Chapter 4 - Environmental Consequences

Table of Contents

Table of Contents (cont'd)

Chapter 4 - Environmental Consequences

Introduction

This chapter describes the scientific basis for determining effects and the environmental consequences that would occur if each alternative considered in detail were implemented. Tables 2-4 and 2-5 in Chapter 2 summarize the outputs and make key comparisons for each alternative. This chapter also explains and expands on the comparative analysis in Chapter 2. The resource outputs and activities described here and in Chapter 2 are not necessarily environmental effects.

Chapter 4 displays and discusses the complex interactions between the various parts of the ecosystem and social system for each alternative. Key indicators were developed to measure and compare how the alternatives respond to each issue. The methodology and modeling techniques used to estimate values for each key indicator are explained throughout Chapter 4 under the appropriate resource.

The estimated consequences assume that any required mitigation measures would be accomplished. Interdisciplinary (ID) team members interpreted the meaning of these estimated key indicator values. These interpretations are used to identify the environmental consequences that would be associated with each alternative. Any direct, indirect and cumulative effects are described by alternative for each resource.

The resource areas in Chapter 4 are organized into 4 groups: 1) *Physical Environment*, 2) *Biological Environment*, 3) *Resource Management Programs* and 4) *Social and Economic Environment.*

A summary section presenting the general effects of alternatives completes this chapter. The summary section includes a description of adverse effects which cannot be avoided. It also discusses the relationship between short-term use and long-term productivity. Any irreversible or irretrievable commitments of resources associated with each alternative are disclosed. Possible conflicts with plans prepared by other agencies are also identified.

Physical Environment

Introduction

This section summarizes the effects each alternative would have on the physical environment, which includes the geology, soil, water and air resources. The effects of the various proposed management practices are displayed as well as the interrelationship between various resources. The effects on the biological environment, existing management programs and the social environment are discussed later in this chapter.

Watersheds are used to analyze the effects on water resources, including sediment production and effects on fisheries. A watershed is the entire land area which drains to a specific point. The mouth of a stream or the junction with tributary streams are commonly used to define watersheds.

However, any specific point along a stream can be used. As an example, the Elk Creek watershed is the entire area that drains to the mouth of Elk Creek, the point where Elk Creek enters the Klamath River, including all tributaries to Elk Creek. The tributaries to Elk Creek also have their own watersheds and any point along Elk Creek has an identifiable watershed. These sub-watersheds are subsets of the Elk Creek watershed. Any watershed can be divided into an infinite number of sub-watersheds based on tributary streams or points along the main stream.

When watersheds are divided into sub-watersheds, there are areas left over. These left-over areas are not "true watersheds" but are still part of the larger watershed. These areas are often referred to as basins, sub-basins, or reach basins rather than watersheds. The characteristics and disturbances in these basins are usually tracked as if these areas are true watersheds.

The forest planning outputs for watersheds are projections from the FORPLAN model. These projections are for the entire Forest. To derive outputs for individual watersheds, the FORPLAN outputs need to be disaggregated into smaller units.

The disaggregation process uses the same information and a similar process as FORPLAN uses for the whole Forest. However, dividing the outputs for the whole Forest into smaller areas adds the possibility of additional error. For example, if the FORPLAN projections include 100 miles of new road to be constructed in the first decade, than a disaggregation into 10 watersheds may assume 10 miles of new roads will be built into each of these watersheds. In reality, 100 miles of road may be built over the next 10 years but as much as 20 miles of new roads may be built in 1 watershed and no new roads built in another watershed.

The disaggregation of FORPLAN outputs into watersheds is necessary for watershed analysis. However, it cannot be assumed that the watershed projections are as accurate as the Forest total outputs.

The Forest is divided into watersheds and basins for analysis purposes. One of these divisions is the 13 NFS watersheds displayed in Figure 3-5. Some of these are "true watersheds" and others are reach basins.

As displayed in Figure 3-5 the Shasta River, Basin 0701, is a true watershed while the West Klamath River, 0901, is a reach basin. However, a true watershed can be formed by combining all of the basins which drain into the 0901 with 0901. This combination forms a watershed that is a subset of the Klamath River watershed.

Analyses which refer to these watersheds and basins treat all 13 as if each were a true watershed. They also include only consideration of NFS land within the basins and do not consider the land under other ownerships.

Several analyses in this section, as well as the Fisheries analysis, rely on outputs from the Forest Sediment Model (refer to Appendices B and G in this EIS). The Sediment Model outputs are expressed as cubic yards of material added to the stream system of a defined watershed during a particular storm event. The storm events used are 2-year storms and 10-year storms.

A 2-year event is a storm of such intensity that it causes streamflow peaks large enough to be equaled or exceeded only once every 2 years on average. A 10-year event has streamflow peaks which are equaled or exceeded only once every 10 years on average. Most landslides and dramatic channel changes occur with 10-year events and larger events, however soil erosion occurs with the less intense 2-year events and smaller storms.

The Sediment Model uses a disaggregation of FORPLAN outputs into compartments, then recombines the compartment outputs into "indicator watersheds." The compartments are land areas about 5,000 to 10,000 acres in size with boundaries based on geographic features and administrative boundaries, but are rarely true watersheds.

The indicator watersheds combine compartments and portions of compartments into true watersheds. They include only consideration of effects on NFS land within the watersheds. Also, some of the indicator watersheds are subsets of other indicator watersheds. The indicator watersheds cannot be added together to arrive at an answer for the entire forest.

The Equivalent Roaded Area (ERA) methodology also uses the disaggregation of FORPLAN outputs into compartments. The compartment data for this analysis is combined into 111 compartment cluster watersheds. The compartment cluster watersheds are not true watersheds but are designed to approximate true watersheds. The compartment cluster watersheds are not subsets of each other and can be combined to arrive at a Forest Total. Also, the compartment clusters include consideration of the private land within the compartment boundaries.

Important Interactions

The physical environment includes geology, soil, water and air. Management activities which affect these resources also affect the biological and social environment. Interactions important to the geology, soil and water resources are discussed in this section. Interactions important to the air resource are discussed in the Air section later in this chapter.

Climate and geology are the primary factors that determine the qualities of the physical environment, such as soil productivity, stream flows and water quality. The geology of an area determines the parent material of the soil and presence of high value minerals and resources, influences geomorphic processes and may determine the presence of hazardous materials.

Geomorphic processes, such as landslides and other mass movements, determine the age and form of land surfaces which influences soil formation and the form of stream channels. Climate also influences geomorphic and soil forming processes as well as determining stream flows. Water quality is influenced by sediment introduced to streams through landslides, soil erosion and channel erosion processes.

Climate, soil and past disturbance history determines the vegetation on a site including the species, age, size and productivity of the vegetation. The vegetation in turn influences slope stability, erosion rates and hydrologic properties of the land it occupies. Vegetation plays a particularly key role in riparian areas where it acts to stabilize stream edges and shade water surfaces. The organic material from vegetation provides soil cover and soil nutrients.

Watershed characteristics, such as stream flow, water quality and fisheries habitat characteristics, are very important to the beneficial uses of water. These beneficial uses include fish production and domestic use (household or agricultural use). Watershed characteristics can be altered by natural disturbance such as wildfire and floods and by management activities.

Watershed disturbance, whether natural or human-caused, can affect the physical environment. Any disturbance which decreases slope stability causes an increase in landslide risk. Disturbances which expose soil to direct rainfall, wind and runoff increase soil erosion. Disturbances which compact soil or otherwise affect rainfall infiltration into soil increase soil erosion and water runoff. Removal of organic matter from a site, either through fire or physical removal, can affect soil productivity as can soil erosion and compaction. Any disturbance which affects water runoff and stream sedimentation affects water quality, stream channels and fish production.

Floods are natural occurrences that have a large impact on the physical environment. Very large and

infrequent floods, 10-year recurrence interval floods and larger, can have detrimental effects on stream channels, riparian areas and water quality for many years following the flood. Management activities which increase the amount of water and sediment produced in a flood also increase the detrimental effects of that flood.

Road construction causes an increase in landslide rate due to the reshaping of slopes and removing stabilizing vegetation. Roads also result in soil compaction and cover disturbance which increases soil erosion and causes loss of soil productivity. The soil compaction increases runoff which results in higher stormflows and increases in stream channel erosion. Roads also cause a large decrease in soil productivity of the road surface through compaction and of the cut slopes through topsoil removal.

Timber harvesting and other vegetation removal affects the vegetative composition of a site, decreasing slope stability and increasing storm runoff until regrowth returns a site to near its potential condition. Timber harvest in riparian areas also affects channel stability and stream shading. The removal of vegetation, especially with the use of a tractor, increases soil erosion and decreases soil productivity due to soil compaction, soil cover disturbance and soil displacement.

Grazing also affects the vegetation on a site. Overgrazing can decrease soil cover and cause soil compaction resulting in an increase in erosion and a decrease in productivity. Overgrazing in riparian areas can deplete vegetation which contributes to stream channel stability and stream shading causing channel erosion and increasing stream temperatures.

Fire also affects the physical environment. The magnitude of fire effects is highly dependent on the intensity of the fire. An intense, hot fire has a much greater effect than a low intensity fire. Fire can kill vegetation, remove protective soil cover, inhibit water filtration and increase the rate of soil erosion. Fire also decreases the amount of organic material on a site, both fine material such as needles and twigs and coarse woody debris (CWD). The decrease in organic material disrupts the nutrient cycling process and can affect long-term soil productivity.

Although fuel treatment can modify the effects of future wildfires, the treatments also have other effects. Prescribed fire has similar effects to wildfire but usually is less intense. Tractor piling of slash for fuel treatment and site preparation can compact soil, disturb soil cover and remove organic material. Removing large logs for fuel treatment can deplete a site of CWD. Fire, whether wild or prescribed, also affects air quality.

Geology

The following geologic hazards and resources have been identified on the Forest:

Geologic Hazards	Geologic Resources
Landslide (Slope Stability)	Groundwater
Hazardous Substances	Rock Materials
Asbestos	Areas of Unique Geologic Value
Radon	Locatable Minerals
Abandoned Mines and Landfills	Oil, Gas and Geothermal Power
Seismic	
Volcanic	
Snow Avalanche	
Land Subsidence and Collapse	

Important Interactions

Important interactions relating to landslide hazards are discussed earlier in this chapter under Physical Environment - Important Interactions. Appendix G - Figure G-1 displays the basic interactions between other natural processes and these geologic hazards and resources in more detail. It also displays the important interactions between land management activities and these geologic hazards and resources. Flood hazard, though often grouped with geologic hazards, is addressed in the hydrology section.

Landslide (Slope Stability) Hazards

Landslide (slope stability) hazards are considered to be the most important of the identified geologic hazards on the Forest and are covered in more detail for 2 reasons.

First, climatic events which cause landslides have occurred many times in the past 40 years causing considerable damage to roads, bridges, fish habitat and other watershed values. Historically, 3 types of events have caused this damage:

1) rain-on-snow events,
2) intense storms occurring in the late winter or spring at the end of a very wet year and
3) large amounts of sustained precipitation occurring over 1 or more winters.

Precipitation records from Happy Camp and Orleans reveal an extended dry period from 1911 to 1938, a wet trend from 1938 to 1975 and another dry trend beginning in 1976 and continuing through 1994. Most of the historic period landslides occurred during the wet period of 1938 to 1975. The 1964 flood, the largest landslide-producing event of the historic period by far, was a rain-on-snow event (Stewart and LaMarche, 1967). Very few landslides have occurred during dry periods such as 1976 to 1994.

Second, typical forest management activities such as road construction and timber harvesting directly influence landslide hazard.

Landslide processes interact with the soil, climate, groundwater, surface water, seismic events, vegetation, fire and certain forest management practices. These interactions are described in more detail in Appendix G. Roads, timber harvesting and intense wildfire can greatly increase natural landslide rates. Roads and harvesting create human-caused effects whereas wildfire effects are basically natural. Roads in particular can accelerate landslide rates, if effective mitigation measures are not applied.

Hazardous Substances

Forest management activities can also interact with some hazardous substances. Management activities conducted in asbestos-bearing rock can release asbestos fibers into the air at rock quarries, at road construction sites, from unpaved and unsurfaced roads exposed to traffic during dry periods and at other sites where dust-producing activities such as yarding of timber or tractor piling of brush are conducted.

Other Geologic Hazards

Seismic and volcanic hazards result from geologic processes. They are not influenced by management activities. However, the construction of improperly designed buildings or dams on or near active faults can result in severe consequences.

Snow avalanche hazards are influenced by snow accumulation, temperature, sound and ground shaking (refer to Appendix G). Timber harvesting and fire can affect snow accumulation rates in avalanche source areas.

Land subsidence can be caused by long-term withdrawal of groundwater in excess of recharge rates from groundwater basins. Collapse of underground openings such as natural caves in marble or lava bedrock or excavated tunnels can be caused by excavation or by heavy equipment operation.

Groundwater Resource

Evapotranspiration and soil infiltration rates influence the volume of water entering a groundwater basin. Removal of vegetation reduces evapotranspiration and makes more water available for infiltration. In contrast, soil compaction such as that caused by a dense road network can increase surface runoff, limiting the water available for infiltration.

Man-made reservoirs can store winter precipitation and augment late summer groundwater levels. Long-term withdrawal of groundwater in excess of recharge rates can result in a lowering of the water table which in turn can cause subsidence.

Pollutants from such sources as improperly designed leach lines or improperly sealed wells can pollute both the groundwater and surface water resource. Agricultural chemicals, abandoned mines, abandoned landfills and spills along transportation routes can affect the quality of the groundwater. Aquifers in volcanic areas are susceptible to rapid pollution due to the high permeability of the rock.

Rock Material Resource

Rock aggregate and rip rap is a valuable resource on the forest used primarily for road construction, stabilizing landslides, reducing surface erosion and improving fish habitat. Removal of the material can cause landslides if done improperly. These materials are also discussed in the Minerals Management section later in this chapter.

Areas of Unique Geologic Value

Geologic SIAs, with the exception of caves, are discussed in the Specially Designated Area Management section later in this chapter. Land allocations are important in whether unique geological values are retained.

The Forest contains unique cave resources which are of national significance. The occurrence of caves is strongly influenced by rock type. For example, solution caverns occur primarily in limestone or marble, while lava tubes develop in fluid basaltic lavas. Slope hydrology, air currents and vegetation play a large role in the development of solution caverns. Management activities that alter the delicate balance of physical and biological processes in cave ecosystems could affect the unique values.

Locatable Minerals, Oil, Gas and Geothermal Resource

Utilization of these resources can involve road construction, stream channel modification and excavations. Such activities can cause landslides. Additionally, some of these activities introduce materials which are potentially hazardous to the environment such as ore-processing chemicals. Refer to Minerals Management section of this chapter for additional information.

Methodology

Landslide Hazards

Landslide hazards were analyzed for each alternative using 4 criteria:

1) predicted volume of landslide generated sediment in cubic yards,
2) standards and guidelines specific to each alternative which address landslide hazard,
3) land allocation patterns and
4) monetary budget proposed for landslide stabilization, inventorying and monitoring of landslide hazards.

Because landslides are relatively rare on the eastside of the Forest, most of the following discussions refer to the westside where landslides are common.

Landslide Sediment Volumes

Landslide volumes were derived from 3 sources: 1) the Sediment Model; 2) an estimate of increased landslide production associated with wildfire and 3) an estimate of the reduction of future landslide volume associated with landslide stabilization projects. It is important to recognize that each source utilizes data with different levels of reliability. These differences are described below.

The Sediment Model

This model predicts landslide volumes for a moderate severity climatic sequence such as that of 1965 through 1975 excluding the 1964 flood. It takes into account **what** activities are being planned, (timber harvesting and road construction), **how much** is planned (acres), **when** it will occur and **where** it will occur (on geologically sensitive or non-sensitive land). Refer to Appendices B and G for more information.

The model predicts total landslide production on the westside and divides it into natural, road-associated and harvest-associated. It accounts for future harvesting and roads as well as for past disturbances (wildfire, harvesting, roads). It does not include the effects of future wildfire or landslide stabilization projects. Vegetative recovery is projected over the 5 decade planning period.

The basic premise of the Sediment Model is that past landslide rates can be used to predict future rates on similar land under similar climatic conditions. The results are imprecise, but allow a comparison of landslide risk between alternatives. The model assumes that a climatic sequence like that of 1965 through 1975 occurs in each of the 5 decades being analyzed. This is not very likely and some decades will be dryer, while others may be wetter (possibly including 1964 type storms). Thus, landslide production over the next 5 decades is likely to fluctuate much more than indicated by the model.

Studies in the western United States indicate that, on the average, roads increase debris slide rates by a factor of about 150 (150 times more landslide volume is produced than would be on undisturbed slope) while clearcut harvesting increases the rate by a factor of about 3 (Amaranthus et.al., 1985). For the Sediment Model, it was assumed that landslide production due to roads would be 20 times the undisturbed rates and the production due to devegetated areas from harvesting and wildfire would be 5 times the undisturbed rate. These factors are based on local studies at Grider Creek and the Salmon River Basin (USFS, 1988; de la Fuente and Haessig, 1993).

Several important assumptions were made. It was assumed that future management activities would be similar to those applied over the past 20 years. It was also assumed that BMPs and 1987 geologic standards and guidelines are applied on all alternatives.

The model is sensitive to allocation patterns. Alternatives which allocate geologically sensitive land to intensive timber management are expected to produce more landslide volume than those which do not. However, in the case of the consolidated inner gorge (part of the suitable land base for some alternatives), the sediment model is not very sensitive to differences in allocation. This is due to the Forest Constraint which does not allow management to be more intensive than Regulation Class 3 (refer to Chapter 2 - Forest Constraints). The outputs of the Sediment Model are displayed in Figure 4-2.

Wildfire

Wildfire projections were not available when the Sediment Model was developed. As a result, the effects of future wildfire on landslide production were computed separately. The results are displayed in Table 4-2 and Figure 4-3. Such predictions are tenuous, because estimating future wildfire location and occurrence is difficult. Because large areas are likely to burn, wildfire is a very important element of the landslide assessment. Some important assumptions are described below.

1) Of the acres predicted to burn in the future, it was assumed that all vegetation would be killed on 84% of the high intensity burn acres, on 50% of the moderate intensity burn acres and on 16% of the low intensity burn acres. These percentages are derived from the burn intensity definitions.

For example, about 16,600 acres per year are predicted to burn in wildfires for Alternative A in the fifth decade of which 4,704 acres would be high intensity, 9,687 acres moderate intensity and 2,246 acres low intensity. This equates to 9,154 acres of land per year or 91,540 acres per decade where all vegetation was killed. The equation is (4,704 x 0.84) + (9,687 x 0.50) + (2,246 x 0.16) = 9,154 acres per year.

2) Based on historical records of fire salvage over the past 30 years, it was assumed that 56% of the area on CAS land which burned in future fires would be salvage logged. The effect on landslide sediment production of this 56% was accounted for in the Sediment Model as part of the green timber sale program. The other 44% was treated as additional disturbance.

For example, if 9,154 acres burn annually at high or moderate intensity, then 1,922 acres would occur on CAS land. The CAS land base comprises 21% of the total, and it is assumed that the fire would be evenly distributed on CAS and non-CAS lands. Then, 21% CAS acres x 9,154 acres burned equals 1,922 fire

acres on CAS. Since it is assumed that 56% of the burned CAS lands would be salvaged logged, this would equal 1,076 acres (0.56 x 1,922 = 1,076). The sediment model accounts for this disturbance, but not the remaining 8,078 acres (9,154 - 1,076 = 8,078). An important implication of this assumption is that a large proportion of the harvest program would be salvage in nature and as such would be randomly distributed across the landscape rather than avoiding the most unstable areas as would be the case with the regular timber program. The Sediment Model does not account for this possibility.

3) It is predicted that wildfire would burn a total of 166,000 acres of land in all disturbance classes for all alternatives in the first decade. This would result in about 94,000 acres of fire-killed vegetation. The predicted total fire area remains the same for the fifth decade and the area of fire-killed vegetation ranges from 82,000 per decade in the Preferred Alternative to 103,000 acres in Alternative E. An average of 94,000 acres of vegetation killed by wildfire per decade was assumed for all alternatives in all decades to simplify the assessment of wildfire effects.

Prescribed Fire

Prescribed fire would vary by alternative (refer to Table 2-5). Prescribed burning for site preparation (burning of logging residue and brush) overlaps with harvested land and is, therefore, accounted for in the Sediment Model. It was assumed that such fire would not accelerate landslide rates beyond that associated with harvesting activities. The other types of prescribed fire are generally designed to reduce the risk of large catastrophic fire in the future. However, they do involve killing some patches of vegetation and, as such, increase landslide rates in local areas. Thus, prescribed fire of the type planned has a positive effect in the long term, but can have local adverse effects which are not accounted for in the Sediment Model.

Watershed Restoration

Watershed restoration activities such as stabilization of active landslides, can be an effective means of reducing the delivery of sediment to the stream system. Past landslide stabilization projects on the Forest have reduced landslide-associated sedimentation at a cost ranging from $2 to $80 per cubic yard. It was assumed that the cost of future stabilization projects for reducing landslide sediment would average $5 per cubic yard. This average cost was then used in conjunction with the landslide stabilization portion of the projected geology budget to estimate the reduction in landslide sediment due to restoration activities (refer to Table 4-2 and Figure 4-4). Volume estimates for the reduction in landslide sediment are not included in the Sediment Model.

Total Net Landslide Volume

The predicted landslide volumes from the Sediment Model adjusted for predicted future wildfire volumes and predicted landslide stabilization volumes provide a useful indicator for assessing potential cumulative watershed effects due to landslide sediment.

Other Geologic Hazards and Resources

Important features in the standards and guidelines relating to geologic hazards and resources were compared among the alternatives.

The potential asbestos hazard was assessed by comparing the miles of new road construction proposed through ultramafic rock. It was assumed that new roads would be built on CAS land only and the potential hazard would be directly proportional to the length of new roads in ultramafic rock.

The key indicator for assessing the rock material resource is the estimated volume of rock and soil material that would be used by each alternative. It was assumed that one-third of all new roads would be rocked and that some alternatives would also rock some existing roads (refer to the Transportation section later in this chapter). The application rate was assumed to be 2,000 cubic yards per mile of road. Additionally, it was assumed that rock would also be used for landslide stabilization and fish habitat improvement projects. It was estimated that one-quarter of the landslide stabilization portion of the Geology Budget would be used for rock at a cost of $20 per cubic yard.

The key indicator for areas of unique geological value is the number of Geologic SIAs recommended for classification by each alternative.

Environmental Consequences

Unsuitable Lands

Consequences Common to All Alternatives

All alternatives would treat active landslides, toe zones of rotational slumps and earthflow deposits, inner gorges developed on unconsolidated material and the severely dissected and weathered granitic terrane as unsuitable for timber management (refer to Chapter 2 - Management Requirements and Chapter 3 - Geology). These areas would be managed to enhance watershed and ecosystem values; no timber yields would be programmed. This type of management would greatly reduce landslide production.

The alternatives vary in how they would deal with other geologically sensitive terrane types (refer to Table 4-3). These variations are discussed under Landslide Hazards as their treatment has an important effect on slope stability.

Landslide (Slope Stability) Hazards

Consequences Common to All Alternatives

General Effects

The direct effects of both natural and management-related landslides include ground cracking, ground displacement, removal of soil and vegetation as well as the destructive effects of landslide debris traveling rapidly down a slope. Debris slides can cause damage to stream channels, fill pools with sediment and destroy vegetation. They can also damage roads and structures. Indirect effects due to secondary processes include the effects of flooding resulting from landslide dam formation, from the failure of such a dam and from bridge or culvert failure following blockage by a landslide or debris flow.

Cumulative effects occur when the effects of individual landslides combine and jointly affect other processes or values. Several examples follow. Small debris slides could join together to form a large debris torrent. Many small landslides could jointly deliver large volumes of sediment to a reservoir or river segment with high fisheries values. Temporary dams formed by logs and debris delivered by several small landslides could fail catastrophically damaging watersheds and downstream structures.

Short-term effects are those which last no longer than 10 years. Effects which last longer than 10 years are considered to be long term. The effects of timber harvesting are long term as they last for several decades. Road construction also has long-term effects. Surface disturbance associated with yarding or site preparation is usually short term, but it can also be long term depending on the intensity of disturbance. These disturbances cause changes in soil structure as well as slope hydrology. Landslides can have major effects on stream channels, lasting for decades.

Wildfires, timber harvesting, road construction as well as utilization of rock, soil and mineral resources would occur with all alternatives. These activities disturb vegetation and soil resulting in increased landslide risk.

Mitigation Measures

Measures taken to mitigate the adverse effects of project activities include the application of Best Management Practices (BMPs) and project design using the principles of soil engineering, environmental and engineering geology, geomorphology, hydrology and soil science. These measures would be available in all alternatives for implementing site-specific projects.

BMPs are a set of general guidelines assembled by the Forest Service and approved by the California Water Quality Control Board in response to the Federal Clean Water Act (Sections 208 and 319). BMPs would be applied in ground and vegetation disturbing activities undertaken and administered by the Forest Service in all alternatives. BMPs are a collection of routine methods and practices used in planning and execution of land use activities that have been found to be effective in mitigating adverse effects. Since BMPs are, for the most part, general in nature, individual projects and site designs will be reviewed by ID teams to ensure the effectiveness of all mitigation measures.

Timber Harvesting - In areas where site investigation reveals a high risk of shallow debris sliding, vegetation leave areas or selective cutting may be prescribed. Work such as that of Gray and Megahan (1981) on the Idaho Batholith suggests that debris slide hazards might be mitigated by leaving vegetation in sensitive areas.

Where there is a risk of increasing landslide potential such as on or above dormant landslides, leaving vegetation can make harvest-associated reductions in evapotranspiration less severe.

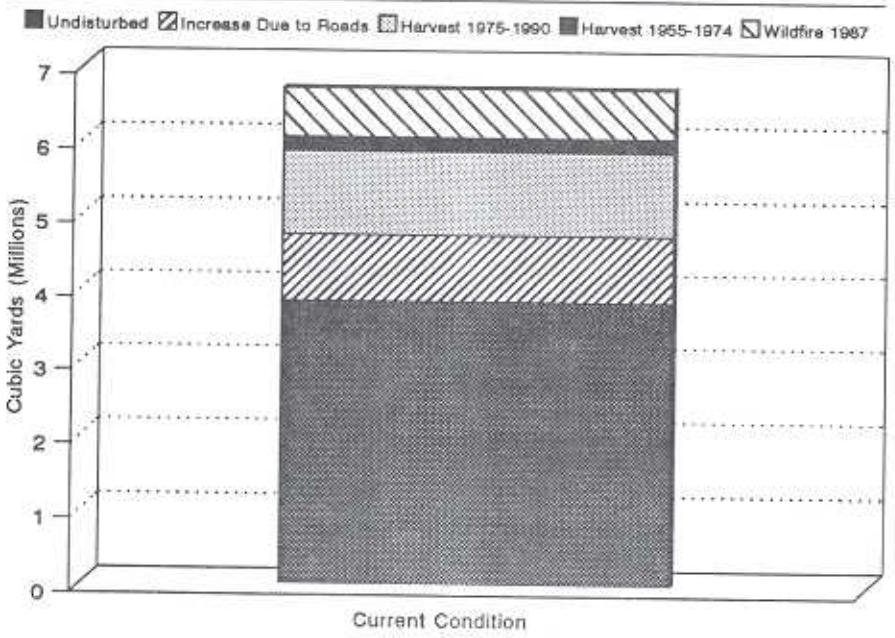
Leave areas are difficult to maintain in some areas due to logging damage and site preparation burning. While the use of leave areas is one of the most commonly used landslide mitigation measures, it deals only with the on-site effects of the vegetation, primarily the mechanical support provided by the roots. It does not address the potential changes in slope hydrology which may be caused by vegetative manipulations upslope from the area.

In summary, it is a fairly straightforward process to leave vegetation on an unstable site to retain local support, but the effectiveness of this action is linked to the assumption that root reinforcement is the only role trees play in the stability of a slope. It is much more difficult to mitigate the potential adverse effects of reduced evapotranspiration, since much larger areas are involved and the hydrology of slopes is generally quite complex.

Roads and Structures - Avoiding the most unstable areas when designing roads and harvesting units is the most reliable mitigation measure. The use of special road design techniques to assure cut and fill slope stability and to stabilize and prevent natural landslides can also be very effective. This might include using rock buttresses and reinforced fills built with special fabrics. Providing subsurface drainage and using sound construction practices involving controlled compaction of fills can also be extremely effective in preventing landslides.

Existing earthflow-slumps would usually be avoided. However, in a few situations, roads can be located and designed to improve the stability of earthflow-slumps. Engineering geology and geotechnical engineering

Figure 4-1. Predicted Landslide Volume (Westside) for Existing Condition (1990)



provide techniques for analyzing site conditions and options for landslide stabilization measures (Varnes, 1978; Veder, 1981; Zaruba and Mencl, 1969).

The current technology is good for designing stable earthen structures and fair for stabilizing natural landslides (Varnes, 1978). Stable earthen structures include road and landing fill, soil disposal areas, road surfacing, geometry of excavations and design of landslide repair. Slope stability is modeled using parameters for the angle of internal friction, cohesion and pore pressures in two-dimensional diagrams that account for slope and soil-body geometry (Varnes, 1978).

However, costs involved in construction of stable earthen structures in the Forest environment often make such measures economically infeasible. Also, many of the earthflow-slumps of the Old Landslide Terrane are too large to be economically stabilized and often very complex, making it difficult to design effective stabilization measures. Attempts to stabilize such large landslides are described by Veder (1981).

The accumulation of debris from multiple landslides can cause cumulative watershed effects. Mitigation would require control of the amount of debris mobilized. For example, by controlling the number of potential management-associated debris flow sites in a watershed, the potential for adverse cumulative watershed effects can be reduced.

Among the types of management related cumulative watershed effects which can be mitigated are formation of landslide dams, changes in channel structure and channel bottom composition, flooding and the formation of debris torrents. These cumulative effects directly affect man-made structures such as roads, bridges and buildings.

Landslide Volume Estimates

Figure 4-1 displays the estimated effect of current disturbance levels on landslide production. The volume labeled "Undisturbed" in Figure 4-1 is the landslide volume the forest would likely produce if it were undisturbed by roads, timber harvesting activities or wildfire. The values for roads, harvesting and wildfire represent the increase in sediment production likely to result from each of these disturbances.

Under undisturbed conditions, an estimated 3.8 million cubic yards of landslide sediment would be produced on the westside of the Forest in response to a moderate climatic sequence such as that which occurred from 1965 through 1975.

Under 1990 disturbance levels, 6.7 million cubic yards are predicted. The 2.9 million cubic yard difference is due to an increase in natural landslide risk from the 1987 wildfires as well as in human-induced landslide risk from roads and timber harvesting. Roads account for 0.9 million cubic yards of the increase, while harvested and burned areas account for the other 2.0 million cubic yards. Road values are smaller than those associated with harvesting and wildfire because the burned and harvested land occupies about 14 times as much land as the roads.

Due to the disturbances which occurred prior to 1990, all alternatives would begin the planning period with a landslide production rate which is 76% higher than undisturbed rates [(6.7 - 3.8) divided by 3.8 x 100 = 76%). These disturbances include 5114 miles of system roads (about 20,500 acres); 181,000 acres of past

timber harvesting (clearcut and shelterwood prescription) and 105,000 acres of land burned at high or moderate intensity in the 1987 wildfires Forest-wide. The overlap in the acres of past harvesting and the 1987 wildfires was accounted for in the Sediment Model. The bulk of the timber harvesting and road construction occurred from 1960 to 1990.

Due to the large area involved, past activities are likely to influence landslide production much more than proposed activities in the first decade for all alternatives. The 2.9 million cubic yards associated with past disturbances tend to make the proposed activities appear relatively insignificant. However, when comparing the effect of new disturbance to that of past disturbance, it is extremely important to recognize that, on average, the westside landslide production is already 76% above undisturbed levels. Each increment above that could be important, despite its small relative size.

The 76% increase in predicted landslide volume over the amount for undisturbed conditions is a Forest-wide average. The value varies considerably between individual watersheds.

Table 4-1 displays the range in this value across major subwatersheds on the Forest expressed as a percent increase over undisturbed conditions. The percentages are derived by subtracting rates for undisturbed conditions (no roads, harvesting or wildfire) from 1990 rates and dividing by undisturbed rates.

Table 4-1. Landslide Production

Watershed Name	Existing (1990) (% increase over undisturbed conditions)
Beaver	91
Butte Valley	55
Clear	69
Dillon	23
East Scott	80
Elk	97
Empire	81
Grider	87
Horse	96
Humbug	64
Independence	150
Indian	86
Klamath	88
Lower Scott	61
McKinney	120

Table 4-1. Landslide Production

Watershed Name	Existing (1990) (% increase over undisturbed conditions)
Middle Scott	40
North Fork Salmon	59
North Scott	66
North Salmon	30
Rock	69
Russian	22
South Fork Salmon	76
South Scott	49
Salmon	61
South Salmon	8
Thompson	76
Ti	97
West Salmon	20

This elevated landslide risk due to past activities is likely to have several consequences. Management-related landslides would occur in response to smaller storms than if the forest were undisturbed. The number, size and effects of landslides would be higher for any given storm than for undisturbed conditions. This would likely affect water quality and fish habitat over the 5-decade planning cycle. These effects would include an increase in total landslide-derived sediment, changes in the nature and distribution of pools and riffles, changes in channel-bottom texture as well as damage to structures.

It is not possible to accurately predict the actual effects which would occur. However, the increase in predicted landslide volume for a disturbed watershed over that of an undisturbed watershed as shown in Table 4-1 provides a useful means of characterizing the magnitude of likely adverse effects.

Observation of the effects of past storms on the Forest reveals that large intense storms such as the 1964 event have resulted in landslides and flooding which caused widespread removal of riparian vegetation, deposition of sediment in low gradient stream reaches and damage to other values. This storm adversely affected fish habitat and water quality in numerous watersheds, many of which were undisturbed.

However, smaller storms such as those occurring between 1965 and 1975 were observed to have relatively small effects on undisturbed watersheds and disproportionately large effects on some roaded and logged watersheds such as the Little North Fork of the Salmon River (de la Fuente and Haessig, 1993).

It is anticipated that future road construction and timber harvesting would produce fewer landslides than such activities have in the past. This would be due to improved design and implementation of these activities and the strict application of standards and guidelines.

All alternatives would begin Decade 1 with the potential to produce 6.7 million cubic yards of landslide sediment. In the absence of future wildfire, this potential is expected to decrease rapidly each decade despite the fact that new road construction and timber harvesting would occur. Several reasons for the drop in each successive decade follow:

- Historic regeneration harvest rates from 1960 to 1990 were higher than those proposed in any alternative. The historic average for the entire Forest is about 60,000 acres per decade, while the highest presently under consideration is 50,000 acres per decade in Alternative G (SOHA).
- Historic road construction rates from 1960 to 1990 were also much higher than those proposed in any alternative. Historically, about 1,700 miles per decade were constructed. The highest alternative proposes 284 per decade. This comparison is based on the assumption that most of the existing roads were built from 1960 to 1990.
- In all alternatives, standards and guidelines require that future harvest avoid extremely sensitive lands prone to landslides. In the past, a considerable amount of harvesting occurred on these lands. The 1987 wildfires also burned some of these areas.
- The effects of the 1987 wildfires, one of the largest wildfires on record (105,000 acres of high and moderate intensity burn), are included in existing disturbances. Future wildfire effects were modeled separately from the Sediment Model as projections were not available at the time the model was run.
- As revegetation occurs over time, slope hydrologic processes and root reinforcement would to return to pre-disturbance levels.
- All alternatives would have similar standards and guidelines relating to slope stability. Guidance would be provided to reduce landslide risk by managing vegetation on unstable lands to promote slope stability and conducting slope stability evaluations for certain activities on geologically unsuitable or potentially unstable lands. Specific standards would be applied to extremely unstable lands. Guidance would also be provided for implementing watershed restoration activities.

Comparison of Alternatives

Landslide Sediment Volumes

Predicted landslide volume will be the primary means of comparing the effects of landslides between alternatives.

Figure 4-2 displays the projected landslide sediment, excluding future wildfire and landslide stabilization projects, that would be delivered to streams for each alternative in each decade. It is assumed that a climatic sequence like that of 1965 through 1975 occurs each decade. The current situation labelled "Existing" is also displayed for comparison purposes.

Figure 4-3 displays the projected landslide sediment, including future wildfire but excluding landslide

Figure 4-2. Landslide Sediment Production Without Future Wildfire or Restoration (Westside)
Decades 1 Through 5

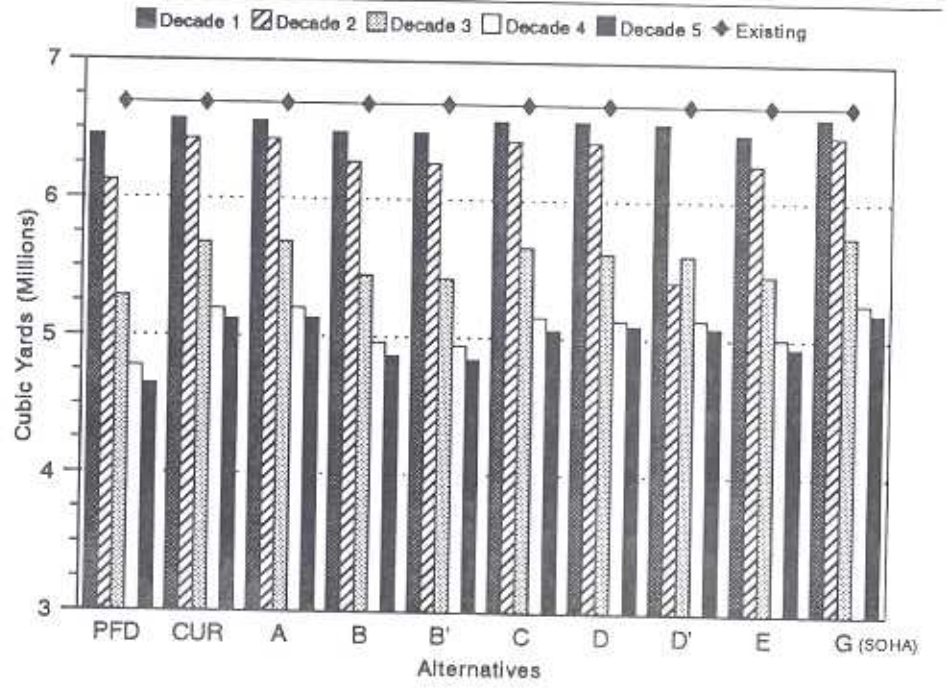
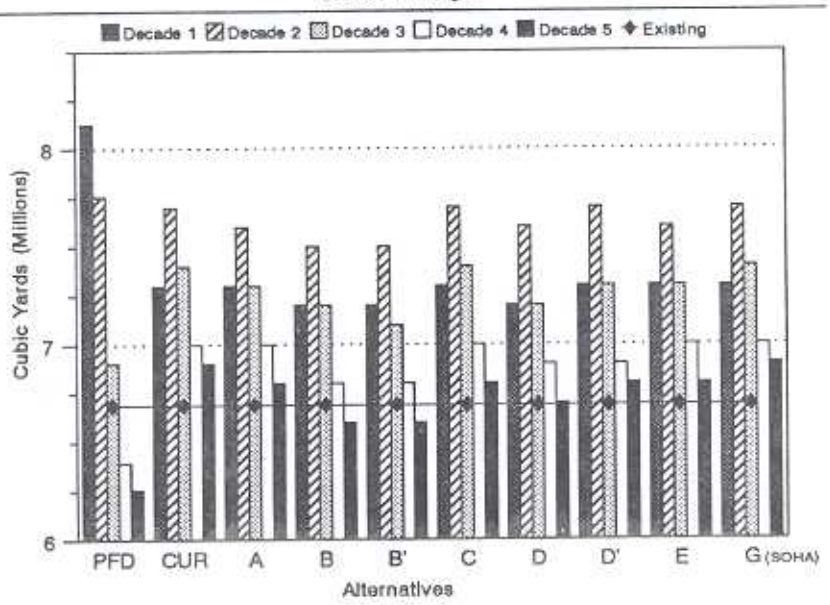


Figure 4-3. Landslide Sediment Production with Future Wildfire Excluding Restoration
Decades 1 Through 5



stabilization projects, that would be delivered to streams for each alternative in each decade. The existing level of sediment production is also displayed.

With any alternative, wildfire would be expected to kill all vegetation on about 94,000 acres per decade. The estimated additional landslide volume due to projected future wildfire ranges from 0.69 million cubic yards in Alternative D to 1.67 million in the Preferred Alternative in Decade 1. It would range from 1.91 million cubic yards in Alternative E to 1.62 million in the Preferred Alternative in Decade 5.

When the effects of future wildfire are added to those from future management activities and natural disturbances, the total landslide production rate would remain above the existing (1990) level through all 5 decades for most alternatives. In the fifth decade, the projected volume for most of the alternatives is expected to again approach the 1990 level. The projected landslide sediment volume for the Preferred Alternative is expected to be below current levels in the fourth decade.

The effects of projected wildfire and recovery from past disturbances are the key factors in explaining the differences in landslide production between alternatives. Although all alternatives will likely experience similar wildfire effects (94,000 acres of fire-killed vegetation per decade), the Preferred Alternative shows greater landslide volumes in the first 2 decades and greater rate of recovery in the last 3 decades than the other alternatives. This is likely due to fewer acres of CAS land that are burned by wildfire and salvaged in the green timber sale program and more acres of fire-disturbed sensitive land.

Figure 4-4 displays the projected landslide sediment including future wildfire and landslide stabilization projects that would be delivered to streams for each alternative in each decade.

The landslide stabilization program for Alternative E would reduce landslide sediment by 800,000 cubic yards per decade. The program for Alternatives Preferred, A, B, B', D and D' would reduce landslide sediment by 720,000 cubic yards per decade. Alternatives Current, C and G(SOHA) would reduce it by 32,000 cubic yards per decade.

When the benefits of landslide stabilization are considered, the projected total landslide volumes for Alternatives Preferred, A, B, B', D, D' and E drop below 1990 levels by the fifth decade. Alternatives Current, C and G(SOHA) would remain above 1990 levels for all decades.

Figure 4-5 displays the projected landslide volume that would be delivered to streams due to the proposed road construction and timber harvesting for each alternative in each decade. It isolates the effects of proposed management activities for each alternative allowing a useful comparison.

The estimated additional landslide volume due to new roads and new timber harvesting would range from 0.095 million cubic yards in the Preferred Alternative to 0.29 in Alternative G(SOHA) in Decade 1. It would range from 0.086 million cubic yards in the Preferred Alternative to 0.26 in Alternative G(SOHA) in Decade 5.

Comparing Figure 4-2 and 4-5, it is evident that wildfire has the greatest potential to accelerate landslide production (assuming that road construction standards are fully applied), even after accounting for the overlap of wildfire and the green timber harvesting program.

Figure 4-4. Total Landslide Sediment Production with Future Wildfire and Improvement Projects

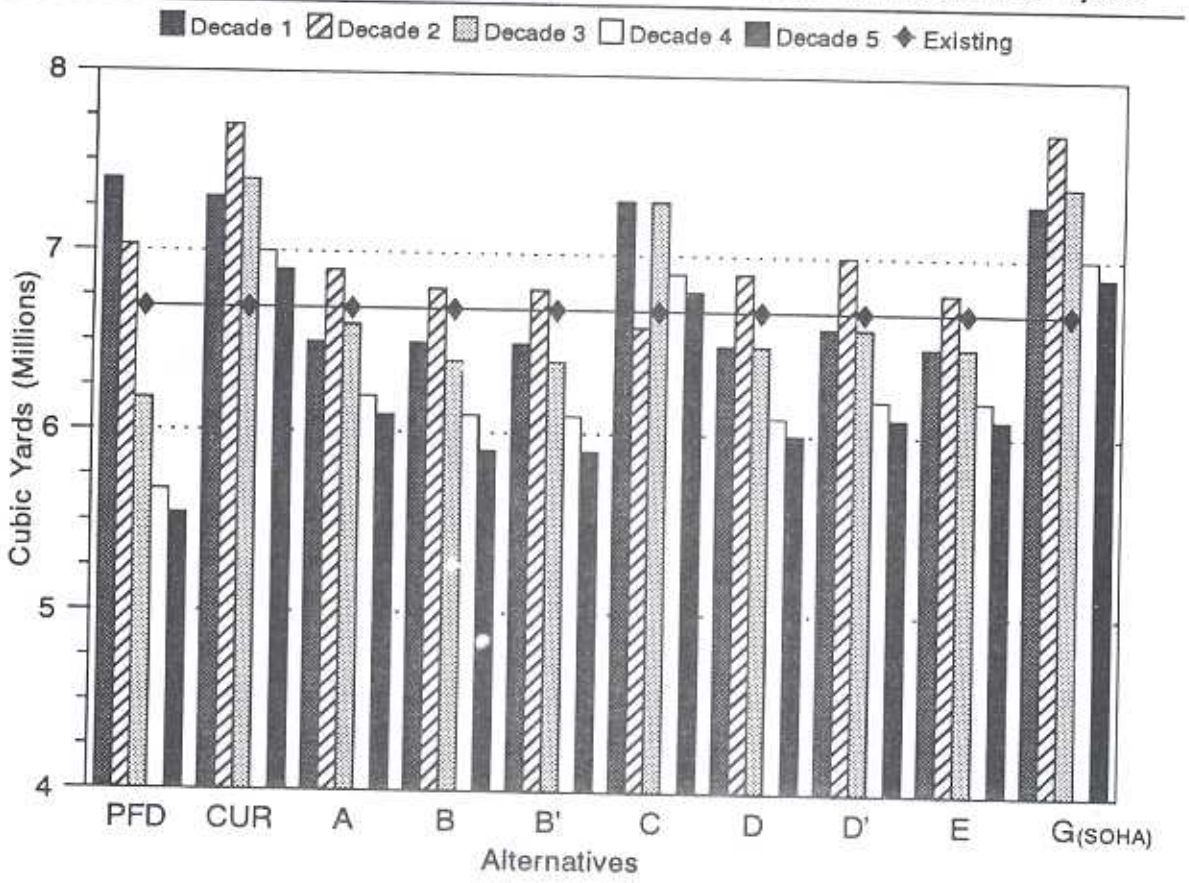
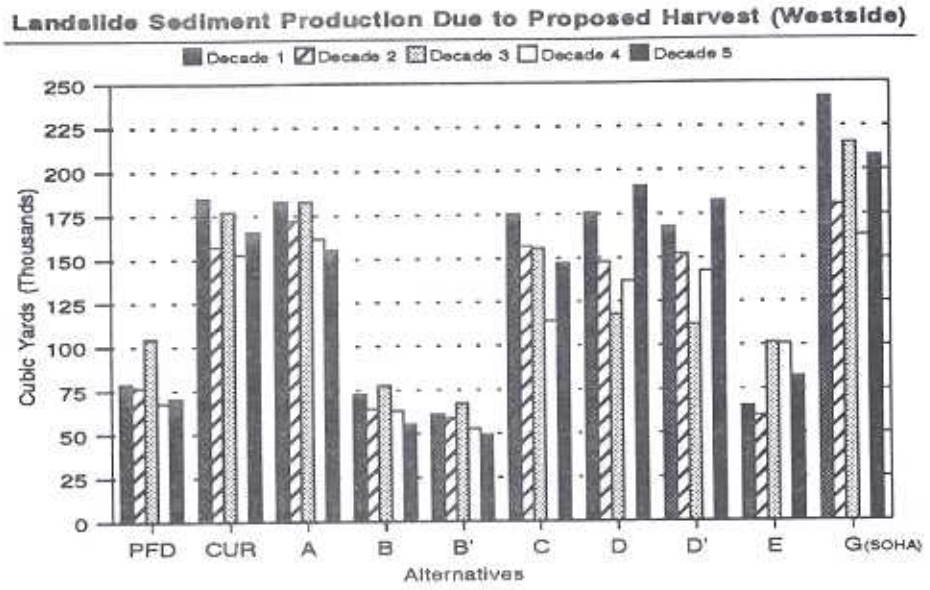


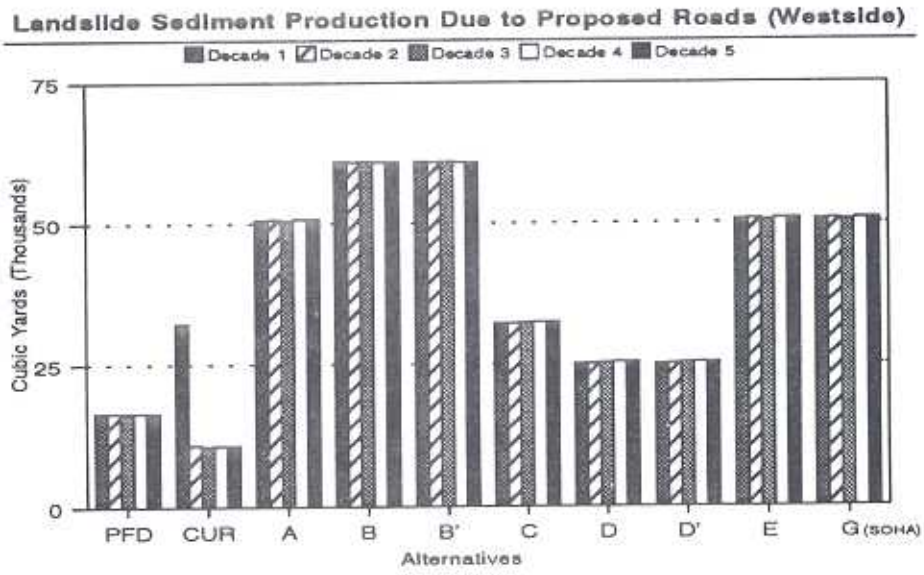
Table 4-2 summarizes the information previously presented. It displays the following information for Decades 1 and 5 for each alternative: Column 2 - landslide volume related to new management activities (roads and timber harvesting); Column 3 - landslide volume associated with new management activities plus past fire and management activities plus undisturbed lands with recovery factors (output of the sediment model); Column 4 - additional landslide volume associated with future wildfire; Column 5 - reduction due to future landslide stabilization projects; Column 6 - net landslide volume from columns 3,4,5; and Column 7 - the percent over undisturbed (undisturbed landslide rate minus the rate for decades 1 and 5, divided by the undisturbed rate). All volumes are expressed in millions of cubic yards.

Table 4-2. Predicted Landslide Volumes in Million Cubic Yards

Alternative(1)	New Activity(2)	Total from Sediment Model (3)	Added Volume Wildfire(4)	Reduction Due to Restoration(5)	Grand Total (6)	Percent Over Undisturbed (7)
Decade 1						
PFD	0.095	6.453	+ 1.670	- 0.720	7.403	94
CUR	0.217	6.569	+ 0.734	- 0.032	7.271	91
A	0.234	6.564	+ 0.697	- 0.720	6.862	81
B	0.134	6.479	+ 0.732	- 0.720	6.491	80
B'	0.122	6.476	+ 0.732	- 0.720	6.487	80
C	0.207	6.566	+ 0.727	- 0.032	7.261	91
D	0.201	6.566	+ 0.688	- 0.720	6.534	81
D'	0.192	6.560	+ 0.719	- 0.720	6.559	82
E	0.116	6.485	+ 0.791	- 0.800	6.476	81
G(SOHA)	0.292	6.611	+ 0.702	- 0.032	7.281	91

Figure 4-5.


Landslide Sediment Production Due to Proposed Harvest (Westside)
Decade 1
Decade 2
Decade 3
Decade 4
Decade 5
Cubic Yards (Thousands)
250
225
200
175
150
125
100
75
50
25
0
PFD
CUR
A
B
B'
C
D
D'
E
G(SOHA)
Alternatives


Landslide Sediment Production Due to Proposed Roads (Westside)
Decade 1
Decade 2
Decade 3
Decade 4
Decade 5
Cubic Yards (Thousands)
75
50
25
0
PFD
CUR
A
B
B'
C
D
D'
E
G (SOHA)
Alternatives

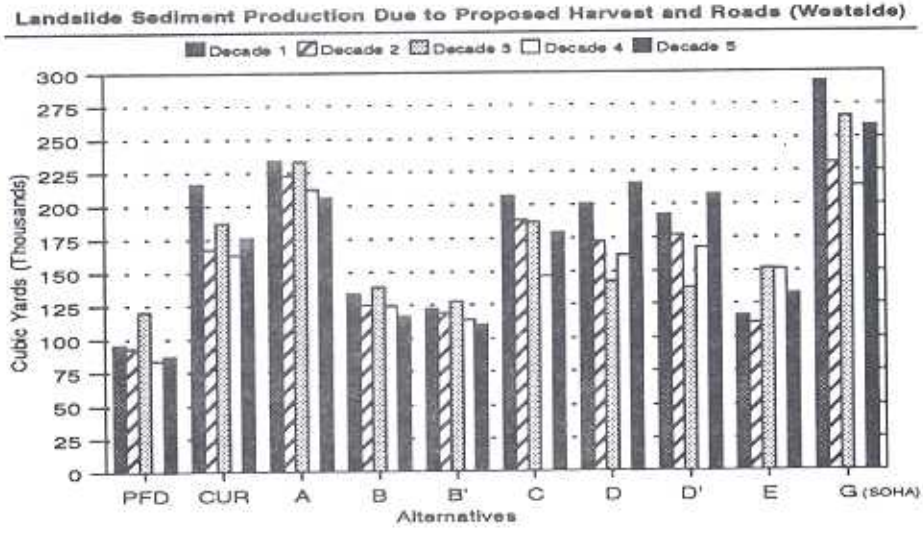

Landslide Sediment Production Due to Proposed Harvest and Roads (Westside)
Decade 1
Decade 2
Decade 3
Decade 4
Decade 5
Cubic Yards (Thousands)
300
275
250
225
200
175
150
125
100
75
50
25
0
PFD
CUR
A
B
B'
C
D
D'
E
G (SOHA)
Alternatives

Table 4-2. Predicted Landslide Volumes in Million Cubic Yards

Alternative(1)	New Activity(2)	Total from Sediment Model (3)	Added Volume Wildfire(4)	Reduction Due to Restoration(5)	Grand Total (6)	Percent Over Undisturbed (7)
Decade 5						
PFD	0.086	4.649	+ 1.616	- 0.720	5.545	45
CUR	0.176	5.121	+ 1.773	- 0.032	6.862	80
A	0.206	5.128	+ 1.683	- 0.720	6.091	70
B	0.116	4.862	+ 1.767	- 0.720	5.909	66
B'	0.110	4.844	+ 1.767	- 0.720	5.890	65
C	0.179	5.064	+ 1.756	- 0.032	6.788	78
D	0.216	5.087	+ 1.662	- 0.720	6.029	69
D'	0.208	5.084	+ 1.737	- 0.720	6.101	70
E	0.133	4.939	+ 1.909	- 0.800	6.048	70
G(SOHA)	0.258	5.198	+ 1.695	- 0.032	6.861	80

The potential for adverse cumulative watershed effects associated with landslide production can be assessed by examining the total landslide volume (Column 6 in Table 4-2) predicted for each alternative.

Figure 4-4 and Table 4-2 show that Alternatives A, B, B', D, D' and E are similar in total and averaged projected landslide volumes over the 5 decades considering management, wildfire and restoration activities. Alternatives G(SOHA), Current and C show the highest 5-decade average landslide sediment production rate among the alternatives. Alternative Preferred has the third lowest 5-decade average total sediment production; Alternatives B and B' are the lowest.

The Preferred Alternative is expected to have the greatest reduction in landslide-produced sediment by the fifth decade. By Decade 5, the total landslide volume would drop to 6.1 million cubic yards for Alternatives A and D', to 6.0 million for Alternatives D and E, to 5.9 million for Alternatives B and B' and to 5.5 million for the Preferred Alternative.

