CHAPTER 4

Environmental Consequences

Introduction

This chapter summarizes the environmental consequences associated with each of the alternatives described in Chapter 2.

The following resources and/or critical elements of the human environment (as described in the BLM NEPA Handbook, H-1790-1, Appendix 5) are not present or would not be affected by any of the alternatives:

- Areas of Critical Environmental Concern (ACEC)
- Cultural resources
- Farm Lands (prime or unique)
- Hazardous or solid wastes
- Minority populations and low income populations
- Native American Religious Concerns
- Wild and Scenic Rivers
- Wilderness

Effects on threatened and endangered species, water quality, and wetlands, riparian zones, and floodplains are addressed in the analysis in this chapter. Effects on air quality would not be significant and have already been analyzed in the RMP EIS (USDI Bureau of Land Management 1994, pp. 4-10 - 4-14), as explained in Chapter 1 under Issues Considered, but Not Analyzed.

Inadequate or Unavailable Information

We will always have incomplete knowledge of the ecology of terrestrial and aquatic ecosystems, and particularly about the development of late-successional forests (USDA and USDI February 1994, pp. 3&4-3 - 3&4-4). The following discussion of the analysis assumptions identifies incomplete information relevant to analysis of the issues, and how BLM will acquire additional information, where possible and necessary.

Assumptions and Assessment Guidelines

We analyzed many issues in this EIS, especially those related to stand development and wildlife habitat, using stand modeling results from the Landscape Management System over a 100-year analysis period. The Landscape Management System (LMS) is a computerized set of software tools that integrates landscape-level spatial information, stand-level inventory data, and tree growth models to project changes through time across the landscape. LMS provides detailed stand-level analysis (see Figures 5 and 6) as well as landscape-level analysis. For the purposes of the modeling, the EIS assumes the year 2002 as the beginning of the 100-year analysis period.

The tree growth model is based on the observed growth and development of fully-stocked natural stands, originally developed with the primary purpose of evaluating timber production. Applying this modeling to the growth and development of plantations for the purpose of evaluating ecological restoration is challenging. The modeling results in the first several decades are likely quite accurate, because it has been possible to calibrate the model based on actual observations of stand development. However, few if any differences in alternative restoration approaches are likely to become apparent in the first several decades. In most cases, differences among alternatives would not apparent until near the end of the 100-year analysis period.

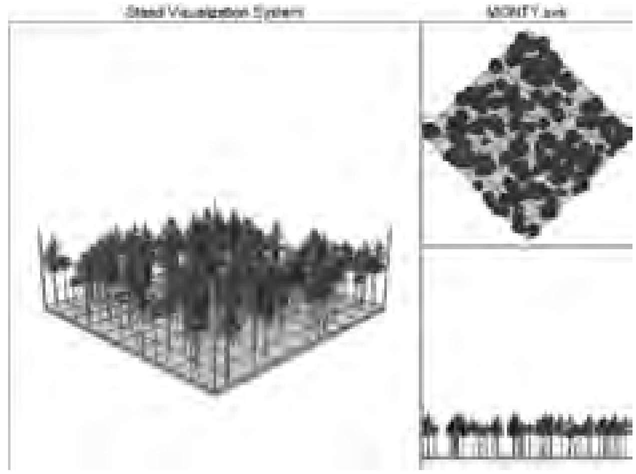


Figure 5. *LMS output showing visualization of stand structure.*

The real value of the modeling results is in demonstrating the comparative outcomes of the alternatives. Absolute values should be interpreted with caution, especially past the first several decades. For example, the tree growth model appears to allow stands to grow and maintain too many large trees at densities too high for the site quality and stand conditions in the planning area (J. Comnick, personal communication, 2002). The model appears to overestimate the amount of live crown that trees would retain at high densities, thereby overestimating growth rates at high densities. Therefore, the modeling results probably slightly overestimate the development of large trees in unthinned stands.

Additionally, the starting stand inventories appear to slightly underestimate tree diameter and height. Starting stand inventories affect not only the stand growth and structure in the modeling, but also the revenues calculated for each alternative. The revenues are dependant on the volume of timber harvested, which is, in turn, extremely sensitive to the starting stand inventories. The apparent underestimation of starting inventories is likely causing an underestimation of revenues in all alternatives that include timber harvest. BLM is currently conducting a series of stand examinations in and near the planning area to calibrate the modeling. We may adjust the starting inventories and modeling parameters between the draft and final EIS based on the results of these stand examinations and other empirical data. Appendix B provides additional information about LMS and the modeling in this analysis.

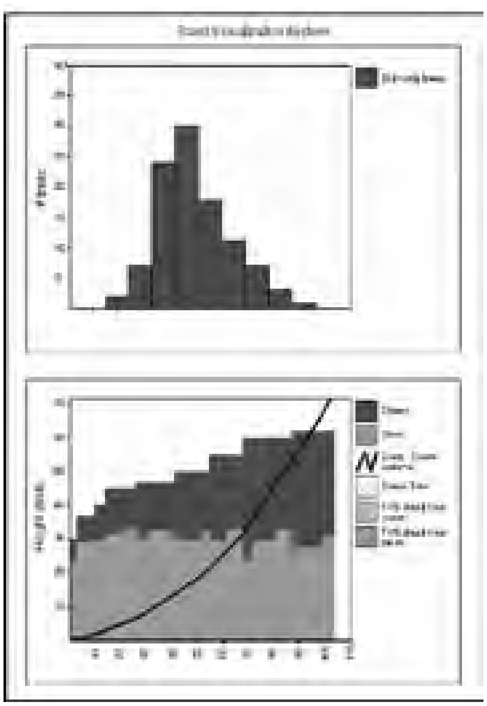


Figure 6. *LMS output charts showing tree diameters, heights, and crown sizes.*

We address the issues identified in Chapter 1 by the parameters described below. Additional information on the analysis methods and assumptions is available in the Upper Siuslaw LSR Restoration project file, which is available for review at the Eugene District Office.

ISSUE 1: *How would road decommissioning and road management actions alter public access to BLM-managed lands?*

- *Miles of road not available for vehicle traffic*

We derived much of the information in this analysis from the road inventory of the planning area completed in 2002. The road inventory included a systematic analysis of the road network, including identification of the environmental risks to aquatic resources.

To understand the effects of road decommissioning on the public's ability to access BLM-managed land, it is necessary to define roads as either "legal public access" or "other." "Legal public access" is defined as either (a) roads for which BLM has acquired a public easement across private land; or (b) roads that begin on BLM-managed land that is legally accessible from state or county roads (see Figure 7).

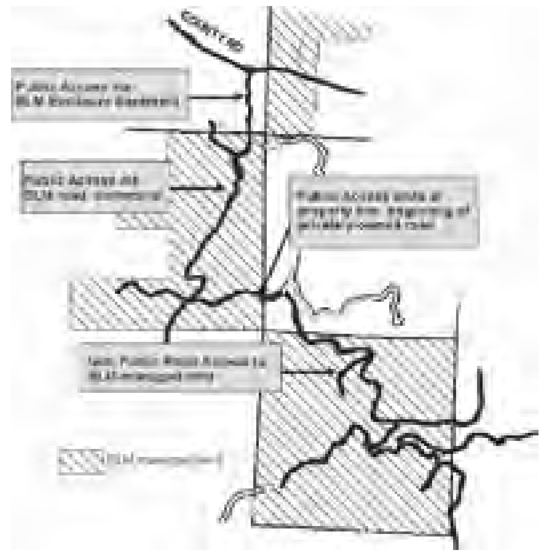


Figure 7. *A sample of the ownership and public access status of a variety of roads that provide access to BLM-managed lands.*

"Other" roads include those for which BLM has not acquired a public easement for access. In such situations, the landowner has the legal authority to close the road to the public at any time, even if private landowners have allowed physical access across their land in the past. This may be true even where BLM has full maintenance responsibilities (i.e., "control") for the road. In addition, there may be roads on privately-owned land that are currently gated, that are not available for public use, or that are available only for short times during the year (e.g., hunting season).

The actions that may be taken to implement road decommissioning are described in Appendix A. Road decommissioning described here may include "decommissioning," "full decommissioning," or "obliteration" as defined in the Western Oregon Transportation Management Plan (USDI BLM 1996b). In this analysis, we assumed that only "non-shared" roads would be available for decommissioning. Even non-shared roads may be covered under existing right-of-way agreements with adjacent landowners, and decommissioning may require the consent of those landowners. In this analysis, we assume that adjacent landowners would consent to decommissioning of non-shared roads.

ISSUE 2: *How much new road construction would be needed to implement restoration actions?*

- *Miles of new road construction*

We determined the estimated length of new road construction based on the average length of new road construction required for past timber sales in the Eugene District. These estimates vary among the different stand age-classes and are altered by some of the alternatives' design features. The estimates are described under this issue for each alternative.

ISSUE 3: *What level of risk to existing late-successional forest would result from restoration activities?*

- *Fire: acres in Fuel Models 5, 10, and 12*
- *Bark beetles (stand level): acres with mortality; number of green trees killed*
- *Bark beetles (landscape level): qualitative analysis*

Forest disturbance processes in the planning area include fire, wind, insects, and disease (USDI BLM 1996a, p. II-23). The vulnerability of existing late-successional stands to disturbance by wind or disease is not likely to be affected by the restoration actions considered here (restoration actions which would affect the susceptibility of young stands to windthrow are addressed in Issue 4).

Restoration actions in young stands may affect the risk of fire and insect disturbance (specifically Douglas-fir bark beetle) across the landscape, including existing late-successional stands (USDA and USDI 1997, pp. 13-17). Therefore, we have evaluated the risk to existing late-successional forests from restoration activities based on the risk of wildfire and Douglas-fir bark beetle infestation.

The analysis measures fire risk by modeling fuel conditions over time. Specific quantities and qualities of surface fuels are assigned to specific "fuel models," which allow comparison of potential fire behavior and fire effects (Anderson 1982). The Fuels Report in the Upper Siuslaw LSR Restoration project file provides detailed information on this analysis and is available for review at the Eugene District Office. Four fuel models are relevant to the current and potential conditions in the planning area:

- Model 5: short shrubs (e.g., salal, swordfern, Oregon grape) that commonly make up the understory of forest stands;
- Model 6: tall shrubs (e.g., oceanspray, hazel, vine maple) that establish in very young stands before canopy closure;
- Model 10: timber with heavy dead and down fuels that occur in young, dense stands;
- Model 12: slash that results from thinning or blowdown of stands.

The analysis measures fire risk by assessing the acres of the stands currently ≤80 years old in Models 5, 10, and 12 as they move through time. Model 5 has low fuel loads and low potential fire effects. In contrast, Models 10 and 12 have high potential for crown fires and severe fire effects. The relatively few acres that are currently in Model 6 rapidly move into other models, largely unaffected by management actions, and the fire risk associated with Model 6 is similar to Model 5. Therefore, for simplicity of display, the analysis combines the acres in Model 6 with Model 5.

Figure 8. *Douglas-fir log with bark beetle infestations.*

We are able to predict the effect of restoration actions on populations of Douglas-fir bark beetle (*Dendroctonus pseudotsugae*) and subsequent Douglas-fir mortality at the stand level. In western Oregon, Douglas-fir bark beetle usually infest Douglas-fir trees >12” dbh (see Figure 8). A general rule of thumb proposed in several papers suggested that for every 10 Douglas-fir trees which are left as coarse woody debris, 6 live Douglas-fir trees would likely be killed in the subsequent two to three years (Hostetler and Ross 1996, Ross 2000). However, this rule of thumb was based primarily on trees larger than those proposed to be left as coarse woody debris in the alternatives in this EIS. Recent data from the Oregon Coast Range (Ross et al. 2001) showed that lower mortality rates, and estimated that the number of beetles produced from 10 down trees had the eventual potential to kill 4 similar-sized green trees. Therefore, this analysis assumes a mortality rate of 4 green trees killed for each 10 trees left as coarse woody debris. Tree mortality may be altered by a wide range of factors, such as the season of cutting, shading on the coarse woody debris, the vigor of attacked live trees, background beetle population levels, and weather conditions. If no additional coarse woody debris is created, bark beetle populations will generally return to normal three years after creation of coarse woody debris (Hostetler and Ross 1996).

Current Douglas-fir bark beetles populations in the planning area appear to be low, based on the very low numbers of trees killed in recent years. From 1985 through 2001, surveys detected from 0-135 trees killed by bark beetles per year over the entire planning area (<1 tree per 180 acres). However, bark beetle populations may increase dramatically if large amounts of coarse woody debris are created across the landscape, especially if combined with poor growing conditions that reduce tree vigor. Under these conditions, Douglas-fir bark beetles could damage existing late-successional forests (USDA and USDI 1997, pp. 15-16).

Epidemic bark beetle outbreaks are usually brief and localized in the Coast Range of Oregon, but are more common east of the Cascade Mountains (Hostetler and Ross 1996, Furniss and Carolin 1977). The most severe outbreak recorded in the Oregon Coast Range occurred in the 1950’s. Wind storms during the winters of 1950-1951 and 1951-1952 blew down tremendous numbers of trees (Greeley et al. 1953). Within the planning area, historical aerial survey maps show that about two-thirds of the area had 40-80 acres of blowdown per square mile, and one-third had over 80 acres of blowdown per square mile. Much of the blowdown was in old stands with large trees, providing prime host material for the beetles. This blowdown, combined with the very dry growing seasons of 1951 and 1952 and a large number of scorched or dead trees from the forest fires of 1951, resulted in the most beetle-caused mortality ever recorded for the Oregon Coast Range. However, even these extreme conditions resulted in only an estimated 11,000 trees (0.42 per acre) killed by bark beetles from 1952-1954.

The low intensity of tree mortality following such severe conditions establishes the relatively low risk of widespread or catastrophic tree mortality from bark beetles in the planning area. While the conditions that would be created by the alternatives differ from natural disturbances, the bark beetle outbreak in the 1950s provides a starting point from which to compare the alternatives on a landscape scale.

Because of the myriad factors influencing this landscape-scale effect, quantitative analysis is not possible here. Therefore, we have considered the landscape-scale effects of restoration actions on Douglas-fir bark beetle populations and subsequent tree mortality with a qualitative analysis, based on the best professional judgment of an expert federal entomologist (See Chapter 5, Consultation).

ISSUE 4: *How would thinning affect development of late-successional forest structural characteristics?*

- *Acres of forest with late-successional structure*
- *Stand density (trees per acre, relative density)*
- *Stand stability (height : diameter)*

There are many descriptions of the structural characteristics of late-successional forests of the Douglas-fir forests region of the Pacific Northwest (Franklin et al. 1981; Old-Growth Definition Task Group 1986; Spies and Franklin 1988; Spies and Franklin 1991; USDA and USDI 1997, p. 57). However, late-successional forest structural characteristics may vary considerably across the region (Spies and Franklin 1991, p. 108), and the broad generalizations in these regional descriptions may be of limited value at finer spatial scales, such as this planning area. Therefore, for the purpose of this analysis, we developed criteria for late-successional forest structure based on local data (see Appendix C). Specifically, we examined stand inventory data that was collected from approximately 1,300 acres of late-successional stands that were harvested between 1985 and 1991 in or near the planning area (see Poage 2000, pp. 10-13). We used this data to a construct minimum threshold for late-successional structural characteristics:

• density of large Douglas-fir (>32” dbh)	>3.25/acre
• density of very large Douglas-fir (>40” dbh)	>3.25/acre
• Coefficient of Variation (CV) of Douglas-fir diameters (>10” dbh)	>0.37
• density of shade-tolerant conifers (>10” dbh)	>5.0/acre

For analysis, we considered a stand to have late-successional forest structure if it meets any three of these four criteria. The data for local late-successional stands discussed above revealed that few stands simultaneously met all four criteria, but most met three of the four. Abundant large and very large Douglas-fir, abundant shade-tolerant conifers, and a wide range of tree diameters are consistent structural characteristics of late-successional forests (Spies and Franklin 1991) (see Figures 9 and 10). The Coefficient of Variation (CV, which is calculated as the standard deviation/mean average) of Douglas-fir tree diameters is a measure of how much the trees in a stand vary in diameter, rather than just describing the stand average or the extremes of the range. A higher CV corresponds to a wider variety of tree diameters. The density of shade-tolerant conifers (primarily western hemlock and western red-cedar) appears to be considerably lower in this planning area than the regional averages (Spies and Franklin 1991, p. 102; Poage 2000, pp. 31-43; Hibbs and Shatford 2001).

We did not include in these criteria all possible structural characteristics of late-successional forests, most notably large snags and logs. The natural production of large snags and logs is difficult to model, in part because large snags and logs are more likely to be created by density-independent mortality (e.g., lightning, root rot, fire) than density-dependent mortality (e.g., tree competition). Tree growth models can effectively model density-dependent mortality, which tends to kill the smaller trees in the stand and thus creates only smaller snags or logs. Therefore, we have assumed that within the 100-year analysis period, sufficient large snags and logs will be present in the currently young stands only if they are created by active management. Given that the snag and coarse woody debris creation prescriptions in the alternatives were based on the levels of snags and logs in existing late-successional forests (USDA and USDI 1997, pp. 58-71), this assumption should be generally as accurate as a more sophisticated modeling approach.

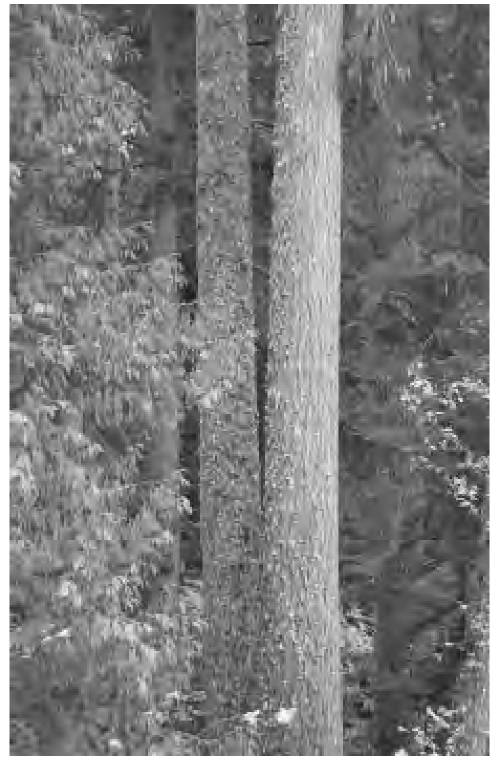


Figure 9. *Large Douglas-fir and an understory with hemlocks and cedars are typical of late-successional stands.*

This set of criteria provides a useful measure of the development of late-successional forest structure across the landscape, allowing the analysis to compare the number of acres that meet this minimum threshold over time and among alternatives. This analytical approach draws an absolute threshold – a stand either has late-successional structure or it does not. While this dichotomous approach is useful for landscape-scale analysis, it does not reflect the reality of stand development, in which late-successional stands exhibit continuous variability in structure (Franklin and Spies 1991).

Therefore, we also evaluate how stands currently ≤80 years old would develop under each alternative through time, and how this development compares with how existing late-successional stands developed. In addition to the late-successional structure threshold described above, we evaluate additional stand-level characteristics to describe the continuous development of stand condition under each alternative. The analysis measures the development of the stand density (in both relative density and trees per acre (TPA)) and the stand stability (in the ratio of tree height : tree diameter). Relative density is a measure of the growing space available to the average tree in a stand; higher values indicate more dense stands. (Curtis 1982) The ratio of tree height to tree diameter gives a measure of the mechanical stability of the tree; higher values indicates less stability. The stand average height : diameter ratio indicates the stability of the stand and the likelihood of catastrophic windthrow. (Lohmander and Helles 1987; Wilson and Oliver 2000).

In contrast to the past silvicultural regimen described in Chapter 3, most existing late-successional stands in the planning area appear to have developed at low tree densities with heterogeneous structure. The FEMAT Report describes generally the development of natural stands (USDA Forest Service et al. 1993, pp. IV-27 - IV-31; see also USDA and

Figure 10. *Late-successional stands characteristically have a wide range of tree diameters.*

USDI 1994, pp. B-1 - B-4). The RMP EIS also provides a general discussion of natural stand development and the effects of stand development on various resources (USDI BLM 1994, pp. IV-28 - IV-36; IV-51 - IV-53). The Siuslaw Watershed Analysis briefly describes likely future stand conditions across the watershed on both public and private lands (USDI BLM 1996a, pp. IV-2 - IV-5). The LSR Assessment describes natural forest successional stages in the LSR area (USDA and USDI 1997, pp. 36, 47-66). These analyses are incorporated here by reference.

Because the planning area lacks young, natural stands (i.e., stands that naturally regenerated following disturbances such as fire or windstorms, rather than timber harvest), our understanding of natural stand development must rely heavily on reconstructive studies, rather than direct observation. As with late-successional forest structure, natural stand development is highly variable and defies easy generalization (Spies and Franklin 1991; Hunter and White 1997; USDA and USDI 1997, pp. 54-55; Franklin et al. 2002).

However, recent studies that have sought to reconstruct the stand development of late-successional stands suggest some regional patterns (Tappeiner et al. 1997, Poage 2000; Winter 2000; Poage and Tappeiner 2002). Tappeiner et al. and Poage each examined a sample of western Oregon stands and found that large, old Douglas-fir trees in the Oregon Coast Range generally developed under low stand densities. In contrast, Winter found that an old-growth stand in western Washington had developed under initial high-density conditions. These contrasting findings reinforce that there may be multiple pathways to late-successional forest structure, and that the most likely or typical pathway may differ from one region to another.

Data from local late-successional stands within and near the planning area are consistent with the findings of Tappeiner et al. and Poage, and support the conclusion that late-successional stands in this planning area typically developed under initial low densities (see Figure 11). Late-successional stands in the planning area average 47 TPA of trees >10" dbh (generally ranging from 20 to 80 TPA). The relative density of Douglas-fir in local late-successional stands is low, averaging 32 (generally ranging from 20 to 50). In comparison, Matrix stands are often thinned when relative density reaches 50 to 60 and are thinned to relative density of 35 to 40 (USDI BLM 1995, pp. 202, 205); thus most local late-successional stands have lower Relative Densities than the post-treatment density under typical thinning prescriptions. Appendix C summarizes this data on local late-successional stands.

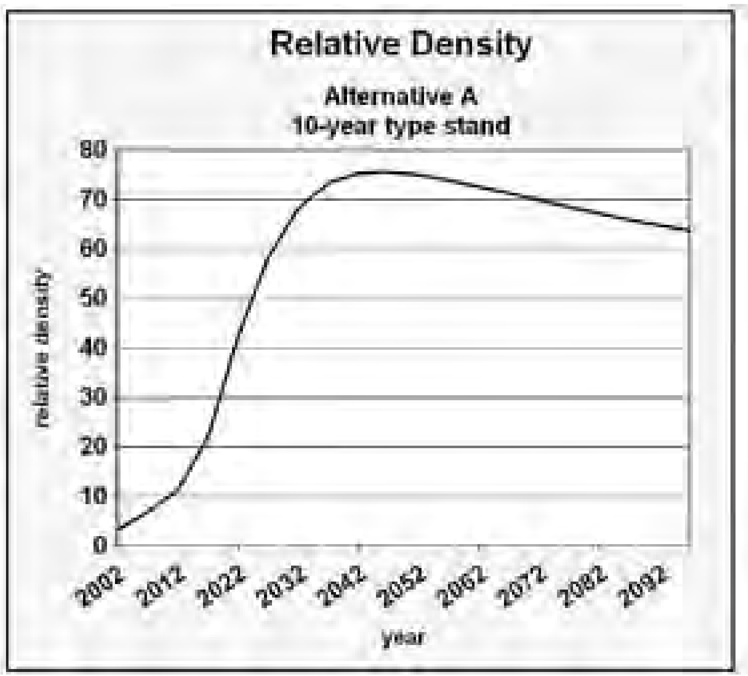
Figure 11. *Many old-growth stands in the planning area appear to have developed under low densities*

How to Read the Graphs

The following section explains how to interpret the graphs related to forest structure.

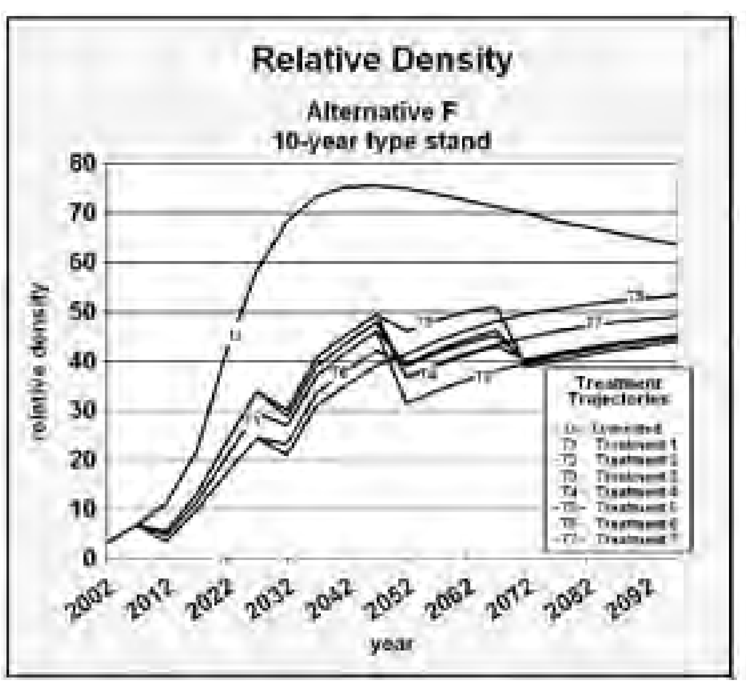
For each alternative, the analysis presents a set of graphs on trees per acre, relative density, and height:diameter ratio for each "type" stand "trajectory" over time. Modeling forest development across the landscape required simplifying the stands into a series of "type" stands: a generalized stand condition for a given age class and its typical management history, for example, "40-year old stands that have been pre-commercially thinned" (see Appendix B). The stand "trajectories" are the type stands combined with specific treatments that would be applied under a given alternative.

For example, there is only one trajectory for each type stand in Alternative A, because there are no treatments. Graph 3 shows the relative density of the single trajectory of the 10-year type stand in Alternative A.



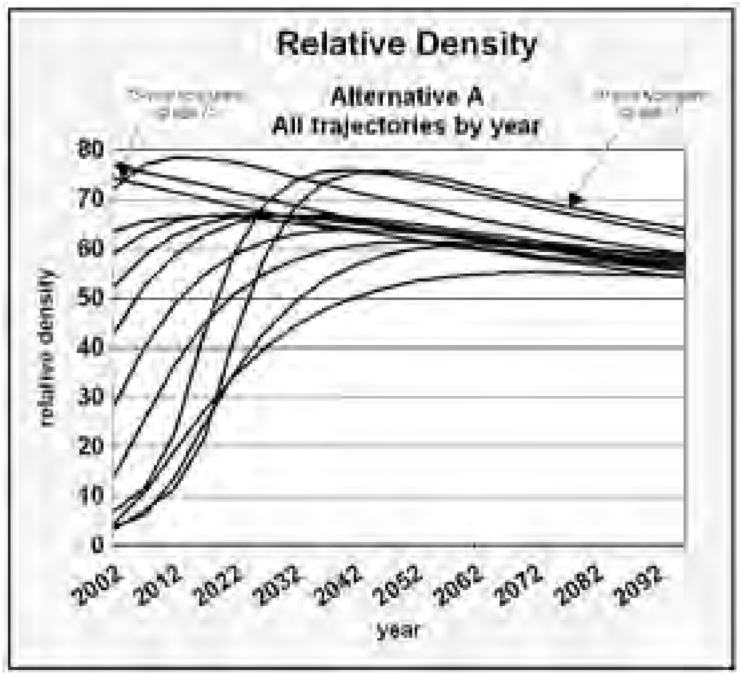
Graph 3.

In the action alternatives, there are often multiple trajectories for each type stand because there are varied treatments. For example, in Alternative F, there are eight trajectories for the 10-year type stand: the untreated stands and seven different treatments. Graph 4 shows the relative density of the eight trajectories of the 10-year type stand in Alternative F.



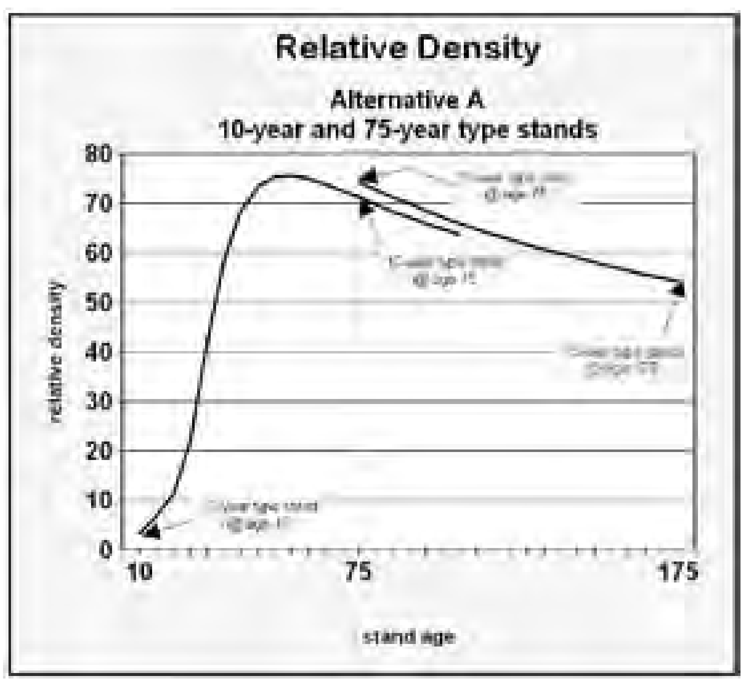
Graph 4.

Presenting data by the year, as shown in Graph 5, would make it difficult to compare the stand characteristics of trajectories at the same type stand.



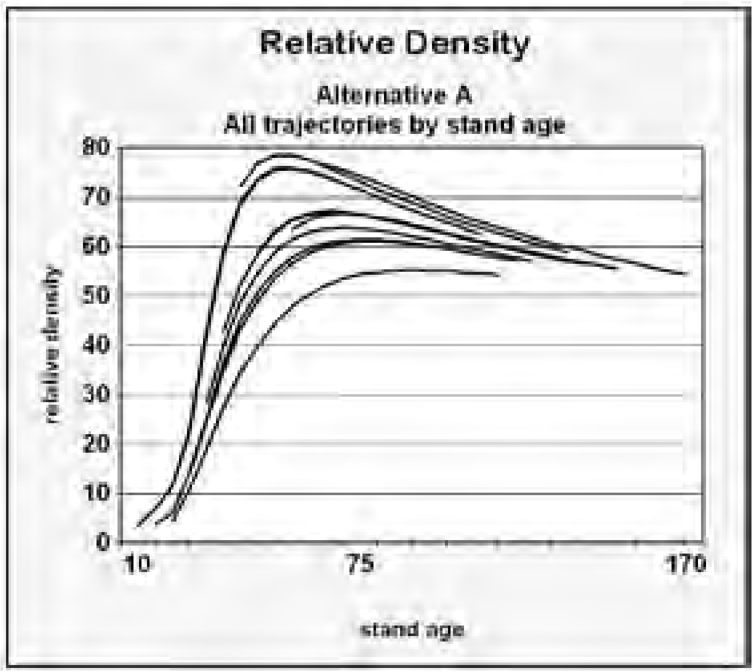
Graph 5.

If we present the data by stand age instead of year, it is easier to compare the characteristics of different trajectories. Treatment trajectories for the various type stands begin and end at different points along the x-axis of the graph. For example, Graph 6 shows the relative densities of the 10-year and 75-year old untreated type stands. The analysis tracks the 10-year old type stand from age 10 to age 110, and the 75-year old type stand from age 75 to age 175.



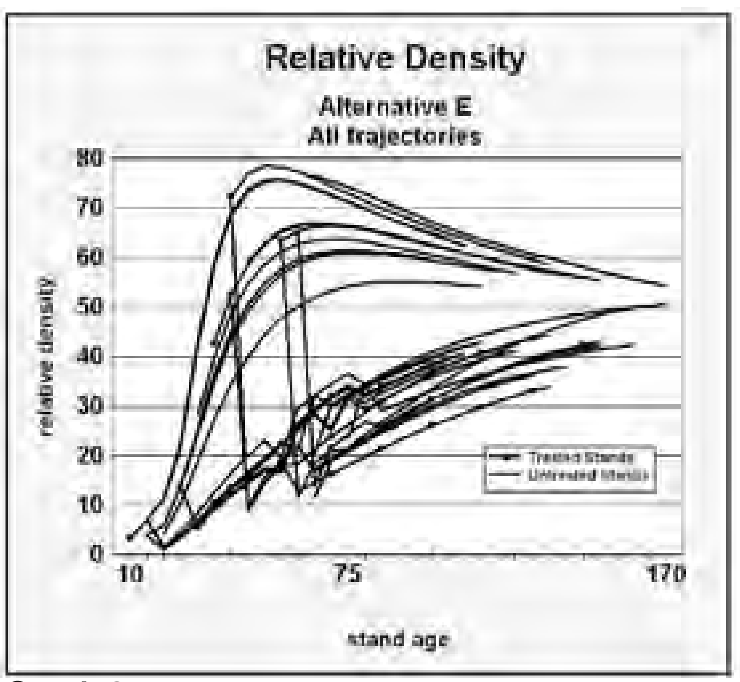
Graph 6.

When all the trajectories for a characteristic are portrayed, many of the graphs become complex. We present these graphs to depict the overall pattern of the suite of stand trajectories for each alternative over time, and do not intend these graphs to convey specific data values for specific trajectories. For example, Graph 7 shows the relative density of all trajectories in Alternative A. The usefulness of this graph is that is shows that all trajectories develop a similar pattern over time.



Graph 7.

In contrast, Graph 8 shows that treated and untreated stands develop very different patterns of relative density under Alternative E.



Graph 8.

ISSUE 5: *What are the effects of restoration activities on marbled murrelet habitat?*

- *Acres of suitable nesting habitat*
- *Acres of target habitat conditions*

Suitable Nesting Habitat

The FWS (1996) has described stands in which marbled murrelets have been found to nest include at a minimum the following criteria:

- at least one tree per acre ≥32”dbh with a branch at least 5” diameter.

Branches of 5” diameter represent a minimum for marbled murrelet nesting, and larger branches increase the likelihood of successful nesting, particularly between 5” and 10”. Every additional inch of branch diameter lessens the chance of the murrelet egg rolling off the branch.

We assume in this analysis that eventual branch size is a result of the overall lifespan of the branch. We used tree crown ratios and height growth from the LMS model to calculate an expected branch life. We assumed tree height growth to be linear over the 100-year analysis period, and branch growth at a constant growth rate of 0.05”/year (radial). These assumptions probably slightly underestimate branch growth in low density stands and overestimate branch growth in high density stands (Kintop, unpublished). Branch size estimates should be used only for demonstrating the comparative outcomes of the alternatives. Absolute values should be interpreted with caution, given the simplifying assumptions needed for analysis.

Target Habitat Conditions

We developed a description of target habitat condition as part of this analysis to describe good quality nesting habitat, rather than the minimum conditions of suitable nesting habitat. The descriptions of stands containing marbled murrelet nests presented in Hamer and Nelson 1995 substantially, but not completely, parallel the criteria we used in this analysis for late-successional forest structure: marbled murrelets prefer to nest in stands that have large trees with large branches, multiple canopy layers, and moderate canopy closure. Therefore, we consider target habitat conditions for marbled murrelets as those stands meeting all three of the following criteria:

- density of large Douglas-fir (>32” dbh) >1.0/acre
- density of shade-tolerant conifers (>10” dbh) >5.0/acre
- Coefficient of Variation (CV) of Douglas-fir diameters (>10” dbh) >0.37

ISSUE 6: *What are the effects of restoration activities on northern spotted owl habitat?*

- *Acres of dispersal habitat*
- *Acres of suitable habitat*
- *Acres of target habitat conditions*

In this analysis, we evaluate dispersal habitat, suitable habitat, and target habitat conditions. Dispersal and suitable habitat are customarily evaluated in consultations with the FWS. We developed a description of target habitat conditions as part of this analysis to describe good quality habitat, rather than the minimum conditions of suitable habitat.

Dispersal Habitat

The FWS defines dispersal habitat as habitat which supports the life needs of an individual animal during dispersal (USDA and USDI February 1994, Appendix G, p. 16), but dispersal habitat does not necessarily provide nesting and foraging habitat for a self-sustaining owl population. We consider stands as dispersal habitat if they meet both of these criteria:

- stands with ≥11” average dbh
- stands with ≥40% canopy closure.

These criteria match those described repeatedly in referenced sources (USDA and USDI February 1994, Appendix G, p. 16; USDI Fish and Wildlife Service 1992b, p. 121; Thomas et al. 1990, p. 310). Dispersal habitat generally develops at about age 40 in stands in the planning area.

Suitable Habitat

Suitable habitat provides at least minimum conditions for nesting, roosting, and foraging habitat. We consider stands as suitable habitat if they are >80 years old or meet the following three criteria:

- ≥1 tree per acre ≥38”dbh (nesting)
- ≥40% canopy closure (roosting)
- ≥8 sq. ft. basal area of shade-tolerant conifers, as a measure of canopy layering (foraging)

We defined these criteria in part based on minimum values from Thrailkill et al. 1998, which reported on the demography and habitat associations of spotted owls inhabiting LSR 267 for 1990-1995. We based the threshold value of shade-tolerant conifer basal area on empirical measurements of existing stands in the planning area that are considered foraging habitat.

