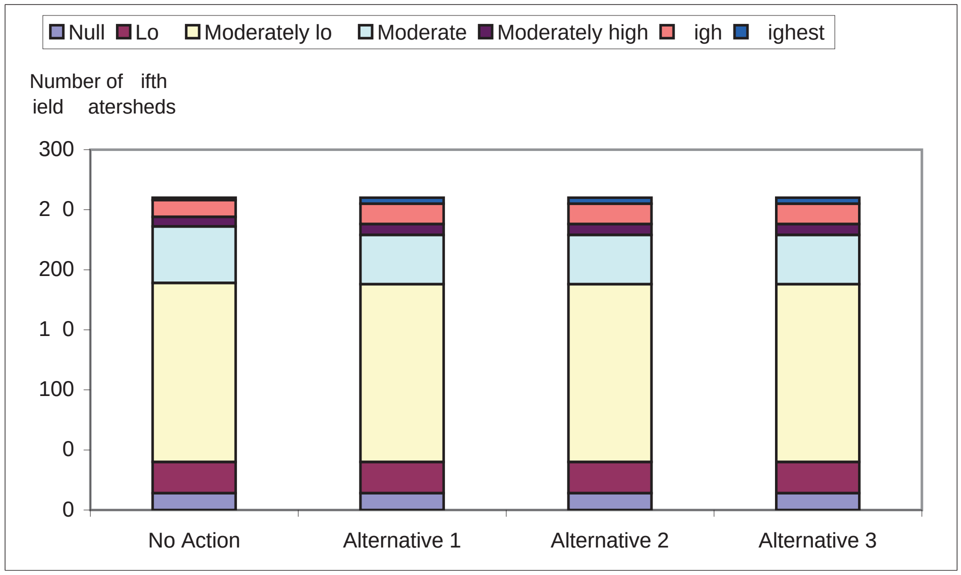


Figure 215. Risk comparison for introduction of invasive plant species that are associated with off-highway vehicle use



The No Action Alternative would have the most fifth-field watersheds in the highest risk category for the introduction of invasive plant species that are associated with off-highway vehicle use. There are seven fifth-field watersheds that would be in the highest risk category and they would be in the Eugene, Roseburg, and Medford districts and the Klamath Falls Resource Area of the Lakeview District. Another 15 fifth-field watersheds would be in the high risk category and they would be in all of the districts within the planning area, except the Klamath Falls Resource Area of the Lakeview District.

Alternative 2 would have the second highest overall risk for the introduction of invasive plant species from off-highway vehicle use. There are five fifth-field watersheds that would be in the highest risk category and they would be in the Roseburg and Medford districts and the Klamath Falls Resource Area of the Lakeview District. There are 15 fifth-field watersheds that would be in the high risk category and they would be in all of the districts within the planning area, except the Klamath Falls Resource Area of the Lakeview District. There would be more emphasis areas designated under Alternative 2 than under Alternatives 1 and 3 in the Medford District. The addition of these emphasis areas under Alternative 2 creates a relative increase in the risk for the introduction of invasive plant species from off-highway vehicle use in those watersheds compared to the level of risk for the same watersheds under Alternatives 1 and 3.

Alternatives 1 and 3 would have the same relative level of risk for the introduction of invasive plant species from off-highway vehicle use and it would be less than the levels under Alternative 2 and the No Action Alternative. There are three fifth-field watersheds that would be in the highest risk category and they would be in the Roseburg and Medford districts. There are 15 fifth-field watersheds that would be in the high risk category and they would be in all of the districts within the planning area, except the Klamath Falls Resource Area of the Lakeview District.

Spreading Invasive Plant Species

Management activities that create susceptibility for the spread of invasive plant species are timber harvesting, associated road management activities, and off-highway vehicle use.

Infestations are introduced and spread more readily in areas that have more human activity (such as high recreational use area). The distribution of high-use recreational use areas does not vary by alternative, except for off-highway vehicle designations.

Over the long term, the potential for the introduction and spread of invasive plant species is higher in the following areas that are associated with timber harvesting activities:

- the matrix areas under the No Action Alternative,
- the timber management areas under Alternatives 1 and 2, and
- the general landscape areas under Alternative 3.

See *Chapter 2* for maps that show the relative amounts and distribution of the land use allocations under each alternative.