The largest landslide sediment volumes associated with new management activities (harvest and roads) are expected to occur with Alternatives G(SOHA), A and Current. Management activities associated with Alternatives G(SOHA) and A will contribute about one-quarter million cubic yards per decade of landslide volume to the Forest total. Alternatives Preferred, B' and B are projected to have the least management-generated landslide volumes. By Decade 5, the total landslide volume from management activities is projected to be 0.116 million cubic yards for Alternative B, 0.110 million for Alternative B' and 0.086 million for the Preferred Alternative.

In Decade 1, Alternatives Preferred, Current, C and G(SOHA) are expected to produce landslides at nearly double the undisturbed rate of 3.8 million cubic yards. The projected landslide sediment produced from Alternatives Current, C and G(SOHA) would be slightly more than double in Decade 2. The Preferred Alternative projects a lower landslide rate in Decade 2.

While there is no widely accepted means of determining the precise level of elevated landslide potential at which adverse cumulative watershed effects will occur, there are several local examples where watersheds were severely damaged when predicted landslide potential approached double the undisturbed rate.

During the period from 1965 to 1975, it was observed that the Little North Fork of the Salmon River experienced severe landslide damage when the predicted landslide rates were 82% over undisturbed rates (de la Fuente and Haessig, 1993). Some watershed managers have suggested using 100% over natural rates (double) as a maximum allowable increase over natural rates to minimize the potential for adverse cumulative watershed effects (Megahan et.al., 1992).

Because this analysis uses Forest-wide averages, the variability of individual watersheds is masked. There is a potential for adverse cumulative effects on individual watersheds which have landslide production rates at or above the Forest-wide average. This could be due to high existing rates (refer to Table 4-1), to intense future wildfire, to a high level of management activities or, more likely, to a combination of these.

For all alternatives, standards and guidelines would require areas with these types of watershed concerns to be managed to improve the watershed condition until certain recovery standards are met. This is expected to prevent any adverse affects of this type due solely to future management activities. Future wildfire could still generate these types of problems, however.

Because landslide volume generated by wildfire is 7 to 13 times higher than the volume related to management activities, it is the greatest cause for concern. The estimates in Table 4-2 indicate that Alternatives Preferred, B and B' would be the best at controlling overall sediment production in both the short-term and long-term. Alternatives Current, C and G (SOHA) would be the least effective. The other alternatives would lie between these 2 groups in effectiveness.

Land Allocation

Table 4-3 compares how each alternative would treat the geologically sensitive lands which are not covered by the Management Requirement relating to CAS

lands (refer to Chapter 2 and to Unsuitable Lands section earlier in this section). The second column in Table 4-3 displays the acres of geologically sensitive land that would be managed as Regulation Classes 1 and 2. The third column displays the acres of consolidated inner gorge that would be managed as Regulation Class 3. The fourth column displays the average number of acres of geologically sensitive land that would be harvested each decade by alternative. This last estimate was generated through a proportionate disaggregation from FORPLAN.

Table 4-3. Geologically Sensitive Land Comparisons in Acres

Alternative	Geologically Sensitive Land Managed as Regulation Class 1 & 2	Consolidated Inner Gorge Managed as Regulation Class 3	Geologically Sensitive Land Harvested Each Decade
PFD	158,000	0	6,400
CUR/RPA	175,000	54,000	10,500
A	121,000	65,000	10,500
B	0	0	0
B'	0	0	0
C	144,000	0	10,100
D	116,000	0	9,000
D'	116,000	0	9,100
E	92,000	0	6,500
G(SOHA)	229,000	67,000	13,200

Alternatives B and B' would allocate all geologically sensitive lands to Regulation Class 3. These alternatives would have the least risk of management-related landslide problems in these sensitive areas.

Alternative E would allocate the least acres of geologically sensitive land to Regulation Class 1 and 2 lands with the exception of Alternatives B and B' which would allocate none. Alternative E would be followed by Alternatives D and D', A, C, Preferred, Current/RPA and G(SOHA) in increasing order. However, the estimated 158,000 acres for the Preferred Alternative includes an unknown amount of unmapped RRs (intermittent streams, unstable and potentially unstable areas). Management activities on these geologically sensitive lands would be likely to include disturbances which could increase the risk of landslides.

All of the inner gorge would be unregulated in Alternatives Preferred, B, B', C, D, D' and E. These alternatives would have the least risk of landslide problems in these sensitive areas.

Alternatives Current/RPA, A and G(SOHA) would manage some of the consolidated inner gorge as Regulation Class 3; these alternatives would have an increased landslide risk on these acres.

Alternatives D and D' would provide for larger RMZs than all other alternatives except for the Preferred. The Preferred Alternative would allocate the most land to RRs which would include more land types than RMZs. RRs would include all intermittent and some ephemeral streams, small wetlands, unstable and potentially unstable lands. Landslide potential would likely be decreased in lands managed as RRs and RMZs.

Geology Budget

Table 4-4 displays the annual total budget for the geology program and the portion of the annual budget that would be used to inventory all geological hazards and resources by alternative. The total budget includes operations, inventory and landslide stabilization.

Table 4-4. Annual Geology Budget in Dollars

Alternative	Total	Inventory	Landslide Stabilization	Operations
PFD	$ 900,000	$ 232,000	$ 452,000	$216,000
CUR,C,G	$ 173,000	$ 0	$ 20,000	$153,000
A, B, B', D, D'	$ 894,000	$ 227,000	$ 452,000	$215,000
E	$1,050,000	$ 320,000	$ 500,000	$230,000

Using a cost of $5 per cubic yard of potential landslide sediment stabilized, Alternative E could reduce sediment by 800,000 cubic yards per decade; the Preferred Alternative and Alternatives A, B, B', D and D' could reduce sediment by 720,000 cubic yards per decade; and Alternatives Current, C and G(SOHA) could reduce sediment by 32,000 cubic yards per decade. Stabilization projects would allow areas with watershed concerns to meet recovery standards more rapidly. In turn, this would allow improved water quality and fish habitat conditions.

Consequences Unique to the Preferred Alternative

The Preferred Alternative would adopt an Aquatic Conservation Strategy, which contains 4 key components: RRs, Key Watersheds, Watershed Analysis and Watershed Restoration. RR standards and guidelines would have a profound effect on the way watersheds are managed in the future, greatly reducing sediment production associated with management activities. Through the process of watershed analysis of Key and Non-Key Watersheds, guidance for site analysis and project-level planning would be developed for RRs and unstable lands. This would include determination of current and desired levels of landslide production.

Standards and guidelines would establish a program to evaluate or upgrade all road crossings on streams to accommodate 100-year flood flows. Guidance would also be provided for implementation of watershed restoration activities, including road reconstruction, stabilization, closure and obliteration. Standards would minimize mining impacts and damages to RRs. Mining operations would undergo a through review for compatibilty with the Aquatic Conservation Strategy ojectives.

Geologic investigations would be a key component in watershed analysis and watershed restoration and are included as part of inventory and operations in the budget for the Preferred Alternative in Table 4-4. Watershed analysis would comprise a significant portion of the budget over the first half of Decade 1.

Hazardous Materials

The geology budget for geology inventory for each alternative is displayed in Table 4-4. Alternatives Preferred, A, B, B', D, D' and E would allocate money for geologic inventories. Alternative E would allocate the most. The Preferred Alternative would allocate the second highest amount. Alternatives A, B, B', D and D' would allocate the third highest amount. Landslide hazards and each of the geological hazards and resources discussed below would be inventoried in these alternatives.

Consequences Common to All Alternatives

All alternatives would involve construction and maintenance of roads in asbestos-bearing rock. Some asbestos-bearing rock is also likely to be used for road surfacing and rip rap in all alternatives except Alternative E. These activities could introduce asbestos fibers into the air.

Asbestos hazards from roads can be mitigated by applying dust abatement measures or by paving on a site-specific or project basis. At quarry sites, the most effective mitigation is avoidance of asbestos-bearing rock, but dust abatement such as by applying water can also be effective.

Asbestos is also known to occur in surface and groundwater in areas underlain by ultramafic rock. Some of the groundwater currently in use is known to contain asbestos. Health hazards posed by asbestos would be analyzed on all projects where the potential exists to introduce asbestos fibers into the air or to develop water for domestic use which may contain asbestos.

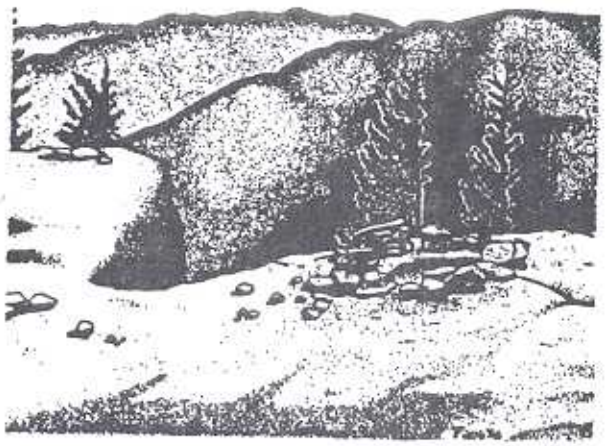
Exposure standards for workers have been set by the Occupational Safety and Health Administration. These standards describe acceptable concentrations of asbestos fibers in the air for the workplace and can affect projects such as road construction, rock crushing and placing of rock on road surfaces. However, no standards exist which address the general public when traveling over roads surfaced with asbestos-bearing rock. New standards exist for maximum contaminant levels for asbestos in domestic drinking water sources. Forest water systems suspected to be vulnerable to asbestos contamination are being evaluated for compliance.

The Forest Service has monitored asbestos concentrations in the air around some rock crushing operations in the Forest. Dust generated by vehicular traffic has also been tested on several forests in California. Most tests yielded results meeting the standards for the workplace. However, in a few instances road dust was found to exceed the standard (Bill Huff, personal communication, 1992). The results of these tests are available at the Forest Service Engineering Center in Pleasant Hill and at the Forest Supervisor's Office in Yreka.

Radon gas which occurs naturally in rock, soil and groundwater can become concentrated in buildings, particularly those with basements and air-tight rooms. This gas would constitute a natural hazard.

Radon hazard can be mitigated by identifying existing levels in dwellings and installing ventilation systems to prevent concentration of the gas. Hazards associated with abandoned mines and landfills can be mitigated by first identifying the substances present and then either removing the contaminated material or neutralizing it in place.

At present, the extent of hazardous materials which may be present in abandoned mines or landfills on the Forest is unknown. A hazardous material inventory is in progress and would be continued with all alternatives. The inherent risk would be present for all alternatives. The degree of risk would vary by alternative according to the standards and guidelines as well as the level of inventory and monitoring proposed. The presence of hazardous substances could damage the natural environment and afflict individuals with various health problems. The social and economic effects of these illnesses would be indirect effects.



Comparison of Alternatives

Table 4-5 displays the average miles of road construction planned in ultramafic rock each decade for the next 5 decades by alternative.

Table 4-5. New Road Construction in Ultramafic Rock

Alternative	Average Miles per Decade
PFD	8
RPA and E	35
CUR, A and G(SOHA)	106
B and B'	99
C	76
D and D'	53

These are the miles with a high likelihood of containing asbestos. Alternatives Current, A and G(SOHA) would have the most miles in this rock type, followed by Alternatives B and B', Alternative C, Alternatives D and D', then Alternatives RPA and E in decreasing order. The Preferred Alternative is projected to have the fewest miles of new road construction in asbestos-bearing rock. Alternative RPA and Current differ in the number of miles of new road construction because RPA is limited by RPA targets and a continuation of current management practices would not be limited. Alternatives with the least miles of construction in asbestos-bearing rock would be the least likely to introduce asbestos fiber into the air.

Geologic Hazards

Consequences Common to All Alternatives

Seismic hazards would generally not be affected by typical forest management activities. Increased seismic risk would occur if facilities were constructed near active faults. Construction of large reservoirs could also cause crustal deformation and possible seismic activity. Facilities constructed near active or potentially active faults could incur damage during an earthquake. Damage could occur from ground rupture, liquefaction, ground shaking and changes in drainage patterns resulting from subsidence and uplift. Damage could also occur from landslides, flooding and fires which may be triggered by an earthquake.

Generally, seismic hazards can be mitigated by identifying and avoiding the construction of facilities in areas where ground rupture, liquefaction, severe ground shaking or induced landslides are likely to occur. Where complete avoidance is not possible, structures can be designed to withstand some of the seismic effects such as ground shaking.

The risk of volcanic eruption on the Goosenest District is the same for all alternatives. Construction of buildings or increased visitor use near active faults or within the danger zone associated with volcanic eruption would increase the risk of damage or harm to facilities and individuals. Damage could occur from directed blasts, pyroclastic flow (hot mixtures of gasses, ash and rock fragments which move rapidly down the flanks of a volcano), mud flows, gas emissions, lava flows and air-fall tephra (volcanic ash and rock fragments).

A minor risk of harm to backcountry winter recreationists and facilities exists due to snow avalanche hazard. No alternative proposes any large change in this type of recreational use or opportunity from the current situation. In addition to creating hazardous conditions for winter recreationists, avalanches can destroy vegetation and re-distribute large amounts of snow on a slope, resulting in different melt patterns the following spring. Timber harvesting and fire can affect snow accumulation rates in avalanche source areas, while local changes in snow accumulation could result in different melt rates.

A minor risk of ground subsidence exists due to groundwater withdrawal in basins such as Scott Valley and Butte Valley. Ground subsidence could disrupt drainage patterns and allow consolidation of the aquifer. Consolidation of the aquifer would reduce its capacity to store water and is in part an irretrievable effect. An indirect effect would be the increased risk of flooding following subsidence.

The occurrence of land subsidence in response to groundwater withdrawal can be mitigated by monitoring groundwater levels and avoiding excessive withdrawal which results in permanent lowering of the groundwater table. The potential for collapse of underground cavities can best be mitigated by inventorying for such cavities and avoiding the construction of roads or buildings over them. In the case of old mining tunnels, other mitigations such as filling the tunnel with soil, rock or concrete are possible.

The collapse of underground openings such as natural caves or excavated tunnels from excavation or from the movement of heavy equipment pose a minor, local risk. Such a collapse might damage the vehicle and operator which caused the collapse, disrupt the surface drainage and change the air flow. In the case of a natural cave, these effects would include the potential loss of unique cave resources. The potential loss of habitat for cave species would be an indirect effect.

Comparison of Alternatives

Alternatives Preferred, A, B, B', D, D' and E would allocate money for inventories to identify collapse hazards. Identification of potential hazards would allow cave resources to be protected and reduce the risks to road builders and users.

Groundwater Resource

Consequences Common to All Alternatives

Groundwater withdrawal can lower the water table and reduce the flow of streams and rivers which are directly fed by the aquifer. Removal of groundwater from the Scott Valley alluvial aquifer likely reduces late summer flows in the Scott River, but the extent of this effect has not been investigated in detail.

Intensive road construction and surface disturbance could directly affect the volume of water which recharges an aquifer. Similarly, reservoirs could capture winter flows and provide recharge to an aquifer in late summer. Land subsidence could be an indirect effect of groundwater withdrawal in some areas.

Groundwater pollution would create a health hazard to human use. Flora and fauna could also be damaged where the groundwater nears and enters streams or rivers. Cumulative effects would occur where multiple withdrawal sites or pollution sites jointly affect overall groundwater volume or quality, respectively. The pollution potential for each alternative is related to the transportation system, recreational use, construction of new facilities and sewage disposal facilities, mining and projected use of chemical pesticides.

All alternatives would involve groundwater use by Forest Service facilities. This use is not likely to have a measurable effect on late summer flows in any of the rivers or major streams. However, groundwater use could affect a few first order streams where spring sources have been developed.

Past groundwater use has been very low, primarily for domestic purposes at campgrounds and fire stations. Historic rates of groundwater use by the Forest Service have been about 11 acre feet of water annually. Most of this is from fractured bedrock aquifers and perched aquifers in landslide deposits, not from the large valley aquifers (refer to Chapter 3 - Geology).

Future use is expected to remain around 11 acre feet per year for all alternatives. All alternatives would involve road construction and vegetation manipulation which could affect groundwater recharge rates. The risk of groundwater pollution would be inherent to all alternatives which involve use of transportation systems (highways and railroads), leach lines, herbicides, solid waste disposal sites, fertilizer and water wells.

The effects on slope hydrology, which could influence the volume of groundwater, are related to the amount of road construction and vegetative manipulation. Table 2-4 displays the miles of road construction by alternative. Table 2-5 displays an approximation of the silvicultual treatment acres by alternative. The absolute effects are unknown. The changes in groundwater volume and movement could be significant on a local level, but are too small to be measured on a Forest-wide basis. The change in water yield would be within the margin of error for the analysis.

Rock Material Resource

Consequences Common to All Alternatives

Removal of rock and soil material would require the same considerations as road construction and similar excavations. Large cuts and fills could activate natural landslides or initiate new slope failures if they are improperly designed. The effects of developing rock and soil sources would include local increases in landslide risk and changes in runoff patterns and aesthetic values. This is especially true in areas where several rock pits or borrow areas are developed.

If rock pits are not revegetated effectively, they can yield concentrated overland flow for many years. Other land uses such as the construction of roads or buildings can isolate rock outcrops preventing access to this resource.

Indirect social benefit from improved roads would accrue due to rock surfacing or paving. Another benefit would be achieving erosion abatement across large parts of a watershed from rock surfacing and from placing rip rap.

Comparison of Alternatives

Table 4-6 displays the average volume of rock and soil material in cubic yards that would be used each decade by the Forest Service for each alternative. The information used to calculate this volume can be found in the Planning Records for Geology.

Table 4-6. Volume of Rock and Soil Material

Alternative	Cubic Yards Per Decade
PFD	714,000
CUR/RPA	466,000
A	359,000
B and B'	422,000
C	569,000
D and D'	1,128,000
E	588,000
G(SOHA)	305,000

The Preferred Alternative would provide more guidance in its standards and guidelines for rock quarry development than the other alternatives.

Areas of Unique Geologic Value

Consequences Common to All Alternatives

Management activities can affect cave resources. Road construction above a cave could cause collapse in shallow caves. If roads above a cave divert surface runoff, the pattern of drainage through a cave could be altered. Modification of vegetative cover on an area draining into a cave could change the chemical character of the water resulting in modification of the cave-forming processes such as solution and precipitation. Uncontrolled recreational use of caves could result in damage to unique features.

All alternatives would apply mitigation measures for cave protection during ground and vegetation disturbing activities.

The Memoranda of Understanding between the Forest and professional caving societies for inventorying caves would be continued with all alternatives.

Comparison of Alternatives

Alternatives D, D' and E would recommend 25 Geological SIAs for classification. Alternative Preferred would recommend 20. Alternative C would recommend 17. Alternative A would recommend 15. Alternatives B and B' would recommend 9. Alternatives Current/RPA and G(SOHA) would not recommend any sites for classification. All alternatives would continue to manage the portion of the Medicine Lake Glass Flow that is within the Forest boundary as a Geologic SIA.

Recommended sites would receive special management to protect their unique values as this would be an objective of the management area. Alternatives which recommend individual sites as SIAs would have less risk of unique values being lost in those areas. Alternatives which recommend more sites as SIAs would likely maintain more special geologic values than those which recommend fewer.

A Forest-wide effort has been initiated to consolidate all existing information on caves within the Forest. The opportunity exists to complete a more comprehensive field inventory of cave resources on the Forest, dependent on available budget. Such an inventory could involve cooperation and shared costs with the National Speleological Society. Benefits would be to reduce the potential for inadvertent damage to cave resources by management activities, and also to increase the opportunity for cave research, public education and recreation.

Alternative E would provide the largest budget for geologic inventories, $320,000 per year; part of which would be available for cave inventory. The annual inventory budget for the Preferred Alternative would be $232,000. Alternatives A, B, B', D and D' would allocate $227,000. Alternatives Current/RPA, C, and G(SOHA) would allocate no money to geologic inventory (refer to Table 4-4). The potential for damage to caves would be substantially reduced by completing a thorough inventory of cave resource identifying the locations of sensitive caves.

The standards and guidelines for the Preferred Alternative would provide more comprehensive guidance for protection of cave resources and for implementing the Cave Resources Protection Act of 1988 than the other alternatives.

Locatable Mineral, Oil, Gas and Geothermal Resources

Consequences Common to All Alternatives

Development of geothermal resources could result in damage to the resource if heat reserves are depleted too rapidly.

The level of development of these resources cannot be predicted. Site-specific analysis would be required before development occurred. Refer to the Minerals Section later in this chapter for additional information on these resources.

Soils

Important Interactions

Important interactions related to soil resources are discussed earlier in this chapter under Physical Environment - Important Interactions.

Methodology

The following key indicators were used to evaluate the differences between alternatives relating to soil productivity:

1) acres of new road construction,
2) soil erosion loss in tons per decade,
3) acres of projected high intensity burn from wildfire, and
4) standards and guidelines relating to soil productivity.

The acres of proposed new road construction for each alternative were compared with the RPA Alternative.

A modified version of the Universal Soil Loss Equation was used for predicting soil erosion loss under the proposed forest management practices for each alternative. This modification was based on "A Guide for Predicting Sheet and Rill Erosion on Forest Land" (Dismeyer and Foster, 1984). The modified Universal Soil Loss Equation considers slope steepness, the nature and properties of the soil, the type and condition of cover, channel cutting as well as the amount and intensity of rainfall or snow melt in calculating soil erosion.

The soil erosion prediction includes the amount of erosion from road surfaces, cut and fill slopes and harvested acres. The acres with silvicultural prescriptions of clearcut, regeneration with reserves, shelterwood, group selection, seed tree, stand maintenance and salvage were used as an estimate of acres harvested. It was assumed that the soil loss tolerance for these management practices would be between 1 and 3 tons per acre during the first year if 50 to 80% soil cover was maintained.

The soil erosion projections are valid for comparing differences between alternatives. It would not be appropriate to use them as an absolute estimate of the amount of erosion produced.

Some validity tests of this model have been conducted on the Forest. Using erosion troughs and erosion bridges, the amount of soil erosion generated under various amounts of cover was compared to that estimated by the Universal Soil Loss Equation. The findings, although not statistically valid, support the validity of the relationship.

A review of the literature also supports the findings of this methodology. For every 0.1 inch of surface soil erosion from forest soils, the decrease in soil productivity ranges from 1 to 7% (Klock 1979; Alexander, 1988).

The soil erosion estimates in tons calculated from this method were used in the Sediment Model as an estimate of surface erosion that would be delivered to streams (refer to Figure 4-6). This information was used to estimate effects in the Water and Fisheries sections of this chapter. The surface erosion estimates do not account for the effects of future wildfire or restoration projects.

Records of historical fire occurrence were analyzed and used to project future acres burned in wildfires by intensity class (refer to Fire and Fuels Management section later in this chapter). The relative acres by alternative are compared.

The standards and guidelines relating to soil productivity were analyzed to determine environmental effects.

Environmental Consequences

Consequences Common to All Alternatives

All alternatives would adopt Forest-wide Standards and Guidelines relating to soil productivity which include BMPs (refer to Geology section earlier in this chapter for explanation of BMPs). These BMPs have been found to be effective in the past on the types of projects for which each is recommended. These standards would likely mitigate any significant adverse effects on the soil resource during project level management activities the majority of the time.

These mitigation measures are expected to minimize organic matter loss, soil erosion, soil compaction, soil displacement and fire damage. Soil permeability, porosity, sedimentation and fertility should also be protected by these guidelines. Generally, the BMPs that mitigate erosion and compaction are expected to be adequate to protect soil fertility and soil productivity. It is expected that any cumulative effects would be minimized by the application of these measures.

With any alternative, there is still the potential that soil productivity could be affected on site specific projects. Despite adherence to standards and guidelines, it is likely that soil productivity would not be maintained on a small percentage of the area due to environmental conditions or human error during implementation at some time during the planning period.

All alternatives would adopt standards and guidelines which provide for adequate soil cover to maintain soil productivity. Cover standards would be higher for soils with a high risk of erosion.

The Universal Soil Loss Equation was used to calculate the cover factors necessary to keep soil loss within acceptable limits. By retaining 50 to 80% soil cover,

the soil erosion rate should be reduced to less than 3 tons per acre per year which is expected to sustain soil productivity.

The soil loss tolerance factor of 3 tons or less per acre per year for soil was used as the maximum rate of annual soil erosion that would allow soil productivity to be sustained economically and indefinitely. The soil loss tolerances (Soil Conservation Service, 1983) range from 1 to 3 tons per acre per year for soil 10 to 60 inches deep.

The loss of 3 tons per acre the first year would be reduced to less than 1 ton per acre by the second year. This soil loss would decline over a 10-year period as ground cover increases through vegetative recovery.

The recovery period for road cut and fill slopes is expected to be similar to that of timber harvest units with erosion decreasing over a 10-year period as vegetation recovers. Erosion from roads surfaced with gravel is only expected to persist for about a year. Unsurfaced roads would likely have some erosional loss as long as they are in use.

New road construction would constitute a irretrievable loss as those acres would not be available for other uses such as growing timber. Construction of new roads could also constitute an irreversible loss of soil productivity due to soil compaction.

All alternatives used the same criteria to determine which lands were suitable for sustained timber production. These are discussed in Chapter 3 - Soils. Before any site disturbing activities occur, a site-specific project level analysis would be conducted including verification of current soil mapping and any irreversible loss of soil productivity would be identified.

Comparison of Alternatives

Figure 4-6 displays the estimated sediment due to surface erosion that would be generated with each alternative in Decades 1 and 5.

Each alternative would have a different potential effect on soil productivity due to differences in estimated surface erosion. These differences come from the variation in new road construction, timber harvesting acres and acres burned by high intensity wildfires.

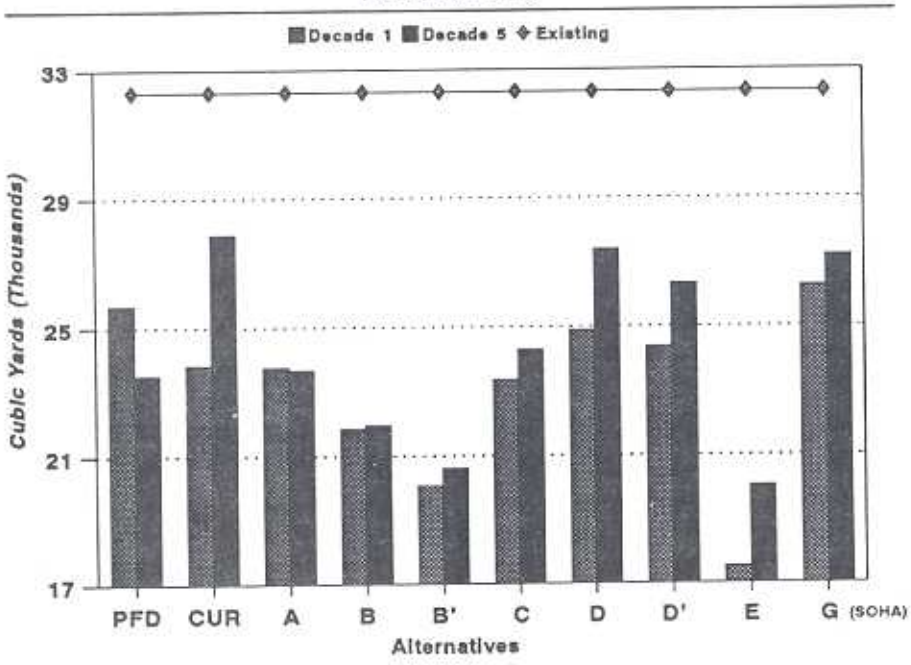
For all alternatives, the amount of high intensity burning from wildfire is expected to be 3,891 acres per year in the first decade. The acres expected to burn by high intensity wildfire in later decades vary as a result of the different amounts of prescribed burning planned in each alternative which would create different fuel loadings.

Any acres burned by high intensity wildfire could have a reduction in soil productivity and nutrient cycling. This reduction would be highly variable and is difficult to project on a Forest-wide level because the site specific locations of future wildfires cannot be accurately projected.

The greater the number of acres harvested and roaded, the higher the risk of reducing soil productivity potential as a result of loss of organic matter, soil erosion, soil compaction and soil displacement.

Regional guidelines to provide for long-term soil productivity and adequate nutrient cycling require a minimum of 5 logs of CWD per acre to be maintained. Alternatives Preferred, A, D, D' and E would meet this criteria. Alternatives Current/RPA, B, B', C and G(SOHA) do not. For alternatives that do not meet the minimum CWD criteria, additional mitigation measures

Figure 4-6. Surface Erosion Sediment Production without Future Wildfire and Restoration For Decades 1 and 5



might be required at the site level to avoid the risk of reductions in soil productivity in the long-term. Refer to the Biological Diversity section for a description of CWD requirements.

Consequences Unique to the Preferred Alternative

New road construction would be about 100 miles (720 acres) per decade in the first decade and 50 miles (360 acres) per decade in the fifth decade, about a 67% reduction from the RPA Alternative. Soil erosion loss associated with timber harvesting activities would range from 28,733 to 86,199 tons per decade. This would be about 48% less than with the Current/RPA Alternative. High intensity burn acres from wildfire would be projected as 3,710 acres per year in the fifth decade, about 45% less than with the Current/RPA Alternative.

The road stabilization program would eventually control most of the priority road sediment sources for non-point pollution. This would allow BMPs to be met which were adopted in response to Section 208 of the Clean Water Act.

The Preferred Alternative would require site treatments which minimize intensive burning unless appropriate for certain specific habitats, communities or stand conditions. Prescribed fires would be planned to minimize the consumption of duff and CWD. Soil and litter disturbance as a result of yarding and heavy equipment operation would also be minimized. This should increase the likelihood of maintaining soil fertility.

Consequences Unique to Current/RPA Alternative

New road construction would be 150 miles (1,080 acres) per decade in the first decade and 50 miles (360 acres) per decade for the fifth decade in the RPA Alternative. New road construction would average 235 miles (1,692 acres) per decade for 5 decades for the Current Alternative, about 57% greater than with the RPA Alternative. Soil erosion loss associated with timber harvesting activities would range from 55,386 to 169,158 tons per decade for both alternatives. High intensity burn acres are projected as 6,769 acres per year in the fifth decade.

Consequences Unique to Alternative A

New road construction would average 235 miles (1,692 acres) per decade for 5 decades, about a 57% increase above the RPA Alternative. Soil erosion loss associated with timber harvesting activities would range from 60,065 to 180,195 tons per decade. This would be about 8% greater than with the Current/RPA Alternative. High intensity burn acres from wildfire would be projected as 4,704 acres per year in the fifth decade, about 30% less than with the RPA Alternative.

Consequences Unique to Alternative B

New road construction would average 284 miles (2,044 acres) per decade for 5 decades, about a 89% increase above the RPA Alternative. Soil erosion loss associated with timber harvesting activities would range from 48,342 to 145,026 tons per decade. This would be about 13% less than with the Current/RPA Alternative. High intensity burn acres from wildfire would be projected as 6,038 acres per year in the fifth decade, about 11% less than with the RPA Alternative.

Consequences Unique to Alternative B'

New road construction would average 203 miles (1,461 acres) per decade for 5 decades, about a 35% increase above the RPA Alternative. Timber harvest and associated soil erosion would be about 14% less than Alternative B. High intensity burn acres would be similar to Alternative B. Effects are expected to be similar to Alternative B.

Consequences Unique to Alternative C

New road construction would average 151 miles (1,087 acres) per decade for 5 decades, about the same as with the RPA Alternative. Soil erosion loss associated with timber harvesting activities would range from 54,586 to 163,758 tons per decade. This would be similar to the Current/RPA Alternative. High intensity burn acres from wildfire would be projected at 5,642 acres per year in the fifth decade, about 17% less than with the RPA Alternative.

Alternative C would emphasize road stabilization and closure. Approximately 7 times as many acres would be treated as under the Current Alternative. High priority road sediment sources for non-point pollution would be controlled soon after discovery and lower priority work would eventually be accomplished as well. This alternative would be the most effective and timely in meeting the BMPs for road stabilization which were adopted in response to Section 208 of the Clean Water Act.

Consequences Unique to Alternatives D

New road construction would average 227 miles (1,634 acres) per decade for 5 decades, about 51% greater than with the RPA Alternative. Soil erosion loss associated with timber harvesting activities would range from 60,904 to 182,712 tons per decade. This would be about 10% greater than with the Current/RPA Alternative. High intensity burn acres from wildfire would be projected at 5,373 acres per year in the fifth decade, about 21% less than with the RPA Alternative.

The road stabilization program would eventually control most of the priority road sediment sources for non-point pollution. This would allow BMPs to be met over time which were adopted in response to Section 208 of the Clean Water Act.

Consequences Unique to Alternatives D'

New road construction would average 207 miles (1,490 acres) per decade for 5 decades, about 38%

greater than with the RPA Alternative. Timber harvesting and associated soil loss estimates as well as estimated high intensity burn acres from wildfire would be similar to Alternative D.

The road stabilization program would eventually control most of the priority road sediment sources for non-point pollution. This would allow BMPs to be met over time which were adopted in response to Section 208 of the Clean Water Act.

Consequences Unique to Alternative E

New road construction would average 119 miles (857 acres) per decade for 5 decades, about 79% of the RPA Alternative. Soil erosion loss associated with timber harvesting activities would range from 29,901 to 89,703 tons per decade. This would be about 46% less than with the Current/RPA Alternative. High intensity burn acres from wildfire are projected as 7,009 in the fifth decade, about 4% greater than with the RPA Alternative.

Consequences Unique to Alternative G(SOHA)

New road construction would average 235 miles (1,692 acres) per decade for 5 decades, about 57% greater than with the RPA Alternative. Soil erosion loss associated with timber harvesting activities would range from 64,675 to 194,025 tons per decade. This would be about 17% greater than with the Current/RPA Alternative. High intensity burn acres from wildfire are projected as 6,610 acres in the fifth decade, about 2% less than with the RPA Alternative. The risk of soil productivity loss would be high due to the amount of road construction and timber harvest planned and the amount of high intensity burn predicted.

Water

Important Interactions

Important Interactions related to water resources are discussed earlier in this chapter under Physical Environment - Important Interactions.

Methodology

Cumulative Watershed Effects (CWE) were assessed through the use of the Equivalent Roaded Area (ERA) methodology and the Forest Sediment Model. Both methods used similar data, but handled it differently. The data used was past and projected future roads, timber harvesting and past wildfire occurrence. The ERA model was used to calculate hydrologic disturbance levels which can cause larger peak stream flows than would occur under pristine conditions. The Sediment Model was used to calculate sediment production from landslides, surface erosion and channel erosion based on predictive models developed for the different sources of sediment.

The ERA method used coefficients to convert hydrologic disturbances into Equivalent Roaded Area. The coefficients were entered in the FORPLAN model and outputs in ERAs were computed for the entire Forest. These numbers were disaggregated into the compartment cluster watersheds and then divided by the area of each compartment cluster to compute a percent ERA.

At the same time, the inherent properties of the primary stream in each compartment cluster, such as channel stability and beneficial uses, were used to compute a Threshold of Concern (TOC). The TOC is an estimated upper limit to land use, expressed in the same terms as percent ERA.

TOCs as defined on the Forest indicate the limit where watershed condition becomes a concern and caution should be used in planning any additional disturbances. This is different from the approach taken by most other Forests, where the TOC is viewed as a limit where no additional disturbances should be planned.

The percent ERA can be compared to the TOC to estimate CWE. One additional calculation was made for this assessment. The percent ERA was divided by the TOC to determine a risk ratio.

Sediment production estimates were calculated for pristine conditions and projected future conditions. Landslide production, surface erosion and channel erosion were all included in the total outputs from the Sediment Model. The landslide production model is described in the Geology section and surface erosion estimates are described in the Soils section of this chapter.

The channel erosion portion of the Sediment Model is estimated for pristine conditions for each watershed and additional erosion due to disturbance is calculated based on increases in landslide production. Sample data from the Forest was used to establish the relationship between channel erosion and landslide production.

Based on the ERA, Sediment Model and Fisheries analyses in the Draft EIS, it became evident that there may be concerns about watershed conditions at the watershed level that are masked by forest-wide averages. To test this, a disaggregation model was applied to the Preferred Alternative. The results indicated that existing watershed conditions in a number of watersheds could limit additional management activities that generate disturbances for all alternatives. In the watersheds that are believed to be in poor condition, the information and assumptions used in the models need to be validated at the watershed level.

Water quality, as determined in this assessment, is a direct product of the watershed condition and water yield assessments. The utility of this assessment is as a relative rather than absolute indicator.

Watershed condition is expressed in terms of the watershed condition class, as described in Chapter 3. In lieu of a Forest-wide inventory of actual watershed conditions, it was assumed that certain land types fall into a general status when disturbed in a certain manner.

For example, active landslides are assumed to be in worst condition, Class 3. A fraction of the high intensity burned acres also fall in this class, while a fraction are in "not fully productive," Class 2. The majority of these lands remain "at productive potential," Class 1. For roads and clearcutting, a portion of the acres of geologically sensitive land which would be disturbed is assumed to become Class 2 or 3, while most of the land remains Class 1. Refer to Appendix G for a table which shows the assumed condition class for each disturbance type/land type combination. Together, Class 2 and 3 lands are considered to be "in declining condition."

FORPLAN outputs provided road and clearcut acres which were proportioned to each landtype according to the alternative's proposed policy for treating geologically sensitive lands. Unlike the CWE analysis, projected future wildfire was factored into this assessment.

A burn severity model was used to estimate the outputs of wildfire acres by burn intensity for each alternative (refer to Fire Management section). Outputs from this model have been proportioned into watersheds based on fuel conditions and fire history. Some double-counting of acres may occur where wildfires would burn areas that are roaded or clearcut. An average "condition coefficient" was applied to the burn acres, because the geologic sensitivity of the land that would burn was not predictable.

Restoration acres were projected based on the fish habitat, range and watershed improvement intent of each alternative. Although these activities are displayed with different effects in the watershed improvement discussion by type of improvement, they were treated as one type of activity in the watershed condition assessment. Restoration work was assumed to be 70% effective at returning Class 2 and 3 lands to Class 1 condition in the same decade as treatment occurs.

Class 2 and 3 lands were assumed to recover naturally at a somewhat slower rate than when actively restored. A noticeable change in condition was assumed to occur by the second decade following disturbance and full recovery was assumed to occur by the fourth decade.

The key assumptions for this assessment are that watershed condition determines the quality of water produced on the Forest; that Class 1 lands always produce water meeting standards, that Class 2 lands produce such water 85% of the time and Class 3 lands produce such water 35% of the time. The water is assumed to be turbid during the winter season when much of the annual water yield occurs. However, other periods are also subject to turbidity.

Water yield was assessed by estimating the increase in average annual yield as a result of management activities for each alternative. The total average annual yield which would result from the increase is displayed as an output.

Mean annual discharge was based on projected increases over baseline associated with timber harvesting. Baseline water yield is a 40-year average based on U.S. Geological Survey stream gage records. Where records are insufficient for proportioning into NFS watersheds, basin area and average per-acre runoff values were used to pro-rate the amount.

Vegetation management studies conducted in Colorado and southwest Oregon formed the basis for the water increase factors used. Separate factors were established for the eastside and westside of the Forest. The yield increase factors include road construction at levels typically associated with conventional harvesting systems.

It was assumed that water yield increases do not accumulate from decade to decade. A decay factor was developed to reduce the increases from 1 decade to the next to model how available sites rapidly resume previous evapotranspiration rates. However, the decay factor was not applied to past disturbances because of modeling difficulties. The projected increases displayed in Table 4-14 may not actually occur due to the recovery of past disturbance. The numbers in Table 4-14 are used to display differences between alternatives rather than show actual water yield increases.

Environmental Consequences

Cumulative Watershed Effects

Comparison of Alternatives

Table 4-7 displays the ERA outputs computed for the entire Forest.

Tables 4-8 and 4-9 display the risk ratios and TOCs of 48 of the 111 compartment cluster watersheds which are of concern because of high risk ratios for Decades 1 and 5, respectively. The compartment clusters not listed have lower risk ratios. The risk ratio is used in assessing the effects to each compartment cluster. If the risk ratio is greater than 1, the compartment cluster is over the TOC. If less than 1, the compartment cluster is under the TOC. Refer to Appendix G for more information concerning this assessment.

Table 4-7. Forest Total ERAs for Decades 1 and 5 by Alternative.									
	Alternative								
PFD	CUR/RPA	A	B	B'	C	D	D'	E	G (SOHA)
Decade 1									
64,047	69,553	71,504	65,735	65,037	68,153	68,440	68,666	61,178	71,758
Decade 5									
38,707	42,069	44,214	41,828	39,512	42,508	43,156	43,072	38,650	48,051

Table 4-8. Risk Ratios for Selected Compartment Clusters - Decade 1												
	Alternative											
Cluster	Existing Condition	PFD	CUR/ RPA	A	B	B'	C	D	D'	E	G (SOHA)	TOC
Walker Creek	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	6.5
Fort Goff Creek	1.6	1.2	1.1	1.1	1.2	1.2	1.1	1.1	1.1	1.3	1.2	7.0
Portuguese Creek	1.1	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	9.5
Seiad Creek	1.1	0.9	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	1.0	8.0
Horse Creek	2.0	1.9	2.0	1.9	1.9	1.9	2.0	1.9	1.9	1.9	2.0	5.5
Doggett Creek	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	8.0
Lower Beaver Creek	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	7.5
Upper Beaver Creek	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.2	1.3	1.3	6.0
Empire Creek	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	8.5
Collins Creek	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	10.0
McKinney Creek	1.4	1.3	1.3	1.4	1.3	1.3	1.3	1.3	1.3	1.3	1.3	9.0
Yreka Creek	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	9.0
Hutton Creek	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	10.5
Upper Indian Creek	1.0	1.0	1.1	1.1	1.0	1.0	1.1	1.1	1.1	1.1	1.1	6.5
East Indian Creek	1.4	1.2	1.3	1.3	1.3	1.2	1.3	1.3	1.4	1.3	1.4	6.0
Cade Creek	2.5	2.3	2.4	2.5	2.3	2.3	2.3	2.4	2.4	2.3	2.4	5.5
China Creek	1.3	1.1	1.2	1.3	1.2	1.2	1.2	1.3	1.3	1.1	1.3	8.5
West Elk Creek	1.2	1.2	1.2	1.3	1.2	1.2	1.2	1.3	1.3	1.2	1.2	7.5
East Elk Creek	1.4	1.2	1.4	1.3	1.3	1.3	1.3	1.5	1.5	1.2	1.4	7.0
Lower Clear Creek	0.8	0.9	0.9	1.0	0.9	0.9	1.0	1.1	1.1	0.8	0.9	8.5
Titus Creek	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.3	7.0
Independence Creek	1.4	1.1	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.1	1.5	7.0
Ukonom Creek	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	1.0	7.0

Table 4-8. Risk Ratios for Selected Compartment Clusters - Decade 1												
	Alternative											
Cluster	Existing Condition	PFD	CUR/ RPA	A	B	B'	C	D	D'	E	G (SOHA)	TOC
Crapo Creek	1.9	1.4	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.6	1.4	4.5
Big Creek	7.2	5.9	6.1	6.3	6.1	6.0	5.9	5.9	5.9	5.9	6.1	2.0
St. Claire Creek	0.8	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	0.7	0.9	6.5
Knownothing Creek	0.9	0.9	1.0	1.0	0.9	0.9	1.0	1.1	1.1	0.8	1.0	7.0
Negro Creek	1.6	1.3	1.3	1.4	1.3	1.3	1.3	1.3	1.3	1.4	1.3	9.5
Indian (Salmon R.)	1.0	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	0.9	1.0	9.0
Crater Creek	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	9.5
Cabin Meadows	1.2	1.2	1.2	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.3	8.0
Rail Creek	1.4	1.5	1.5	1.5	1.4	1.5	1.5	1.5	1.5	1.4	1.5	10.0
Kangaroo Creek	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	10.5
Mill (Callahan)	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	9.0
Boulder (Callahan)	1.2	1.2	1.2	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.3	7.5
Sugar Creek	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	8.5
Etna Creek	1.5	1.5	1.5	1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.6	7.0
Kidder Creek	4.7	4.7	4.8	4.8	4.7	4.7	4.8	4.8	4.8	4.7	4.8	6.5
Tompkins Creek	0.9	0.9	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.8	1.1	6.0
Ferry Creek	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	12.0
Mill (Scott Bar)	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	9.5
Indian (Scott R.)	1.8	1.7	1.7	1.8	1.7	1.7	1.7	1.7	1.7	1.7	1.8	9.0
McAdams Creek	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	7.0
Moffett Creek	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	7.0
Reynolds Creek	1.1	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	8.0
Sandy Bar Creek	1.1	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.3	6.0
Antelope Creek	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	0.9	1.1	8.0
Butte Creek	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.1	9.5

Table 4-9. Risk Ratios for Selected Compartment Clusters - Decade 5

	Alternative											
Cluster	Existing Condition	PFD	CUR/ RPA	A	B	B'	C	D	D'	E	G (SOHA)	TOC
Walker Creek	1.1	0.5	0.6	0.6	0.6	0.5	0.6	0.6	0.6	0.5	0.7	6.5
Fort Goff Creek	1.6	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	7.0
Portuguese Creek	1.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	9.5
Seiad Creek	1.1	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	8.0
Horse Creek	2.0	1.6	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.8	5.5
Doggett Creek	1.7	1.7	1.6	1.7	1.6	1.6	1.6	1.6	1.6	1.7	1.7	8.0
Lower Beaver Creek	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	7.5
Upper Beaver Creek	1.3	1.1	1.1	1.1	1.2	1.1	1.1	1.1	1.1	1.1	1.2	6.0
Empire Creek	1.6	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.7	8.5
Collins Creek	1.0	1.0	1.1	1.1	1.0	1.0	1.1	1.1	1.1	1.0	1.1	10.0
McKinney Creek	1.4	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.3	9.0
Yreka Creek	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.1	9.0
Hutton Creek	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	10.5
Upper Indian Creek	1.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.1	0.9	6.5
East Indian Creek	1.4	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.8	6.0
Cade Creek	2.5	1.1	1.3	1.4	1.3	1.3	1.3	1.3	1.3	1.1	1.4	5.5
China Creek	1.3	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.7	8.5
West Elk Creek	1.2	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	7.5
East Elk Creek	1.4	0.3	0.4	0.5	0.4	0.4	0.5	0.5	0.5	0.3	0.5	7.0
Lower Clear Creek	0.8	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.3	8.5
Titus Creek	1.2	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.3	0.4	7.0
Independence Creek	1.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	7.0
Ukonom Creek	0.9	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.2	7.0
Crapo Creek	1.9	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.4	4.5
Big Creek	7.2	0.7	1.8	1.9	1.7	1.7	1.8	1.9	1.9	0.7	2.0	2.0
St. Claire Creek	0.8	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.4	6.5
Knownothing Creek	0.9	0.4	0.4	0.4	0.3	0.3	0.4	0.4	0.4	0.4	0.4	7.0
Negro Creek	1.6	0.4	0.6	0.6	0.5	0.5	0.6	0.6	0.6	0.4	0.6	9.5
Indian (Salmon R.)	1.0	0.4	0.4	0.4	0.3	0.3	0.4	0.4	0.4	0.2	0.4	9.0
Crater Creek	1.1	1.0	1.0	1.0	0.9	0.9	1.0	1.0	1.0	0.9	1.0	9.5
Cabin Meadows	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	8.0

Table 4-9. Risk Ratios for Selected Compartment Clusters - Decade 5												
		Alternative										
Cluster	Existing Condition	PFD	CUR/ RPA	A	B	B'	C	D	D'	E	G (SOHA)	TOC
Rail Creek	1.4	1.4	1.4	1.4	1.3	1.4	1.4	1.4	1.4	1.4	1.4	10.0
Kangaroo Creek	1.4	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	10.5
Mill (Callahan)	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	9.0
Boulder (Callahan)	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.2	7.5
Sugar Creek	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	8.5
Etna Creek	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	7.0
Kidder Creek	4.7	4.8	4.8	4.8	4.7	4.7	4.8	4.8	4.8	4.7	4.8	6.5
Tompkins Creek	0.9	0.5	0.4	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.5	6.0
Ferry Creek	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	12.0
Mill (Scott Bar)	1.3	1.2	1.2	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.3	9.5
Indian (Scott R.)	1.8	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	9.0
McAdams Creek	1.6	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	7.0
Moffett Creek	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	7.0
Reynolds Creek	1.1	0.6	0.6	0.6	0.5	0.5	0.6	0.6	0.6	0.7	0.6	8.0
Sandy Bar Creek	1.1	0.6	0.6	0.7	0.7	0.6	0.6	0.7	0.7	0.6	0.8	6.0
Antelope Creek	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.1	8.0
Butte Creek	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.1	9.5

Table 4-10. Cubic Yards per Acre Total Sediment Production for 10-year Event - Decade 1											
	Alternative										
Watershed	Pristine	PFD	CUR/ RPA	A	B	B'	C	D	D'	E	G (SOHA)
Beaver Creek	4.4	8.5	8.6	8.5	8.5	8.5	8.6	8.6	8.6	8.5	8.6
Antelope Creek	1.1	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	2.1
Clear Creek	4.5	7.4	7.3	7.4	7.3	7.3	7.4	7.4	7.4	7.3	7.3
Dillon Creek	5.4	7.3	7.2	7.2	6.9	6.9	6.9	7.0	7.0	6.9	7.2
East Fork ScottR.	1.4	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Elk Creek	4.0	7.9	8.1	8.1	7.9	7.9	8.1	8.1	8.0	7.9	8.1
Empire Creek	1.5	2.8	2.8	2.8	2.7	2.7	2.8	2.7	2.7	2.8	2.8
Grider Creek	3.7	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	7.1
Horse Creek	3.5	6.9	7.0	6.9	6.9	6.9	7.0	6.9	6.9	6.9	7.1
Humbug Creek	3.0	5.3	5.1	5.2	5.1	5.1	5.2	5.1	5.1	5.1	5.1
Independence Creek	3.7	8.7	8.7	8.7	8.7	8.7	8.7	8.9	8.8	8.7	9.0

Table 4-10. Cubic Yards per Acre Total Sediment Production for 10-year Event - Decade 1											
	Alternative										
Watershed	Pristine	PFD	CUR/ RPA	A	B	B'	C	D	D'	E	G (SOHA)
Indian Creek	8.3	15.6	15.8	15.7	15.4	15.4	15.9	15.8	15.8	15.6	15.9
Klamath River	4.0	7.7	7.8	7.8	7.7	7.7	7.8	7.8	7.8	7.7	7.9
Scott River	5.0	8.7	8.8	8.8	8.6	8.6	8.8	8.7	8.7	8.6	8.9
McKinney Creek	2.2	4.8	4.8	4.9	4.8	4.8	4.8	4.8	4.8	4.8	4.8
Middle Scott River	3.3	4.9	4.9	4.9	4.8	4.8	4.9	4.9	4.9	4.8	5.0
North F. Salmon River	10.3	17.3	17.5	17.6	17.3	17.2	17.4	17.4	17.4	17.3	17.5
Mill Creek	2.5	4.4	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.4
Little NF Salmon River	3.6	4.8	4.8	4.8	4.7	4.7	4.8	4.8	4.8	4.7	4.8
Rock Creek	8.6	14.5	14.6	14.4	14.3	14.3	14.6	14.5	14.5	14.4	14.6
Russian Creek	3.9	4.9	4.9	5.0	4.9	4.9	4.9	4.9	4.9	4.9	5.1
South Fork Salmon River	8.0	14.7	14.7	14.7	14.5	14.5	14.7	14.7	14.7	14.5	14.7
South Scott River	2.5	4.0	4.0	4.1	3.8	3.8	4.0	4.0	4.0	3.9	4.1
Salmon River	10.8	18.2	18.2	18.3	18.1	18.1	18.2	18.3	18.3	18.0	18.3
Upper South Salmon	7.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Thompson Creek	3.5	6.1	6.1	6.1	6.1	6.0	6.1	6.1	6.1	6.0	6.3
Ukonom Creek	4.3	8.4	8.3	8.3	8.4	8.3	8.3	8.4	8.4	8.3	8.9
Wooley Creek	13.1	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.6

Tables 4-10 and 4-11 list the total cubic yard per acre sediment production for a 10-year flood event in the 28 sediment indicator watersheds for pristine conditions and for each alternative for Decades 1 and 5, respectively.

Table 4-11. Cubic Yards per Acre Total Sediment Production for 10-year Event - Decade 5											
	Alternative										
Watershed	Pristine	PFD	CUR/ RPA	A	B	B'	C	D	D'	E	G (SOHA)
Beaver Creek	4.4	7.6	7.8	7.3	7.4	7.3	7.8	7.8	7.8	7.6	8.1
Antelope Creek	1.1	1.7	1.8	1.7	1.7	1.6	1.7	1.7	1.7	1.6	2.5
Clear Creek	4.5	4.9	4.9	5.0	4.9	4.9	5.0	5.2	5.2	4.5	4.9
Dillon Creek	5.4	7.1	7.3	7.2	6.8	6.8	6.8	7.0	7.0	6.6	7.2
East Fork ScottR.	1.4	2.2	2.3	2.4	2.1	2.1	2.2	2.2	2.2	2.2	2.3
Elk Creek	4.0	5.0	5.4	5.2	5.0	5.0	5.3	5.3	5.3	4.7	5.4
Empire Creek	1.5	2.7	2.8	2.8	2.5	2.5	3.0	2.7	2.7	2.9	2.8
Grider Creek	3.7	4.9	5.1	5.3	5.0	4.9	4.9	5.0	5.0	4.9	5.7
Horse Creek	3.5	5.6	5.9	5.3	5.4	5.4	5.9	5.8	5.8	5.6	6.2
Humbug Creek	3.0	5.1	5.3	6.0	4.8	4.8	5.5	5.0	5.0	5.5	5.2
Independence Creek	3.7	3.8	3.9	3.8	3.9	3.8	3.8	3.9	3.9	3.7	4.3

Table 4-11. Cubic Yards per Acre Total Sediment Production for 10-year Event - Decade 5											
	Alternative										
Watershed	Pristine	PFD	CUR/ RPA	A	B	B'	C	D	D'	E	G (SOHA)
Indian Creek	8.3	12.5	12.9	13.1	11.9	11.8	12.8	12.9	12.9	12.1	13.2
Klamath River	4.0	6.6	6.8	6.8	6.3	6.3	6.7	6.6	6.6	6.0	7.0
Scott River	5.0	8.7	8.9	9.0	8.2	8.2	8.8	8.7	8.7	7.7	9.0
McKinney Creek	2.2	3.6	4.0	4.7	3.3	3.3	4.0	3.6	3.6	4.0	3.9
Middle Scott River	3.3	5.0	5.2	5.2	4.8	4.7	5.0	5.0	5.0	4.7	5.2
North F. Salmon River	10.3	14.5	14.5	14.7	14.2	14.0	14.3	14.5	14.5	12.2	14.6
Mill Creek	2.5	4.4	4.3	4.4	4.2	4.2	4.3	4.3	4.3	4.5	4.7
Little NF Salmon River	3.6	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.1	4.4
Rock Creek	8.6	12.6	12.7	12.4	12.1	12.1	12.7	12.5	12.5	12.2	12.6
Russian Creek	3.9	4.9	4.8	4.8	4.8	4.7	4.7	4.8	4.7	4.5	5.2
South F. Salmon River	8.0	11.7	11.6	11.7	11.1	11.1	11.5	11.7	11.7	12.2	11.6
South Scott River	2.5	4.0	4.1	4.2	3.7	3.6	3.9	4.0	4.0	4.1	4.0
Salmon River	10.8	14.7	14.8	14.9	14.4	14.3	14.6	14.9	14.9	12.4	14.8
Upper South Salmon	7.0	8.5	8.6	8.7	8.5	8.5	8.5	8.5	8.5	7.7	8.6
Thompson Creek	3.5	4.4	4.5	4.5	4.5	4.4	4.5	4.6	4.6	4.5	5.0
Ukonom Creek	4.3	5.2	5.2	5.2	5.3	5.2	5.2	5.2	5.2	5.0	6.3
Wooley Creek	13.1	15.5	15.5	15.5	15.6	15.5	15.5	15.5	15.5	13.4	15.7

Consequences Common to All Alternatives

Watersheds would recover from past fires and management activities over time in all alternatives. The amount of time required for recovery would vary according to current conditions, the cause of the conditions that need recovery, any restoration activities proposed by the alternatives and any new disturbances that occur either naturally or due to management. Some watersheds are currently in good condition. Others may recover within a few years, while others could take several decades to recover.