Target Habitat Conditions

Target habitat conditions for spotted owls parallel the descriptions of late-successional forest structure. Thrailkill et al. 1998 found that spotted owls preferred stands with a high amount of structural heterogeneity, including a broad range of tree diameters, large trees in the overstory, a high density of shade-tolerant conifers and hardwoods, intermediate levels of canopy closure, and canopy layering. Therefore, we use the definition of late-successional structure for target habitat conditions (see Issue 4).

ISSUE 7: *What are the effects of restoration activities on coho salmon habitat?*

- *In-stream structure: miles of stream with stable structures by stream order groups (1-2, 3-5)*

- *Acres of riparian area (<100' from stream) that contain sufficient large conifers to provide large woody debris to streams*
- *Water quality: cubic yards/year of chronic and episodic sedimentation*
- *Miles additional habitat made available by removal of barriers*

In-stream Structure

In this analysis, we measure stream complexity by the miles of stream with stable structures that would be created. The analysis considers in-stream structures stable if they are cabled or include >16 logs/mile that are >24" diameter (see Figure 12). We assume that a 50-year flood would remove uncabled logs ≤24" diameter in 3rd-order streams and larger, based on observations of the effect of the 1996 floods in the Siuslaw River Basin. We assume that logs would not be removed by a 50-year flood in smaller streams.

Riparian Stands

We developed the target number of large conifers in the riparian area (<100' from streams) from the quantity of large woody debris in the Oregon Department of Fish and Wildlife (ODFW) Riparian Habitat Benchmarks (Thom et al. 2000).

- ≥13 conifer trees/acre ≥24" dbh
- ≥13 conifer trees/acre ≥32" dbh

We developed these criteria from the ODFW benchmark for "key pieces" of large woody debris in the streams, not from the benchmark for desirable densities of large conifers in the riparian area. The ODFW benchmark for density of large conifers in the riparian area is so high as to raise questions of its reliability: none of the local late-successional stands exhibit such high density of large trees (see Appendix C). Regardless, that benchmark is useless in comparing alternatives in this analysis, because no stand develops such densities under any alternative in the 100-year analysis period. Instead, we measure when the riparian area can provide a sufficient source to meet the benchmark for key pieces (≥24" dbh) of large woody debris. Given that trees =24" dbh represent a minimum size for key pieces, we also measure when the riparian area can provide a source of larger pieces (≥32" dbh) that would provide greater stability to in-stream structure. We measure the time when the riparian stand would have twice the number of trees of the target size to ensure that no more than half of the largest cohort would needed for large woody debris to reach the riparian habitat benchmark.

Figure 12. *Large logs are needed to provide stable structures in streams.*

In this analysis, we do not address the effect of converting hardwood-dominated riparian areas to conifers. The Siuslaw Watershed Analysis and LSR Assessment discuss the use of silviculture in converting hardwood-dominated riparian areas to conifers to provide a better supply of large woody debris to streams and thereby improve fish habitat (Watershed Analysis, pp. IV-1; V-1; USDA and USDI 1997, p. 45). However, the planning area has such a small amount of hardwood-dominated riparian areas (approximately 1% of the planning area) that there would be no measurable effect on coho salmon habitat from the different approaches in the alternatives.

Sedimentation

Sources of fine sediment delivery to the stream system include chronic delivery from existing road surface erosion, episodic delivery from landslides resulting from culvert failures during storm events, and temporary pulses of sediment from culvert replacement or removal, in-stream restoration projects, and new road construction.

In this analysis, we assume that application of best management practices would eliminate the potential for sedimentation to streams from yarding of timber, which is consistent with the findings of the watershed analysis (USDI BLM 1996a, pp. II-7 - II-8).

We also assume that hauling of timber from the thinning proposed in some of the alternatives is unlikely to result in significant sedimentation. There is little potential for significant sedimentation from timber hauling in the planning area because many mainline haul routes adjacent to streams are paved, including the Siuslaw County Road, Oxbow Creek Road, Buck Creek Road, and Doe Creek Road. Outside of the planning area, major access roads are also paved, including Lorane Highway and Wolf Creek Road. Additionally, much of the timber hauling would occur during the summer, because many thinning operations would be seasonally limited by temporary roads, which would further reduce the potential for cumulative sedimentation to streams.

The absolute values in the analysis of sedimentation should be interpreted with caution for a variety of reasons. Although the road data collected in the 2002 road inventory is of high quality, the sediment model simplifies a complex road system and lacks erosion factors from the planning area. The estimates of sediment yield from other sources are approximate and rely on coarse averages. However, any estimation errors would be uniformly applied across the alternatives. The primary value of this analysis is in demonstrating the relative contribution of the various sediment sources. Appendix D provides additional explanation of the sedimentation analysis assumptions and methodology.

Road erosion: We estimate sediment delivery from existing road surface erosion based on field observations in 2002 road inventory and the Washington Standard Methodology for Conducting Watershed Analysis (Washington Forest Practices Board 1995). Because factors used in the Washington methodology were based on a combination of studies performed in the Idaho Batholith area and elsewhere, we made one deviation to the traffic factor to more accurately reflect the lithology of the planning area. We calibrated the calculations in this analysis to data from unpublished research performed in southwestern Washington, which is expected to more accurately reflect sediment yields in the planning area (Sullivan and Duncan 1980).

Culvert failure: The 2002 road inventory identified 73 culverts that are currently at risk of failure. In this analysis, we assume that these culverts would fail within the 100-year analysis period if not replaced or removed. We calculated the amount of sediment that would be delivered from these culverts if they fail based on estimated average values for the depth of fill, the active channel width, and the road prism width. This estimate does not include mass wasting from debris flows or any other catastrophic road drainage problem.

Culvert replacement: Replacement or removal of culverts would cause a temporary pulse of sediment, but few studies have quantified this sediment delivery. Monitoring results from the Lolo National Forest, Montana, indicate that between 1 to 2 cubic yards were introduced into the stream during and after culvert removal (Lolo, 2000). However, empirical observations in the planning area indicate that little sedimentation has been observed during culvert replacement or removal (N. Armantrout, L. Poole, S. Steiner, C. Vostal, personal communication, 2002). Best management practices, such as dewatering, straw bales, and numerous bio-engineering techniques, appear to reduce sediment production substantially. Therefore, we estimate that 1 cubic yard would be delivered to the stream channel during each culvert replacement or removal. We assume that culverts would be replaced or removed at an even pace over the ten-year plan period.

In-stream projects: During in-stream restoration projects, channel bank and bed disturbances can lead to sedimentation, but no studies have quantified this sediment delivery. Based on empirical observations of past in-stream projects in the planning area, we estimate that 0.25 cubic yards of sediment would be created per restoration site (N. Armantrout, L. Poole, S. Steiner, C. Vostal, personal communication, 2002). We assume that in-stream restoration projects would occur at an even pace over the ten-year plan period.

New road construction: In this analysis, we assume that if new road construction would cross streams, it would contribute sediment to the stream system. We estimate the number of stream crossings required based on the average number required in past timber sales: one stream crossing per 9,500' of new road construction (see Issue 2). Because the stream crossings would be temporary and removed before the onset of winter rains, we estimate that the sediment delivery from stream crossing construction and removal would be approximately the same as produced by culvert replacement: 1 cubic yard/crossing.

Barriers

We determined the effect of the removal of barriers on available fish habitat by field survey of streams above barriers to assess potential habitat conditions.

ISSUE 8: *How would restoration activities affect the presence and spread of noxious weeds?*

- *Miles of new road construction*
- *Miles of road decommissioned*

The Siuslaw Watershed Analysis and the LSR Assessment highlight the importance of roads as the primary vector for the spread of noxious weeds in the planning area (USDI BLM 1996a, p. II-40; USDA and USDI 1997, p. 28). The LSR Assessment explained that forest establishment and growth reduces or eliminates populations of most of the weeds of concern in the planning area. Thus, differences among the alternatives on effects to noxious weeds are generally reflected by the differences in the net change in road mileage in the planning area.

ISSUE 9: *What would be the economic effects of restoration activities?*

- *Months of contract work created*
- *Dollars (present day) of revenue generated*

In this analysis, we calculated average production rates for the types of restoration treatments outlined under the alternatives based on past experience with similar contracts. We measured the amount of contract work created in months of work, based on 20 work days per month.

We estimate that silvicultural contract work can be completed at a rate ranging from two acres per worker per day in the youngest stands to one acre per worker per day in older stands.

We estimate that a two-person crew can decommission a mile of road in four days, based on past experience with road decommissioning. A wide variety of factors, such as fire restrictions, seasonal restrictions to protect northern spotted owl nesting, number of culverts, amount of fill, and terrain, influence the length of road that could be decommissioned in a single season.

All action alternatives would replace 10 culverts, based on the recommendations of the 2002 road inventory. Given the culvert locations, depth of fill, other environmental characteristics of the sites and culvert design, we estimate that each culvert would take a three-person crew seven days to install.

We estimate that one mile of in-stream structure construction could be completed in 60 days; that a two-person crew could complete one mile of riparian falling in three days; and that a three-person crew could pull over and yard two trees per day.

We calculated revenues generated from the sale of cut trees based on current prices. We reduced the gross revenues by the costs needed to remove the cut trees. We did not discount the costs and revenues to the present because of the uncertainty of actual project dates. We assume a selling price of $320 per thousand board feet (MBF) and typical timber removal levels from 10 - 20 MBF per acre, depending on the stand age and specific thinning prescription. This removal level assumes that approximately three-fourths of the cut trees would be removed and one-fourth would be left as coarse woody debris.

The analysis does not attempt to account for indirect economic benefits resulting from restoration, such as economic benefits associated with increased fish populations, recreation opportunities, or special forests products.

ISSUE 10: *What are the costs of restoration?*

- *Dollars (present day) of contract costs – labor and material*
- *Dollars (present day) of BLM staff cost – project planning, layout, contract administration*

Costs of restoration include actual contract costs (the amount BLM would pay to a contractor to perform specified work) and BLM staff costs (reconnaissance, project planning, field surveys, environmental clearances, unit layout, and contract administration). As stated above, we did not discount costs and revenues to present because of uncertainty in determining actual project dates.

Figure 13. *Contract costs for restoration actions such as culvert replacements were based on past experience with similar contracts.*

We calculated contract costs for non-commercial silvicultural treatments based on current contract prices for similar treatments throughout the district, with adjustments for expected mitigation work or where the required work would be more difficult. These costs would vary from $110 per acre to $200 per acre, depending upon the level of work per acre. In a few circumstances, we estimated costs as high as $500 per acre where extensive handwork for mitigation would be expected. We imbedded contract costs for silvicultural treatments that would include removal of cut trees within the revenues from the sale of cut trees, and the revenues described below are the remainder after those costs were deducted. Costs for removal may be as high as $1,600 per acre.

We calculated BLM staff costs for silvicultural treatments based on past experience with similar contracts. We assume that non-commercial silvicultural projects would be prepared and administered at a rate of 200 to 300 acres per BLM work-month and an average work-month cost of $5,000. For silvicultural treatments in which commercial removal would be anticipated, we assumes the district average preparation and administration cost for FY 2000 through FY 2002 expenditures: $150 of BLM staff costs per MBF of timber removed.

We calculated contract costs for in-stream projects, road decommissioning, and culvert replacements based on current contract prices for similar work throughout the district (see Figure 13). We estimated BLM staff costs for these treatments based on past experience with similar contracts. As with silvicultural treatments, we assume an average BLM work-month cost of $5,000.

Impacts of the Alternatives

The analysis of impacts is organized by alternative, with a discussion of how the alternative would respond to each issue. In the discussion of each issue, we present the direct, indirect, and cumulative effects together. This organization best reflects the interrelated nature of many of the issues, and acknowledges that the distinction between direct, indirect, and cumulative effects is indistinct for many of the issues.

The Council on Environmental Quality (CEQ) regulations require that the analysis of environmental consequences discuss "...any adverse environmental effects which cannot be avoided should the proposal be implemented, the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and any irreversible or irretrievable commitments of resources which would be involved in the proposal should it be implemented." (40 CFR 1502.16). We address these topics below as part of the discussion of the environmental consequences related to each issue.

The CEQ regulations (40 CFR 1502.16) also require a discussion of "possible conflicts between the proposed action and the objectives of Federal, regional, State, and local (and in the case of a reservation, Indian tribe) land use plans, policies and controls for the area concerned." This EIS incorporates by reference the discussion in the RMP EIS and the Northwest Forest Plan Final SEIS concerning conflicts with other plans (USDI BLM 1994, pp. xvii, 4-135 - 4-137; USDA and USDI, February 1994, pp. 3&4-319 and 3&4-320, and Appendix D). Implementing the decisions in the RMP regarding LSR and Riparian Reserve management, as proposed in all action alternatives of this EIS, would not alter the conclusions of the RMP EIS regarding the possible conflicts with other plans. The management direction in this EIS applies only to BLM-administered lands where state and local land use plans, policies, and controls have little application, and has no application to tribal and Indian-owned lands.

ALTERNATIVE A

No Action

Alternative A would take no management actions except those specifically required by the RMP, or by law or policy.

ISSUE 1: *How would road decommissioning and road management actions alter public access to BLM-managed lands?*

Under Alternative A, there would be no large-scale or long-term program of road decommissioning on BLM-managed land within the planning area. The only anticipated road closures would be in response to natural events, such as fire or landslides, that would require a road to be closed to protect public safety.

There are currently 12 miles of road that are "passively" decommissioning; that is, because of lack of regular maintenance, the roads are becoming impassable over time (see Chapter 3). It is reasonably foreseeable that a small number of additional roads would passively decommission, continuing the current trend.

Public access to private timber lands would likely continue to decrease under all alternatives (see Chapter 3).

Key Points

- Public access to BLM-managed lands would not change because roads would not be closed or decommissioned.

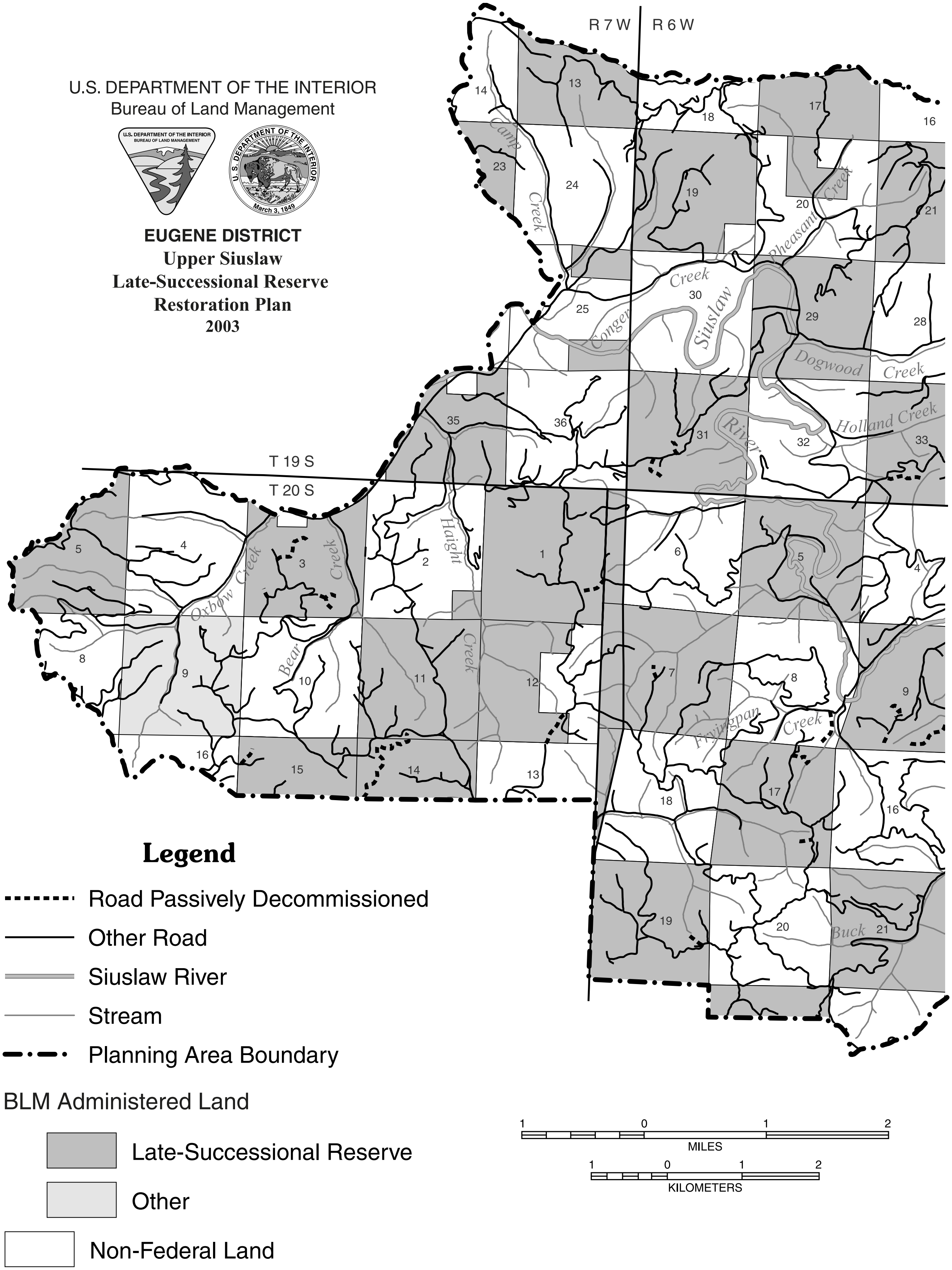
ISSUE 2: *How much new road construction would be needed to implement restoration actions?*

Under Alternative A, no new road construction would occur on BLM-managed land in support of restoration. It is not reasonably foreseeable that BLM would be constructing roads for other management purposes, except in response to catastrophic events, such as extensive fire or windthrow.

Some new road would likely be constructed by private timber companies across BLM-managed land to access private land, but the amount of future new road construction is unknown. In the past three years, less than one mile of new road has been constructed on BLM-managed land in the planning area in response to private timber company requests. Therefore, it is reasonably foreseeable that actions taken by private timber companies would result in less than a half-mile of new road construction per year in the planning area.

Key Points

- No new roads would be constructed.


U.S. DEPARTMENT OF THE INTERIOR
Bureau of Land Management
EUGENE DISTRICT
Upper Siuslaw
Late-Successional Reserve
Restoration Plan
2003
R 7 W
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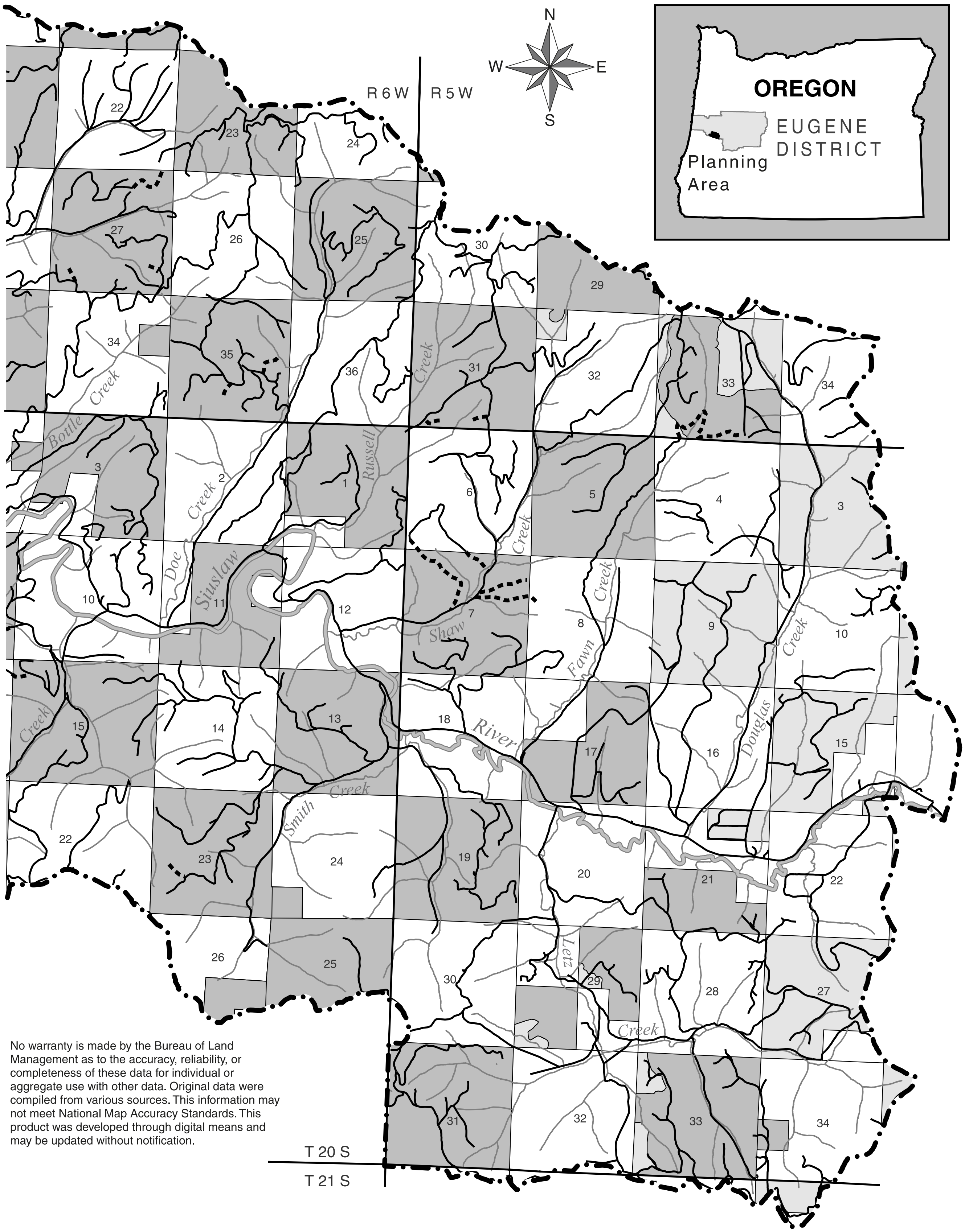
T 19 S
T 20 S
Camp Creek
Conger Creek
Siuslaw River
Pheasant Creek
Dogwood Creek
Holland Creek
Oxbow Creek
Haight Creek
Bear Creek
Fryingpan Creek
Buck
Legend
Road Passively Decommissioned
Other Road
Siuslaw River
Stream
Planning Area Boundary
BLM Administered Land
Late-Successional Reserve
Other
Non-Federal Land
MILES
KILOMETERS

Map 1: Alternative A - Road Decommissioning



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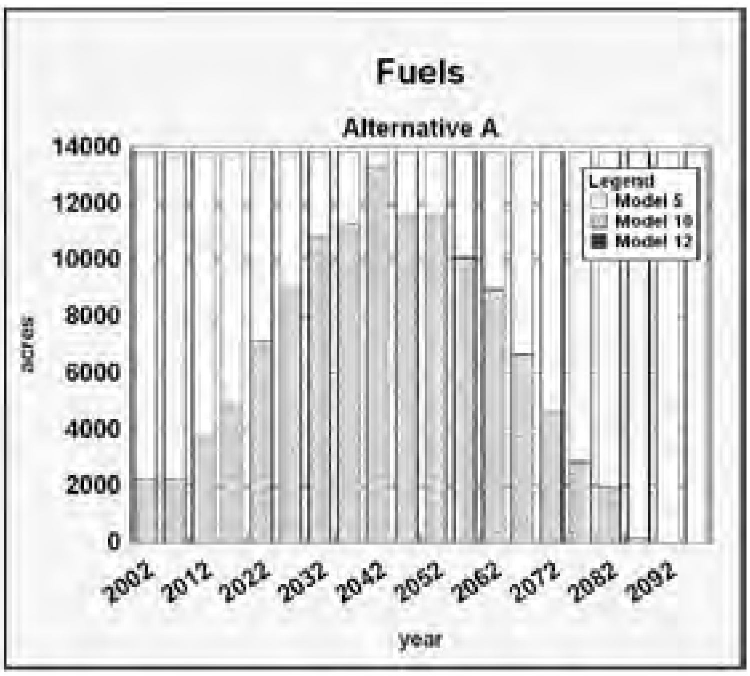
ISSUE 3: *What level of risk to existing late-successional forest would result from restoration activities?*

Fire: In the absence of active stand management, the portion of the landscape in Fuel Model 10 would increase dramatically and persistently (see Graph 9). For about 40 years, the majority of stands currently ≤80 years old would be in Fuel Model 10, which would present a substantial and long-lasting risk of severe fire. Fires in Fuel Model 10 would likely be hot and severe and have a high potential for crowning and burning out of control. Maintaining such a large portion of the landscape in this fuel model for such a long period of time would pose a high risk of catastrophic fire that would damage existing late-successional forests and slow development of late-successional forest structure in stands currently ≤80 years old.



Graph 9

Bark Beetles: At the individual stand scale, there would be no increased risk of Douglas-fir bark beetle damage under Alternative A. Within the stands currently ≤80 years old, there would be minimal or low levels of tree mortality caused by bark beetles, because no coarse woody debris would be created by active management. In the absence of active stand management, stands currently ≤80 years old would develop at high densities (see Issue 4). Tree mortality would be gradual and largely limited to the smaller trees in the stand and therefore would not contribute to an increase in the bark beetle population.

At the landscape scale, bark beetle populations would continue to respond to natural disturbances caused by wind or fire. Bark beetles would maintain their low population levels in trees stressed by root disease and windthrown or broken trees, with small, temporary population increases after severe wind events. In the absence of large, natural disturbances, the number of trees killed by bark beetles would remain quite low in the planning area, and bark beetles would not pose a high risk to existing late-successional forests. If a natural disturbance, such as a severe windstorm, occurs within the planning area, especially in older stands, some of the remaining large trees within those stands would likely be killed by bark beetles.

Key Points

- The majority of young stands would present a substantial and long-lasting risk of severe fire.
- Bark beetle populations would remain low and would not pose a high risk to existing late-successional forests.

ISSUE 4: *How would thinning affect development of late-successional forest structural characteristics?*

Under Alternative A, BLM would conduct no active stand management. All stands currently ≤80 years old would continue on their existing developmental pathway, which has been set by the past silvicultural regimen.

No stands currently ≤80 years old would meet the criteria for late-successional forest structure within the 100-year analysis period (Graph 38). Although some stands would eventually develop Douglas-fir trees >40" dbh, none of the stands would develop sufficient shade-tolerant conifers or an adequate range of tree diameters. High stand densities would also slow the development of very large Douglas-fir trees compared to all of the action alternatives. Snags and woody debris would originate mostly from small-diameter trees as a result of density-dependent mortality.

Even though stands currently ≤80 years old in the planning area are at different ages and developmental conditions (see Figures 14 and 15), nearly all would converge towards a single developmental pathway in the absence of disturbance such as windstorm or fire (see Figure 16). All of these stands would still be very dense in 100 years.

Figure 14. *Under Alternative A, this 10-year-old stand that has not been thinned would develop similar structure in 100 years to the stand in Figure 15*

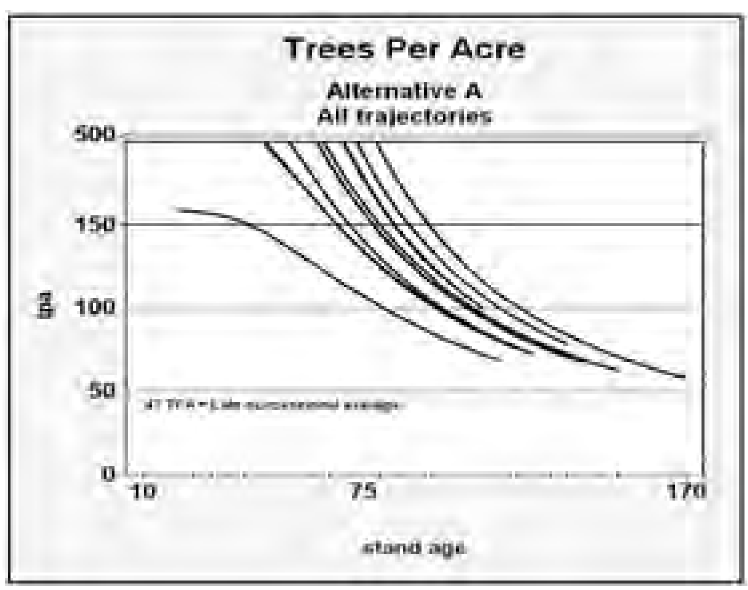
Figure 15. *This 15-year-old stand has been pre-commercially thinned to a wide spacing.*

At the end of the 100-year analysis period, these stands would have 60-100 TPA and high relative densities – from 55 to 65, above the point at which density-dependent mortality occurs (see Graphs 10 and 11). As these stands age, individual tree growth would slow. This stage is described as the "stem exclusion" stage, in which stand density declines, stand mortality increases, and stand differentiation begins (Oliver and Larson 1990).

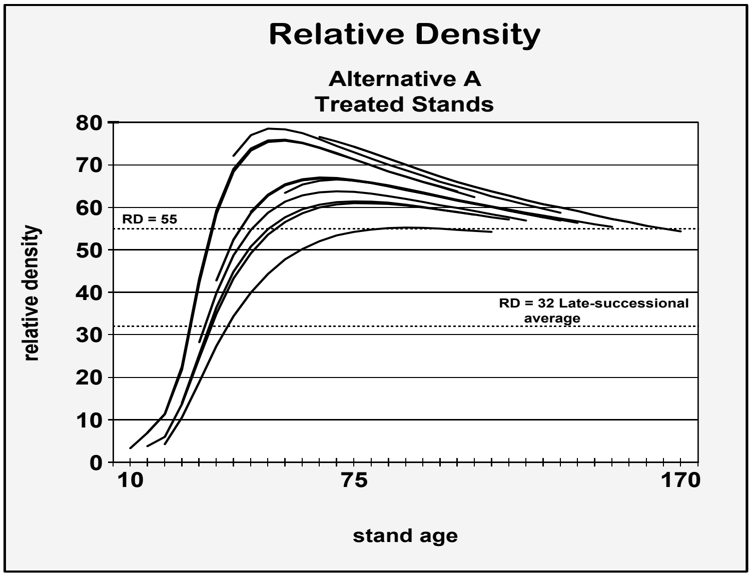
The stands currently ≤80 years old have less variation in structure than natural stands (USDA and USDI 1997, p. 36). If left untreated, these stands would not differentiate as rapidly as natural stands, and would most likely enter an extended period of high density and uniform structure that would extend beyond the 100-year analysis period. This would result in less differential competition between neighboring trees, and relatively little difference in individual tree growth rates. As a result, stands would "stagnate." The entire population of trees would slow in growth, and the average stand diameter would grow less rapidly than natural stands (Smith and Reukema 1986, Tappeiner et al. 1997, Poage 2000, Poage and Tappeiner 2002). For example, Figures 17 and 18 illustrate the development of the 30-year-old type stand, showing its current condition and the high-density uniform structure of the stand at the end of the 100-year analysis period.

Figure 16. *This 45-year-old stand shows the dense, uniform structure that would be typical of stands under Alternative A*

The high density of overstory Douglas-fir would effectively suppress growth of shade-tolerant conifers. The high density would also result in small crowns on the Douglas-fir, as lower branches would die nearly as fast as growth occurs at the tops. Branch size would remain small, as any given branch would have a relatively short lifespan. The slowing of tree diameter growth rates would result in tall trees with relatively small diameters, increasing stand susceptibility to windthrow (Wilson and Oliver 2000). These stands would all develop height:diameter ratios greater than 70, which some studies have found to be unstable for Douglas-fir (Lohmander and Helles 1987; Wilson and Oliver 2000) (see Graph 12). Should a severe windstorm occur, uniform stands of this type would likely react more catastrophically than natural stands (USDA and USDI 1997, Appendix A, p. 4; Wilson and Oliver 2000, pp. 917-918).

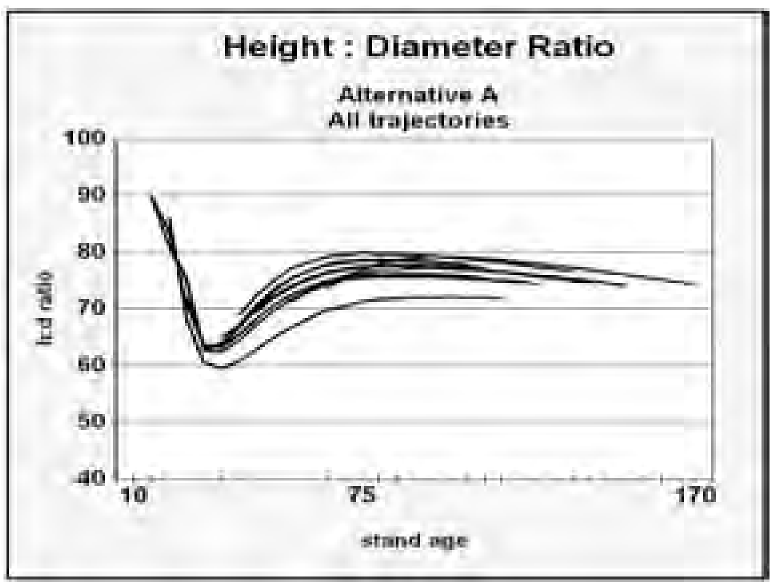


Graph 10



Graph 11.

Following catastrophic disturbance, it is reasonably foreseeable that salvage harvest would occur to reduce risks of fire and insect infestation (USDA and USDI 1994 pp. C-13 - C-16; USDA and USDI 1997, p. 41), and the resultant salvage harvest would effectively start the stand over.



Graph 12

Key Points

- No young stands would develop late-successional structure within the 100-year analysis period.
- Stands would converge to a high-density, uniform condition.
- Stands may be highly unstable if subjected to natural disturbances.

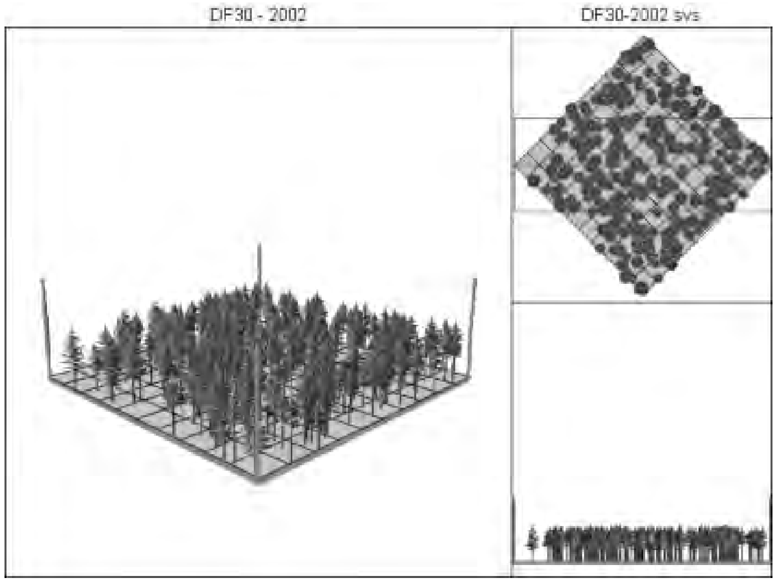


Figure 17. *A 30-year-old stand in 2002.*

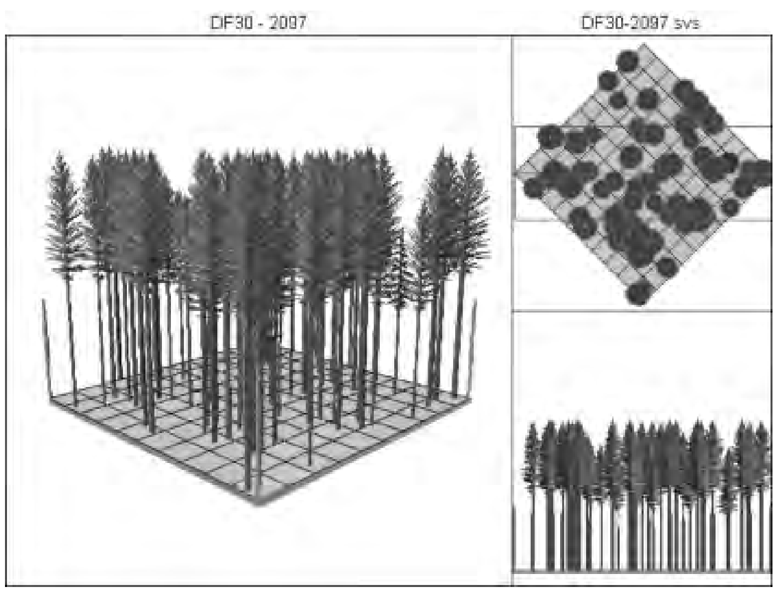


Figure 18. *The same stand as in Figure 17 in 2097 under Alternative A.*

ISSUE 5: *What are the effects of restoration activities on marbled murrelet habitat?*

Under Alternative A, trees would continue growing under dense conditions. In 20 years, 200 acres of stands would develop at least one tree per acre ≥32” dbh, but dense stand conditions would inhibit the growth of the branches and trees would not yet develop at least one branch 5” diameter. In 50 years, 6,500 acres would have at least one tree per acre ≥32” dbh, but only 500 acres would have trees with at least one branch 5” diameter. All stands would have at least one tree per acre ≥32” ” dbh at the end of the 100-year analysis period; 11,850 acres (86%) would also have at least one branch 5” diameter on at least one tree per acre and therefore be considered suitable marbled murrelet nesting habitat (see Graph 41).

Under Alternative A, no stands currently ≤80 years old would achieve target habitat conditions within the 100-year analysis period.

Key Points

- High stand density would slow the development of suitable nesting habitat.
- No young stands would achieve target habitat conditions within 100 years.