The No Action Alternative and Alternatives 1 and 2 would concentrate timber harvesting and the associated road management activities in the matrix, adaptive management area, and timber management area land use allocations, which would consist of 33%, 37%, and 48% of the BLM-administered lands, respectively. Under Alternative 3, timber management activities would occur throughout the general landscape area, which includes 66 % of the BLM-administered lands.

The potential for the spread of invasive plant species from existing weed infestations and as a result of infestations that are associated with timber harvesting activities would be the lowest under the No Action Alternative. Alternative 1 would have the second lowest amount of area in a land use allocation with an emphasis on timber harvesting activities. Alternative 3 would contribute more to invasive plant species spread from timber harvesting activities than the other alternatives because timber harvesting and road construction would be most dispersed across the BLM-administered lands and would occur on a larger proportion of the BLM-administered lands.

There is less potential for the introduction and spread of invasive plant species with larger late-successional reserves or late-successional management areas. Within the planning area, Alternative 1 would have 28% of the BLM-administered lands in late-successional management areas, Alternative 2 would have 19%, and the No Action Alternative would have 36% in late-successional reserves. There would be larger blocks of land in late-successional management areas or late-successional reserves under Alternative 1 and the No Action Alternative compared to Alternative 2. Therefore, less introduction and spread of invasive plant species would be expected under Alternative 1 and the No Action Alternative than under Alternative 2.

Under Alternative 2, the BLM-administered lands in the Western Cascades physiographic province within the Salem District would predominately be in the timber management area land use allocation. There would be larger blocks of late-successional reserves under the No Action Alternative and late-successional management areas under Alternative 1. Therefore, in the Western Cascades province within the Salem District, the spread potential for invasive plant species would be higher under Alternative 2 than it would be under the No Action Alternative and Alternative 1.

Invasive plant species infestations in riparian areas spread as seeds and vegetative propagules that are carried downstream. The risk of the spread of invasive plant species along riparian habitats would be higher under Alternatives 2 and 3 than under the No Action Alternative and Alternative 1 because more infestations that are associated with timber harvesting would be introduced along intermittent streams under Alternatives 2 and 3 with their relatively narrow riparian management areas widths along most of the intermittent streams.

Compared to the other alternatives, Alternative 2 would have the greatest risk of introducing invasive plant species infestations and Alternative 3 would have the greatest potential of spreading invasive plant species based the following factors:

- current invasive plant species distribution
- timber harvesting activity levels
- proximity of harvesting to streams
- off-highway vehicle designations
- land use allocation arrangement

For the introduction and spread of invasive plant species, Alternative 2 would have the greatest number of high risk and moderate risk fifth-field watersheds that are associated with timber harvesting activities over the next 10 years. The No Action Alternative, closely followed by Alternative 1, would have the fewest.

Alternative 3 would create the greatest risk of introducing and spreading invasive plant species in riparian habitats. The No Action Alternative, closely followed by Alternative 1, would create the lowest risk of introducing and spreading invasive plant species in riparian habitats.

Under Alternative 3, invasive plant species would spread most readily. Under the No Action Alternative, invasive plant species would spread the least over the long term. Of the action alternatives, Alternative 1 would have the lowest risk of invasive plant species spread.

Although off-highway designations favor invasive plant species introduction and spread under the No Action Alternative relative to the action alternatives, when considered in combination with timber harvesting activities and associated road management activities, the No Action Alternative would have the lowest overall potential to introduce and spread invasive plant species and Alternative 3 would have the greatest overall potential for introduction and spread.

Management activities on other land ownerships would also contribute to the amount of lands made susceptible to the introduction and spread of invasive plant species that are associated with timber harvesting activities, road construction, off-highway vehicle use, and other recreational activities. Because the BLM is rarely the predominate landowner within the fifth-field watersheds within the planning area (see the *Introduction* to this chapter), the overall influence that the BLM management activities would have on the introduction and spread of invasive plant species across all lands is limited.

Mitigation Measures

Applying the following mitigation measures would reduce the risk of the introduction and spread of invasive plant species that are associated with shade-reducing and soil-disturbing management activities:

- Use cable or aerial logging methods in fifth-field watersheds that are at high risk for the introduction of invasive plant species.
- Use clean heavy equipment on actions that would operate off of roads.
- In infested areas, where the transport of invasive plant species seeds or propagules on heavy equipment is likely, clean the heavy equipment before leaving the project site, except in emergency situations.
- Use weed-free straw and mulch.
- Consistent with project objectives, retain native vegetation in and around project locations and minimize soil disturbance.