For all alternatives, the tendency is for CWE to decrease over time as watersheds recover. For most of the listed compartment cluster watersheds, the risk ratios decrease or remain the same in the first decade compared to the existing condition. For the fifth decade, the Forest total ERAs decrease dramatically from the first decade for all alternatives. The compartment clusters also show a general decrease of risk ratios. This decrease of CWE over time is primarily attributed to the recovery of recent wildfire effects, specifically the 1987 wildfires.

While wildfires will certainly occur in the future, and acreages of future wildfires have been estimated Forest-wide, this information was not used in the CWE analysis as it is difficult to predict when or where a wildfire will occur in the future. Therefore, the CWE analysis is optimistic in terms of recovery from the existing situation and may be highly optimistic in certain watersheds.

A check of the risk ratios of the compartment cluster watersheds shows a tremendous recovery of some watersheds in 5 decades while others show little if any recovery. Typically, the watersheds with large recoveries have had a great deal of disturbance in recent wildfires. Also, in certain compartment clusters such as Fort Goff, Ukonom and Crapo Creeks, allocations to management areas such as wilderness, backcountry or critical wildlife habitat would restrict future disturbances due to management activities.

Other compartment clusters currently have a high risk ratio which show little recovery by the fifth decade. Some of these such as Horse Creek, Lower Beaver

Creek and Sugar Creek contain a large proportion of private land within the compartment cluster. This private land was given a general, unchanging disturbance level that is fairly high. In some cases this high private land disturbance level is justified, in other cases it is not. The size and complexity of the analysis area does not allow private land disturbance levels to be determined on a site-specific basis.

For this and other reasons, several compartment cluster watersheds are listed as over threshold (risk ratio 1.0 or greater) through the fifth decade. However, watershed concerns were not the limiting factor in the FORPLAN model for any land disturbing activities in any alternative at the forest scale. FORPLAN uses Forest averages to limit activities, not TOCs on individual watersheds. The Forest total disturbance level is well below TOC due to averaging of disturbed areas with undisturbed areas. It is assumed that if land-disturbing activities are limited in one watershed, the activity can be moved to less disturbed watersheds on the Forest. A site-specific, project level watershed analysis would be conducted before any land-disturbing activities occur.

A disaggregation model was applied to the Preferred Alternative for the Final EIS analysis. It showed that watershed condition could be a limiting factor at the watershed scale. With some watersheds modeled as being in poor condition, activities could not always be moved to other parts of the watershed. This would likely be the case for all alternatives.

The Sediment Model also shows a decrease in sediment production from Decade 1 to Decade 5 for most watersheds. For several watersheds, such as Elk Creek, Clear Creek and the Salmon River, this decrease is primarily the result of recovery from recent wildfire. For other watersheds, such as Beaver Creek and Rock Creek, some recovery is expected due to less intensive timber management in the future than in the past. Still other watersheds, such as Dillon Creek and the Scott River, are expected to remain nearly the same or increase in sediment production over time due to an increase in timber management activity over past levels.

The Sediment Model provides comparisons of alternatives, of projected sediment production versus pristine estimates for each watershed and of watersheds. However, it does not model sediment movement within the stream system. While it is known that some sediment is transported through each stream reach and some is deposited, the factors which influence the amount of deposition are inadequately understood and the interaction of factors is too complex for accurate predictions.

Sediment is generally divided into fine and coarse sediment. Fine sediment is coarse sand and smaller, while coarse sediment is fine gravel and larger. Landslides and channel erosion are sources of both fine and coarse sediment while surface erosion provides mostly fine sediment. Fine sediments are generally transported through stream reaches much more readily than coarse sediments, however fine sediments can be deposited in mixtures with coarse sediment and embed the coarse sediment. Also, sand can be deposited in pools and backwaters under certain conditions.

Sediment introduction into streams is natural and essential. Over time, streams achieve a balance between sediment input and transport. Large increases in sediment production can upset this balance and result in undesired channel changes such as channel widening, deposition of fine material and loss of riparian habitat. Determining when an increase in sediment production would be detrimental is very difficult, therefore, thresholds have not been established for sediment production at this time.

Consequences Common to Alternatives Preferred, B, B' and E

These alternatives would have the lowest CWE of the alternatives considered. Alternative E would have the lowest Forest Total ERA (wildfire effects not included) in both the first and fifth decade due to the emphasis on amenity resources. The Preferred Alternative would be second lowest because the low harvest levels and small road construction program are somewhat offset by the large prescribed fire program. The harvest level for the Preferred Alternative was reduced due to watershed conditions based on the disaggregation model; a cautious approach is most consistent with the alternative's theme to maintain ecosystem heatlh. Alternatives B and B' would have a low CWE due to the relatively light disturbance on the acreages disturbed. Alternative B' would have a lower overall CWE than B due to the greater restrictions on activities in HCAs.

The disaggregation for these alternatives indicates that most compartment cluster watersheds would drop below TOC by Decade 5 (refer to Physical Environment - Introduction for a discussion on disaggregation). The clusters with a large amount of private ownership and those heavily affected by recent wildfire would be exceptions as explained above. Upper Indian Creek in Alternative E also shows a risk ratio greater than 1 due to disaggregation. This is probably because Alternative E proposes limitations on land-disturbing activities in so many areas that the land which would remain available for timber management would receive a greater impact. Overall there does not appear to be a general problem with clusters exceeding threshold over the long term with these alternatives.

The Sediment Model estimates for these alternatives generally decrease over time through the fifth decade. The sediment production rates for Indian Creek, Rock Creek and the Salmon River which have high pristine

sedimentation estimates and very high projected sediment rates in Decade 1 would decrease by Decade 5. Independence Creek and McKinney Creek which have sediment production estimates in Decade 1 that are more than twice pristine would dramatically decrease by Decade 5.

Overall, it appears that these alternatives would result in acceptable levels of sediment production due to management activities over the long term. However, when sediment production due to wildfire is added, Alternative E would have a considerably higher cumulative effect (refer to Geology in this chapter). The large sediment increase due to wildfire in Alternative E stems from leaving large amounts of cover, while funding a small fuel treatment program. This would lead to a large future wildfire occurence at high intensities with an associated high sediment production.

Consequences Common to Alternatives Current/RPA, A, C, D and D'

These alternatives would have very similar CWEs and would be slightly higher than Alternatives Preferred, B, B' and E. The risk ratios of the listed compartment clusters show only slight differences between these alternatives. The Sediment Model outputs show similar results to the ERA analysis. Overall, all of these alternatives appear to propose activities within tolerable levels of disturbance and sediment production.

Consequences Unique to Alternative G(SOHA)

While this alternative would have the highest Forest Total ERA, the overall effect on the compartment cluster watersheds does not seem to be much different than the second group of alternatives. Because Alternative G(SOHA) would manage SOHAs which are generally smaller and include much less area Forestwide than HCAs, the additional disturbance in Alternative G(SOHA) would primarily be distributed in compartment clusters which would not have SOHAs or would have SOHAs which are smaller than the corresponding HCAs would be in the other alternatives.

The disturbance in other compartment clusters would only be slightly higher than with the other alternatives. All compartment clusters are projected to be well below TOC in the long-term.

The sediment production estimates for this alternative are also high. The increase in sediment production would occur primarily in the same watersheds as the ERA increase, such as Independence Creek and Ukonom Creek. In other streams, the sediment production would be similar to the other alternatives. It appears that this alternative would also produce acceptable levels of sediment production in the long-term.

Water Quality

Comparison of Alternatives

Water quality is affected by watershed and riparian conditions as well as by CWE. Since CWE has already been discussed earlier in this section and riparian conditions are discussed in the Fisheries section later in this chapter, this section will only discuss water quality in terms of watershed conditions.

All alternatives are designed to comply with environmental laws for maintaining water quality. Any projects that were found not to comply with water quality regulations during the site-specific analysis would not be implemented.

Table 4-12 displays the percent of the Forest projected to be in each condition class for each alternative for Decades 1 and 5.

Table 4-13 displays the water quality outputs in thousand acre-feet of water expected to meet and not meet water quality objectives.

Consequences Common to All Alternatives

Both watershed condition and water quality are projected to improve during the first decade then decline by the fifth decade. This conclusion is different

Table 4-12. Watershed Condition Class in Percent of Total Forest

	Alternative									
	PFD	CUR/RPA	A	B	B'	C	D	D'	E	G (SOHA)
Decade 1										
Class 1	98.6	98.1	98.4	98.3	98.4	98.1	98.6	98.6	98.5	98.1
Class 2	0.8	1.1	0.9	1.0	0.9	1.1	0.8	0.8	0.9	1.1
Class 3	0.6	0.8	0.7	0.7	0.7	0.8	0.6	0.6	0.6	0.8
Decade 5										
Class 1	95.9	89.2	94.0	91.6	92.2	95.9	93.5	93.3	92.9	87.8
Class 2	2.7	6.4	3.4	5.0	4.5	2.7	3.9	4.1	4.3	7.4
Class 3	1.4	4.4	2.6	3.4	3.3	1.5	2.6	2.6	2.8	4.8

Table 4-13. Water Quality Outputs in Thousands of Acre-feet Per Year.										
	Alternative									
	PFD	CUR/RPA	A	B	B'	C	D	D'	E	G (SOHA)
Decade 1										
Meeting	3,959	3,973	3,981	3,996	3,977	3,969	3,993	3,977	3,961	3,984
Not Meeting	20	27	24	24	23	27	20	19	20	28
Decade 5										
Meeting	3,930	3,855	3,912	3,886	3,885	3,957	3,916	3,914	3,886	3,828
Not Meeting	52	153	89	118	113	54	91	92	99	170

than that of the CWE analysis. The different conclusion is due to future fire projections being included in this analysis, but not in the CWE analysis. The CWE analysis will be overly optimistic if future fires occur as forecasted, but this analysis may be overly pessimistic if future wildfires are smaller and less intense than expected.

Table 4-13 shows that more than 99% of the water would meet water quality objectives with all alternatives in the first decade. Due to this small variation between alternatives in the first decade, the fifth decade water quality estimates will be the primary factor used to compare alternatives.

Consequences Common to Alternatives Preferred and C

These alternatives would have the greatest percent, 98.7%, of water meeting water quality objectives in the fifth decade. This is probably due to the low harvest levels, small road construction program and aggressive fuels management program of the Preferred Alternative which results in a projected decrease in future wildfire acres that would burn with high and moderate intensity by Decade 5. Wildfire is the single largest factor influencing future watershed condition estimates. The Preferred Alternative and Alternative C would have special standards and guidelines for extremely unstable and geologically sensitive lands. Alternative C also proposes closing many roads and restoring watershed conditions.

Consequences Common to Alternatives Current/RPA and G(SOHA)

These alternatives would have the lowest percentages of water projected to meet water quality objectives, about 96%. These alternatives would have relatively small watershed restoration and fuel management programs. These alternatives would have relatively high levels of land-disturbing activities. Alternative G (SOHA) would build a large number of roads.

Consequences Common to Alternatives A, D, D' and E

Over 97.5% of the water is estimated to meet water quality objectives in Decade 5 with these alternatives. While these alternatives would not treat fuels as aggressively as the Preferred Alternative, they would have aggressive watershed restoration programs. Alternatives A, D and D' propose greater timber harvesting levels and associated disturbance than Alternative E, but this is offset by larger fuels management programs. An aggressive road closure program in Alternatives D and D' would also offset the larger timber harvesting program as roads produce a high rate of sediment.

Consequences Common to Alternatives B and B'

Over 97% of the water is estimated to meet water quality objectives in Decade 5 with these alternatives, slightly less than with Alternatives A, D, D' and E. While Alternatives B and B' would protect geologically sensitive land and propose a large amount of restoration, they would also build more roads than the other alternatives and would have a relatively small fuel management program.

Water Yield

Consequences Common to All Alternatives

Removal of vegetation would result in a temporary increase in annual water yield which is not evenly distributed through time or space. This increase in yield could have both beneficial and adverse effects, depending on the timing of the increase. Usually, much of the increase would be available during the growing season. However, a portion could occur during the rainy season when surplus water would be a detriment. Similar effects would occur with increased snow accumulation and melt rates in forest clearings, especially during rain-on-snow events.

Water use would also affect water yield. Diversion of water from the Forest which benefits the individual user could affect instream use and riparian condition as well as water quality through increases in stream temperatures and through return flows adding nutrients and pollutants.

Comparison of Alternatives

Table 4-14 displays the average annual water yield and percent increase over baseline for Decades 1 and 5

Table 4-14. Average Annual Water Yield (Thousands of Acre-feet and Percent Increase).										
	Alternative									
Baseline	PFD	CUR/RPA	A	B	B'	C	D	D'	E	G (SOHA)
Decade 1										
3,952	3,979 0.7%	4,000 1.2%	4,006 1.4%	4,020 1.7%	4,000 1.2%	3,996 1.1%	4,013 1.5%	3,996 1.1%	3,982 0.8%	4,012 1.5%
Decade 5										
3,952	3,982 0.8%	4,006 1.4%	4,001 1.2%	4,004 1.3%	3,998 1.2%	4,011 1.5%	4,007 1.4%	4,006 1.4%	3,985 0.8%	3,998 1.2%

for each alternative. There is little difference between the alternatives. Generally, the greater the level of timber harvest, the greater the water yield increase.

All alternatives would generate slight water yield increases in all decades above the current total yield of 3,952 thousand acre feet of about 4000 thousand acre feet plus or minus 20 thousand acre feet. This would be less than a 2% increase for all alternatives. A slight variation in yield is projected from decade to decade depending on the number of acres harvested in that period.

The differences between alternatives in any given decade are also small, less than 1% of the total. The increase above baseline of approximately 50 thousand acre feet forest-wide is not considered a significant benefit as little would occur in areas of water demand. Also, much of the increase would occur during spring and fall when the demand is not as high. No adverse actions are anticipated as a result of management-induced yield increase.

Watershed Restoration

Comparison of Alternatives

The objectives and the consequences of the proposed watershed improvement projects would differ between alternatives. Some treatments would be more extensive such as rangeland seeding, while others would be more intensive such as landslide stabilization. The intensive treatments have higher costs and greater benefits per acre.

The period of effectiveness also varies by treatment. Some treatments have a lag time before maximum benefits are derived. Riparian planting would provide effective shade in the second or third decade and provide effective woody structure in 5 or more decades. Root strength for channel stability would be established within a decade or two, while structural treatment of landslides could be effective immediately. Although each alternative proposes a unique mixture of treatments, the treatments would have the same attributes.

Table 4-15 displays the watershed restoration program levels by total watershed program dollars and by acres treated per year. The program dollars would include inventory and operation costs as well as watershed improvement and restoration projects. Inventory costs include maintaining a watershed improvement needs inventory as well as other water resource inventories. Operation costs include program planning, monitoring and other aspects of watershed management not tied directly to improvements. The program costs and improvement acres are not directly related because of the differing requirements and treatments proposed by each alternative.

Consequences Common to Alternatives Preferred, D and D'

These alternatives propose nearly a 7-fold increase over the current program in terms of acres treated. They would provide for a diverse program that would result in better establishment and protection of riparian areas by planting and fencing. The alternatives would stabilize 90 acres of landslides per year which would result in a direct improvement in water quality. The road stabilization program would eventually control most of the priority road sediment sources, markedly improving watershed conditions and water quality. The Preferred Alternative would focus on upgrading roads and restoring channel complexity.

Consequences Common to Alternative Current/RPA

The Current Alternative program was assumed to be at a level typical of the 1980's. The RPA goals call for a 77% increase in the watershed improvement program over current levels. Both the Current and RPA Alternative programs would distribute the program as it was in 1990 with stream stabilization being the

Table 4-15. Annual Watershed Restoration Program Levels								
	Alternative							
	PFD	CUR	A	B & B'	C	D & D'	E	G (SOHA)
Watershed Budget (Millions of Dollars)	1.06	0.49	1.06	0.77	1.04	1.06	1.14	0.39
Acres Treated	2,100	325	1,426	1,157	337	2,100	1,843	204

predominant activity. The Current Alternative would gradually improve riparian conditions, primarily in areas where past management activities and/or natural catastrophes may have created adverse effects. RPA Alternative would improve these conditions more rapidly.

Consequences Unique to Alternative A

Alternative A proposes a significant increase over the current program, quadrupling the number of acres treated. It would emphasize both the stabilization of landslides and re-establishment of riparian areas. In addition, it would add range improvement projects for combined range and watershed objectives, a very extensive treatment.

Consequences Unique to Alternatives B and B'

Alternatives B and B' propose an increase above the current program. The restoration program would emphasize revegetation of riparian zones, stream stabilization and landslide stabilization. In addition, standards and guidelines would emphasize cost-effectiveness which could increase the watershed benefits derived from limited dollars. Therefore, Alternatives B and B' would have less road improvement work than the Current Alternative, except for 28 acres of fillslope stabilization per year which would not be done with Current. The aggressive landslide stabilization program would improve watershed conditions and water quality over time, especially on the landslide-prone westside of the Forest.

Consequences Unique to Alternative C

Alternative C's program would include riparian revegetation at current levels and stream stabilization at slightly decreased levels. This would gradually improve overall riparian conditions over time. There would be a considerable emphasis on road stabilization and closure with 7 times the acreage being treated as under current management. Although the road work would be prioritized primarily for wildlife objectives, there could be far-reaching benefits to watershed conditions and water quality if treated sites were chronic sediment sources.

The high cost in program dollars with low acreage treated is the result of the emphasis on road work which is a very intensive treatment. Landslide stabilization of 4 acres per year would be similar to current levels.

Consequences Unique to Alternative E

Alternative E would have the most ambitious watershed restoration program. It would accomplish much more of all treatment types than the current program except for road stabilization which would be the same at 6 acres per year. Overall, this alternative would have about 6 times the targeted acreage as the Current Alternative. Targeted acreage would be slightly smaller than for Alternatives Preferred, D and D' due to a smaller range improvement program.

Consequences Unique to Alternative G(SOHA)

Alternative G(SOHA) would maintain the minimal program level of the 1980s. This would include 50 acres per year of riparian revegetation and 4 acres per year of landslide stabilization. It would be similar to the Current Alternative, but have less stream stabilization and no remedial road work. It proposes the smallest program level of the considered alternatives.

Air

Important Interactions

Wildfire, residential wood and trash burning, agricultural burning, prescribed burning, vehicle emissions, construction and use of unpaved roads, asbestos from asbestos containing native rock and hazardous material spills can create smoke and/or dust. Smoke and dust have the potential to significantly affect air quality.

Fire produces carbon monoxide, suspended particulate matter (PM-10) and polycyclic hydrocarbons as pollutants. The smoke produced by fires can affect visibility as well as other air pollutant standards. The other activities listed can also affect the concentration of pollutants and visibility.

Methodology

Air quality can be evaluated in terms of visibility and the concentration of pollutants. The potential effects on air quality associated with each alternative were estimated qualitatively using air quality data, common sense, past experience and estimates of the amount of management activities planned. The effects are described in a narrative fashion.

It is assumed that the differences between alternatives in acres treated by prescribed burning would not affect overall air quality as the Siskiyou County Air Pollution Control District and the Oregon State Smoke Management Plan would not allow burning on days in which the cumulative air quality would not meet State air quality standards.

Environmental Consequences

Consequences Common to All Alternatives

The effect of wildfire on air quality depends on the number of acres burned, condition of fuels burned, duration of the wildfire, the airshed, wind velocity, wind direction and the weather conditions. During large wildfires, air pollutants could temporarily reduce visibility and increase carbon monoxide and PM-10

concentrations to levels which may exceed ambient air quality standards.

If inversion layers coincide with large wildfires preventing the dispersal of pollutants, the quality of the air could become a health and safety hazard. As wildfires are a natural part of the ecosystem, their effect on air quality would not be included in determining if our management activities are in compliance with the legal requirements of the Clean Air Act.

Residential and agricultural burning is not within the Forest's control as the permit system is administered by the State. However, they would need to be considered in assessing cumulative effects for air quality on site specific projects. Pollution created by residential burning is most noticeable when it occurs in areas where wood is the preferred fuel for cooking and heating. This pollution would most often occur in the late fall, winter and early spring when dispersion of pollutants is fairly poor.

Prescribed burning plans would only allow for prescribed burning to occur during certain weather conditions at specified fuel moisture concentrations. The timing of prescribed burning generally allows the pollutants to disperse fairly rapidly. Despite the efforts to control smoke in designing and conducting prescribed burning treatments, some impairment to visibility might occasionally occur. Prescribed burning also has the potential to improve air quality by reducing the acres that may burn in future wildfires.

Prescribed burning, construction and other activities would occur within certain sideboards that comply with the regulations of the California Air Resources Board and the Siskiyou County Air Pollution Control District in California or with the Oregon Department of Environmental Quality and the Oregon State Smoke Management Plan in Oregon for all alternatives. The intent of these regulations is for air quality to not exceed the ambient air quality standards. In determining allowable burn days, these regulating agencies take into account the projected cumulative effects of all parties requesting to burn on any given day.

It is assumed that under all alternatives, a small percentage of days could temporarily exceed the standards in localized areas due to the cumulative effects of wildfire, prescribed burning and intrusions from agricultural burning or other non-Forest burning. In the long term, air quality is expected to be well below ambient air quality standards for both Class I areas and within the standards for Class II areas except for a few occasions as described above. Refer to the Fire Management section of this chapter for a discussion of Smoke Management.

Vehicle emissions produce PM-10, carbon monoxide and nitrogen dioxide. In areas where vehicle use is concentrated such as popular recreational sites and in communities within or adjacent to the Forest boundaries, air pollution could become noticeable at certain times of the year, especially when added to residential and agricultural burning.

The construction and use of unpaved roads could produce enough dust to temporarily impair air visibility locally. PM-10 control is an important aspect of dust management. With all alternatives, measures such as watering or oiling unpaved roads during management activities would be used to control dust. Due to these mitigation measures, the effects of road dust are expected to be localized and temporary and would not diminish overall air quality despite any differences in unpaved road miles between alternatives.

When some types of rock are disturbed, asbestos is released into the air. It could be hazardous to human health if carcinogens are breathed into the lungs. Whenever asbestos is known to occur at a site proposed for development, the Occupational Safety and Health Administration regulations would be followed. If asbestos-containing rock material is proposed for use in non-surfacing applications such as rip rap, a thorough analysis of cost, benefit and potential health risks would be required.

Whenever possible, constructing new roads through asbestos-bearing rock would be avoided. Table 4-5 in the Geology section of this chapter shows the estimated number of miles of new road that would be built through asbestos-bearing (ultramafic) rock in the next 50 years for each alternative.

However, the actual effects for new road construction, existing rock pits, existing roads and existing recreational trails through asbestos-bearing formations are unknown because no studies have occurred to date. Therefore, these comparisons do not provide any information on the effects on air quality. Possible mitigation measures would include relocation, closure, paving or watering. All alternatives would require some mitigation on a case by case basis when a safety hazard was identified.

Some hazardous materials could volatilize into the air if spilled or illegally dumped. Although not a consequence of management activities, hazardous material spills and dumps would be expected to occur, occasionally. They would be treated in accordance with the Forest Spill Contingency Plan. Spills would be coordinated with appropriate State and local agencies. Clean up of illegal hazardous material dumps would be coordinated with the Environmental Protection Agency and with the appropriate law enforcement organizations (refer to Chapter 3 - Law Enforcement).

Forest management activities involving hazardous materials would develop and adhere to a Spill Prevention Control Countermeasures Plan which would be consistent with the Forest Spill Contingency Plan.

While it is not possible to predict the actual effects of these spills and dumps, it is expected that the above measures would minimize any adverse effects on air quality.

Because the prevailing winds are from the west, activities on the Six Rivers National Forest and on private lands to the west can affect air quality. Activities on private land and adjacent forests to the north and south can also affect air quality when the winds blow from those directions.

The air quality related values identified for the Marble Mountain Wilderness would be adopted under any alternative. A description of these values can be found in Appendix F of the Forest Plan. These values would be used in coordinating with other agencies for the purpose of managing air quality in the Marble Mountain Wilderness.

Comparison of Alternatives

The total suspended particulates produced by prescribed burning would vary by alternatives depending on the mixture of management activities proposed.

The alternatives would vary in the number of acres treated in the fuel management program; refer to Table 2-5. In general, air quality decreases as more acres are burned. An additional consideration is that wildlife and range habitat improvement prescribed burns tend to burn at higher intensities resulting in more complete combustion and producing less particulate matter than lower intensity burns. Slash fuels tend to smolder longer and produce more particulate matter. Site preparation and fire hazard reduction would primarly treat slash fuels.

The Preferred Alternative would treat the most total acres for fuel management, followed by Alternatives A, D, D', C, B, B', G(SOHA), Cur/RPA and E in decreasing order. The Preferred Alternative would also treat the most slash fuels, followed by Alternatives A, G(SOHA), D, D', C, B, Cur/RPA, B' and E in decreasing order.

Consequences Common to All Alternatives but Alternative C

All alternatives but Alternative C would fund air quality monitoring at the existing level. This would provide for monitoring the Marble Mountain Wilderness Class I area. The data obtained would be used to continue the assessment of air quality in a Class 1 area.

Consequences Unique to Alternative C

Alternative C would provide for additional monitoring of air quality. An additional $40,000 per year would allow monitoring to be extended to the Siskiyou, Trinity Alps and Russian Wilderness Areas as well as to some areas outside of wilderness. The data obtained would be used to increase knowledge of the relationships between management activities and air quality. An assessment could be made of whether air quality goals were being met in Class 2 areas.

Consequences Common to All Alternatives but Alternative E

Rock sources in ultramafic rock would be examined for asbestos. Asbestos containing aggregate may be used for road surfacing if the asbestos levels fall within the standards established by the State of California. There could be some health risk to road users if carcinogens are breathed into the lungs. The degree of risk is unknown since no studies have been conducted to date.

Consequences Unique to Alternative E

The effects of asbestos would be mitigated by avoiding asbestos-bearing rock as a new source for crushed rock for road surfaces. The risk of asbestos-associated health problems related to new road construction is expected to be less than with the other alternatives, but there is not enough information to quantify the effects or determine if they would be significant.

Biological Environment

Introduction

This section of the Environmental Consequences chapter discusses the effects on the biological resources that would occur for each alternative considered in detail. First, the effects of proposed management activities on various aspects of biological diversity is presented. Next, the effects of management activities on riparian areas, Sensitive plants, wildlife and fisheries are discussed. In the next 2 sections of this chapter, the effects of each alternative on resource Management Programs and on the social and economic environments are presented. The last section is a summary of important effects.

Biological Diversity

Important Interactions

Managing for biological diversity must give consideration to local and National social values and needs as human activities, along with ecological processes, have a great influence on maintaining diversity.

The existing diversity in geology, soils, plant and animal species in the Forest is influenced by ecological processes, management actions and social demands. Forest communities are dynamic; they change over time. Successional change and associated plant stress are important factors which can affect the future structure of the forest, rangeland and aquatic ecosystems. The proportion and type of vegetation in each seral stage will change over time, whether or not management activities occur. Refer to the Fisheries section for a discussion of important aquatic habitat conditions.

Forest management activities influence some of the ecological parameters important to biological diversity in the Klamath Province. Fire management practices, control of water flows and access roads can affect forest, rangeland and aquatic ecosystems. Ecosystems are also affected by vegetative manipulation such as prescribed burning, grazing, logging and planting. Fishing and hunting are also important factors. These activities can be seen as having beneficial or adverse effects on diversity or they may simply be viewed as a change from past or current conditions.

Climate, geology and soils are basic factors that determine an area's capacity to grow vegetation. These factors plus plant distribution and genetic composition determine the potential vegetation of an area. Other variables such as fire, insects, disease and other ecological disturbances can influence the vegetative status at any given point in time. Vegetation type and condition largely determine which species of fish and wildlife can be supported in any given area.

Many ecological factors are not affected by management activities, but can influence management actions. The climate and geology of the area are examples of things that need to be considered when planning management activities.

Wildfire is the ecosystem's natural regulator or manager of biomass levels. Fire plays a dominant role in creating the diversity that makes up the Forest. The frequent occurrence of low to moderate intensity wildfires can maintain Forest openings and densities, regulate the accumulation of CWD, control the abundance of shade tolerant species that grow under closed canopies and regulate the available forage and cover for wildlife. Fire also plays a role in fish habitat and population cycles.

Wildfires, fire suppression and prescribed burning can change vegetation patterns. Community composition including age, size and species can be altered by fires or fire suppression. Forest processes can also be altered. These changes can in turn affect many Forest resources. The interactions of fire with other resources are discussed under the appropriate resource elsewhere in this chapter.

Access routes can also affect forest, rangeland and aquatic ecosystems. Roads may cause fragmentation and affect the movements of wildlife species. Roads may also affect sedimentation levels in streams and alter vegetative recruitment patterns in adjacent aquatic systems.

Access routes can allow the introduction of non-native plants and animals, diseases and pathogens. Convenient access can also increase fishing, hunting, poaching and recreational use. Roads can also help control damage from natural catastrophes such as floods and fires.

Land allocations and the associated standards and guidelines are important to the future biological diversity on the Forest. The intensity of management permitted in each management area has a major effect on vegetative patterns at the landscape level. Vegetation management activities such as burning, grazing, planting and harvesting can change vegetative patterns; specifically the size, shape and composition. Standards and guidelines and intensity of management can also affect composition and structure at the stand level.

Vegetative manipulation can affect the current and long-term wildlife, fish and plant populations. Distribution and dispersal of the populations as well as the utilization of these resources by humans can be influenced by these activities.

Ecosystems are continually evolving and changing over time. No single picture of the Forest can represent the historic pattern and composition of the forest.

Methodology

A number of criteria for the biological diversity elements of composition, structure and ecosystem functioning were analyzed. No single criteria should be used alone as a measure of biological diversity. Many of these criteria are discussed in other sections of this chapter. It is important to recognize their role in contributing to a biologically diverse forest.

Table 4-16 lists the criteria analyzed for the 3 elements of biological diversity and tells where in this chapter each criteria is discussed.

Table 4-16. Biological Diversity Criteria

Criteria	Chapter 4 Section Where Discussed
Composition	
Seral stage by forest type	Biological Diversity.
Rangeland type	Biological Diversity, Range.
Species diversity	Biological Diversity, Wildlife, Fisheries, Timber, Appendix F.
Community diversity, special emphasis habitats	Geology, Biological Diversity, Sensitive Plants, Wildlife, Fisheries, Wilderness, Minerals, Timber.
Genetic diversity	Biological Diversity, Timber, Appendix F.
TE&S and candidate species	Sensitive Plants, Wildlife, Fisheries.
Endemic communities	Sensitive Plants.
Reforestation	Timber.
Human diversity	Social.
Structure	
Stand structure	Biological Diversity, Wildlife, Timber, Appendix F.
Vegetative pattern	Biological Diversity, Timber.
"Old growth"	Biological Diversity.
Fragmentation (openings and road density)	Biological Diversity, Transportation.
Function	
Seral stage changes	Biological Diversity.
Connectivity	Biological Diversity, Wildlife.
Ecological role of fire	Biological Diversity, Wilderness, Timber, Fire.
Refugia and Key Watersheds	Biological Diversity.

Table 4-16. Biological Diversity Criteria

Criteria	Chapter 4 Section Where Discussed
Ecosystem capacity to maintain wildlife habitat	Wildlife.
Aquatic ecosystem capability to maintain fish viability	Fisheries.
Rangeland ecosystem capacity	Range, Wild Horse.
Management of unique vegetation or habitats	Sensitive Plants, Wildlife, Timber.
Soil productivity	Soils.
Forest health	Biological Diversity, Timber, Appendix F.

All of the above criteria when considered together provide an assessment of how each alternative addresses the issue of biological diversity which is the maintenance of a functioning, healthy ecosystem with a variety of species and structural parts. Although discussed in separate sections, there is great overlap between composition, structure and function in the ecosystem.

The analysis of seral stages shows how each alternative would respond to the issues of "old growth" and vegetative diversity. For the "old growth" analysis, seral stages 4BC and 5C were assumed to meet the criteria for "old growth."

It is very difficult to accurately predict the growth, maturation and death of vegetation. The FORPLAN model was used to predict the number of acres in each seral stage by major forest type in the current condition. This information is used as a baseline for comparison.

FORPLAN was used to project seral stage changes over the planning period in response to each alternative's proposed management strategies with the exception of Alternative E. Seral stage changes for Alternative E were estimated through comparisons with the other alternatives. These projections were based on the assumption that individual forest stands would move into later seral stages throughout time. Hardwood stands, non-coniferous species and non-capable acres were not included in these projections. It was assumed that the number of acres in each forest type would not change over time.

FORPLAN is a non-spatial model and does not predict where any particular seral stage would occur. Site-specific factors in localized areas such as site capability limits are not accounted for by the Forest-

wide averages of seral stages displayed in this analysis. Appendix B contains a description of the FORPLAN model.

The FORPLAN seral stage analysis does not include the effects of each alternative's fuel management program on reducing the intensity of future wildfires. The effect of stand replacing wildfires are not included in the projections, although wildfires are accounted for as part of the mortality function included in FORPLAN. Actual seral stage acres could be very different from the projections. These factors are analyzed separately from the seral stage projections.

Areas which have had little vegetative manipulation in the past such as wilderness and other unroaded areas were used to estimate the range of natural variabilty of some aspects of landscape and stand level diversity. Although this range represents only a relatively small area as seen at one point in time, it provides a useful baseline to determine if estimated future effects would be within this natural variation.

Other criteria were addressed through a comparison of the standards and guidelines related to that criteria for each alternative.

To analyze connectivity for each alternative, estimates for the acres in various management areas were used. Areas which formed large blocks of land were calculated as one group. These include wilderness, LSRs, HCAs, furbearers and backcountry.

Other acres which were determined to have management direction which would likely be suitable to link the habitat between these large blocks were the second group. These linkage areas include T&E species habitat, RNAs, SIAs, sacred site cultural areas, Wild Rivers, Scenic Rivers, RRs and RMZs, Scenic Highways, VQOs for Preservation and Retention, Landscape Linkages and "old growth." The alternative maps were examined to determine a rough estimate of the width of the linkage areas.

It is very difficult to accurately predict changes in diversity given the current level of scientific information available. The predictions are most useful for comparing alternatives and should not be used as indications of absolute values. In many cases the prediction or objectives for the criteria were compared to the existing situation and an estimation of whether they would be within the range of natural variability was made.

The analyses for the preferred alternative, Alternative 9, in Chapters 3 and 4 of the FSEIS are hereby incorporated by reference to display the effects of the Preferred Alternative in this EIS at the regional level (USDA Forest Service and USDI BLM et.al., 1994).

Environmental Consequences

Composition

Seral Stage by Forest Type

Consequences Common to All Alternatives

All alternatives would maintain a mixture of forest types and size classes at the Forest level. A mixture of seral stages throughout the Forest would provide for both horizontal and vertical diversity. The relative percent of the Forest in each major forest type would not be measurably changed, although there would be some improvement from the current situation in distribution for most forest types in all alternatives. All alternatives would maintain the minor conifer species through appropriate standards and guidelines.

Comparison of Alternatives

Alternatives Preferred and A would manage for seral stages on a landscape basis. All other alternatives would manage for seral stages on a compartment basis. Successful achievement of seral stage objectives is more likely at the landscape level due to the way forest types are distributed across the Forest and to the wildfire regime that regulates the Klamath Province.

At the compartment basis, it is more likely that all seral stages would not always be available for any given forest type due to the occurrence of past fires. The same seral stage distribution could appear less successful due solely to the accounting system used.

Table 4-17 displays the projected number of acres within each seral stage at the end of the fifth decade by alternative for all forest types and for each forest type. The existing condition is presented as a baseline for comparison.

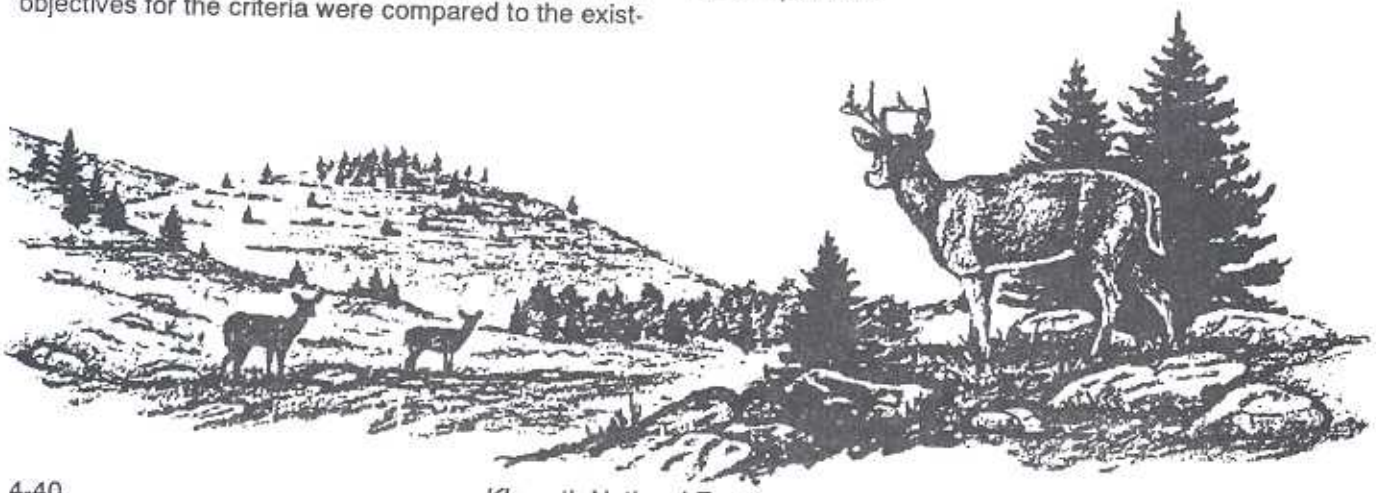


Table 4-17. Seral Stage Distribution at Decade 5 in Thousands of Acres

	Existing Condition	Alternative								
		PFD	CUR/ RPA	A	B	B'	C	D	D'	E	G (SOHA)
All Forest Types											
Seral Stage 1	190	118	143	165	144	190	212	152	142	98	136
Seral Stage 2	43	130	134	103	117	95	75	126	115	116	125
Seral Stage 3A	432	244	285	280	242	254	288	256	292	228	319
Seral Stage 3BC	296	208	219	236	197	203	213	220	221	209	216
Seral Stage 4A	203	14	285	334	356	359	282	283	290	172	284
Seral Stage 4BC	29	319	0	0	0	0	0	0	0	180	0
Seral Stage 5C	197	357	317	272	334	289	320	353	329	387	310
Total	**1390**										
Mixed Conifer - Westside											
Seral Stage 1	107	57	63	87	48	115	144	83	53	44	67
Seral Stage 2	25	67	74	59	68	49	28	52	55	64	69
Seral Stage 3A	200	48	76	91	26	53	57	62	90	51	78
Seral Stage 3BC	177	109	107	120	109	108	106	110	111	104	106
Seral Stage 4A	92	0	172	216	239	237	173	169	174	90	171
Seral Stage 4BC	0	217	0	0	0	0	0	0	0	140	0
Seral Stage 5C	120	223	229	148	231	159	213	245	238	228	230
Total	**721**										
Douglas-fir											
Seral Stage 1	52	28	43	33	31	33	27	28	29	30	18
Seral Stage 2	7	34	41	28	39	35	31	37	40	39	41
Seral Stage 3A	70	69	77	59	88	75	89	72	75	63	95
Seral Stage 3BC	53	52	59	64	48	46	55	61	60	51	60
Seral Stage 4A	95	0	69	69	67	71	70	71	71	68	68
Seral Stage 4BC	0	72	0	0	0	0	0	0	0	0	0
Seral Stage 5C	60	82	41	84	64	77	65	68	62	86	55
Total	**337**										
Mixed Conifer - Eastside											
Seral Stage 1	9	16	12	6	22	17	12	12	15	5	9
Seral Stage 2	3	12	12	6	7	9	10	9	9	4	6
Seral Stage 3A	51	14	16	17	8	7	17	14	13	7	23
Seral Stage 3BC	38	11	17	18	11	11	16	17	17	12	18
Seral Stage 4A	0	0	34	34	35	34	34	31	33	0	32
Seral Stage 4BC	0	30	0	0	0	0	0	0	0	40	0
Seral Stage 5C	3	21	13	23	21	26	15	21	17	36	16
Total	**104**										

Table 4-17. Seral Stage Distribution at Decade 5 in Thousands of Acres

	Existing Condition	Alternative									
		PFD	CUR/ RPA	A	B	B'	C	D	D'	E	G (SOHA)
Ponderosa Pine											
Seral Stage 1	18	8	15	15	15	15	16	21	15	13	14
Seral Stage 2	7	11	1	6	0	0	1	11	6	4	2
Seral Stage 3A	61	63	66	63	70	66	64	52	63	62	69
Seral Stage 3BC	13	17	17	15	14	18	18	15	15	20	14
Seral Stage 4A	0	0	0	0	0	0	0	0	0	0	0
Seral Stage 4BC	0	0	0	0	0	0	0	0	0	0	0
Seral Stage 5C	0	0	0	0	0	0	0	0	0	0	0
Total	**99**										
True Fir - Westside											
Seral Stage 1	2	4	8	17	20	6	11	2	23	3	24
Seral Stage 2	0	4	3	2	2	1	3	15	2	4	3
Seral Stage 3A	41	39	40	40	41	45	51	41	41	38	41
Seral Stage 3BC	0	3	3	3	2	2	1	2	2	4	3
Seral Stage 4A	14	13	9	14	14	15	4	11	11	13	13
Seral Stage 4BC	19	0	0	0	0	0	0	0	0	0	0
Seral Stage 5C	11	24	24	11	8	18	17	16	7	25	3
Total	**87**										
True Fir - Eastside											
Seral Stage 1	2	4	1	6	3	4	1	4	6	2	2
Seral Stage 2	1	2	2	1	1	1	2	1	2	1	3
Seral Stage 3A	9	10	9	9	9	8	9	14	9	7	11
Seral Stage 3BC	0	3	4	4	3	3	4	4	4	4	5
Seral Stage 4A	2	1	1	1	1	2	1	1	1	1	0
Seral Stage 4BC	10	0	0	0	0	0	0	0	0	0	0
Seral Stage 5C	3	7	10	6	10	9	10	3	5	12	6
Total	**27**										
Lodgepole Pine											
Seral Stage 1	0	1	1	1	5	0	1	2	1	1	2
Seral Stage 2	0	0	1	1	0	0	0	1	1	0	1
Seral Stage 3A	0	1	1	1	0	0	1	1	1	0	2
Seral Stage 3BC	15	13	12	12	10	15	13	11	12	14	10
Seral Stage 4A	0	0	0	0	0	0	0	0	0	0	0
Seral Stage 4BC	0	0	0	0	0	0	0	0	0	0	0
Seral Stage 5C	0	0	0	0	0	0	0	0	0	0	0
Total	**15**										

Seral Stages - The total acres in all forest types in seral stage 1 would be less than or equal to the current 14% in all alternatives, except Alternative C. Generally, the westside true fir and the lodgepole pine in seral stage 1 would increase in all alternatives. The eastside mixed conifer and eastside true fir in seral stage 1 would increase for most alternatives. This is due to the large amount of these types currently in older age stands that would be returned to seral stage 1 in the next 50 years through decadence, timber harvesting and wildfire.

The other forest types would generally decrease for all alternatives in seral stage 1 due to fewer acres being allocated to timber production (Regulation Classes 1 and 2) than in the past.

In all alternatives, the total acres in all forest types in seral stage 2 would increase from the current low of 3% as stands presently in seral stage 1 grow. This is also true for each individual forest type except ponderosa pine. For ponderosa pine, Alternatives Current/RPA, A, B, B', C, D', E and G(SOHA) would decrease from the current 7% in seral stage 2.

The total acres in all forest types in the middle seral stages (3A and 3BC) would decrease in all alternatives over the next 50 years due to the current shortage of older early seral stages available to grow into them. This is generally true for each individual forest type as well with some exceptions.

The ponderosa pine type would increase or remain the same for all alternatives, except Alternative D for seral stage 3A. The Douglas-fir type in seral stage 3A would increase for Alternatives Current/RPA, B, B', C, D, D' and G(SOHA). The Douglas-fir type for seral stag 3BC would increase for all alternatives except Alternatives Preferred, B and B'.

The amount of eastside and westside true fir in seral stage 3BC would increase in all alternatives, which would be an improvement from the current situation where this seral stage is lacking. This would be accompanied by a decrease or no change in the 3A seral stage for true fir for all alternatives except Alternatives B' and C on the westside and for Alternatives Preferred, D and G(SOHA) on the eastside.

In some areas, the site capabilities may limit the vegetation from progressing beyond the 3A or 3BC seral stages. Some of these sites may in fact have reached an equilibrium state. It is not known how this would influence wildlife habitats in the future.

In all alternatives the total amount of mature and "old growth" seral stages (4A, 4BC and 5C) for all forest types combined would increase from the current 31%. In 50 years the total mature and "old growth" seral stages for all forest types combined would range from 42% in Alternative G(SOHA) to 54% in Alternative E.

The acres of mature 4A stands would range from 1% in the Preferred Alternative to 26% in Alternatives B and B' for all forest types combined. Except for Alternatives Preferred which would have 23% and Alternative E which would have 13% of seral stage 4BC, no alternatives would have any 4BC by the fifth decade. As these stands move into the 5C seral stages or into early seral stages through stand replacing events, there would not be enough seral stage 3BC stands to replace them within the next 50 years.

The "old growth" 4BC and 5C seral stage stands for all forest types combined would comprise from 20% in Alternative A to 49% in the Preferred Alternative, a significant increase from the current 16%.

The amount of land supporting mature and "old growth" seral stages of eastside and westside true fir would decrease in all alternatives over the next 50 years. Due to stand replacing events such as timber harvesting, wildfire, insect infestation and diseases; most of the stands currently in these seral stages which are in unregulated areas would be converted to early seral stages. There are currently no seral stage 3BC stands to replace them in the next 5 decades.

Although early seral stage lodgepole and ponderosa pine stands would move towards later seral stages increasing in size and mean average age, they would not reach seral stages 4ABC or 5C within 50 years in any alternative. Also the number of acres supporting the largest lodgepole, seral stage 3BC, would decrease as a result of decadence, harvesting and wildfire in all alternatives except Alternative B' which would retain 15% of the forest type in seral stage 3BC.

The ponderosa pine forest type has undergone dramatic changes in seral stage distribution and species composition following settlement by Europeans. Beginning in the late 1800s and continuing into the 1920s, railroad logging removed the majority of mature ponderosa pine stands on the eastside of the Forest where relatively flat terrain allowed easy access. More recently, suppression of wildfire has resulted in invasion of these stands by white fir, which competes with pine for moisture during periods of low precipitation. The resulting stands are overstocked relative to site class and available moisture, and at risk to large scale insect infestation and catastrophic wildfire. In many cases, these stands are unlikely to attain the structural characteristics of late-successional ponderosa pine forests.

The ponderosa pine forest type is currently lacking in later seral stages and a continued shortage is projected for all alternatives over the next 5 decades. Under all alternatives except the Preferred Alternative, development of existing early- to mid-mature stands into late-mature stands would likely be retarded by white fir ingrowth and lack of low intensity fire. Under the Preferred Alternative, much of the Forest's

eastside pine habitat would be included in the Goosenest AMA. A primary objective of the AMA would be acceleration of mature pine characteristics through the use of techniques such as thinning and prescribed fire.

With the exception of the ponderosa pine forest type, the projected distribution and amounts of each seral stage for all alternatives appears to be within the natural range of variability seen throughout the Klamath Province.

Wildfire Effects - The above projections do not account for the effect of wildfires except for those effects which overlap with the mortality function of the model. The effect of wildfires on seral stages can be complex. In stand replacing wildfires, the effects are fairly simple, the stands are returned to an early seral stage.

In moderate or low intensity wildfires, much of the stand composition and structure may be left on the site. The interaction of these elements remaining from the pre-fire stand with elements of the new stand could cause the stand to function as any seral stage depending on the site-specific circumstances.

Due to heavy fuel loading, the risk of wildfire occurring in the mature and "old growth" stands would be high in all alternatives where the fuels were not treated. This could decrease the future amount of later seral stages if stand replacing catastrophic wildfires occurred as a result.

Fuel Treatment - The Preferred Alternative proposes to conduct fuel treatment on the most acres of any alternative. Due to this treatment, it is projected to have the fewest acres burnt by stand replacing (high intensity) wildfires in the fifth decade, an average of about 3,700 acres per year.

Alternative A would conduct fuel treatment activities on the second greatest number of acres; estimates for stand replacing wildfires in the fifth decade average about 4,700 acres per year. (Refer to Tables 2-4, 2-5 and the Fire Management section later in this chapter). Alternatives Preferred and A are the most likely to achieve seral stage distributions similar to those projected in Table 4-17.

Listed in decreasing order, Alternatives D, D', C, B and B' would conduct fuel treatments on fewer acres than the above 2 alternatives. Projections for stand replacing wildfires in the fifth decade range from a yearly average of about 5,400 to 6,200. There is a greater risk that these alternatives might not achieve seral stage distributions similar to those projected in Table 4-17 due to the number of acres expected to burn in stand replacing wildfires in the future.

Listed in decreasing order, Alternatives G(SOHA), Current and E would treat fuels on the least acres. Stand replacing wildfires in the fifth decade are estimated at about 6,600 acres per year for Alternative G(SOHA), at 6,800 acres for Current and at 7,000 acres per year for Alternative E. There is the highest risk of not achieving seral stage distributions similar to those projected in Table 4-17 with these alternatives.

Rangeland Types

Consequences Common to All Alternatives

Wildfires are the primary natural disturbance that would affect rangeland types. Some cover types, particularly the tree and chaparral types, would be returned to earlier seral stages and others such as grasslands would generally be replaced by the same species. The Riparian Woodlands and Wetlands would likely be least affected as their moist conditions do not generally support the spread of fire.

Firewood cutting, grazing, type conversions and prescribed burning are the management activities most likely to affect rangeland cover types. Logging of adjacent stands could also affect these types if trees were yarded through them. All alternatives would use contract specifications which are designed to protect key resource values such as meadows and wetlands.

Firewood cutting would most likely occur in the Juniper and Riparian Woodlands cover types which support conifers and hardwood tree species. Firewood cutting would have little effect on composition unless entire stands were designated for removal. Structure and ecological processes could be altered depending on how many trees were removed. All alternatives would continue to use the permit system to require mitigating measures for firewood cutting.

Grazing would primarily occur in the Juniper, Riparian Woodlands, Ceanothus Mixed Chaparral, Bitterbrush, Montane Meadow, Alpine Grassland and Wetlands cover types. Early seral stages of Scrub Oak Mixed Chaparral and Montane Shrubland might also be used by livestock.

Grazing can change the age, composition and structure of communities through consumption. Individual plants can be consumed or preferred species can be eradicated. Trampling can affect structure and ecosystem processes. Heavy use such as might occur around water sources and salt blocks could cause soil compaction and/or erosion. Bank cutting in stream areas can also be a concern.

Grazing can also be beneficial by fostering nutrient cycling, aiding in decomposition of organic material and enhancing foods and habitats of some species. All alternatives would establish standards and guidelines to maintain ecological processes and minimize any adverse effects relating to grazing.

Type conversions would be most likely to occur in chaparral or grass types where existing species do not

meet the desired future condition. Type conversions generally use mechanical equipment or herbicides, either alone or in conjunction with prescribed fire. Mechanical methods crush, sever or dig up plants, while herbicides kill or injure certain species or groups of species, so different species can become established. These practices would have the greatest effect on ecosystem processes. Composition, structure and function are generally all altered.

None of the alternatives would emphasize converting rangeland types to other rangeland types. However, all alternatives might use type conversions on individual sites, after the appropriate project environmental analyses were completed, if they were determined necessary to achieve management area goals.

Alternatives Preferred and A propose restocking 90% of non-stocked capable commercial forest land that is currently covered by shrubs and/or grass. Alternatives D and D' propose restocking 30% of these areas. The other alternatives would not emphasize re-establishment of commercial conifers on currently non-stocked areas, but may apply these treatments on a case by case basis if it led to achievement of management area goals.

Prescribed fire could occur in any of the cover types for fire hazard reduction. Reducing fuel loadings could help reduce the size and intensity of future wildfires. Prescribed fire would create different age classes and might return cover types to earlier seral stages. Prescribed fire might also be used to maintain meadows by reducing or eliminating encroaching vegetation.

In the chaparral and shrub types, spring burning may alter community composition by favoring sprouting species over seed-dependent species.

Comparison of Alternatives

Alternatives with more acres proposed for fire hazard reduction, wildlife habitat enhancement, range improvement and watershed fuel reduction in their fuel treatment programs would affect more acres through prescribed burning and other fuel treatment activities on rangeland types as described above. A sizeable proportion of these acres would likely be in rangeland types.

The Preferred Alternative would propose 15,675 acres per year for these types of treatments. Alternative A would propose 7,500 acres per year for these types of treatments. Alternatives D and D' would propose 3,500 acres per year. Alternatives B, B', C and E would propose 3,040 acres per year. Alternatives Current/RPA and G(SOHA) would propose 400 acres per year and these acres would be for the purpose of fire hazard reduction only.

Wildlife habitat enhancement might include mechanical means, as well as prescribed fire as described above, to meet management goals. Mechanical techniques would be similar to those described for type conversion. In many cases, the objective would be to alter the age class and structure of the existing communities without changing the composition. The Preferred Alternative would propose treatment on 4,300 acres per year for wildlife habitat enhancement, while Alternative A would propose 2,000 acres per year. Alternatives B, B', C, D, D' and E would propose 500 acres per year, while Alternatives Current/RPA and G(SOHA) would only have incidental amounts.

Species Diversity

Consequences Common to All Alternatives

All alternatives would have standards and guidelines which are consistent with current laws and direction for maintaining species diversity.

Animal Diversity - Animal diversity would be maintained on the Forest in any alternative (refer to Wildlife and Fisheries sections in this chapter).

Vegetative Composition - All alternatives are expected to retain adequate diversity at the stand level in unregulated areas due to natural regeneration. Stand level diversity within the range of natural variation is expected to be retained on regulated lands in all alternatives due to planting mixtures of species and relying on supplemental natural regeneration. Refer to the Sensitive Plant Species and Timber Management sections later in this chapter.

Comparison of Alternatives

Vegetative Composition - On regulated lands for all alternatives except Current/RPA and G(SOHA), there would be a shift towards more shade tolerant species. Due to the proposed practices in the other alternatives which would create small openings and/or leave lots of structural elements in treated stands, much of the regeneration would be influenced by overstory vegetation. This would benefit shade tolerant species such as true fir and incense cedar and be detrimental to intolerant species. A higher proportion of shade tolerant species would become established in timber harvesting units than in the current situation.

This shift in species composition to the more shade tolerant would be most pronounced in Alternatives Preferred, B, B' and E which would have the smallest openings and leave the most structural elements.

Alternatives Current/RPA and G(SOHA) would use the practice of clearcutting. Regeneration would experience similar amounts of shading and competition to the current situation. Species composition at the stand level would be similar to what it is on regulated

lands today. There would be a higher proportion of shade intolerant species than in the other alternatives.

Vegetative Diversity - Alternatives were analyzed to see if a minimum of 5% of each forest type would be maintained in each seral stage at the Forest-wide level. This analysis identifies future potential shortages for each alternative.