ISSUE 6: *What are the effects of restoration activities on northern spotted owl habitat?*

Because no federal actions would be taken, Alternative A would not affect existing spotted owl critical habitat. However, the portions of critical habitat that are currently ≤80 years old would not become suitable habitat during the 100-year analysis period.

Currently, 3,728 acres (27%) of stands ≤80 years old provide dispersal habitat. Under Alternative A, all stands would meet the criteria for dispersal habitat in 35 years (see Graph 39).

No stands currently ≤80 years old would become suitable habitat within the 100-year analysis period. The high density of the stands would prevent the development of a second canopy layer, and therefore the stands would not develop adequate foraging habitat for owls.

No stands currently ≤80 years old would achieve target habitat conditions within the 100-year analysis period.

Key Points

- All young stands would develop into dispersal habitat within 35 years.
- No young stands would develop into suitable habitat within 100 years.
- No young stands would achieve target habitat conditions within 100 years.

Figure 19. *Many streams would remain deficient in large woody debris under Alternative A.*

ISSUE 7: *What are the effects of restoration activities on coho salmon habitat?*

Under Alternative A, BLM would take no actions to increase stream structure, replace or remove barrier culverts, or restore riparian areas for the benefit of coho salmon and other aquatic resources. Roads that degrade water quality and introduce unwanted sediments into streams would not be decommissioned.

In-stream structure: Many streams would remain deficient in large woody debris (see Figure 19). Improvement in degraded fish habitat would occur only when riparian stands grow large conifer trees, and those large trees die and fall into the stream. Long-term stability of in-stream large woody debris would improve water quality by reducing erosional stream velocities, trapping sediments and replenishing groundwater reservoirs that are vital for water storage, water purification, and temperature regulation.

Riparian stands: In approximately 70 years, all riparian areas would develop sufficient densities of trees ≥24" dbh to provide key pieces of large woody debris. This rate is similar to that under the action alternatives. At the end of the 100-year analysis period, approximately 2,500 acres out of 3,400 acres in riparian areas would develop sufficient densities of trees ≥32" dbh to provide more stable key pieces of large woody debris. Alternative A is the slowest of all alternatives to develop sufficient density of these larger trees.

Sedimentation: Road segments that are currently delivering fine sediment to streams would remain in their current condition. These road segments would cause chronic sediment production of approximately 108.0 cubic yards of sediment/year if they continue to be used, and sediment inputs to streams could exceed 10% of background stream turbidity levels.

Many culverts at risk of failure would not be identified and replaced in the absence of road decommissioning. Sedimentation from approximately 30 "total or partial" barrier culverts on BLM-controlled roads would continue and cumulatively may exceed 10% of background stream turbidity levels. The 73 "high-risk"culverts identified in the 2002

Figure 20. *Under Alternative A, barrier culverts would continue to block access to potential fish habitat.*

road inventory would continue to pose a high risk for road failure. Road-related landslides could escalate because of a lack of road maintenance and culvert replacement. Sediment delivery from landslides would produce larger quantities of sediment than the chronic production from low-use forest roads and would exceed 10% of background stream turbidity levels.

There would be no sedimentation directly caused by restoration actions, such as culvert replacement, road decommissioning, and in-stream structures.

Barriers: Under Alternative A, barrier culverts would continue to prevent access to otherwise suitable habitat for coho salmon and other species (see Figure 20).

Key Points

- No stable in-stream structure would be created.
- 72% of young riparian forests would develop sufficient density of very large (≥32” dbh) conifers in 100 years.
- Chronic road-related sedimentation would continue at 108.0 cubic yards/year.
- Barrier culverts would continue to block fish habitat.

ISSUE 8: *How would restoration activities affect the presence and spread of noxious weeds?*

Alternative A would involve no disturbance to soils and existing vegetation from restoration activities and no new road construction. Therefore, there would be little potential for the introduction, establishment, and spread of noxious weeds. The dense stands retained under Alternative A would reduce the light reaching the forest floor, limiting the growth of existing noxious weeds. However, existing seed banks of some noxious weeds, such as Scotch broom, would persist in the soil for decades.

Existing primary roads, especially heavily traveled routes, would continue to be maintained, and therefore continue to provide pathways for the spread of noxious weeds. As a result of limited road maintenance and road use, existing secondary roads would gradually become more shaded as adjacent trees encroach the roadway. This would reduce noxious weed infestations and reduce the potential for roads to act as pathways for the spread of weeds.

As in all alternatives, continued implementation of an integrated noxious weed control program, coupled with continued monitoring and adaptive management, would contribute to a further reduction in noxious weed infestations in the planning area.

KEY POINTS

- There would be no additional noxious weed establishment.
- Tree growth would reduce existing noxious weed infestations.

ISSUE 9: *What would be the economic effects of restoration activities?*

KEY POINTS

- There would be no economic benefits derived as a result of restoration.

ISSUE 10: *What are the costs of restoration?*

KEY POINTS

- There would be no costs incurred as a result of restoration.

ALTERNATIVE B

Plantation and Road Management with No Timber Harvest

Alternative B is designed to accomplish restoration without timber removal. It would thin Douglas-fir plantations, but would leave untreated all unmanaged stands and stands >50 years old. No trees would be intentionally felled or pulled into streams, and no in-stream structures would be constructed. All roads would be decommissioned where legally possible. No new roads would be constructed.

ISSUE 1: *How would road decommissioning and road management actions alter public access to BLM-managed lands?*

Under Alternative B, approximately 79 miles of road would be decommissioned (47% of the total 169 miles of road on BLM-managed land in the planning area), which would reduce road density from the current density of 4.4 miles of road per square mile to approximately 2.3 miles of road per square mile (see Figure 21). An additional 12 miles of road are "passively" decommissioning (See Chapter 3). Roads that would be decommissioned under this alternative are shown on Map 2.

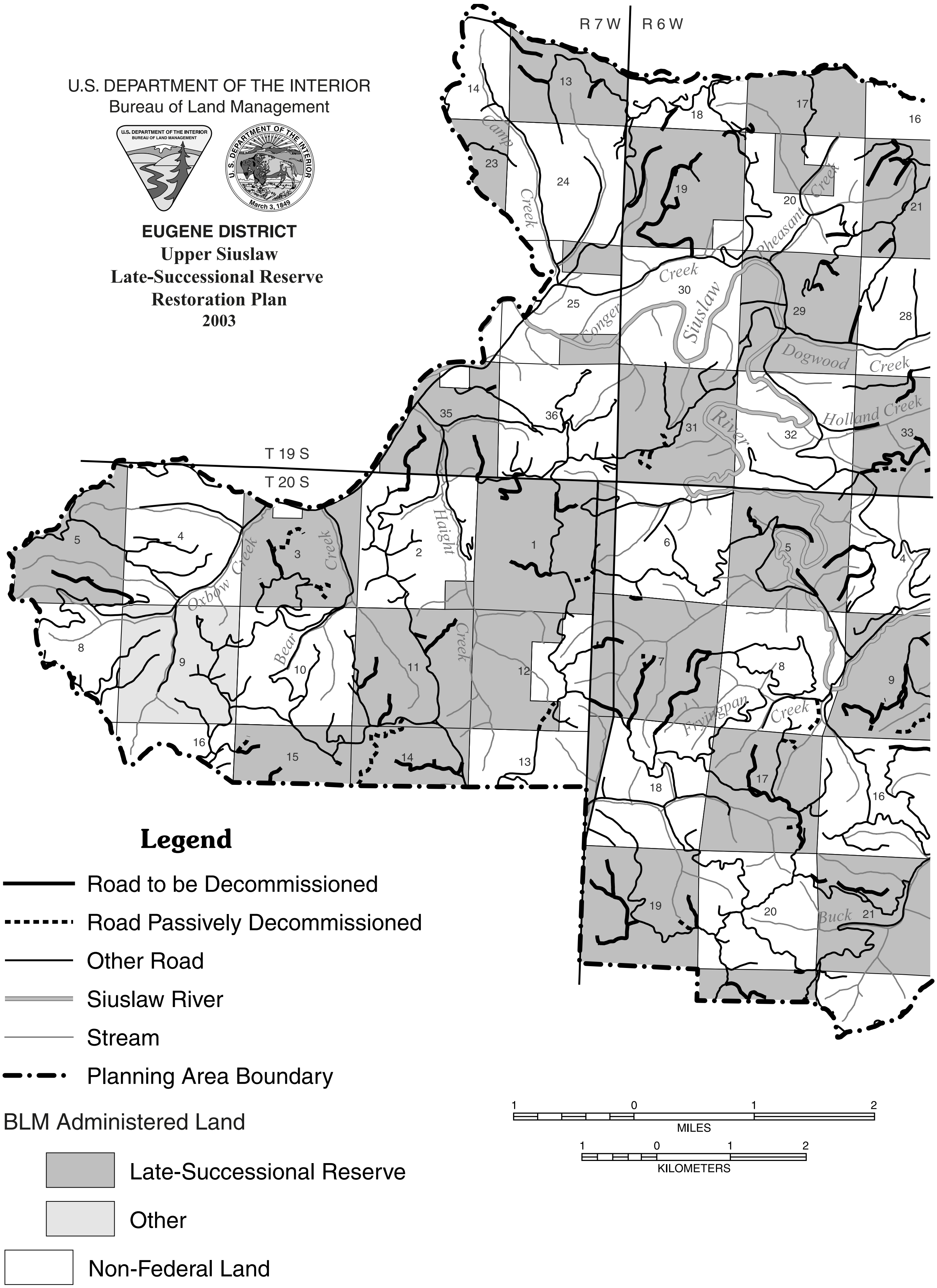
Approximately 25 miles of legal public access roads would be decommissioned (33% of the total 75 miles of legal public access roads). The public would be able to enter the public land in question, but that part of the road lying on public land would be decommissioned and would not be accessible by motor vehicle.

Under Alternative B, 54 miles of "other" roads would also be decommissioned. ("Other" roads would require crossing private land for which BLM has not obtained a legal easement).

Figure 21. *Alternative B would decommission 79 miles of road: more than any other alternative.*

Key Points

- 79 miles (47%) of road on BLM-administered land would be decommissioned.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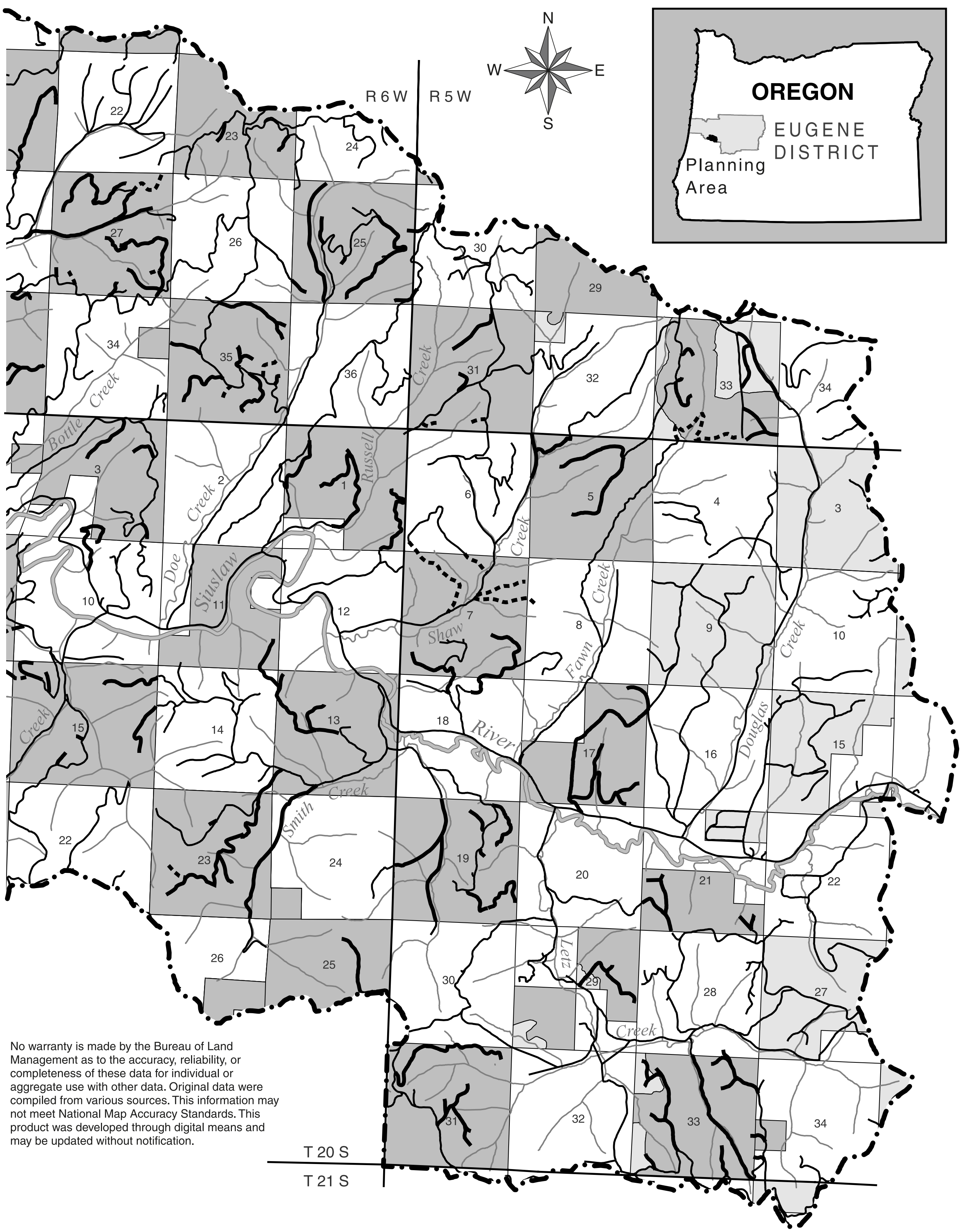
Upper Siuslaw
Late-Successional Reserve
Restoration Plan
2003
R 7 W
R 6 W
T 19 S
T 20 S
Camp Creek
Pheasant Creek
Conger Creek
Siuslaw River
Dogwood Creek
Holland Creek
Oxbow Creek
Haight Creek
Bear Creek
Fryingpan Creek
Buck
Legend
Road to be Decommissioned
Road Passively Decommissioned
Other Road
Siuslaw River
Stream
Planning Area Boundary
BLM Administered Land
Late-Successional Reserve
Other
Non-Federal Land
MILES
KILOMETERS

Map 2: Alternative B - Road Decommissioning



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ISSUE 2: *How much new road construction would be needed to implement restoration actions?*

Under Alternative B, no new roads would be constructed to support restoration. The full extent of restoration activities in Alternative B would occur in areas that can be treated without constructing new roads. Areas farthest from access roads would remain untreated.

Because 79 miles of road would be decommissioned, and no new roads would be constructed, Alternative B would result in a cumulative reduction in roads and road density in the planning area. The ratio of roads decommissioned : roads constructed (79: 0) is the highest among the alternatives.

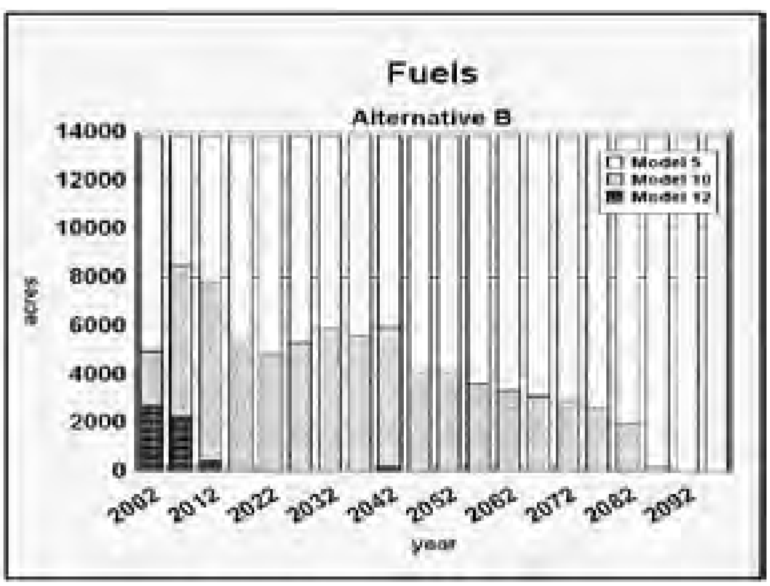
Key Points

- No roads would be constructed.

ISSUE 3: *What level of risk to existing late-successional forest would result from restoration activities?*

Fire: Because all cut trees would be left in the stands, thinning in Alternative B would immediately create a substantial acreage (2,700 acres) in Fuel Model 12 (see Graph 13). These acres would quickly move into Fuel Models 5 and 10 over a 15-year span as the slash decomposes. Thinning would also reduce the acres in Fuel Model 10 and dramatically shorten the time before these acres move back into Fuel Model 5. Thinning presents a trade-off of a short duration of Fuel Model 12 replacing a long duration in Model 10. Mitigation measures incorporated into the design of Alternative B (see Appendix A) would be effective in reducing the fire risk to an acceptable level.

Bark Beetles: At the individual stand scale, there would be some increased risk of bark beetle damage under Alternative B, because large quantities of coarse woody debris would be created by stand management. On approximately 11,300 acres of stands currently 80 years old, the effects of Alternative B on bark beetles would be similar to Alternative A, because stands would either remain untreated, or the residual live trees would be unlikely to experience mortality from bark beetle infestation. However, the remaining 2,500 acres of stands would experience tree mortality, with a total of approximately 5,000-9,900 trees killed by bark beetles.



Graph 13.

This relatively low intensity of mortality (approximately 2-4 TPA) would have little effect on stand structure , but would contribute to snag and coarse woody debris levels. Some additional bark beetle mortality would occur following future coarse woody debris creation that would occur in 10 to 20-year intervals under Alternative B, but such mortality would likely be minor (approximately 4 TPA) because of the moderate quantities of coarse woody debris created and the small number of acres over which debris would be created in any one year. Furthermore, this effect may be moderated by adaptive management in future coarse woody debris creation efforts: tree mortality caused by bark beetles following one interval of coarse woody debris creation may obviate the need for the next interval of coarse woody debris creation. If a natural disturbance, such as a severe windstorm, were to occur, bark beetles would likely cause additional tree mortality.

At the landscape scale, bark beetle populations would be greater than under Alternative A. There would be an increased risk of bark beetle attack on large trees in late-successional stands near thinned, young stands. However, tree mortality in late-successional stands would likely be patchy and sporadic, rather than widespread, and would be unlikely to lead to habitat degradation. If extensive natural disturbances were to occur within the planning area, especially in older stands, some of the remaining large trees within those stands would likely be killed by bark beetles. In such a case, restoration treatments in Alternative B could have a cumulative effect of increasing tree mortality from bark beetles. However, mitigation measures, such as altering the timing and season of tree felling, or deployment of Douglas-fir beetle anti-aggregation pheromone (Schmitz and Gibson 1996; Oregon Department of Forestry 1999), would likely be effective at averting additional tree mortality.

Key Points

- Thinned stands would move into a low-risk fuel model, resulting in an overall low risk of severe fire.
- Bark beetles would likely cause some individual tree mortality, but would not pose a high risk to existing late-successional forests.

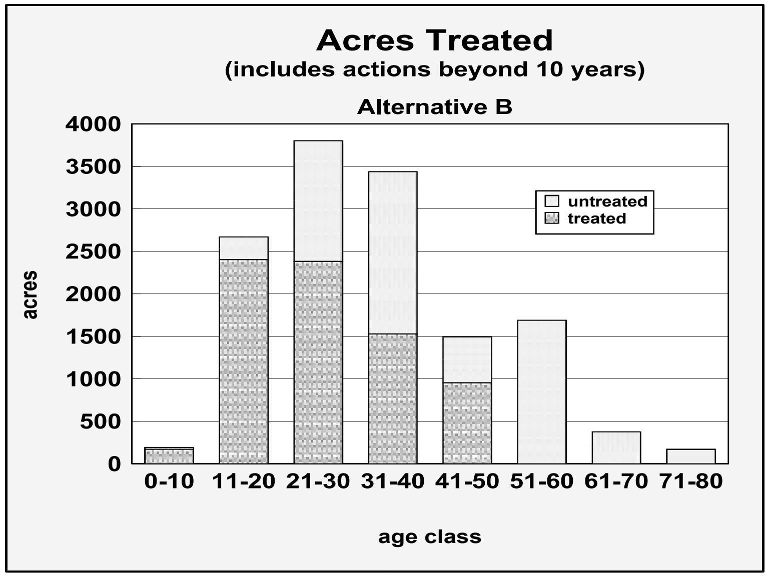
ISSUE 4: *How would thinning affect development of late-successional forest structural characteristics?*

Under Alternative B, approximately 6,400 acres of the 13,800 acres of stands currently 80 years old would receive no treatment and would continue on their existing developmental pathway (see Graph 14). These untreated stands would develop as described under Alternative A.

Within the 100-year analysis period, 2,300 acres of the stands currently 80 years old would develop late-successional structure.

Because Alternative B would not remove any cut trees, thinning prescriptions would be limited to cutting the smaller trees to mitigate fuel loadings and bark beetle impacts. This would temporarily reduce the range of tree diameters. Individual tree growth rates and stand mean diameter would increase. Subsequent coarse woody debris creation may lower stand mean diameter slightly.

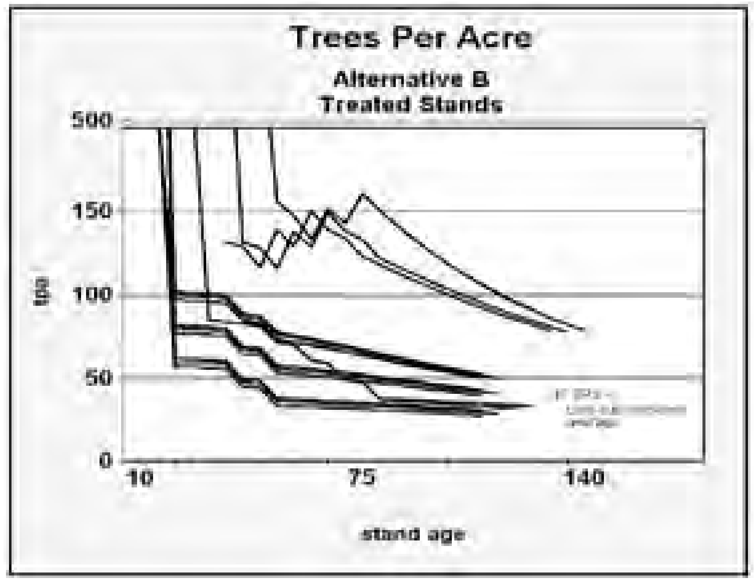
Development of understories of shade-tolerant conifers would be inhibited. In stands <30 years old, the extensive ground covered by cut trees would limit the natural establishment or planting of shade-tolerant conifer seedlings (see Figure 22). In stands 30 years old, the overstory would be too dense, even after thinning, to allow growth of shade-tolerant conifers in the understory. In all of the prescriptions, subsequent treatments would likely cut (or create snags of) 10 TPA at 10 to 20-year intervals beyond the 10-year span of the proposed plan. Shade-tolerant conifers could be planted at the time of future coarse woody debris/snag treatments and would be more likely to establish and grow than those planted after the initial thinning.



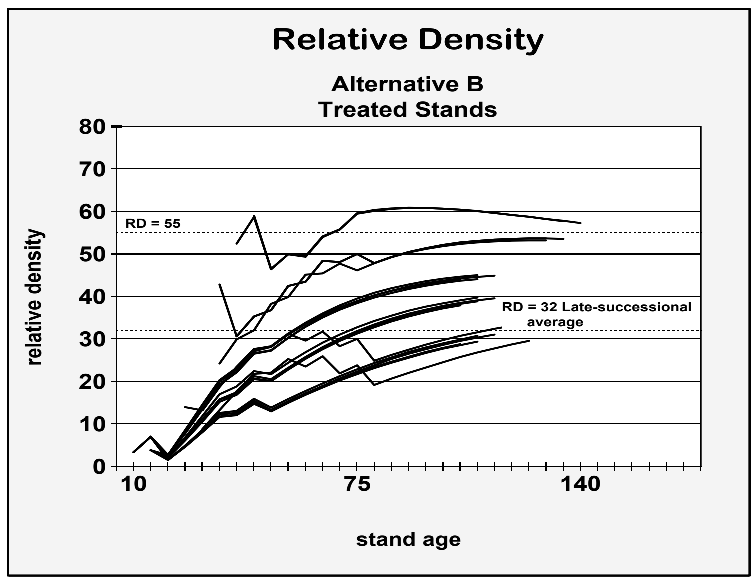
Graph 14.

Figure 22. *Thinning without timber removal in young stands would result in extensive ground coverage by cut trees, which would limit establishment of conifer seedlings.*

Stands <21 years old would be thinned to three levels of residual density: 40-60, 60-80, and 80-110 Douglas-fir TPA. Cut trees would typically be 8"-10" dbh. At the end of the 100-year analysis period, these three thinning prescriptions would place these stands on three distinct pathways, with 30, 40, and 50 TPA, and relative densities of approximately 30, 40, and 45 (see Graphs 15 and 16). Natural establishment of Douglas-fir and shade-tolerant conifer seedlings would occur after thinning and would result in some rebound of stand density. However, natural establishment of seedlings would be limited in some areas by the extensive ground covered by cut trees left after thinning. The cut trees would also generally preclude planting. These stands would develop height:diameter ratios between 55 and 65, which would be stable (Lohmander and Helles 1987; Wilson and Oliver 2000) (see Graph 17). The first coarse woody debris/snag treatments, which would occur in approximately 20-25 years, would typically cut or kill trees 16" -22" dbh.



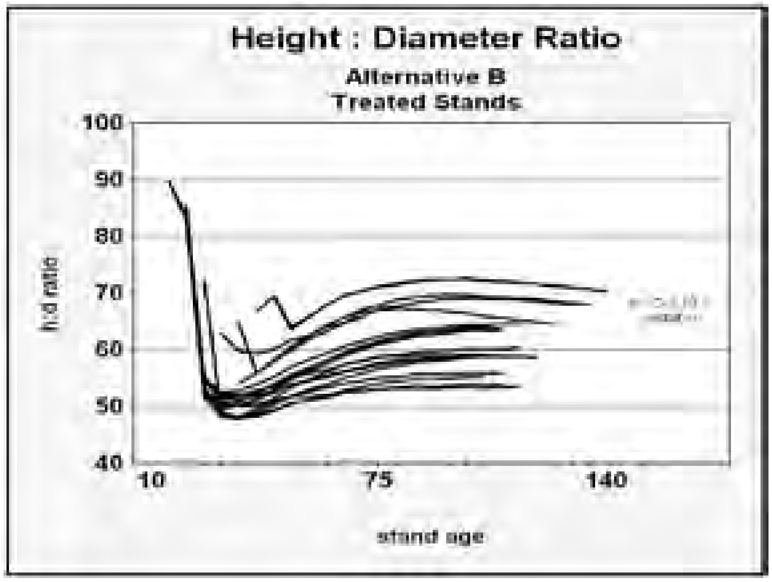
Graph 15.



Graph 16.

Stands 21-30 years old would be thinned to 50-100 Douglas-fir TPA. Cut trees would typically be 10”-14” dbh. At the end of the 100-year analysis period, these treatments would result in 30 -35 TPA and a relative density of 30-35 (see Graphs 15 and 16). This relative density would allow trees to maintain crown ratios at or above 50%, and would provide sufficient light for growth of naturally-seeded shade-tolerant conifers. However, the natural establishment of shade-tolerant conifers would be delayed in some areas by the extensive ground covered by cut trees. For example, Figures 23 and 24 illustrate the development of the 30-year-old stand, showing the thinning treatment in 2002, and the moderately open overstory and moderate development of the shade-tolerant understory in at the end of the 100-year analysis period. These stands would develop height:diameter ratios between 60 and 65, which would generally be stable (Lohmander and Helles 1987; Wilson and Oliver 2000) (see Graph 17). Coarse woody debris/snag treatments would typically cut or kill trees 16”-24” dbh in the first treatment, which would occur in approximately 20-25 years.

Stands 31-40 years old would be thinned to 100-150 Douglas-fir TPA. Cut trees would typically be 10” -16” dbh. At the end of the 100-year analysis period, these treatments would result in about 75 TPA and would maintain high relative densities – between 50 and 55, just below the point at which density-dependent mortality would begin (see Graphs 15 and 16). At the end of the 100-year analysis period, these stands would be essentially similar to the unthinned stands. Crown ratios would remain near 50%, shade-tolerant conifer growth would be suppressed, and understory trees would remain small and considerably below the overstory canopy. The natural establishment of shade-tolerant conifers would be delayed in some areas by the extensive ground covered by cut trees. These stands would develop height:diameter ratios around 70, which studies have found may be unstable for Douglas-fir (Lohmander and Helles 1987; Wilson and Oliver 2000) (see Graph 17). Coarse woody debris/snag treatments would typically cut or kill trees 18”-24” dbh in the first treatment, which would occur in approximately 15-20 years.



Graph 17.

Stands 41-50 years old would be thinned to 100-200 Douglas-fir TPA. Cut trees would typically be 12”-16” dbh. At the end of the 100-year analysis period, these treatments would result in 75-85 TPA and would maintain high relative densities – about 55, the point at which density-dependent mortality would begin (see Graphs 15 and 16). At the end of the 100-year analysis period, these stands would be essentially similar to the unthinned stands. Crown ratios would decrease to less than 50%, shade-tolerant conifer growth would be suppressed, and understory trees would remain small and considerably below the overstory canopy. These stands would develop height:diameter ratios near 70, which studies have found may be unstable for Douglas-fir (Lohmander and Helles 1987; Wilson and Oliver 2000) (see Graph 17). Coarse woody debris/snag treatments would typically cut or kill trees 20”-24” dbh in the first treatment, which would occur in approximately 15 years.

Table 3. - Alternative B - Stand Treatment and Results Summary

STAND TREATMENT AND RESULTS		STAND AGE			
		<21	**21-30**	**31-40**	**41-50**
Thinning prescription (during 10-year span of proposed plan)	**TPA***	40-60 60-80 80-110	50	100-150	100-200
Resulting Stand Characteristics (end of 100-year analysis period)	**TPA**	30 40 50	30-35	75	75-85
	RD	30 40 50	30-35	50-55	55
	H:D	55-65	60-65	70	70

*Uplands and 100-foot riparian areas would receive same treatments

In summary, extensive thinning in stands ≤30 years old would effectively speed the development of large Douglas-fir trees, and would be moderately effective at establishing some shade-tolerant conifers. However, thinning would not effectively spread the range of tree diameters because relatively few new trees would be able to establish following thinning in the absence of some removal of cut trees. Thinning would create stands that are likely to be stable over the 100-year analysis period (see Table 3).

Thinning would also be extensive in stands 31-50 years old, but the mitigations necessary to avoid unacceptable fuel loadings and bark beetle impacts would severely limit the effectiveness of thinning. Thinning in these stands would do little to speed the development of late-successional forest structure compared to unthinned stands, and would create stands that would be at the upper limit of stand stability (see Table 3). Stands >50 years old would not be thinned and would develop as described under Alternative A.

Key Points

- 7,400 acres (54%) of stands currently ≤80 years old would be treated over 10 years.
- 2,300 acres would develop late-successional structure.
- Thinning would speed development of late-successional structure in stands ≤30 years old.
- Thining in stands 31-50 years old would be ineffective, and stands may become unstable.

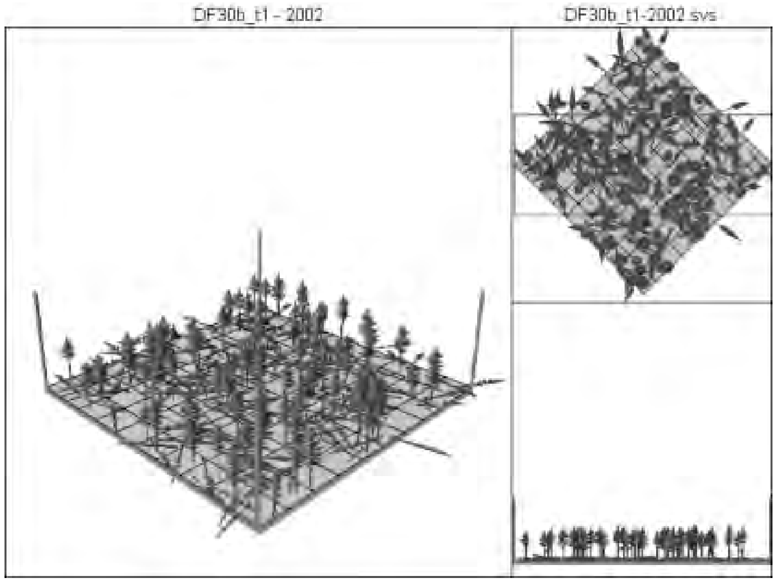


Figure 23. *Thinning of the 30-year-old Type Stand*

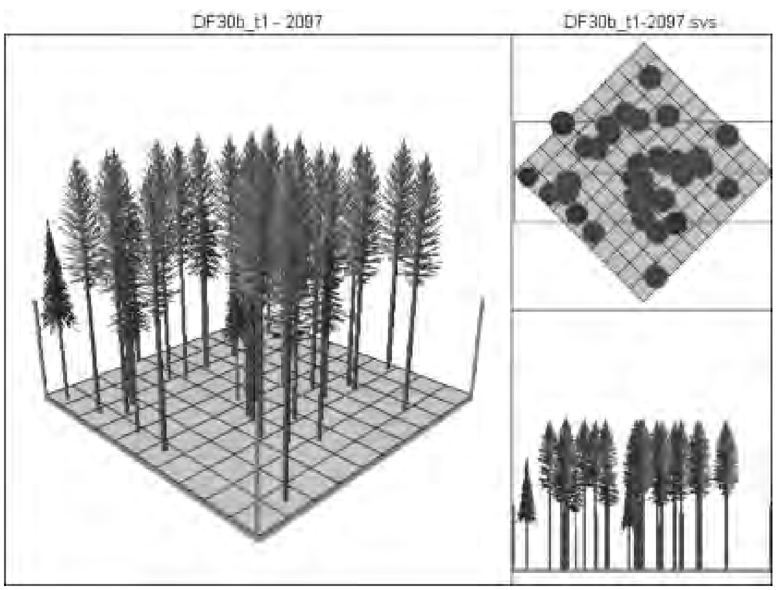


Figure 24. *Development of the 30-year-old Type Stand*

ISSUE 5: *What are the effects of restoration activities on marbled murrelet habitat?*

Alternative B would not thin stands >50 years old and would thereby avoid adverse effects to marbled murrelets.

Under Alternative B, stands would develop trees 32” dbh at approximately the same rate as in Alternative A. However, Alternative B would speed the development of large branches. In 50 years, 2,000 acres would have at least one tree per acre with at least one branch 5” diameter, nearly four times the amount in Alternative A. In Alternative B, nearly all of the stands currently 80 years old would be able to grow at least one tree per acre with at least one branch 5” diameter within the 100-year analysis period (13,600 acres or 98%). The most heavily thinned stands would have trees with even larger branches (up to 7-1/2” diameter at the end of the 100-year analysis period).

Under Alternative B, no stands currently ≤80 years old would achieve target habitat conditions within the 100-year analysis period, because none of the stands would develop a wide enough range of tree diameters, and few stands would support sufficient shade-tolerant conifers.

Key Points

- All stands would have trees 32” dbh, and almost all would develop branches 5” and larger (up to 7-1/2”) within 100 years.
- No young stands would achieve target habitat conditions within 100 years.

ISSUE 6: *What are the effects of restoration activities on northern spotted owl habitat?*

In Alternative B, stands >50 years old would not be thinned, which would generally maintain dispersal habitat and avoid impacts to foraging habitat. Alternative B would periodically create small quantities of snags and coarse woody debris after thinning, which would continue to improve habitat conditions for spotted owl prey species and thereby improve foraging habitat quality.

Dispersal habitat development under Alternative B would be similar to Alternatives A, C, and F. All stands would become dispersal habitat within 80 years; most of the stands (13,000 acres or 94%) would become dispersal habitat within 40 years. The amount of dispersal habitat would periodically drop slightly relative to Alternative A as a result of coarse woody debris creation in future decades. However, at the time of these periodic drops in dispersal habitat, 85% of currently young stands will have already developed into dispersal habitat.

Under Alternative B, 3,200 acres (23% of stands currently 80 years old) would become suitable habitat by the end of the 100-year analysis period. A smaller acreage – 2,300 acres (17%) – would achieve target habitat conditions nesting habitat by the end of the 100-year analysis period.

Key Points

- All young stands would develop into dispersal habitat similar to Alternative A, except for some slight periodic reductions resulting from coarse woody debris creation.
- 3,200 acres would develop into suitable habitat within 100 years.
- 2,300 acres would achieve target habitat conditions within 100 years.

ISSUE 7: *What are the effects of restoration activities on coho salmon habitat?*

In-stream structure: Alternative B would not intentionally create any in-stream woody debris, but the thinning actions in the riparian area would incidentally fall substantial quantities of logs into streams. Alternative B would thin 1,800 acres (53%) of riparian areas (105.7 miles of 1st-2nd-order streams; 23.6 miles of 3rd-5th-order streams). Thinning would produce relatively small logs (8"-12" diameter, with some logs 12"-20" diameter). All cut trees would be retained in the riparian area, producing large quantities of logs (generally 80-200 TPA). Approximately 160 trees per stream mile (approximately 25 TPA) would be felled directly into streams, meeting the ODFW riparian habitat benchmark for total pieces of woody debris, but completely lacking in key pieces.

On 1st and 2nd-order streams, this woody debris would be generally stable and would result in increased stream complexity of 105.7 miles of 1st and 2nd order streams (although this debris would likely not be stable in the event of a flood larger than the 50-year flood).

These logs would not be stable in 3rd-5th-order streams and would likely be lost from the stream system following a 50-year flood, except on the five stream systems with existing stable structure (see Chapter 3). On all other 3rd-5th-order streams, Alternative B would have long-term effects on stream complexity similar to Alternative A.

It is reasonably foreseeable that, beyond the 10-year span of this plan, 10 TPA would be felled at 10-year intervals in thinned riparian stands, providing logs generally 12"-24" diameter, with some logs >24" diameter in later treatments. However, in the absence of intentional, directional falling to the stream, too few of these trees would likely enter the stream channel to provide stable, in-stream structure in 3rd-5th-order streams.

Riparian stands: Alternative B would have effects on the development of riparian trees large enough to provide key pieces of woody debris (24" dbh) similar to all alternatives (See Alternative A, Issue 7). However, it would take considerably longer to develop sufficient density of very large trees that would provide more stable key pieces of woody debris (32" dbh): at the end of the 100-year analysis period, approximately 2,900 acres out of 3,400 riparian acres (84%) would have developed 13 trees per acre 32" dbh. Alternative B would be faster than Alternatives A, C, and F to develop sufficient density of these larger trees, but slower than Alternatives D and E.

Sedimentation: Under Alternative B (like all action alternatives), all non-shared, BLM-controlled roads that are capable of delivering fine sediment to streams would be decommissioned. The 2002 road inventory found that approximately 4.9 miles of BLM-controlled roads are capable of delivering fine sediment to streams, and an additional 0.7 miles that are shared roads could be decommissioned with the consent of private owners. After decommissioning, natural drainage would be restored. This decommissioning would reduce chronic, road-related sediment delivery to the streams from 108.0 cubic yards/year to 74.0 cubic yards/year. Although Alternative B would decommission additional roads beyond the roads that are capable of delivering sediments to streams, the additional road decommissioning would have no measurable effect on the amount of sediment reaching streams. During road decommissioning, there would be short-term pulses of sedimentation from activities such as subsoiling and culvert removal.

Under Alternative B (like all action alternatives), all culverts identified in the 2002 road inventory as a high-risk of failure would be replaced or removed. This would eliminate the potential sedimentation from road-related landslides, but would result in temporary pulses of sediment of approximately 7.3 cubic yards/year over 10 years. Additionally, under Alternative B (and all other action alternatives), 10 fish-barrier culverts identified in the 2002 road inventory would be replaced or removed, which would result in temporary pulses of sediment of approximately 1.7 cubic yards/year over 10 years.

Under Alternative B, there would be no new road construction or construction of in-stream structures.

Barriers: Alternative B (like all action alternatives) would remove culverts that constitute barriers to the movement of anadromous fish and other aquatic organisms or replace them with passage-friendly culverts, bridges, or crossings. The 2002 road inventory assessed 16 fish-barrier culverts on BLM-controlled roads, of which 10 were recommended for removal or replacement. Removing or replacing these 10 fish-barrier culverts would open 7.0 miles of new habitat available for coho salmon.

Key Points

- Stable in-stream structure would be created on 105.7 miles of 1st-2nd-order streams, and 0 miles of 3rd-5th-order streams in 10 years.
- 84% of young riparian forests would develop sufficient density of very large (32” dbh) conifers in 100 years.
- Existing road-related sedimentation would be reduced to 74.0 cubic yards/year. Restoration actions would cause a total of 9.0 cubic yards of sediment/year.
- Removal of 10 barrier culverts would open 7.0 miles of new coho salmon habitat.

ISSUE 8: *How would restoration activities affect the presence and spread of noxious weeds?*

Alternative B would result in some disturbance to both soils and existing vegetation from forest management activities in stands <50 years old, which could potentially result in further establishment and spread of noxious weeds in treated stands within the planning area. However, Alternative B would include no new road construction, which would avoid the creation of new vectors for the spread of noxious weeds

Decommissioning 79 miles of road would substantially reduce the vectors for the introduction, establishment, and spread of noxious weeds within the planning area (see Figure 25). Alternative B would decommission the most roads of all the alternatives, thus contributing to the greatest reduction of potential road vectors for noxious weeds within the planning area.

Figure 25. *Extensive road decommissioning in Alternative B would reduce the establishment and spread of noxious weeds.*

Existing primary and secondary roadways remaining open to vehicular traffic, especially heavily traveled routes, would continue to be vectors for the spread of weeds. Infrequently traveled secondary roads would gradually become more shaded over time as native vegetation and overhead shade from adjacent trees encroach existing roadways. This would contribute to a reduction in noxious weeds.

As in all alternatives, continued implementation of an integrated noxious weed control program, coupled with continued monitoring and adaptive management, would contribute to a further reduction in noxious weed infestations in the planning area.

Key Points

- Decommissioning 79 miles of road and no new road construction would reduce noxious weed establishment and spread.

ISSUE 9: *What would be the economic effects of restoration activities?*

Under Alternative B, there would be 8,100 acres of non-commercial silvicultural treatments, which would generate approximately 250 months of contract work over the entire 10-year implementation period (30 months of work for silvicultural treatments for each of the first three years of implementation, 40 months of work for each of the second three years, and 10 months of work for each of the final four years).

Decommissioning 79 miles of road would generate 32 months of contract work.

Replacing 10 culverts would generate 11 months of contract work, the same as in all action alternatives.

Because all silvicultural treatments under Alternative B would be non-commercial, there would be no revenue generated from the sale of forest products. Some post/pole and firewood sales and other special forest product sales would likely occur, but these activities would provide negligible revenue.

Key Points

- 293 months of contract work over 10 years.
- No revenue would be generated.

ISSUE 10: *What are the costs of restoration?*

During the 10-year span of the proposed plan, silvicultural treatments in Alternative B would incur $1.35 million in contract costs and $400,000 in BLM staff costs (8 work months per year, or $40,000 per year).

Decommissioning 79 miles of road would incur $1.2 million in contract costs and $790,000 in BLM staff costs. Replacing culverts would incur $790,000 in contract costs and $370,000 in BLM staff costs, the same as all action alternatives.

Key Points

- $3.3 million in contract costs over 10 years.
- $1.6 million in BLM staff costs over 10 years.

ALTERNATIVE C

Continue Current Management Approach

Alternative C is designed to continue the current pace of restoration, using current silvicultural techniques and stream restoration strategies. Stands would be thinned at ages 41-80 years old. In-stream woody debris structures would be constructed, and some structures would be cabled for stability. Alternative C would decommission eroding roads and roads in late-successional forest and would construct new roads as needed.

ISSUE 1: *How would road decommissioning and road management actions alter public access to BLM-managed lands?*

Under Alternative C, approximately 24 miles of road would be decommissioned (14% of the total 169 miles on BLM-managed land in the planning area), which would reduce road density from the current density of 4.4 miles of road per square mile to approximately 3.8 miles of road per square mile. An additional 12 miles of road are "passively" decommissioning (See Chapter 3). Roads that would be decommissioned under this alternative are shown on Map 3.

Approximately 5 miles of legal public access roads (7% of the total 75 miles of legal public access) would be decommissioned. Visitors would be able to enter the public land in question, but that part of the road lying on public land would be decommissioned and would not be accessible by motor vehicle.

Under Alternative C, 19 miles of "other" roads would also be decommissioned. ("Other" roads would require crossing private land for which BLM has not obtained a legal easement).

Key Points

- 24 miles (14%) of road on BLM-managed land would be decommissioned.

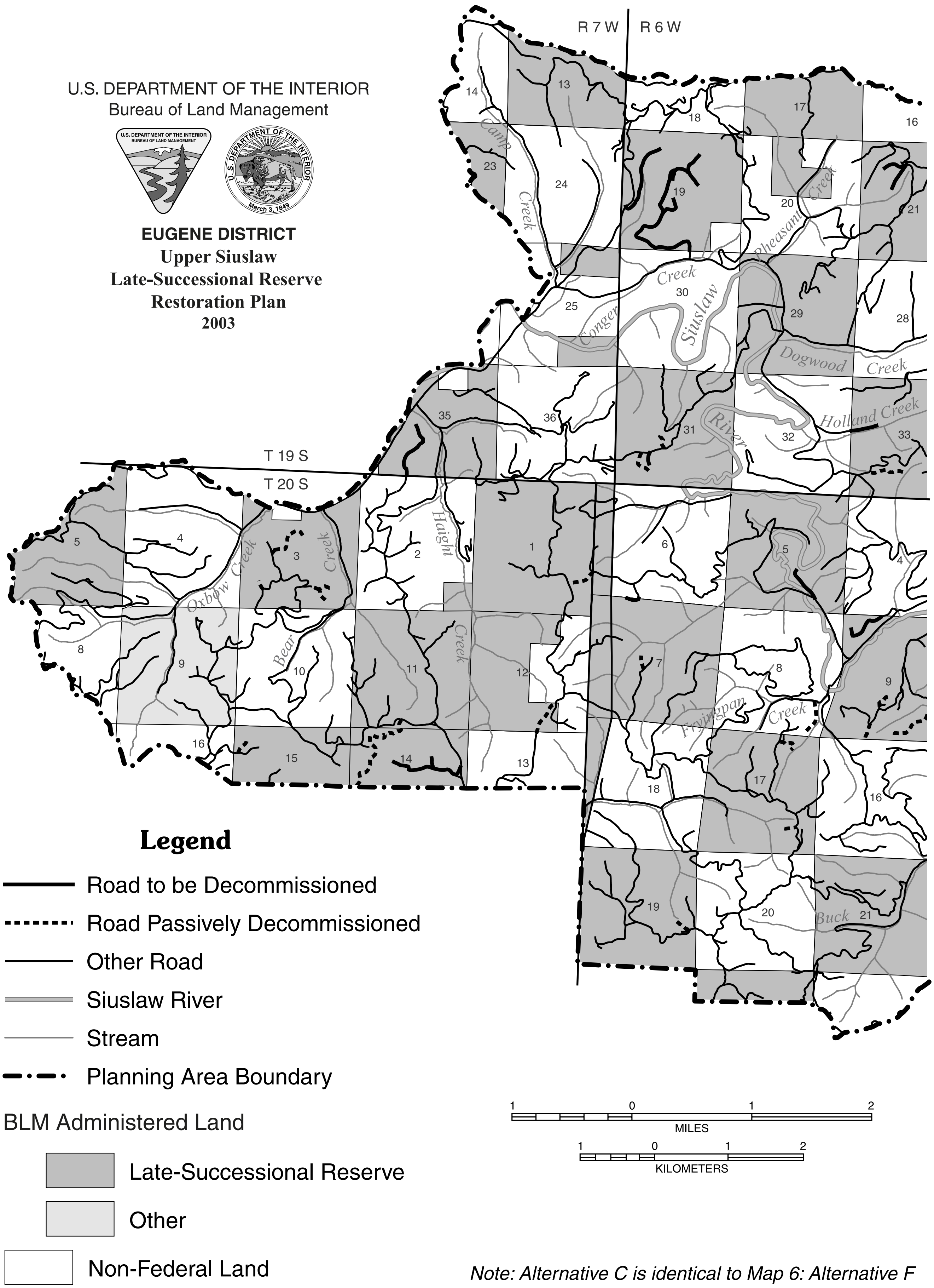
ISSUE 2: *How much new road construction would be needed to implement restoration actions?*

No road construction would be needed to treat the very young (≤20 year old) stands, because the existing road system would provide adequate access for pre-commercial thinning.

Under Alternative C, approximately 900 acres of stands ranging from 41-80 years old would be thinned in the next 10 years and some cut trees would be removed. This would require suitable road access for yarders, log trucks, and other harvesting equipment. Based on past thinning operations in the planning area, an average of 40.2 feet of new road would be constructed per acre harvested. Therefore, Alternative C would result in approximately 36,180 feet (6.9 miles) of new road construction over the 10-year span of the proposed plan. Most or all of the new road construction would be temporary construction; the new roads would be decommissioned and blocked following the completion of thinning operations. It is possible, but unlikely, that a portion of the new road construction would need to be permanent road construction with gravel or paved surface.

Key Points

- 6.9 miles of new temporary road would be constructed.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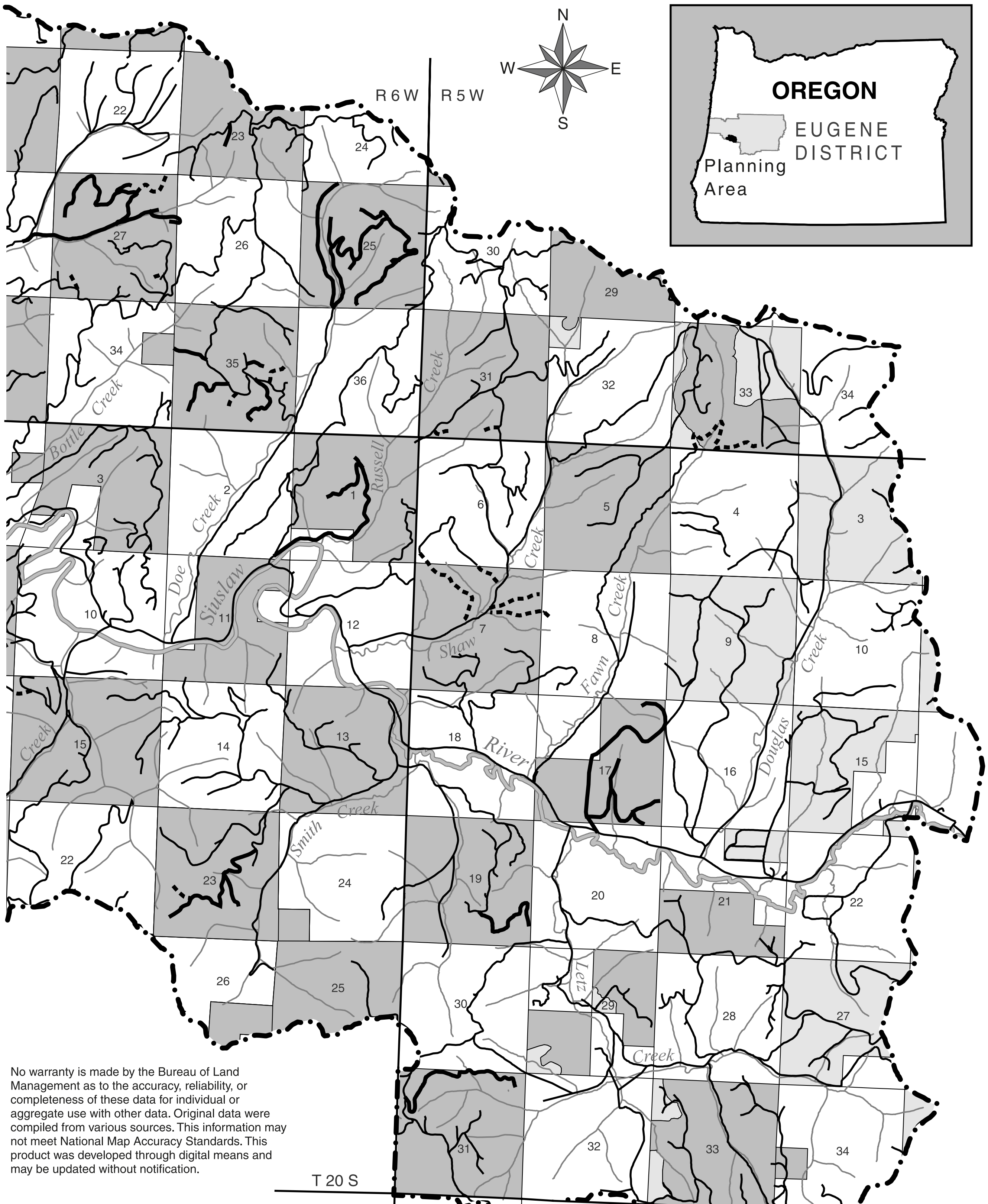
Note: Alternative C is identical to Map 6: Alternative F

Map 3: Alternative C - Road Decommissioning



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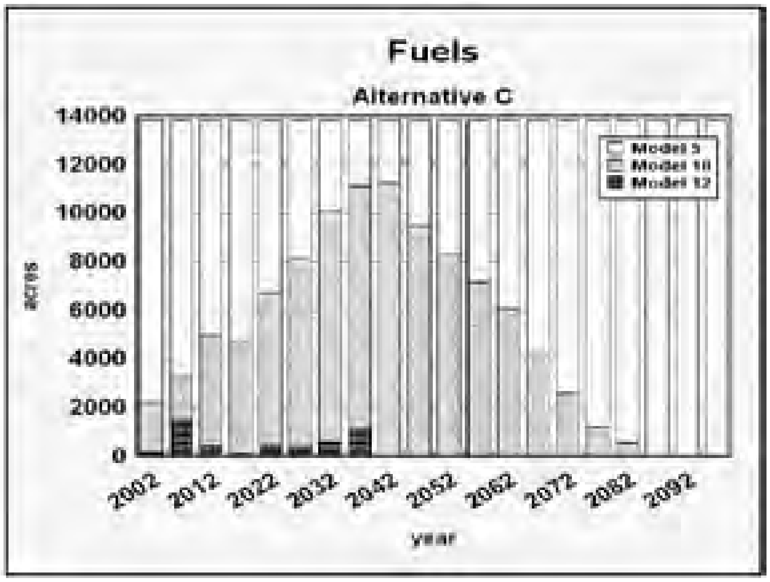
ISSUE 3: *What level of risk to existing late-successional forest would result from restoration activities?*



Graph 18.

Fire: Thinning in Alternative C would periodically create a small acreage (<1,000 acres) in Fuel Model 12, but these acres would quickly decrease as the slash decomposes (see Graph 18). The thinning would only slightly reduce the acreage in Model 10, compared to Alternative A. Similar to Alternative A, the majority of stands currently ≤80 years old would be in Model 10 for about 40 years, which would present a substantial and long-lasting risk of severe fire. Maintaining such a large portion of the landscape in this fuel model for such a long period of time would pose a high risk of catastrophic fire that would damage existing late-successional forests and retard development of late-successional forest characteristics in young stands.

Bark Beetles: At the individual stand scale, there would be some increased risk of bark beetle damage under Alternative C. Approximately 900 acres of young stands would experience tree mortality, with a total of approximately 900-5,400 trees killed by bark beetles. This relatively low intensity of mortality (approximately 1-6 TPA) would have little effect of stand structure, but would contribute to snag and coarse woody debris levels. Some additional bark beetle mortality would occur if snags and coarse woody debris are created at the time of thinning, similar to Alternative F. If snag and coarse woody debris creation is delayed, any additional effect may be moderated by adaptive management: tree mortality cause by bark beetles following thinning may obviate the need for snag and coarse woody debris creation, similar to Alternatives B, D, and E. If a natural disturbance, such as a severe windstorm, were to occur, bark beetles would likely cause additional tree mortality. However, the thinning in Alternative C would create stands that would be relatively stable, which would reduce the likelihood of extensive blowdown in thinned stands (see Issue 4).

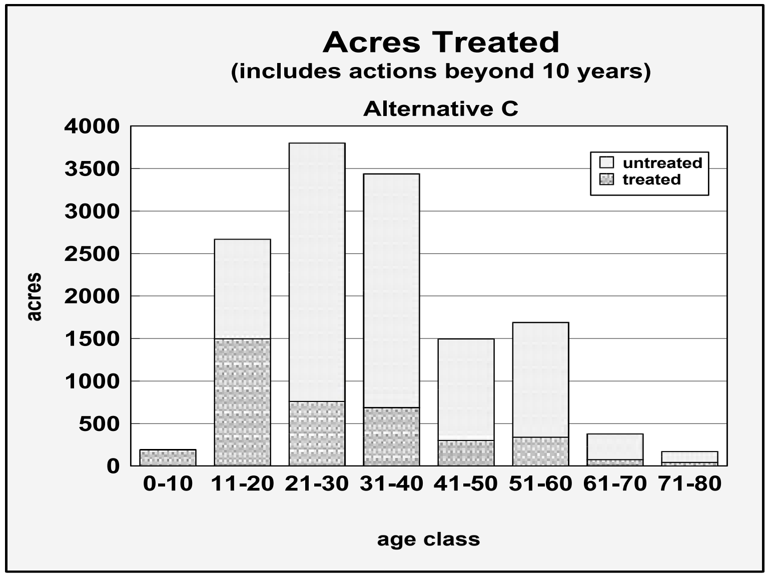
At the landscape scale, bark beetle populations would be larger than in Alternative A, but smaller than other action alternatives. There would be a slightly increased risk of bark beetle attack on large trees in late-successional stands near thinned, young stands. Otherwise, effects of Alternative C on bark beetle populations would be similar to Alternative B.

Key Points

- The large acreage of unthinned stands would pose a high risk of severe fire, but thinned stands would move into a low-risk fuel model.
- Bark beetles would cause some individual tree mortality, but would not pose a high risk to existing late-successional forests.

ISSUE 4: *How would thinning affect development of late-successional forest structural characteristics?*

Under Alternative C, approximately 9,900 acres of the 13,800 acres of stands currently ≤80 years old would receive no treatment and would continue on their existing developmental pathway (see Graph 19). Alternative C leaves more acres untreated than any other action alternative. These untreated stands would develop as described under Alternative A.



Graph 19.

Alternative C would thin with timber harvest approximately 900 acres during the 10-year span of the proposed plan. It is reasonably foreseeable that under the management approach of Alternative C, an additional 3,000 would be thinned beyond the 10-year span of the proposed plan (i.e., when stands that are currently ≤30 years old become 41-80 years old).

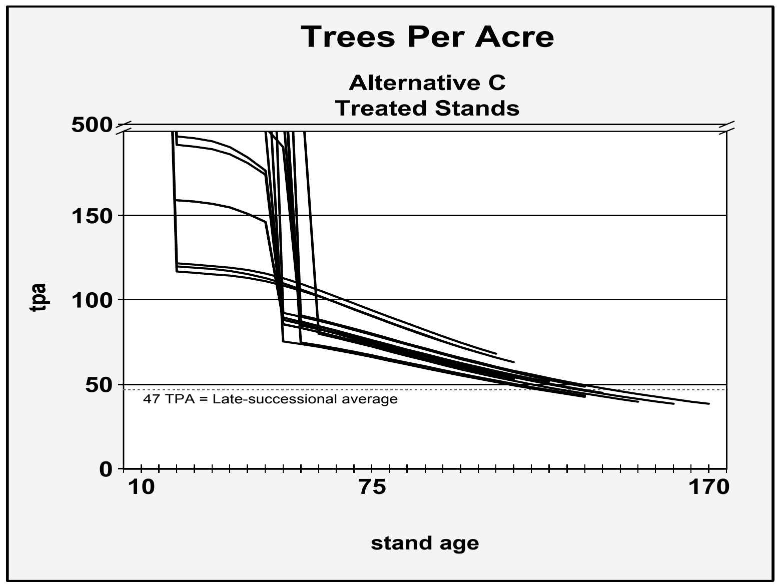
Within the 100-year analysis period, 100 acres of the stands currently ≤80 years old would develop late-successional characteristics. Alternative C would be slightly more effective than the No Action alternative at speeding the development of large Douglas-fir trees and shade-tolerant conifers, but would be less effective than all other action alternatives. Alternative C would not be effective at spreading the range of tree diameters.

Figure 26.. *Thinning prescriptions in Alternative C would maintain even, moderate-density overstories.*

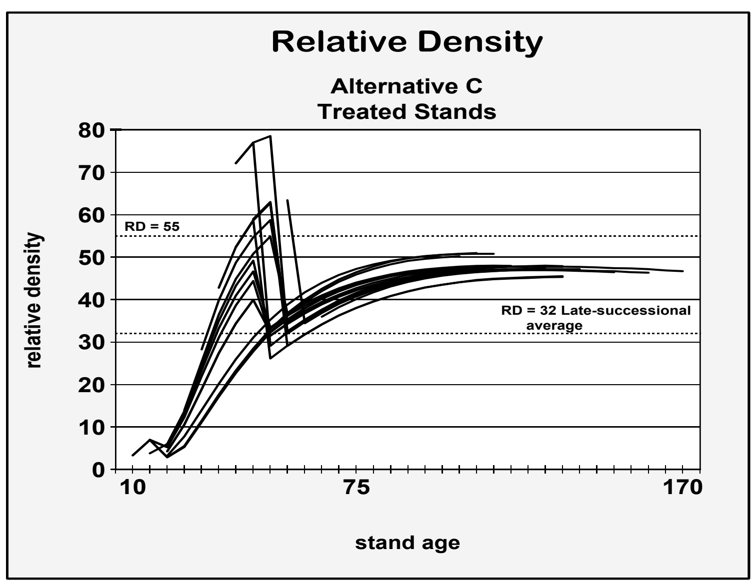
Thinning prescriptions in Alternative C would thin stands from below, i.e., cut the smaller trees (see Figure 26). However, the thinning prescriptions would not be as limited as in Alternative B (see Table 4), because removal of some cut trees in Alternative C would mitigate fuel loadings and bark beetle impacts. Thinning would increase individual tree growth rates and thereby increase stand mean tree diameters. These thinning prescriptions would temporarily reduce the range of tree diameters by preferentially cutting the smaller diameter trees. Development of understories of shade-tolerant conifers would be inhibited because the overstory would be too dense, even after thinning, to allow growth of shade-tolerant conifers in the understory.

Stands <21 years of age would be pre-commercially thinned to two levels of residual density: 110 or 150-200 Douglas-fir TPA. Stands would not be treated between ages 21 and 40 (the stands in those age classes that are shown as treated are those that would be expected to be treated beyond the 10-year span of the proposed plan, when the stands are >40 years old).

Stands 41-50 years of age would be thinned to 60-110 Douglas-fir TPA. Cut trees would typically be 8”-14” dbh. At the end of the 100-year analysis period, these treatments would result in 45-50 TPA and a relative density of 45-50, below the point at which density-dependent mortality would begin (see Graphs 20 and 21). Crown ratios would remain near 50%. The overstory would be open enough to allow establishment of shade-tolerant conifers, but growth would be suppressed, and understory trees would either remain small or eventually die. These stands would develop height:diameter ratios around 65, which would generally be stable (Lohmander and Helles 1987; Wilson and Oliver 2000) (see Graph 22).

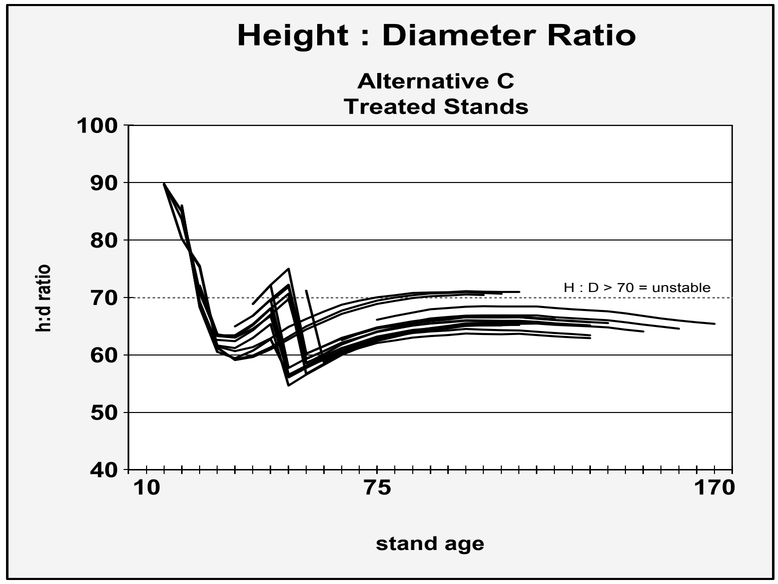


Graph 20.



Graph 21.

Stands 51-80 years of age would be thinned to 50-110 Douglas-fir TPA. Cut trees would typically be 8”-16” dbh. At the end of the analysis period, these treatments would result in about 40 TPA and a relative density of approximately 45, below the point at which density-dependent mortality would begin (see Graphs 20 and 21). Crown ratios would remain near 50%.



Graph 22.

The overstory would be open enough to allow establishment of shade-tolerant conifers, but growth would be suppressed, and understory trees would either remain small or eventually die. For example, Figures 27 and 28 illustrate the development of the 30-year-old stand, showing the thinning treatment (note that the stand is not thinned until 2027), and the moderately dense, uniform structure of the stand in 2097. These stands would develop height:diameter ratios around 65, which would generally be stable (Lohmander and Helles 1987; Wilson and Oliver 2000) (see Graph 22).

Table 4. - Stand Treatment and Results Summary Alternative C

STAND TREATMENT AND RESULTS		STAND AGE			
		<21	21-40	41-50	51-80
Thinning prescription (during 10-year span of proposed plan)	**TPA***	110 150-200	Untreated	60-110	110 150-200
Resulting Stand Characteristics (end of 100-year analysis period)	**TPA**			45-50	
	RD			45-50	
	H:D			65	

*Uplands and 100-foot riparian areas would receive same treatments

In summary, Alternative C would treat a small portion of the young stands in the planning area, and the thinning prescriptions would do little to speed the development of late-successional forest structural characteristics. The thinning prescriptions would create stands of trees with moderately large diameters that are likely to be moderately stable (see Table 4). However, the approach in Alternative C of a single thinning from below with few if any follow-up treatments would retain too much overstory density to allow the development of a shade-tolerant conifer understory and would not spread the range of tree diameters.

Key Points

- 900 acres (6%) would be treated over 10 years; a total of 3,900 acres (28%) of stands currently ≤80 years old would be treated including probable treatments beyond 10 years.
- 100 acres would develop late-successional structure.
- Thinning would not effectively speed development of late-successional structure, but stands would likely be stable.

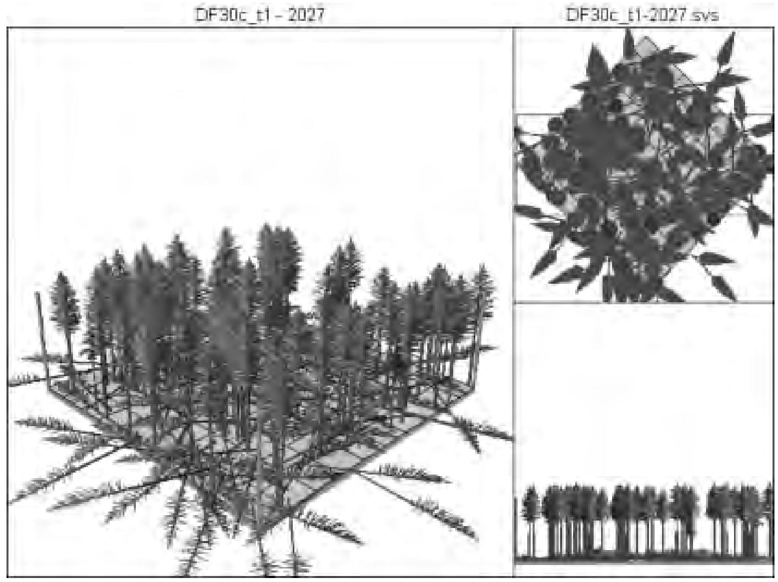


Figure 27. *Thinning of the 30-year-old Type Stand*

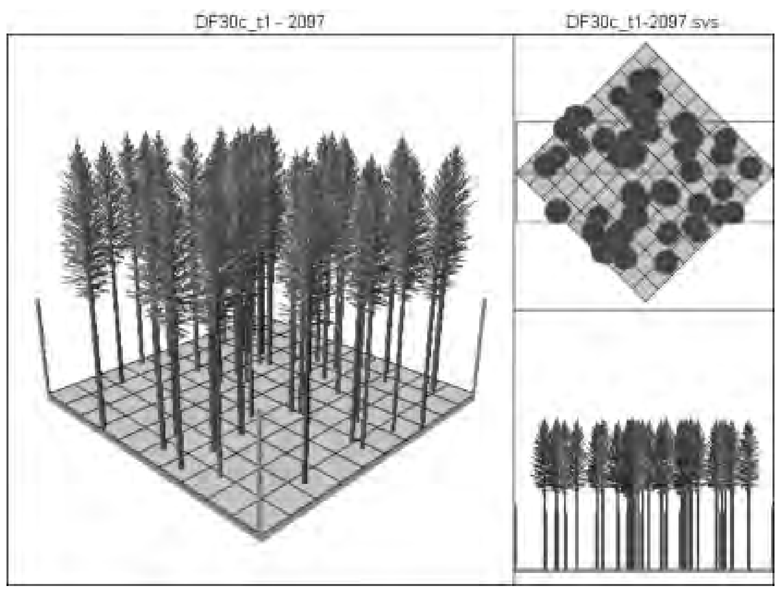


Figure 28. *Development of the 30-year-old Type Stand*

ISSUE 5: *What are the effects of restoration activities on marbled murrelet habitat?*

Alternative C would thin stands ≤80 years old, but would avoid adverse effects to marbled murrelets by evaluating stands 51-80 years old prior to thinning to determine if stands are potential habitat for marbled murrelets. Stands that are potential habitat would be thinned only if surveys find the stands to be unoccupied by marbled murrelets.

Under Alternative C, stands would develop trees ≥32" dbh at approximately the same rate as in Alternative A. However, Alternative C would speed the development of large branches. In 50 years, 1,200 acres would have at least one tree per acre with at least one branch 5" in diameter, twice the amount in Alternative A. In Alternative C, nearly all of the young stands would have at least one tree per acre with at least one branch 5" in diameter within the100-year analysis period (13,300 acres or 96%). The maximum branch size in Alternative C would be only slightly larger than in Alternative A for all age classes (1/3" - 1/2" larger at the end of the 100-year analysis period).

Under Alternative C, no stands that are currently ≤80 years old would achieve target habitat conditions within the 100-year analysis period, because none of the stands would develop a wide enough range of tree diameters, and few stands would support sufficient shade-tolerant conifers.

Key Points

- All stands would have trees ≥32" dbh, and almost all would develop branches 5" in diameter within 100 years.
- No young stands would achieve target habitat conditions within 100 years.

ISSUE 6: *What are the effects of restoration activities on northern spotted owl habitat?*

Development of dispersal habitat under Alternative C would be largely indistinguishable from Alternative A, partly because Alternative C would thin the fewest acres of any action alternative. In addition, thinning prescriptions in Alternative C would maintain dispersal habitat, because they would retain more than 40% canopy closure. Although thinning might temporarily decrease habitat quality (see Anthony et al. 2001, which found that owls avoided recently thinned stands within their home range), the thinned stands would continue to meet the definition of dispersal habitat. Under Alternative C, most of the stands currently ≤80 years old (13,500 or 98%) would become dispersal habitat in 25 years, and all stands would become dispersal habitat in 30 years. Alternative C may affect critical habitat by degrading existing dispersal habitat, but would not downgrade (i.e., altering the stand conditions below the threshold conditions for dispersal habitat) any existing dispersal habitat.

Under Alternative C, 1,700 acres (12% of stands currently ≤80 years old) would become suitable habitat within the 100-year analysis period. A very small acreage – 100 acres (<1%) – would achieve target habitat conditions within the 100-year analysis period. (The acreage achieving target habitat conditions would decline from 400 acres in ninety years, because shade-tolerant conifers in the understory would die as the stand density would increase).

Key Points

- All young stands would develop into dispersal habitat, similar to Alternative A.
- 1,700 acres would develop into suitable habitat within 100 years.
- 100 acres would achieve target habitat conditions within 100 years.

ISSUE 7: *What are the effects of restoration activities on coho salmon habitat?*

In-stream structure: Alternative C would construct a minimum of 56 in-stream structures per mile, using at least 3 key pieces of wood per structure, in 3.8 miles of 3rd-5th-order streams (see Figure 29). Structures would be augmented with off-site materials (e.g., large logs and boulders) and cabled as needed to assure structural stability. These structures would persist after a 50-year flood, because of the stabilization of in-stream structures with off-site materials and cabling.

Figure 29. *Alternative C would construct in-stream structures using heavy machinery and cabling as needed to assure stability.*

Under Alternative C, trees would be felled or pulled into streams adjacent to upland thinning actions (35.9 miles of 1st -2nd-order streams; 8.0 miles of 3rd-5th-order streams). Alternative C would thin 600 acres (18%) of riparian areas over the 10-year span of the proposed plan, and a total of 1,000 acres (28%) of riparian areas including probable treatments beyond 10 years. Riparian stands would be thinned from below, producing relatively small logs (8”-12” diameter, with some logs 12”-20” diameter). Enough trees would be felled or pulled into streams to add approximately 50-160 trees per mile. These logs would not be stable in 3rd-5th-order streams unless combined in structures with larger logs or cabled, but would generally be stable in 1st -2nd-order streams. This would provide a range of debris concentrations in smaller streams adjacent to upland thinning actions, in some cases meeting the minimum quantity in the ODFW riparian habitat benchmark. Thinned stands would likely not have additional treatments beyond the 10-year span of the proposed plan. Streams adjacent to untreated stands would not receive additional logs, except for the in-stream structures described above.

Riparian stands: Alternative C would have effects on the development of large riparian trees (≥24” dbh) similar to all alternatives (See Alternative A, Issue 7). However, it would take considerably longer to develop sufficient density of very large trees that would provide more stable key pieces of woody debris (≥32” dbh): at the end of the 100-year analysis period, approximately 2,500 acres out of 3,400 riparian acres (74%) would have developed ≥13 TPA ≥32” dbh. Alternative C would not thin within 50’ of streams, and would use the same thinning prescriptions in the outer portion of the riparian area as in the uplands, which would be only slightly better than Alternative A at speeding the development of very large trees (see Issue 4). Overall, Alternative C would treat fewer riparian acres than any other action alternative. As a result, Alternative C would be only slightly faster than Alternative A (No Action) to develop sufficient density of these larger trees, but slower than all other action alternatives.