Only Alternative E would achieve 5% in each seral stage for all forest types combined. The other alternatives would have a shortage in the 4BC seral stage at the fifth decade except for the Preferred Alternative which would have a shortage in the 4A seral stage. All alternatives would show an improvement in seral stage 2 from the current condition which is currently only 3% of the forested area.

The situation for the westside mixed conifer forest type is similar to that for all forest types combined. All alternatives except the Preferred and E would have less than 5% in seral stage 4BC for westside mixed conifer at the fifth decade, while the Preferred Alternative would have less than 5% in seral stage 4A. Except for seral stage 2 in Alternative C and seral stage 3A in Alternative B, all alternatives would have more than 5% of the forest type in each seral stage. All alternatives would show an improvement in seral stage 2 from the current condition which is currently below 5%.

For the Douglas-fir forest type, all alternatives would have less than 5% in seral stage 4BC at the fifth decade except the Preferred Alternative which would have less than 5% in seral stage 4A. All alternatives would have more than 5% of the forest type in each of the other seral stages. All alternatives would show an improvement in seral stage 2 from the current condition which is currently below 5%.

All alternatives except Alternatives Preferred and E would have less than 5% in seral stage 4BC for eastside mixed conifer at the fifth decade. Except for seral stage 4A in the Preferred Alternative and seral stage 2 and 4A in Alternative E, all alternatives would have more than 5% of the forest type in all other seral stages. All alternatives would show an improvement in seral stage 2 and all alternatives except the Alternatives Preferred and E would show an improvement in seral stage 4A which is currently below 5%.

All alternatives would have less than 5% in seral stages 4A, 4BC and 5C for ponderosa pine at the fifth decade. Alternatives Current/RPA, B, B', C, E and G(SOHA) would have less than 5% in seral stage 2 for ponderosa pine by the fifth decade.

All alternatives would have less than 5% in seral stage 4BC for westside true fir at the fifth decade. All alternatives except Alternatives D and E would have increased the amount of land in seral stage 1 to meet the 5% criteria by Decade 5. All alternatives would show an improvement in seral stage 2 from the current condition. All alternatives except Alternatives Preferred, D and E would still be below 5% for seral stage 2. All alternatives would show an improvement in seral stage 3BC from the current condition, but only Alternative E would meet 5% by the fifth decade. Alternative G(SOHA) would not meet the 5% criteria for seral stage 5C by the fifth decade.

All alternatives would have less than 5% in seral stage 4BC for eastside true fir at the fifth decade. All alternatives would have increased the amount of land in seral stage 3BC to meet the 5% criteria by Decade 5. Alternative G(SOHA) would not meet the 5% criteria for seral stage 4A by the fifth decade.

All alternatives would have less than 5% in seral stages 4A, 4BC and 5C for lodgepole pine at the fifth decade. Alternative B' would have less than 5% in seral stage 1 by the fifth decade. Alternatives Preferred, B, B', C and E would have less than 5% in seral stage 2 for lodgepole pine by the fifth decade. Alternatives B, B' and E would have less than 5% in seral stage 3A.

Optimal levels of seral stages for vegetative diversity needs have not been determined or agreed upon by the scientific community. No value judgements of which alternatives would best meet vegetative diversity needs can be made.

Consequences Unique to the Preferred Alternative

The analyses for Alternative 9 in the FSEIS, which are incorporated by reference, indicates that the Preferred Alternative would adequately provide for species diversity for late-successional and "old growth" species at the regional (spotted owl range) level.

Community Diversity

Consequences Common to All Alternatives

Discussions of how each alternative would treat special emphasis habitats are included in the following sections of this chapter: Sensitive Plant Species, Wildlife, Fisheries and Timber Management. Caves, which are discussed under Geology, provide roosts and maternity structures for bats as do mining structures. Cave species such as springtails, mites and beetles feed on fungi and bacteria growing on decaying vegetative matter washed down from above (Wilson, 1992). All alternatives are expected to maintain these populations at a level similar to current.

Comparison of Alternatives

The management of mineral hot springs is included in the discussion on leasable minerals in the Minerals section of this chapter. Mineral hot springs support archaebacteria, one-celled microorganisms which are candidates for a separate kingdom of life (Wilson, 1992). The Preferred Alternative would provide the most protection for these habitats by prohibiting any

new leasable mineral development in RRs and by imposing special restrictions on the most acres with a very high to high leasable mineral potential. Alternatives B and B' would impose special restrictions on the next most acres with very high and high leasable mineral potential, followed in decreasing order by Alternatives E, C, D and D', A, Current/RPA and G(SOHA).

Genetic Diversity

Comparison of Alternatives

Uncertainty exists on how to quantify or project genetic richness in an ecosystem, especially one as diverse as the Klamath Province. It is not known how much genetic richness would be adequate. However, it is believed that the management practices proposed in all alternatives would not significantly alter the richness from that existing in the current situation.

None of the alternatives would manipulate large contiguous areas of vegetation. Reforestation efforts could cause some reductions in the gene pool at the stand level. However, all alternatives would use the Tree Improvement Master Plan for the California Region as well as available management plans for individual conifer species. These management techniques, coupled with natural reforestation are expected to maintain the genetic viability of vegetative species.

There would be minor differences in maintaining genetic diversity between alternatives. Alternatives that propose higher levels of stand replacing or ground disturbing activities would have a higher risk of modifying the genetic vegetative diversity, primarily at the stand level.

Widespread stand-replacing events like intense catastrophic wildfires have the potential to alter genetic richness. Refer to the discussion of how the alternatives would reduce the occurrence of high intensity wildfire earlier in this section.

Widespread insect and disease attack would not be expected with any alternative due to management practices which maintain species diversity and ecosystem health. Refer to discussion on timber stand improvement later in this section.

The risk of events such as intense wildfire due to heavy fuel loadings and of catastrophic insect and disease occurrence due to stand decadence are much higher in the stands which meet the criteria for "old growth." Refer to "old growth" discussion later in this section.

Small populations are of most concern for maintaining genetic diversity. If populations reach critical levels and are isolated, inbreeding (mating among relatives) can reduce genetic diversity.

Providing for populations with unique vegetative communities can counteract this isolation effect. RNAs and Botanical SIAs play an important role in maintaining genetic diversity of rare and unique plant species and communities. For example, candidate SIAs such as Rock Fence, China Mountain, Cory Peak and Poker Flat support communities which flourish on ultrabasic soils. Scott Mountain candidate SIA supports serpentine endemic plant communities. Comparisons can be made such as Alternatives Preferred, B, B', C, D, D' and E would recommend Scott Mountain SIA for establishment and might have less risk of reductions in genetic diversity for these species.

All alternatives would propose establishment of the 9 RNAs currently in the establishment process. Alternatives D, D' and E would recommend all potential SIAs and all potential acres for establishment including the 15,000 acre Siskiyou Crest Zone. The Preferred Alternative would recommend 18 Botanical and 6 Botanical and Geologic SIAs for establishment, while Alternative C would recommend 17 Botanical and 6 Botanical and Geologic candidate SIAs for establishment. These alternatives would have the least risk of genetic variability in populations existing in these areas experiencing critical reductions.

Alternative A would recommend 10 Botanical SIAs and 4 Botanical and Geologic SIAs while Alternatives B and B' would recommend the 15,000 acre Siskiyou Crest Scenic SIA, 6 Botanical and 3 Botanical and Geologic SIAs. These alternatives would have a higher risk of genetic diversity reduction, since fewer types of communities would be managed as SIAs. Alternatives Current/RPA and G(SOHA) would recommend 4 Botanical SIAs. They would have the highest risk as the populations in the communities not in SIAs could be reduced over time by management activities.

Genetic diversity of wildlife species is generally thought to benefit from the introduction of animals from different areas or when animals from different subpopulations interact. None of the alternatives make any special provision for increasing genetic diversity for wildlife or fish.

For the local fisheries, the introduction of hatchery fish are seen as detrimental to the genetic richness of wild fish stocks. Maintaining the genetic diversity and integrity of wild fish stocks would be a continuing concern as the demand for fish outputs increases in all alternatives. Gene pools within wild fish populations have already been affected for many years through the introduction of hatchery stock. Through interbreeding with hatchery fish, the genetic composition of wild runs has permanently been modified.

Current Forest research on delineating individual genetic stocks of Sensitive species and recommending management actions to retain the maximum amount of genetic diversity and resiliency within these wild stocks would be continued in all alternatives.

Riparian biological diversity would be improved or maintained by conservation or culture of diverse native vegetative species. Conservation of "old growth" conifer habitat in RRs/RMZs and, where riparian habitat is in poor condition, aggressive restoration programs, would combine to improve cold-water fish diversity on the Forest. Since the average riparian condition on the Forest is below optimum for fish habitat, alternatives proposing scheduled harvest adjacent to streams would probably further lower fish habitat quality and diversity. Alternatives Current/RPA, A, and G(SOHA) propose scheduling harvest in the RMZs on the Forest.

Alternatives with a higher investment in riparian restoration programs would complete fish riparian habitat restoration sooner (refer to the Fisheries section). This would more quickly aid recovery of depressed fish stocks. It is estimated that Alternatives Preferred, A, B, B', D, D' and E would meet riparian vegetation restoration needs for fisheries within 40 years (including time for trees to reach size and density requirements). Alternatives Current/RPA, C and G(SOHA) would probably require more than 100 years to do so. Accelerated recovery of fish stocks would lower the risk of loss of genetic diversity of the populations.

Structure

Stand Structure

Stand structure includes such elements as canopy composition, quantity and quality of snags, the hardwood component and CWD. Structural elements provide a variety of habitats for plant and animal species, both aquatic and terrestrial.

Comparison of Alternatives

Canopy Composition - Forest-wide, all alternatives would maintain a variety of stand structures including both even-aged and multi-storied stands for both the short- and long-term. The amount of land managed using various silvicultural systems which would create differing structures would vary by alternative, primarily on the regulated land (refer to Timber Management section later in this chapter).

The green tree retention (GTR) prescription which would be used in Alternatives Preferred, A, B, B', C, D, D' or E would create stands with some attributes of seral stage 1 while maintaining some structural attributes of older seral stages (refer to Appendix F).

The habitat attributes of individual stands based on the differing structures would also vary by alternative. Depending on the amount of habitat attributes available under any given alternative, different plants and animal species would be favored at different places and times within the Forest. (Refer to Wildlife section later in this chapter).

Seral stage projections indicate that the number of acres with dense canopies should increase in the next 50 years in all alternatives. This is based primarily on the increase in later seral stages and on the number of acres harvested and reforested in the past and in the future which would attain canopy closure over time.

High intensity wildfires which are generally stand replacing would function the same as regeneration harvests and are expected to achieve closed canopies throughout time. It is estimated that there would be roughly as many acres burned in high intensity wildfire per year as receive regeneration cuts in all alternatives except Alternatives B and B'. High intensity wildfire acres for Alternatives B and B' are estimated at roughly twice the acreage that would be regenerated through timber harvesting.

Low and moderate intensity wildfires which tend to reduce canopy densities are projected to burn roughly 2 to 3 times as many acres as receive regeneration cutting in each alternative.

The cumulative effect of regeneration cutting and wildfire in all intensity classes would probably leave stand densities similar to the current situation or have more acres with less dense canopies than shown in the seral stage projections for all alternatives except Alternatives B and B'. Alternatives B and B' would likely have more acres with dense canopies than the seral stage projections show. This would be due to more high intensity burn and regeneration acres per year than moderate and low intensity acres in Alternatives B and B'.

Snags - In unregulated areas (areas managed for resources other than timber production with no programmed timber yields), snag densities and population levels of snag-dependent species would vary from low to high levels in all alternatives. This would primarily be a result of natural variation, but management practices such as fuel treatment and firewood cutting would also have an effect in areas where these activities were permitted.

Structural attributes for snags would be low in regenerated stands in most cases for all alternatives, but are expected to be adequate in all alternatives for wildlife habitat needs (refer to Wildlife section).

Alternative C would have the highest snag objectives of all alternatives; 4 to 21 snags per acre depending on the regulation class. Alternatives B and B' would have the second highest objectives, 7 to 10 depending on the site class. Alternative E's objectives would be to leave 5 to 8 snags per acre. The Preferred Alternative's objectives would be 5 snags per acre. Alternative A's objectives would be to leave 1.5 to 9 depending on the regulation class. Alternative Current/RPA, D, D' and G(SOHA) would have the lowest objectives, 1.5 snags per acre.

Alternatives Preferred and A would measure snag objectives on a landscape level basis, while Alternatives D and D' would measure them on a compartment basis. All other alternatives would use a stand level basis. Greater variations in snag levels in individual stands would be allowed in Alternatives Preferred, A, D and D'.

The current situation is estimated as 1.9 to 3.8 snags per acre, but this is believed to be a conservative estimate (refer to Chapter 3 - Biological Diversity). The snag objectives for Alternatives Preferred, A and E are probably closest to approximating the current condition based on the Forest-wide average.

Hardwood Component - In unregulated areas, the hardwood component for all alternatives would generally be similar to the current situation in unregulated areas. Exceptions would occur when management areas objectives required vegetative manipulation to meet resource needs. The objectives could call for either an increase or decrease in the amount of hardwoods depending on the resources emphasized in any given management area. In areas where firewood cutting was permitted, many hardwood species would be removed. Forest-wide, the percentage of hardwoods would probably not be substantially different from what it is today in any alternative.

In regulated areas, the objectives for hardwood retention would vary by alternative. The Preferred Alternative would have the highest objectives for hardwood retention of all alternatives, from 10 to 35 square feet of basal area per acre. Alternative A would have the second highest objective, from 5 to 20 square feet of basal area per acre of trees greater than 10 inches DBH depending on the regulation class. Alternative C would have the next highest objective, 2 to 13 trees greater than 12 inches DBH.

The objective for Alternative E would be to retain 6 trees greater than 12 inches DBH. Alternatives Current/RPA, B, B', D, D' and G(SOHA) would have objectives for 2 to 8 square feet of basal area of trees greater than 80 years old.

The hardwood objectives on regulated land for all alternatives would be adequate to maintain a structural component that is within the range of natural variability for stands which include hardwoods, between 0 and 41% of total basal area.

The objectives for all alternatives would probably be adequate to maintain genetic diversity for hardwoods. However, alternatives which retained more hardwoods would allow for the maintenance of more genetic richness and have less risk of loss due to catastrophic disturbances.

Alternatives with objectives which maintain more hardwoods would provide higher habitat capability for hardwood-associated species (refer to the Wildlife section).

Coarse Woody Debris - The Preferred Alternative would have the highest objectives for CWD, from 5 to 20 pieces per acre about 40 cubic feet in size. Alternatives A, D, D' and E would have the second highest objectives, 5 logs per acre greater than 40 cubic feet in size. Alternatives B and B' would have the next highest objective, 4 down logs per acres greater than 40 cubic feet in size.

Alternatives Current/RPA and G(SOHA) would have the objectives of retaining from 80 to 200 cubic feet of down material per acre depending on the regulation class. Alternative C would have the lowest objective, 2 down logs per acre greater than 40 cubic feet in size.

The objectives for all alternatives would be within the range of natural variability found within the Forest, 0 to 13 pieces being common. The upper range of the objective for the Preferred Alternative might be overly ambitious for the existing situation. Refer to the Soils section earlier in this chapter for a discussion of soil productivity and nutrient cycling.

Alternatives which retain more CWD would have an increased risk of higher intensity fires occurring if ignitions occurred in those areas. Due to past management practices, particularly fire exclusion, higher concentrations of CWD have accumulated than are believed to have existed prior to fire suppression.

In all alternatives these areas with high fuel loading would have a high risk of intense future wildfire occurring until the fuels were treated. (Refer to earlier discussion in this section on fuel treatment by alternative). Intense wildfire could affect many aspects of biological diversity. High intensity wildfire has a high risk of reducing the site productivity on those acres. The larger the number of acres burned in high intensity wildfire, the more acres at risk of productivity loss.

Alternatives which retain more CWD would likely better provide for fungi, arthropods, bryophytes and other organisms which use downed logs for habitat. CWD is also important to the needs of marten and fisher as well as some amphibians and plants.

Vegetative Patterns

Comparison of Alternatives

Stand Shapes - Currently, vegetative stand shapes are fairly similar for all seral stages, except seral stage 1 and 2 which are somewhat closer to the shape of a circle due to past management activities (refer to Table 3-10).

A slight change from the current situation in stand shape might occur on lands managed as Regulation Classes 1 and 2. With the more frequent use of prescriptions which maintain elements of both later

and early seral stages in many of the alternatives, the timber harvesting units would not always be the same shapes as they generally were in the past.

Alternatives Current/RPA and G(SOHA) which would emphasize the use of clearcutting prescriptions would likely have slightly more circular shapes than the other alternatives. Alternatives which rely primarily on GTR prescriptions and group selection would have more irregular boundaries than the alternatives which use clearcutting. The Preferred Alternative would emphasize mimicking the shapes of natural stands.

In all alternatives, unregulated land and Regulation Class 3 would comprise the majority of the Forest. These lands would range from 58% in Alternative G(SOHA) to 83% in the Preferred Alternative. There would likely be a greater variety of shapes in these areas than on Regulation Class 1 and 2 lands.

The shapes of unregulated stands would be controlled primarily by stand replacing events such as wildfire, insect infestations or disease. Where vegetative manipulation occurred on unregulated or Regulation Class 3 lands, resource concerns such as wildlife needs and visual quality objectives would more likely determine the shape than the economics of the proposed treatment.

Based on observation of past stand shapes, stands on lands managed as unregulated or as Regulation Class 3 are expected to be more linear and to follow topographical features more frequently than stands managed as Regulation Class 1 and 2.

All alternatives would likely retain shapes relatively similar to the current situation. However, as early seral stages progress to later stages, the shapes of those stands would become more circular as well. Forest-wide, stand shape is expected to be within the range of natural variability.

Stand Sizes - Currently there is a wide range of patch and stand sizes found in the Forest due to the diversity of topography, geology, soils, fire histories and past management activities. Actual future vegetative patch sizes would be determined at the project level during management activities.

All alternatives except Alternative D and D' would include standards and guidelines which limit the size of even-aged stands to no more than 60 acres in size in the Douglas-fir type and no more than 40 acres in size in all other types, except in special circumstances such as where catastrophic damage has occurred. Alternatives D and D' would limit the size of even-aged regeneration units to no more than 40 acres in size for the Douglas-fir type and no more than 25 acres in size for all other types.

For uneven-aged prescriptions in all alternatives, created openings would be less than 2 1/2 acres in size. Alternatives B and B' would have many small openings less than 2 1/2 acres in size due to the emphasis on group selection, an uneven-age system.

The GTR prescription for Alternatives Preferred and E would also result in many small openings because a large proportion of the trees covering an average of 15% and 20% of the area, respectively, would generally be left in clumps within the timber regeneration units. The Preferred Alternative would allow larger units to "emulate natural stand size" when necessary to meet biological diversity objectives.

Generally in the portion of the Forest managed for timber production (Regulation Class 1 and 2 lands), all alternatives would create stands smaller than the current average stand size which averages from 33 to 102 acres depending on the seral stage (refer to Table 3-10). Regulation Class 1 and 2 lands would range from 17% of the Forest in the Preferred Alternative to 42% in Alternative G(SOHA).

Although the average size of created stands would be relatively similar for all alternatives, patch (opening) size on regulated land would vary.

Opening size on Regulation Class 1 and 2 lands in Alternatives Current/RPA, A, C and G(SOHA) would probably average about 33 acres, the same as currently in seral stage 1. Opening size on Regulation Class 1 and 2 lands would probably average about 20 acres in Alternatives D and D', about 15 acres in Alternatives Preferred and E and about 2 acres in Alternatives B and B'. These averages would be within the range of natural variability of patch sizes, but would be much less than the current averages.

Smaller patches increase the amount of edge effect. Edge effects include the climatic effects of wind, temperature, light and humidity. These effects can be beneficial or adverse. Edge effect may increase the richness of plant and animal species that occurs in the transition zone where 2 plant communities or seral stages meet and mix. Adverse effects include windthrow, invasion by weedy and non-native species, microclimate change and population declines of species associated with interior habitat. Tailed frogs, Douglas squirrel and western wood pewee are species which are adversely affected by edge effects.

Alternatives B and B' would be expected to have the greatest edge effect. They would be followed by Alternatives Preferred and E, Alternatives D and D' and Alternatives Current/RPA, A, C and G(SOHA) in decreasing order. Alternatives with more edge effect would provide suitable habitat for species which flourish in these edge areas such as deer. They would provide less suitable habitat for interior species and species adversely affected by edge effects.

Small stands would be suitable for species with small home ranges, but not for species which require large

home ranges for viability. Smaller stand sizes would result in less likelihood of stands in these areas functioning as dispersal corridors for plant and animal species (refer to Connectivity later in this section).

The unregulated portion of the Forest which ranges from 49% in Alternative G(SOHA) to 79% in the Preferred Alternative would receive little or no vegetative manipulation. Stands in these areas would include a mixture of large and small stands due to wildfire and other stand replacing events. Some stands would likely be very large due to the occurrence of intense wildfires. Alternatives which are expected to reduce the number of acres burning in intense wildfire due to fuel management would likely have a smaller range of stand sizes than those alternatives with more projected intense wildfire acres (refer to discussion on Wildfire Effects earlier in this section).

It is expected that the unregulated portion of the Forest in all alternatives would have a range of stand sizes similar to the current situation throughout the 50 year planning period. The distribution of these stands among the seral stages is expected to be similar to the current situation as well.

These predictions are based on the assumption that there would not be any radical changes in the environment during the period. It is also assumed that the aggressive fuel treatment programs in Alternatives Preferred and A would not alter wildfire occurrence to the point where it was outside the range of wildfire behavior as observed over the past 20 years.

Little change is expected in the amount of interior habitat available to plant and animal species Forestwide with any alternative. Interior habitat is the portion of mature and "old growth" forest that is buffered and protected from edge effects. (Refer to Wildlife section later in this chapter for discussion of wildlife which use the later seral stages).

"Old Growth"

Comparison of Alternatives

Seral stages 4BC and 5C are assumed to meet the criteria for "old growth" (refer to Chapter 3 - Biological Diversity). In the current situation, 16% of the Forest meets this "old growth" criteria. The Preferred Alternative would provide the most "old growth" by Decade 5, 49%. It would be followed by Alternative E with 41%, Alternative D with 25%, Alternatives B and D' with 24%, Alternatives Current/RPA and C with 23%, Alternative G(SOHA) with 22%, Alternative B' with 21% and Alternative A with 20%.

"Old growth" is important for vegetative diversity and for some wildlife species habitat needs (refer to seral stage discussion in this section and to Wildlife section later in this chapter). However, it is not know how much "old growth" is desirable. All alternatives would provide for more "old growth" than in the current situation.

Alternatives which retain more acres exhibiting "old growth" characteristics would be more likely to experience catastrophic stand replacing events. The presence of large amounts of CWD, dead and dying trees as well as multiple canopy layers would make these stands more susceptible to high intensity wildfires. The presence of tree mortality and decay would make these stands more susceptible to insect and disease attack which could spread to adjacent stands.

Fragmentation

Consequences Common to All Alternatives

The Forest currently and historically has had a great degree of natural diversity and fragmentation. This has resulted in a host of endemic species and unique vegetation patterns. Because of this diversity of patterns, management activities are not expected to cause any significant differences from the current situation in the degree of fragmentation at the Forest level for any alternative.

With all alternatives, the degree of fragmentation could increase at the local level in some areas due to management activities, particularly those which include vegetative manipulation. The Del Norte salamander, tailed frog, wolverine and wood duck are examples of species which would not thrive in fragmented habitat.

In all alternatives, new road construction would alter the vegetation and terrain, making dispersal opportunities for many of the smaller species hazardous and exposing them to predation. The openings created during road construction and maintenance would also change the ambient air temperature near the road surface, modify wind flow patterns and alter the amount of sunlight which reaches the forest floor. This would affect certain species which use these areas.

The effect would be greater for alternatives with more miles of new road construction, more miles of road maintained on the transportation system and more miles managed as open for use. The Preferred Alternative would construct and maintain the least miles of road on its transportation system. Alternative E would have the second least miles of road. Alternative RPA would have the third least because road miles are limited by RPA goals. These alternatives would be followed by Alternatives C, B', D', Current and D, then A and G(SOHA) in increasing order. Alternative B would construct and maintain the most miles of road on its transportation system.

Alternatives Preferred, D and D' would manage the fewest miles of road as open for use. These alternatives would be followed by Alternatives E, RPA, B', C

in increasing order. Alternatives Current, A and G(SOHA) would manage the second most miles as open for use. Alternative B would manage the most miles as open (Refer to Transportation section later in this chapter).

Function

Seral Stage Changes

Consequences Common to All Alternatives

In all alternatives stand-replacing, high intensity wildfires and vegetative stress including drought, floods, fluctuating water tables, competition, insects and disease would be the primary regulators of vegetation. These factors would be similar for all alternatives with the possible exception of high intensity wildfires (refer to Fire Management and to previous discussion in this section).

Comparison of Alternatives

Alternatives with larger timber stand improvement programs are expected to be more successful at reducing plant stress and the occurrence of insect and disease attack on regulated land. Alternatives Preferred and A would have the largest programs of 10,000 acres and 9,110 acres per year, respectively. The Current/RPA alternative would have the next largest with 5,040 acres per year.

Alternatives D , D', B, G(SOHA), B' and C in decreasing order would range from 2,770 to 1,960 acres per year. Alternative E would have the smallest program, only 770 acres per year. (Refer to Timber Management section later in this chapter for a discussion of the benefits of the program).

The rate at which vegetation is returned to an earlier seral stage is important. In all alternatives wildfire, catastrophic events and timber harvesting would be the primary factors which return stands to earlier seral stages. High intensity wildfires are considered stand replacing fires where most of the vegetation is consumed in the fire or killed.

Low and moderate intensity fires result in a percentage of the vegetation being killed or consumed, however the stand continues to maintain characteristics of the pre-fire stand. The stand may or may not change seral stages (refer to Table 2-4 for acres projected to be burned in future wildfires by intensity class for each alternative).

Silvicultural prescriptions and post harvesting treatments can also cause seral stage changes (refer to Table 2-5). Clearcutting and removal step shelterwood prescriptions would replace the stand and return it to seral stage 1.

GTR, seed step shelterwood, removal step shelterwood and group selection prescriptions could have various effects depending on the amount and distribution of vegetation left in the stand. The seral stage could be altered to an earlier seral stage such as converting a 4BC stand to a 4A if many of the structural elements were left. Examples include leaving 20% of the trees scattered throughout the stand in a GTR prescription or leaving 10 to 20 trees per acre in a shelterwood cut.

If very few residuals are left, the stand would return to seral stage 1 but retain some of the structural characteristics of an older seral stage. Examples are GTR or seed step shelterwood prescriptions where only 3 to 5 trees per acre are left. Group selection prescriptions would return small areas to seral stage 1 and leave adjacent areas in older seral stages.

In stands which retain structural components of later seral stages, the stand may continue to provide habitat for the species dependent on those later seral stage attributes. However, the situation for late seral stage habitat is expected to improve in all alternatives as 20% or more of the forested land would meet the criteria for "old growth" by the fifth decade compared to the current 16%.

Connectivity

Consequences Common to All Alternatives

There are 3 types of connective habitat important at the Forest level: 1) large blocks of continous habitat, free of roads, clearcuts and other human intrusions; 2) habitat corridors between reserves and other large habitat blocks; 3) maintaining the landscape matrix or "overall landscape condition" in a state where the movement of fragmentation-sensitive organisms is not significantly impeded (Noss, undated).

Large blocks of land with connectivity provide habitat for species which require interior habitat. Many wildlife species need escape routes and hiding cover to elude predators. Connective habitat can also be used for annual migration or can provide thermal cover. Some plant and animal species need dispersal routes to provide opportunities for exchange of genetic material during reproduction to maintain species viability and genetic richness. Some animal species which need dispersal habitat are the spotted owl, fisher, marten, black bear, tailed frog and western pond turtle.

The large blocks of habitat would include wilderness and backcountry management areas as well as LSRs, HCAs, CHUs and furbearer habitat within the T&E species habitat and Special Habitat management areas.

Management of these blocks would include few human intrusions. They would be either unregulated or Regulation Class 3. Despite similar management, these blocks would not be homogenous forest types (refer to fragmentation and seral stage discussions

earlier in this section). However, a large proportion of these areas should support later seral stage vegetation due to the limited management activities allowed. Exceptions would be where catastrophic stand-replacing events occurred.

These large blocks would provide "refugia" (refer to Chapter 3 - Biological Diversity). These areas would minimize the amount of edge effect and support species which require interior habitat on any given seral stage. The tailed frog, western wood pewee and Douglas squirrel are examples of species that need late-successional interior habitat.

The areas which link these large blocks would have similar management to the blocks, either unregulated or Regulation Class 3. These areas would also be fragmented like the blocks, but would likely provide habitat corridors or connectivity between the blocks.

It is assumed that fragmentation for either the blocks or linkages is not detrimental to plant and animal species as it would be similar to the pre-settlement condition and minimize intrusions that cause barriers to connectivity. The assumption is based on the fact that these species evolved with these ecosystems which are regulated by wildfire and are believed to have always had this high degree of fragmentation.

Landscape patterns in the Klamath Province have rarely provided for continuous, undisturbed linkages of vegetation. Large and small openings caused by fire, insects, disease and soil type have always been present. Travel barriers exist such as rivers, landslides, cliffs and changes in vegetation due to soil type, microclimate and elevation. Generally, wildlife can cross natural barriers such as rivers. However, when roads run along the rivers, the barrier becomes more difficult to cross.

The scientific community has not agreed upon an optimal width or minimum effective width of habitat linkage for the Klamath Mountains Province, so no estimates of which alternatives would provide the most effective connective habitat could be made. Alternatives are compared on overall width and on the width of most constricting portion for each linkage area.

Comparison of Alternatives

Alternative E would have the most acreage in large blocks, 53% of the Forest. The Preferred Alternative would have 46% and Alternative A would have 45% of the Forest in large blocks. Alternatives B, B', C, D and D' would have 43% of the Forest in large blocks. Alternative Current/RPA would have 42%. Alternative G(SOHA) would have 30%.

Alternative B would have the most acres suitable as linkages between the large blocks of habitat, 13% of the Forest. Alternative C would have the second highest at 12%. Alternative B' would have 11%. Alternatives Preferred and G(SOHA) would have 10%. Alternative E would have 8% and Alternative A would have 7%. Alternative Current/RPA would have 5%. Alternatives D and D' would have 4%.

In the Preferred Alternative, there is only one LSR on the eastside. In the other alternatives there would not be any land allocations on the eastside to provide connectivity between the HCAs.

In all alternatives there would not be any land allocations on the westside which would provide connectivity with the following LSRs or HCAs to other parts of the Forest: the one in the Cow Creek area on Oak Knoll Ranger District, the one in Collins Creek area on Oak Knoll, the one in Crater Creek area on Scott River Ranger District; and the one in the Kangaroo Lake area on Scott River Ranger District. This is primarily due to the intermingled private ownership.

In all alternatives, except Alternatives Preferred, B and G(SOHA), the 50-11-40 rule would be implemented in the matrix and might provide the third type of connective habitat. The Preferred Alternative's GTR requirement might provide the third type of connectivity in the matrix.

Riparian vegetation found along rivers, streams, springs and wet meadows provides food, water and cover for terrestrial and aquatic species. Stream and river areas are often used as dispersal routes or the third type of connective habitat.

It is not known how wide riparian dispersal routes need to be to function effectively as connective habitat or what attributes are critical. Alternatives were evaluated on how well current conditions would be maintained. However, it is uncertain what species benefit and how in the current situation. So no judgements of the relative value of the RRs and RMZs to biological diversity could be made.

The Preferred Alternative would maintain the largest RRs on the largest area of all alternatives. Interim RRs would be at least the width of 2 site potential tree heights or the width of the inner gorge or 300 feet on either side of fish-bearing streams. Interim RRs would be at least the width of 1 site potential tree or 150 feet on either side of permanently flowing nonfish-bearing streams. Interim RRs would be 100 feet slope distance or the width of 1 site potential tree on seasonally flowing or intermittent streams, wetlands less than 1 acre and unstable or potentially unstable areas. Interim RRs would be 150 feet slope distance or the height of 1 site potential tree on constructed ponds and reservoirs and wetlands greater than 1 acre. Interim RRs would be 300 feet slope distance or the height of 2 site potential trees on lakes and natural ponds. RRs would be unregulated. This alternative would have the least risk of altering factors important to plant and animal dispersal near streams.

Alternatives D and D' would maintain the second largest RMZs. RMZs would be 300 feet wide and unregulated on perennial streams which support anadromous fish. On perennial streams which support residential fish, RMZs would include 150 feet of unregulated and an additional 150 feet of regulation class 3. Perennial streams which do not support fish would have RMZs of 150 feet wide unregulated with the next 100 feet managed as Regulation Class 3. All other streams would have 100 foot unregulated RMZs. This alternative would also have little risk of altering factors important to dispersal near streams.

Alternative C would maintain unregulated RMZs that are 100 foot wide or extend to the edge of the riparian vegetation on perennial streams, as well as providing buffers on intermittent and ephemeral streams. Alternative E would maintain RMZs that extend to the inner gorge and are unregulated for perennial and intermittent streams. These alternatives would have the third least risk of altering factors important to dispersal near streams.

Alternatives B and B' would maintain unregulated 100-foot wide RMZs on perennial streams. They would have the fourth highest risk of altering factors important to dispersal near streams.

Alternatives Current/RPA, A and G(SOHA) would maintain 100-foot wide RMZs on perennial streams and manage them as Regulation Class 3. Alternative A would also provide for RMZs on intermittent and ephemeral streams which would be managed as Regulation Class 3. These alternatives would have the greatest risk of altering factors important to plant and animal dispersal as they would allow vegetative manipulation within RMZs, even though the manipulation would be conducted to meet riparian objectives.

Consequences Unique to the Preferred Alternative

In the Preferred Alternative, the linkage between the Trinity Alps Wilderness and Russian Wilderness would generally be greater than 1 mile wide but less than 1/2 mile at the narrowest points. The linkage between the Marble Mountain Wilderness and Russian Wilderness would generally be greater than 1 mile wide including the narrowest points.

The linkages between the Marble Mountain Wilderness and Red Butte Wilderness would generally be greater than 3 miles wide and would be greater than 1 mile wide at its narrowest point. The linkages between the Marble Mountain Wilderness and Siskiyou Wilderness would generally be greater than 1 mile wide and less than 1/2 mile at the narrowest points.

The analysis for Alternative 9 in Chapters 3 and 4 of the FSEIS, which is incorporated by reference, indicates that the land allocations in the Preferred Alternative in this EIS would adequately provide for connective habitat for late-successional and "old growth" species at the regional (spotted owl range) level.

Consequences Unique to Alternative Current/RPA

In the Current/RPA Alternative, the linkage between the Trinity Alps Wilderness and Russian Wilderness would generally be greater than 3 miles wide and greater than 1 mile wide at the narrowest points. A second linkage between these areas would be less than 1 mile wide for considerable stretches and less than 1/4 mile wide at its narrowest points.

The linkage between the Marble Mountain Wilderness and Russian Wilderness would generally be less than 1 mile wide and less than 1/2 mile wide at the narrowest points. The linkages between the Marble Mountain Wilderness and Red Butte Wilderness would generally be less than 1 mile wide and less than 1/4 mile wide at its narrowest point through the Seiad Valley.

This alternative would not have any linkage between the Marble Mountain Wilderness and Siskiyou Wilderness except what the 50-11-40 rule and RMZs provided.

Consequences Unique to Alternative A

In Alternative A, the linkage between the Trinity Alps Wilderness and Russian Wilderness would generally be greater than 1 mile wide including at the narrowest points. The linkage between the Marble Mountain Wilderness and Russian Wilderness would generally be less than 1 mile wide and less than 1/4 mile wide at the narrowest points.

The linkages between the Marble Mountain Wilderness and Red Butte Wilderness would generally be greater than 3 miles wide, but would be less than 1/4 mile wide at its narrowest point through the Seiad Valley. The linkages between the Marble Mountain Wilderness and Siskiyou Wilderness would generally be greater than 1 mile wide and less than 1/2 mile at the narrowest points. A second linkage between these areas would be less than 1 mile wide for considerable distances and less than 1/4 mile wide at the narrowest points.

Consequences Common to Alternatives B and B'

In these alternatives, the linkages between the Trinity Alps Wilderness and Russian Wilderness and between the Marble Mountain Wilderness and Russian Wilderness would generally be greater than 1 mile wide including at the narrowest points. A second linkage between the Trinity Alps Wilderness and Russian Wilderness would generally be greater than 1 mile wide and less than 1/2 mile wide at the narrowest points.

The linkages between the Marble Mountain Wilderness and Red Butte Wilderness and between the Marble Mountain Wilderness and Siskiyou Wilderness would be less than 1 mile wide for considerable distances and less than 1/2 mile wide at the narrowest points. A second linkage between the Marble Mountain Wilderness and Siskiyou Wilderness would be less than 1 mile wide for considerable distances and less than 1/4 mile wide at the narrowest points.

Consequences Unique to Alternative C

Alternative C would provide the widest habitat linkages between wilderness and the best distribution of land for habitat linkages. This is primarily due to the Landscape Linkage Management Area designed just for this purpose. All linkages between wilderness would be greater than 1/2 mile wide at their narrowest points and would be greater than 3 miles wide on the average.

Alternative C would have 2 possible linkages between the Marble Mountain Wilderness and Siskiyou Wilderness. The second linkage would be less than 1 mile wide for considerable stretches and less than 1/4 mile wide at its narrowest points. There would also be 2 linkages between the Trinity Alps Wilderness and Russian Wilderness. The second linkage would generally be more than 1 mile wide and would more than 1/2 mile wide at its narrowest points.

Consequences Common to Alternatives D and D'

In these alternatives, the linkages between the Trinity Alps Wilderness and Russian Wilderness would generally be greater than 1 mile wide including at the narrowest points. A second linkage between these areas would be less than 1 mile wide for considerable distances and less than 1 mile wide at the narrowest points.

The linkage between the Marble Mountain Wilderness and Russian Wilderness would be less than 1 mile wide for considerable stretches and less than 1/4 mile wide at the narrowest points. The linkages between the Marble Mountain Wilderness and Red Butte Wilderness and between the Marble Mountain Wilderness and Siskiyou Wilderness would be less than 1 mile wide for considerable distances and less than 1/2 mile wide at the narrowest points. A second linkage between the Marble Mountain Wilderness and Siskiyou Wilderness would be less than 1 mile wide for considerable distances and less than 1/4 mile wide at the narrowest points.

Consequences Unique to Alternative E

Alternative E would provide the second largest linkages between wilderness. The linkage between the Trinity Alps Wilderness and Russian Wilderness would generally be greater than 3 miles wide and more than 1 mile at the narrowest points. A second linkage between these areas would generally be greater than 1 mile wide and greater than 1 mile at its narrowest points. The linkage between the Marble Mountain Wilderness and Russian Wilderness would generally be greater than 1 mile wide and more than 1 mile at the narrowest points.

The linkages between the Marble Mountain Wilderness and Red Butte Wilderness and the Marble Mountain and Siskiyou Wilderness would generally be greater than 1 mile wide and less than 1/2 mile at the narrowest points. A second linkage between the Marble Mountain Wilderness and Siskiyou Wilderness would be less than 1 mile wide for considerable stretches and less than 1/4 mile wide at its narrowest points.

Consequences Unique to Alternative G(SOHA)

Alternative G(SOHA) would provide the narrowest habitat linkages between wilderness of all alternatives. The linkage between the Trinity Alps Wilderness and Russian Wilderness , the Marble Mountain Wilderness and Russian Wilderness, and the Marble Mountain Wilderness and Red Butte Wilderness would generally be less than 1 mile wide and less than 1/4 mile wide at the narrowest points.

This alternative would not provide any linkage between the Marble Mountain Wilderness and Siskiyou Wilderness through land allocations. Connectivity in the matrix would be limited to what RMZs provided.

Ecological Role of Fire

Comparison of Alternatives

Fire plays a critical function in regulating ecosystems in the Klamath Province. All alternatives would use prescribed fire for fuel treatment needs along with other techniques. The Preferred Alternative proposes the largest fuel treatment program, targeting about 27,000 acres per year. Alternative A would target about 14,000 acres. Alternatives D and D' would target about 11,000. Alternative C would target about 10,000 acres. Alternatives B and B' would target about 8,000 acres. Alternative G(SOHA) would target about 7,000 acres. Alternative Current/RPA would target about 6,000 acres. Alternative E would target about 5,000 acres per year. Refer to Fire Management in this chapter.

In addition all alternatives, except Current/RPA and G(SOHA) would use prescribed natural fire (PNF) as a tool in wilderness. The Preferred Alternative would target about 8,000 acres of wilderness per year for PNF and prescribed fire. Alternatives A, B, B', C, D and D' would target 1500 acres of wilderness per year for PNF. Alternatives A and C would also used prescribed fire in wilderness. Alternative E would target 100 acres of wilderness for PNF and prescribed fire.

The objective for using fire in wilderness would vary by alternative. The Preferred Alternative would emphasize the ecological role of fire. Alternatives A, B, B', D, D' and E would emphasize maintenance and restoration of wilderness values. Alternative A would also emphasize recreating or maintaining vegetative conditions. Alternative C would emphasize reducing fuel loading and reducing the risk of catastrophic fires. Refer to Wilderness section in this chapter.

The Preferred Alternative would also use PNF in LSRs, while Alternatives B and D would use PNF in the larger HCAs. The objective in the Preferred Alternative would be to maintain long term habitat quality and ecological characteristics. Alternatives B and D would emphasize the maintenance of habitat.

Alternatives Preferred and A would also use PNF in the Backcountry Management Area. The objective in the Preferred Alternative would be for fire to play its ecological role. The objective in Alternative A would be to obtain desired ecological characteristics.

The Preferred Alternative goes the farthest towards restoring the natural role of fire in the ecosystem with its large prescribed fire and PNF programs. Alternatives A, B and D would provide the second greatest opportunities for fire to perform its ecological role with their relatively large fuel management programs and considerable use of PNF. Alternatives B', C and D' would provide the next greatest opportunities with their relatively large fuel management programs and some use of PNF. Alternative E would provide the second least opportunities with a small fuel management program and limited use of PNF. Alternatives Current/RPA and G(SOHA) provide the least opportunities for fire to play its regulating role in the ecosystem due to their emphasis on fire suppression.

Refugia and Key Watersheds

Refugia are areas of contiguous habitat upon which some species depend, usually species at risk. The first type of connective habitat discussed earlier in this section, the large continuous blocks, serve as refugia for late seral and "old growth" species. Key Watersheds are watersheds containing habitat for potentially threatened fish stocks or species, making them refugia.

The Preferred Alternative would establish a system of LSRs designed to function as refugia for late successional and "old growth" species. It would also establish Key Watersheds to provide for the viability of aquatic species (refer to Preferred Alternative Land Allocations and Analysis Watersheds Maps in Final EIS map packet for locations).

Alternatives D and D' would establish riverscape refugia to preserve the genetic diversity of wild anadromous fish stocks.

All alternatives except the Preferred and G(SOHA) would establish HCAs which would function as refugia for the northern spotted owl and associated species. Alternative G(SOHA) would establish SOHAs which would also function as refugia for the spotted owl and associated species. Refer to connectivity discussion earlier in this section for analyses of how these refugia would function as connective habitat. Refer to the Wildlife and Fisheries sections for analyses of how each alternative would provide habitat for species viability needs.

Riparian Management

Important Interactions

Management activities can affect riparian areas and riparian-dependent resources. Livestock management, vegetation management including timber harvesting activities, mining, recreation and fuel management activities have the greatest potential to alter riparian ecosystems. Ecological processes and catastrophic events such as flooding can also influence riparian area composition, structure and function.

Land allocations, RR/RMZ widths, proposed management activities within RR/RMZs, standards and guidelines as well as restoration proposals influence riparian health and riparian-dependent resources.

Interactions specific to geology, water, biological diversity, wildlife, fisheries and range are discussed in more detail in those sections of this chapter.

Environmental Consequences

Direct, indirect and cumulative effects are discussed in terms of key physical aquatic and terrestrial parameters. These include maintaining water quality which includes water temperature, fine sediment loads, embeddedness and nutrient levels. Stream channel integrity, primary pool frequency, instream flows, water table levels in wet meadows, native and non-native plant community diversity and productivity, CWD, stream canopy cover and riparian vegetation to provide ground cover are also important parameters.

Where sufficient information exists to adequately assess the effects of management activities on these parameters, the analysis and interpretations are found in the individual resource sections in this chapter. Refer to the Geology, Soils, Water, Biological Diversity, Wildlife, Fisheries and Range sections in this chapter.

In some cases such as for water table and nutrient levels, there is not enough data available to establish criteria for the parameters or to estimate the effects of the alternatives. These analyses would need to be made during project level planning on a site-specific basis.

Sensitive Plant Species

Important Interactions

Plant species are listed as Sensitive by the Forest Service due to various factors of natural rarity or human threats to the quantity or quality of habitat. Ecological processes are the primary influence in a plant's environment. Human actions can be important if they alter these ecological processes. A number of factors can affect Sensitive plant species.

Intense wildfire can kill plants and their seeds, significantly altering soil and vegetative ecosystems as well as preventing the reestablishment of plant populations. Low to moderate intensity wildfire or prescribed fire can create or maintain open habitat required by some Sensitive species. Exclusion of fire in areas with a high historical fire frequency can slowly change vegetative conditions reducing habitat suitability for species dependant on early seral stages or forest openings.

Habitat disturbance is needed or tolerated by some species during certain times of the year, but for most species it presents a threat to individuals or populations. The degree of threat is generally determined by the intensity of disturbance to the site and vegetation.

The primary management activities that have affected Sensitive plant populations in the past are road construction, developing rock quarries, mining in serpentine soils and some timber harvesting practices.

Log deck landings, tractor piling of slash and other practices that intensely disturb or compact soils can damage or remove Sensitive populations or habitat. Moderate or light soil disturbances such as those caused by some tractor or skid trails might also threaten some species, but can also be designed to enhance habitat for a few species if done at the appropriate time of year.

Indirect effects from soil-disturbing activities near Sensitive plant populations can be significant as well. The introduction of invasive and competitive weed species, increased fire risk through woody fuel buildups and changes in water flow patterns can all threaten Sensitive species.

Other things that may adversely affect certain Sensitive plant populations or habitat are livestock grazing, particularly in riparian areas, heavy recreational use, some fire control actions and fire exclusion.

About 40% of the Sensitive plant species on the Forest inhabit serpentine or other ultramafic soil and rock habitats which if mined could damage or destroy sensitive populations or habitat. Disturbance or removal of soil or rock can kill the plants growing there and prevent reestablishment of the population.

Projects can be developed in ways that prevent or mitigate most adverse effects on plants. Management activities can sometimes be designed to enhance or create habitat, particularly for those species that require some habitat disturbance.

Activities that can benefit some Sensitive plant species include prescribed fire, mechanical removal of non-native weed species that out-compete the Sensitive species for water and space and protection of areas from overuse by people or livestock.

Methodology

Each species has different biological requirements and must be assessed on a site-specific basis at the project level. However, a general assessment of risk to Sensitive populations can be made by evaluating management standards and guidelines.

Certain land allocations permit activities which can disturb soil and/or vegetation. Observation of past management activities on the Forest has shown that, while infrequent, adverse effects to Sensitive plant populations have been associated with timber harvest activities more often than other management actions. Therefore, it was assumed that management prescriptions which include regulated timber harvest pose a higher risk to Sensitive plant species than those that are unregulated.

Adverse effects can also be associated with livestock grazing. Sensitive plant species located in range allotments were identified and potential mitigation measures identified based on past experience. The Forest-wide Biological Evaluation of Grazing Allotments, completed in August 1994 which contains this information, is incorporated by reference. The information appropriate to the Forest Plan EIS analysis is summarized in the discussions of alternatives.

Many of the Sensitive plant species and other species of special interest or of local concern occur on ultramafic soils or in riparian areas. The management prescriptions and standards and guidelines for these habitat types were compared to identify the relative risks between alternatives for these species and for populations that may exist but have not yet been identified.

The Siskiyou Mountain Crest from Mount Ashland southwest to Cook and Green Pass and the Scott Mountain Crest from Scott Mountain northeast to China Mountain contain high concentrations of Sensitive plant species. Significant endemic populations of Cooke's phacelia, Siskiyou mariposa lily and Yreka phlox which can be found in only a few locations in the world exist on the Forest. Allocations of these areas are tracked by alternative.

Environmental Consequences

Consequences Common to All Alternatives

All alternatives would provide management standards designed to maintain the continued existence of all Sensitive plant species on the Forest. This should prevent the need for any plant species to be Federally listed as T&E. Field inventories of all habitat identified as suitable would be required prior to all ground disturbing activities. Sensitive habitat would be managed to sustain or improve populations.

While some populations of Sensitive species might occasionally be affected by management or permitted activities, this would occur only if a biological evaluation had determined that no threats to the long-term viability of the species existed. In these instances, projects would be designed to include mitigation measures for Sensitive species.

As information becomes available, Species Management Guides would be developed and would function as guidance for implementing management activities in Sensitive plant habitat. Habitat enhancement opportunities would be addressed for individual species on a site-specific basis in the management guides. The Forest would pursue obtaining the information needed to determine the biological status of Sensitive species where information is lacking.

All alternatives would emphasize ecosystem management. The matrix of vegetative habitats and plant communities provided would help assure the continued existence of all native plant species on the Forest. This would decrease the chances of additional plant species becoming rare or threatened. Use of native plant species for revegetation and restoration work would also contribute to the conditions most suitable for native plant communities to be maintained.

Most of the identified ore bodies of chromite and other locatable metals found in serpentine soils are too small to be economically mined at this time. Based on the current situation, they present a relatively low risk to Sensitive plant communities. However, chrome is a strategic metal and future economic or military conditions could arise which would pose a threat to any serpentine endemic species found in areas with high mineral potential. Site-specific potential impacts from timber salvage or other management activities on unregulated land could exist with all alternatives. The proposed management standards and guidelines for all alternatives would provide for low risk to the populations on these soils.

All alternatives would manage the Siskiyou mariposa lily and Cooke's phacelia using the existing species management guides. A management guide has not yet been written for the Yreka phlox, but these areas would be unregulated in all alternatives and no management prescriptions that present risk to the species would be used.

To date, current grazing studies have not established an actual risk from livestock disturbance. *Phacelia dalesiana* which is found in the East Fork Allotment benefits from disturbance if it is timed appropriately. All alternatives would develop Management Guides which would provide direction for managing disturbance to this species so it does not occur during critical life stages.

Comparison of Alternatives

Alternatives Preferred, B, B', C and E would manage 75% or more of the serpentine soils on the Forest as unregulated or as Regulation Class 3. The risk of adverse effects on any endemic species that live on serpentine soil and have not yet been discovered would be very low.

Alternatives Current/RPA, A, D, D' and G(SOHA) would manage between 50 and 75% of the Forest's serpentine soils as unregulated or as Regulation Class 3. The risk to serpentine-endemic species would be generally low, but not quite as low as for the previous group of alternatives.

Alternatives with larger riparian area land allocations would provide more protection for Sensitive plant species that thrive in riparian habitat. This includes *Campanula wilkinsiana, Castilleja elata, Ivesia pickeringii, Raillardella pringlei* and *Trillium ovatum sp. oettingeri.* There would be less risk of mechanical damage from logging, livestock trampling and other site-disturbing activities. The Preferred Alternative would have the largest RRs and apply them to more land than any other alternative. Alternatives D and D' would have the second largest RMZs and apply them to the second-most acreage. Alternative C would have the next largest; it would be followed by Alternatives E, B and B'.

The risks to Sensitive species inhabiting streamside areas would be very low with these alternatives. Alternatives Current/RPA, A and G(SOHA) would have the smallest RMZs which would be managed as Regulation Class 3 to provide for riparian values. The risk to Sensitive species inhabiting streamside areas in these alternatives would be slightly higher than those of the previous group. In all alternatives, standards and guidelines would minimize any potential impacts to Sensitive plants from ground-disturbing activities.

All alternatives, except Alternative G(SOHA), would manage the botanically rich area along the Siskiyou Crest as an LSR or HCA. Alternatives B, B', D, D' and E would recommend the entire 15,000 acre Siskiyou Crest Zone as a Scenic SIA. Alternatives Preferred and C would recommend 6 Botanical SIAs along the Siskiyou Crest, while Alternative A would recommend 5,

Alternatives Current/RPA and G(SOHA) would not recommend any.

While management activities would vary by alternative for this crest zone, the management prescriptions for all alternatives except Alternative G(SOHA) would pose a very low risk to the Sensitive plant communities found there. Alternative G(SOHA) would present a slightly higher risk as it would include a small amount of scheduled timber harvest along some areas of the crest. The management prescriptions for all alternatives would be adequate to maintain the Sensitive plant communities over time in this area.

Alternatives Preferred, C, D, D' and E would recommend China Mountain, Cory Peak and Kangaroo Lake as Botanical and Geologic SIAs and Scott Mountain as a Botanical SIA; these are all along the Scott Mountain Crest. Alternatives B and B' would recommend China Mountain and Cory Peak as Botanical and Geologic SIAs as well as Scott Mountain as a Botanical SIA. Alternative A would recommend Cory Peak and Kangaroo Lake as Botanical and Geologic SIAs.

Areas recommended as SIAs would receive special management. A primary objective of the Botanical SIAs would be to protect plant populations. Sensitive plant communities along the Siskiyou and Scott Mountain Crests which are not recommended for SIAs would be managed by Forest-wide management standards. Plant populations in areas recommended as SIAs would have less risk than those in other management areas.

Alternatives with larger fuel reduction programs are expected to have the most effect on reducing the number of acres that burn in high intensity fires in the future. High intensity wildland fires generally kill understory plants and place Sensitive plant populations at risk. The Preferred Alternative proposes the largest fuel reduction program, followed by Alternatives A, D, D', C, B, B', G(SOHA), Current/RPA and E in decreasing order.

Moderate and low intensity prescribed fire and other fuel reduction treatments would be used in conjunction with buffering of Sensitive plant populations to reduce risk to these populations. In addition to protecting existing populations, lower intensity prescribed fire would also limit the destruction of seed reserves in the soil. While some plants may be well-adapted to fire disturbance, there is still the risk of fire suppression damage to populations of Sensitive plants associated with wildland fires. The plants are seldom adapted to this type of disturbance.

Consequences Unique to Alternative Preferred

The Preferred Alternative would include standards and guidelines that might benefit Sensitive plants. One standard would minimize competition from introduced species by emphasizing the use of native species. Another would require mining structures, facilities and roads to be located outside RRs when possible which would likely reduce disturbance to plant populations in these habitats as well as aiding in their recovery.

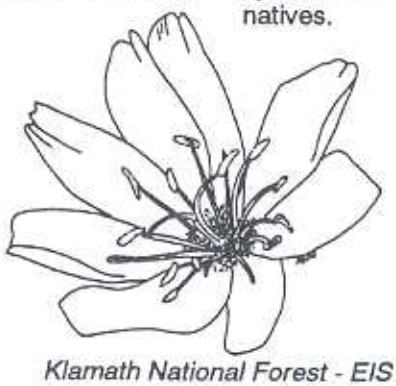
Standards and guidelines would also include protective measures for Sensitive plants during rock source development and planning for fire fighting. While these effects are usually insignificant, they could result in cumulative effects to Sensitive species. This alternative would provide the most specific direction to reduce these risks.

The Preferred Alternative would propose livestock utilization standards limiting the intensity of grazing on permanent rangelands. The prescribed limits would allow grazed plants to develop a level of root reserves which should lead to less impact on populations as a result of the interactions between grazing and droughts. *Raillardella pringlei* which is found in the Bear Creek and Mill Creek Grazing Allotments and is sometimes heavily grazied is likely to be less at risk to the utilization standards.