Sedimentation: Alternative C would have effects on sedimentation from existing roads, road decommissioning, and culvert replacement and removal similar to Alternative B.

Alternative C includes approximately 6.9 miles of new temporary road construction, which would be decommissioned after a single logging season. The new road construction may include approximately 4 temporary stream crossings over the 10-year span of the proposed plan. These stream crossings would cause temporary pulses of approximately 0.4 cubic yards of sediment/year over 10 years from culvert placement and removal.

Construction of in-stream structures in Alternative C would cause temporary pulses of approximately 1.0 cubic yard of sediment/year over 10 years from disturbance to the stream channel bed and banks.

Barriers: Alternative C would have effects on fish-barrier culverts and make additional habitat available similar to all action alternatives (See Alternative B, Issue 7).

Key Points

- Stable in-stream structure would be created on 35.9 miles of 1st-2nd-order streams, and 3.8 miles of 3rd-5th-order streams in 10 years.
- 74% of young riparian forests would develop sufficient density of very large (≥32" dbh) conifers in 100 years.
- Existing road-related sedimentation would be reduced to 74.0 cubic yards/year. Restoration actions and associated road construction would cause a total of 10.4 cubic yards of sediment/year.
- Removal of 10 barrier culverts would open 7.0 miles of new coho salmon habitat.

ISSUE 8: *How would restoration activities affect the presence and spread of noxious weeds?*

Alternative C would result in some disturbance to both soils and existing vegetation from forest management and aquatic restoration activities in stands ≤80 years old, which could potentially result in further establishment and spread of noxious weeds in treated stands within the planning area.

Decommissioning 24 miles of road would reduce the vectors for the introduction, establishment, and spread of noxious weeds within the planning area, but would be partially offset by the construction of 6.9 miles of new road. However, new road construction would be temporary and would provide vectors for the spread of noxious weeds only until the temporary roads are decommissioned.

Effects on noxious weeds on roads that are not decommissioned would be the same as in Alternative A.

Key Points

- Decommissioning 24 miles of road would be partially offset by construction of 6.9 miles of new roads and would only slightly reduce noxious weed establishment and spread.

ISSUE 9: *What would be the economic effects of restoration activities?*

Under Alternative C, there would be 1,400 acres of non-commercial silvicultural treatments, which would generate 36 months of contract work over the entire 10-year span of the proposed plan (1 month of work for silvicultural treatments for each of the first three years of implementation, 7 months of work for each of the second three years, and 3 months of work for each of the final four years).

Decommissioning 24 miles of road would generate 14 months of contract work.

Replacing 10 culverts would generate 11 months of contract work, the same as in all action alternatives.

In-stream restoration would generate 12 months of contract work, the same as in Alternatives D and F.

There would be 900 acres of commercial thinning timber sales over the 10-year span of the proposed plan, which would generate $2.8 million in revenues. Alternative C would have opportunities for revenue from commercial thinning beyond the 10-year span of the proposed plan.

Key Points

- 69 months of contract work over 10 years.
- $2.8 million of revenue over 10 years.

ISSUE 10: *What are the costs of restoration?*

For the 10-year span of the proposed plan, silvicultural treatments in Alternative C would incur $171,000 in contract costs and $1.4 million in BLM staff costs (30 work months per year, or $140,000 per year, much of which would be the preparation of timber sales).

Decommissioning 24 miles of road would incur $360,000 in contract costs and $240,000 in BLM staff costs. Culvert replacement costs would be the same as in all action alternatives (see Alternative B). In-stream restoration would incur $80,000 in contract costs and $40,000 in BLM staff costs.

Key Points

- $1.4 million in contract costs over 10 years.
- $2.1 million in BLM staff costs over 10 years.

ALTERNATIVE D (preferred alternative)

T&E Species Recovery

Alternative D is designed to take advantage of restoration opportunities that would have the least short-term adverse effects with the most long-term benefits to habitat for northern spotted owls, marbled murrelets, and coho salmon. All commercial thinning would be completed within the next 10 years. Riparian stands would be thinned without timber removal. In-stream woody debris structures would be constructed, and some structures would be cabled for stability. Alternative D would decommission eroding roads and roads in or adjacent to late-successional forest. New road construction would be limited to short, temporary spur roads.

ISSUE 1: *How would road decommissioning and road management actions alter public access to BLM-managed lands?*

Under Alternative D, approximately 45 miles of road would be decommissioned (27% of the total 169 miles on BLM-managed land in the planning area), which would reduce road density from the current density of 4.4 miles of road per square mile to approximately 3.2 miles of road per square mile. An additional 12 miles of road are "passively" decommissioning (see Chapter 3). Roads that would be decommissioned under this alternative are shown on Map 4.

Approximately 14 miles legal public access roads (19% of the total 75 miles of legal public access) would be decommissioned. Visitors would be able to enter the public land in question, but that part of the road lying on public land would be decommissioned and would not be accessible by motor vehicle.

Under Alternative D, 31 miles of "other" roads would be decommissioned. ("Other" roads would require crossing private land for which BLM has not obtained a legal easement).

Key Points

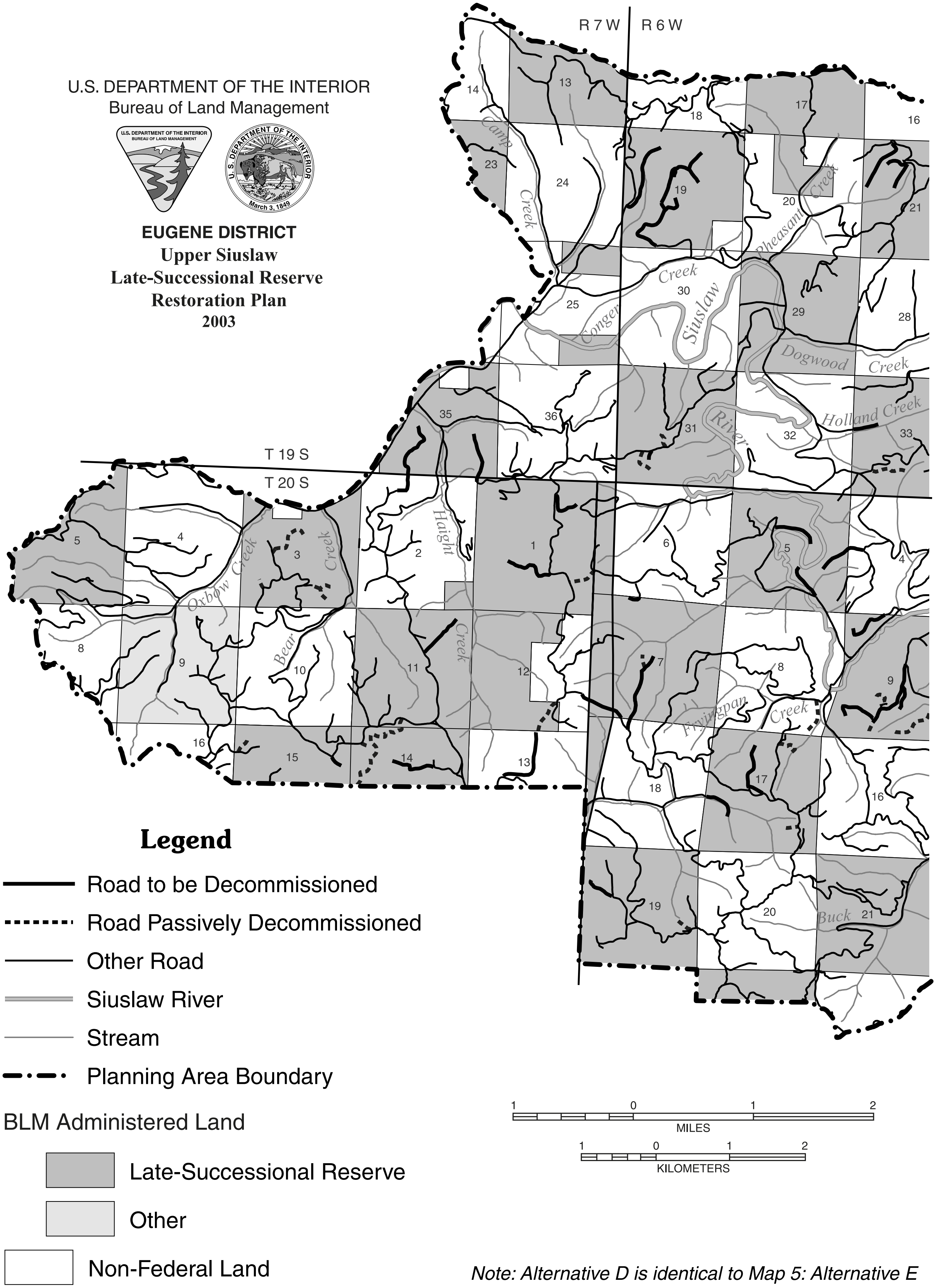
- 45 miles (27%) of road on BLM-administered land would be decommissioned.

ISSUE 2: *How much new road construction would be needed to implement restoration actions?*

Under Alternative D, there would be no new permanent road construction in order to implement restoration actions. Any new road construction would be restricted to (1) spur roads <200' long, (2) temporary use for a single logging season, and (3) outside of Riparian Reserves with no new stream crossings.

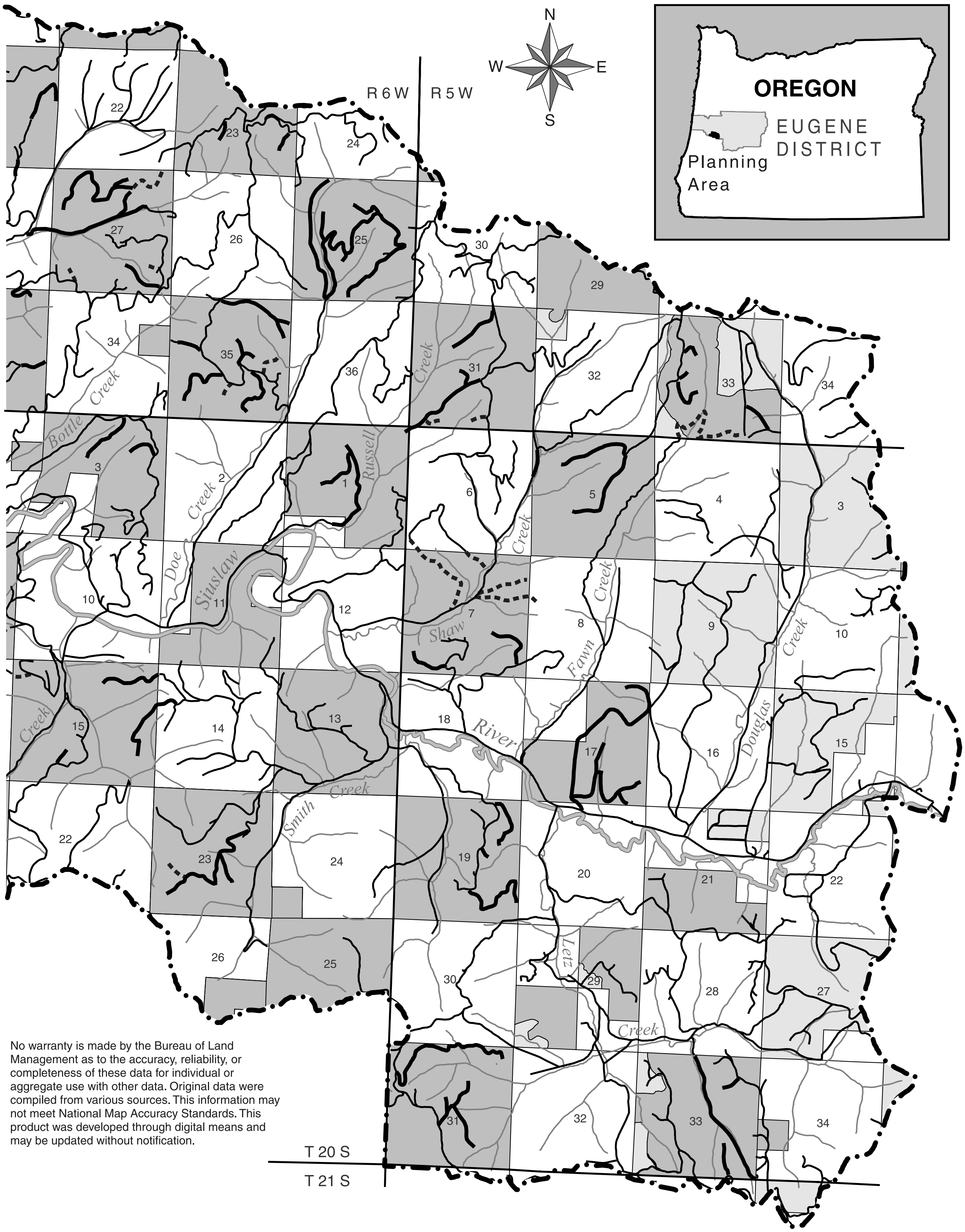
No road construction would be needed to treat stands ≤30 years old, because the existing road system would provide adequate access for thinning.

Under Alternative D, there would be approximately 1,700 acres of 31-40-year-old stands treated. For each treatment unit (averaging 25 acres per unit), 50' on temporary spurs would be constructed. Therefore, approximately 3,400' of spur roads would be constructed to implement restoration actions in the 31-40 year age classes.



U.S. DEPARTMENT OF THE INTERIOR
Bureau of Land Management
EUGENE DISTRICT
Upper Siuslaw
Late-Successional Reserve
Restoration Plan
2003
R 7 W
R 6 W
T 19 S
T 20 S
Camp Creek
Pheasant Creek
Conger Creek
Siuslaw River
Dogwood Creek
Holland Creek
Oxbow Creek
Haight Creek
Bear Creek
Fryingpan Creek
Buck
Legend
Road to be Decommissioned
Road Passively Decommissioned
Other Road
Siuslaw River
Stream
Planning Area Boundary
BLM Administered Land
Late-Successional Reserve
Other
Non-Federal Land
MILES
KILOMETERS
Note: Alternative D is identical to Map 5: Alternative E

Map 4: Alternative D - Road Decommissioning



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In addition, there are approximately 1,300 acres of 41-60-year-old stands treated under Alternative D. For each treatment unit, 300' of temporary spurs would be constructed. Therefore, approximately 15,480' of spur roads would be constructed to implement restoration actions in the 41-60 year age classes.

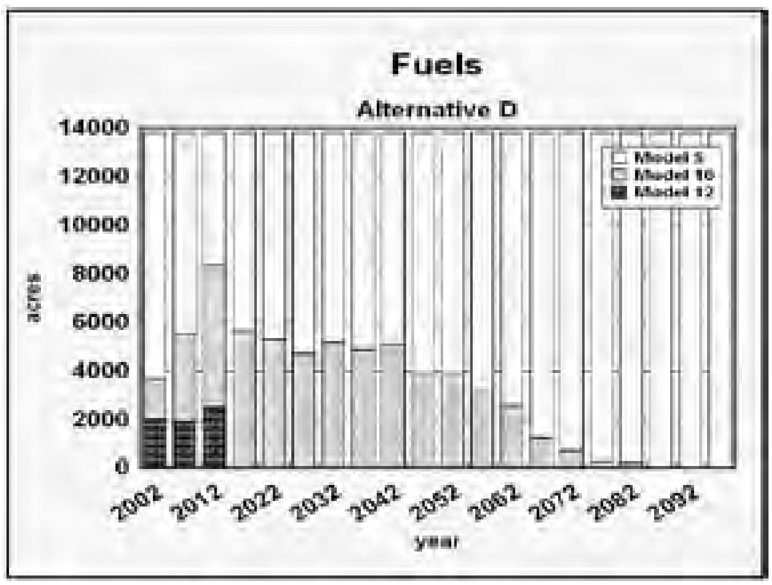
In total, under Alternative D, there would be approximately 3.6 miles of new road constructed during the 10-year span of the proposed plan in order to implement silvicultural restoration actions.

Key Points

- Approximately 3.6 miles of new temporary spur roads would be constructed.

ISSUE 3: *What level of risk to existing late-successional forest would result from restoration activities?*

Fire: Similar to Alternative B, thinning in Alternative D would immediately create a substantial acreage (2,000 acres) in Fuel Model 12 (see Graph 23). These acres would quickly decrease as the slash would decompose, so that the acres in Model 12 would largely disappear within 15 years. Even more dramatically than Alternative B, the thinning in Alternative D would reduce the acreage in Model 10 and shorten the time before these acres move back into Model 5. For almost all of the 100-year analysis period, Alternative D would maintain the majority of the landscape in Model 5, which presents a much lower risk of catastrophic fire



Graph 23.

Bark Beetles: At the individual stand scale, there would be some increased risk of bark beetle damage under Alternative D. Approximately 3,000 acres of young stands would experience tree mortality, with a total of approximately 3,000-12,000 trees killed by bark beetles. This relatively low intensity of mortality (approximately 1-4 TPA) would have little effect of stand structure, but would contribute to snag and coarse woody debris levels. Some additional bark beetle mortality would occur following future coarse woody debris creation that would occur on 10-20-year intervals under Alternative D, but such mortality would likely be minor (approximately 4 TPA) because of the moderate quantities of coarse woody debris created and the small acres over which debris would be created in any one year. Furthermore, this effect may be moderated by adaptive management in future coarse woody debris creation efforts: tree mortality caused by bark beetles following one interval of coarse woody debris creation may obviate the need for the next interval of coarse woody debris creation. If a natural disturbance, such as a severe windstorm, were to occur, bark beetles would likely cause additional tree mortality. However, the thinning in Alternative D would create stands that would be relatively stable, which would reduce the likelihood of extensive blowdown (see Issue 4).

At the landscape scale, bark beetle populations would be slightly larger than in Alternative B, because of the greater acreage treated. There would be an increased risk of bark beetle attack on large trees in late-successional stands near thinned, young stands. Otherwise, effects of Alternative D on bark beetle populations would be similar to Alternative B.

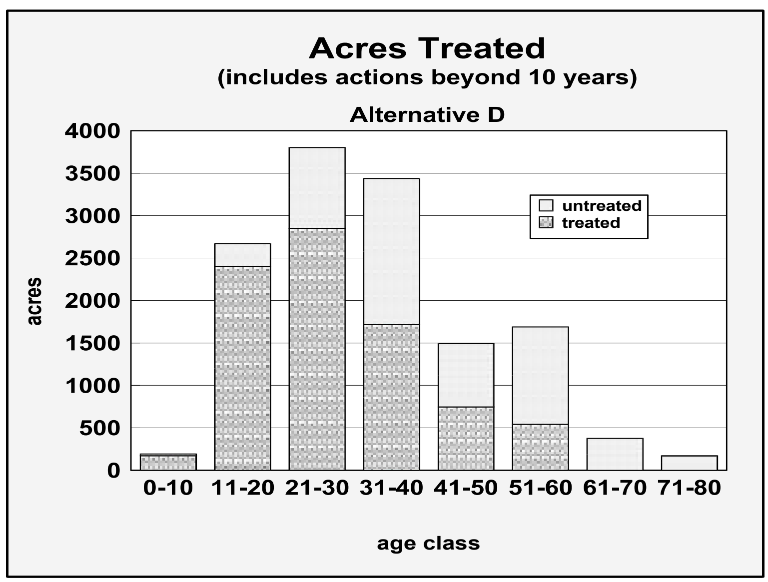
Key Points

- Thinned stands would move into a low-risk fuel model, substantially reducing the risk of severe fire.
- Bark beetles would likely cause some individual tree mortality, but would not pose a high risk to existing late-successional forests.

ISSUE 4: *How would thinning affect development of late-successional forest structural characteristics?*

Under Alternative D, approximately 5,400 acres of the 13,800 acres of stands currently ≤80 years old would receive no treatment and would continue on their existing developmental pathway (see Graph 24). These untreated stands would develop as described under Alternative A.

Alternative D would thin approximately 8,400 acres during the 10-year span of the proposed plan. It is reasonably foreseeable that under the management approach of Alternative D, most or all of these acres would receive additional non-commercial treatments beyond the 10-year span of the proposed plan.



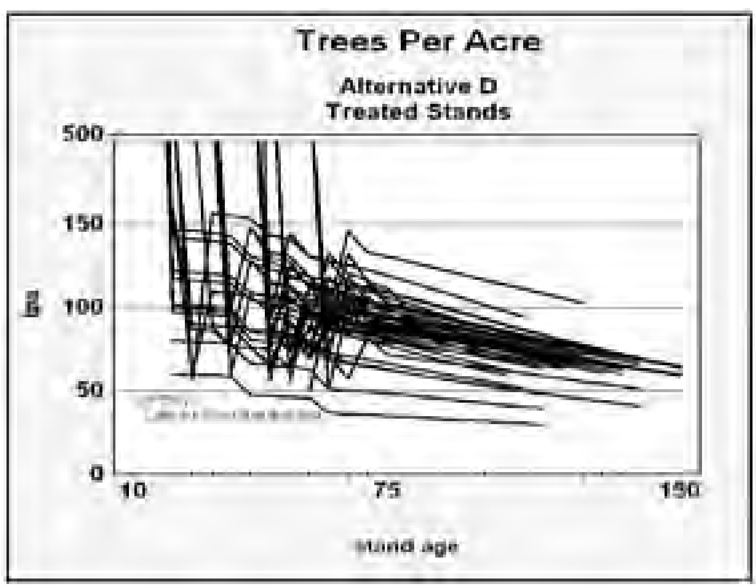
Graph 24.

Within the 100-year analysis period, approximately 6,000 acres of the stands currently ≤80 years old would develop late-successional structure. Alternative D would be more effective at speeding the development of late-successional structure than all other alternatives except Alternative E.

Alternative D would differ from Alternatives B, C, and F in that it would use proportional thinning (which removes trees across all diameters in proportion to their occurrence within the stand). The thinning prescriptions would not be as limited as in Alternative B (see Table 5), because removal of some cut trees in Alternative D would mitigate fuel loadings and bark beetle impacts. Thinning would increase individual tree growth rates and thereby increase stand mean tree diameters. These thinning prescriptions would not reduce the range of tree diameters as in Alternatives B, C, and F, which use thinning from below (preferentially cutting the smaller trees). Alternative D would employ a wide range of thinning prescriptions (see Table 5 and Figure 30). Under most prescriptions, overstory densities would be low enough to permit moderate to good growth of shade-tolerant conifers. Under the lightest thinning prescriptions, development of understories of shade-tolerant conifers would be somewhat inhibited because the overstory would be too dense, even after thinning, to allow growth of shade-tolerant conifers in the understory. The spatially uneven prescriptions of Alternative D would accelerate tree growth in those

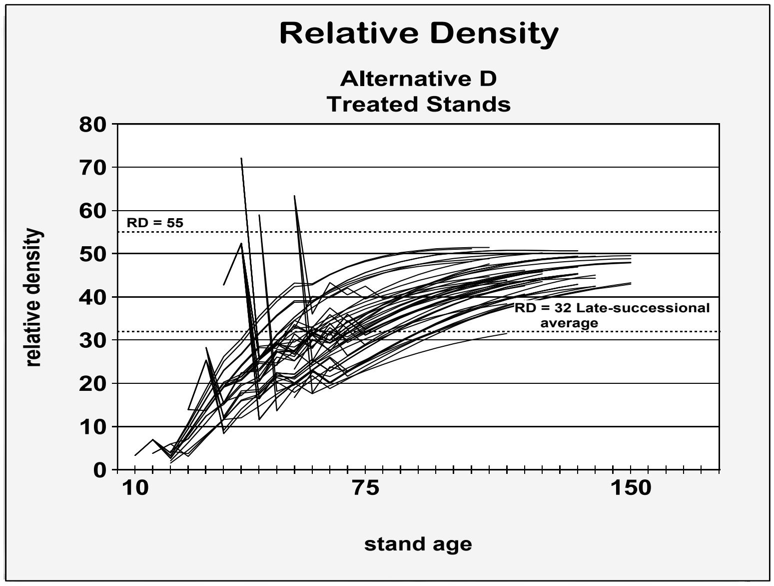
Figure 30. *Alternative D would employ a wide variety of thinning prescriptions, many of which create uneven overstories with adundant shade-tolerant conifers in the uderstory.*

areas of lower local density. In all of the prescriptions, subsequent treatments would likely cut (or create snags of) 10 TPA at 10-20-year intervals beyond the 10-year span of the proposed plan.



Graph 25.

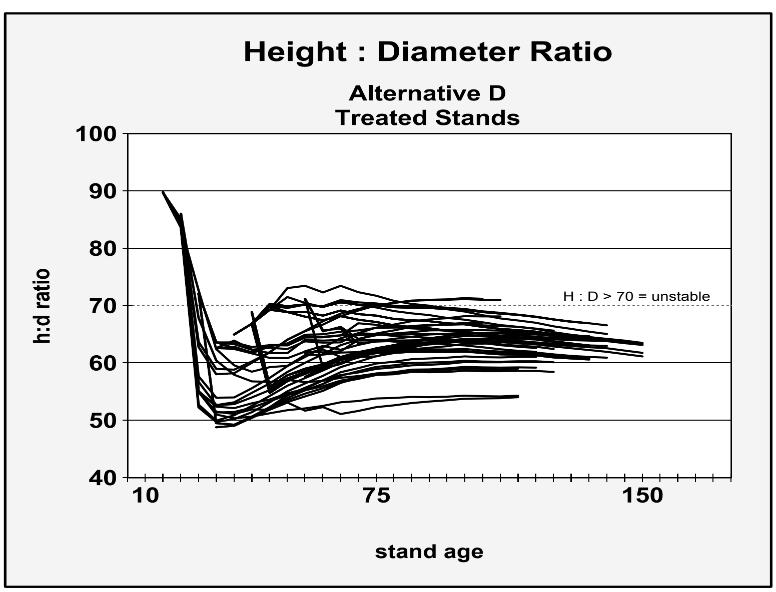
Stands <16 years old would be non-commercially thinned to three levels of residual density: 70, 90, or 135 Douglas-



Graph 26.

fir TPA. Stands 16-20 years old would be non-commercially thinned to 50, 70, or 90 Douglas-fir TPA. Riparian stands would be non-commercially thinned to 80 Douglas-fir TPA. The sizes of trees cut would vary between 2”-12” dbh. At the end of the 100-year analysis period, these stands would exhibit a wide range of stand structures: 50-95 TPA (of which 25-60 TPA would be Douglas-fir overstory trees) and stand relative densities between 40-50, below the point at which density-dependent mortality would occur (see Graphs 25 and 26). Most of these stands would develop height: diameter ratios between 60-65, which would generally be stable, but the lightest thinning prescriptions would develop height : diameter ratios between 65-70, which may be less stable (Lohmander and Helles 1987; Wilson and Oliver 2000) (see Graph 27).

Stands 21-30 years old would be thinned proportionally to 50, 70, or 90 Douglas-fir TPA. Trees between 4”-16” dbh would be cut. Riparian stands and stands that were not pre-commercially thinned would be thinned from below to 80 Douglas-fir TPA, cutting trees between 4”-10” dbh. Cut trees would be left in place within 100’ of streams; elsewhere, thinning may include removal of some cut trees, depending upon the size of trees cut, and whether removal is necessary to reduce fuel and bark beetle risk. At the end of the 100-year analysis period, these stands would have 60-75 TPA (of which 25-40 TPA would be Douglas-fir overstory trees) and stand relative densities between 40-50, below the point at which density-dependent mortality would occur (see Graphs 25 and 26). For example, Figures 31 and 32 illustrate the development of the 30-year-old stand, showing the thinning treatment in 2007, and the good development of the shade-tolerant understory in 2097. Though overall stand density at the end of the 100-year analysis period would be similar among the treatments, the stand structure, especially the development of the understory, would vary widely among the treatments (see Figures 33 to 38). All of these stands would develop height: diameter ratios between 55-65, which would generally be stable (Lohmander and Helles 1987; Wilson and Oliver 2000) (see Graph 27).



Graph 27.

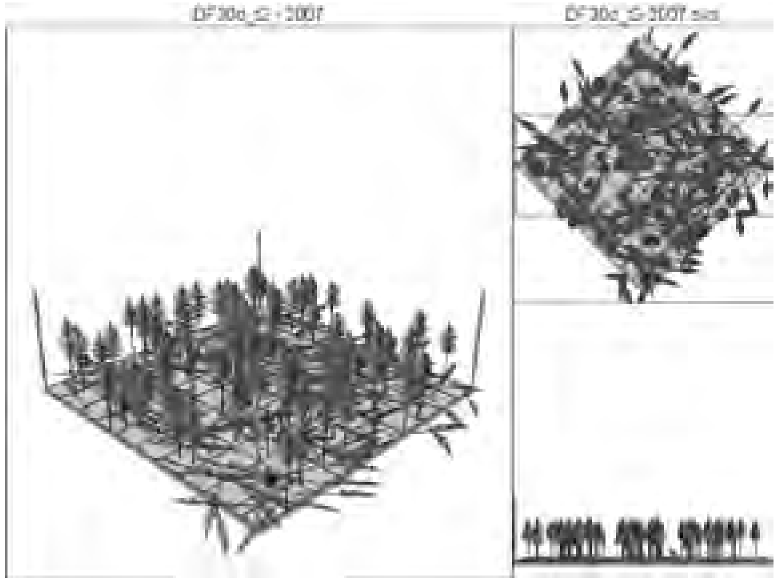


Figure 31. *Thinning of the 30-year-old Type Stand*

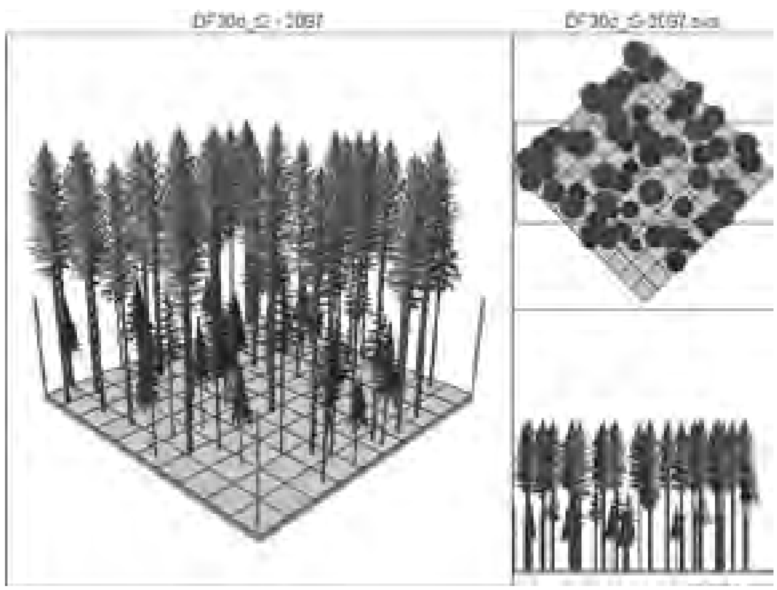


Figure 32. *Development of the 30-year-old Type Stand*

Stands 31-40 years old would be thinned proportionally to 50, 70, or 90 Douglas-fir TPA. Riparian stands and stands that were not pre-commercially thinned would be thinned from below to 80 Douglas-fir TPA. Cut trees would be left in place within 100' of streams; elsewhere, thinning would usually include removal of some cut trees to reduce fuel and bark beetle risk. Cut trees would typically be 8"-18" dbh. At the end of the 100-year analysis period, these stands would have 60-70 TPA (of which 25-45 TPA would be Douglas-fir overstory trees) and stand relative densities between 42-50, below the point at which density-dependent mortality would occur (see Graphs 25 and 26). Crown ratios would remain near or above 50%. The overstory would be open enough to allow establishment of shade-tolerant conifers, but growth would be somewhat suppressed in the lightest thinning prescription. In the more open stands, the shade-tolerant understory would show moderate to good growth and begin to reach up to the lower level of the overstory trees. Most of these stands would develop height:diameter ratios between 60-65, which would generally be stable, but the lightest thinning prescriptions would develop height : diameter ratios between 65-70, which may be less stable. (Lohmander and Helles 1987; Wilson and Oliver 2000) (see Graph 27).

Stands 41-60 years old would be thinned proportionally to 50, 70, or 90 Douglas-fir TPA. Riparian stands and stands that were not pre-commercially thinned would be thinned from below to 80 Douglas-fir TPA. Cut trees would be left in place within 100' of streams; elsewhere, thinning would usually include removal of some cut trees to reduce fuel and bark beetle risk. Cut trees would typically be 8"-24" dbh. At the end of the 100-year analysis period, these stands would have 40-70 TPA (of which 25-35 TPA would be Douglas-fir overstory trees) and stand relative densities between 40-50, below the point at which density-dependent mortality would begin (see Graphs 25 and 26). Crown ratios would remain near 50%. The overstory would be open enough to allow establishment of shade-tolerant conifers, but growth would be somewhat suppressed, and understory trees would remain small and considerably below the overstory canopy. Growth of the shade-tolerant understory would not be as vigorous as in stands thinned between 31-40 years old. These stands would develop height:diameter ratios between 60-67, which would generally be stable (Lohmander and Helles 1987; Wilson and Oliver 2000) (see Graph 27).

Table 5. - Stand Treatment and Results Summary - Alternative D

STAND TREATMENT AND RESULTS		STAND AGE <16	16-20	21-30	31-40	41-55
Thinning prescription Upland (during 10-year span of proposed plan)	TPA	70 90 135	50 70 90	50 70 90	50 70 90	50 70 90
Thinning prescription Riparian (during 10-year span of proposed plan)	TPA		80	80	80	80
Resulting Stand Characteristics (end of 100-year analysis period)	TPA	30 40 50	30-35	60-70	40-70	40-70
	RD	30 40 45	30-35	40-50	42-50	40-50
	H:D	55-65	60-65	55-65	60-65	60-67

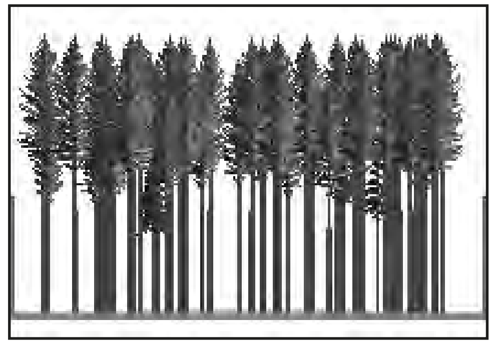


Figure 33
Under Alternative D, untreated stands would develop a high-density, uniform condition with no understory of shade-tolerant conifers.

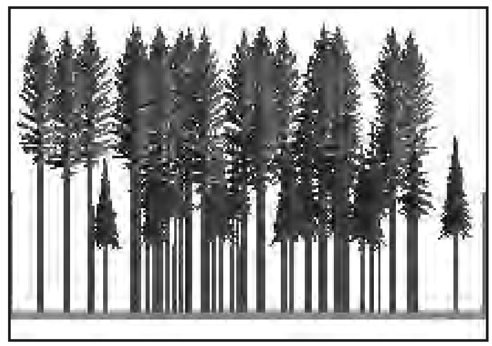


Figure 34
Treatment 1 (proportional thin to 50 TPA) would create a low-density overstory of Douglas-fir, with shade-tolerant conifers growing well into the overstory, creating deep canopy.

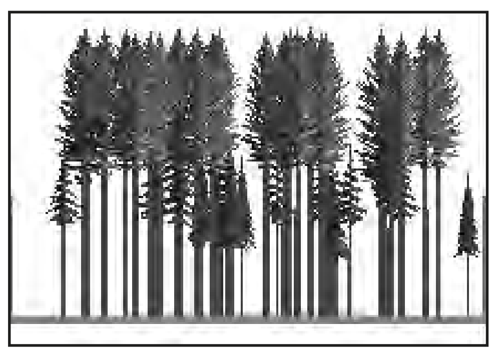


Figure 35
Treatment 2 (proportional thin to 70 TPA) would create a moderate-density overstory of Douglas-fir, with shade-tolerant conifers growing well, though not quite as far into the overstory as Treatment 1.

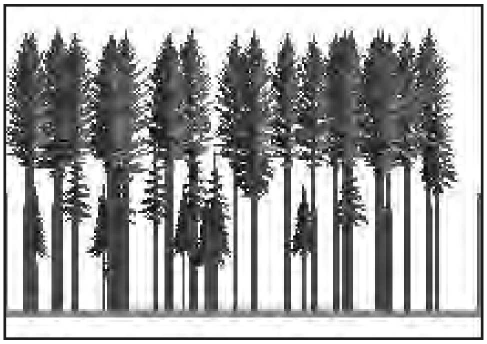


Figure 36
Treatment 3 (proportional thin to 90 TPA) would create a moderate-density overstory of Douglas-fir, with shade-tolerant conifers just reaching the bottom of the overstory.

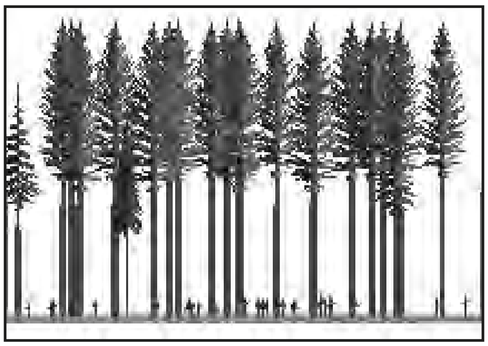


Figure 37
Treatment 4 (thin from below to 80 TPA), which would be applied to stands that had not been pre-commercially thinned, would create an even, moderate-density overstory of Douglas-fir, with small, slow-growing shade-tolerant conifers.