The livestock utilization standards should also mitigate the risk to plants from livestock trampling. *Campanula wilkinsiana* which is found in the Big Flat Grazing Allotment; *Horkelia hendersonii* which is found in the Dry Lake and East Beaver Allotments; *Ivesia pickeringii* which is found in the Grouse Creek Allotment; *Lomatium peckianum* which is found in the East Beaver, Panther Creek and South Klamath Allotments; *Tauschia howellii* found in the East Beaver and Little North Fork Allotments; and *Trillium ovatum sp. oettinger* found in the Boulder, Mill Creek, Carter Meadow, Shackelford, Etna Creek, South Russian and Kidder Creek Allotments have possible trampling risks associated with them.

Consequences Unique to Alternative E

Alternative E would not allow livestock grazing in wilderness. The risk to high elevation riparian plant species would be much lower than for the other alternatives.



Wildlife

Important Interactions

The management of multiple uses on the Forest can affect wildlife and wildlife habitat in a number of ways. Some wildlife species require large areas, relatively undisturbed by human activities while others thrive in the habitats created through resource management activities. The following discussion briefly describes some of the effects of the commonly proposed management activities.

Timber management activities directly affect habitat quality and quantity for wildlife. One of the most important effects is the local change in vegetative seral stage. The intensity and duration of effects are dependent upon the amount of ground affected and the prescription applied.

Treatment prescriptions determine the size of openings to be created within forest stands (individual trees or many acres), the character of the replacement stand (even aged, two-storied, uneven aged, etc.) and the amount and type of habitat components (snags, live trees, down logs, hardwoods) to be retained within treated areas. Thinnings can release suppressed trees, increase structural diversity and create small openings.

Even-age management can increase forage production for forest ungulates and, at the same time, make sites unsuitable for species dependent on mature forests. Effects may be beneficial, adverse, neutral, short term, long-term or cumulative depending on the actions proposed and the wildlife species affected.

Wildlife species may be affected indirectly through disturbance caused by the loud noises associated with tree felling, yarding, hauling and road construction. Some individuals may be displaced by loud and continuous disturbance in the vicinity of nest and den sites.

Prescribed burns (alone or in conjunction with removal of dead and dying timber) and prescribed natural fire can be used to treat unmanaged stands in order to reduce fuel loading resulting from fire suppression. This can result in short-term benefits to some wildlife species through the stimulation of browse and forage. It can also result in short-term adverse effects through the reduction of the multi-layered character of a stand or the loss of CWD. Long-term benefits, however, could be the reduced wildfire hazard which makes future maintenance of the habitat more likely.

Recreational use can increase noise and human presence which affects habitat use and, potentially, the reproductive success of some wildlife species. Disturbances to Threatened, Endangered and Sensitive (TE&S) species are the greatest concern. Hunting affects the number and distribution of game species. The effects are partially dependent on public demand and access to wildlife.

Livestock grazing influences the amount of forage and browse available for wildlife. Seasonal forage allocations for livestock in addition to year round use by deer and elk may result in localized over-utilization of the range resources. Grazing in meadows can affect habitat quality by potentially changing habitat structure and vegetative species composition and by reducing the cover available for species which nest on the ground. The degradation of riparian habitats due to bank cutting, soil compaction, siltation and pollution from waste matter are other potential effects.

Mining has the potential to affect wildlife habitat through ground disturbing activities which remove vegetation. Mining often occurs within important wildlife habitats such as riparian areas and can interfere with localized use for foraging, watering or travel. The noise and increased human presence due to mining can also affect wildlife.

The acquisition and exchange of NFS lands can affect the quantity of various habitats on the Forest.

Construction of Forest roads can result in habitat loss or degradation. Roads also allow the public greater access to wildlife which can increase disturbance, result in road kills and increase poaching. On the other hand, roads provide ground access for fire control or habitat management projects.

Land allocations proposed by the various alternatives would establish management areas. The direction specific to each management area would affect the quality and quantity of habitat for wildlife.

Methodology

Environmental consequences were analyzed using several tools. A mixture of qualitative and quantitative measures were used to estimate the effect on habitat for TE&S species, Candidate Species, Management Indicator Species (MIS) and on special habitat elements.

TE&S species were assessed primarily through proposed land allocations, through standards and guidelines, and on how well recovery plan goals or current management direction would be met by each alternative.

MIS were chosen to represent the major vegetative types, seral stages and special habitat elements necessary for wildlife species other than TE&S on the Forest. Selected species are those whose population changes are believed to indicate the effects of management activities on the other species they represent.

When site-specific information on local population levels and habitat needs is lacking, biologists must rely

on the best available information from research to make assumptions and predictions as to the effects of resource management activities on population viability. The use of Habitat Capability Models (HCMs) is a common technique used to accomplish this task.

HCMs are descriptions of physical and biological habitat variables developed by the Forest Service for a particular species or a group of species based on the best available research. The variables are described in terms of high, moderate or low habitat capability.

It is assumed that high quality habitat is preferred by the species, moderate quality habitat is required and low quality habitat is marginal. In terms of viability, moderate and high quality habitats are assumed to be needed for long-term viability while low habitat quality represents habitat which is not acceptable for reproduction.

Projections of seral stage progressions were based on age and did not take into account site-specific information such as site class.

The HCMs used in this analysis are displayed in Appendix I. Not all variables displayed in the HCMs were used in the analysis since some were not measurable at a Forest-wide level. The spatial information such as the distance between cover and forage areas is an example. The variables for which Forest-wide information was accessible such as seral stage were used to rate the quality of habitat available as a result of implementation of the various alternatives.

Several of the species discussions include information on current and future Forest-wide HCM. These figures were derived by using HCMs to rate seral stages of all forest vegetation types. High capability habitats received a value of 1.0, moderate capability rated 0.66 and low capability rated 0.33. These values were then used in conjunction with acres generated from FORPLAN for each seral stage and vegetation type to estimate Forest-wide habitat capability values for the end of each decade. These values are used to present an overall trend in the quality of habitat available. They do not reflect spatiality or configuration of habitat.

Information on seral stages was not available for Alternative E, so habitat capability ratings could not be calculated for that alternative.

Population estimates were based on suitable habitat projections. It was assumed that all suitable habitat would be occupied. Because spatial requirements were not included, population estimates may be optimistic.

The amount, management intent, distribution and habitat quality of land allocations were also considered in this analysis. General, qualitative assumptions were made about the effects of these land allocations on wildlife based upon habitat requirements as described in the HCMs.

For instance, marten require mature and older seral stage vegetation. Lands allocated to marten habitat were considered to contribute more towards maintaining viability than lands allocated to General Forest. Where species are known to be sensitive to disturbance, suspected of having a limited distribution or their response to management activities is unknown; habitat protection was assumed to be necessary for viability.

Standards and guidelines which could potentially affect wildlife and wildlife habitat were identified for each alternative.

The effects on snag-dependent MIS species are discussed in terms of percentage of optimum habitat level. Optimum habitat level was determined collectively from habitat capability information for each MIS species in this group. It is based on the number, size class and decay class required to support high population levels. An average of 5 snags per acre (high quality habitat) in a variety of size and decay classes would support optimum population levels. Approximately 2.8 to 4.45 snags per acre (moderate quality habitat) would support 60 to 80% of optimum population levels. An average of 2.5 snags per acre (low quality habitat) would support 50% of optimum population levels.

Green tree retention standards and guidelines were also evaluated in terms of habitat capability (refer to Appendix I for snag and green tree habitat capability tables). Timber inventory data from unmanaged stands on the Forest indicate that snag levels across the forest are quite variable from low to high, depending on such attributes as forest type, site class and age of stand.

Additional assumptions

The viability thresholds of populations are not known for most species. Population viability for a species (under 36 CFR 219.19) was evaluated in terms of the probability or likelihood that the species would persist in a well-distributed pattern throughout its range within the planning area. Maintenance of a well-distributed array of suitable contiguous habitat areas for selected wildlife species was expected to maintain adequate numbers of breeding animals throughout the planning horizon.

T&E species populations are not considered viable until they reach recovery plan levels and may be removed from Federal listing.

The occurrence and abundance of wildlife species is a function of the quantity and quality of suitable habitat and its distribution across the landscape. Other non-habitat factors such as predation, disease, competition and randomness are not considered in this assess-

ment because they are not well understood for most species or are not within the scope of this Forest Plan. The magnitude of change in the quantity and quality of wildlife habitat generally indicates the magnitude of change in population levels of wildlife associated with the affected seral stage(s). Actual population parameters such as density, reproductive success and survival require intensive site-specific studies and cannot be estimated based on habitat availability alone.

Effects on MIS species generally reflect effects on other species which share or use similar habitats.

An activity that benefits one species may adversely affect another species.

Fragmentation of large contiguous blocks of suitable habitat and corresponding increase in "edge effect" reduce the amount and effectiveness of forest interior conditions and eliminate or displace wildlife species dependent on those conditions.

Once fully regulated, areas managed for higher timber yields with short rotations are not expected to provide nesting, roosting or denning habitat for wildlife species associated with "old growth" or mature forest. Some alternatives include silvicultural prescriptions in timber management areas which would retain some of the structural attributes found in older forests.

An example is the GTR prescription in Alternatives Preferred and E which would maintain trees on 15 to 20% of the area. However, whether or not these prescriptions will meet the needs of old "growth"and mature forest wildlife species can only be answered through careful research and monitoring.

Conversely, it is assumed that those areas managed under Regulation Class 3 have the potential to provide for the habitat needs of "old growth" and mature forest species. Timber management within these areas would be designed to enhance other resource values and would allow for more continuous cover, less forest fragmentation and retain larger, older trees than would typically occur within Regulation Class 1 and 2 lands (refer to Timber Management section later in this chapter for a general description of regulated lands).

Wildfire has a significant influence on the character of vegetation within the Klamath Mountains Province (refer to Fire Management section of this chapter). Fire can have varying effects on vegetative communities and on wildlife habitats. Low intensity fire can result in increased grass, forb and shrub productivity with minimal changes in the overstory stand structure. On the other hand, high intensity fires can eliminate forested stands altogether.

Since the frequency, occurrence and magnitude of wildfire is influenced by so many factors, it is difficult to estimate its effects. Some alternatives propose measures to reduce the occurrence of high intensity wildfire. This is especially important for the maintenance of wildlife habitat within large land allocations such as HCAs and LSRs. The lack of a prescribed burn program is assumed to pose a significant risk of habitat loss for species associated with older seral stages.

This discussion of environmental consequences is based on wildlife management principles and literature regarding wildlife habitat relationships and wildlife ecology including professional journals, agency reports, local research and the California Wildlife Habitat Relationships system (CDFG, 1990). Refer to Chapter 3 - Wildlife for a discussion of the habitat relationships of each species and to Appendix I for the habitat requirements.

Environmental Consequences

Threatened and Endangered Species

Bald Eagle

Consequences Common to All Alternatives

All alternatives would protect the Forest's 6 known nest sites and 4 communal winter roost sites and any new territories discovered in the future. Approximately 7,200 acres would be dedicated to provide for nesting and roosting habitat. Individual management strategies would be written to address the appropriateness of activities within primary disturbance zones.

All alternatives would comply with the Pacific bald eagle recovery plan. Activities in the vicinity of occupied or suspected territories require consultation with the USFWS and would be designed so that they are not likely to adversely affect the bald eagle. Annual surveys to determine breeding status and wintering populations would be conducted. Management strategies for nest and major roost sites would be developed.

None of the alternative outputs show an increase in the bald eagle population by the end of the fifth decade (refer to Table 2-4). This is not to say that a population increase is not possible or even likely. In fact, statewide, the breeding population has been increasing over the last few years. However, the amount of available breeding and roosting habitat alone is not a reasonable predictor of future habitat trends. Poisoning from lead, pesticides and other contaminants as well as electrocution associated with powerlines and shooting are important factors. When combined, these factors have as much if not more effect on future population trends than the amount of habitat available.

Peregrine Falcon

Consequences Common to All Alternatives

All alternatives would protect the 14 known active eyries on the Forest as well as any new territories discovered in the future. Nest protection zones average 1/2 mile around nest sites. Protection of the nest zone helps to ensure suitability of the nest site and occupation by breeding adults. In addition, a large buffer would be managed to maintain and enhance the surrounding foraging habitats. Individual management strategies would be written to address the appropriateness of various activities within the surrounding management areas.

All alternatives comply with the recovery plan for the Peregrine Falcon (Pacific population). Activities in the vicinity of occupied or suspected territories would require consultation with the USFWS and would be designed so they are not likely to adversely affect the peregrine falcon. Annual surveys would be conducted to determine breeding status. Eyrie management strategies would be developed.

As in the case of the bald eagle, none of the alternative outputs show an increase in the peregrine falcon population by the end of the fifth decade (refer to Table 2-4). Peregrine falcons are dependent on a unique resource (large cliffs) for nesting that is a fixed quantity on the Forest. In addition, other factors such as environmental contaminants, shooting and collision with powerlines also act to limit populations at this time. Therefore, the amount of available habitat alone is not a reliable predictor of future population trends.

Northern Spotted Owl *(also an MIS)*

Consequences Common to All Alternatives

Management activities would be addressed in site-specific biological evaluations and consultation with the USFWS would be conducted in order to reduce adverse effects on occupied spotted owl territories that occur within the forest matrix (regulated land).

Comparison of Alternatives

The strategies for maintaining a viable population of spotted owls vary by alternative. The Preferred Alternative would be consistent with the ROD for the FSEIS (USDA Forest Service and USDI BLM, 1994). LSRs, RRs and other elements of an ecosystem approach would provide for spotted owls along with other late-successional species.

Alternatives Current/RPA, A, B', C, D' and E would be consistent with the Interagency Scientific Committee's (ISC) Conservation Strategy (Thomas et.al., 1990). According to strategy guidelines, individual HCA management plans would be developed which would address allowable, desired and planned management activities in each area.

Alternative E would incorporate the proposed Critical Habitat boundaries as described by the USFWS in addition to HCAs.

Alternatives B and D would establish HCAs, but allow active management within them; they would be managed as Regulation Class 3 which would be inconsistent with the ISC strategy. Although the ISC strategy encourages the development and testing of silvicultural prescriptions which would create or maintain owl habitat, no such treatments have been approved for application within HCAs, other than tree planting.

Alternative G(SOHA) would maintain Spotted Owl Habitat Areas (SOHAs) as prescribed in the 1984 Pacific Southwest Regional Guide.

All alternatives except for G(SOHA) result in a high likelihood that the spotted owl will persist in a well distributed pattern across the Forest. After a final recovery plan is approved by the USFWS and the Forest Service has identified objectives for recovery, management planning direction will be evaluated and adjusted as appropriate for all alternatives.

All alternatives except Preferred, Current/RPA and G(SOHA) would inventory HCAs to determine population densities. Following the initial inventories, a proportion of known activity centers would be visited each year to determine reproductive status.

Table 4-18 compares the Forest-wide weighted index habitat suitability rating for the northern spotted owl by alternative for cover and feeding. Refer to Appendix I for habitat suitability values for each forest type and seral stage.

Table 4-18. Habitat Suitability for Northern Spotted Owl (Weighted Index)

Alternative	Fifth Decade
Cover (Current 1987 = 0.479)	
PFD	0.543
CUR/RPA	0.509
A	0.500
B	0.531
B'	0.503
C	0.502
D	0.537
D'	0.518
G(SOHA)	0.506

Table 4-18. Habitat Suitability for Northern Spotted Owl (Weighted Index)	
Alternative	**Fifth Decade**
Feeding (Current 1987 = 0.485)	
PFD	0.549
CUR/RPA	0.519
A	0.509
B	0.539
B'	0.510
C	0.513
D	0.546
D'	0.527
G(SOHA)	0.514

Note: Low capability = 0.333, Moderate capability = 0.666, High capability = 1.000. These values should be used to compare trends in suitable habitat.

Consequences Common to All Alternatives Except Preferred, E and G(SOHA)

There are 142 pairs of spotted owls known to occupy Category 1 through 3 HCAs, 63 pairs occur within the 80-acre retention areas (category 4 HCAs). An additional 5 pairs are expected to occur within the large HCAs (category 1 and 2) (Thomas et.al., 1990). At least 10 pairs are known to occur outside of HCAs. The management of these 10 pairs would be addressed at the project level should a proposed activity occur within their home range.

Consequences Unique to the Preferred Alternative

The Preferred Alternative would manage approximately 396,600 acres within LSRs to provide habitat for northern spotted owls and other species associated with late-successional forest conditions. In addition, some habitat will be available within other land allocations that are Congressionally designated and administratively withdrawn. These areas would be unregulated, no timber yields would be scheduled.

There are 139 pairs and territorial singles known to occupy LSRs. In addition, there would be 129 100-acre LSRs maintained around pairs and territorial singles. At least 1 pair is known to occur outside of LSRs.

A prescribed burn program would be initiated within LSRs to reduce fuel build-ups and lower the risk of habitat loss due to catastrophic wildfire. Approximately 4,000 acres per year would be treated. In addition, approximately 350 acres of potentially suitable habitat would be improved annually through thinning and planting. The effectiveness of these treatments would be monitored.

The portion of the Forest that is outside LSRs and other unregulated lands (forest matrix) would be managed for varying levels of timber production. RRs and other unregulated land allocations would provide for owl dispersal between LSRs.

This alternative would potentially increase the total amount of suitable spotted owl habitat 21% by the end of the fifth decade from approximately 458,000 acres in the current situation to 552,000 acres. Forest-wide habitat capability values for both cover and feeding would increase by 13% by the end of the fifth decade as shown in Table 4-18.

Consequences Unique to Current/RPA Alternative

The Current/RPA alternative would manage approximately 428,000 acres within HCAs (101,600 of which occurs within wilderness) to provide spotted owl habitat. These areas would be unregulated, no timber yield would be scheduled.

The portion of the Forest outside HCAs and other reserved lands would be managed for varying levels of timber production. Timber and other resource management activities would comply with the 50-11-40 rule in order to provide for owl dispersal between HCAs.

From a landscape perspective, the mosaic of management areas is likely to maintain some owl pairs, although populations using Regulation Class 1 and 2 lands would not be expected to remain stable.

The total amount of suitable spotted owl habitat would potentially increase 5% by the end of the fifth decade from approximately 458,000 acres in the current situation to 481,000 acres. Forest-wide habitat capability values for cover and feeding would increase by 6% and 7%, respectively, by the end of the fifth decade.

Consequences Unique to Alternative A

Alternative A would manage approximately 428,000 acres within HCAs (101,600 of which occurs within wilderness) to provide spotted owl habitat. These areas would be unregulated. Approximately 350 acres of potentially suitable habitat would be improved annually through thinning and planting. The effectiveness of these treatments would be monitored.

The portion of the Forest outside HCAs and other reserved lands would be managed for varying levels of timber production. Timber and other resource management activities would comply with the 50-11-40 rule in order to provide for owl dispersal between HCAs.

From a landscape perspective, the mosaic of management areas is likely to maintain some owl pairs, although populations using Regulation Class 1 and 2 lands would not be expected to remain stable.

Forest-wide, the total amount of suitable spotted owl habitat would remain about constant through the end of the fifth decade at approximately 458,000 acres. Forest-wide habitat capability values for both cover and feeding would increase by 4% by the end of the fifth decade. Based on the habitat projected to be available, it is estimated that 180 pairs of spotted owls could be supported in Decade 1 and 191 pairs in Decade 5.

Consequences Unique to Alternative B

Alternative B would manage approximately 428,000 acres within HCAs (101,600 of which occurs within wilderness) to provide spotted owl habitat. HCAs would be actively managed to provide suitable owl habitat. Minimal timber yields would be programmed. Silvicultural prescriptions would be developed to enhance suitable and marginally suitable habitat or to accelerate the development or creation of habitat in stands currently unsuitable for spotted owls. Management activities would be carried out according to guidelines specified in individual HCA management plans.

Treated areas would also undergo prescribed burning in order to reduce the fuel loading. An additional 50 acres per year would be treated annually with planting only in order to improve habitat quality. The effects of these treatments would be monitored. Coordination with the Northern Spotted Owl Oversight Team, interagency Technical Review Team and Northern Spotted Owl Steering Committee would be required. Consultation with USFWS would be conducted.

The portion of the Forest outside of HCAs and reserved lands would be managed for varying levels of timber production. Timber management would comply with the 50-11-40 rule in order to provide for owl dispersal between HCAs.

From a landscape perspective, the mosaic of management areas is likely to maintain some owl pairs, although populations using Regulation Class 2 lands would not be expected to remain stable.

The total amount of suitable spotted owl habitat would potentially increase 15% Forest-wide by the end of the fifth decade from approximately 458,000 in the current situation to approximately 526,000 acres. Forest-wide habitat capability values for both cover and feeding would increase by 11% by the end of the fifth decade.

Consequences Unique to Alternative B'

Alternative B' would manage approximately 428,000 acres within HCAs (101,600 of which occur within wilderness) to provide spotted owl habitat. These areas would be unregulated. Approximately 350 acres of potentially suitable habitat would be improved annually through thinning and planting. The effectiveness of these treatments would be monitored.

The portion of the Forest outside HCAs and other reserved lands would be managed for varying levels of timber production. Timber management would comply with the 50-11-40 rule in order to provide for owl dispersal between HCAs.

From a landscape perspective, the mosaic of management areas is likely to maintain some owl pairs, although populations within Regulation Class 2 areas would not be expected to remain stable.

The total amount of suitable spotted owl habitat would potentially increase 5% Forest-wide by the end of the fifth decade from approximately 458,000 acres in the current situation to approximately 480,000. Forest-wide habitat capability values for both cover and feeding would increase by 5% by the end of the fifth decade.

Consequences Unique to Alternative C

Alternative C would manage approximately 456,000 acres within HCAs (123,000 of which occur within wilderness) to provide spotted owl habitat. These modified HCAs incorporate 8 additional known owl pairs into the large HCAs (category 1 and 2). All HCAs would be unregulated. Approximately 350 acres of potentially suitable habitat would be improved annually through thinning and planting. The effectiveness of these treatments would be monitored.

The portions of the Forest outside of HCAs and other reserved lands would be managed for varying levels of timber production. Timber management would comply with the 50-11-40 rule in order to provide for owl dispersal between HCAs.

From a landscape perspective, the mosaic of management areas is likely to maintain some owl pairs, although populations using Regulation Class 1 and 2 lands would not be expected to remain stable.

The total amount of suitable spotted owl habitat would potentially increase 10% Forest-wide by the end of the fifth decade from approximately 458,000 acres in the current situation to approximately 504,000. Forest-wide habitat capability values for cover and feeding would increase by 5% and 6%, respectively, by the end of the fifth decade.

Consequences Unique to Alternative D

Alternative D would manage approximately 428,000 acres within HCAs (101,600 of which occur within wilderness) to provide spotted owl habitat.

Within HCAs, vegetative manipulation would be allowed in vegetation classes 3P, p0 through p3 (refer to Table 3-6 in the EIS for explanation of acronyms) and non-stocked areas to improve owl habitat. Minimal timber yields would be programmed. Silvicultural prescriptions would be developed in order to ac-

celerate the development or creation of habitat in stands currently unsuitable for spotted owls.

Following treatment, these areas would undergo prescribed burning in order to reduce fuel loading. An additional 150 acres of potentially suitable habitat would be improved annually through thinning and planting. The effectiveness of these treatments would be monitored.

Management activities would be carried out according to guidelines specified in individual HCA management plans. Coordination with the Northern Spotted Owl Oversight Team and interagency Technical Review Team would occur. Consultation with USFWS would be conducted.

The portions of the Forest outside HCAs and unregulated areas would be managed for varying levels of timber production. Timber and other resource management activities would comply with the 50-11-40 rule in order to provide for owl dispersal between HCAs.

From a landscape perspective, the mosaic of management areas is likely to maintain some owl pairs, although populations using Regulation Class 1 and 2 lands would not be expected to remain stable.

The total amount of suitable spotted owl habitat would potentially increase 24% Forest-wide by the end of the fifth decade from approximately 458,000 in the current situation to approximately 570,000 acres. Forest-wide habitat capability values for cover and feeding would increase by 12% and 13%, respectively, by the end of the fifth decade.

Consequences Unique to Alternative D'

Alternative D' would manage approximately 428,000 acres within HCAs (101,600 of which occur within wilderness) to provide spotted owl habitat. These areas would be unregulated. Approximately 350 acres of potentially suitable habitat would be improved annually through thinning and planting. The effectiveness of these treatments would be monitored.

Portions of the Forest outside HCAs and other reserved lands would be managed for varying levels of timber production. Timber and other resource management activities would comply with the 50-11-40 rule to provide for owl dispersal between HCAs.

From a landscape perspective, the mosaic of management areas is likely to maintain some owl pairs, although populations using Regulation Class 1 and 2 lands would not be expected to remain stable.

The total amount of suitable spotted owl habitat would potentially increase 17% Forest-wide from approximately 458,000 acres in the current situation to approximately 538,000 by the end of the fifth decade. Forest-wide habitat capability values for cover and feeding would increase by 8% and 9%, respectively, by the end of the fifth decade.

Consequences Unique to Alternative E

Alternative E would manage approximately 589,000 acres within HCAs and proposed Critical Habitat boundaries to provide spotted owl habitat. All HCAs and Critical Habitat would be unregulated. These areas would incorporate 12 additional known owl pairs into the large HCAs (category 1 and 2) and Critical Habitat.

There are 169 pairs of spotted owls known to occupy Critical Habitat and HCAs, 57 of which occur within the 80-acre retention areas (category 4 HCAs). At least 8 pairs are known to occur outside of HCAs and Critical Habitat. Approximately 350 acres of potentially suitable habitat would be improved annually through thinning and planting. The effectiveness of these treatments would be monitored.

The portion of the Forest outside HCAs and other reserved lands would be managed for varying levels of timber production. Timber and other resource management activities would comply with the 50-11-40 rule to provide for owl dispersal between HCAs.

From a landscape perspective, the mosaic of management areas is likely to maintain some owl pairs, although populations using Regulation Class 1 and 2 lands would not be expected to remain stable.

Consequences Unique to Alternative G(SOHA)

Alternative G(SOHA) would manage a network of 97 individual SOHAs of approximately 1650 acres each. This is considerably less than the average home ranges per pair of owls within the Klamath Province. These SOHAs would be unregulated. There are 103 pairs of spotted owls known to occupy the SOHAs and 74 pairs are known to occur outside SOHAs.

The portions of the Forest outside SOHAs and other unregulated lands would be managed for varying levels of timber production. No management strategy would be implemented to ensure the maintenance of dispersal habitat between territories.

From a landscape perspective, the mosaic of management areas is likely to maintain some owl pairs, although populations using Regulation Class 1 and 2 lands would not be expected to remain stable.

Suitable habitat would potentially increase 11% Forest-wide from 458,000 acres in the current situation to 508,000 acres by the end of decade 5. Forest-wide habitat capability for both cover and feeding would increase by 6% by the end of the fifth decade.

The likelihood for SOHA networks to provide for viable northern spotted owl populations was assessed in the Forest Service's Final EIS on Management for the Northern Spotted Owl in the National Forests (January,

1992). Based on numerous factors including distribution, dispersal, patch size and spacing; it was determined that SOHAs provide a low likelihood of maintenance of population viability.

Candidates for Federal Listing

Common to All Alternatives

The effects on the Forest's candidate species can be assessed through information contained in various sections below.The Karuk Indian snail is indirectly addressed in the Riparian section.

The guidelines contained within the Region 5 Furbearer Literature Review include an assumption that marten and fisher habitat areas provide for wolverine as well. Therefore, the effects on marten and fisher habitat should be used to gauge potential effects on California wolverine habitat.

Consequences Unique to the Preferred Alternative

The Preferred Alternative would include Survey and Manage standards and guidelines which would provide for the viability of the Siskiyou Mountain and Del Norte salamanders and for bat populations.

The Grassland/Shrub-steppe Association standards and guidelines would provide for viability of the ferruginous hawk and loggerhead shrike.

Consequences Common to All Alternatives Except for Preferred Alternative

Management of the Siskiyou Mountain Salamander, Del Norte Salamander, loggerhead shrike, ferruginous hawk and Pacific western big-earred bat would be determined at the site level.

Forest Service Sensitive Animal Species

Northern Goshawk *(also an MIS)*

Comparison of Alternatives

All alternatives, except the Preferred and G(SOHA), would maintain 72 nesting habitat areas of approximately 200 acres each. Alternative G(SOHA) would maintain the same 72 nesting habitat areas, but they would be only 50 acres each. Although the later is consistent with minimum Regional Planning Direction for goshawk, local research on the Forest indicates that retaining 50 acres of nesting habitat for the purpose of confining a goshawk territory to a single management unit over time is unlikely to achieve the goal of long-term territory maintenance (refer to Chapter 3 - Wildlife, Goshawk section).

The Preferred Alternative would provide habitat protection for 41% of the Forest's 90 known goshawk territories in large LSRs and in RRs. Additional standards and guidelines would be used to maintain and enhance habitat in the remaining territories occurring on matrix lands and in the Goosenest AMA.

The probability of maintenance of goshawk populations may be higher within LSRs, HCAs, wilderness and other large unregulated areas than in areas where moderate to high intensity timber management is conducted. A study conducted on the Kaibab National Forest in Arizona compared nest occupancy rates for nests with buffers of 16 to 200 hectares in partially harvested areas to nests located in untreated areas. Nest occupancy rates in the treated areas were 75 to 80% lower than in the untreated areas. It was speculated that this decline was due to degradation of forage habitat (Crocker-Bedford, 1990). Studies on the the Forest (Woodbridge and Detrich, in press; Allison and Woodbridge, 1993) indicate that goshawk territories occur in areas containing larger patches of mature forest habitat than the surrounding landscape.

Degradation of forage habitat can be partially mitigated through the retention of large green trees, logs and snags and through management activities which maintain adequate proportions of early to late seral stages throughout goshawk territories (USDA Forest Service, 1992).

The secretive nature and high mobility of nesting goshawks makes inventory and estimation of population size difficult. Studies conducted on the Forest suggest that the distribution of goshawk territories is correlated with landscape features such as meadows, northerly slopes and riparian areas; therefore estimation of population size from amount of suitable habitat is unlikely to provide useful information at the Forest level. In addition, territorial behavior by nesting goshawks acts to further reduce the proportion of 'suitable habitat' that is actually occupied by goshawks.

All alternatives would survey at least 4 goshawk territories each year to determine occupancy and reproductive status. All alternatives except Current/RPA and G(SOHA) would include yearly landscape level surveys to locate additional active sites for possible substitution into the network of nesting habitat areas.

The alternatives would treat varying amounts of land to improve habitat within the nesting habitat areas. Alternatives Preferred, A, B, B', C, D, D' and E would treat 600 acres each year. Alternative Current/RPA would treat 200 acres and Alternative G(SOHA) would treat 100 acres each year. These improvements would include activities such as prescribed burning and snag creation. The objective would be maintenance of moderate and high quality habitat within these areas.

Consequences Unique to the Preferred Alternative

Under the Preferred Alternative, nesting and foraging habitat for goshawks would be provided in large LSRs and RRs. Of the 90 goshawk territories identified on the Forest, 37 are in LSRs, 17 in the AMA and 36 are within matrix lands. Most territories in matrix lands would receive at least partial protection by RRs. A single territory on the Goosenest Ranger District lies outside of the range of the northern spotted owl. To provide additional protection for the 59% of known goshawk territories that are not within LSRs, the following standards and guidelines for goshawk territory management would be proposed:

Primary Nest Zone: Within a 1/2-mile radius (504 acres) of a goshawk nest or cluster of alternate nests, maintain 40% (mixed conifer) or 60% (Douglas-fir/hardwood) in dense mature forest cover. The remaining 40 to 60% will be managed for large tree conditions, but lower canopy closures and small openings are allowable.

Foraging Habitat Zone: Within a 1-mile radius (1,500 acres, excluding Primary Zone), maintain 60% (900 acres) in mid-mature to "old growth" condition. Desired conditions include open understories, large CWD, large snags and small openings. It is expected that additional foraging habitat will be provided by RRs, standards and guidelines for snag and green replacement tree retention and the GTR standard.

Disturbance to nesting goshawks would be minimized by implementation of a seasonal restriction on activities within the Primary Nesting Zone (1/2-mile radius) during the period extending from March 1st through August 31st.

Regional planning guidelines specify that Forests will manage for a minimum density of 1 goshawk territory per 18 square miles. Distances between territories are not to exceed 12 miles. Under the Preferred Alternative, all known territories would be fully protected, and newly discovered territories would be protected until a fully occupied territory network is established.

Consequences Unique to Current/RPA Alternative

In the existing situation, 31 of the 200-acre nest habitat areas would occur within within HCAs and other unregulated land allocations.

More than half (57%) of the network goshawk areas on the Forest would be within the forest matrix and subject to timber management activities adjacent to nesting areas. The relatively large amount of land that would be scheduled for high and moderate timber yields (13% in Regulation Class 1 and 21% in Regulation Class 2) may not provide for goshawk population maintenance within the forest matrix.

The approximation used in FORPLAN projected that about 6080 acres would be harvested annually mainly through clearcutting and shelterwood prescriptions. The standards and guidelines would maintain 1.5 snags per acre, but would not require green tree or hardwood retention. This could result in degradation of foraging habitat if not mitigated at the project level. The probability of population maintenance within large unregulated land allocations would be higher than in the forest matrix.

Consequences Unique to Alternative A

About half of the 200-acre nest habitat areas would occur within HCAs and other unregulated land allocations.

The probability of population maintenance is higher for the proportion of the goshawk network that is within HCAs or other large allocations. The occupancy rate of territories within the Forest matrix could be affected by the intensity of adjacent timber management. The relatively large amount of land scheduled for high and moderate timber yields (16% of the land base in Regulation Class 1 and 12% in Regulation Class 2) may not provide for population maintenance within the forest matrix.

The approximation used in FORPLAN projected that about 6,120 acres would be harvested annually mainly through clearcutting prescriptions. Degradation of foraging areas could be partially mitigated by standards and guidelines which would require maintenance of more snags, green trees and hardwoods than currently required.

Consequences Unique to Alternatives B and B'

Ten of the 200-acres nest habitat areas would be located within within wilderness and other unregulated areas.

Only a small proportion of the network goshawk areas on the Forest would be located within large unregulated land allocations. The majority of the network would be within Regulation Class 2 (24 territories) and Regulation Class 3 (38 territories) forest lands and would be subject to timber management activities adjacent to nesting areas. However, the low intensity of timber management would probably provide adequate foraging and replacement nesting habitat to maintain goshawk populations throughout the planning period.

The approximation used in FORPLAN projected that in Alternative B about 4,980 acres and in Alternative B' about 4,240 acres would be harvested annually mainly through group selection. Standards and guidelines would provide for the maintenance of more snags and green trees than are currently required.

Consequences Unique to Alternative C

In Alternative C, half of the 200-acre nest habitat areas would be located within within wilderness, HCAs and other unregulated land allocations.

About half of the designated goshawk habitat areas would be within the Forest matrix and subject to timber harvesting activities adjacent to nesting areas. The amount of land scheduled for high and moderate timber yields (7% in Regulation Class 1 and 22% in Regulation Class 2) would likely provide sufficient foraging habitat to maintain goshawk occupancy over the planning period.

The approximation used in FORPLAN projected that about 6,140 acres would be harvested annually mainly through clearcutting and shelterwood prescriptions. Standards and guidelines would maintain more snags, green trees and hardwoods than are currently required. This would be more than all the other alternatives except the Preferred.

Consequences Unique to Alternatives D and D'

In these alternatives, 31 of the 200-acre nest habitat areas would be located within wilderness, HCAs and other unregulated land areas.

Twenty-seven network territories would be within Regulation Class 1 and 2 lands, while 14 would be within Regulation Class 3 lands. These territories would be subject to timber management activities adjacent to nesting areas. The amount of land scheduled for high and moderate timber yields (10% in Regulation Class 1 and 18% in Regulation Class 2) could affect the occupancy of network territories in the forest matrix over time through degradation of foraging habitat.

The approximation used in FORPLAN projected that in Alternative D about 5,760 acres and in Alternative D' about 5,630 acres would be harvested annually mainly through clearcutting prescriptions. Degradation of foraging habitat could be partially mitigated through the standards and guidelines which would maintain more snags, hardwoods and green trees than are currently required.

Consequences Unique to Alternative E

In Alternative E, 57 of the 200-acre nest habitat areas would be located within wilderness, HCAs and other unregulated land allocations.

The majority of network goshawk habitat areas would be within unregulated land allocations and would not be subject to disturbance or modification of nesting and foraging habitat from resource management activities in adjacent areas. The amount of land scheduled for moderate timber yields (20% in Regulation Class 2) would be likely to provide sufficient foraging habitat within the forest matrix.

The approximation used in FORPLAN projected that about 5,490 acres would be harvested annually mainly through regeneration with reserve prescriptions. Standards and guidelines would provide for the maintenance of more snags and green trees than are currently required.

Consequences Unique to Alternative G(SOHA)

In Alternative G(SOHA), 72 areas of 50 acres each would be managed to provide goshawk habitat. Twelve of these network sites would be located within wilderness, SOHAs and other unregulated areas.

The majority of the nest habitat areas would be adjacent to Regulation Class 1 and 2 lands and would be subject to timber management activities adjacent to nesting areas. The relatively large amount of land scheduled for high and moderate timber yields (15% in Regulation Class 1 and 26% in Regulation Class 2) would not likely provide for population maintenance within the forest matrix.

This effect would be particularly important on the eastside of the Forest where few nest habitat areas would be located within SOHA's. In addition, the small size (50 acres) of nesting stands would further reduce the probability of population maintenance. The approximation used in FORPLAN projected that about 6,790 acres would be harvested annually mainly through clearcutting and shelterwood prescriptions. Standards and guidelines for retention of snags would be the same as in the current situation. Retention of hardwoods and green trees would not be required.

Pacific fisher and American marten

(also an MIS)

Consequences Common to All Alternatives

Although the amount and distribution of areas allocated to the management of marten and fisher varies between alternatives, each alternative used the same information to designate and evaluate these areas. This information, including HCMs, is presented in the Region 5 Furbearer Literature Review for the Management of Fisher and Marten.

At this time, management strategies based on the information in the literature review are assumed to contribute to maintaining viable population of marten and fisher. For the purpose of this discussion, marten and fisher habitat areas which would be provided within large, unregulated areas such as wilderness, LSRs and HCAs will be referred to as reproductive units. Areas outside of large, unregulated areas managed specifically for marten or fisher habitat will be referred to as habitat management areas. Each reproductive unit or habitat management area is expected to provide for 1 male and 2 female home ranges.

The reproductive units currently provided within wilderness would be the same for all alternatives. Approximately 27 low to high quality marten and 3 low quality fisher reproductive units are currently provided within wilderness. However, management activities within wilderness could not be directed at habitat management.

Based on information from field observations and radiotracking from several researchers, riparian corridors and saddles over ridgetops are assumed to be important for travel ways and connectivity (Freel, 1991). Connectivity is important both for daily movement through territories and dispersal of juveniles from their natal area to a site where they eventually settle to breed.

Without successful dispersal, deceased individuals in the breeding population will not be replaced by recruits among dispersing juveniles and displaced adults. When large blocks of suitable habitat for a species exists, the rate of successful dispersal from 1 block to another clearly declines with increasing distance between them (Thomas et.al., 1990). The marten and fisher HCMs describe moderate quality habitat areas as being no greater than 3 and 8 miles apart, respectively.

Refer to Appendix I for information on travel corridor parameters and their associated habitat quality rating. Moderate quality travel corridors for marten have 50 to 60% canopy closure and are 150 to 299 feet wide when occurring within mature stands or are 300 to 599 feet wide when adjacent to forest openings. Moderate quality travel corridors for fisher have 50 to 60% canopy closure and are 300 to 599 feet wide when occurring within mature stands or are 600 to 1,199 feet wide when adjacent to forest openings.

Consequences Common to All Alternatives except Preferred and G(SOHA)

All alternatives except Preferred and G(SOHA) would implement HCAs. Whether unregulated or managed as Regulation Class 3, HCAs could provide 22 additional marten and 9 additional fisher reproductive units.

Marten

Comparison of Alternatives

All alternatives except Current/RPA and G(SOHA) would inventory marten reproductive units and/or habitat management areas and conduct habitat improvements. Alternative C would inventory 3 areas per year, while the others would inventory 5 per year. Management strategies would be prepared which would address habitat improvements in marten habitat. Alternative C would conduct 50 acres of habitat improvement within the marten habitat management areas, while the others except the Preferred Alternative would conduct 150 acres per year. The Preferred Alternative does not include marten habitat management areas, but would conduct habitat improvement activities within LSRs that would likely benefit marten. The intent of these improvements would be to provide and maintain moderate and high quality habitat. These improvements, in conjunction with the inventory work, would be valuable in testing the applicability of the Regional HCMs.

Table 4-19 compares the Forest-wide weighted index habitat suitability rating for the marten by alternative for cover and feeding.

Table 4-19. Habitat Suitability for Marten (Weighted Index)

Alternative	Fifth Decade
Cover (Current (1987) = 0.442)	
PFD	0.507
CUR/RPA	0.482
A	0.464
B & B'	0.501
C	0.471
D & D'	0.500
G(SOHA)	0.478
Feeding (Current (1987) = 0.442	
PFD	0.573
CUR/RPA	0.490
A	0.472
B & B'	0.509
C	0.479
D & D'	0.508
G(SOHA)	0.486

Note: Low capability = 0.333, Moderate capability = 0.666, High capability = 1.000. These values should be used to compare trends in habitat. Refer to Appendix I for habitat suitability values for each forest type and seral stage.

Consequences Unique to the Preferred Alternative

Under the Preferred Alternative, 396,600 acres would be managed as LSRs. These areas would be managed to protect and enhance conditions of late-successional and "old growth" forest ecosystems which would serve as habitat for late-successional and "old growth" related species, including marten. The LSRs would potentially provide for 23 low to moderate quality marten reproductive units.

Mitigation measures applied within the matrix and AMA would benefit marten and help to reduce the level of disturbance to individuals. Mitigation measures within

the matrix would include the retention of CWD, green trees, snags and 100-acre LSRs.

Approximately 95,300 acres of suitable denning and foraging habitat would exist outside of LSRs and wilderness. These areas would be managed for varying levels of timber yields. It is difficult to predict how many territories might be provided for over time in these areas. Approximately 37% of those acres would be unregulated or managed for Regulation Class 3. Individuals could be displaced in areas managed for Regulation Class 2 due to the immediate loss and degradation of older seral stages. Forest-wide, habitat capability for cover and feeding habitat would increase by 15% and 27%, respectively, by the end of the fifth decade.

Consequences Unique to Current/RPA Alternative

Forty-nine low to high quality marten reproductive units would be provided within wilderness and HCAs. The future suitability of the current 170,000 acres of high and moderate quality foraging and denning habitat within HCAs and wilderness would be dependent upon vegetative succession and wildfire. Outside HCAs and wilderness, the amount and distribution of suitable habitat would vary over time, mainly as a result of timber management activities and wildfire occurrence.

Approximately 124,000 acres of suitable foraging and denning habitat currently exists outside of wilderness and HCAs. It is difficult to predict how many additional territories might be maintained over time. The 27% of these acres that would be unregulated or managed under Regulation Class 3 would be expected to provide suitable habitat in the long-term. The remaining acres which would be managed under Regulation Classes 1 and 2 could result in displacement of individuals through the immediate loss or degradation of habitat. Forest-wide, habitat capability for cover and feeding would increase by 9% and 11%, respectively, by the end of the fifth decade.

Consequences Unique to Alternative A

In addition to reproductive units already existing within HCAs and wilderness, Alternative A would designate 15 areas to be managed for marten habitat. Based on the seral stage composition, these additional habitat management areas currently provide low to moderate quality habitat. Over time, habitat quality would be expected to improve as stands in mid-seral stage (3B&C) developed into older stands. Marten habitat management strategies would guide management activities in improving habitat for marten. These 15 territories would be managed as Regulation Class 3.

Incorporation of these additional areas would fill in some gaps in spacing and meet the moderate to high habitat capability model parameters for spacing as presented in the Region 5 Furbearer Literature Review.

Approximately 116,000 acres of suitable denning and foraging currently exist outside of HCAs, wilderness and the proposed marten habitat areas. These areas would be managed for varying levels of timber yields. It is difficult to predict how many territories might be provided for over time in these areas. Approximately 34% of those acres would be unregulated or managed as Regulation Class 3. Individuals could be displaced due to the immediate loss and degradation of habitat in the remainder of the area which would be managed as Regulation Classes 1 and 2. Forest-wide, habitat capability for cover and feeding habitat would increase by 5% and 7%, respectively, by the end of the fifth decade.

Consequences Unique to Alternatives B and B'

Habitat for marten would be provided primarily within wilderness, HCAs and an additional 15 designated marten habitat management areas. The 15 low to moderate quality marten habitat management areas would be managed as Regulation Class 3 to improve habitat. It is expected that the quality of habitat within these areas would improve over time through management and with the natural succession of younger stands.

Incorporation of these additional areas would fill in some gaps in spacing and meet the moderate to high habitat capability model parameters for spacing as presented in the Region 5 Furbearer Literature Review.

In Alternative B, HCAs would be managed as Regulation Class 3 with prescriptions designed to improve habitat for northern spotted owls. This objective would be consistent with the management intent for marten. Alternative B' would have unregulated HCAs. It is likely that wilderness and HCAs in either alternative would continue to provide for approximately 49 marten reproductive units.

Approximately 129,000 acres of suitable foraging and denning habitat currently exist outside of HCAs, wilderness and the proposed marten areas. It is expected that habitat for marten would be available over time within the 55% of those areas that would be unregulated or managed as Regulation Class 3. The remaining acres would be managed as Regulation Class 2 and would likely result in displacement of some individuals. Forest-wide, habitat capability for cover and feeding would increase by 13% and 15%, respectively, by the end of the fifth decade.

Consequences Unique to Alternative C

Alternative C would provide for marten through management areas such as wilderness, HCAs and

habitat linkages on the westside. On the eastside, 6 marten habitat areas would be designated and managed as Regulation Class 3. Habitat linkages would provide for at least 2 additional reproductive units on the westside of the Forest.

Approximately 116,000 acres of suitable marten habitat currently exists outside of HCAs, wilderness and proposed habitat linkages. The 35% of those acres that would be unregulated or managed under Regulation Class 3 would be expected to provide habitat for marten over time. The remaining acres managed under Regulation Classes 1 and 2 would likely result in displacement of some individuals due to immediate loss or degradation of habitat. Forest-wide, habitat capability for cover and feeding would increase by 7% and 8%, respectively, by the end of the fifth decade.

Consequences Unique to Alternatives D and D'

Habitat for marten would be provided primarily through HCAs, wilderness and an additional 15 designated marten habitat management areas. The additional 15 low to moderate quality marten habitat areas would be managed to improve marten habitat. Minimal timber yields would be programmed. It is expected that habitat quality would improve over time through management and with the natural succession of younger stands.

Incorporation of these additional areas would fill in some gaps in spacing and meet the moderate to high habitat capability model parameters for spacing as presented in the Region 5 Furbearer Literature Review.

In Alternative D, unsuitable owl habitat within HCAs would be managed to promote development of large, multi-layered stands resulting in minimal timber yields. This objective would be consistent with management intent for marten habitat. In Alternative D', HCAs would be unregulated. With either alternative, HCAs and wilderness would likely continue to provide for approximately 49 marten reproductive units.

Approximately 118,000 acres of suitable marten habitat currently exists in areas outside of HCAs, wilderness and the proposed marten habitat areas. The 36% of those acres that would be unregulated or managed as Regulation Class 3 would be expected to provide habitat for marten over time. The remaining acres managed under Regulation Classes 1 or 2 would likely result in immediate displacement of some individuals and loss or degradation of suitable habitat. Forest-wide, habitat capability for cover and feeding would increase by 13% and 15%, respectively, by the end of the fifth decade.

Consequences Unique to Alternative E

Habitat for marten would be provided throughout the Forest. In addition to HCAs and wilderness, 15 additional low to moderate quality marten habitat areas would be designated. These additional areas would be unregulated. Future suitability of habitat within these areas would be dependent upon natural processes such as vegetative succession and wildfire.

Incorporation of these additional areas would fill in some gaps in spacing and meet the moderate to high habitat capability model parameters for spacing as presented in the Region 5 Furbearer Literature Review.

Approximately 121,000 acres of suitable foraging and denning habitat currently exist outside HCAs, wilderness and proposed marten habitat areas. The 60% of those acres that would be unregulated or managed as Regulation Class 3 would provide additional marten territories. Backcountry areas and ecologically significant stands of "old growth" (as defined by the Scientific Panel on Late-Successional Forest Ecosystems) would be part of the unregulated portion. The remaining acres of suitable habitat managed as Regulation Class 2 would likely result in the displacement of some individuals due to the loss or degradation of habitat. Forest-wide, habitat capability is expected to increase by the end of the fifth decade.

Consequences Unique to Alternative G(SOHA)

Habitat for marten would be provided primarily through large unregulated areas, mainly wilderness and some SOHAs. Approximately 32 low to high quality marten reproductive units could be supported within these management areas. Habitat suitability within these areas would be dependent on natural processes including vegetative succession and wildfire.

Outside wilderness and the proposed SOHAs, 161,000 acres of suitable marten habitat currently exist. The 26% of those areas that would be unregulated or managed under Regulation Class 3 could provide some habitat for marten over time. The remaining acres managed under Regulation Class 1 and 2 could result in displacement of individuals through the loss and degradation of habitat. Forest-wide, habitat capability for cover and feeding would increase by 8% and 10%, respectively, by the end of the fifth decade.

Fisher

Comparison of Alternatives

All alternatives except Alternatives Current/RPA and G (SOHA) would inventory 5 fisher reproductive units or habitat management areas each year to determine occupancy. Management strategies would be developed for each habitat management area to determine which activities would occur within them. Approximately 150 acres of habitat improvement would occur within the habitat management areas per year.

The improvements would include activities such as prescribed burning, thinning and planting. The intent of these improvements would be to provide and maintain moderate and high quality habitat. These improvements, in conjunction with the inventory work, would be valuable in testing the applicability of the Regional HCMs.

Table 4-20 compares the Forest-wide weighted index habitat suitability rating for the fisher by alternative for cover and feeding. Refer to Appendix I for habitat suitability values for each forest type and seral stage.

Table 4-20. Habitat Suitability for Fisher (Weighted Index)

Alternative	Fifth Decade
Cover (Current (1987) = 0.461)	
PFD	0.531
CUR/RPA	0.499
A	0.495
B & B'	0.525
C	0.496
D & D'	0.533
G(SOHA)	0.506
Feeding (Current (1987) = 0.467)	
PFD	0.582
CUR/RPA	0.526
A	0.515
B & B'	0.549
C	0.509
D & D'	0.553
G(SOHA)	0.530

Note: Low capability = 0.333, Moderate capability = 0.666, High capability = 1.000. These values should be used to compare trends in habitat.

Consequences Unique to the Preferred Alternative

Under the Preferred Alternative, 396,600 acres would currently be managed as LSRs. These areas would be managed to protect and enhance conditions of late-successional and "old growth" forest ecosystems which would serve as habitat for late-successional and "old growth" related species, including fisher. The LSRs would potentially provide for 8 low quality fisher reproductive units.

In addition to fisher reproductive units provided within LSRs and wilderness, the Preferred Alternative would provide fisher habitat within a Managed Wildlife Area. The seral stage composition within this additional area currently provides for a low quality reproductive unit. The objective of management within this area would be to improve late-successional habitat, including fisher habitat; minimal timber yields would be scheduled. Over time, habitat quality would likely improve as mid-seral stage stands developed into older stands.

Mitigation measures applied within the matrix and AMA would benefit fisher and help reduce the level of disturbance to individuals. Mitigation measures within the matrix would include the retention of CWD, green trees, snags and 100-acre LSRs.

Approximately 235,000 acres of suitable foraging and denning habitat currently occurs outside of LSRs, wilderness and the Managed Wildlife Area. The 33% of those acres that would be unregulated or managed as Regulation Class 3 would likely provide suitable habitat over time. The remaining areas which would be managed as Regulation Class 2 could result in some displacement of individuals due to loss or degradation of older seral stage forested habitat. Forest-wide habitat capability for cover and feeding would increase by 15% and 25%, respectively, by the end of the fifth decade.

Consequences Unique to Current/RPA Alternative

Habitat for fisher reproductive units would continue to be provided primarily within wilderness and HCAs. These areas could support approximately 12 reproductive units. Suitability of the existing 310,000 acres of foraging and denning habitat within wilderness and HCAs would fluctuate over time, primarily as a result of natural succession which includes wildfire.

Outside HCAs and wilderness, approximately 294,000 acres of suitable habitat currently exists. The 33% of those acres which would be unregulated or managed as Regulation Class 3 might provide an unknown number of additional habitat areas over time. The remaining areas would be managed more intensively and individuals could be displaced due to degradation or immediate loss of habitat. Forest-wide, habitat capability for cover and feeding would increase by 8% and 13%, respectively, by the end of the fifth decade.

Consequences Unique to Alternative A

In addition to fisher reproductive units provided within HCAs and wilderness, Alternative A would designate 5 fisher habitat management areas. These areas would provide for better distribution of territories within the northwest portion of the Forest than the existing situation does. The seral stage composition within these additional areas currently provides for low quality reproductive units. The objective of individual management strategies would be to improve fisher habitat; minimal timber yields would be scheduled. Over time, however, habitat quality could improve as mid seral stage stands developed into older stands.

Approximately 276,000 acres of suitable foraging and denning habitat currently occurs outside of HCAs, wilderness and proposed fisher habitat management areas. The 54% of those acres that would be unregulated or managed as Regulation Class 3 would likely provide some suitable habitat over time. The more intensive management of the remaining areas could result in displacement of individuals due to the immediate loss and degradation of habitat. Forest-wide habitat capability for cover and feeding would increase by 7% and 10%, respectively, by the end of the fifth decade.

Consequences Unique to Alternatives B and B'

The management intent within HCAs for both Alternatives B and B' would be consistent with habitat objectives for fisher. In addition to fisher reproductive units provided within HCAs and wilderness, these alternatives would designate 5 fisher habitat management areas. These areas would provide for better distribution of territories within the northwest portion of the Forest than the existing situation does. The seral stage composition within these additional areas currently provide for low quality reproductive units. The objective of individual management strategies would be to improve fisher habitat; minimal timber yields would be scheduled. Habitat quality could improve over time due to vegetative succession and habitat improvement efforts.

Approximately 317,000 acres of suitable habitat currently exist outside of wilderness, HCAs and proposed fisher habitat areas. The 67% of those acres that would be unregulated or managed as Regulation Class 3 could provide some habitat for fisher over time. The remaining acres managed as Regulation Class 2 could result in temporary displacement of individuals due to loss or degradation of habitat. Forest-wide, habitat capability for cover and feeding would increase by 14% and 18%, respectively, by the end of the fifth decade.

Consequences Unique to Alternative C

Habitat for fisher would be provided through other management areas, mainly wilderness, HCAs and Habitat Linkages. Habitat Linkages could provide at least 1 additional reproductive unit. Although the linkages would be scheduled for minimal timber yields, this is not expected to result in loss of fisher habitat. In fact, it could prove beneficial to fisher since prescriptions would be designed to enhance habitat for optimum levels of "old growth" dependent species.

An additional 317,000 acres of suitable habitat currently exists outside of HCAs, wilderness and habitat linkages. The 67% of those acres that would be unregulated or managed as Regulation Class 3 would be expected to contribute to maintenance of individuals. The remaining areas that would be managed as Regulation Classes 1 and 2 could result in the displacement of individuals due to loss or degradation of habitat. Forest-wide, habitat capability for cover and feeding would increase by 8% and 9%, respectively, by the end of the fifth decade.

Consequences Unique to Alternatives D and D'

The management intent within HCAs for both Alternatives D and D' would be consistent with habitat objectives for fisher. In addition to fisher reproductive units provided within wilderness and HCAs, these alternatives would designate 5 fisher habitat management areas. Although these 5 areas currently provide low quality habitat, they improve the distribution of habitat areas. The objective of individual fisher habitat management area strategies would be to improve fisher habitat; minimal timber yields would be scheduled. It is expected that habitat quality within those territories would improve over time due to vegetative succession and habitat improvement efforts.

Approximately 282,000 acres of suitable habitat currently exist outside wilderness, HCAs and proposed fisher habitat areas. The 46% of those acres that would be unregulated or managed as Regulation Class 3 would be expected to provide some habitat for fisher over time. The remaining acres which would be managed as Regulation Class 1 or 2 could result in temporary displacement of individuals due to loss or degradation of habitat. Forest-wide habitat capability for cover and feeding would increase by 16% and 18%, respectively, by the end of the fifth decade.

Consequences Unique to Alternative E

In addition to fisher habitat provided within wilderness and HCAs, Alternative E would designate 5 fisher habitat management areas. These areas would be unregulated. Although these 5 areas currently provide low quality habitat, they improve the distribution of habitat areas. Future suitability of these areas would be dependent on natural processes including vegetative succession and wildfire.

Approximately 287,000 acres of suitable habitat currently exists outside of wilderness, HCAs and proposed fisher habitat management areas. The 71% of these acres which would be unregulated or managed as Regulation Class 3 would be expected to provide suitable habitat over time. Included within the unregulated portion are Backcountry and ecologically significant "old growth" stands. The remaining acres which would be managed as Regulation Class 2 could result in some displacement of individuals due to loss or degradation of habitat.

Consequences Unique to Alternative G(SOHA)

Wilderness and SOHAs adjacent to wilderness would provide for approximately 5 low quality fisher reproductive units. Future habitat suitability within those areas would be dependent on natural processes, mainly vegetative succession and wildfire.

Outside wilderness and SOHAs, approximately 347,000 acres of suitable habitat currently exist. The 26% of those acres which would be unregulated or managed as Regulation Class 3 would be expected to provide some habitat for fisher over time. The remaining areas which would be managed as Regulation Classes 1 and 2 would likely result in the displacement of individuals through the loss and degradation of habitat. Forest-wide habitat capability for cover and feeding would increase by 10% and 14%, respectively, by the end of the fifth decade.

Connectivity Between Marten and Fisher Areas

Consequences Common to All Alternatives except Preferred, D and D'

Connectivity between marten and fisher habitat management areas differs by alternative. These alternatives at a minimum would manage for 100 foot riparian areas on either side of perennial streams with the objective of maintaining 80% shade on the surface of any flowing water. This falls within the range of low quality travel habitat for marten provided that the riparian areas occur adjacent to mature stands.

This standard alone is insufficient in meeting even low quality objectives for fisher travel habitat. Other land allocations besides RMZs (for example, visual quality management areas, recreation and scenic river corridors, geologically unsuitable areas, etc.), however, can contribute to providing connectivity. These vary by alternatives as well. In areas of mixed ownership ("checkerboard ownership"), the ability to provide connectivity between habitat areas is limited. This is the case along a short portion of the Siskiyou Crest, in the vicinity of Scott Mountain and in the Antelope Creek area on the Goosenest Ranger District.

Consequences Unique to the Preferred Alternative

Interim widths of RRs under the Preferred Alternative may provide moderate or better connectivity between most reproductive units on the westside of the Forest. Site-specific assessment of connectivity would be addressed during watershed analysis.

The network of RRs on the Goosenest Ranger District do not adequately provide for connectivity between reproductive units. Management of marten, fisher and other "old growth" and late-successional forest associated species would be addressed in the AMA Plan.

Management for connectivity between marten reproductive units may be limited in some areas of mixed ownership (for example, northeast and southwest of Scott Mountain, along a portion of Siskiyou Crest and Antelope Creek).

RRs alone would provide for moderate habitat connectivity between marten areas on the westside of the Forest. RRs in conjunction with other management areas (Scenic Rivers, Recreational Rivers and the geologic sensitive land within other management areas) would provide connectivity between marten and fisher areas.

Consequences Unique to Current/RPA Alternative

Distance between reproductive units, in many cases, would be greater than that described in the HCMs as necessary for moderate or high quality habitat. RMZs in conjunction with other management areas (Retention VQOs, Scenic Rivers, Recreational Rivers and geologically sensitive land within other management areas) would provide connectivity between most marten and fisher habitat areas a few exceptions.

Marten connectivity would have some "weak links," mainly between the Marble Mountain and Siskiyou Wilderness. Marten connectivity between habitat areas on the Goosenest Ranger District could be impeded due to the amount of Regulation Class 1 land. There are few management areas which could insure maintenance of suitable linkages between these marten areas on the eastside. This could result in greater mortality of dispersing individuals. Territories which become vacant could remain vacant for longer periods of time.

There would be little moderate and high quality travel habitat for fisher maintained northwest of the Marble Mountain Wilderness. These areas of low quality connectivity, where the distance between marten and fisher habitat areas exceeds 3 and 8 miles respectively, could result in greater mortality of dispersing individuals. Vacant territories could remain vacant for longer periods of time.

Consequences Common to Alternatives A, C, D and D'

RMZs in conjunction with other management areas, especially when they occur adjacent to RMZs, would provide connectivity between marten and fisher areas. Adequate connectivity would be provided between most of the marten and fisher areas on the Forest with the exception of marten connectivity on the Goosenest Ranger District. Connectivity would be impeded due to the amount of Regulation Class 1 land and the few management areas which could insure maintenance of suitable linkages between marten areas. This could result in greater mortality of dispersing individuals and territories which become vacant could remain vacant for longer periods of time.

Consequences Unique to Alternatives B and B'

RMZs in conjunction with other management areas (Retention VQOs, Scenic and Recreational Rivers and geologically sensitive land within other management areas), especially when they occur adjacent to riparian zones, would provide connectivity between marten and fisher areas. Connectivity on the Goosenest Ranger District would likely improve as the areas

between marten habitat would be in Regulation Class 2 with moderate timber yields scheduled, rather than the higher yields scheduled in the current situation. A greater proportion of older stands would be present than if these areas were Regulation Class 1. This would increase the likelihood that suitable travel and dispersal habitat would be available through time.

Consequences Unique to Alternative E

RMZs in conjunction with other management areas throughout the westside of the Forest would provide high quality travel habitat between fisher and marten areas. Connectivity on the Goosenest Ranger District would likely improve as the areas between marten habitat would be in Regulation Class 2 with moderate timber yields scheduled, rather than the higher yields scheduled in the Current Alternative. A greater proportion of older stands would be present than if these areas were Regulation Class 1. This would increase the likelihood that suitable travel and dispersal habitat would be available through time.

Consequences Unique to Alternative G(SOHA)

Connectivity between marten and fisher habitat areas would decrease from the current situation. RMZs and other management areas would not provide sufficient connectivity. The distance between marten and fisher habitat areas would be greater than in the current situation. The large amount of Regulation Class 1 and 2 land adjacent to habitat areas could further reduce the quality of travel and dispersal habitat. Less suitable habitat would be maintained along portions of the Forest boundary than in the Current Alternative which would reduce connectivity with adjacent forests as well.

Great gray owl

Currently, there are no confirmed nesting great gray owls on the Forest. Several reliable observations of individuals have occurred, primarily within wilderness. The Preferred Alternative is the only alternative which specifies protecting the integrity of nest sites and managing forested habitat adjacent to meadows to provide cover for meadow foragers in its standards and guidelines. All alternatives, except Current/RPA and G(SOHA), would conduct annual surveys in areas of suitable habitat and provide for habitat improvement of occupied sites.

Willow flycatcher

Currently, there are no confirmed nesting willow flycatchers on the Forest. Individuals have been located during the breeding season, however, and additional surveys are planned for the next 2 seasons. The Preferred Alternative is the only alternative which specifies maintaining the integrity of known willow flycatcher nest sites in its standards and guidelines. All alternatives, except Current/RPA and G (SOHA), would conduct annual surveys in areas of suitable habitat and provide for habitat improvement of occupied sites.

Western pond turtle

The Preferred Alternative would include RRs which provide a high degree of protection to streamside habitats used by western pond turtles. All alternatives except Current/RPA and G(SOHA) would conduct annual surveys and provide for protection and improvement of occupied sites.

Management Indicator Species

Black bear

Common to All Alternatives

All alternatives would maintain a mixture of early and late seral vegetation. Black bear would be expected to persist with any alternative, although local populations might change in response to different management strategies proposed by the alternatives.

Table 4-21 compares the Forest-wide weighted index habitat suitability rating for black bear by alternative for cover and feeding. Refer to Appendix I for habitat suitability values for each forest type and seral stage.

Table 4-21. Habitat Suitability for Black Bear (Weighted Index)

Alternative	Fifth Decade
Cover (Current (1987) = 0.502)	
PFD	0.581
CUR/RPA	0.552
A	0.538
B & B'	0.571
C	0.548
D & D'	0.572
G(SOHA)	0.554
Feeding (Current (1987) = 0.621)	
PFD	0.622
CUR/RPA	0.621
A	0.623
B & B'	0.623
C	0.621
D & D'	0.624
G(SOHA)	0.624

Note: Low capability = 0.333, Moderate capability = 0.666, High capability = 1.000. These values should be used to compare trends in habitat.

Forest-wide habitat capability for feeding habitat remains near moderate levels and changes very little through the end of the fifth decade for all alternatives.

Younger seral stage vegetation which could be used as foraging habitat would be created by timber management activities using a variety of prescriptions in all alternatives. Maximum use of created openings would be partially dependent on the amount of cover from snags, green conifers and hardwoods retained within timber harvesting units. Group selection would probably create optimum sized openings.

The amount of retained CWD, a component associated with spring and summer foraging, differs by alternative. High, moderate or low amounts of CWD material refer to the quality of that component for foraging habitat. Hardwoods provide an important food source during late summer and fall. The discussions of effects on hardwood associated species are applicable to black bear forage habitat capability.

The change in the amount of dense older seral stage forest (indicated by the change in forest cover habitat capability) and changes in road density are the best measurable indications of the change in the amount of high quality denning habitat.

Open road densities have a major influence on the number of animals harvested and on local populations. Large, unroaded areas with mature to old growth vegetation provide the highest quality denning habitat. Changes in open road densities are presented in the black-tailed deer sections. Average open road densities for all alternatives fall within the range of low habitat capability for black bear. The acres of released roadless areas to be managed, likely resulting in increased disturbance to local bear populations within those areas, vary by alternative.

Consequences Unique to the Preferred Alternative

About 18% of the Forest would be managed as Regulation Class 2, mainly using GTR prescriptions and to a lesser extent group selection. This alternative would retain the most snags, green trees and hardwoods of all alternatives. Standards and guidelines for Regulation Class 2 lands would require retention of moderate to high amounts of CWD after harvest. Forest-wide habitat capability values for cover would increase 16% by the end of the fifth decade, mainly due to the increase in the amount of dense older seral stage forest. About 9% of the released roadless areas would be managed as Regulation Class 2, while 89% would be unregulated.

Consequences Unique to Current/RPA Alternative

About 33% of the Forest would be managed as Regulation Class 1 and 2 using mainly clearcutting and shelterwood prescriptions. This alternative would retain few snags, green trees and hardwoods relative to the other alternatives. Standards and guidelines for Regulation Class 1 and 2 lands would require retention of low to moderate amounts of CWD after harvest. Forest-wide habitat capability values for cover would increase 10% by the end of the fifth decade, mainly due to an increase in dense older seral stages. About 38% of the Forest's released roadless areas would be managed as Regulation Classes 1 and 2, while 51% would be unregulated.

Consequences Unique to Alternative A

About 28% of the forest would be managed as Regulation Class 1 and 2 using mainly GTR prescriptions. Standards and guidelines for Regulation Class 1 and 2 areas would require retention of moderate amounts of snags, green conifers and hardwoods relative to the other alternatives. Within Regulation Class 1 and 2 areas, low to moderate amounts of CWD would be retained after harvest. Forest-wide habitat capability values for cover would increase 7% by the end of the fifth decade. About 21% of the released roadless areas would be managed as Regulation Class 1 and 2, while 51% would be unregulated.

Consequences Unique to Alternatives B and B'

About 22% of the Forest would be managed as Regulation Class 2 mainly using group selection and to a lesser extent GTR prescriptions. GTR and group selection prescriptions would result in the creation of early successional vegetation and could provide forage habitat in optimum mixed patches. Within those areas, low to moderate amounts of CWD would be retained after harvest. Forest-wide habitat capability values for cover would increase 14% by the end of the fifth decade. About 21% of the released roadless areas would be managed as Regulation Class 2, while 37% would be unregulated.

Consequences Unique to Alternative C

About 29% of the Forest would be managed as Regulation Class 1 and 2 mainly using GTR and shelterwood prescriptions, although some group selection would occur. Standards and guidelines for Regulation Class 1 and 2 lands would retain high amounts of snags, green conifers and hardwoods after harvest relative to the other alternatives. Within Regulation Class 1 and 2 lands, low to moderate amounts of CWD would be retained after harvest. Forest-wide habitat capability values for cover would increase 9% by the end of the fifth decade. About 21% of the released roadless areas would be managed as Regulation Class 1 and 2, while 58% would be unregulated.

Consequences Unique to Alternatives D and D'

About 28% of the Forest would be managed as Regulation Class 1 and 2, mainly by GTR and shelterwood prescriptions, although some group selection

would occur. Standards and guidelines for Regulation Class 1 and 2 lands would retain moderate amounts of snags, green conifers and hardwoods relative to the other alternatives. Moderate to high amounts of CWD would be retained after harvest on Regulation Class 1 and 2 lands. Forest-wide habitat capability values for cover would increase 14% by the end of the fifth decade. About 29% of the released roadless areas would be managed as Regulation Class 1 and 2, while 52% would be unregulated.

Consequences Unique to Alternative E

About 20% of the Forest would be managed as Regulation Class 2, mainly by GTR prescriptions, although some group selection would occur. Standards and guidelines for Regulation Class 2 areas would require retention of moderate amounts of snags, green conifers and hardwoods relative to the other alternatives. Within those areas, moderate to high amounts of CWD would be retained after harvest. The total amount of dense, older seral stage forest would increase by 20% at the end of the fifth decade. All the released roadless areas would be unregulated.

Consequences Unique to Alternative G(SOHA)

About 42% of the Forest would be managed as Regulation Class 1 and 2, mainly by clearcutting and shelterwood prescriptions. Standards and guidelines for Regulation Class 2 areas would retain low amounts of snags, green conifers and hardwoods relative to the other alternatives. Moderate to high amounts of CWD would be retained after harvest on Regulation Class 1 and 2 lands. Forest-wide habitat capability values for cover would increase 10% by the end of the fifth decade. About 52% of the released roadless areas would be managed under Regulation Classes 1 and 2, the most of all the alternatives, while 33% would be unregulated.

Black-tailed deer

Common to All Alternatives

All alternatives would have both beneficial and adverse effects on black-tailed deer. Each alternative would provide a mixture of early and late seral stages that would be expected to support viable populations of black-tailed deer. However, individual herd numbers would vary by alternative.

Table 4-22 compares the Forest-wide weighted index habitat suitability rating for black-tailed deer by alternative for cover and feeding habitat. Refer to Appendix I for habitat suitability values for each forest type and seral stage.

Forest-wide habitat capability values for forage and cover are moderate throughout the fifth decade, but some fluctuations do occur. However, the Forest-wide assessment is based on predicted changes in the amounts, size class and density of forested vegetation only. It does not account for the potential benefits which would result from burning and other habitat improvements. Therefore, the change in forage condition could be better than what the Forest-wide values show.

Table 4-22. Habitat Suitability for Black-Tailed Deer (Weighted Index)

Alternative	Fifth Decade
Cover (Current (1987) = 0.552)	
PFD	0.565
CUR/RPA	0.575
A	0.545
B & B'	0.568
C	0.572
D & D'	0.595
G(SOHA)	0.567
Feeding (Current (1987) = 0.664)	
PFD	0.638
CUR/RPA	0.654
A	0.658
B & B'	0.651
C	0.662
D & D'	0.633
G(SOHA)	0.657

Note: Low capability = 0.333, Moderate capability = 0.666, High capability = 1.000. These values should be used to compare trends in habitat.

Regulation Class 1 and 2 lands have the potential to provide foraging habitat for deer. The percentage of the Forest land base allocated to these regulation classes varies by alternative. The amount of prescribed burning, another management activity which can improve deer forage habitat, also varies by alternative.

Emphasis on rejunvenation of decadent and mature bitterbrush communities on the eastside would help stabilize those communities. An improvement in the distribution of browse classes by seral stage would likely increase populations in the McCloud Flats Herd Area.

Open road densities can affect deer populations, especially during the hunting season, by providing public access. The average open road density varies by alternative. Hardwoods provide nutritious forage for deer. The discussion of effects on the hardwood MIS species is applicable to black-tailed deer. All alternatives designate management areas in which the objec-

tive of providing deer habitat is coemphasized with other resource needs.

Consequences Unique to the Preferred Alternative

Timber stand regeneration, which would result in early seral-stage vegetation, would be an acceptable management practice on 18% of the Forest. About 23,925 acres per year of prescribed burning and other fuel treatment would be planned to reduce fuel loading for other than site preparation needs. This activity could benefit forage production as well. About 900 acres a year would be treated to improve big game habitat. Methods would include crushing brush to stimulate new growth, thinning oak stands to improve mast production and prescribed burning to stimulate new growth of forage. This alternative would also provide for the inventory and mapping of winter and summer habitat.

The overall change in habitat capability values of forest types for cover and feeding would be a 2% increase and a 4% decrease, respectively by the end of the fifth decade. Forage capabilities would increase on the eastside, but decrease by an equal amount on the westside of the Forest. This should help improve forage conditions in the McCloud Flats Herd Area.

The level of prescribed burning, wildland fire, treatment of hardwoods and chaparral vegetation types might help stabilize populations, rather than result in large declines. An increase in the number of acres to be treated on the eastside could benefit those populations.

Approximately 83,000 acres would be managed specifically for winter range. Management activities would be consistent with Deer Herd Management Plans and would be designed to improve forage to cover ratios and forage quality. Competition with livestock grazing might occur in some local areas, although shifting concentrations of livestock away from sensitive areas such as riparian habitat would be emphasized.

The average open road density on regulated land would increase from 2.65 miles per square mile in the current situation to 3.09 miles per square mile by the end of the fifth decade. This density falls within the range for poor habitat capability.

Consequences Unique to Current/RPA Alternative

Timber stand regeneration, which would result in early seral-stage vegetation, would be an acceptable management practice on 33% of the Forest. About 410 acres per year of prescribed burning and other fuel treatment would be planned to reduce fuel loading for other than site preparation needs. This activity could benefit forage production as well. In addition, 600 acres of habitat would be improved annually and would include crushing brush to stimulate growth and thinning in oak stands to increase mast production.

The overall change in habitat capability values for cover and feeding would be a 4.2% increase and a 1.5% decrease, respectively, by the end of the fifth decade.

Approximately 128,000 acres of forested habitat would be managed to produce both timber and deer habitat as Regulation Class 2. Prescriptions would be consistent with Deer Herd Management Plans and would be based on such things as forage to cover ratios and forage quality. Competition with livestock grazing might occur in some local areas particularly riparian habitat.

The average open road density on regulated land would decrease slightly from 2.65 miles per square mile in the current situation to 2.51 miles per square mile by the end of the fifth decade. This density falls within the range for moderate habitat capability.

Consequences Unique to Alternative A

Timber stand regeneration, which would result in early seral-stage vegetation, would be an acceptable management practice on 28% of the Forest. About 9,100 acres of prescribed burning and other fuel treatment per year would be planned to reduce fuel loading for other than site preparation needs.

Included in these acres are 2,000 acres a year that would be treated by prescribed burning to stimulate forage. In addition, about 600 acres a year would be treated to improve big game habitat through methods such as crushing brush to stimulate new growth and thinning oak stands to improve mast production. This alternative would also provide for the inventory and mapping of winter and summer habitat.

The overall change in habitat capability values for cover and feeding would be a 1.3% decrease and a 0.9% decrease, respectively, by the end of the fifth decade.

About 500,000 of forested habitat would be managed to produce both timber and deer habitat as Regulation Class 2. Prescriptions would be consistent with Deer Herd Management Plans and would be based on such things as forage to cover ratios and forage quality. Competition with livestock grazing may occur in some local areas, although this alternative would emphasize shifting concentrations of livestock away from sensitive areas such as riparian habitat.

The average open road density on regulated land would increase from 2.65 miles per square mile in the current situation to 2.92 miles per square mile by the end of the fifth decade. This density falls within the range for moderate habitat capability.

Consequences Unique to Alternatives B and B'

Timber stand regeneration, which would result in early seral-stage vegetation, would be an acceptable management practice on 22% of the Forest. About 4,550 acres per year of prescribed burning and other fuel treatment would be planned to reduce fuel loading for other than site preparation needs. In addition, about 1,100 acres a year would be treated to improve big game habitat. Methods would include crushing brush to stimulate new growth, thinning oak stands to improve mast production and prescribed burning to stimulate new growth of forage (500 acres of prescribed burning acres also included in 4,550 acre total above). These alternatives would also provide for the inventory and mapping of winter and summer habitat.

The overall change in habitat capability values for cover and feeding would be a 2.9% increase and a 2.0% decrease, respectively, by the end of the fifth decade.

About 336,000 acres of forested habitat would be managed to produce both timber and deer habitat as Regulation Class 2. Prescriptions would be consistent with Deer Herd Management Plans and would be based on such things as forage to cover ratios and forage quality. Competition with livestock grazing might occur in some local areas, although these alternatives would emphasize shifting concentrations of livestock away from sensitive areas such as riparian habitat.

The average open road density on regulated land would decrease from 2.65 miles per square mile in the current situation to 2.29 miles per square mile by the end of the fifth decade. This density falls within the range for moderate habitat capability.

Consequences Unique to Alternative C

Timber stand regeneration, which would result in early seral-stage vegetation, would be an acceptable management practice on 29% of the Forest. About 4,550 acres a year of prescribed burning and other fuel treatment would be planned to reduce fuel loading for other than site preparation needs.

About 1,100 acres a year would be treated to improve big game habitat. Methods would include crushing brush to stimulate new growth, thinning oak stands to improve mast production and prescribed burning to stimulate new growth of forage (500 acres of prescribed burning are also included in 4,550 acre total above). This alternative would also provide for the inventory and mapping of winter and summer habitat.

The overall change in habitat capability values for cover and feeding would be a 3.6% increase and a 0.3% decrease, respectively, by the end of the fifth decade.

About 128,000 acres of forested habitat would be managed to produce both timber and deer habitat as Regulation Class 2. Prescriptions would be consistent with Deer Herd Management Plans and would be based on such things as forage to cover ratios and forage quality. Competition with livestock grazing might occur in some local areas, although this alternative would emphasize shifting concentrations of livestock away from sensitive areas such as riparian habitat.

The average open road density on regulated land would decrease from 2.65 miles per square mile in the current situation to 2.29 miles per square mile by the end of the fifth decade. This density falls within the range for moderate habitat capability.

Consequences Unique to Alternatives D and D'

Timber stand regeneration, which would result in early seral-stage vegetation, would be an acceptable management practice on 28% of the Forest. About 5,160 acres per year of prescribed burning and other fuel treatment would be planned to reduce fuel loading for other than site preparation needs.

About 1,100 acres per year would be treated to improve big game habitat. Methods would include crushing brush to stimulate new growth, thinning oak stands to improve mast production and prescribed burning to stimulate new growth of forage (500 acres of prescribed burning acres are included in 5,160 acres total above). These alternatives would also provide for inventorying and mapping winter and summer habitat.

The overall change in habitat capability values for cover and feeding would be a 7.8% increase and a 4.7% decrease, respectively, by the end of the fifth decade.

Approximately 51,000 acres of forested habitat would be managed to produce both timber and deer habitat as Regulation Class 2. Prescriptions would be consistent with Deer Herd Management Plans and would be based on such things as forage to cover ratios and forage quality. Competition with livestock grazing might occur in some local areas, although these alternatives would emphasize shifting concentrations of livestock away from sensitive areas such as riparian habitat.

The average open road density on regulated land would decrease from 2.65 miles per square mile in the current situation to 2.37 miles per square mile by the end of the fifth decade. This density falls within the range for moderate habitat capability.

Consequences Unique to Alternative E

Timber stand regeneration, which would result in early seral-stage vegetation, would be an acceptable management practice on 20% of the Forest. About 3,150 acres per year of prescribed burning and other

fuel treatment would be planned to reduce fuel loading for other than site preparation needs.

About 1,100 acres per year would be treated to improve big game habitat. Methods would include crushing brush to stimulate new growth, thinning oak stands to improve mast production and prescribed burning to stimulate new growth of forage (500 acres of prescribed burning included in 3,150 acre total above). This alternative would also provide for the inventory and mapping of winter and summer habitat.

Approximately 128,000 acres of forested habitat would be managed to produce timber and deer habitat as Regulation Class 2. Prescriptions would be consistent with Deer Herd Management Plans and would be based on such things as forage to cover ratios and forage quality. Competition with livestock grazing might occur in some local areas, although grazing would be eliminated in the wilderness.

The average open road density on regulated land would increase from 2.65 miles per square mile in the current situation to 2.91 miles per square mile by the end of the fifth decade. This density falls within the range for moderate habitat capability.

Consequences Unique to Alternative G(SOHA)

Timber stand regeneration, which would result in early seral-stage vegetation, would be an acceptable management practice on 42% of the Forest. About 410 acres of prescribed burning and other fuel treatment per year would be planned to reduce fuel loading for other than site preparation needs. This activity could result in increased forage production. In addition, habitat improvement would occur on 600 acres annually for the purpose of increasing forage and mast production.

The overall change in habitat capability values for cover and feeding would be a 2.7% increase and a 1.1% decrease, respectively, by the end of the fifth decade.

Approximately 43,000 acres of forested habitat would be managed to produce both timber and deer habitat on the Goosenest Ranger District as Regulation Class 2. Prescriptions would be consistent with Deer Herd Management Plans and would be based on such things as forage to cover ratios and forage quality. Competition with livestock grazing might occur in some local areas, particularly riparian habitats.

The average open road density on regulated land would decrease from 2.65 miles per square mile in the current situation to 2.37 miles per square mile by the end of the fifth decade. This density falls within the range for moderate habitat capability.

Hardwood MIS

Consequences Common to All Alternatives

None of the alternatives propose site conversion of currently stocked, pure hardwood stands. Habitat for species which use pure hardwood stands would be maintained.

The standards and guidelines which address the maintenance of the hardwood component within managed conifer stands vary by alternative. This direction would have the most influence on habitat capability in Douglas-fir and mixed conifer Regulation Class 1 and 2 areas where regeneration harvesting would occur. They would generally have less influence on habitat quality in Regulation Class 3 areas where timber harvesting would remove only specified trees with the exception of fire salvage.

Although hardwood-associated wildlife species are expected to persist in all alternatives, their local abundance relative to habitat capability would vary by alternative. In unregulated and Regulation Class 3 areas, local populations of hardwood-associated species would be influenced by the abundance and condition of hardwoods that occur within Douglas-fir and mixed conifer stands.

Effects on hardwood-associated species would be better measured at the project level.

Consequences Common to Alternatives Current/RPA, B, B', D, D' and G(SOHA)

In these alternatives, the objectives are to maintain from 2 to 8 square feet of basal area per acre of hardwoods where hardwoods occur with conifers. Lands managed for lower timber yields would retain more hardwoods than lands managed for higher timber yields. These standards and guidelines for hardwood retention would provide for low capability hardwood habitat in all regulated areas.

These areas would include about 674,000 acres of currently stocked Douglas-fir and mixed conifer forest which would be managed as Regulation Classes 1 and 2 in the Current/RPA Alternative. It would include about 208,200 and 415,000 acres of currently stocked Douglas-fir and mixed conifer stands which would be managed as Regulation Classes 2 and 3, respectively in Alternatives B and B'.

About 311,000 acres of currently stocked Douglas-fir and mixed conifer would be managed as Regulation Classes 1 and 2, while about 168,600 acres would be managed as Regulation Class 3 in Alternatives D and D'. Approximately 607,000 acres of currently stocked Douglas-fir and mixed conifer forest would be managed as regulated land in Alternative G(SOHA).

Consequences Unique to the Preferred Alternative

The objective would be to maintain from 10 to 35 square feet of basal area per acre of hardwoods where

hardwoods occur with conifers. Lands managed for lower timber yields are expected to provide more hardwoods than lands managed for higher timber yields. There are approximately 349,000 acres of currently stocked Douglas-fir and mixed conifer stands that would be managed as Regulation Class 2 which could potentially provide moderate habitat capability for hardwood-associated species over time. The approximately 30,100 acres of currently stocked Douglas-fir and mixed conifer stands that would be managed as Regulation Class 3 could potentially provide high habitat capability over time.

Consequences Unique to Alternative A

Hardwood retention standards and guidelines would vary by Regulation Class. Within Regulation Class 3 areas, the approximately 155,000 acres of currently stocked Douglas-fir and mixed conifer stands would potentially provide for high capability habitat. The approximately 101,600 acres of currently stocked Douglas-fir and mixed conifer forest that would be managed as Regulation Class 2 would provide for moderate capability habitat. Areas managed as Regulation Class 1, approximately 189,600 acres of currently stocked Douglas-fir and mixed conifer forest, would provide for low habitat capability.

Consequences Unique to Alternative C

Hardwood retention standards and guidelines would vary by regulation class and vegetation type. Hardwoods could be left scattered or in clumps. With such variability, it is difficult to gauge the potential effects of this alternative. Regulation Class 1 and 2 areas, approximately 170,600 acres, could potentially provide low to moderate habitat capability for hardwood-associated species over time. The approximately 194,000 acres of currently stocked Douglas-fir and mixed conifer stands that would be in Regulation Class 3 could potentially provide for moderate habitat capability over time.

Consequences Unique to Alternative E

The standards and guidelines for hardwood retention would provide for low capability hardwood habitat on Regulation Class 2 and 3 areas. Approximately 180,000 acres of mixed conifer and Douglas-fir would be Regulation Class 2. Approximately 27,300 acres would be Regulation Class 3.

Snag MIS

Comparison of Alternatives

Snag retention standards and guidelines vary among alternatives from 1.5 per acre in Alternatives Current/RPA and G(SOHA) to an average of 5 per acre in the Preferred Alternative. Standards and guidelines also vary by regulation class in some alternatives. Most alternatives include requirements for live tree retention to provide for "future" snags (refer to Chapter 3 - Wildlife). Refer to Methodology earlier in this section for information on optimum habitat levels for snag-dependent species.

Consequences Unique to Preferred Alternative

Approximately 865,000 acres of stocked, forested land would be unregulated. The quality of habitat for snag-dependent species would vary from high to low depending on the density, size, height and decay class of snags occurring within the forested stands.

Snag densities within LSRs and RRs would gradually increase as stands age and mortality occurs. Salvage in LSRs would be limited to treatment of large mortality events such as fires and insect infestations. On matrix and AMA lands, standards and guidelines for snag management would include retention and recruitment of an average of 5 snags per acre in a variety of size and age classes, measured on a landscape basis, including at least 2 snags per acre in the largest available size class. Retention of green replacement trees in clumps with retained snags would provide a large amount of future snags. Overall, this alternative would provide for high population levels of snag-dependent wildlife, 100% of optimum levels over time.

Consequences Unique to Current/RPA Alternative

Approximately 668,000 acres of stocked forested land would be unregulated. The quality of habitat for snag-dependent species would vary from high to low depending on the density, size, height and decay class of snags occurring within the forested stands. On the approximately 680,000 forested acres managed for some level of timber output, snag retention would allow for maintenance of 40% of optimum habitat levels of snag-dependent species over time. Some temporary loss of local populations would occur as well. Green replacement tree guidelines would provide for a low level of future snags.

Consequences Unique to Alternative A

Approximately 645,000 acres of stocked, forested land would be unregulated. The quality of habitat for snag-dependent species would vary from high to low depending on the density, size, height and decay class of snags occurring within the forested stands. Approximately 711,000 acres would be managed to provide some level of timber output. Roughly 2/3 of these acres would be in Regulation Class 2 or 3 lands where snags would be managed at levels close to or below that necessary to maintain 40% of optimum population levels of snag-dependent species. Green replacement tree guidelines on these areas would provide for moderate to low levels of "future" snags. Snag management on Regulation Class 1 areas would maintain populations at less than 40% of optimum;

green replacement tree guidelines would provide for a low level of future snags.

Consequences Unique to Alternatives B and B'

Approximately 500,000 acres of stocked, forested land would be unregulated. The quality of habitat for snag-dependent species would vary from high to low depending on the density, size, height and decay class of snags occurring within the forested stands. Approximately 877,000 acres would be in Regulation Classes 2 and 3 where snags management would provide for maintenance of 40 to 70% of optimum levels of snag-dependent populations over time. The guidelines for green replacement trees would provide a moderate amount of future snags.

Consequences Unique to Alternative C

Approximately 707,000 acres of stocked, forested land would be unregulated. The quality of habitat for snag-dependent species would vary from high to low depending on the density, size, height and decay class of snags occurring within the forested stands. Approximately 645,000 acres would be managed as Regulation Classes 1, 2 and 3. Snag retention guidelines would provide for maintenance of 40 to 100% of optimum levels of snag-dependent populations over time. The guidelines for green replacement trees would provide a moderate amount of future snags.

Consequences Unique to Alternatives D and D'

Approximately 634,000 acres of stocked, forested land would be unregulated. The quality of habitat for snag-dependent species would vary from high to low depending on the density, size, height and decay class of snags occurring within the forested stands. Approximately 741,000 acres would be managed as Regulation Classes 1, 2 and 3. Snag retention guidelines would provide for maintenance of 60 to 80% of optimum levels of snag-dependent populations over time. Retention of green replacement trees within managed acres would provide for moderate to high level of future snags as well.

Consequences Unique to Alternative E

Approximately 954,000 acres of stocked, forested land would be unregulated. of The quality of habitat for snag-dependent species would vary from high to low depending on the density, size, height and decay class of snags occurring within the forested stands. Approximately 385,000 acres would be in Regulation Class 2 and 3. Snag and green replacement tree guidelines applied on those managed acres would provide for moderate to high levels of snag-dependent species over time.

Consequences Unique to Alternative G(SOHA)

Approximately 534,000 acres of stocked, forested land would be unregulated. The quality of habitat for snag-dependent species would vary from high to low depending on the density, size, height and decay class of snags occurring within the forested stands. Approximately 846,000 acres would be in Regulation Classes 1, 2 and 3. Snag management guidelines would maintain snag-dependent populations at less than 40% of optimum over time. There would be no provision for future snags.

Riparian: River/Stream and Marsh/Lake/Pond

Comparison of Alternatives

The alternatives are assessed based on the management intent of the standards and guidelines relating to riparian areas. All alternatives would establish RRs or RMZs, but these would vary in width for each alternative as well as in the intensity of timber management permitted and in whether or not intermittent and ephemeral areas are included. RMZs which do not include intermittent and ephemeral areas would be less beneficial for riparian species which occur in headwater habitats such as the tailed frog.

Consequences Unique to the Preferred Alternative

This alternative would have the largest and most extensive RRs. Refer to Biological Diversity section for a description. These areas would be unregulated. The Aquatic Conservation Strategy would guide the management of these areas. Watershed restoration, as well as Key Watersheds and watershed analysis, emphasize the maintenance and restoration of healthy aquatic systems. These standards and guidelines would promote high habitat quality in riparian habitats.

Consequences Common to Alternatives Current/RPA and G(SOHA)

RMZs would extend a minimum of 100 feet on either side of perennial streams and ponds; they would be in Regulation Class 3. Intermittent streams and other riparian areas would be dealt with on a case by case basis. Standards and guidelines require maintenance of 80% shade on water surfaces. These 2 variables fall within the range of moderate habitat capability according to the Forest's HCM. Regulation Class 3 RMZs, however, could affect the ability to maintain or provide other habitat variables (for example, water temperature, amount of dead and down, number of snags, etc.) at moderate or high habitat capability.

Consequences Unique to Alternative A

RMZs would extend 100 feet on either side of all perennial streams, designated intermittent or

ephemeral streams and around meadows, lakes, ponds, seeps, springs and bogs. This covers a broader range of riparian habitats than in the current situation.

RMZs would be in Regulation Class 3. Shade would be required on 80% of water surfaces in RMZs. The RMZ width and percent cover variables fall within the range of moderate habitat capability according to the Forest's HCM. RMZs in Regulation Class 3, however, could affect the ability to maintain or provide other habitat variables (for example, water temperature, amount of dead and down, number of snags, etc.) at moderate or high habitat capability. Areas with watershed concerns would be managed to meet watershed recovery objectives. This would likely lead to improved conditions for riparian MIS in those areas more quickly than with a continuation of current management.

Consequences Unique to Alternatives B and B'

RMZs would extend 100 feet on either side of all perennial waters; these areas would be unregulated. The objective would be to develop or maintain a 100% canopy closure on perennial water surfaces. These variables fall within the range of moderate to high quality habitat for the Forest's riparian MIS species. Since RMZs apply only to perennial systems, management of other riparian habitats could create low habitat quality.

Consequences Unique to Alternative C

RMZs would extend a minimum of 100 feet on either side of all perennial riparian systems and would extend beyond 100 feet where necessary to incorporate all riparian vegetation. RMZ objectives include bank stability, low water temperature, healthy bank vegetation and other water quality and wildlife habitat objectives. Intermittent and ephemeral streams would be managed to maintain downstream water quality and any on-sight riparian vegetation or moisture-dependent wildlife habitat attributes. These variables rate a moderate to high habitat quality in perennial riparian habitats with an additional emphasis on the management of intermittent and ephemeral systems.

Consequences Unique to Alternatives D and D'

Watershed management would be emphasized with Sensitive anadromous fish stocks receiving special attention. RMZ widths would vary depending on the sensitivity of the fisheries resources. RMZ widths for perennial streams would vary from 150 to 300 feet on either side. Management in these areas would focus on water temperature, CWD and the re-establishment of large conifers. Intermittent and ephemeral riparian areas would have an unregulated 100 foot wide RMZ with an adjacent 100 foot wide zone which would be managed for both timber and riparian resources as Regulation Class 2. These variables rate a moderate to high habitat quality for riparian associated MIS.

Consequences Unique to Alternative E

Perennial riparian areas would be managed through the establishment of 100-foot wide unregulated RMZs. The objective of vegetative management would be to provide 80% shade on the surface of perennial waters. These variables fall within the range of moderate to high quality habitat for the Forest's riparian MIS species. Because only perennial streams are included, other riparian habitats may be at risk of providing only low habitat quality due to management activities.

Mature Ponderosa Pine Forest MIS

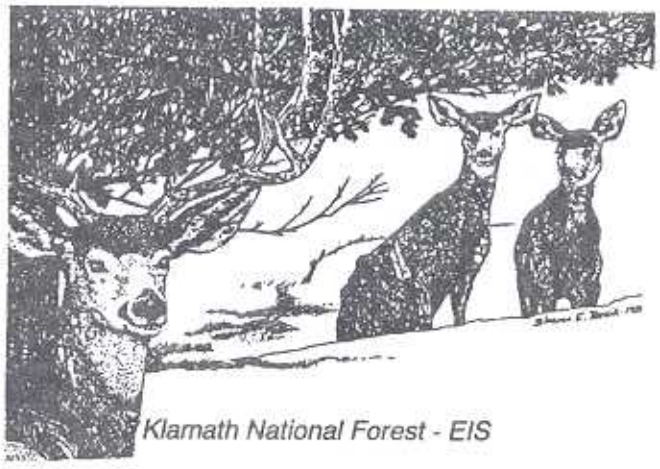
Refer to seral stage discussion in the Biological Diversity section.

Game Species

Elk

Elk populations are expected to increase on the westside of the Forest with all alternatives, because populations are currently small and not restricted by limited resources. Monitoring to identify key use areas and movement patterns would be continued in cooperation with CDFG. This information would be used to better manage for elk herds.

The Preferred Alternative would include standards and guidelines which direct the Forest to develop a management strategy in cooperation with CDFG, manage key winter and spring use areas, manage open roads where appropriate and work with CDFG to increase public awareness and support for the elk management program. Although specific habitat needs differ, in general, the environmental consequences displayed for black tailed deer can be applied to elk.



Fisheries

Important Interactions

Anadromous and resident fish species experience a number of human and natural factors which affect their growth, reproductive success and survival. Human activities affecting fish and fisheries habitat include road construction; timber harvesting; grazing; mining; water diversions; hatchery activities; commercial, sport and tribal fishing; and recreation (refer to Chapter 3 - Fisheries for discussion). Some of these activities originate outside of the Forest boundary.

Natural factors influencing fisheries resources include wildfire, landslides, flood, drought, disease, climatic conditions and ocean productivity cycles (refer to Physical Environment - Important Interactions, Geology and Soils earlier in this chapter). Occurring independently or in combination, human and natural factors affect the abundance and diversity of fish populations and their habitat.

Methodology

Index streams for which existing condition information was available were used to estimate how each alternative's management direction might affect the fish habitat criteria listed in Table 3-16. The 19 index streams are assumed to be representative of the Forest as a whole. The evaluation of consequences on fish habitat was based primarily on changes in habitat that would result from changes in sediment yields and levels of watershed restoration and location of potential areas of disturbance.

Sediment yields were developed through analysis of the soil and geologic conditions (refer to the Geology and Soils sections in this chapter). Levels of watershed restoration were projected from 1987-1991 levels and from estimates of where regeneration harvesting would occur.

Changes in habitat conditions were used to estimate changes in existing smolt production of anadromous salmonids and rainbow trout. Existing smolt production was estimated by intensive biological surveys using the methodology of Hankin and Reeves (1988). These counts provide a 'snap-shot' view of standing crops at one moment in time and may vary according to habitat conditions present. Rainbow trout numbers were estimated by multiplying available acres of habitat times an average density of rainbow trout per acre (Platts and McHenry, 1988). The number derived from literature may over-estimate the existing densities found on the eastside of the Forest (Goosenest Ranger District).

The smolt output numbers are for comparision purposes only and are not intended to reflect actual outputs. Actual outputs are affected by natural and human-influenced fluctuations in number of adults returning to spawn, on- and off-Forest suitability and stochastic events.

Using sediment yield as the primary driver for quantitative analysis of changes in habitat and for smolt output estimates has some uncertainities and limitations associated with it. While there is sufficient support to show that increased or high sediment yields influence fish and their habitat (USDA Forest Service et.al., 1993; Meehan, 1991; Harr and Nichols, 1993), the processes involved in delivering sediment to streams are not clearly understood. There is also a missing link between sediment delivery to channels and its subsequent transport in streams (Chen, 1992). A lag time coefficient was included in the estimates to account for the delay when various management activities and their influence on habitat conditions occur.

Environmental Consequences

Riparian Management

Comparison of Alternatives

Alternatives Preferred, D and D' would have the widest RRs/RMZs for perennial, intermittent and ephemeral streams with no programmed timber yields. Alternatives A and C would also specify RMZs for all 3 stream categories; however Alternative A would program minimal timber yields in all 3 stream category RMZs. Alternative E would specify RMZs for perennial and intermittent streams. Alternatives Current/RPA, B, B' and G(SOHA) would not specify RMZs for intermittent or ephemeral streams. Current/RPA and G(SOHA) would program minimal timber yields in RMZs. (Refer to the Biological Diversity section for a more detailed description of RRs/RMZs.)

The Preferred Alternative, followed by Alternatives D and D' are expected to be the most effective for maintenance and protection of riparian fish habitat values due to the large RRs/RMZs and to the standards and guidelines relating to Key Watersheds and to refugia, respectively. Alternatives C and E would likely be the next most effective.

Alternatives Current/RPA, A and G(SOHA) would pose the greatest risk of damage to riparian ecosystems. Although vegetative manipulation would occur only to achieve riparian objectives, timber harvesting and other vegetative manipulation practices near streams would likely increase the amount of incidental sediment discharges to aquatic habitat. This could be significant on a localized basis. In addition, increased access to riparian habitat could occur as a consequence of these management practices which would increase disturbance levels within the RMZ.

Habitat Conditions

Comparison of Alternatives

Water Temperature and Stream Canopy Cover - All alternatives would require that shade be maintained

on at least 80% of the stream surface of all flowing water. This may meet habitat criteria for stream shade if current site water temperatures are optimal.

Where water temperatures are sub-optimal for fish production and survival, then any removal of riparian vegetation which provides shade to a stream may increase water temperatures in summer and decrease them in winter.

With the standard of 80% surface shade incorporated into each alternative, the rate of revegetation is the key factor which determines the length of time it will take to meet the criterion on individual streams.

The planned riparian restoration programs for each alternative indicate that Alternatives Preferred and E would permit Forest streams to reach the temperature and shade criteria in fewer years than would any other alternative. Alternatives A, B, B', D and D' would accomplish these criteria in the next most rapid period followed by Alternative C. Alternatives Current/RPA and G(SOHA) would be the slowest in recovering riparian areas to meet the temperature and shade criteria.

Fines and Embeddedness - The fisheries criteria for fines and embeddedness in spawning habitat are not currently met in several of the 19 streams surveyed (refer to Table 3-17).

Management activities which disturb the site, such as timber harvesting and road construction, are expected to generate sediment delivery from sources above stream channels on individual streams. The landslide production due to management activities and existing conditions alone would be less than the existing condition for all alternatives in all decades due to recovery factors (refer to Figure 4-2).

However, the cumulative landslide production which includes the effects of future wildfire is expected to exceed the existing sediment levels in Decade 2 for all alternatives (refer to Figure 4-3). Therefore, there could be further degradation of spawning substrate on individual streams.

As discussed in the Geology section, Alternatives Preferred, B and B' would be the best at controlling overall sediment production and would therefore have the least risk of degrading spawning habitat. Alternatives Current, C and G(SOHA) would be the least effective at controlling sediment production and would have the greatest risk of degradation to spawning habitat. The other alternatives would fall in between these 2 groups.

With increasing ERAs, sediment delivery to streams can be expected to increase. ERAs show a similar type of ranking for the alternatives as for sediment production, except that Alternative A would be in the high risk group and Alternative E would be in the low risk group (refer to Table 4-7). The difference is due to the fact that ERAs do not account for the effects of future wildfire or restoration projects.

Pools - Twelve of the 19 index fisheries streams meet the minimum criteria for pools (Table 3-17). Increased sediment delivery and a decrease in CWD recruitment would tend to reduce the habitat quality in these streams so that they may not meet the minimum criteria in the future.

Another factor influencing the frequency of primary pools in streams is the level of instream structure construction planned for each alternative (refer to Restoration section below). The lowest level would occur in Alternative C, the next lowest in Alternatives Current/RPA and G (SOHA). Alternatives Preferred, A, B, B', D and D' all plan structure construction at a higher level and the highest level would occur in Alternative E. In the Preferred Alternative, restoration levels would be established through an ecosystem analysis process which includes a comprehensive watershed analysis at the landscape/watershed scale. This approach is expected to maximize restoration effectiveness.

Due to this combination of factors, Alternatives Preferred and E would provide the conditions to meet the criteria for pool frequency most quickly. This alternative would be followed by Alternatives B and B' which have the next lowest ERA's and proposed structure construction in the middle range. Next would be Alternative A with relatively low ERA's, then Alternatives C, D and D' with Current/RPA slightly higher due to regulated RMZs. Alternative G(SOHA) would likely take the longest to attain fisheries criteria for primary pools in fish streams.

Coarse Woody Debris - Attainment of CWD values for fish habitat would require local refinement of suitable frequency ranges, reintroduction of material to habitat altered by management activities and natural events (short-term) as well as riparian revegetation and protection for the long-term recruitment of CWD.

Alternative E is expected to have the highest annual level of both instream habitat structure construction and riparian restoration. It is expected to meet the criteria for stream CWD in the shortest time.

Alternatives Preferred, A, B, B', D and D' would all have identical levels of instream and riparian habitat restoration. The Preferred Alternative would require the highest level of retention of standing trees for future recruitment of CWD and is expected to meet the criteria for CWD sooner than the other alternatives with the same restoration levels. Alternatives B and B' would have regulated RMZs and would be expected to take slightly longer than other alternatives with the same restoration levels.

Alternative C with a lower restoration level would take longer than the previous group of alternatives to meet the criteria. Alternatives Current/RPA and G(SOHA) would have regulated RMZs and are expected to take the longest to reach the CWD optimum for Forest streams.

Riparian Ground Cover - There is not sufficient data to evaluate the criteria for green trees in riparian areas. Using the previous Forest criteria of a minimum of 15 large trees per acre, none of the 19 index streams meet this criteria. Any removal of trees within riparian areas would increase the lag time between present level and the meeting of the need for large standing trees in riparian areas.

Alternatives Current/RPA and G(SOHA) would program minimal timber yields from all RMZs, while Alternatives B and B' would program minimal yields from ephemeral and intermittent RMZs. Alternatives Preferred, D and D' would have unregulated RRs/RMZs which would provide the most protection for existing green trees.

The restoration program would also affect the criteria for ground cover. Riparian habitat restoration would be largest in Alternative E, followed by Alternatives Preferred, A, B, B', D and D'. As discussed earlier, the Preferred Alternative may provide the most effective restoration program because of the comprehensive analysis at the landscape/watershed scale outlined by that alternative. Alternative C would have the next highest amount of riparian restoration. The least amount of riparian restoration would occur in Alternatives Current/RPA and G(SOHA).

The combination of riparian protection and restoration shows that the Preferred Alternative has the highest likelihood of meeting the riparian cover criteria. It would be followed by Alternatives E, D and D'. Alternatives Current/RPA and G(SOHA) have the least probability of meeting the criteria for standing green trees, while Alternative C would have the second least. The other alternatives would be between these groups.

Restoration

Consequences Common to All Alternatives

Watershed restoration projects provide important tools for limiting upslope sources of sediment, improving the condition of areas with watershed concerns and improving the quality of fish habitat. The program levels for watershed restoration projects are displayed in Table 4-15 in the Water section earlier in this chapter.

Actual watershed restoration levels may vary as restoration needs are identified in watershed-scale ecosystem analysis. Alternatives will minimize ground-disturbing activities within riparian areas providing greater protection of aquatic habitat.

Fish habitat restoration techniques can be applied in the riparian area, instream or on the hillslope. Fish habitat restoration is expected to increase smolt production and aquatic species diversity as habitat needs are attained.

Riparian Restoration - All alternatives would manage riparian areas for the continuing stability and productivity of riparian-dependent resources. Riparian restoration would emphasize meeting fisheries habitat criteria for stream canopy cover, CWD and ground cover through planting native vegetation including conifers.

It is important to implement riparian restoration silvicultural projects early in a program because of the additional time necessary for trees to reach size and density objectives and become fully functional in riparian ecosystems. Mixed conifer and Douglas-fir on the westside would reach objective size in 30 years and mixed conifer on the eastside would reach objective size in 22 years.

Instream Restoration - Instream structure construction would utilize natural materials. It would emphasize meeting the criteria for CWD and pool frequency which is expected to improve rearing habitat for juvenile fish as well as holding and spawning habitat for adults. However, the cost-effectiveness of these structures must be considered.

Hillslope Restoration - Watershed restoration which focuses on hillslope sediment sources would also play an important role in maintenance or restoration of aquatic and riparian habitat. This type of restoration would be expected to decrease landslide and surface derived sediment (refer to Geology and Water sections of this chapter). Hillslope restoration could also increase CWD recruitment.

Comparison of Alternatives

Table 4-23 displays the proposed annual budget for the Fisheries Program by alternative.

There are 2 fishery program budget elements. Administration includes surveys and study costs. Investments includes project design, implementation and monitoring. These budget allocations were used to establish the restoration level for each alternative.

Fish habitat restoration program levels would be lowest for Alternatives Current, C and G(SOHA). The RPA goal is to increase anadromous fish structural improvements and fishing capacity 26% over the current level. This would require a considerably higher budget than in the Current Alternative. Alternatives Preferred, A, B, B', D and D' would have an intermediate funding level. Alternative E would be highest. These investments would result in different accomplishment levels for riparian acre restoration and instream structure by alternative.

Table 4-23. Annual Fisheries Budget in Thousands of Dollars								
	Alternative							
Budget Element	PFD	CUR	A	B & B'	C	D & D'	E	G(SOHA)
Administration	970.8	734.2	970.8	970.8	734.2	970.8	1,229.8	734.2
Investments	1,140.0	862.1	1,140.0	1,140.0	862.1	1,140.0	1,444.1	862.1

Riparian Restoration - Alternatives investing more dollars in riparian restoration would be able to meet fish habitat needs for riparian characteristics more quickly, assuming a high rate of project effectiveness.

Riparian acres restored would range from an average of 966 acres per year for Alternatives Current and G(SOHA) to a high of 1,617 acres per year for Alternative E, a difference of 651 acres per year. The other alternatives would treat an average of 1,277 acres per year.

Instream Habitat Restoration - Instream habitat restoration depends on the dollars spent and 'appropriate' acres. 'Appropriate' acres are a subset of available acres and were determined using the current habitat conditions and estimates of where regeneration harvesting would occur. A notable difference between alternatives is the number of appropriate instream acres for restoration.

Table 4-24 displays the total number of available acres as well as the estimated number of 'appropriate' acres for anadromous and for Sensitive species by alternative.

Table 4-24. Available and 'Appropriate' Fish Instream Habitat Acres		
	Anadromous	Sensitive
Total Available Acres:	786	320
'Appropriate' Acres by Alternative:		
PFD	448	172
CUR/RPA	398	120
A	453	172
B & B'	746	320
C	454	120
D & D'	448	172
E	598	172
G(SOHA)	323	120

Alternatives B and B' would have the highest number of 'appropriate' acres for instream restoration. However, the Preferred Alternative may provide the most effective restoration program because of the comprehensive analysis at the landscape/watershed scale. Alternatives Current/RPA and G (SOHA) would have the lowest number of 'appropriate' acres. Alternatives B and B' would plan restoration projects on all available Sensitive species habitat acres in the first decade and would do the most towards restoring Sensitive species habitats and populations. The inappropriate habitat acres are expected to recover over time and become suitable for instream fish habitat restoration.

Alternatives B, B' and E would have the most active riparian restoration program when both dollars and appropriate acres are considered. Alternatives Preferred, A, D and D' would have the next highest level of riparian restoration. Alternatives Preferred, A, B, B', D, D' and E would be the most aggressive in restoring fish habitat quality in Forest streams. Refer to Table 4-26 for an estimation of how the restoration for each alternative would affect habitat productivity expressed in terms of smolt output numbers.

Alternatives Preferred, D and D' would have the highest level of watershed protection as well as high levels of watershed restoration and would, therefore, be expected to provide the best quality water for fish resources.

Alternatives A, B, B', D, D' and E would including funds for fencing of sensitive Goosenest riparian areas. Alternatives Current and G(SOHA) would be funded at current program levels and would treat less than 1/5 as much area as Alternatives Preferred, D and D'.

Fuels treatment - Alternatives which treat the most acres in their fuel management programs are expected to have the greatest reduction in acres burned at high intensity in future wildfires. As shown by Figure 4-10 in the Fire Management section of this chapter, the Preferred Alternative is projected to have the least acres burned by high intensity future wildfire in the fifth decade. The projection for the Preferred Alternative is very similar to the historical level of high intensity burn acres. Alternative A is projected to have the second least, followed by Alternatives D and D', C, B and B', G(SOHA), Current/RPA and E in increasing order.

Alternatives with the least projected high intensity acres are expected to best maintain riparian fish habitat components in the long-term and to recover more rapidly. However, there would be short-term increases in the sedimentation rate due to loss of surface cover from prescribed burning and other fuel treatment methods. The larger the fuel treatment program, the greater this short-term effect.