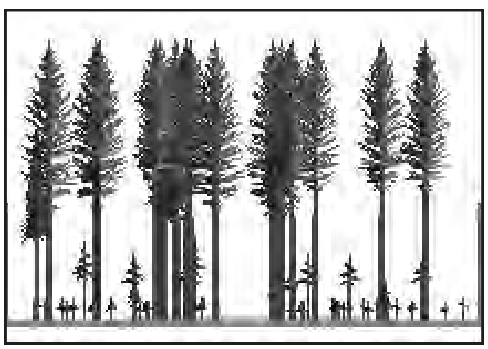


Figure 38
Treatment 5 (thin from below to 80 TPA), which would be applied in riparian areas, would create an uneven, low-density overstory of Douglas-fir, with small shade-tolerant conifers beginning to grow well in response to periodic coarse woody debris creation.

In summary, Alternative D would treat a moderate portion of the stands currently ≤80 years old in the planning area, and the thinning prescriptions would speed the development of late-successional forest structural characteristics. The thinning prescriptions would create wide variety of stand structures, in many cases allowing the development of shade-tolerant understories (see Table 5 and Figures 33 to 38, illustrating the various treatments of the 30-year-old stands, and the resultant range of structural conditions at the end of the 100-year analysis period).

Thinning and subsequent planting of shade-tolerant conifers would be most effective in stands 21-40 years old, where cut trees would be removed. In these stands, the thinning would open the overstory enough to allow establishment and growth of shade-tolerant conifers; the relatively low height of the overstory would help delay overstory reclosure while the shade-tolerant trees would grow to a size to become part of the stand structure. It is reasonable to assume that later coarse woody treatments would aid in further delaying overstory reclosure. The proportional thinnings would retain much of the size range of the overstory and allow additional differentiation of the overstory. Thinning in stands ≥20 years old would be similar to B and would delay the establishment of shade-tolerant understories (see Alternative B, Issue 4).

Key Points

- 8,400 acres (61%) of stands currently ≤80 years old would be treated over 10 years.
- 6,000 acres would develop late-successional structure.
- Thinning would effectively speed development of late-successional structure, maintaining the range of tree diameters, while allowing growth and establishment of shade-tolerant conifers. Most treated stands would be stable.

ISSUE 5: *What are the effects of restoration activities on marbled murrelet habitat?*

Alternative D would thin stands ≤60 years old, but would avoid adverse effects to marbled murrelets by evaluating stands 51-60 years old prior to thinning to determine if stands are potential habitat for marbled murrelets. Stands that are potential habitat would be thinned only if surveys find the stands to be unoccupied by marbled murrelets.

Under Alternative D, stands would develop trees ≥32" dbh at approximately the same rate as in Alternative A. However, Alternative D would speed the development of large branches. In 50 years, 6,000 acres would have at least one tree per acre with at least one branch 5" in diameter, faster than all alternatives except Alternative E. In Alternative D, nearly all of the stands currently ≤80 years old would have at least one tree per acre with at least one branch 5" in diameter within 100-year analysis period (13,600 acres or 98%). The maximum branch size in Alternative D would be larger than in Alternative A for all age classes, depending on the treatment prescriptions (1/2" - 1-1/2" larger at the end of the 100-year analysis period).

Under Alternative D, 3,800 acres (28% of stands currently ≤80 years old) would achieve target habitat conditions within the 100-year analysis period. These stands would develop a range of tree diameters, support shade-tolerant conifers, and grow large trees.

KEY POINTS

- All stands would have trees ≥32" dbh, and almost all would develop branches 5" and larger within 100 years.
- 3,800 acres of young stands would achieve target habitat conditions within 100 years.

ISSUE 6: *What are the effects of restoration activities on northern spotted owl habitat?*

Alternative D would both maintain existing levels of dispersal habitat and develop suitable and target habitat conditions. Alternative D would not thin any stands >60 years old. Within current owl home ranges that currently have less than 40% suitable habitat, Alternative D would not thin stands >50 years old. In existing dispersal habitat within current owl home ranges, thinning would retain at least 40% canopy closure. Although such thinning might temporarily decrease habitat quality (see Anthony et al. 2001, which found that owls avoided recently thinned stands within their home range), the thinned stands would continue to meet the definition of dispersal habitat, similar to Alternatives C and F. None of the thinning prescriptions would harvest trees >20" dbh (although some trees >20" dbh would be cut for coarse woody debris creation). As a result of these measures, Alternative D would not adversely affect current owl pairs. Similar to Alternative B, Alternative D would periodically create smaller quantities of snags and coarse woody debris after thinning, which would continue to improve habitat conditions for spotted owl prey species and thereby improve foraging habitat quality.

Under Alternative D, the overall quantity of dispersal habitat would not decrease from current amounts (although some stands that are currently dispersal would be thinned to below 40% canopy closure, other stands would develop into dispersal habitat to maintain or increase the overall acreage). Additional dispersal habitat would develop more slowly than in Alternatives A, B, C, and F. Most of the stands currently ≤80 years old (13,200 or 96%) would become dispersal habitat in 45 years, and all stands would become dispersal habitat in 55 years.

Alternative D may affect critical habitat by degrading existing dispersal habitat and downgrading (i.e., altering the stand conditions below the threshold conditions for dispersal habitat) some stands outside of owl home ranges. However, the total amount of dispersal habitat in the planning area would not be reduced.

Alternative D would develop more suitable habitat and target habitat conditions than any alternative except Alternative E. Under Alternative D, 6,600 acres (48% of stands currently ≤80 years old) would become suitable habitat within the 100-year analysis period. Almost as much acreage – 6,000 acres (43%) – would achieve target habitat conditions within the 100-year analysis period.

Key Points

- All young stands would develop into dispersal habitat, but more slowly than Alternatives A, B, C, and F. Dispersal habitat would not decrease from current amounts.
- 6,000 acres would develop into suitable habitat within 100 years.
- 6,600 acres would achieve target habitat conditions within 100 years.

ISSUE 7: *What are the effects of restoration activities on coho salmon habitat?*

In-stream structure: Alternative D would have increase stream complexity on more miles of stream than any other alternative. A minimum of 30 in-stream structures per mile, using at least 3 key pieces of wood per structure, would be installed in 3.8 miles of 3rd-5th-order streams. Similar to Alternative C, structures would be augmented with off-site materials and cabled as needed to assure structural stability. Similar to Alternative C, 3.8 miles of 3rd-5th-order streams would continue to have increased complexity after a 50-year flood, because of the stabilization of in-stream structures with off-site materials and cabling.

Under Alternative D, trees would be felled or pulled trees into all streams adjacent to stands ≤80 years old (199.5 miles of 1st-2nd-order streams; 44.6 miles of 3rd-5th-order streams). Alternative D would thin 2,200 acres of riparian areas over 10 years (65% of riparian stands ≤80 years old). Riparian stands would be thinned from below, producing relatively small logs (8”-12” diameter, with some logs 12”-20” diameter). However, all cut trees would be retained in the riparian area, producing large quantities of logs (generally 70-200 TPA). Sufficient trees could be felled directly into streams to add 160 trees/mile (approximately 25 TPA), meeting the minimum quantity in the ODFW riparian habitat benchmark for total pieces of woody debris. These logs would not be stable in 3rd-5th-order streams unless combined in structures with larger logs (such as along 51-80-year-old stands described below), but would generally be stable in 1st-2nd-order streams. Even if these logs were to be moved by a flood in 1st -2nd-order streams, they would generally be caught by stable structures downstream. It is reasonably foreseeable beyond the 10-year span of this proposed plan that 10 TPA would be felled at 10-year intervals in thinned riparian stands, providing logs generally 12”- 24” diameter, with some logs >24” diameter in later treatments.

On streams with riparian stands that would not be otherwise thinned, approximately160 trees/mile would be felled or pulled into the stream, which would provide at least the minimum quantity in the` ODFW benchmark. Similar to Alternative E, it would be possible to create logs ≥24” in diameter from stands >50 years old and thus would be able to create stable in-stream structure in 3rd-5th-order streams adjacent to 51-80-year-old stands (5.8 miles of the 3rd-5th-order streams). In total, Alternative D would be able to create stable in-stream structure on 8.2 miles of 3rd-5th-order streams (up to 3.8 miles by cabling and augmentation, and 5.8 miles by riparian thinning and tree-falling – note that there is some overlap between these two categories).

Figure 39. *Alternative D, like all action alternatives, would replace or remove high-risk culverts and fish barrier culverts.*

Riparian stands: Alternative D would have effects on the development of large riparian trees (≥24” dbh) similar to all alternatives (See Alternative A, Issue 7). However, it would take considerably longer to develop sufficient density of very large trees that would provide more stable key pieces of woody debris (≥32” dbh): at the end of the 100-year analysis period, approximately 3,100 acres out of 3,400 riparian acres (92%) would have developed ≥13 TPA ≥32” dbh. Alternative D would use a different prescription in the riparian area than in the uplands and would treat more riparian acres than any alternative except Alternative E. As a result, Alternative D would be faster than all alternatives except Alternative E to develop sufficient density of these larger trees.

Sedimentation: Alternative D would have effects on sedimentation from existing roads, road decommissioning, and culvert replacement and removal similar to Alternative B (see Figure 39).

New road construction in Alternative D would be limited to short spurs that would be decommissioned after a single logging season. New road construction would not occur within Riparian Reserves, and no new stream crossings would be constructed. As a result, new road construction under Alternative D would produce negligible if any sediment delivery to streams.

Construction of in-stream structures in Alternative D would have effects similar to Alternative C.

Barriers: Alternative D would have effects on fish-barrier culverts and make additional habitat available similar to all action alternatives (See Alternative B, Issue 7).

Key Points

- Stable in-stream structures would be created on 199.5 miles of 1st-2nd-order streams and 8.2 miles of 3rd-5th-order streams in 10 years.
- 92% of young riparian forests would develop sufficient density of very large (≥32” dbh) conifers in 100 years.
- Existing road-related sedimentation would be reduced to 74.0 cubic yards/year. Restoration actions would cause a total of 10.0 cubic yards of sediment/year.
- Removal of 10 barrier culverts would open 7.0 miles of new coho salmon habitat.

ISSUE 8: *How would restoration activities affect the presence and spread of noxious weeds?*

Alternative D would result in some disturbance to both soils and existing vegetation from forest management and aquatic restoration activities in stands ≤60 years old, which could potentially result in further establishment and spread of noxious weeds in treated stands within the planning area.

Decommissioning 45 miles of road would reduce the vectors for the introduction, establishment, and spread of noxious weeds within the planning area. Alternative D would include only 3.6 miles of new road construction, which would be temporary and would provide vectors for the spread of noxious weeds only until the roads are decommissioned.

Effects on noxious weeds on roads that are not decommissioned would be the same as in Alternative A.

Key Points

- Decommissioning 45 miles of road would be only slightly offset by construction of 3.6 miles of new roads and would reduce noxious weed establishment and spread.

ISSUE 9: *What would be the economic effects of restoration activities?*

Under Alternative D, 5,500 acres would be treated with non-commercial silvicultural treatments, which would generate an estimated 195 months of contract work over the entire 10-year span of the proposed plan. There would be 11 month of work for silvicultural treatments for each of the first three years of implementation, 38 months of work for each of the second three years, and 11 months of work for each of the final four years.

Decommissioning 45 miles of road would generate 18 months of contract work.

Replacing 10 culverts would generate 11 months of contract work, the same as in all action alternatives.

In-stream restoration would generate 12 months of contract work, the same as in Alternatives C and F.

There would be 3,100 acres of commercial thinning timber sales over the 10-year span of the proposed plan, which would generate $11.6 million in revenues.

Key Points

- 236 months of contract work over 10 years.
- $11.6 million of revenue over 10 years.

ISSUE 10: *What are the costs of restoration?*

For the 10-year span of the proposed plan, silvicultural treatments in Alternative D would incur $920,000 in contract costs and $5.5 million in BLM staff costs (122 work months per year, or $550,000 per year, much of which would be the preparation of timber sales).

Decommissioning 45 miles of road would incur $675,000 in contract costs and $450,000 in BLM staff costs. Culvert replacement costs would be the same as in all action alternatives (see Alternative B). In-stream restoration would incur $80,000 in contract costs and $40,000 in BLM staff costs.

Key Points

- $2.4 million in contract costs over 10 years.
- $6.4 million in BLM staff costs over 10 years.

ALTERNATIVE E

Reduce stand densities as quickly as possible

Alternative E is designed to achieve tree densities typical of local late-successional forests as soon as possible. All commercial thinning would be completed within the next 10 years. Trees would be felled or pulled into all streams adjacent to stands ≤80 years old, but woody debris would not be cabled for stability. Alternative E would decommission eroding roads and roads in or adjacent to late-successional forest. New roads would be constructed as needed.

ISSUE 1: *How would road decommissioning and road management actions alter public access to BLM-managed lands?*

Under Alternative E, road decommissioning and effects on public access would be the same as in Alternative D.

Key Points

- 45 miles (27%) of road on BLM-managed land would be decommissioned.

ISSUE 2: *How much new road construction would be needed to implement restoration actions?*

Under Alternative E, most or all of the new road construction would be temporary construction; the new roads would be decommissioned and blocked following the completion of thinning operations. It is possible, but unlikely, that a portion of the new road construction would need to be permanent road construction with gravel or paved surface. Although there would be no permanent stream crossings, temporary crossings would be likely to occur, but would be single-season use only.

No road construction would be needed to treat the very young (≤20 year old) stands, because the existing road system would provide adequate access for non-commercial thinning.

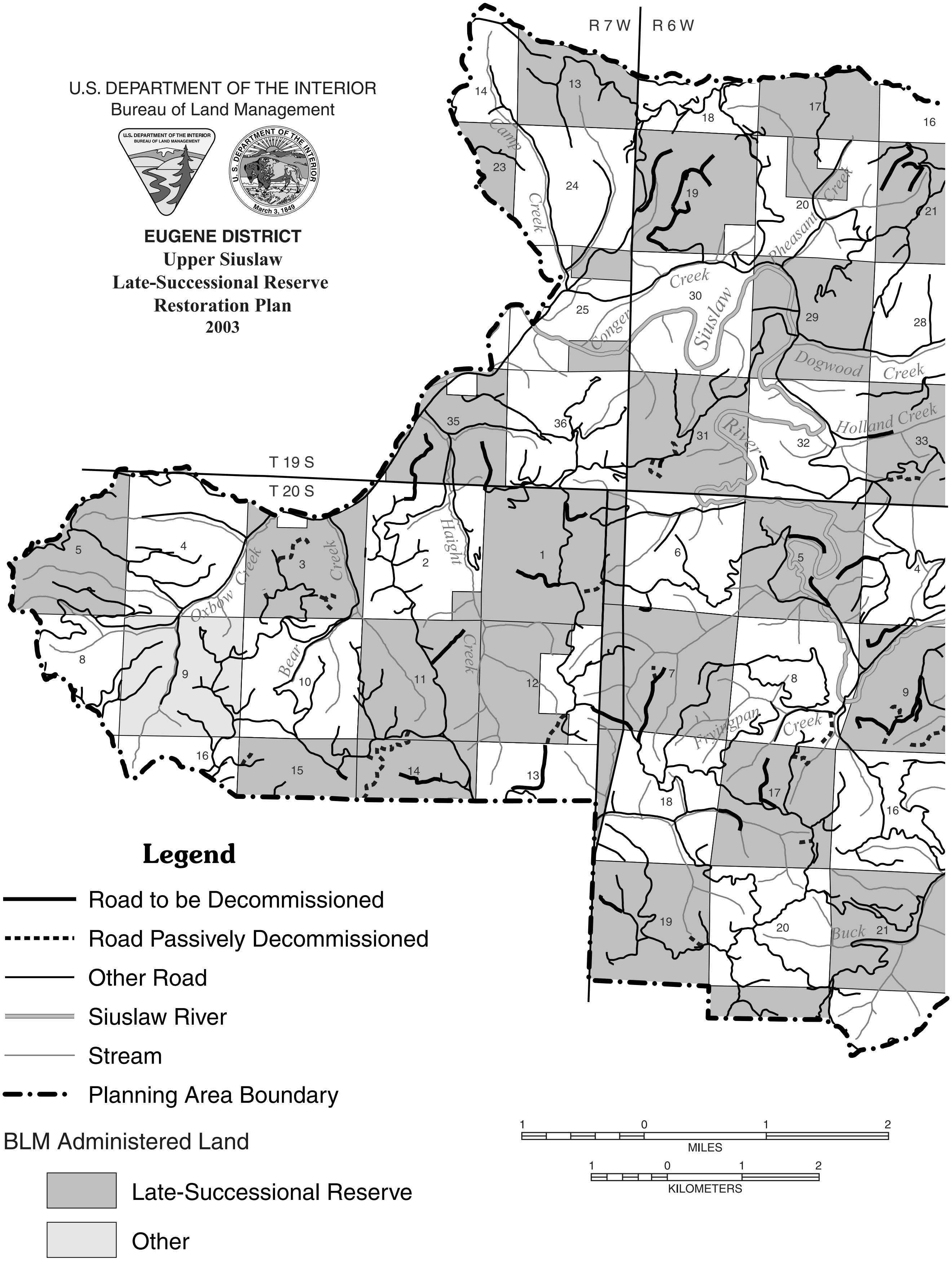
Under Alternative E, there would be approximately 5,400 acres of 21-40-year-old stands treated. For each treatment unit (averaging 25 acres per unit), 50’ of temporary spurs would be constructed (the same assumption as described under Alternative D). Therefore, approximately 10,850’ of new roads would be constructed to implement restoration actions in the 21-40 year age classes.

In addition, there are approximately 1,680 acres of 41-60-year-old stands treated under Alternative E. For these stands, 40.2’ of new roads would be constructed per acre that would harvested (the same assumption as described under Alternative C). Therefore, approximately 67,500’ of new road would be constructed to implement restoration actions in the 41-60 year age classes.

In total, under Alternative E, there would be approximately 15.0 miles of new road constructed in order to implement silvicultural restoration actions.

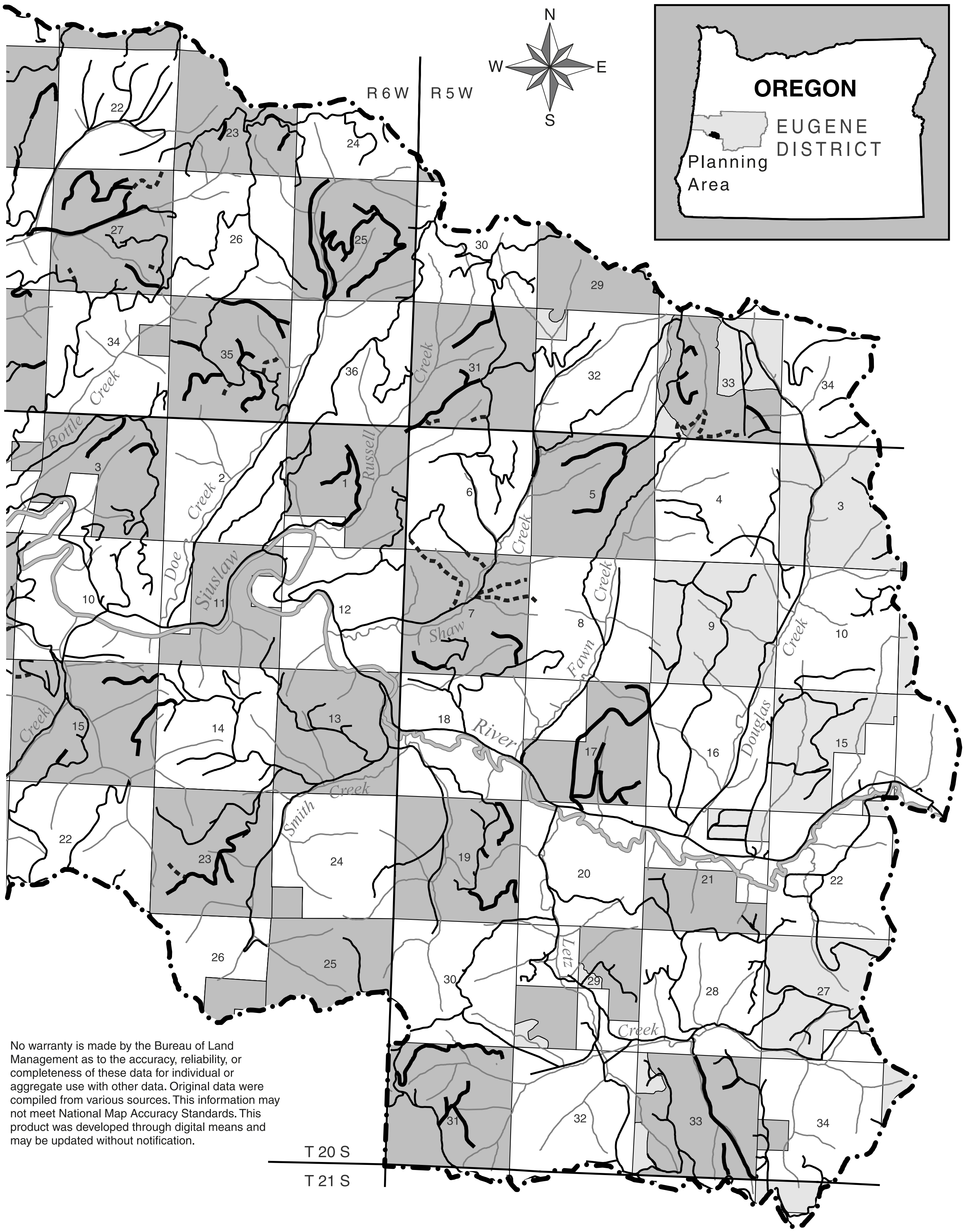
Key Points

- 15.0 miles of new temporary road would be constructed.



Note: Alternative E is identical to Map 4: Alternative D

Map 5: Alternative E - Road Decommissioning



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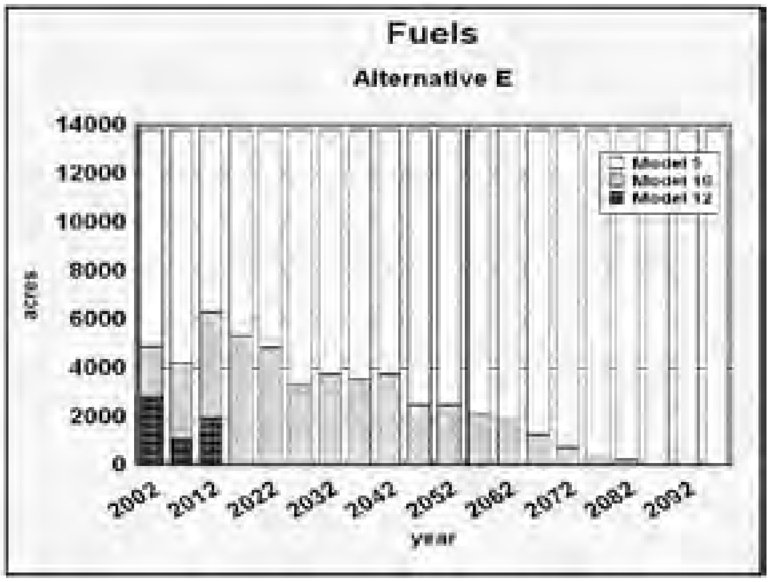
ISSUE 3: *What level of risk to existing late-successional forest would result from restoration activities?*



Graph 28.

Fire: Similar to Alternatives B and D, thinning in Alternative E would immediately create a substantial acreage (2,800 acres) in Fuel Model 12 (see Graph 28). These acres would quickly decrease as the slash would decompose, so that the acres in Model 12 would largely disappear within 15 years. Even more dramatically than Alternative B, the thinning in Alternative E would reduce the acreage in Model 10 and shorten the time before these acres move back into Model 5. Throughout the 100-year analysis period, Alternative E would maintain the majority of the landscape in Model 5, which presents a much lower risk of catastrophic fire.

Bark Beetles: At the individual stand scale, there would be some increased risk of bark beetle damage under Alternative E. Approximately 4,300 acres of young stands would experience tree mortality, with a total of approximately 4,300-17,000 trees killed by bark beetles. Otherwise, the stand-level effects of Alternative E would be similar to Alternative D.

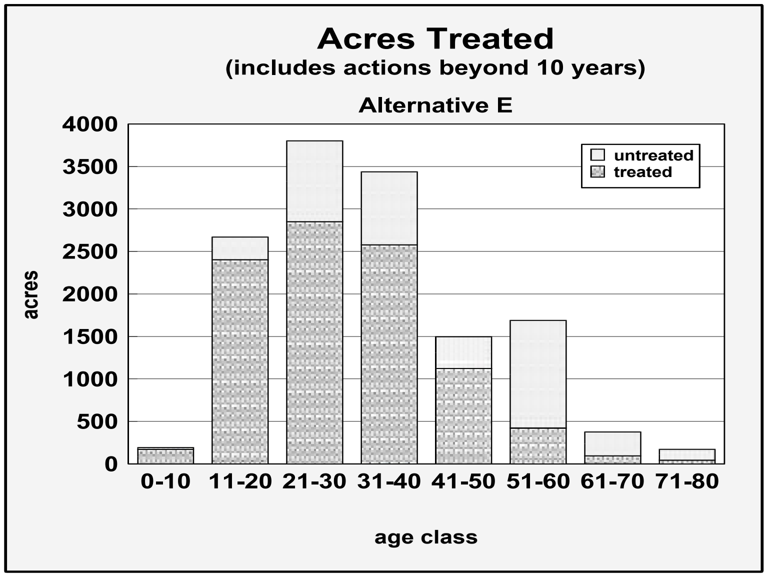
At the landscape scale, bark beetle populations would be the highest of all alternatives, because of the greater acreage treated. There would be an increased risk of bark beetle attack on large trees in late-successional stands near thinned, young stands. However, there would still not be a high risk to existing late-successional forests and mitigation measures would still be effective, if needed, at reducing mortality levels, similar to Alternative B.

Key Points

- Thinned stands would move into a low risk fuel model, resulting in an overall low risk of severe fire.
- Bark beetles would likely cause some individual tree mortality, but would not pose a high risk to existing late-successional forests.

ISSUE 4: *How would thinning affect development of late-successional forest structural characteristics?*

Under Alternative E, approximately 4,100 acres of the 13,800 acres of young stands would receive no treatment and would continue on their existing developmental pathway (see Graph 29). These untreated stands would develop as described under Alternative A.



Graph 29.

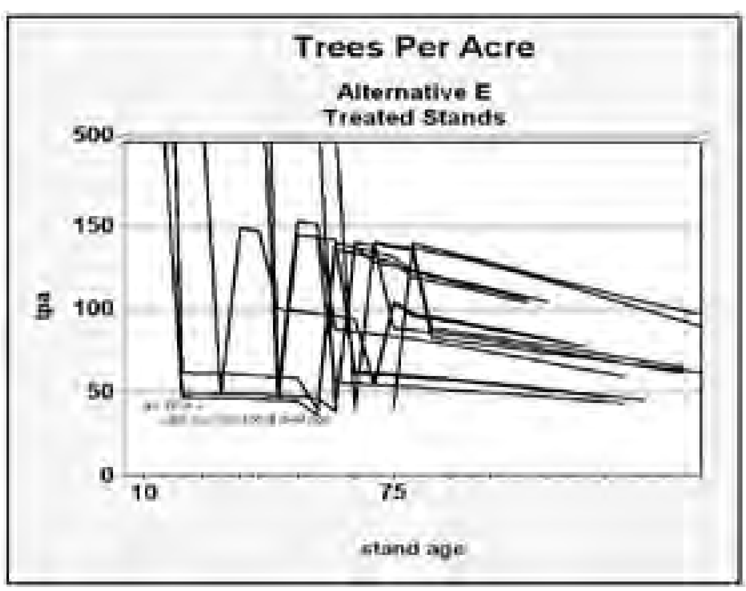
Alternative E would thin approximately 9,700 acres during the 10-year span of the proposed plan. It is reasonably foreseeable that under the management approach of Alternative E, most or all of these acres would receive additional non-commercial treatments beyond the 10-year span of the proposed plan.

Within the 100-year analysis period, approximately 8,800 acres of the stands currently ≤80 years old would develop late-successional structure. Alternative E would be the most effective alternative at speeding the development of late-successional structure.

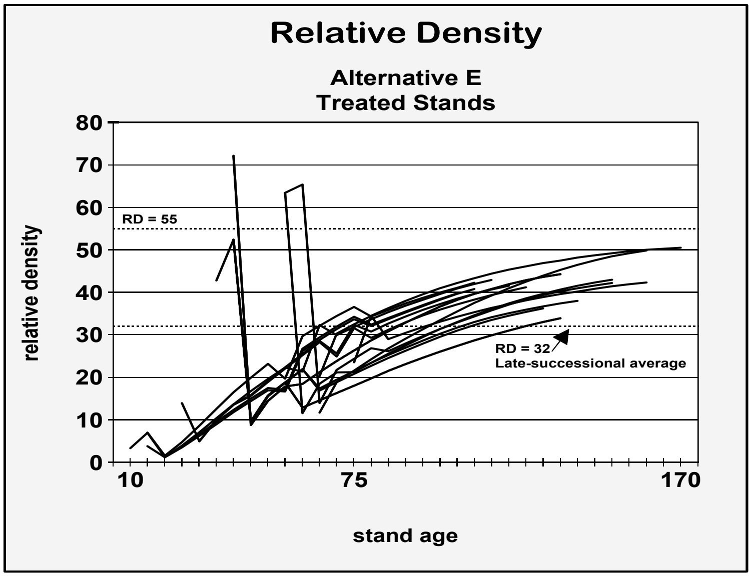
Figure 40. *Alternative E would thin mid-seral stands to the same low densities as young stands.*

Figure 41. *Alternative E would proportionally thin young stands to low densities with uneven spacing.*

Alternative E would be similar to Alternative D (but would differ from Alternatives B, C, and F) in that it would use proportional thinning (which removes trees across all diameters in proportion to their occurrence within the stand). The thinning prescriptions in stands >20 years old would not be as limited as in Alternative B, because removal of some cut trees in Alternative E would mitigate fuel loadings and bark beetle impacts. Thinning would increase individual tree growth rates and thereby increase stand mean tree diameters. These thinning prescriptions would not reduce the range of tree diameters as in Alternatives B, C, and F, which use thinning from below. Alternative E would employ only relatively heavy thinning prescriptions, thinning stands more heavily than the heaviest prescriptions in Alternative D (see Table 6 and Figures 40 and 41). Under most prescriptions, overstory densities would be low enough to permit good to excellent growth of shade-tolerant conifers. It is reasonable to assume that later coarse woody debris treatments would delay overstory reclosure. Development of understories of shade-tolerant conifers would be somewhat inhibited in older stands, because the overstory would be too dense, even after thinning, to allow for maximum growth of shade-tolerant conifers. Growth of the shade-tolerant understory would likely continue



Graph 30.

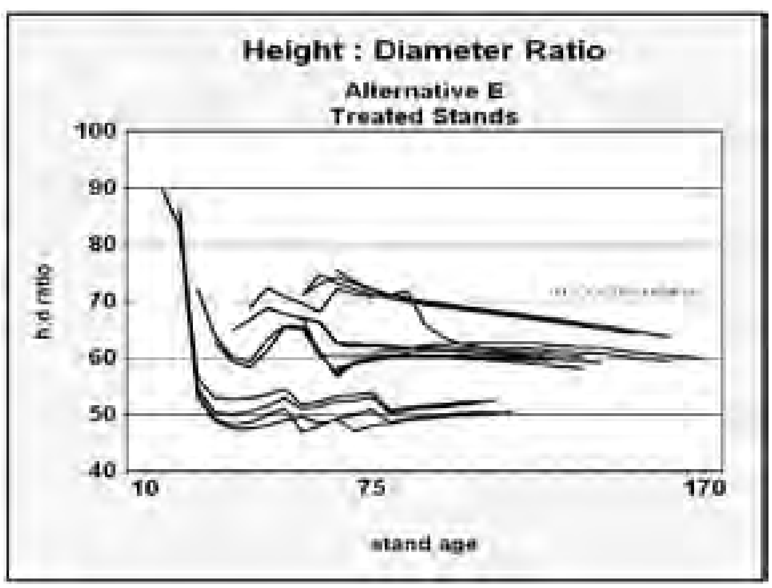


Graph 31.

past the 100-year analytical period, and would result in some stands that have a predominance of western hemlock and western red-cedar. In order to manage the understory density, some non-commercial thinning of the shade-tolerant conifer understory might be necessary.

Stands <21 years old would be non-commercially thinned to 35-55 Douglas-fir TPA. The effect of this thinning would be similar to the heaviest thinning prescription for this age class in Alternative B. Trees between 2"-8" dbh would be cut. By the end of the analytical period, these stands would have 80-100 TPA, of which 20-25 would be Douglas-fir overstory trees. (Graph 30 shows dramatic increases in TPA at stand ages 30-80; these increases result from underplanting). Stand relative densities would be around 40, well below the point at which density-dependent mortality would occur (see Graph 31). Overstory trees would have full crowns. These stands would develop height:diameter ratios around 50, which would be very stable (Lohmander and Helles 1987; Wilson and Oliver 2000) (see Graph 32).

Stands 21-40 years old would be thinned proportionally to 35-55 Douglas-fir TPA with some removal of cut trees. Trees between 4"-18" dbh would be cut. Thinning would generally include removal of cut trees to reduce fuel and bark beetle risk. At the end of the 100-year analysis period, these stands would have 80-100 TPA, of which 25 -30 would be Douglas-fir overstory trees (see Graph 30). Stand relative densities would be around 40, well below the point at which density-dependent mortality would occur (see Graph 31). For example, Figures 42 and 43 illustrate the development of the 30-year-old stand, showing the thinning treatment in 2002, and the open overstory and good development of the shade-tolerant understory in 2097. These stands would develop height: diameter ratios



Graph 32.

around 60, which would be stable (Lohmander and Helles 1987; Wilson and Oliver 2000) (see Graph 32).

Stands 41-60 years old would be thinned proportionally to 35-55 Douglas-fir TPA. Trees between 4”-20” dbh would be cut. Thinning would generally include removal of cut trees to reduce fuel and bark beetle risk. At the end of the 100-year analysis period, these stands would have 50-90 TPA, of which 25-30 would be Douglas-fir overstory trees (see Graph 30). Stand relative densities would be 40-45, well below the point at which density-dependent mortality would occur (see Graph 31). These stands would develop height : diameter ratios between 60-65, which would be stable (Lohmander and Helles 1987; Wilson and Oliver 2000) (see Graph 32).

Stands 61-80 years old would be thinned to 35-55 Douglas-fir TPA, but some stands would be proportionally thinned and some would be thinned from below, based on site-specific stand conditions. Many of these older, high-density stands with no history of management may not be suitable for proportional thinning: the smaller diameter trees, because of a long period of suppression, may not respond to increased growing space and may be at risk of wind damage after thinning. Therefore, under Alternative E, only half of the treated stands 61-70 years old would be proportionally thinned. The other half of the stands 61-70 years old and all of the treated stands 71-80 years old would be thinned from below. In the proportionally thinned stands, trees between 4”-24” dbh would be cut. In the stands thinned from below, trees between 4”-18” would be cut. Thinning would generally include removal of cut trees to reduce fuel and bark beetle risk. At the end of the 100-year analysis period, under both prescriptions, these stands would have 60-90 TPA, of which 25-30 would be Douglas-fir overstory trees (see Graph 30). Stand relative densities would be 40-50, below the point at which density-dependent mortality would occur (see Graph 31). These stands would develop height:diameter ratios between 60-65, which would be stable (Lohmander and Helles 1987; Wilson and Oliver 2000) (see Graph 32). However, thinning from below appears to reduce dramatically the effectiveness of the treatment at speeding the growth of shade-tolerant conifers and spreading the range of tree diameters, while proportional thinning appears to be effective even in stands 61-70 years old.

Table 6. - Stand Treatment and Results Summary Alternative E

STAND TREATMENT AND RESULTS		STAND AGE			
		<21	21-40	41-50	51-80
Thinning prescription (during 10-year span of proposed plan)	TPA*	30-35	35-55	35-55	35-55
Resulting Stand Characteristics (end of 100-year analysis period)	TPA	80-100	80-100	50-90	60-90
	RD	40	40	45-50	40-50
	H:D	50	60	60-65	60-65

*Uplands and 100-foot riparian areas would receive same treatments

In summary, Alternative E would treat a large portion of the stands currently ≤80 years old in the planning area, and the thinning prescriptions would speed the development of late-successional forest structural characteristics. Thinning and subsequent planting of shade-tolerant conifers would be most effective in stands 21-60 years old and in the stands 61-70 years old that would be proportionally thinned. Thinned stands would be stable and would be open in character for an extended period of time (see Table 6). Overstory trees would develop and retain large, full crowns. The proportional thinning prescriptions would retain much of the size range of the overstory and allow additional differentiation of the overstory, and would allow development of shade-tolerant understories.

Key Points

- 9,700 acres (70%) of stands currently ≤80 years old would be treated over 10 years.
- 8,800 acres would develop late-successional structure.
- Thinning would most effectively speed development of late-successional structure in stands 21-60 years old and in the stands 61-70 years old that would be proportionally thinned.
- Thinning would be ineffective in stands 61-80 years old that would be thinned from below, but stands would be stable.