Alternatives with smaller fuel treatment programs and a corresponding higher risk of high intensity wildfire are expected to produce more sediment in the long-term

(refer to Geology section) due to a loss of surface cover and deeply rooted vegetation.

Habitat Quality Rating

Figure 4-7 illustrates the overall habitat rating at the end of Decade 1. It was obtained by combining the 19 index stream Habitat Quality Ratings for each alternative. The ratings for eastside and westside are displayed separately. The existing condition is also shown for comparison purposes as well as a subjective judgement of good, fair and poor.

On the eastside, Alternative E would have the highest estimated quality habitat, followed by B, B', Preferred and A, D and D', C, Current/RPA and then G(SOHA) in decreasing order. None of the alternatives are projected to be in the low category. On the westside, the Preferred Alternative would provide the best habitat conditions, followed closely by Alternative E, B', B, Current/RPA and A. Alternative G(SOHA) would provide for the lowest quality habitat. These values are an accumulation of conditions associated with the 19 survey streams and the qualitative evaluation of 46 additional streams. Conditions evaluated at the District level show greater fluctuations.

Outputs

Consequences Common to All Alternatives

The effects of management practices on fish habitat productivity and eventual smolt production are due to physical alterations in fish habitat. All alternatives would use BMPs which are designed to minimize disruption of soil and water resources during management activities.

Fish populations in the Klamath River and its tributaries are affected by the amount of fishing allowed in both the ocean and in the river by anglers. These effects are expected to be similar for all alternatives. The amount of land available for grazing and mining in each alternative would be similar enough that no difference in effects on fish habitat is expected on a Forest-wide basis.

Comparison of Alternatives

Table 4-25 compares the estimated outputs for each alternative.

Fish output projections were based on the potential change in fish habitat conditions on the Forest by management strategy. However, anadromous fish production on the Forest is directly affected by off-Forest activities and conditions such as commercial, sport and tribal fishing; CDFG hatchery practices; climatic trends; and ocean productivity levels. Projected outputs should be used for comparison purposes only, not as actual population targets.

Most of the fishery outputs show a range with Alternatives Current/RPA and G(SOHA) on the low end and Alternatives Preferred and E on the high end. There is a difference of 153,000 smolts per year for the first decade between the highest and lowest alternative for total Forest-wide smolt production.

Selected Fish Species

Comparison of Alternatives

The current population of spring chinook is of concern due to low numbers. This stock is thought to be at risk

Figure 4-7. Overall Habitat Rating by Alternative With Watershed Restoration

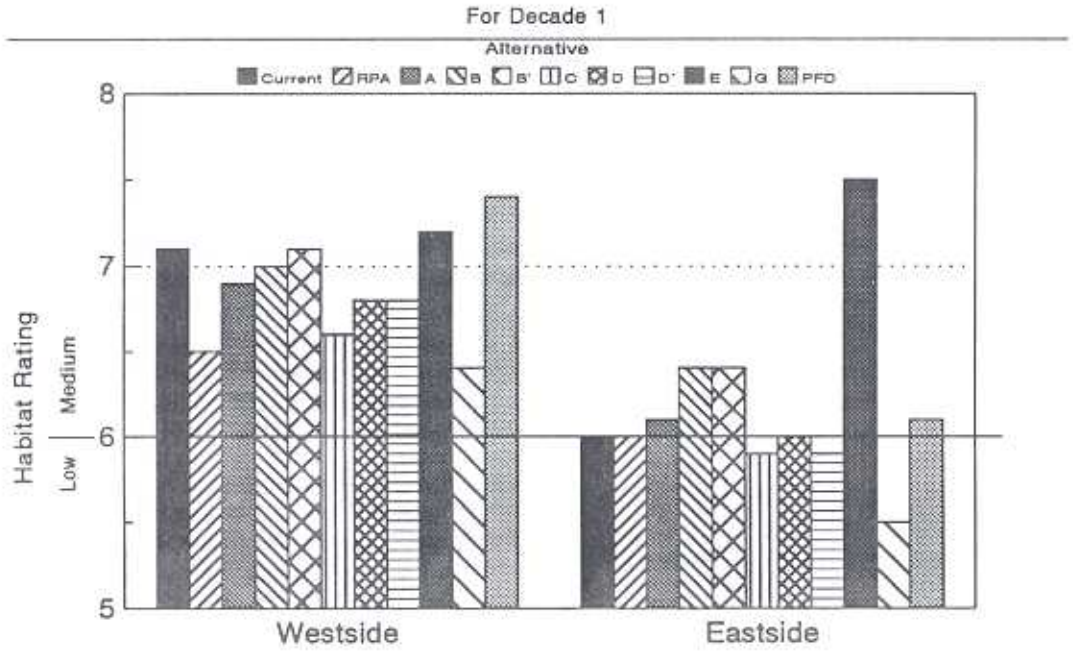


Table 4-25. Comparison of Annual Fisheries Outputs for Decade 1

Indicator	Alternative							
	PFD	CUR	A	B & B'	C	D & D'	E	G(SOHA)
Resident sport pound (thousands)	44.3	43.2	44.9	45.4	42.6	45.0	46.1	39.9
Tributary smolt production (thousands)	273	265	258	263/265	250	257	269	244
Forest smolt production (thousands)	1,487	1,417	1,425	1,437/1,456	1,372	1,417	1,477	1,334
Additional smolts from structure (thousands)	2.4	1.8	2.4	2.4	1.8	2.4	2.4	1.8
Riparian habitat (acres)	1,277	966	1,277	1,277	966	1,277	1,617	966
Additional smolts from acres (thousand)	239.7	181.2	239.7	239.7	181.2	239.7	303.6	181.2
Additional smolts from watershed restoration acres (thousands)	54.2	4.4	55.3	56.5	4.4	55.0	61.0	4.4
Total smolt production (thousands)	1,760	1,682	1,683	1,699/1,721	1,622	1,674	1,746	1,578

of loss. Recent data show the summer steelhead population to be approaching the same situation.

The analysis of risk ratios for selected compartment clusters indicates that portions of Sensitive species habitat presently have calculated ERAs which exceed the TOC (refer to Water section earlier in this chapter). These watersheds include East and West Elk Creek, Lower Clear Creek, Upper Indian Creek and East Indian Creek. The Indian and Elk Creek watersheds would remain above the TOC for all alternatives in Decade 1. Lower Clear Creek would remain above the TOC for Alternatives A, C, D and D' in the first decade. By the fifth decade, the Indian Creek watershed would drop below the TOC levels for all but Alternative E (Upper Indian Creek only). The Elk and Clear Creek watersheds are projected to recover by Decade 5 to below the TOC for all alternatives.

Alternatives with low or no programmed timber yields in critical watersheds and active restoration programs would afford Sensitive populations the greatest chance for recovery and for preservation of the remaining genetic richness of the stocks. However, the factors which are limiting to these populations are not completely understood and probably include many off-Forest factors.

The Preferred Alternative's proposal to manage Key Watersheds with special standards would have the most compatible management for these critical watersheds and the best chance for recovery. The management of refugia in Alternatives D and D' would likely provide the second most compatible management. Alternatives Preferred, A, B, B', D, D' and E would have relatively active habitat restoration programs.

The alternatives would have different acreage of Sensitive species habitat appropriate for restoration in the first decade (refer to Table 4-25). Alternatives which more quickly initiate restoration on acres affecting Sensitive species would have a much more positive effect on recovery of these populations. Alternative B and B' would have the most acreage appropriate for restoration. Alternatives Preferred, A, D, D' and E would have a moderate number of acres available. Alternatives Current/RPA, C and G(SOHA) would have the least acres available.

The Preferred Alternative is expected to have the most positive effect on the recovery of Sensitive fish populations on the Forest due to its management of Key Watersheds as well as the approach and size of its restoration program. There would be a shift away from in-stream structures and greater focus on restoring or maintaining upslope conditions.

Table 4-26 compares the estimated population numbers for selected species for each alternative in the first decade.

The population estimates for summer steelhead and spring chinook salmon are slightly greater than the Current Alternative for Alternatives Preferred, B, B' and quite a bit higher for Alternative E. The other alternatives would be the same or slightly lower than the Current Alternative.

The estimates of population increases would not be significant for any alternative for either of the 2 Sensitive species. When site-specific habitat variables are figured into survival at each life stage on the Forest, these populations may further decline. Factors beyond the Forest's control such as drought, ocean fishing,

Table 4-26. Estimated Number of Selected Fish Species Per Year for Decade 1								
	Alternative							
Indicator	PFD	CUR	A	B& B'	C	D&D'	E	G (SOHA)
Adult summer steelhead	1,462	1,343	1,430	1,454	1,351	1,414	1,558	1,360
Adult spring chinook	375	340	363	372	343	362	395	344
Rainbow trout (eastside)	11,128	11,430	11,156	11,567	10,817	10,927	13,104	10,297

dams and poaching have not been included in this analysis of population response to management activities. It is highly speculative to estimate the effect of habitat restoration alone.

The population estimates for rainbow trout on the eastside are slightly higher than the Current Alternative for Alternatives B and B' and considerably higher for Alternative E. The other alternatives would be the considerably lower than the Current Alternative.

Consequences Unique to Preferred Alternative

The consequences of designating Key Watersheds, the special management of RRs and the comprehensive watershed analysis requirements were not included in the Sediment Model as management decisions would be made at the project-level based on information from the ecosystem analysis process. The resulting productivity for Sensitive species could therefore be higher than that projected using Sediment Model outputs due to a possible reduction in sediment production from activities within the designated Key Watershed areas.

Wild and Scenic Rivers

Nomination of rivers to WSR status could increase fish values because waters will be managed to emphasize the outstanding values in the river corridor. Alternative E would recommend the most miles, followed by Alternatives A, Preferred, B and B', D and D', and then C in decreasing order. Alternatives Current/RPA and G(SOHA) would not recommend any additional miles for designation.

Resource Management Programs

Introduction

This section discusses the effects of the alternative management strategies proposed for each alternative on the existing resource management programs. It builds on the effects related to the physical and biological environments identified in the previous sections. The economic effects and the effects on the social environment will be discussed in the next section of this chapter.

Visual Resource Management

Important Interactions

Site-disturbing activities have a direct effect on the visual quality of the Forest. The size of the effect is a function of many factors including all aspects of project design, the size and type of the project, the construction equipment and practices used as well as the reclamation potential and success of the site. Activities or events that would have the greatest impact on visual quality are timber management, road construction, wildfire and mineral extraction.

Timber harvesting, site preparation, plantation establishment and road construction activities can affect visual quality. Road construction, clearcut and seed tree regeneration harvesting methods create the most severe effect on visual quality. They are followed by shelterwood, group selection, GTR and individual-tree selection cutting in decreasing order. Intensive timber management can change a natural-appearing landscape dominated by stands of mixed species and mixed age classes to one dominated by noticeable geometric patterns, even-age stands with color and textural contrasts.

Large wildfires can noticeably change the visual character of some landscapes. Wildfire can increase an area's natural diversity and alter its vegetative pattern. Natural succession creates new groups of plant species which differ in height, color and texture from the surrounding vegetation. The charred remains of wildfires can be noticeable for decades, yet they are considered natural appearing because wildfire has always been a natural component of the ecosystem.

However the fire salvage activities that usually follow wildfire can create unnatural-appearing contrasts. Road construction, logging and site preparation can create long-term visual contrasts.

Mineral development activities can create long-term impacts on visual quality. Vegetation removal, ground disturbance, road construction and the construction of structures create contrasts. Mineral development has traditionally occurred along watercourses where forest roads and trails are frequently located. Although only a few acres may be involved, these activities can visually dominate forest settings.

Methodology

Three key indicators were used to assess the consequences of each alternative:

1) Inventoried and Recommended Visual Quality Objectives,
2) Existing and Future Visual Condition and
3) Visual Quality Index.

The key indicators are elements from the Forest Service Visual Management System. Refer to Chapter 3 - Visual Resource Management for a more detailed description of the elements in the Visual Management System.

Inventoried and Recommended Visual Quality Objectives

Inventoried VQOs (IVQOs) are derived from an inventory of physical and social environmental factors. They set preliminary standards for the appearance of the landscape by a particular time in the future. They approximate the public's expectations for natural-appearing landscapes for all acres of the Forest. The IVQOs emphasize the maintenance of a more natural appearance in areas with special scenic attractions and near public use areas. Conserving visually untouched, pristine scenery is not a component or objective of the IVQOs.

Recommended VQOs are established for each alternative. The recommended VQOs are based on the objectives of the alternative and its mixture of management prescriptions. Consequently, each alternative has a unique mixture of VQOs. Once the Forest Plan is approved, the recommended VQOs in the selected alternative become Adopted VQOs. Effects are assessed by comparing the recommended VQOs for each alternative to the IVQOs.

Existing and Future Visual Conditions

Existing Visual Condition (EVC) describes the present appearance of the forest in terms of the amount of visible landscape alteration. The Future Visual Condition is a projection of the appearance created by each alternative. The 6 levels of visual condition range from Untouched to Drastic Disturbance with the first 5 levels corresponding to the 5 VQOs of Preservation to Maximum Modification. The sixth level, Drastic Disturbance, corresponds to the visual condition of Unacceptable Modification. Assessment of effects is based on predicting the future visual conditions and comparing them with the current visual conditions for each alternative.

Visual Quality Index

The Visual Quality Index (VQI) is a cumulative indicator of natural appearance. Based on a scale of 0 to 100, a VQI of 100 means that all Forest lands would meet the Preservation VQO which is a visually untouched state. Conversely, a score of 45 means all Forest lands would meet Maximum Modification. Values are weighted by the acres in variety class and VQO. "A" class scenery with Preservation VQOs score highest while "C" class scenery and Maximum Modification VQOs score lowest. The VQI quickly displays cumulative differences between alternatives as they relate to overall visual quality. Assessment of general effects is based on comparing the VQI scores for each alternative to determine the historic and projected future trends in overall natural character of the Forest.

Environmental Consequences

Consequences Common to All Alternatives

Preservation VQOs would be assigned to wilderness which would all retain a natural appearance. This is estimated as 381,100 acres or 23% of the total Forest acres.

All alternatives would retain the near-natural appearance of the Forest's eligible State Scenic Highways. The foreground and middleground distance zones as seen from Highways 3, 96, 97, 263 and Interstate 5 would be managed with a minimum VQO of Partial Retention, thereby retaining their near natural appearance. These zones represent 192,360 total acres along 230 miles of highway and average 835 acres per mile. This is considerably less than the 1,000 acre per mile maximum listed in the Regional guideline.

The immediate river environment of the Forest's designated National WSRs would retain a natural or near-natural appearance. The river corridors as delineated in Appendix J for the designated portions of the Klamath River, Scott River, Salmon River and Wooley Creek would be managed with VQOs of Partial Retention or Retention (includes both Recreational and Scenic classifications). This zone is approximately 51,000 acres (includes some eligible scenic highways listed above). Those segments of rivers in wilderness would be managed with a Preservation VQO as mentioned earlier.

Existing visual disturbances would gradually become revegetated and appear more natural over time. These existing contrasts; due primarily to previous logging, road construction and past hydraulic gold mining; vary widely in size and intensity. Hence the duration of their effect would vary.

A range of approximately 1.287 million to 1.295 million acres of NFS lands would be open to mineral entry under the various alternatives. Market conditions would greatly influence the amount of lands developed for minerals and visual effects would vary greatly from site to site. It is impossible to predict the actual effects until site-specific projects are proposed. It can be assumed that alternatives with more land open to mineral entry would have a greater likelihood of experiencing adverse visual effects.

An estimated 16,600 acres per year would burn in wildfires resulting in noticeable effects to the landscape. As wildfire is a natural process, these effects would be natural appearing. However the salvage activities following the wildfires could create noticeable man-caused effects. The intensity of the effect on visual quality would depend on the type of salvage undertaken.

An estimated 10 to 28 miles per year of new roads would be constructed under the alternatives, primarily to provide access to timber sale units. Visual effects from these roads would be highly variable depending on such factors as topography, road design, viewing distance and angle. Due to this variability, it is impossible to predict the actual visual effects of such activities.

Meeting VQOs and conserving naturally established scenic character may require mitigation measures such as retention of islands of vegetation in harvesting units, feathering of edges, shaping units, cutting stumps flush with the ground, lopping and scattering of tops, hand piling of slash and adjustments to road alignment and construction. These measures may increase per unit costs for timber sales and increase wildfire frequency and intensity, while generally being favorable to wildlife and watershed needs.

Comparison of Alternatives

Table 4-27 compares the VQOs that would be recommended for each alternative to the EVC and IVQO.

The VQI is a general cumulative rating of the visual condition of the entire Forest. Table 4-28 illustrates the VQI of each alternative for Decade 5 comparing the overall visual quality of each alternative to: 1) the other alternatives, 2) the minimum visual quality possible if

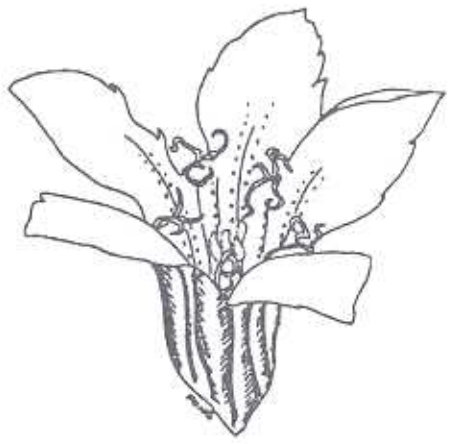


Table 4-27. Comparison of Recommended VQOs to IVQOs by Alternative by Thousand Acres (Percent of Total Forest Lands)

	Preservation	Retention	Partial Retention	Modification	Maximum Modification	Unacceptable Modification
EVC	742 (44%)	296 (18%)	205 (12%)	179 (11%)	101 (6%)	157.0 (9%)
IVQO	384 (23%)	164 (10%)	663 (39%)	418 (25%)	51 (3%)	0.0 (0%)
PFD	389 (23%)	128 (8%)	802 (47%)	248 (15%)	113 (7%)	0.0 (0%)
CUR/RPA	384 (23%)	95 (5%)	466 (28%)	488 (29%)	247 (15%)	0.0 (0%)
A	384 (23%)	438 (26%)	413 (25%)	87 (5%)	358 (21%)	0.0 (0%)
B & B'	386 (23%)	181 (11%)	719 (43%)	345 (20%)	49 (3%)	0.0 (0%)
C	406 (24%)	556 (33%)	486 (29%)	213 (13%)	19 (1%)	0.0 (0%)
D & D'	384 (23%)	122 (7%)	517 (31%)	421 (25%)	236 (14%)	0.0 (0%)
E	674 (40%)	611 (36%)	294 (18%)	51 (3%)	50 (3%)	0.0 (0%)
G(SOHA)	384 (23%)	95 (5%)	466 (28%)	488 (29%)	247 (15%)	0.0 (0%)

the Forest landscape was dominated by very obvious alterations, 3) the EVC and 4) the visual quality that would result if the VQOs were implemented.

Table 4-28. Visual Quality Index for Decade 5

VQI	Alternative or Indicator
100	Maximum VQI (assumes all lands meet Type I EVC or Preservation)
80	EVC of the Forest (1991)
79	IVQO
77	Preferred
73	Current/RPA
77	A
79	B and B'
83	C
74	D and D'
87	E
73	G (SOHA)
45	Minimum VQI (assumes all lands meet Type V EVC or Maximum Modification)

The VQI for the Forest's existing visual condition in 1991 was 80. If the entire Forest was in visual condition Class I (appearing essentially untouched), the VQI would be 100. This represents a 20% decline in the last 100-plus years of the Forest's overall natural character. If the Forest continues current management practices (Current/RPA), the VQI would be 73, representing a 27% decline in the next 50 years.

With the exception of Alternative E, irreversible and irretrievable effects would occur on a significant portion of the Forest's 742,000 acres of Class 1 'Untouched Landscapes.' About one-third of these visually pristine settings largely coincide with roadless areas that were released for potential development by legal authority of the 1984 California Wilderness Act. Approximately 360,000 acres (49% of Class 1 settings) of highly valued, visually unaltered settings would be noticeably changed, primarily to achieve timber, fuels and road construction objectives with Alternatives Current/RPA, B, B', C, D, D' and G(SOHA). However, Alternatives B, B', D, D' and E would recommend the 15,000 acre Siskiyou Crest Zone for designation as a Scenic SIA; this would maintain all Class 1 scenery in that area. Due to some released roadless areas being allocated to Backcountry, Alternative A would noticeably change about 327,500 acres (44% of Class 1 settings), while the Preferred Alternative would noticeably change about 331,000 acres (45%). Alternative E, by contrast, would retain the untouched scenic character in all roadless areas (about 241,000 acres) to achieve ecological and social objectives and only about 16% of the Class 1 landscapes would be altered.

Consequences Unique to the Preferred Alternative

This alternative would manage visual quality by adopting the IVQOs with some changes that reduce the natural appearance in some sensitive locations and increase it in others.

Reductions in visual quality from the IVQOs would occur in the following areas: 1) foreground zones of some Recreational WSR segments of the Scott and Salmon Rivers would be managed to achieve Partial Retention rather than Retention; 2) approximately half of the background views from high sensitivity viewpoints would be managed to achieve Modification rather than Partial Retention; 3) approximately two-thirds of the low sensitivity, seldom seen areas would

be managed to achieve Maximum Modification rather than Partial Retention or Modification as recommended by the IVQOs. These reductions in visual quality are made primarily to achieve timber, fuels and road construction objectives.

More natural appearing conditions than those recommended by the IVQOs would occur in the following areas:

1) LSRs encompassing many acres forest-wide would be managed to achieve a minimum VQO of Partial Retention, including areas the IVQOs recommend for Modification and Maximum Modification. The LSRs also overlap some background view areas that this alternative would otherwise manage as Modification.
2) RNAs, SIAs, Backcountry areas and Wild WSRs would also create significant acreages with a Retention VQO that would otherwise be managed for less natural-appearing settings.

This alternative would manage 1,319,000 acres (79%) of the Forest for the VQOs of Preservation, Retention and Partial Retention which would maintain natural or near natural appearing conditions. Preservation VQOs, totaling 389,000 acres (23%) would be assigned to wilderness and both designated and recommended Wild Rivers.

Lands managed for a Retention VQO total about 128,000 acres (8%) and include the foreground of most high sensitivity roads, trails and rivers. This would include the foreground and middleground of eligible State Scenic Highways such as 3, 263, 96, 97 and Interstate 5 as well as the corridors and viewsheds (middleground) of both designated and recommended Scenic rivers. RNAs, SIAs, Backcountry and the middleground of viewsheds of Wild Rivers would also be managed with a Retention VQO.

Partial Retention areas total about 802,000 acres (47%) and would occur in the middleground distance zones of high sensitivity routes and eligible State Scenic Highways, the foreground of moderate sensitivity travel routes and the corridors of both designated and recommended Recreational rivers. LSR, BVNG, Special Habitat, Manged Wildlife Areas, Cultural Areas and RRs would also be managed to achieve the Partial Retention VQO.

Society's activities would be allowed to visually dominate the landscape on 361,000 acres (22% of the total Forest). A Modification VQO would apply to 248,000 acres (15%) of the Forest and a Maximum Modification VQO to 113,000 acres (7%). This would meet the Regional Office guideline of not more than 3 to 7% of the total Forest acres in Maximum Modification. This alternative would modify approximately 14,700 of the 371,000 acres of variety class A scenery by managing these lands as Modification and Maximum Modification.

The VQI for this alternative would be 77. This represents a slight decline in the Forest's cumulative natural appearance from the existing condition rating of 80.

Consequences Common to Alternatives Current/RPA and G(SOHA)

Alternative Current/RPA is a projection of current Forest management. Alternative G(SOHA) is a projection of the management practices that were current in 1987. Both of these alternatives would manage the visual resource by using IVQOs as a base with the significant differences stated below.

On the westside of the Forest, the background distance zones of high sensitivity travel routes generally would be managed for other resource values such as timber production. These areas would be managed for a Modification VQO, whereas the IVQO would have been Partial Retention.

On the eastside of the Forest, gentler slopes and vegetative screening would decrease the visibility of management activities. This would allow the VQO of Partial Retention to be met in background distance zones from high sensitivity travel routes. Therefore, these areas would generally retain a natural appearance.

Alternatives Current/RPA and G(SOHA) would manage 945,000 acres (56%) of the Forest for the VQOs of Preservation, Retention and Partial Retention which would maintain natural or near-natural appearing conditions. This is the lowest acreage of all alternatives. Preservation areas totalling 384,000 acres (23%) would include wilderness and RNAs.

Retention areas which include the foreground distance zones of high visual sensitivity travel routes such as roads, rivers and trails would total 95,000 acres (5%).

The middleground distance zones for these travel routes would be managed to meet a VQO of Partial Retention. This equates to approximately 466,000 acres (28%) of the total Forest.

Society's activities would be allowed to dominate the landscape on 735,000 (44%) of the total Forest. Approximately 488,000 acres (29%) would be managed for Modification. Approximately 247,000 acres (15%) would be managed for a VQO of Maximum Modification.

This would represent an increase of 265,000 acres from both Modification and Maximum Modification IVQO levels. It would be nearly double the Regional guidelines which restrict Maximum Modification acres to no more than 3 to 7% of the total Forest acres. This alternative would modify approximately 44,000 acres of variety class A scenery by managing these lands as Modification and Maximum Modification.

The VQIs for these alternatives would be 73. These alternatives would create the greatest decline in the Forest's cumulative natural appearance from the existing condition rating of 80.

Consequences Unique to Alternative A

This alternative would manage for visual quality by assigning VQOs to each management area, consistent with the overall resource objectives for that area. This would create great contrasts in views or a "chopped up" appearance as one travels on the Forest's major travelways, trails and rivers.

This alternative would manage 1,235,000 acres (74%) of the Forest for the VQOs of Preservation, Retention and Partial Retention which would maintain natural or near-natural appearing conditions. Lands with a Preservation VQO total 384,000 acres (23%) and include wilderness, SIAs and all recommended RNAs.

Lands managed for a Retention VQO would total 438,000 acres (26%) and would include Backcountry (parts of Kangaroo, Condrey Mountain and Russian released roadless areas) and the corridors of both designated and recommended WSRs. Partial Retention areas total 413,000 acres (25%) and would occur in the foreground and middleground distance zones of high sensitivity routes and eligible State Scenic Highways, the foreground of moderate sensitivity travel routes and in the corridors of both designated and recommended Recreational rivers.

Society's activities would be allowed to dominate the landscape on 445,000 (26%) of the total Forest. Approximately 87,000 acres (5%) would be managed for Modification. Approximately 358,000 acres (21%) would be managed for a VQO of Maximum Modification. This would be 3 times the Regional Office guideline of no more than 3 to 7% of the total Forest acres in Maximum Modification. This alternative would modify approximately 38,000 acres of variety class A scenery, by managing these lands as Modification and Maximum Modification.

The VQI for this alternative would be 77. This would represent a slight decline in the Forest's cumulative natural appearance from the existing condition rating of 80.

Consequences Unique to Alternatives B & B'

These alternatives would manage for visual quality by adopting the IVQOs with some minor changes. The changes would be to create recommended VQOs for both the river corridors and the viewsheds of designated and recommended WSRs.

These alternatives would manage 1,286,000 acres (77%) of the Forest for the VQOs of Preservation, Retention and Partial Retention which would maintain natural or near-natural appearing conditions. Lands with a Preservation VQO total 386,000 acres (23%) and would include wilderness as well as existing and recommended Wild river corridors.

Lands managed for a Retention VQO total 181,000 acres (11%) and would include the foreground of high sensitivity routes, eligible State Scenic Highways, designated and recommended Scenic river corridors as well as viewsheds for designated and recommended Wild rivers and Scenic rivers. Lands managed for a Partial Retention VQO would total 719,000 acres (43%) and would include the middleground and background distance zones of high sensitivity routes, the foreground of moderate sensitivity travel routes and the viewsheds of both designated and recommended Recreational rivers.

Society's activities would be allowed to dominate the landscape on 394,000 acres (23%) of the total Forest. Approximately 345,000 acres (20%) would be managed for Modification and would be located in the middleground distance zone of moderate sensitivity routes and low sensitivity areas. Approximately 49,000 acres (3%) would be managed for a VQO of Maximum Modification which is consistent with the Regional guideline of no more than 3 to 7% in Maximum Modification. In this alternative, no variety class A lands would be managed as Modification or Maximum Modification.

The VQI for these alternatives would be 79. This would represent a slight decline in the Forest's cumulative natural appearance from the existing condition rating of 80.

Consequences Unique to Alternative C

This alternative would manage for visual quality by adopting IVQOs with some changes. The changes would be to create recommended VQOs for both the river corridors and the viewsheds of designated and recommended WSRs.

Alternative C would manage 1,448,000 acres (86%) of the Forest for the VQOs of Preservation, Retention and Partial Retention which would maintain natural or near-natural appearing conditions. This is the highest of any alternative. Lands with a Preservation VQO total 406,000 acres (24%) and include wilderness, RNAs and both existing and recommended Wild river corridors.

Lands managed for a Retention VQO total 556,000 acres (33%) and include the foreground of high sensitivity routes, eligible State Scenic Highways and both designated and recommended Scenic river corridors as well as Wild viewsheds and Scenic viewsheds. Partial Retention would total 486,000 acres (29%) and would include the middleground and background distance zones of high sensitivity routes, the foreground of moderate sensitivity travel routes and both the corridors and viewsheds of designated and recommended Recreational rivers.

Society's activities would be allowed to dominate the landscape on 232,000 acres (14%) of the total Forest. Approximately 213,000 acres (13%) would be managed for Modification and would be located in the middleground distance zone of moderate sensitivity routes and low sensitivity areas. Approximately 19,000 acres (1%) would be managed for a VQO of Maximum Modification which is significantly less than the Regional guideline of no more than 3 to 7% in Maximum Modification. In this alternative, no variety class A lands would be managed as Modification or Maximum Modification.

The VQI for this alternative would be 83. This alternative would be an improvement in the Forest's cumulative natural appearance from the existing condition rating of 80.

Consequences Unique to Alternative D and D'

These alternatives would manage for visual quality by adopting the VQOs in current use with some changes. The changes would create VQOs for designated and recommended WSRs corridors and viewsheds.

These alternatives would manage 1,023,000 acres (61%) of the Forest for the VQOs of Preservation, Retention and Partial Retention which would maintain natural or near-natural appearing conditions. Lands managed for a Preservation VQO would total 384,000 acres (23%) and would include wilderness.

Lands managed for a Retention VQO would total 122,000 acres (7%) including the foreground of high sensitivity routes, eligible State Scenic Highways and the corridors of designated and recommended WSRs. Lands managed for a Partial Retention VQO would total 517,000 acres (31%) including the middleground of high sensitivity travel routes and the foreground of moderate sensitivity routes.

Society's activities would be allowed to dominate the landscape on 657,000 acres (39%) of the total Forest. Approximately 421,000 acres (25%) would be managed for Modification. Approximately 236,000 acres (14%) would be managed for Maximum Modification which would be twice the regional guideline of no more than 3 to 7% of the Forest in Maximum Modification. These alternatives would modify approximately 32,000 acres of variety class A scenery by managing these lands as Modification or Maximum Modification.

The VQI for these alternatives would be 74. This would represent a decline in the Forest's cumulative natural appearance from the existing condition rating of 80.

Consequences Unique to Alternative E

This alternative would manage for visual quality by adopting the VQOs in current use with some minor changes. The changes would create VQOs for designated and recommended WSR corridors and viewsheds.

Alternative E would manage 1,579,000 acres (94%) of the Forest for the VQOs of Preservation, Retention and Partial Retention which would maintain natural or near-natural appearing conditions. Lands managed for a Preservation VQO would total 674,000 acres (40%) and would include wilderness, RNAs, Backcountry and both designated and recommended Wild river corridors.

Lands managed for a Retention VQO would total 611,100 acres (36%) including the foreground of high sensitivity routes, eligible State Scenic Highways and the corridors and viewsheds of designated and recommended Scenic rivers. Lands managed for a Partial Retention VQO would total 294,000 acres (18%) including the middleground of high sensitivity routes, eligible State Scenic Highways, the foreground of moderate sensitivity travel routes as well as the viewsheds of both designated and recommended Recreational rivers.

Society's activities would be allowed to dominate the landscape on 101,000 acres (6%) of the total Forest. Approximately 51,000 acres (3%) would be managed for Modification. Approximately 50,000 acres (3%) would be managed for a VQO of Maximum Modification which is consistent with the Regional guideline of no more than 3 to 7% in Maximum Modification. In this alternative, no variety class A lands would be managed as Modification or Maximum Modification.

The VQI would be 87. This would represent the greatest improvement in the Forest's cumulative natural appearance from the existing condition rating of 80.

Recreation Management

Important Interactions

The Forest's recreational resources are affected primarily by land allocations. Management prescriptions associated with land allocations govern the recreational setting and hence the opportunities which that land can provide. For example, land allocations that require road access will favor motorized opportunities in the roaded natural and rural ROS settings. Allocations that do not require road access will favor nonmotorized opportunities in more primitive settings.

Visual resource, timber, transportation system and wildlife management activities have the greatest potential to affect Forest recreational activities and settings.

Changes in visual quality and ROS classes are closely related. Changes in visual quality could change the

ROS class. This would alter the type of the recreational experience available for the Forest visitor.

In general, the more human activity modifies the scenic quality, the less primitive the recreational setting.

Timber management can affect the ROS through silvicultural practices, road construction and road maintenance. Intensive management can change a semi-primitive setting to a roaded natural or rural setting.

Road system management also affects recreational use. System roads provide increased access for recreational users, primarily for dispersed use. Road management which includes maintenance, surfacing and closures affects all recreational opportunities. Roads which receive high levels of maintenance are likely to be used more frequently for recreational use by standard passenger vehicles. Roads which receive little or no maintenance might only be used by all-wheel drive vehicles or dirt bikes. Road closures provide opportunities for non-motorized recreational opportunities.

Wildlife management often precludes road construction or controls road density. In areas where road construction is not appropriate, ROS opportunities towards the primitive end of the spectrum will be available. Where road density is controlled, semi-primitive motorized opportunities will be available.

The level of management for developed recreational sites, for dispersed areas and for trails can have a direct effect on the quality of the recreational experience.

Methodology

Each alternative was analyzed to determine the quantitative and qualitative effects on recreational opportunities. Quantitative effects include the amount of land allocated to each ROS class in acres and the amount of use measured in RVDs. Qualitative effects include the effects related to the intensity of management, the character of the landscape and the recreational settings provided. These effects are estimated based on past experience and are discussed in a narrative fashion.

For a summary of the quantitative effects for the first and fifth decades, refer to Chapter 2, Tables 2-4 and 2-16.

As an area becomes more developed, the recreational opportunities move from the primitive end of the spectrum to the rural end. If an area that is currently allocated to a management prescription that allows development is allocated to one that does not, the recreational opportunities would move in the other direction.

There are other management areas where changes toward the less developed end of the ROS may occur over time without specific direction. An example would be changes from a rural to roaded natural settings in areas with a partial retention VQO. The extent of such changes is difficult to predict; both settings are compatible with a partial retention VQO. Therefore, they are not considered in the estimated changes in ROS class by alternative.

Acres in each ROS class were estimated using VQOs. Based on the ROS inventory criteria used, roaded natural settings with maximum modification VQOs become rural. This creates a bias towards the developed end of the spectrum. GTR prescriptions which would leave a more natural-appearing and less geometric pattern were portrayed the same as clearcuts in this simple model. The actual resulting setting could be considered roaded natural, rather than rural.

Environmental Consequences

Consequences Common to all Alternatives

The majority of recreational use would be in developed recreational sites or would consist of dispersed use in river corridors and along principal roads and trails. All alternatives would meet the demand for developed and dispersed recreational opportunities through the fifth decade (refer to Chapter 3 for projected RVDs).

No additional roads or trails would be proposed solely for OHV use. OHV opportunities would be managed to protect resources, promote safety and minimize social conflicts. Usable acres open to OHV use would range from 406,000 to 408,000 in the summer and from 401,500 to 403,500 acres in the winter.

Designated wilderness, the Pacific Crest Trail (PCT), the Boundary and Clear Creek National Recreation Trails and a portion of the Kelsey National Recreation Trail would remain closed to OHVs.

Recreational residences would be permitted unless a future use determination study identified a higher public need or an existing residence was substantially damaged by flood waters. Future use determinations would be completed at least 2 years before the expiration date which is 2008 for all current permits.

Consequences Common to All Alternatives but Current/RPA and G(SOHA)

These alternatives would all increase recreation funding between 100 and 135% which would enhance recreational opportunities. They would have more intensive levels of recreation management than the Current/RPA Alternative. They would generally provide standard levels of service for developed sites, dispersed areas and the trail system. Existing facilities would be rehabilitated and new facilities constructed. Recreational roads that receive high use would be

Table 4-29. ROS Class in Thousands of Acres									
		Alternatives							
ROS	Current Inventory	PFD	CUR/ RPA	A	B & B'	C	D & D'	E	G(SOHA)
P	208	208	208	208	208	208	208	208	208
SPNM	340	301	182	272	215	281	188	302	181
SPM	36	63	94	44	40	83	95	217	93
RN	802	730	711	600	939	923	725	638	713
R	294	378	485	556	278	185	464	315	485

maintained to meet user needs. Visitor information and education programs would be emphasized. User expectations would be met for developed sites and for dispersed recreational areas.

Comparison of Alternatives

Table 4-29 displays the amount of land estimated to be in each ROS class in thousands of acres for each alternative.

Additions to the National WSR System would be recommended under these alternatives (refer to the Wild and Scenic Rivers Management section).

Consequences Unique to the Preferred Alternative

This alternative would manage all developed sites and dispersed areas at standard levels. Necessary reconstruction would be completed in the first decade. Additional facilities would be developed as needed to meet user demand. Reconstruction and construction of new facilities would consider the needs of impaired individuals and a multicultural society.

Dispersed recreational opportunities would be enhanced, including the development of staging area support facilities and additional river access. Typical recreational activities would include hiking, horseback riding, hiking, mountain biking, whitewater boating and recreational panning. Panning opportunities would be provided at campgrounds withdrawn from mineral entry. Public awareness of forest management, ecology and history would be increased by developing Information and Education programs.

Trails and trailheads would be constructed or reconstructed to meet user needs. Approximately 100 miles of trail would be constructed in the first decade. Trails would be maintained to standard levels. The trail system would meet established management objectives in the first decade.

Approximately 29,000 acres of released roadless areas would be allocated specifically to Backcountry to enhance semi-primitive recreational opportunities.

About 572,000 acres (34% of the Forest) would be available for primitive and semi-primitive recreational opportunities. Acreage available for semi-primitive non-motorized opportunities would decrease from the current situation by 12% (39,000 acres). Acreage in the semi-primitive motorized opportunity class would increase by about 75% (27,000 acres).

Roaded natural acreage would decrease from the current situation by about 9% (72,000 acres). Rural ROS class acreage would increase by an estimated 29% (84,000 acres).

New recreational facilities within RRs, including trails and dispersed sites, should be desinged to allow present and future attainment of Aquatic Conservation Strategy objectives. The impact of existing recreational facilities within RRs would be evaluated and mitigated where necessary to ensure attainment of Aquatic Conservation Strategy objectives. Dispersed and developed recreational practices within RRs would be adjusted if they prevented Aquatic Conservation Strategy objectives from being met.

Public education, limits and/or area closures would be used to minimize any adverse effects to riparian-dependent resources.

Currently, the majority of dispersed and developed recreational activities on the Forest occur adjacent to streams and rivers where water related activities such as fishing, swimming and boating. These opportunities could be reduced in the Preferred Alternative in order to obtain Aquatic Conservation Strategy objectives.

The shady, cooler climate and aesthetic qualities within riparian areas are what attract campers, picnickers and hikers. Attempts to relocate water related activities may be met with resistance by the general public. This may be somewhat mitigated through public education efforts. There would also be added costs if facilities and trails had to be located outside of RRs as mitigation measures.

Consequences Unique to Alternative Current/RPA

Developed sites and dispersed areas would continue to be managed at low standard levels. High use campgrounds and picnic areas would gradually deteriorate due to the low funding level.

Facilities would be maintained where possible. Some sites might have to be consolidated or abandoned. There would be limited construction of new facilities and little rehabilitation of existing ones to meet changing needs. Roads with high recreational use would not be well maintained. Information and education programs would be not be emphasized. Visitor expectations would not likely be met.

Trail and trailhead construction and reconstruction would receive little emphasis. Trail maintenance would be less than standard. Eventually, the trail system would not meet user expectations.

About 29% (484,000 acres) of the Forest would be managed for primitive and semi-primitive recreational opportunities. Acreage available for semi-primitive non-motorized opportunities would decrease by about 47% (158,000 acres) from the current condition. Acreage in the semi-primitive motorized opportunity class would increase by 161% (58,000 acres).

Roaded natural acreage would decrease from the current situation by about 11% (91,000 acres). Rural ROS class acreage would increase by an estimated 65% (191,000 acres).

Consequences Unique to Alternative A

Most developed sites and dispersed areas would be managed at standard levels. Campgrounds and picnic areas would be brought up to standard levels by the end of the second decade. Additional facilities would be developed based on user needs. Emphasis would be placed on an interpretive program to increase public awareness of Forest management and local history.

Trail and trailhead construction and reconstruction would occur to meet user expectations. About 100 miles of trail would be constructed in the first decade. Trails would maintained at the standard level. The trail system would meet established management objectives by the second decade.

Approximately 32,500 acres of released roadless areas would be dedicated specifically for backcountry recreational opportunities to enhance semi-primitive opportunities.

Three additions to the State Scenic Highway Program would be proposed. This would precipitate proposals for the construction of vistas, overlooks, pull outs, interpretive sites and day use areas.

About 31% (524,000 acres) of the Forest would be managed for primitive and semi-primitive recreation opportunities. Acreage available for semi-primitive nonmotorized opportunities would decrease from the current situation by about 20% (68,000 acres). Acreage in the semi-primitive motorized opportunity class would increase by about 22% (8,000 acres).

Roaded natural acreage would decrease from the current situation by about 25% (202,000 acres), while rural ROS class acreage would increase by an estimated 89% (262,000 acres).

Consequences Unique to Alternatives B and B'

These alternative would manage all developed sites and dispersed areas at standard levels. Necessary reconstruction would be completed in the first decade. Additional facilities would be developed to meet user demand (refer to planning records for a list of specific sites). The proposal for a ski development on West Haight Mountain would be adopted and encouraged.

Dispersed recreational opportunities would be enhanced, including the development of staging area support facilities and additional river access. Typical activities would include mountain biking, whitewater boating and recreational panning. Panning opportunities would be provided at campgrounds withdrawn from mineral entry. Public awareness of Forest management, ecology and history would be increased by improving public information programs.

Trails and trailheads would be constructed or reconstructed to meet user needs. Approximately 100 miles of trail would be constructed in the first decade. Trails would be maintained to standard levels. The trail system would meet established management objectives in the first decade.

One Scenic Byway would be proposed. This would precipitate proposals for the construction of vistas, overlooks, pull outs, interpretive sites and day use areas.

About 28% (463,000 acres) of the Forest would be managed for primitive and semi-primitive recreation opportunities. Acreage available for semi-primitive nonmotorized opportunities would decrease by about 37% (125,000 acres) from the current situation. Acreage in the semi-primitive motorized opportunity class would increase about 11% (4,000 acres).

Roaded natural acreage would increase from the current situation by about 17% (137,000 acres). Rural ROS class acreage would decrease by an estimated 5% (16,000 acres).

Consequences Unique to Alternative C

Developed sites and dispersed areas would be managed at standard levels. Reconstruction needs would be met during the first decade. Additional facilities would be developed to meet recreational demand, but the highest priority would be on restoration of existing facilities. Interpretive site development would increase public awareness of the Forest's unique features such as RNAs and SIAs. Public cooperators would be encouraged to increase national

awareness of the Forest's recreational resources and promote tourism locally.

Trail and trailhead construction and reconstruction would occur to meet user needs. There would be approximately 120 miles of trail construction in the first decade. Trail maintenance would be at the standard level. The trail system would meet established management objectives in the first decade.

One Scenic Byway would be proposed. This would precipitate proposals for the construction of vistas, overlooks, pull outs, interpretive sites and day use areas.

About 34% (572,000 acres) of the Forest would be managed for primitive and semi-primitive recreational opportunities. Acreage available for semi-primitive nonmotorized opportunities would decrease about 17% (59,000 acres). Acreage in the semi-primitive motorized opportunity class would increase about 130% (47,000 acres).

Roaded natural acreage would increase from the current situation by about 15% (121,000 acres). Rural ROS class acreage would decrease by an estimated 37% (109,000 acres).

Consequences Unique to Alternatives D and D'

Developed sites and dispersed areas would be managed at standard levels. Campgrounds and picnic areas would be brought up to standard levels by the second decade. Additional facilities would be developed to meet user demand, particularly campgrounds near major highways. The information program would emphasize increased awareness of less utilized fishing opportunities to decrease impacts on over-utilized fisheries. It would increase awareness of the special attributes of WSRs such as streams with outstandingly remarkable fisheries and water quality values.

Trail and trailhead construction and reconstruction would occur to meet user expectations. About 100 miles of trail would be constructed in the first decade. Trails would be managed at the standard level and the trail system would meet established management objectives by the second decade.

About 29% (491,000 acres) of the Forest would be managed for primitive and semi-primitive recreational opportunities. Acreage available for semi-primitive nonmotorized opportunities would decrease about 45% (152,000 acres). Acreage in the semi-primitive motorized opportunity class would increase about 164% (59,000 acres).

Roaded natural acreage would decrease from the current situation by about 10% (77,000 acres). Rural ROS class acreage would increase by an estimated 58% (170,000 acres).

Consequences Unique to Alternative E

Developed sites and dispersed areas would be managed at standard levels. Campground and picnic area conditions would be improved to meet management objectives and visitor expectations would be met in the first decade. Additional facilities would be developed to meet user demand.

Approximately 120 miles of new trails would be constructed in the first decade. Trails would be maintained to standard levels and the trail system would meet established objectives and user needs in the first decade.

There would be no development in released roadless areas and approximately 241,000 acres would be dedicated specifically for backcountry recreation to enhance semi-primitive opportunities.

About 43% (727,000 acres) of the Forest would be available for primitive and semi-primitive recreational opportunities. Acreage available for semi-primitive non-motorized opportunities would decrease about 11% (38,000 acres) from the current situation. Approximately 5 times as many acres would be available in the semi-primitive motorized opportunity class (181,000 acre increase).

Roaded natural acreage would decrease from the current situation by about 20% (164,000 acres). Rural ROS class acreage would increase by an estimated 7% (21,000 acres).

Consequences Unique to Alternative G(SOHA)

Alternative G(SOHA) would be similar to the Current Alternative, but there would be less funding available for construction and reconstruction of recreational facilities.

Developed sites and dispersed areas would continue to be managed at low standard levels. High use campgrounds and picnic areas would gradually deteriorate due to funding levels. Facilities would be maintained where possible. Some sites might have to be consolidated or abandoned. There would be limited construction of new facilities and little rehabilitation of existing ones to meet changing needs. Roads which receive high recreational use would not be well maintained. Information and education programs would be not be emphasized. Visitor expectations would not be met.

Trail and trailhead construction and reconstruction would receive little emphasis. Trails maintenance would be less than standard. Eventually, the trail system would not meet user expectations.

About 29% (482,000 acres) of the Forest would be available for primitive and semi-primitive recreational opportunities. Acreage available for semi-primitive non-motorized opportunities would decrease by 47% (159,000 acres). Acreage in the semi-primitive

motorized opportunity class would increase by 158% (57,000 acres).

Roaded natural acreage would decrease from the current situation by about 11% (89,000 acres). Rural ROS class acreage would increase by an estimated 65% (191,000 acres).

Wilderness Management

Important Interactions

Wilderness management is essentially the management of human use and its influences to preserve naturalness and outstanding opportunities for solitude. It includes everything that is done to preserve the natural character of wilderness for the use and enjoyment of future generations. Management activities that can affect the wilderness resource include recreation management, fire management and range management. Trail development and maintenance is considered to be part of recreation management.

Recreation management in wilderness relies primarily on managing visitor use and on trail maintenance activities. The most common problems associated with recreational use are (1) disruption of solitude by overcrowding, (2) littering and (3) campsite impacts to vegetation. The most common problems associated with trails are (1) excessive erosion, (2) muddy stretches in areas of water saturated soils and (3) development of impromptu trails. Visitor behavior can dramatically affect the intensity of impact. Influencing the behavior of wilderness visitors is the key for maintaining a natural setting. As more emphasis is placed on recreation management, undesirable visitor actions and associated effects can be reduced.

Fire significantly influences the functioning of ecosystems. It can alter plant community composition, interrupt and alter succession, regulate fuel accumulation and influence nutrient cycling and energy flow. Periodic fires often result in vegetational mosaics of contrasting age classes, species composition and vegetation types.

The scale of the vegetational mosaic is influenced by the terrain. Steep and broken terrain often shows more complex patterns than level, gently rolling terrain. Aggressive fire suppression in wilderness for the past 50 to 80 years may have resulted in increased fuel accumulations and modifications of the vegetative structure. Re-introduction of fire into the wilderness ecosystem may require the reduction of fuel buildups by planned ignition to reduce the risks of prescribed natural burns escaping from the wilderness.

Grazing by domestic animals also influences the wilderness ecosystem. Grazing can change the composition of meadow communities due to preferential feedings on some plant species or the sensitivity of some species to forage utilization. Heavy grazing can reduce the vigor and even eliminate dominant species. The site may be physically altered due to compaction, accelerated erosion or changes in the water table which would change how the ecosystem functions. Exotic plant species may be introduced with livestock. Site degradation and the addition of exotic species can permanently alter ecological communities and processes.

Some recreational users of wilderness feel that the grazing of commercial livestock is inappropriate in the wilderness environment and detracts from their recreational experience. However, it is specifically permitted by the Wilderness Act and enabling legislation.

Methodology

Each alternative is analyzed in terms of whether management would be standard or low standard. Special features of the wilderness management program relating to recreation, fire management and range are described for each alternative.

Standard management includes planning and implementation of policies and actions to achieve wilderness management objectives. Specifically, standard management includes the planning and implementation of visitor education and, if necessary, management of visitors to control overuse. Facility maintenance, regulations for recreational and commercial stock use, wilderness patrols, and public information are included in standard management.

Low standard management is anything less than this. At low standard levels, wilderness resource degradation may occur from improper recreational use, lack of trail maintenance or the inability to meet wilderness management objectives.

Environmental Consequences

Consequences Common to All Alternatives

None of the alternatives would recommend any additional areas for wilderness designation as projected demand ranges from only 36% of maximum practical capacity currently to only 57% by the fifth decade (refer to Chapter 3, Recreation). Recreational use in wilderness is expected to increase at a moderate rate based on projected demand.

Standards and guidelines would provide for the preservation of ecological integrity, for natural landscapes and for opportunities of solitude and primitive recreation. Management would be consistent with the 1964 Wilderness Act and the 1984 California Wilderness Act.

Comparison of Alternatives

Alternatives Preferred, A, C and E would use both prescribed natural fire (PNF) and prescribed fire to meet wilderness management objectives (refer to Fire

Management later in this chapter for explanation of fire terms).

Alternatives B, B', D and D' would also use PNF to maintain or restore wilderness values to the wilderness. However, planned ignitions would be allowed only in situations where lightning-caused fires could not be tolerated due to heavy fuel accumulations which would result in unacceptable fire behavior or in threat to life, property or resource values.

Alternatives Current/RPA and G(SOHA) would take immediate suppression action on all wildfires and no prescribed burning would be planned within the wilderness.

The wilderness management objectives relating to fire management would vary by alternative. The primary objective for the Preferred Alternative would be to allow fire to play its ecological role. Alternative A's objectives would be to restore or maintain wilderness values and to recreate or maintain vegetative conditions. Alternative C's objectives would be to reduce the risk of catastrophic fires and to reduce fuel loading to presuppression levels. The primary objective for Alternatives B, B', D, D' and E would be to maintain or restore wilderness values.

Approximately 8,000 acres of wilderness per year would be targeted for treatment in the Preferred Alternative's fuel management program. Approximately 1,500 wilderness acres per year would be targeted for treatment in the fuel management program for Alternatives A, B, B', C, D and D'. Approximately 100 wilderness acres per year would be targeted for treatment in Alternative E's fuel management program. No wilderness acres would be targeted in the fuel management programs for Alternatives Current/RPA and G(SOHA).

Consequences Common to All Alternatives But Current/RPA and G(SOHA)

Wilderness would be managed at standard levels. The presence of uniformed Forest Service personnel would be evident. The condition and use of the wilderness resource would be monitored. Wilderness users would receive information on minimum impact techniques to reduce litter, trampled vegetation and overcrowding in popular areas. The information provided at trailheads, on bulletin boards and at other points of interest would include maps, brochures and guidebooks.

Additional trailheads would be constructed as necessary to help distribute wilderness use. The trail system would be maintained to meet wilderness management objectives and reduce resource damage. Problems with erosion, mud puddles and impromptu trails would be corrected as discovered.

An approved fire management plan would be required prior to any use of management-ignited prescribed fire within the wilderness. Each PNF would have a burn plan prepared within 48 hours of discovery. Suppression actions would be taken on any fire which threatened life or property.

Consequences Common to Alternatives Current/RPA and G(SOHA)

Wilderness would be managed at low standard levels with these alternatives. The presence of uniformed Forest Service personnel would be minimal. The condition and use of the wilderness resource would not be monitored and the information program would be minimal. Litter, trampled vegetation and overcrowding in popular areas would be noticeable. Informational bulletin boards, trailheads and trails would receive only sporadic maintenance. Some resource damage associated with trails and heavy use in destination areas could continue unchecked for indefinite periods.

Consequences Common to All Alternatives But Alternative E

Standards and guidelines would provide for the distribution of livestock numbers through AOIs as necessary to prevent deterioration of the wilderness resource.

Consequences Unique to Alternative E

Commercial grazing of livestock would be excluded from the wilderness. The influence of grazing would be considerably less than in the current situation and over time there would be little evidence of grazing except in areas which receive heavy use by pack stock.

Released Roadless Area Management

Methodology

Retaining the roadless character of existing released roadless areas is an important issue. Areas released for multiple use management by the California Wilderness Act of 1984 were examined to determine their current condition. Those areas which currently meet the original definition for a roadless area are discussed individually in Appendix C. Sorts on the database were conducted to determine the intensity of timber management proposed and the VQO by alternative for each roadless area; this information is presented in Appendix C. This section describes the consequences related to the released roadless areas as a group.

Environmental Consequences

Comparison of Alternatives

Figure 4-8 compares the relative land allocations of the released roadless areas for each alternative.