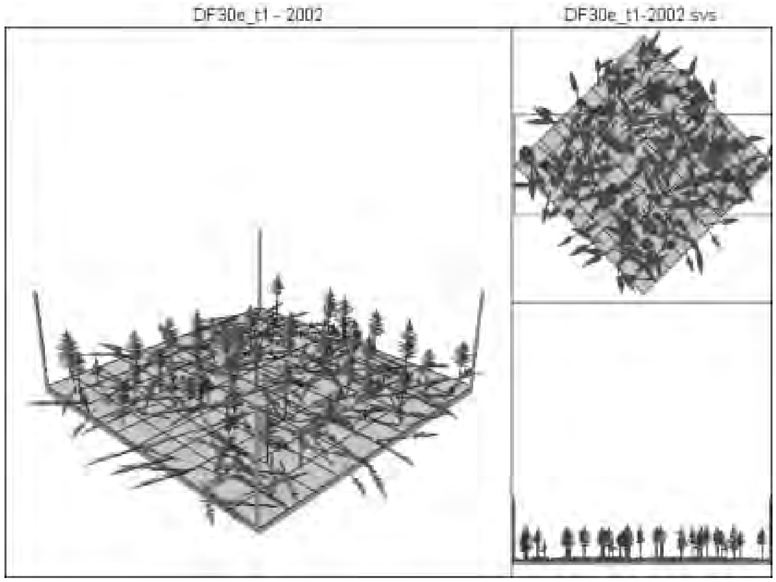


Figure 42. *Thinning of the 30-year-old Type Stand*

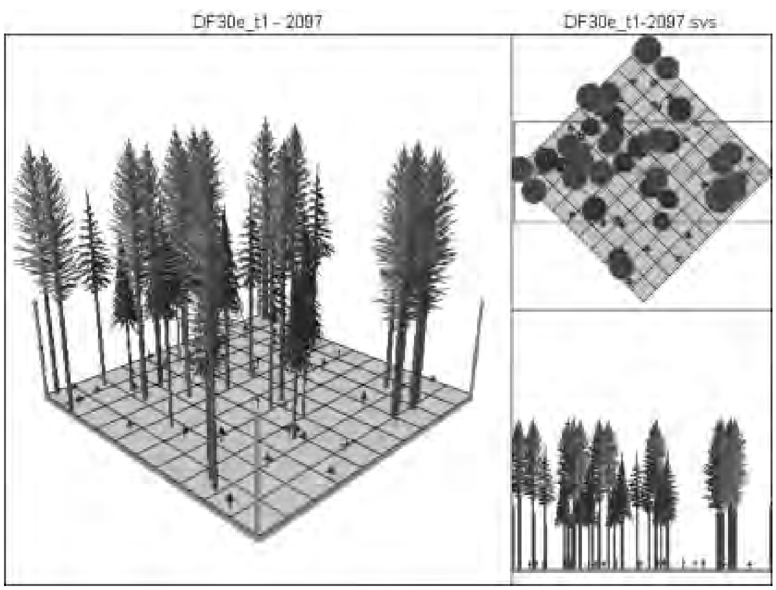


Figure 43. *Development of the 30-year-old Type Stand*

ISSUE 5: *What are the effects of restoration activities on marbled murrelet habitat?*

Alternative E would thin stands ≤80 years old, but would avoid adverse effects to marbled murrelets by evaluating stands 50-80 years old prior to thinning to determine if stands are potential habitat for marbled murrelets. Stands that are potential habitat would be thinned only if surveys find the stands to be unoccupied by marbled murrelets.

Under Alternative E, stands would develop trees ≥32" dbh at a faster rate than any other alternative. In addition, Alternative E would speed the development of large branches more than any other alternative. In 50 years, 8,300 acres would have at least one tree per acre with at least one branch 5" in diameter. In Alternative E, nearly all of the stand currently ≤80 years old would have at least one tree per acre with at least one branch 5" in diameter within the100-year analysis period (13,600 acres or 98%). The maximum branch size in Alternative E would be larger than in Alternative A for all age classes (1-1/2" - 2" larger at the end of the 100-year analysis period).

Under Alternative E, 3,900 acres (28% of stands currently ≤80 years old) would achieve target habitat conditions within the 100-year analysis period. These stands would develop a range of tree diameters, support shade-tolerant conifers, and grow large trees.

Key Points

- All stands would have trees ≥32" dbh, and almost all would develop branches 5" and larger (up to 7") within 100 years.
- 3,900 acres of young stands would achieve target habitat conditions within 100 years.

ISSUE 6: *What are the effects of restoration activities on northern spotted owl habitat?*

Alternative E would temporarily reduce the amount of dispersal habitat, but would most effectively develop suitable and target habitat conditions nesting habitat. Alternative E would thin stands ≤80 years old, but would generally avoid thinning stands 51-80 years old within current owl home ranges, and thereby avoid degrading suitable habitat within home ranges. Alternative E may affect critical habitat by reducing the amount of dispersal habitat in the planning area.

Under Alternative E, thinning would drop the amount of current dispersal habitat from 3,700 acres to 2,400 acres in 5 years. Alternative E is the only alternative that would reduce the amount of dispersal habitat below current levels. In 10 years, the amount of dispersal habitat would return to current levels. This 10-year reduction in the amount of dispersal habitat may adversely affect spotted owls. Under Alternative E, additional dispersal habitat would develop more slowly than any other alternative. Most of the stands currently ≤80 years old (13,000 or 94%) would become dispersal habitat in 60 years, and all stands would become dispersal habitat in 65 years.

Alternative E would develop more suitable habitat and target habitat conditions than any other alternative: 9,600 acres (70% of stands currently ≤80 years old) would become suitable habitat within the 100-year analysis period. Almost as much acreage – 8,800 acres (64%) – would achieve target habitat conditions within the 100-year analysis period.

Key Points

- All young stands would develop into dispersal habitat, but more slowly than any other alternative. Dispersal habitat would decrease from current levels for 10 years.
- 9,600 acres would develop into suitable habitat within 100 years.
- 8,800 acres would achieve target habitat conditions within 100 years.

ISSUE 7: *What are the effects of restoration activities on coho salmon habitat?*

In-stream structure: Alternative E would create in-stream woody debris structures, but would differ from Alternatives C, D, and F in that structures would not be cabled to assure structural stability. Alternative E would thin 2,400 acres (70%) of riparian areas and would create approximately 160 pieces/mile of woody debris along all streams with riparian stands ≤80 years old (199.5 miles of 1st-2nd-order streams; 55.4 miles of 3rd-5th-order streams). This quantity would meet the ODFW minimum riparian habitat benchmark for total pieces of woody debris. In most stands, trees felled to the stream would be 8”-20” diameter, generally larger than in all other alternatives. On 1st-2nd-order streams, this woody debris would be generally stable and would result in increased stream complexity of 199.5 miles of 1st -2nd-order streams (although this debris would likely not be stable in the event of a flood larger than the 50-year flood).

Alternative E would be able to create logs ≥24” in diameter from stands >50 years old and thus would be able to create stable in-stream structure in 3rd-5th-order streams adjacent to 51-80-year-old stands (5.8 miles of the 3rd-5th-order streams) (see Figure 44). In 3rd-5th-order streams adjacent to younger stands, the woody debris created would not be stable and would likely be lost from the stream system following a 50-year flood, except on the

Figure 44. *Alternative E would create stable in-stream structure on larger streams adjacent to mid-seral stands.*

five stream systems with existing stable structure (see Chapter 3). It is not reasonably foreseeable that a sufficient number of logs ≥24" diameter would be available from off-site to make up for this deficit in streams in younger stands. However, beyond the 10-year span of the proposed plan, it is reasonably foreseeable that 5 TPA would be felled at 10-year intervals in thinned riparian stands, providing logs generally 12"-24" diameter, with some logs ≥24" diameter in later treatments. In approximately 40-50 years, woody debris creation in most stands currently less than 35 years old would be able to provide stable, in-stream structure in 3^{rd}-5^{th}-order streams. Therefore, Alternative E would create stable in-stream structure on 5.8 miles of 3^{rd}-5^{th}-order streams, but woody debris created on other 3^{rd}-5^{th}-order streams would not be stable for the next 40-50 years.

Riparian stands: Alternative E would have effects on the development of riparian trees big enough to provide key pieces of woody debris (≥24" dbh) similar to all alternatives (See Alternative A, Issue 7). However, it would take considerably longer to develop sufficient density of very large trees that would provide more stable key pieces of woody debris (≥32" dbh): at the end of the 100-year analysis period, approximately 3,300 acres out of 3,400 riparian acres (95%) would have developed ≥13 TPA ≥32" dbh. Alternative E is faster than all other alternatives to develop sufficient density of these larger trees.

Sedimentation: Alternative E would have effects on sedimentation from existing roads, road decommissioning, and culvert replacement and removal similar to Alternative B.

Alternative E includes approximately 15.0 miles of new road construction, which would be decommissioned after a single logging season. The new road construction would include approximately 8 temporary stream crossings over the 10-year plan period, which would cause temporary pulses of approximately 0.8 cubic yards of sediment/year over 10 years from culvert placement and removal.

Alternative E would not construct in-stream structures as would Alternatives C, D, and F, but would fall or pull over trees into streams, which would cause temporary pulses of approximately 1.0 cubic yard of sediment/year over 10 years from disturbance to the stream channel bed and banks.

Barriers: Alternative E would have effects on fish-barrier culverts and make additional habitat available similar to all action alternatives (See Alternative B, Issue 7).

Key Points

- Stable in-stream structure would be created on 199.5 miles of 1^{st}-2^{nd}-order streams, and 5.8 miles of 3^{rd}-5^{th}-order streams in 10 years.
- 95% of young riparian forests would develop sufficient density of very large (≥32" dbh) conifers in 100 years.
- Existing road-related sedimentation would be reduced to 74.0 cubic yards/year. Restoration actions and associated road construction would cause a total of 10.8 cubic yards of sediment/year.
- Removal of 10 barrier culverts would open 7.0 miles of new coho salmon habitat.

ISSUE 8: *How would restoration activities affect the presence and spread of noxious weeds?*

Alternative E would result in some disturbance to both soils and existing vegetation from forest management and aquatic restoration activities in stands ≤80 years old, which could potentially result in further establishment and spread of noxious weeds in treated stands within the planning area.

The decommissioning of 45 miles of road would reduce the vectors for the introduction, establishment, and spread of noxious weeds within the planning area, but would be partially offset by the construction of 15.0 miles of new road, the most new road construction of any alternative. However, new road construction would be temporary and would provide vectors for the spread of noxious weeds only until the temporary roads are decommissioned.

Effects on noxious weeds on roads that are not decommissioned would be the same as in Alternative A.

Key Points

- Decommissioning 45 miles of road would be partially offset by construction of 15.0 miles of new roads, but would reduce noxious weed establishment and spread.

ISSUE 9: *What would be the economic effects of restoration activities?*

Under Alternative E, 9,700 acres would be treated with non-commercial silvicultural treatments, which would generate approximately 320 months of contract work over the entire 10-year span of the proposed plan. There would be 100 months of work for silvicultural treatments for each of the first three years of implementation, 130 months of work for each of the second three years, and 90 months of work for each of the final four years.

Decommissioning 45 miles of road would generate 18 months of contract work, the same as in Alternative D.

Replacing 10 culverts would generate 11 months of contract work, the same as in all action alternatives.

Falling and pulling riparian trees for in-stream structure would generate 35 months of contract work (23 months for falling 160 trees per mile over 77 miles, and 12 months for pulling and yarding 2 trees per mile over 77 miles).

There would be approximately 3,900 acres of commercial thinning timber sales within the 10-year period, which would generate $20.2 million in revenues

Key Points

- 384 months of contract work over 10 years.
- $20.2 million of revenue over 10 years.

ISSUE 10: *What are the costs of restoration?*

For the 10-year span of the proposed plan, silvicultural treatments in Alternative E would incur approximately $2.23 million in contract costs and $9.7 million in BLM staff costs (220 work months per year, or $970,000 per year, much of which would be the preparation of thinning timber sales).

Road decommissioning costs would be the same as in Alternative D. Culvert replacement costs would be the same as in all action alternatives (see Alternative B). In-stream restoration would incur $190,000 in contract costs and $75,000 in BLM staff costs.

Key Points

- $3.9 million in contracts over 10 years.
- $10.6 million in BLM staff costs over 10 years.

ALTERNATIVE F

Multi-entry and multi-trajectory thinning

Alternative F is designed to accomplish restoration using multiple thinning of stands to maintain stand vigor and develop stand stability while maintaining canopy closure. In-stream woody debris structures would be constructed on larger streams, and some structures would be cabled for stability. Alternative F would decommission eroding roads and roads in late-successional forest and would construct new roads as needed.

ISSUE 1: *How would road decommissioning and road management actions alter public access to BLM-managed lands?*

Alternative F is similar to Alternative C in terms of the miles of road that would be decommissioned. Under the multiple commercial thinning scenario of Alternative F, a permanent road network would be necessary, limiting opportunities for road decommissioning.

Key Points

- 24 miles (14%) of road on BLM-managed land would be decommissioned.

ISSUE 2: *How much new road construction would be needed to implement restoration actions?*

Under Alternative F, most or all of the new road construction would be temporary construction; the new roads would be decommissioned and blocked following the completion of thinning operations. Even though many roads would need to be reused for future thinning, new road construction would be decommissioned between stand entries. It is possible, but unlikely, that a portion of the new road construction would need to be permanent road construction with gravel or paved surface. Although there would be no permanent stream crossings, temporary crossings would be likely to occur, but would be single-season use only.

No road construction would be needed to treat the very young (≤24 year old) stands, because the existing road system would provide adequate access for pre-commercial thinning.

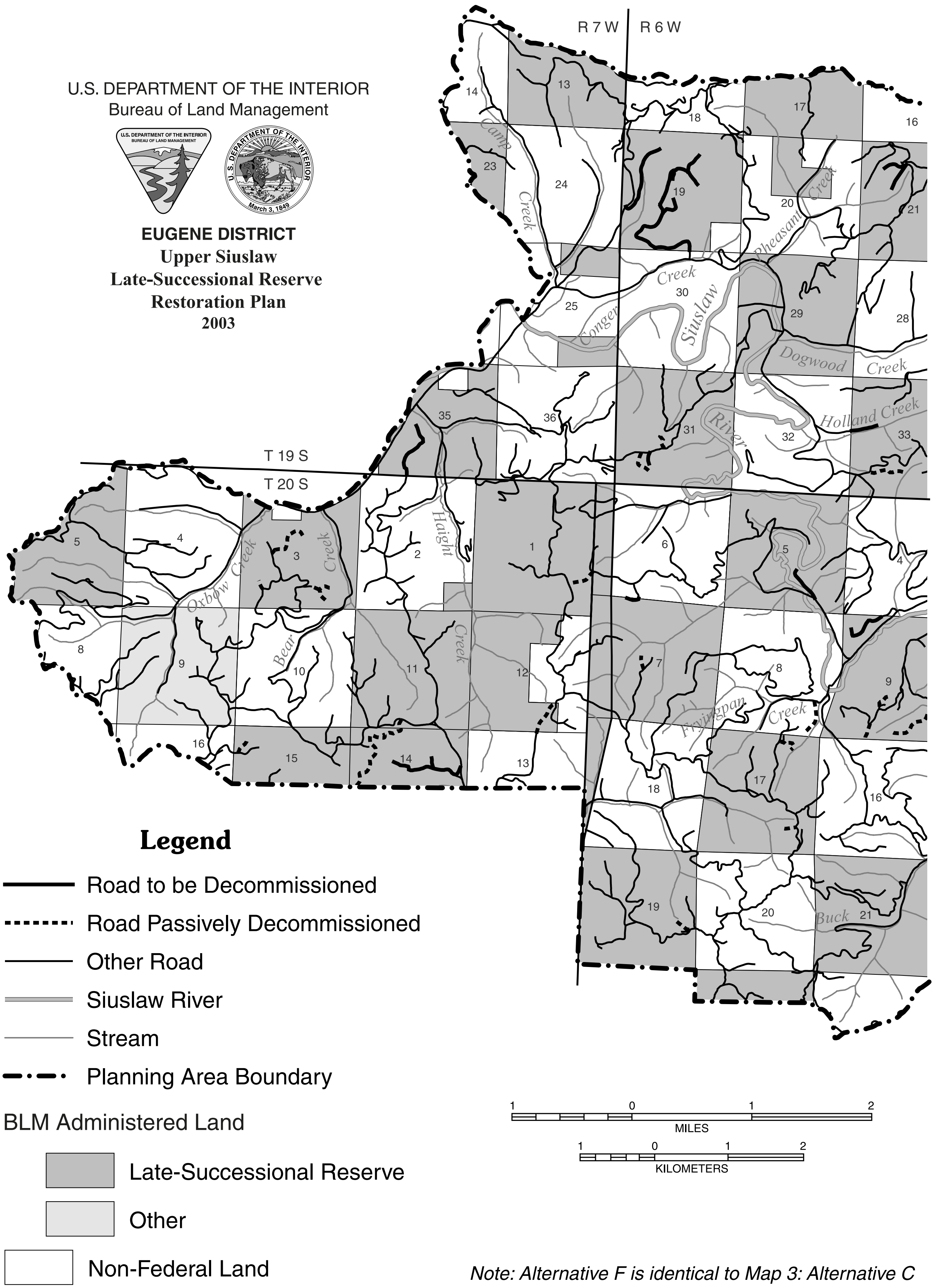
Under Alternative F, there would be approximately 3,055 acres of 25-40 year old stands treated. For each treatment unit (averaging 25 acres per unit), 50’ of temporary spurs would be constructed (the same assumption as described under Alternative D). Therefore, approximately 6,100’ of new road would be constructed to implement restoration actions in the 25-40 year age classes.

In addition, there are approximately 1,350 acres in the 41-80-year-old stands treated under Alternative F. For these stands, 40.2’ of new road would be constructed per acre that would harvested (the same assumption as described under Alternative C). Therefore, approximately 52,270’ of new road would be constructed to implement restoration actions in the 41-80 year age classes.

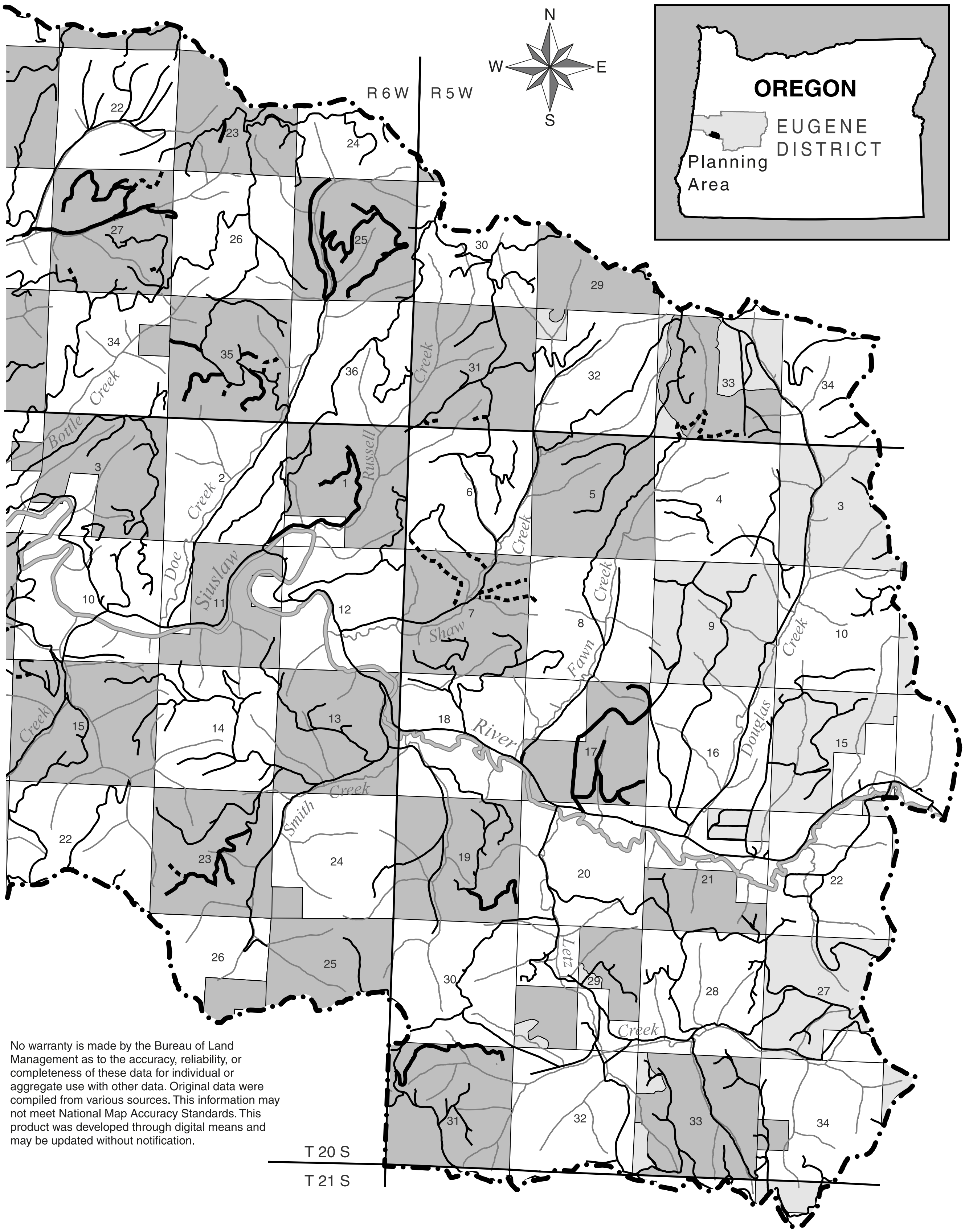
In total, under Alternative F, there would be approximately 11.5 miles of new road constructed in order to implement silvicultural restoration actions.

Key Points

- 11.5 miles of new temporary road would be constructed.


U.S. DEPARTMENT OF THE INTERIOR
Bureau of Land Management
EUGENE DISTRICT
Upper Siuslaw
Late-Successional Reserve
Restoration Plan
2003
R 7 W
R 6 W
T 19 S
T 20 S
Camp Creek
Conger Creek
Siuslaw River
Pheasant Creek
Dogwood Creek
Holland Creek
Oxbow Creek
Haight Creek
Bear Creek
Fryingpan Creek
Buck
Legend
Road to be Decommissioned
Road Passively Decommissioned
Other Road
Siuslaw River
Stream
Planning Area Boundary
BLM Administered Land
Late-Successional Reserve
Other
Non-Federal Land
MILES
KILOMETERS
Note: Alternative F is identical to Map 3: Alternative C

Map 6: Alternative F - Road Decommissioning



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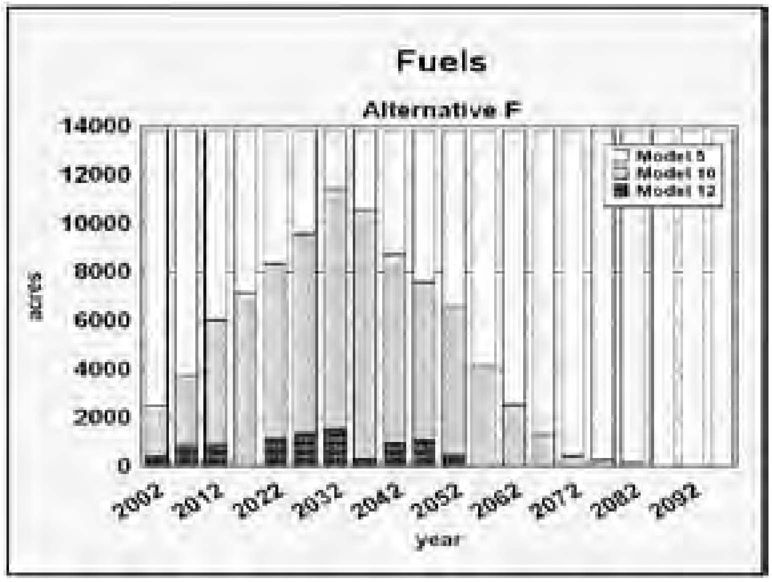
ISSUE 3: *What level of risk to existing late-successional forest would result from restoration activities?*

Fire: Similar to Alternative C, thinning in Alternative F would periodically create a small acreage (<2,000 acres) in Fuel Model 12, but these acres would quickly decrease as the slash decomposes (see Graph 33). Alternative F would periodically create more acres in Model 12 in future decades as a result of repeated thinning. The analysis may overstate the amount of fuel that would be created by the future thinning, which may not result in Model 12 fuel levels (and a shorter subsequent time in Model 10). The thinning in Alternative F would only slightly reduce the future acreage in Model 10, compared to Alternative A, but repeated thinning would shorten the time that a large acreage would be in Model 10. This would still present a substantial risk of severe fire, although less so than Alternatives A or C.



Graph 33.

Bark Beetles: At the individual stand scale, there would be some increased risk of bark beetle damage under Alternative F. Approximately 1,900 acres of young stands would experience tree mortality, with a total of approximately 1,900-11,600 trees killed by bark beetles. This relatively low intensity of mortality (approximately 1-6 TPA) would have little effect of stand structure, but would contribute to snag and coarse woody debris levels. Some additional bark beetle mortality would occur if snags and coarse woody debris are created at the time of thinning, similar to Alternative C. If snag and coarse woody debris creation is delayed, any additional effect may be moderated by adaptive management: tree mortality caused by bark beetles following thinning may obviate the need for snag and coarse woody debris creation, similar to Alternatives B, D, and E. If a natural disturbance, such as a severe windstorm, were to occur, bark beetles would likely cause additional tree mortality. However, the thinning in Alternative F would create stands that would be relatively stable, which would reduce the likelihood of extensive blowdown (see Issue 4).

At the landscape scale, bark beetle populations would be slightly lower than Alternative B, and there would be a slightly lower risk of bark beetle attack on large trees in late-successional stands near thinned, young stands. Otherwise, effects of Alternative F on bark beetle populations would be similar to Alternative B.

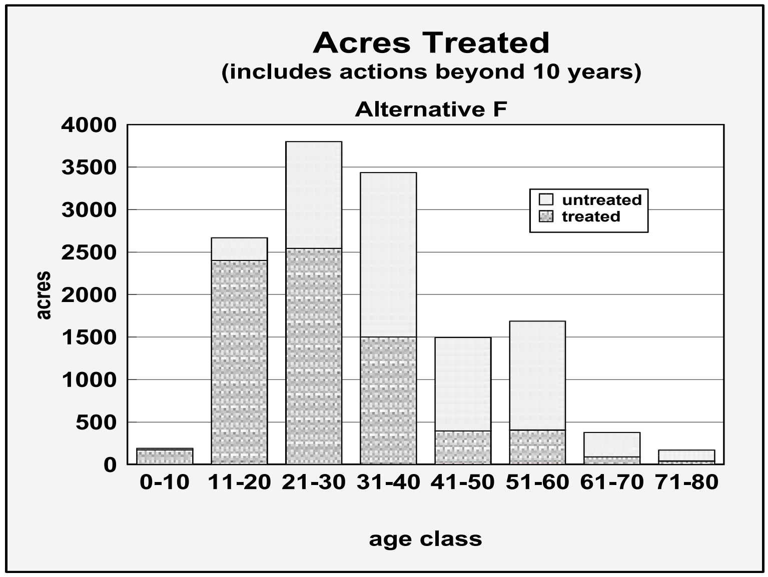
Key Points

- Thinned stands would move into a low-risk fuel model, but the large acreage of unthinned stands would pose a risk of severe fire.
- Bark beetles would likely cause some individual tree mortality, but would not pose a high risk to existing late-successional forests.

ISSUE 4: *How would thinning affect development of late-successional forest structural characteristics?*

Under Alternative F, approximately 6,300 acres of the 13,800 acres of young stands would receive no treatment and would continue on their existing developmental pathway (see Graph 34). These untreated stands would develop as described under Alternative A.

Alternative F would thin approximately 6,100 acres during the 10-year span of the proposed plan. It is reasonably foreseeable that under the management approach of Alternative F, most of these acres would receive additional thinning beyond the 10-year span of the proposed plan, and 1,400 additional acres would be thinned.



Graph 34.

Within the 100-year analysis period, approximately 1,000 acres of stands currently ≤80 years old would develop late-successional structure. Alternative F would have limited effectiveness at speeding the development of late-successional structure. The repeated thinning from below would maintain or increase the vigor of the residual trees, increasing the mean diameter and canopies of the residual trees within the stand (see Figure 45). However, the growth of the shade-tolerant understory would be inhibited by the maintenance of high levels of canopy closure. The repeated thinning from below would continually reduce the range of tree diameters.

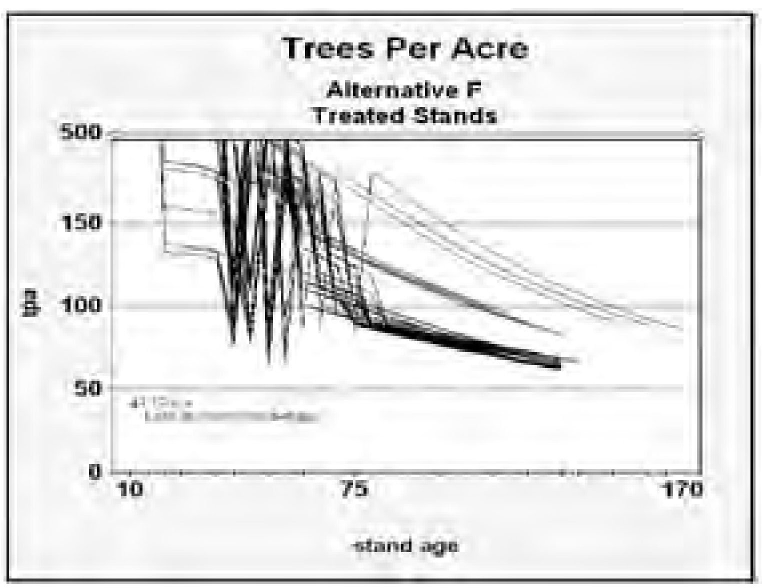
Figure 45. *Repeated thinning in Alternative F would maintain canopy closure and produce stable stands.*

Alternative F would differ from Alternative B, D, and E in that it would employ repeated commercial entry into the stands to periodically reduce stand density past the 10-year span of the proposed plan. Alternative F would employ relatively light thinning prescriptions (see Table 7), designed to maintain 40% canopy cover and thereby reduce any short-term impacts to northern spotted owl dispersal habitat (see Issue 6). Most of the cut trees would be removed, which would mitigate fuel loadings and bark beetle impacts. Thinning would increase individual tree growth rates and thereby increase stand mean tree diameters. These thinning prescriptions would reduce the range of tree diameters by thinning from below, which would preferentially cut the smaller trees, similar to Alternatives B and C.

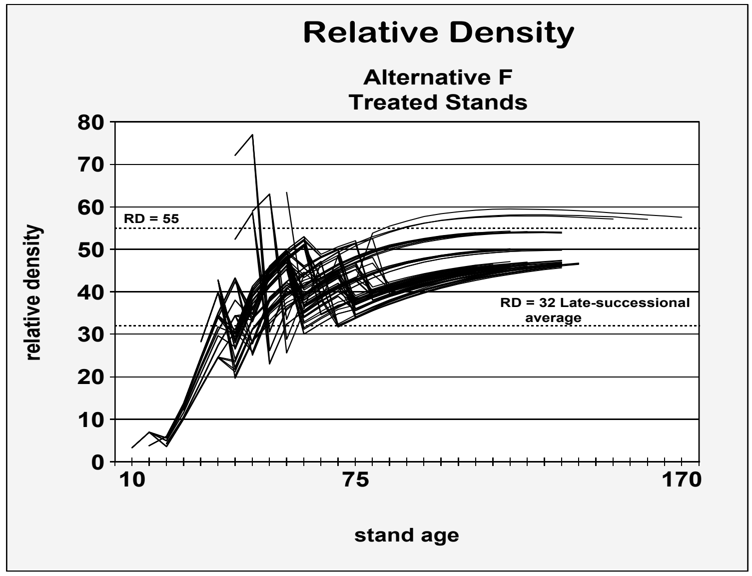
Development of understory shade-tolerant conifers would be inhibited by the high overstory densities necessary to maintain 40% canopy closure. In most prescriptions, stands would eventually become strongly two-tiered, with a moderately dense Douglas-fir overstory high above a slow-growing understory of shade-tolerant conifers. In contrast to Alternative C (and stands >30 years old in Alternative B), where reclosure of the stand would cause mortality of the shade-tolerant understory, the repeated thinning in Alternative F would allow continued survival of understory trees. Stands would likely have a relatively static structure at the end of the 100-year analytical period, similar to many of the moderately dense mature stands in the planning area. Some natural disturbance would be needed to remove enough of the overstory Douglas-fir trees to accelerate growth of the shade-tolerant understory. It is reasonably foreseeable that patch cuts may be included in subsequent thinning beyond the 10-year span of the proposed plan. Patch cuts would reduce overstory density sufficiently to accelerate understory growth in the immediate location of the patch cuts, which would improve the overall development of shade-tolerant understories and spread the range of tree diameters.

Stands <21 years of age would be pre-commercially thinned to 135-250 TPA. Trees 2”-8” dbh would be cut. At the end of the 100-year analytical period, these stands would have 75-110 TPA, of which 40-50 would be overstory Douglas-fir, with relative densities of 42-53, just below the point at which density-dependent mortality would occur (see Graphs 35 and 36). Overstory trees would have moderate crowns, and canopy cover would be high (50 - 75%). These stands would develop height:diameter ratios between 60-65, which would be stable (Lohmander and Helles 1987; Wilson and Oliver 2000) (see Graph 37).

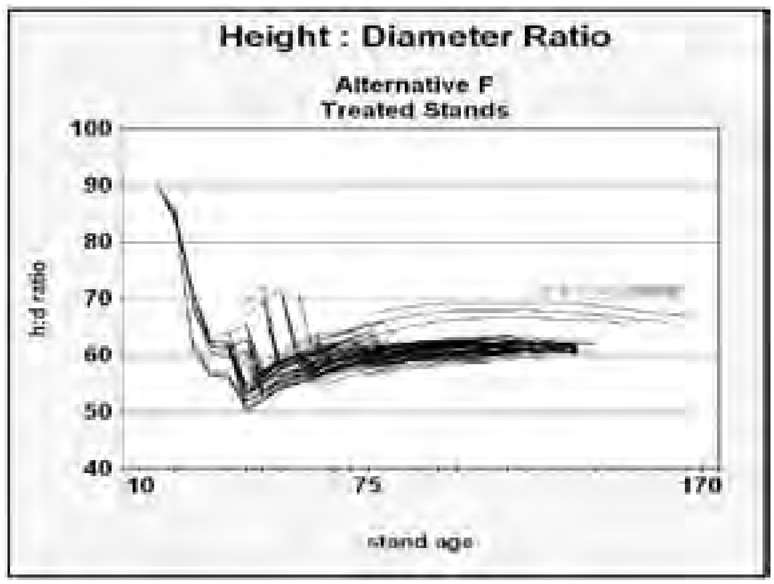
Stands 21-40 years of age would be thinned with a variety of treatments: the younger stands in the age class would be pre-commercially thinned to 105-250 TPA. The older stands in the age class would be commercially thinned from below to 60-35 TPA. Trees 4”-18” dbh would be cut. Thinning of these stands would sometimes include removal of cut trees, depending upon the size of trees cut and whether removal would be necessary to reduce fuel and bark beetle risk. At the end of the 100-year analytical period, these stands would have 65-100



Graph 35



Graph 36.



Graph 37.

TPA, of which 35-45 would be Douglas-fir overstory trees, with relative densities of 45-55, just at or below the point at which density-dependent mortality would occur (see Graphs 35 and 36). For example, Figures 46 and 47 illustrate the development of the 30-year-old stand, showing the first thinning treatment in 2012, and the moderately dense overstory and limited development of the shade-tolerant understory in 2097. These stands would develop height: diameter ratios between 60-65, which would be stable (Lohmander and Helles 1987; Wilson and Oliver 2000) (see Graph 37).

Stands 41-80 years of age would be thinned from below to 55-105 TPA. Trees 4”-20” dbh would be cut. Thinning would generally include removal of cut trees to reduce fuel and bark beetle risk. At the end of the 100-year analytical period, these stands would have 70-100 TPA, of which 35-45 would be Douglas-fir overstory trees, with relative densities of 45-58, just at or below the point at which density-dependent mortality would occur (see Graphs 35 and 36). These stands would develop height:diameter ratios between 60-70, which would generally be stable, but the older stands would develop height:diameter ratios between 65-70, which may be less stable (Lohmander and Helles 1987; Wilson and Oliver 2000) (see Graph 37).

Table 7. - Stand Treatment and Results Summary - Alternative F

STAND TREATMENT AND RESULTS		STAND AGE		
		<21	21-40	51-80
Thinning prescription (during 10-year span of proposed plan)	**TPA***	135-250	105-250 60-135	55-105
Resulting Stand Characteristics (end of 100-year analysis period)	**TPA**	75-110	65-100	70-100
	RD	42-53	45-55	45-58
	H:D	60-65	60-65	60-70

*Uplands and 100-foot riparian areas would receive same treatments

In summary, Alternative F would treat a moderate portion of the young stands in the planning area, and the thinning prescriptions would slightly speed the development of late-successional forest structure. The thinning prescriptions would create stable stands of trees with a moderately large-diameter Douglas-fir overstory, high above a small, slow-growing understory, with considerable separation between overstory and understory canopies (although future patch cuts may accelerate understory growth in patches). Despite the variety of thinning prescriptions, most stands would develop similar structure, particularly with regard to understory development (see Table 7 and Figures 48 to 55). The thinning in Alternative F would prevent the extensive density-dependent mortality and stand stagnation that would occur in Alternative A. However, creation of late-successional structure in these stands would require some natural disturbance or additional thinning to reduce overstory density and thereby increase understory growth.

Key Points

- 6,100 (44%) of stands ≤80 years old would be treated over 10 years.
- 1,000 acres would develop late-successional structure.
- Thinning would have limited effectiveness in creating late-successional structure, but stands would be stable.

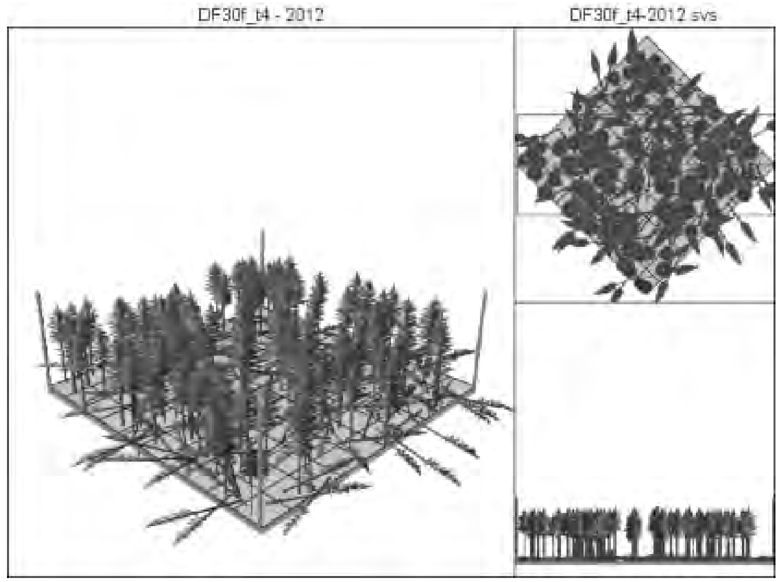
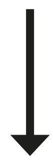


Figure 46. *Thinning of the 30-year-old Type Stand*



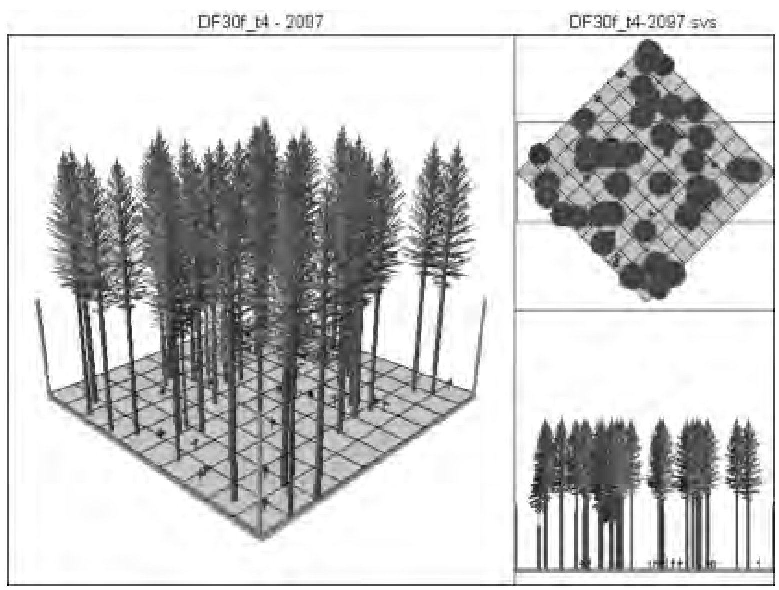


Figure 47. *Development of the 30-year-old Type Stand*

Figure 48
Untreated stands would develop a high-density, uniform condition, with no understory of shade-tolerant conifers.

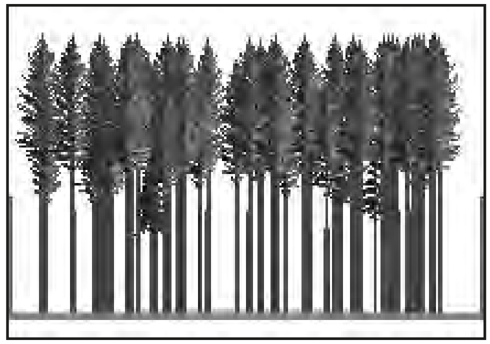


Figure 49
Treatment 1 (1st thin-102 TPA; 2nd thin-70 TPA; 3rd thin-45 TPA) would create a moderate-density overstory of Douglas-fir, with small, slow-growing shade-tolerant conifers.

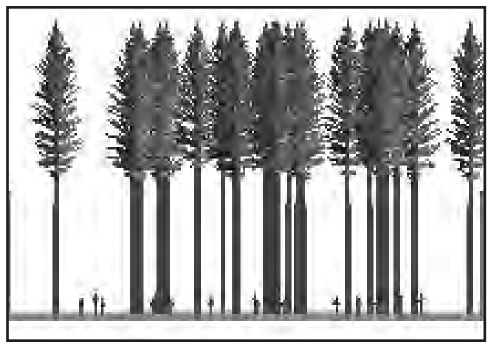


Figure 50
Treatment 2 (1st thin-102 TPA; 2nd thin-50 TPA; 3rd thin-45 TPA) would create a moderate-density overstory of Douglas-fir, with small, slow-growing shade-tolerant conifers.

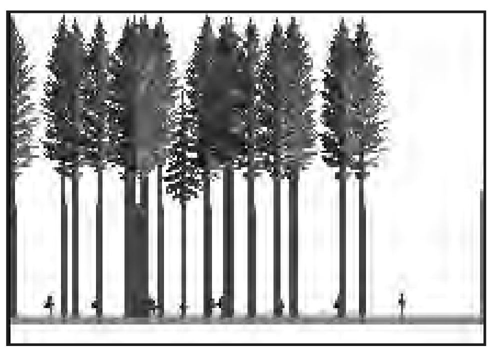
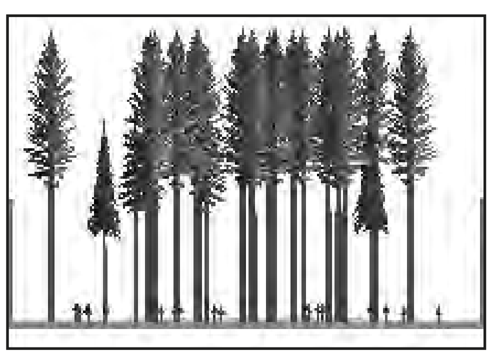


Figure 51
Treatment 3 (1st thin-110 TPA; 2nd thin-85 TPA; 3rd thin-45 TPA) would create a moderate-density overstory of Douglas-fir, with small, slow-growing shade-tolerant conifers. (Note that the few, larger shade-tolerant conifers are part of the original cohort).



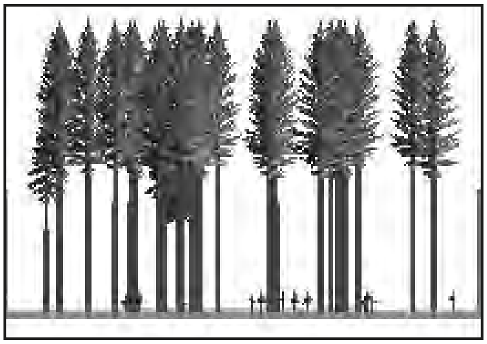


Figure 52
Treatment 4 (1st thin-110 TPA; 2nd thin-60 TPA; 3rd thin-45 TPA) would create a moderate-density overstory of Douglas-fir, with small, slow-growing shade-tolerant conifers.

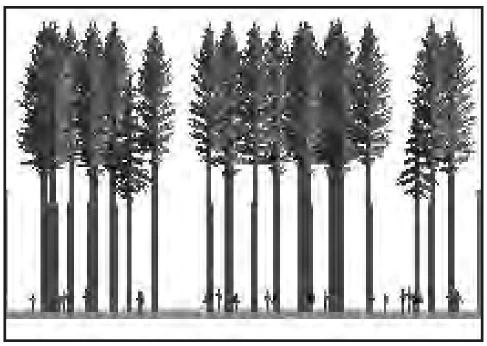


Figure 53
Treatment 5 (1st thin-70 TPA; 2nd thin-50 TPA) would create a moderate-density overstory of Douglas-fir, with small, slow-growing shade-tolerant conifers.

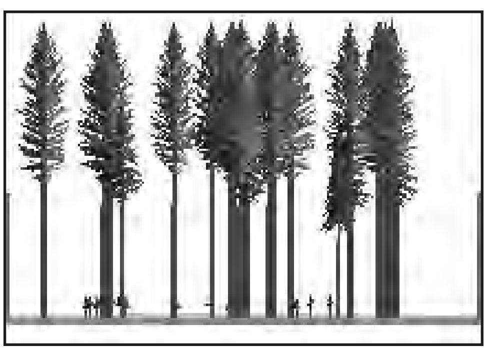


Figure 54
Treatment 6 (1st thin-80 TPA; 2nd thin-65 TPA; 3rd thin-45 TPA) would create a moderate-density overstory of Douglas-fir, with small, slow-growing shade-tolerant conifers. (Note that the few, larger shade-tolerant conifers are part of the original cohort).

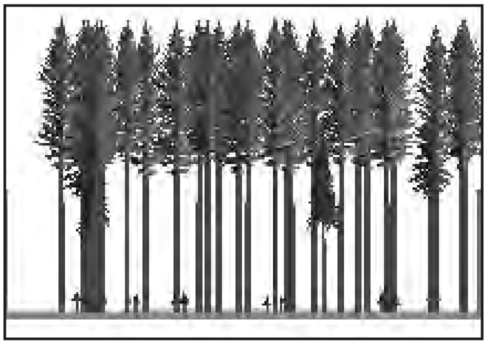


Figure 55
Treatment 7 (1st thin-100 TPA; 2nd thin-60 TPA) would create a moderate-density overstory of Douglas-fir, with small, slow-growing shade-tolerant conifers. (Note that the few, larger shade-tolerant conifers are part of the original cohort).

ISSUE 5: *What are the effects of restoration activities on marbled murrelet habitat?*

Alternative F would thin stands ≤80 years old, but would avoid adverse effects to marbled murrelets by evaluated stands 51-80 years old prior to thinning to determine if stands are potential habitat for marbled murrelets. Stands that are potential habitat would be thinned only if surveys find the stands to be unoccupied by marbled murrelets.

Under Alternative F, stands would develop trees ≥32” dbh at approximately the same rate as in Alternative A. However, Alternative F would speed the development of large branches. In 50 years, 5,200 acres would have at least one tree per acre with at least one branch 5” in diameter, five times the amount in Alternative A. In Alternative F, nearly all of the stands currently ≤80 years old would have at least one tree per acre with at least one branch 5” in diameter within the100-year analysis period (13,600 acres or 98%). The maximum branch size in Alternative F would be larger than in Alternative A for all age classes, depending on the treatment prescriptions (1/2” - 1” larger at the end of the 100-year analysis period).

Under Alternative F, 200 acres (1% of stands currently ≤80 years old) would achieve target habitat conditions within the 100-year analysis period. Very few stands would develop a wide enough range of tree diameters under Alternative F to meet the criteria for target habitat conditions.

Key Points

- All stands would have trees ≥32” dbh, and almost all would develop branches 5” and larger within 100 years.
- 200 acres of young stands would achieve target habitat conditions within 100 years.

ISSUE 6: *What are the effects of restoration activities on northern spotted owl habitat?*

Development of dispersal habitat under Alternative F would be largely indistinguishable from Alternative A. All thinning prescriptions in Alternative F would maintain dispersal habitat, because thinned stands would retain more than 40% canopy closure. Although thinning might temporarily decrease habitat quality (see Anthony et al. 2001, which found that owls avoided recently thinned stands within their home range), the thinned stands would continue to meet the definition of dispersal habitat. Because Alternative F would thin stands repeatedly, current owl pairs might be adversely affected if they avoid recently thinned stands, even though thinned stands would continue to meet the definition of dispersal habitat. However, it is uncertain whether owls would always avoid recently thinned stands or how long owls would avoid recently thinned stands. Under Alternative F, most of the stands currently ≤80 years old (13,600 or 98%) would become dispersal habitat in 35 years, and all stands would become dispersal habitat in 40 years. Alternative F may affect critical habitat by degrading existing dispersal habitat, but would not downgrade (i.e., altering the stand conditions below the threshold conditions for dispersal habitat) any existing dispersal habitat.

Under Alternative F, 3,800 acres (28% of stands currently ≤80 years old) would become suitable habitat by the end of the 100-year analysis period. A small acreage – 1,000 acres (7%) – would achieve target habitat conditions by the end of the 100-year analysis period.

Key Points

- All young stands would develop into dispersal habitat similar to Alternative A.
- 3,800 acres would develop into suitable habitat within 100 years.
- 1,000 acres would achieve target habitat conditions within 100 years.

ISSUE 7: *What are the effects of restoration activities on coho salmon habitat?*

In-stream structure: Alternative F would have effects on in-stream structure similar to Alternative C, except that Alternative F would not fall or pull over trees in addition to constructed structures. Alternative F would create stable structures and meet the ODFW riparian habitat benchmark on 3.8 miles of 3rd-5th-order streams, but would not create woody debris on other streams (see Figure 56).

Figure 56. *Although Alternative F would create in-stream structures in larger streams, it would not create woody debris in small streams.*

Riparian stands: Alternative F would thin 1,500 acres (44%) of riparian areas (<100 feet from streams) over the10-year span of the proposed plan, and a total of 1,900 acres (55%) of riparian areas including probable treatments beyond 10 years. Alternative F would have effects on the development of riparian trees big enough to provide key pieces of woody debris (≥24" dbh) similar to all alternatives (See Alternative A, Issue 7). However, it would take considerably longer to develop very large trees that would provide more stable key pieces of woody debris (≥32" dbh): at the end of the 100-year analysis period, approximately 2,700 acres out of 3,400 riparian acres (80%) would have developed sufficient density of trees ≥32" dbh. Alternative F is slower than all other alternatives except Alternatives A and C to develop sufficient density of these larger trees, primarily because it treats fewer riparian acres than all other alternatives except Alternatives A and C.

Sedimentation: Alternative F would have effects on sedimentation from existing roads, road decommissioning, and culvert replacement and removal similar to Alternative B.

Alternative F includes approximately 11.5 miles of new road construction, which would be decommissioned after a single logging season. The new road construction may include approximately 6 temporary stream crossings over the 10-year span of the proposed plan, which would cause temporary pulses of approximately 0.6 cubic yards of sediment/year of sedimentation over 10 years from culvert placement and removal.

Construction of in-stream structures in Alternative F would have effects similar to Alternative C.

Barriers: Alternative F would have effects on fish-barrier culverts and make additional habitat available similar to all action alternatives (See Alternative B, Issue 7).

Key Points

- Stable in-stream structure would be created on 0 miles 1^{st}-2^{nd}-order streams, and 3.8 miles of 3^{rd}-5^{th}-order streams in 10 years.
- 80% of young riparian forests would develop sufficient density of very large (≥32" dbh) conifers in 100 years.
- Existing road-related sedimentation would be reduced to 74.0 cubic yards/year. Restoration actions and associated road construction would cause a total of 10.6 cubic yards of sediment/year.
- Removal of 10 barrier culverts would open 7.0 miles of new coho salmon habitat.

ISSUE 8: *How would restoration activities affect the presence and spread of noxious weeds?*

Alternative F would result in some disturbance to both soils and existing vegetation from forest management and aquatic restoration activities in stands ≤80 years old, which could potentially result in further establishment and spread of noxious weeds in treated stands within the planning area.

The decommissioning of 24 miles of road would reduce the vectors for the introduction, establishment, and spread of noxious weeds within the planning area, but would be partially offset by the construction of 11.5 miles of new road. However, new road construction would be temporary and would provide vectors for the spread of noxious weeds only until the temporary roads are decommissioned.

Effects on noxious weeds on roads that are not decommissioned would be the same as in Alternative A.

Key Points

- Decommissioning 24 miles of road would be partially offset by construction of 11.5 miles of new roads and would only slightly reduce noxious weed establishment and spread.

ISSUE 9: *What would be the economic effects of restoration activities?*

Under Alternative F, 6,100 acres would be treated with non-commercial silvicultural treatments, which would generate 350 months of contract work over the 10-year span of the proposed plan. There would be 20 months of work for silvicultural treatments for each of the first three years of implementation, 50 months of work for each of the second three years, and 35 months of work for each of the final four years.

Decommissioning 24 miles of road would generate 10 months of contract work, the same as in Alternative C.

Replacing 10 culverts would generate 11 months of contract work, the same as in all action alternatives.

In-stream restoration would generate 12 months of contract work, the same as in Alternatives C and D.

There would be approximately 3,400 acres of commercial thinning timber sales within the 10-year period, which would generate $12.7 million in revenues. Alternative F would have opportunities for revenue for commercial thinning beyond the 10-year span of the proposed plan.

Key Points

- 383 months of contract work over 10 years.
- $12.7 million of revenue over 10 years.

ISSUE 10: *What are the costs of restoration?*

For the 10-year span of the proposed plan, silvicultural treatments in Alternative F would incur $486,000 in contract costs and $4.5 million in BLM staff costs (100 work months per year, much of which would be the preparation of thinning timber sales).

Road decommissioning costs would be the same as in Alternative C. Culvert replacement costs would be the same as in all action alternatives (see Alternative B). In-stream restoration would incur $80,000 in contract costs and $40,000 in BLM staff costs.

Key Points

- $1.7 million in contracts over 10 years.
- $5.2 million in BLM staff costs over 10 years.

COMPARISON OF THE IMPACTS OF THE ALTERNATIVES

This section compares the key points from the above analysis that relate to the three goals described in the purpose of the action.

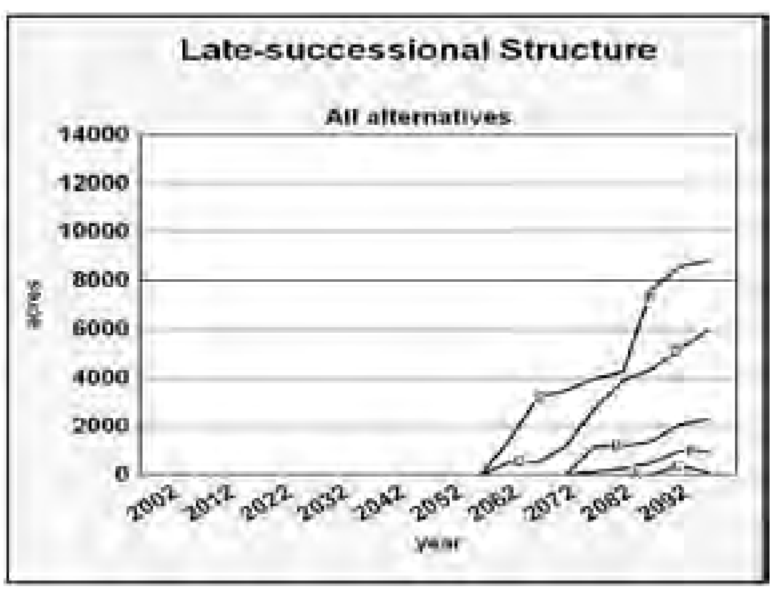
Protect and enhance late-successional and old-growth forest ecosystems

Alternative A (No Action) would pose a high risk of catastrophic fire, because almost all stands currently ≤80 years old would go through a prolonged period of stand stagnation. Each of the action alternatives would pose a lower risk of catastrophic fire, roughly in proportion to how many acres would be thinned. Unlike attainment of late-successional structure (see below), the future fire risk appears to depend on whether stands are thinned, rather than how they are thinned.

Douglas-fir bark beetle infestations would be unlikely to cause widespread or catastrophic damage to existing late-successional stands under any of the alternatives, although there would likely be some individual tree mortality in both existing late-successional stands and stands currently ≤80 years old under all of the action alternatives, particularly alternatives B, D, and E.

Foster the development of late-successional forest structure and composition in plantations and young forests

The alternatives vary widely in how well they would speed the development of late-successional forest structure, and Alternatives E and D would be considerably more effective than the other alternatives (see Graph 38). Figures 57 to 62 illustrate that the alternatives would result in very different stand structures, with particular difference in the development of shade-tolerant conifer understories. (Note that Alternatives D and F would apply multiple treatments in the illustrated age-class; the full range of treatments is shown in Figures 33 to 38 and Figures 48 to 55, respectively).



Graph 38.

The development of northern spotted owl and marbled murrelet suitable habitat and target habitat conditions show overall patterns similar to development of late-successional forest structure (though less clearly in murrelet suitable habitat) (see Graphs 39 to 42). However, there is some trade-off between the long-term development of late-successional

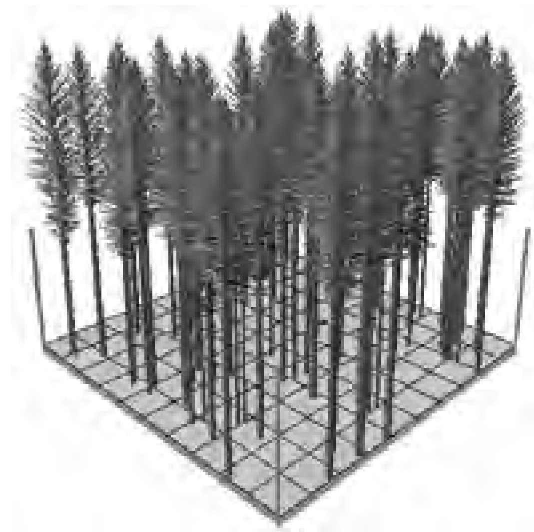


Figure 57
Under Alternative A (No Action), the stand would have a high-density, uniform condition with no understory of shade-tolerant conifers.

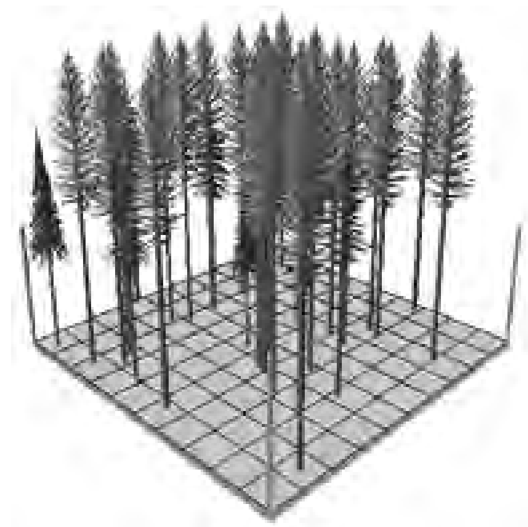


Figure 58
Under Alternative B, the stand would have a moderately open overstory with moderate development of shade-tolerant conifers.

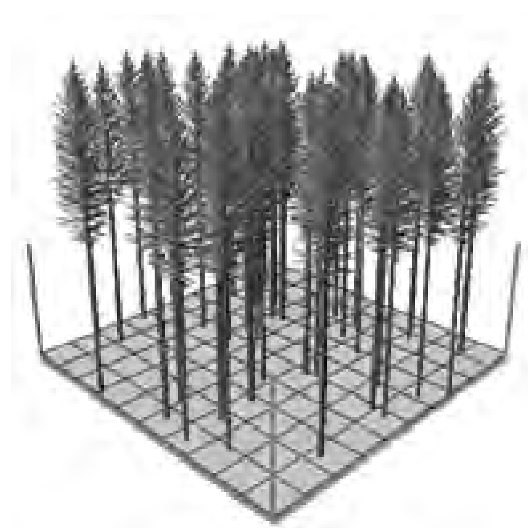


Figure 59
Under Alternative C, the stand would have a moderately dense, uniform overstory with no understory of shade-tolerant conifers.

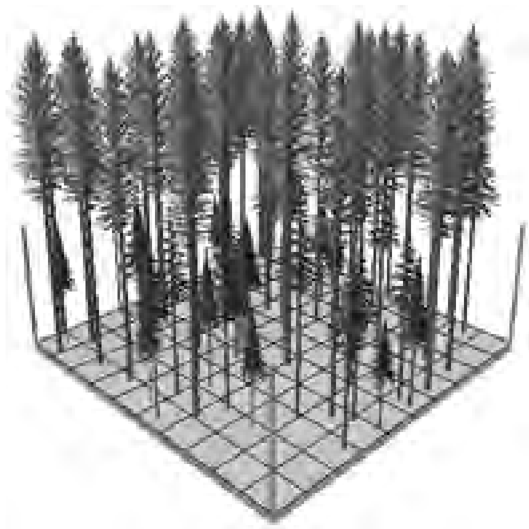


Figure 60
Under Alternative D, the stand would have a moderately open overstory with good development of shade-tolerant conifers in the understory (see Figures 33 to 38 for the full range of treatments).

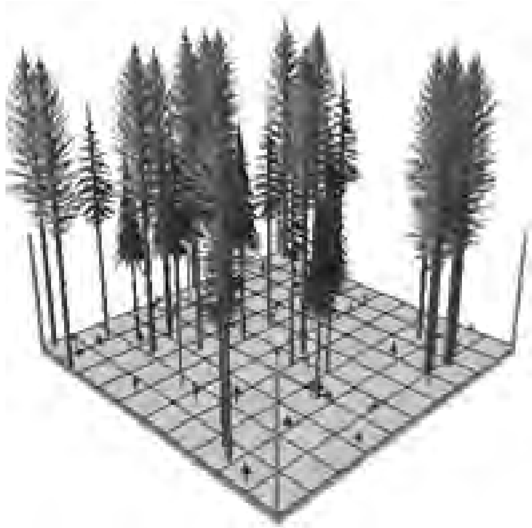


Figure 61
Under Alternative E, the stand would have an open overstory with abundant large shade-tolerant conifers, and scattered smaller shade-tolerant conifers.

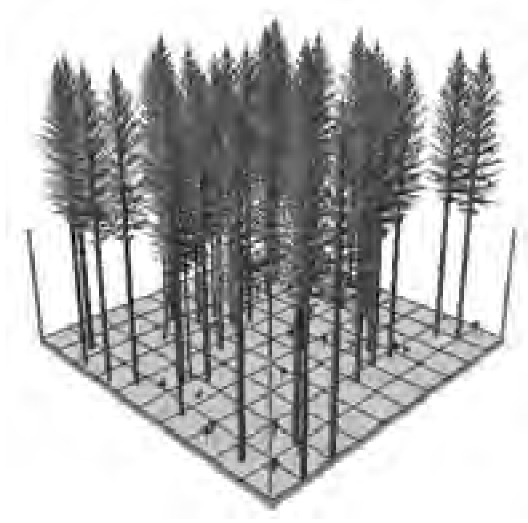
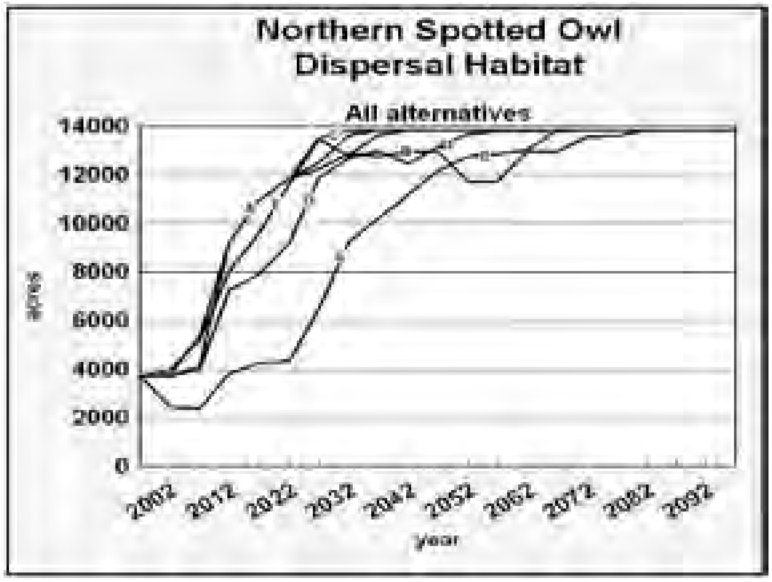
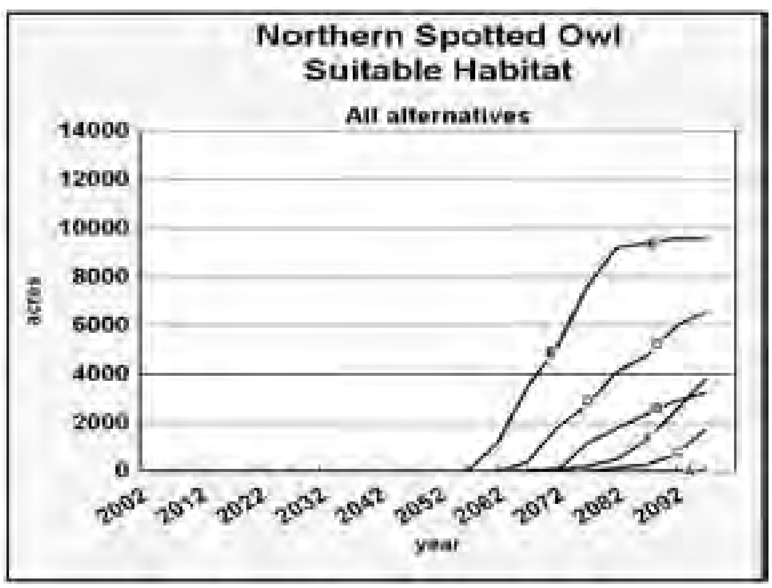


Figure 62
Under Alternative F, the stand would have a moderately dense, uniform overstory with small slow-growing shade-tolerant conifers in the understory (see Figures 49 to 55 for the full range of treatments).

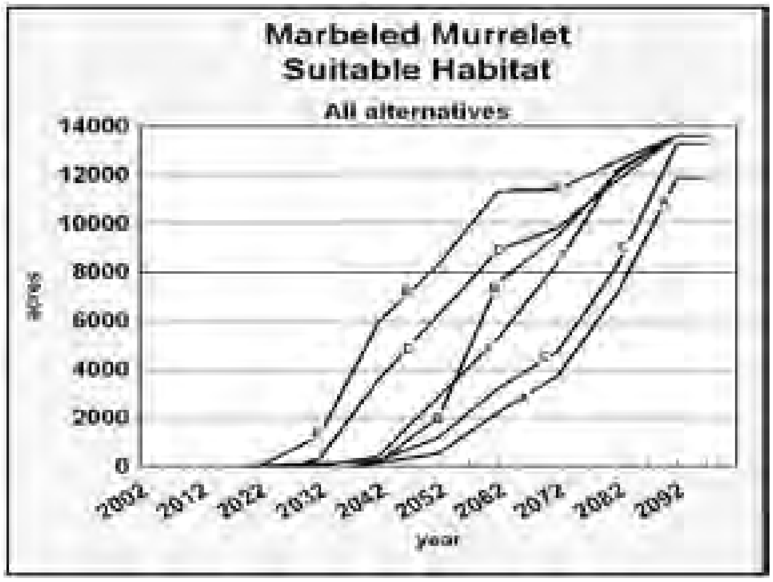
structure (see Graph 38) and the short-term development of spotted owl dispersal habitat (see Graph 39). Alternative E, which would be the most effective at speeding the development of late-successional structure, would provide the least spotted owl dispersal habitat in the short-term and even temporarily reduce it from the current amount. Alternatives A, C, and F, which would maximize the development of dispersal habitat, would be largely ineffective at speeding the development of late-successional structure.



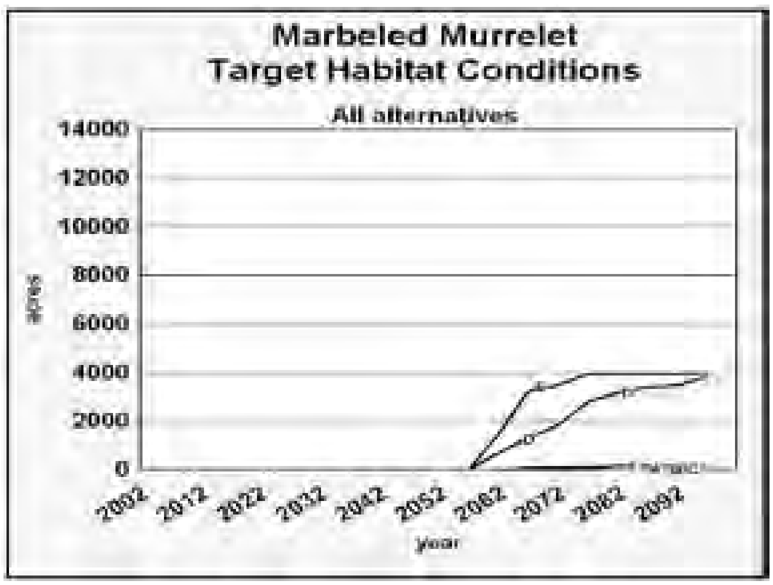
Graph 39.



Graph 40.



Graph 41.



Graph 42.

Reconnect streams and reconnect stream channels to their riparian zones and upslope areas

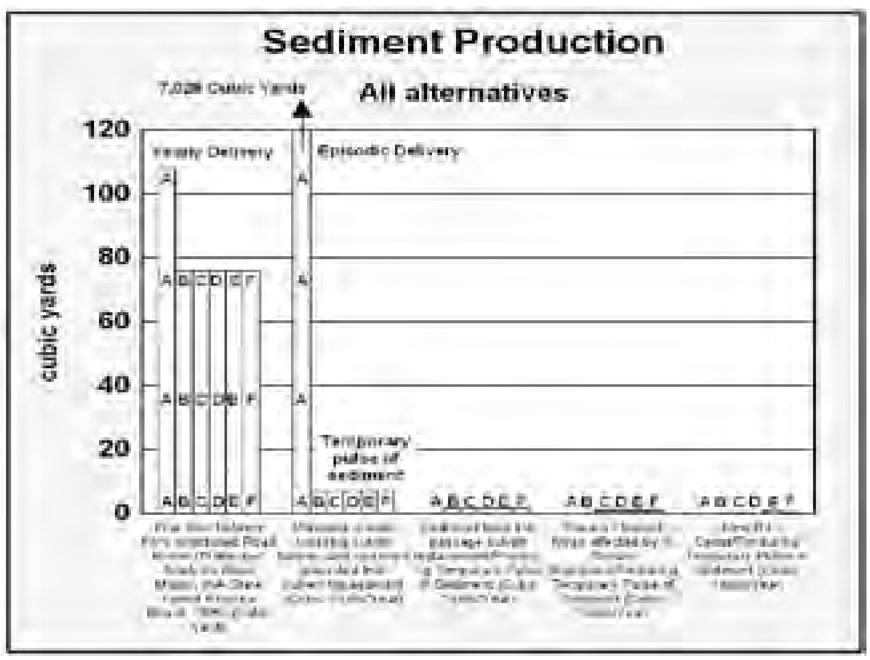
The action alternatives would have generally similar effects on coho salmon habitat in most respects, but Alternative A (No Action) would be sharply different from each of the action alternatives (see Table 8).

All action alternatives would create additional woody debris in streams, though Alternative D would create stable structure on the most stream miles; Alternative B would be ineffective in creating stable structure in larger streams; and Alternative F would not add debris to smaller streams.

Riparian stands would develop very large conifers roughly in proportion to the amount of the riparian area than would be thinned, but the difference among alternatives is much less distinct than for the attainment of late-successional structure in upland stands.

Alternative A (No Action) would continue to produce the most chronic sedimentation to streams and would pose a high risk of catastrophic sedimentation from culvert failures (see Graph 43). All of the action alternatives would result in an overall reduction sedimentation to a similar extent, despite differences in the design features related to in-stream restoration, road construction, and road decommissioning (see Graph 44).

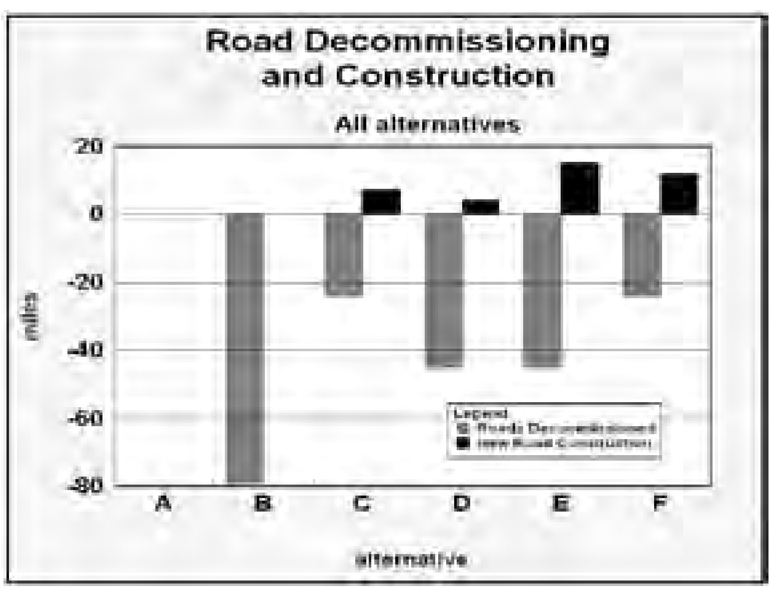
All of the action alternatives would remove fish-barrier culverts and open additional habitat.



Graph 43.

Table 8. Summary of effects on coho salmon habitat

	A	B	C	D	E	F
Stable structure created on 1st-2nd-order streams (miles)	0	105.7	35.9	199.5	199.5	0
Stable structure created on 3rd-5th-order streams (miles)	0	0	3.8	8.2	5.8	3.8
Riparian stands with very large conifers (≥13 TPA ≥32" dbh) at the end of 100-year analysis period (acres)	2,500	2,900	2,500	3,100	3,300	2,700
Total chronic sedimentation (cubic yards/year) (including all restoration actions, but excluding episodic delivery)	108.0	83.0	84.4	84.0	84.8	84.6
Additional fish habitat (stream miles)	0	7.0	7.0	7.0	7.0	7.0



Graph 44.