Figure 4-8. Land Allocation Comparison for Released Roadless Areas

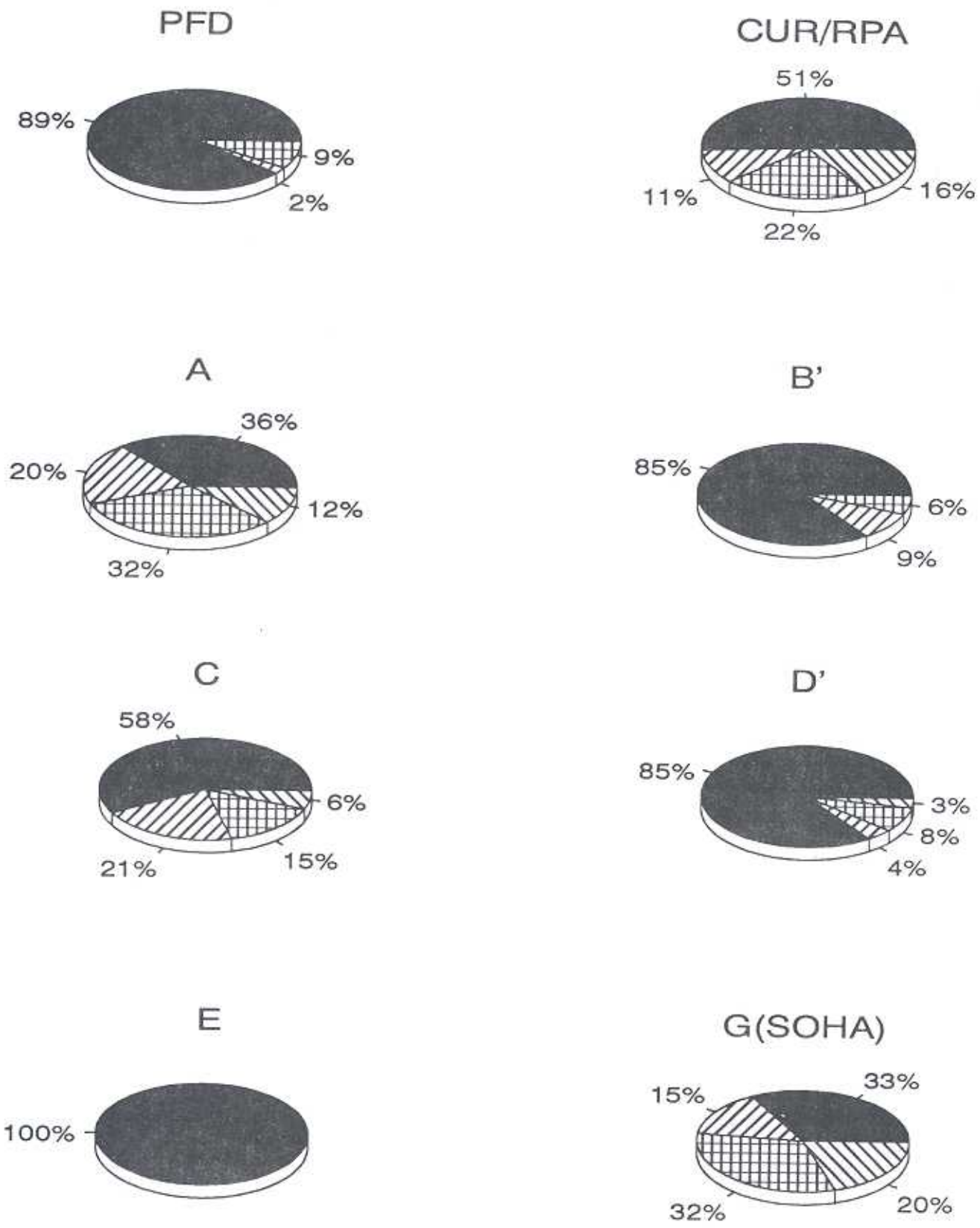


Table 4-30. Allocation for Released Roadless Areas as Percent of Total										
	Alternative									
Allocation	PFD	CUR/ RPA	A	B	B'	C	D	D'	E	G(SOHA)
Unregulated	89	51	51	36	85	58	52	85	100	33
Regulation Class 3	2	11	28	43	9	21	19	4	0	15
Regulation Class 2	9	22	4	21	6	15	18	8	0	32
Regulation Class 1	0	16	17	0	0	6	11	3	0	20

Table 4-30 displays the percentage of land allocated to each regulation class for the released roadless areas by alternative.

Alternative E would allocate all released roadless areas to Backcountry Management. The Preferred Alternative would allocate 89% of all released roadless areas to unregulated management areas. Alternatives B' and D' would allocate 85% of the released roadless areas to unregulated management areas. Alternatives C, D, Current/RPA and A would place slightly over half of the areas in unregulated management areas. Alternatives B and G(SOHA) would allocate 36 and 33% to unregulated, respectively. An unregulated allocation would generally allow natural integrity to be maintained. Roads would not likely be constructed in those areas unless they were deemed necessary to meet the management objectives of the area which would be non-timber management objectives.

Each alternative, except Alternative E, would allocate varying amounts of land to the 3 regulation classes. Allocation to Regulation Class 3 would vary from 2% in the Preferred Alternative to 43% in Alternative B. Regulation Class 3 emphasizes non-timber resources resulting in minimal timber yields; roads would be constructed in these areas only when they enhance the resources of primary interest.

Allocation to Regulation Class 2 varies from 4% in Alternative A to 32% in Alternative G(SOHA). Regulation Class 2 co-emphasizes timber and other resources; roads would be constructed as deemed necessary for resource management.

Allocation to Regulation Class 1 varies from none in several alternatives to 20% in Alternative G(SOHA). Regulation Class 1 emphasizes timber management; roads would likely be constructed in most of these areas.

Allocating a released roadless area to a management area that would have a programmed timber yield could constitute an irreversible commitment of resources. Once the area was developed through the construction of roads or other activities that have a modified appearance, the roadless character of the area would be lost.

If management activities in unregulated areas included road construction or noticeable activities, this would also constitute an irreversible commitment. Before any irreversible commitments were made, a site-specific environmental analysis would be conducted for each project to display the trade-offs for the decision-maker.

Table 4-31 displays the VQOs that would be associated with the released roadless areas for each alternative.

The Preservation VQO allows primarily ecological changes. Alternative E would manage 100%, Alternative C would manage 5%, while Alternatives Preferred, B and B' would manage 1% of the total released roadless acres for this VQO.

The Retention and Partial Retention VQOs manage for natural-appearing landscapes. Alternative C would manage 85%, the Preferred Alternative would manage 81%, Alternative A would manage 78%, Alternatives B and B' would manage 76%, Alternatives D and D' would manage 57%, while Alternatives Current/RPA and G(SOHA) would manage 46% of the released roadless acres for natural-appearing landscapes.

Table 4-31. VQOs for Released Roadless Areas in Percent of Total								
	Alternative							
VQO	PFD	CUR/RPA	A	B & B'	C	D & D'	E	G(SOHA)
Preservation	1	0	0	1	5	0	100	0
Retention	18	7	62	26	63	10	0	7
Partial Retention	63	39	16	50	22	47	0	39
Modification	11	33	1	18	8	23	0	33
Maximum Modification	7	21	21	5	2	20	0	21

Modification and Maximum Modification VQOs allow human activities to be dominant in the landscape. Human activities would be allowed to dominate on 10% of the area in Alternative C, on 18% in the Preferred Alternative, on 22% of the area in Alternative A, on 23% in Alternatives B and B', on 43% in Alternatives D and D' and on 54% of the released roadless acres in Alternatives RPA and G(SOHA).

Consequences Unique to the Preferred Alternative

Approximately 29,000 acres would be allocated to land uses which provide for backcountry recreation. Of these, about 17,000 acres would also be included in more restrictive land use allocations such as Wild Rivers and Special Habitat. This Backcountry Management Area would include the upper portions of the Condrey Mountain Area along the PCT and the Kangaroo Area from the western boundary of Oak Knoll Ranger District to the East Fork of Seiad Creek. These areas would retain their roadless characteristics. The Preferred Alternative would prohibit new road construction in roadless areas within Key Watersheds.

Consequences Unique to Alternative A

Approximately 32,500 acres would be allocated to land uses which provide for backcountry recreation. Of these, about 17,000 acres would also be included in more restrictive land use allocations such as Wild Rivers and T&E Species habitat. This Backcountry Management Area would include the upper portions of the Condrey Mountain Area along the PCT, the Kangaroo Area from the western boundary of Oak Knoll Ranger District to the East Fork of Seiad Creek and the area around Meek, Ruffey and Smith Lakes of the Russian Area. These areas would retain their roadless characteristics.

Consequences Unique to Alternative E

All of the released roadless areas, approximately 241,000 acres according to the database, would be allocated to land uses which provide for backcountry recreation. About 131,600 of these acres would also be included in more restrictive land use allocations such as Wild Rivers and T&E Species habitat. These areas would retain their roadless characteristics.

Wild and Scenic Rivers Management

Designated Wild and Scenic Rivers

Important Interactions

Certain rivers were designated as components in the National Wild and Scenic Rivers (WSRs) System because they possess outstandingly remarkable resource values, are free flowing and were found suitable. The designation resulted in a classification based on the presence or lack of man's influence in the river corridor.

Although the river's values and classification are protected in accordance with the National Wild and Scenic Rivers Act (WSRA), land allocations and management activities both within and outside the corridor could affect river values and/or classifications. Depending on the land allocations selected for land outside the river corridor, the potential effects would vary greatly. The allocation of land to timber regulation classes creates the greatest conflict between resource use and WSR values and classification.

Regulation Class 1 and 2 areas that can be seen from the river environment could create conflicting resource uses. This in turn could affect the visual quality and thereby the quality of the recreational experience. Other resource activities which might affect river values are road construction, mineral developments, water diversions and to a lesser degree, water quality degradation.

Environmental Consequences

Consequences Common to All Alternatives

All alternatives would have the same 202.3 miles of currently designated components in the National WSRs System. All alternatives would protect the Klamath River, Scott River, Wooley Creek and Salmon River's outstandingly remarkable anadromous fisheries values. Their free-flowing conditions would be maintained. All rivers would be managed according to the revised USDA-USDI Guidelines for Eligibility, Classification and Management of River Areas dated September 7, 1982 and other applicable laws and regulations.

Until final boundaries are established, an interim boundary of 1/4 mile from each ordinary high water mark of the river would be managed to protect the outstandingly remarkable values for which the river was designated and to preserve the river's free-flowing condition. The final boundaries would be established through the selection of an alternative in the Forest Plan by the Regional Forester. Refer to Appendix J for detailed boundary descriptions and to the map packet for a map of the boundaries proposed for designated rivers in the Preferred Alternative. The proposed boundaries have not changed from the Draft EIS.

The 1986 Amendment to the WSRA requires review of the classifications for rivers designated before January 1,1986 within 10 years through regular agency planning processes. To comply with this law, a review of the classifications for the Forest's designated rivers was completed during the planning process for the Forest Plan. No segments were found to qualify for reclassification on the Scott River or Wooley Creek.

Table 4-32. Recommendations for River Corridor Widths of Designated WSRs

	Alternatives							
	PFD	CUR/RPA	A	B & B'	C	D & D'	E	G(SOHA)
Width	Varies	1/4 mile each side	1/4 mile each side	1/4 mile each side	1/4 mile each side	3/8 mile each side	1/4 mile each side	First line riparian vegetation
Configuration	Varies	Uniform	Varies *	Varies *	Uniform	Varies	Uniform	Uniform
Average Acres per Mile **	254	294	281	281	294	480***	320	34

* The river corridor extends only to the high water line as it passes through communities along the river and is a uniform 1/4 mile on each side of the river elsewhere.

** Average acres per mile for all designated rivers including private lands.

*** This average would exceed the maximum allowable (320 acres per mile) as stipulated in the 1986 Amendment to the WSRA.

The existing classifications on these 2 rivers would remain the same for all alternatives.

There are 2 designated river segments classified as Wild. Segment 2 (4.3 miles) of the North Fork Salmon River has 3.8 miles within the Marble Mountain Wilderness, while 0.5 miles are outside wilderness. Segment 2 (6.4 miles) of Wooley Creek is entirely within wilderness. The portions of these 2 river segments within wilderness would be managed for a Preservation VQO and remain in a pristine condition in all alternatives.

Comparison of Alternatives

Table 4-32 lists each alternative's proposal for designated WSR corridor widths and configurations.

Two segments on the Klamath River, a segment on the South Fork Salmon River and a segment on the North Fork Salmon River would be recommended for reclassification in some alternatives as a result of each alternative group's classification review. The first 3 segments listed above meet the qualifications for a scenic classification.

Table 4-33 lists the classifications of these segments by alternative. The Current/RPA Alternative shows the existing classifiation.

Table 4-34 displays the changes in the total miles of classifications that would be created by the alternative recommendations listed above.

With any alternative, management activities would continue to occur both inside and outside the river corridors (beyond approximately 1/4 mile) which would visually alter the landscape. The design of these activities would be compatible with the classifications of the river. However, conflicts between management activities and river values would continue to occur. Those alternatives that propose Retention or Partial Retention VQOs would retain a more natural-appearing viewshed from the river than alternatives proposing Modification.

Table 4-35 lists the VQOs that would be associated with the various river classifications for each alternative.

Consequences Unique to the Preferred Alternative

The river corridors would be of varying widths. This would allow for community expansion, for land adjustments using the Small Tracts Act (refer to Lands Program Management later in this chapter) and for portions of the river viewshed to be included. The river

Table 4-33. Classification Recommendation for Designated WSR Segments

	Alternative							
River/Segment/Miles	PFD	CUR/RPA	A	B & B'	C	D & D'	E	G(SOHA)
Klamath River								
Segment 1A - Seattle Creek to Williams Point - 6.5 miles	Rec	Rec	Rec	Scenic	Rec	Rec	Scenic	Rec
Segment 1B - Ti Bar to Mouth of Salmon - 15.1 miles	Rec	Rec	Rec	Scenic	Rec	Rec	Scenic	Rec
South Fork Salmon River								
Segment 3 - Cecilville Bridge to St. Claire Creek - 1.8 miles	Rec	Rec	Rec	Rec	Rec	Rec	Scenic	Rec
North Fork Salmon River								
Segment 2A - Current Wilderness boundary to Mule Bridge Campground - 0.5 miles	Rec	Wild	Wild	Wild	Wild	Wild	Wild	Wild

Table 4-34. Designated Miles of WSR by Classification by Alternative								
	Alternative							
River Classification	PFD	CUR/RPA	A	B & B'	C	D & D'	E	G (SOHA)
Wild	11.2	11.7	11.7	11.7	11.7	11.7	11.7	11.7
Scenic	20.5	20.5	20.5	42.1	20.5	20.5	43.9	20.5
Recreational	170.6	170.1	170.1	148.5	170.1	170.1	146.7	170.1
Total	**202.3**	**202.3**	**202.3**	**202.3**	**202.3**	**202.3**	**202.3**	**202.3**

corridors would average 254 acres per mile for all rivers. Boundaries for currently designated WSRs would vary from 2.5 miles wide to accomodate scenic features to the river's width at high water mark to accomodate the potential expansion of adjacent communities.

This alternative would recommend reclassification of a 1/2 mile segment of the North Fork Salmon River outside wilderness from Wild to Recreational. This reclassification would more accurately match the land uses which are currently occurring along this stretch (e.g., access road to Mule Bridge trailhead). It would also allow the construction of a dispersed camping area at the trailhead with 3 to 5 sites including picnic tables and grills. No other segments would be reclassified.

Visual quality management would differ by river classification. Segments classified as Wild outside wilderness would be managed for a Preservation VQO in the corridor and for a Retention VQO outside the corridor. Segments classified as Scenic would be managed for a Retention VQO in the river corridor while the middleground of the viewshed outside the corridor would be managed for a Partial Retention VQO. Segments classified as Recreational would be managed for a Partial Retention VQO in both the river corridor and the middleground of the viewshed. These VQOs would retain a natural or near natural-appearing landscape both within and outside the river corridor.

Consequences Unique to Current/RPA Alternative

The river corridor would be a uniform 1/4 mile wide on each side of the river, including through communities. The acreage would average 294 acres per river mile. Land adjustments which utilize the Small Tracts Act or the Townsite Act would not be possible within the river corridor.

Designated river classifications would remain the same as in the current situation; no reclassifications would be recommended.

Visual quality management would differ by river classification. The VQO for Wild segment corridors outside wilderness would be Partial Retention, while the VQO for Wild River viewsheds outside the corridor would be Modification. These levels of visual management

Table 4-35. Forest VQOs From Designated WSRs by Classification and Zone								
	Alternative							
River Classification	PFD	CUR/RPA	A	B & B'	C	D & D'	E	G(SOHA)
Wild *								
In Corridor	P/P	P/PR	P/R	P/P	P/P	P/R	P/P	P/PR
Out Corridor	P/R	P/M	P/M	P/R	P/R	P/PR	P/R	P/M
Scenic								
In Corridor	R	R	R	R	R	R	R	R
Out Corridor	PR	PR, M	PR, M	R	PR	PR	R	PR, M
Recreational								
In Corridor	PR	R	PR	R**	R**	R	R	R
Out Corridor	PR	PR, M	PR, M	PR	PR	PR	PR	PR, M

Note: * The first value listed in each column represents the portion of the river segments in wilderness, while the second value represents the 1/2 mile portion of North Fork Salmon River outside of wilderness.
** Excludes both the North and South Forks Salmon River which are managed as Partial Retention.

Descriptions of terms and acronyms:

In Corridor=Area within actual river corridor(approximately 1/4 mile each side of river).
Out Corridor=River viewshed area outside or beyond corridor (approximately 2-3 miles each side of river).
P=Preservation Visual Quality Objective (VQO) **R**=Retention VQO **PR**=Partial Retention VQO **M**=Modification VQO.

would be inconsistent with the laws and regulations governing management of Wild Rivers.

The river corridors of both Scenic and Recreational segments would be managed for a Retention VQO. The river viewshed outside the corridors of Scenic and Recreational segments along the Klamath and Scott Rivers would be managed primarily for Partial Retention. The viewshed outside the river corridors along both the North and South Fork Salmon River would be managed primarily for Modification.

The river corridors would retain a natural or near natural-appearing landscape. The lands outside the corridor along the Salmon River and its forks would appear modified by management activities, while those along the Klamath and Scott Rivers would have a near-natural appearance.

Consequences Unique to Alternative A

The river corridor would generally be 1/4 mile wide on each side of the river. Corridors which pass through communities such as Sawyers Bar, Forks of Salmon, Cecilville, Happy Camp and Somes Bar would extend only to the high water line on each side of the river to allow for community expansion in these areas. The corridor width would also be variable around private lands to aid in the consolidation of land ownership. The river corridors would average 281 acres per river mile for all rivers.

Designated river classifications would remain the same as in the current situation; no reclassifications would be recommended.

Visual quality management would differ by river classification. Wild segments outside wilderness would be managed for a Retention VQO in the corridor, while the river viewshed outside the corridor would be managed for a Modification VQO. This level of visual management would be inconsistent with the laws and regulations governing management of Wild Rivers.

Scenic segment river corridors would be managed for a Retention VQO and Recreational corridors for Partial Retention. The river viewshed outside the corridors of Scenic and Recreational segments along the Klamath and Scott Rivers would be managed primarily for Partial Retention.

The river corridors would retain a natural or near natural-appearing landscape. The lands outside the corridor along the Salmon River and its forks would appear modified by management activities, while those along the Klamath and Scott Rivers would have a near-natural appearance.

Consequences Unique to Alternatives B and B'

The river corridor would generally be 1/4 mile wide on each side of the river. Exceptions would be allowed around communities and private lands to allow for land adjustments using the Townsite Act and Small Tracts Act. The river corridors would average 281 acres per mile for all rivers.

Reclassification of the 2 Klamath River segments would be recommended. This would convert 21.6 miles of designated Recreational Rivers to a Scenic designation. These changes would create no noticeable change in on-the-ground management as the current management is consistent with a Scenic classification.

Visual quality management would differ by river classification. Segments classified as Wild (outside wilderness) would be managed for a Preservation VQO in the corridor and for a Retention VQO outside the corridor. The river corridor of both Scenic and Recreational segments would be managed for a Retention VQO, except the North and South Forks Salmon River which would both be managed for a Partial Retention VQO. The VQO for the viewshed outside the corridor of a Scenic segment would be Retention, while it would be Partial Retention on a Recreational segment. These VQOs would retain a natural or near natural-appearing landscape in both the river corridors and the viewsheds (middleground).

Consequences Unique to Alternative C

The river corridor would be a uniform 1/4 mile wide on each side of the river, including through communities. This would average 294 acres per river mile. Land adjustments which utilize the Small Tracts Act or the Townsite Act would not be possible within the river corridor.

Designated river classifications would remain the same as in the current situation; no reclassifications would be recommended.

Visual quality management would differ by river classification. For Wild River segments outside wilderness, the corridor would be managed for a Preservation VQO, while the middleground of the viewshed would be managed for a Retention VQO. The corridors of segments classified as Scenic or Recreational would be managed for a Retention VQO, except for both the North and South Forks Salmon River where the corridor would be managed for a Partial Retention VQO. The middleground of the viewshed outside the corridor of both Scenic and Recreational rivers would be managed for a Partial Retention VQO. These VQOs would retain a natural or near natural-appearing landscape in both the river corridors and the middleground of the viewsheds.

Consequences Unique to Alternatives D & D'

The river corridor would be a uniform 3/8 mile wide on each side of the river, including through communities. This would average 480 acres per river mile which exceeds the current legal maximum of 320 acres per mile as stipulated in the 1986 Amendment to the WSRA. Land adjustments which use the Small Tracts

Act or the Townsite Act would not be possible within the river corridor.

Designated river classifications would remain the same as in the current situation; no reclassifications would be recommended.

Visual quality management would be the same for all WSRs regardless of classification. The river corridors would be managed for a Retention VQO and and the viewsheds outside the corridors would be managed for Partial Retention. These VQOs would retain a natural or near natural-appearing landscape in both the river corridors and the middleground of the viewsheds.

Consequences Unique to Alternative E

The river corridor would be a uniform 1/4 mile wide on each side of the river, including through communities. This would average 320 acres per river mile, the maximum allowable under legal constraints. Land adjustments which use the Small Tracts Act would not be possible within the river corridor.

Reclassification of the 2 Klamath River segments and the South Fork Salmon River segment would be recommended. This would convert 23.4 miles of designated Recreational rivers to a Scenic designation. These changes would create no noticeable change in on-the-ground management as the current management is consistent with a Scenic classification.

Visual quality management would differ by river classification. The corridor of Wild segments outside wilderness would be managed for a Preservation VQO, while the viewshed would be managed for a Retention VQO. The corridors and viewsheds of Scenic segments would be managed for a Retention VQO. The corridor of Recreational segments would be managed for a Retention VQO, while the viewshed outside the corridor would be managed for a Partial Retention VQO. These VQOs would retain a natural or near natural-appearing landscape in both the river corridors and the middleground of the viewsheds.

Consequences Unique to Alternative G(SOHA)

The river corridor would extend to the first line of permanently established riparian vegetation along each river segment. This is consistent with the State's WSR boundary designation. Because all communities and most private lands would be outside the corridor, there would be minimal WSR management constraints on land adjustments. The corridors would average approximately 285 feet in width and 34 acres per river mile which minimizes the number of acres in the corridors.

Designated river classifications would remain the same as in the current situation; no reclassifications would be recommended.

Visual quality management would differ by river classification. The corridors of Wild segments outside wilderness would be managed for a Partial Retention VQO, while the river viewshed outside the corridor would be managed for a Modification VQO. These levels of visual management would be inconsistent with the laws and regulations governing management of Wild Rivers.

The river corridors of both Scenic and Recreational segments would be managed for a Retention VQO. The river viewshed outside the corridors of Scenic and Recreational segments along the Klamath and Scott Rivers would be managed primarily for Partial Retention. The viewshed outside the river corridors along both the North and South Fork Salmon River would be managed primarily for Modification.

The river corridors would retain a natural or near natural-appearing landscape. The lands outside the corridor along the Salmon River and its forks would appear modified by management activities, while those along the Klamath and Scott Rivers would have a near-natural appearance.

Additional Designation

Other rivers in the Forest were studied as potential additions to the National WSRs System. Thirteen rivers were determined to be eligible having 1 or more outstandingly remarkable values. Recommendations for additional designation were made from these rivers.

Table 4-36 lists the study river recommendations by alternative. Refer to Appendix E for a description of outstandingly remarkable values by river and the environmental consequences associated with recommendation of each river by alternative.

Table 4-36. Forest Study River Recommendations in Miles

	Alternative							
River Classification	PFD	CUR/RPA	A	B & B'	C	D & D'	E	G(SOHA)
Wild	101.1	0	123.8	93.7	112.2	102.7	126.6	0
Scenic	10.6	0	1.0	15.2	5.2	12.9	26.3	0
Recreational	59.6	0	50.8	52.8	14.0	31.9	33.4	0
Total	**171.3**	**0**	**175.6**	**161.7**	**131.4**	**147.5**	**186.3**	**0**

Specially Designated Area Management

Research Natural Areas

Important Interactions

Forest Service policy allows for very little active management within RNAs. Management activities that could affect RNA values include livestock grazing, mineral exploration and development, recreation and fire management. Resources that might benefit from RNA designation include some species of wildlife, unique ecological communities and some aspects of biological diversity. Resource knowledge, research opportunities and research partnerships could increase with RNA establishment.

Methodology

Alternatives were evaluated by comparing the number of RNAs proposed, their size in acres and ecological elements that would benefit from their establishment.

Environmental Consequences

Consequences Common to All Alternatives

The Forest has 9 candidate RNAs which are presently in some stage of the administrative establishment process. All alternatives would continue the establishment process for all candidate areas. These RNAs would contribute to meeting the Regional targets for major vegetative types in the Klamath Mountains and Cascade Range provinces plus 2 geologic elements. Their recommendation and subsequent establishment by the Chief of the Forest Service would provide an opportunity for ecological research and contribute to the maintaining certain aspects of the biological diversity of the Forest.

The 9 areas total approximately 12,500 acres. About 10,000 acres would be within wilderness. The exact acreage might vary slightly by alternative once the specific boundaries are assessed. Chapter 3 - Specially Designated Area Management contains information on the candidate RNAs.

In all alternatives, the standards and guidelines would permit very few activities to affect RNAs. Forest Service manual direction limits the types of activities that can occur within RNAs.

By law, existing grazing allotments and mining claims would continue, however AOIs, RPDs and plans of operations would have special stipulations to minimize the effect on RNA values and to rehabilitate any damage. Livestock grazing has the potential to adversely affect vegetation and water resources within all RNAs, particularly where meadows or other riparian areas occur, but no serious impacts are predicted.

Mining activities could potentially damage vegetation and geologic resources. Mining claims and areas with a high potential for locatable minerals exist within the Crater Creek RNA, but there are no currently active claims. In all alternatives, the Forest would request that BLM withdraw RNAs from further mineral entry.

Where existing trails are maintained within RNAs, dispersed recreational use could cause minor impacts to RNA values. Any recreational use that interferes with the management objectives of an RNA would be prohibited.

Wildfires could destroy vegetation and disrupt ongoing research. However, because wildfire is a natural process that is expected to occur periodically in any given area, it would not necessarily detract from the scientific values of an RNA. Prescribed fire might also be appropriate in some RNAs. Until a management strategy addressing the role of natural fire, prescribed fire and fire suppression is developed for each RNA, all fires threatening RNA values would be suppressed using methods that minimize ground and vegetation disturbance. In some cases on a longer time scale, there would be cumulative effects on the ecosystems due to past fire exclusion.

Implementation strategies would be developed for all RNAs after establishment as funding allows.

The RNA Management Program would continue to evaluate the suitability of other areas on the Forest as RNAs, although the intensity of this program might vary somewhat by alternative. Additional target elements identified by the Regional RNA Committee and opportunities identified on the Forest would trigger these evaluations.

With all alternatives, some areas potentially suitable as RNAs, but not yet identified, might be rendered unsuitable during the planning period through the implementation of resource projects. Alteration of the ecosystems by human activities would constitute an irreversible loss of potential RNAs.

Consequences Unique to Alternative E

This alternative would provide additional protection for vegetative and research values on approximately 10,000 acres of candidate RNAs within wilderness due to the exclusion of livestock grazing.

Special Interest Areas

Important Interactions

Management activities that could affect SIA values include fire suppression, mineral exploration and development, and livestock grazing.

Methodology

Based on its goals, each alternative recommended a group of candidate SIAs for designation. Alternatives were evaluated by comparing the number of SIAs recommended, their size in acres and the potential impacts that would occur without designation.

Table 4-37 displays the SIAs recommended by each alternative.

Environmental Consequences

Consequences Common to All Alternatives

SIA establishment would protect and highlight some of the special botanic, geologic and scenic features on the Forest. Botanic SIAs would protect some Sensitive and endemic plants species. SIAs would also provide opportunities for public education and enjoyment of natural resources.

In all alternatives, the 4 candidate Botanical SIAs currently being managed as SIAs would be designated. They are Little Shasta Meadow, Lake Mountain Foxtail Pine, Seiad Baker Cypress and Indian Creek Brewer Spruce Botanical Areas. Medicine Lake Glass Flow Geologic SIA, which was designated in the Record of Decision for the Modoc National Forest Plan EIS and is partially within the Klamath National Forest boundaries, would also be managed as an SIA in all alternatives.

In all alternatives, the 9 candidate SIAs within wilderness would receive protection from wilderness status even if not designated as SIAs. These are Bear Peak, Elk Hole, Preston Peak, Black Rock, Caeser Peak Snowfield, Cement Banks, Coffee Creek Stream Capture, Marble Rim and parts of the Digger Pine area.

Any other SIA candidates not designated in the Forest Plan would be managed under a variety of management prescriptions which would afford varying protection to the special interest values identified for each area. Many of the unique features identified in these areas would still be afforded protection at the project level such as Sensitive plant populations. Other values could be lost through project-level management activities, an irreversible loss. The interpretive, educational and recreational opportunities identified for these sites, however, would not be taken.

Implementation schedules would be prepared for each designated SIA establishing specific management direction. Work would begin on these schedules within 1 year of establishment and be completed as funding allows. Potential conflicts with other resource objectives would be addressed on a case by case basis as these strategies are developed.

Under all alternatives the management area prescription for SIAs would not directly modify the natural ecological processes of the area. However, since most SIAs are relatively small, there could be indirect effects from adjacent management prescriptions that would vary by alternative. The unique natural features would be protected from direct management actions in these areas. Tree removal and road building would be prohibited unless these activities are prescribed in the implementation schedules for enhancement of SIA values. Removal of trees encroaching on wet meadows is an example.

Wildfire could destroy vegetation in SIAs. Because wildfire is a natural process expected to occur periodically in any given area, it would not necessarily detract from SIA values. In some cases on a longer time scale, there would be cumulative effects on the ecosystems from the past exclusion of fire. Damage to SIA resources could also occur from fire control activities should a wildfire occur. The site-specific implementation schedules would define the role of fire control and use.

Mining activities could potentially damage vegetation and geologic resources. Livestock grazing has the potential to adversely affect vegetation and water resources within many SIAs, particularly where meadows or other riparian areas occur, but no serious impacts are predicted. By law existing mining claims and grazing allotments would continue, however plans of operations and AOIs would include special stipulations to minimize effects on SIA values and to rehabilitate any damage. The Forest would request BLM to withdraw SIAs from further mineral entry on a case-by-case basis when necessary to protect SIA values.

Evaluation of future potential SIAs would occur as they are identified. Potential SIA values would be protected until the candidate SIAs are either established or released to other management prescriptions.

Consequences Unique to the Preferred Alternative

This alternative would recommend all 6 of the Botanical and Geological SIAs, 18 Botanical SIAs and 21 Geological SIAs for designation. This is 45 of the 52 candidate SIAs, 63% of the total candidate acreage. The Cook and Green Pass, Mount Ashland/Siskiyou Peak, Observation Peak, Red Mountain, White Mountain and Condrey Mountain Blueschist SIAs along the Siskiyou Crest would be recommended; about 17% of the total Siskiyou Crest area.

Consequences Common to Alternatives Current/RPA and G(SOHA)

Designation would be completed for the 4 candidate Botanical SIAs in the designation process which are currently being managed as SIAs. The Medicine Lake Glass Flow Geologic SIA would continue as an SIA.

Table 4-37. Special Interest Area Recommendations								
	Alternative							
Special Interest Areas	PFD	CUR/RPA	A	B&B'	C	D&D'	E	G(SOHA)
Scenic Area:								
Siskiyou Crest Zone				X		X	X	
Botanical and Geologic Areas								
Black Lava Butte and Callahan Flow	X		X	X	X	X	X	
China Mountain	X			X	X	X	X	
Cook and Green Pass	X		X		X			
Cory Peak	X		X	X	X	X	X	
Kangaroo Lake	X		X		X	X	X	
Preston Peak	X				X	X	X	
Botanical Areas								
Bear Peak	X		X		X	X	X	
Digger Pine	X		X		X	X	X	
Duck Lake	X		X	X	X	X	X	
Elk Hole	X		X		X	X	X	
Horse Creek	X				X	X	X	
Indian Creek Brewer Spruce	X	X	X	X	X	X	X	X
Lake Mountain Foxtail Pine	X	X	X	X	X	X	X	X
Little Shasta Meadow	X	X	X	X	X	X	X	X
Mount Ashland/Siskiyou Peak	X		X		X			
Observation Peak	X		X		X			
Poker Flat	X				X	X	X	
Red Mountain	X				X			
Rhododendron Patch	X					X	X	
Rock Fence Creek	X				X	X	X	
Scott Mountain	X			X	X	X	X	
Seiad Baker Cypress	X	X	X	X	X	X	X	X
Sutcliffe Creek	X				X	X	X	
White Mountain	X				X			
Geologic Areas								
Antelope Sink			X		X	X	X	
Ash Creek Butte Rock Glacier	X				X	X	X	
Bloomer Debris Avalanche	X		X	X		X	X	
Cabin Meadow Pillow Lava	X			X	X	X	X	
Caeser Peak Perennial Icefield	X		X			X	X	
Cement Banks	X		X			X	X	

Table 4-37. Special Interest Area Recommendations								
	Alternative							
Special Interest Areas	PFD	CUR/RPA	A	B&B'	C	D&D'	E	G(SOHA)
Geologic Areas (cont'd)								
Coffee Creek Stream Capture	X		X		X	X	X	
Condrey Mountain Blueschist	X		X		X			
Condrey Mountain Schist Type Section	X				X	X	X	
Deek Creek Landslide	X				X	X	X	
Elk Lick	X		X	X		X	X	
Fourmile Hill Tree Molds	X				X	X	X	
Hole in the Ground	X			X	X	X	X	
Little Glass Mountain	X		X	X	X	X	X	
Little Grider Debris Avalanche	X				X	X	X	
McCash Creek Debris Avalanche	X					X	X	
Medicine Lake Glass Flow	X	X	X	X	X	X	X	X
Murderers Bar Landslide	X		X	X	X	X	X	
North Russian Landslide Dam	X				X	X	X	
Pumic Crater	X			X	X	X	X	
Rainbow Mountain						X	X	
Scorpian Caves			X	X	X	X	X	
Spees Peak Debris Avalanche			X			X	X	
Sulfur Spring			X			X	X	
West Fork Waterfall and Landslide	X		X	X	X	X	X	
Whitney Creek Volcanic Mudflow			X			X	X	
Wooley Creek Batholith Roof Zone	X		X	X	X	X	X	

These alternatives would manage about 6% of the total candidate acreage as SIAs.

Consequences Unique to Alternative A

Alternative A would recommend 4 Botanical and Geologic, 10 Botanical and 16 Geologic SIAs for designation. This is 26 of the 52 candidate SIAs, 41% of the total candidate acreage. The Cook and Green Pass, Mount Ashland/Siskiyou Peak, Observation Peak, and Condrey Mountain Blueschist SIAs along the Siskiyou Crest would be recommended; about 13% of the total Siskiyou Crest area.

Consequences Unique to Alternatives B and B'

These alternatives would recommend 1 Scenic, 3 Botanical and Geologic, 6 Botanical and 10 Geologic SIAs for designation. This is 20 of the 52 candidate SIAs, about 79% of the total candidate acreage. This alternative would recommend the entire 15,000 acre Siskiyou Crest which includes 6 other candiate areas.

Consequences Unique to Alternative C

Alternative C would recommend 6 Botanical and Geologic, 17 Botanical and 18 Geologic SIAs for designation. This is 41 of the 52 candidate SIAs, 62% of the total candidate acreage. The Cook and Green Pass, Mount Ashland/Siskiyou Peak, Observation Peak, Red Mountain, White Mountain and Condrey Mountain Blueschist SIAs along the Siskiyou Crest would be recommended; about 17% of the total Siskiyou Crest area.

Consequences Common to Alternatives D, D' and E

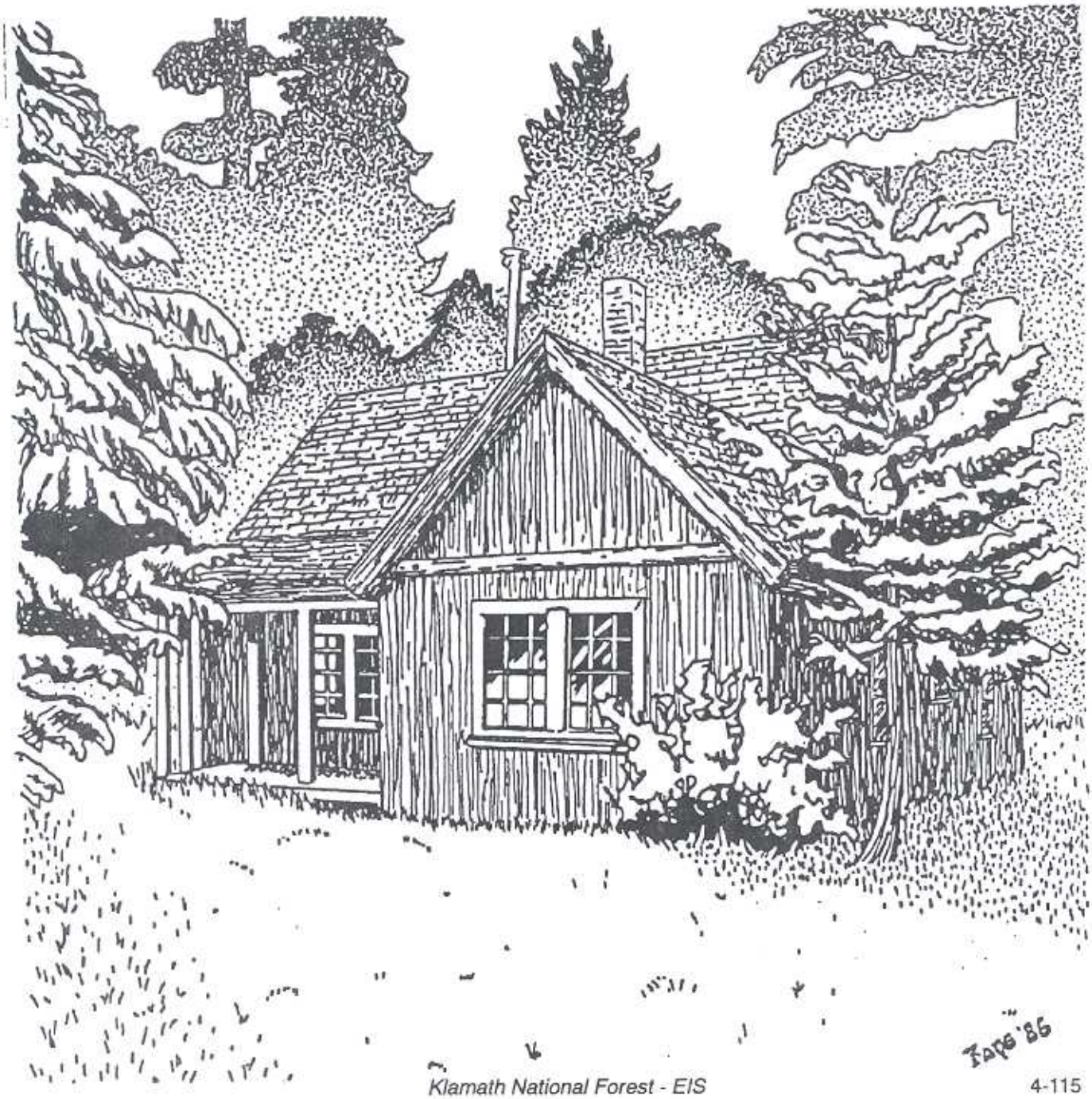
These alternatives would recommend 1 Scenic, 5 Botanical and Geologic, 14 Botanical and 26 Geologic SIAs for designation, all candidate areas. These alternatives would recommend the most SIAs and the most acreage of all alternatives. The entire Siskiyou Crest Zone would be recommended which includes 6 other candidate areas. These alternatives would have the highest likelihood of maintaining these ecological, recreational and educational values.

National Natural Landmarks

Consequences Common to All Alternatives

No National Natural Landmarks (NNLs) have been designated on the Forest to date. NNLs are designated in coordination with the National Park Service. The Park Service is currently under a legal moratorium on designating any new NNLs while they revise their evaluation and recommendation process. Further evaluation of the Forest for potential NNL candidates would be deferred until the National Park Service establishes its new process.

All natural areas on the Forest that qualify for NNL status have been analyzed as candidate SIAs or RNAs.



Butte Valley National Grassland

Consequences Common to All Alternatives

All alternatives would manage the BVNG to meet the objectives described in Chapter 3. All alternatives would use the same standards and guidelines. Management would be similar to current management. The condition of the range and wildlife habitat would be expected to gradually improve over time.

Lands Program

Important Interactions

Lands Program activities occur in response to Forest management needs and to adjacent landowner needs as authorized by laws, regulations and policies. The accomplishment of many land use activities depends on other Forest programs for funding. The primary forest management activities that influence land use activities are timber harvesting, transportation system development, mineral exploration and development as well as protection of cultural resources.

Activities on private land and mineral withdrawals also affect the Lands Program. Public use of federal land may also lead to a certain amount of unauthorized uses including encroachment, occupancy trespass, timber trespass, illegal disposal of hazardous wastes and production of illegal drugs.

Methodology

The consequences to the various elements of the Lands Program were estimated based on past knowledge and expected future trends. These consequences are described in a narrative fashion. The funding level for each alternative is also identified.

Environmental Consequences

Consequences Common to All Alternatives

Landownership

The mixed ownership pattern on parts of the Forest would continue to provide opportunities for landownership adjustment through exchange, donation and purchase. Exchanges would be considered when they are in the public interest; private goals would also be considered.

Private land within designated wilderness and designated WSR corridors would continue to be a priority for acquisition. Private parcels within areas recommended for designation as WSRs would become a priority for acquisition with the exception of existing townsites.

As there is no means to estimate how many private landowners would be willing to sell, the effect on the land use program can not be quantified. However, alternatives such as Alternative E with a greater number of river miles proposed for designation would be expected to have a somewhat greater effect. The width of designated WSR corridors could also affect the tools available for landownership adjustments within WSR corridors (refer to the Wild and Scenic Rivers Management section earlier in this chapter).

Cultural resource surveys are required prior to land exchange or disposal. The potential costs and delays could make some proposals not viable. However, since the regulations are the same, the effects would not vary between alternatives.

Property Boundary Location and Encroachments

The immediate need for accurate property boundary location is generated from planned activities by the Forest Service or other landowners near the boundary. The long-term need is to determine all property boundaries accurately. The need for property boundary location is expected to increase with all alternatives as activities on private lands increase. As more of the work is accomplished, more encroachments are expected to be discovered. The property boundary location program and the number of encroachments to resolve would not vary substantially by alternative.

Special Uses and Rights-of-Way

As mining activity, movement onto private land and activities on private lands increase; requests for special use authorizations, the need for rights-of-way cost-share agreements and the need for rights-of-way acquisitions would increase above existing levels with all alternatives. However, the trends in mining activity and in settlement are expected to be the same regardless of the alternative. The requirements for cultural resource surveys prior to implementation of these types of activities could cause additional time and expense that might make them infeasible.

Special use applications would continue to be generated externally. Although the number of proposals cannot be predicted, they are assumed to be the same for all alternatives and to have similar effects, except perhaps the Preferred Alternative (covered later). It is expected that the existing electronic communication sites would continue to be used.

Withdrawals

Any new proposals for Wild segments of WSRs that are enacted by Congress would be withdrawn from mineral entry under the provisions of the WSRA subject to valid existing rights. These are not expected to increase the workload of the Lands Program substantially.

For alternatives that recommend withdrawal from mineral entry and leasing for administrative sites, developed recreation sites and RNAs; recommenda-

tions would have to be made to the BLM. The number of recommendations for mineral withdrawal is not expected to prove an impact on the Lands Program under any alternative.

Innocent Encroachment Issue

As mentioned above, the number of innocent encroachments is expected to increase as more property boundaries are located. Resolutions that are to the mutual benefit of all parties involved would be sought for all alternatives. The Small Tracts Act would be the primary means of resolution for innocent encroachments. The number of requests for relief under the Small Tracts Act is expected to increase. A cultural resource inventory would be required prior to any use of the Small Tracts Act.

Community Expansion Issue

With all alternatives, community expansion would be encouraged when it was deemed to be in the common interest of the federal government and the local community. The Small Tracts Act, the Townsite Act and land exchange would be used to respond to the needs of these communities.

Cultural resource surveys are required prior to use of the Small Tracts Act, the Townsite Act and any land exchange or disposal. Because the regulations are the same for all alternatives, the social effects and the effects on the Lands Program would not vary between alternatives.

Utility Corridors Issue

In all alternatives, the determination as to whether the expansion of existing utility corridors or the construction of new ones would be consistent with land allocations made in the Forest Plan would be made in the site-specific analysis on a project by project basis.

Comparison of Alternatives

Timber harvesting and transportation system development activities often require cost-share and rights-of-way agreements, locating property boundaries and designating property corners. The cost-share program is expected to be constant under all alternatives.

The Lands Program would be larger in the other 3 areas for those alternatives which allocate more land to timber management. Alternative B would have the largest number of regulated acres and would therefore have the greatest workload for the Lands Program. Alternative B would be followed by Alternatives G(SOHA), D, A, Current/RPA, C, D', B', E and Preferred in decreasing order.

The funding level of the Lands Program directly affects the Forest's ability to respond to external and internal land use needs. All alternatives except the Preferred, A, .B and B' would fund the Lands Program at a moderate level. This moderate level program would be similar to the existing level. Legal requirements would be met and resource program needs would generate the majority of the work. Landownership adjustment analyses would occur for high priority lands only. For all alternatives, high priority land would include wilderness and WSRs.

Alternatives Preferred, A, B and B' would fund the Lands Program at a high level. This program would process and administer special use permits and landownership adjustment requests in a more timely manner. These alternatives would have a larger Lands Program than the first group of alternatives.

Consequences Unique to the Preferred Alternative

The Preferred Alternative would fund the Lands Program at a high level. It would include consolidation of ownership for more effective ecosystem management, including the attainment of Aquatic Conservation Strategy objectives, as a high priority for land ownership adjustment.

More costly and restrictive standards would be applied to easements and rights-of-way permits within RRs than in the past; this could discourage these types of projects due to increased costs. There would also be special requirements for hydroelectric power projects for the purpose of maintaining favorable flows and protecting fish habitat. New support facilities for hydroelectric projects would have to be placed outside RRs if possible. New and existing ones within RRs would have to meet Aquatic Conservation Strategy objectives or be relocated. These requirements would increase the costs of these projects which could discourage applications for these types of special use permits.

Consequences Unique to Alternative A

Alternative A would fund the Lands Program at a high level. This alternative would emphasize resolution of the community expansion issue for the communities of Sawyers Bar, Happy Camp, Somes Bar, Scott Bar, Forks of the Salmon/Knownothing area, Yreka and Cecilville. Funding would be made available to consider these external proposals. Land exchange priorities for this alternative would include river access areas for important fisheries and recreational streams. Coordinated resource management plans would be sought in areas where mixed ownership might pose potential conflicts between resources.

Consequences Unique to Alternatives B and B'

Alternatives B and B' would fund the Lands Program at a high level. This program would take a proactive approach to land adjustment. Special emphasis would be placed on acquiring land within WSR corridors. The primary tools to achieve this would be the Small Tracts

Act and the Townsite Act. Easements for access would have to be obtained if there was disposal of any lands valuable for recreational uses, especially along rivers.

Consequences Unique to Alternative C

Alternative C would emphasize consolidating ownership of lands to meet biological diversity needs and to protect habitat for T&E and Sensitive species. This alternative would require that an interdisciplinary process be used to prioritize potential land exchanges.

Consequences Unique to Alternatives D and D'

High priority lands for land adjustment would include areas that provide access to streams, lakes and ponds. This alternative would require that an interdisciplinary process be used to prioritize potential land exchanges. Coordinated resource management plans would be sought in areas where mixed ownership might pose potential conflicts between resources.

Law Enforcement

Consequences Common to All Alternatives

All laws and regulations would continue to be enforced. Vigorous efforts to protect the resources and public health would continue under all alternatives.

Although increasing restrictions on public use could create an environment that increases the ease of illegal activities; local, State and Federal law enforcement activities are expected to counteract this tendency in all alternatives.

Vandalism of cultural sites, occupancy trespass, forest products trespass, drug production and hazardous waste disposal cases would be prosecuted in the courts when other methods of prevention or resolution were found to be inappropriate or ineffective. The current methods of prevention and resolution identified in Chapter 3 - Law Enforcement would continue to be used in all alternatives.

All alternatives provide for funding the law enforcement program at a moderate level. This would include funding for surveillance, arrest and prosecution. Cooperative work with the Sheriff's office and other local law enforcement agencies would be emphasized.

Minerals Management

Important Interactions

The timing, location and extent of mineral activities depend on current and projected market values. Market value is a function of supply and demand. Availability and ease of access are also important elements of mineral exploration and development.

Most management activities interact with mineral extraction activities to some degree. Those with the greatest potential to adversely affect mineral exploration and development are special wildlife habitat needs, recreation and visual quality management, timber management, transportation system development and cultural resources. Activities which may conflict with surface use during mineral exploration and development include Native American spiritual ceremonies, fishing and recreational use of rivers and streams.

Methodology

The effect on the minerals resource has been estimated based on the amount of land available for mineral entry and on management direction which would restrict or constrain mineral activities. Two key indicators are used to reflect this:

1) acres of land by mineral potential rating withdrawn from locatable and leasable entry and
2) acres of land by mineral potential rating open to entry, but with special requirements.

The consequences of the alternatives on the minerals resource have been analyzed by grouping the proposed management areas by their level of restrictions.

The timing, location and extent of mining activities are generally based on specific proposals from private individuals or companies. Therefore, the indirect effects of protecting other resources cannot be quantified but might include reduced mineral production, production delays, increased operating costs and increased reclamation costs. These impacts can only be analyzed on a site-specific basis after the activities have been proposed.

Environmental Consequences

Consequences Common to All Alternatives

Minerals Program

All alternatives would accomplish certain non-discretionary actions including those actions required by law or regulation. Examples include responding to proposals for lease agreements and reviewing proposed plans of operations.

All alternatives would request funding for the Minerals Program at a level which would allow the Forest to provide some facilitation for mineral and energy resource exploration and development in order to minimize environmental degradation in addition to accomplishing the non-discretionary actions. Some monitoring of plans of operations would also be funded.

With any alternative, if less funding was received than requested, the minerals program would be reduced.

Discretionary actions would be discontinued first. If the budget was constrained to the point where non-discretionary actions could not be accomplished, the failure to comply with the law could cause a high risk of environmental degradation.

Mineral and Energy Development

Mineral activity would be allowed in most management areas under all alternatives in accordance with existing laws and regulations. Management practices or administrative conditions that would withdraw lands from mining activities in certain management areas or which would constrain mineral exploration, access and/or development would have the most significant effect on development of the mineral resource.

The demand for mineral exploration and development is expected to be the same under any alternative. The amount of land available for mineral development would be very similar under all alternatives (refer to Table 4-39). Therefore, the number of plans of operations and leases is expected to be very similar for all alternatives, varying only in response to changes in the national economy. This would include plans of operations for locatable minerals, mineral leases and associated permits for leasable minerals as well as mineral material disposal permits.

Cultural resource surveys and analysis would be required for these types of permits before any mineral development activities could occur which might cause delays and additional expense for required mitigation measures.

Locatable mineral activities would be expected to occur primarily on the westside of the Forest which has all of the high and moderate mineral potential land for locatable minerals. The mineral potential for locatable minerals on the eastside of the Forest is unknown.

Geothermal, oil and gas development would be expected to occur primarily on the east side of the Goosenest Ranger District within the Glass Mountain KGRA where the potential is rated high. Some development would also be expected to occur on the remainder of the Goosenest Ranger District and in the upper reaches of Elk Creek on the Happy Camp Ranger District where the potential for leasable minerals rates as moderate. Development of these resources would be restricted by the stipulations that appear on standard lease forms and by the restrictions required by pertinent laws.

Common variety mineral material would likely be used in all parts of the Forest as it occurs throughout the Forest.

Because demand would be the same for all alternatives, the Forest's energy program is expected to be the same for all mineral energy resources under any alternative. All alternatives would make the same small, but important contribution towards achieving the National goal of self-sufficiency. For a discussion of non-mineral energy resources, refer to the Timber Management, Other Products section later in this chapter.

Surface Use

In all alternatives, emphasis would be placed on the timely processing of mineral exploration and development proposals, consistent with the existing regulations. The regulations governing surface use provide the authority to deal with surface use conflicts. Approved plans of operations would include provisions to minimize adverse effects on surface resources through fair and reasonable surface-use restrictions and through reclamation measures. No approval would be given for use of the surface, including residential occupancy, unless the proposed use is both reasonable and necessary for the level of mineral activity proposed.

Requirements would be imposed for reasonable protection of air quality, water quality, scenic values, fish habitat and wildlife habitat consistent with individual management area direction. Plans of operations would include provisions for promptly restoring affected lands to a second productive use.

Mineral activities in areas where the Karuk people hold spiritual ceremonies could be affected for a short period each summer. Although the Forest Service has no authority to require operators to stop operations during this period, recommendations to do so can be made. In the past, the operators in these areas have complied with requests by Karuk Tribal members to stop mining activities during the ceremonies.

Comparison of Alternatives

Mineral and Energy Development

Withdrawal of an area from mineral entry adversely affects mineral and energy development. An area may be withdrawn to limit mineral activities, maintain other public values or to reserve an area for a particular public purpose or program.

Wildlife habitat, recreation and visual quality management would affect the minerals resource through restrictions. Adverse effects caused by restrictions include delays or increased costs associated with protecting the wildlife, the recreational value and the visual quality resource.

Management areas are categorized by level of restriction in Table 4-38. The total acres in each category are displayed by alternative in Table 4-39. Table 4-39 displays the comparative results of each alternative's land allocations on locatable mineral exploration and development opportunities. Withdrawals from mineral entry would be requested for proposed Wild segments of WSRs and for RNAs. The acres withdrawn from

mineral entry in Table 4-39 include the existing withdrawals for wilderness, Wild segments of WSR, administrative sites and developed recreational sites as described in Chapter 3 - Minerals. For comparative purposes, column 1992 Base displays the acres currently withdrawn.

Table 4-38. Management Areas by Level of Restrictions for Locatable Minerals

Restriction Level	Management Areas
Withdrawal From Mineral Entry	Wilderness
	Wild Rivers
	Research Natural Areas
Special Requirements	Threatened and Endangered Species Habitat, Special Habitat
	Sensitive Species Habitat
	Special Interest Areas
	Cultural Sites
	Backcountry
	Habitat Linkage (Alternative C only)
	Retention (Visual Quality Objectives)
	Scenic and Recreational Rivers
	Riparian (Preferred Alternative only)
	Geologically Unsuitable
	Inner Gorge/Unconsolidated Material
Few or No Special Requirements	Butte Valley National Grassland
	Riparian (All Alternatives but Preferred)
	Big Game Habitat Management
	Partial Retention (Visual Quality Objectives)
	Forage
	General Forest

The first group of management areas in Table 4-38 by law is currently withdrawn or would be proposed for withdrawal from mineral entry and leasing. Withdrawal of these lands from mineral entry would constitute an irretrievable commitment of resources. Within these management areas, only mineral activities conducted under valid existing rights established prior to the withdrawal would be allowed.

As Table 4-39 shows for the first group of management areas, Alternatives Current/RPA and G(SOHA) would recommend the least land for withdrawal from mineral entry. They would be followed by Alternatives Preferred, D, D', B, B', C, A and E in increasing order. The acreage differences between alternatives are so slight that about 23% of the Forest would be recommended for withdrawal under any alternative.

The acreage difference between alternatives comes from the number of acres that each alternative would propose for designation as Wild segments of WSRs. With Alternatives Preferred, Current/RPA, B, B' or G(SOHA) roughly 1,000 acres would be withdrawn on which the mineral potential rates as high to very high in addition to the current withdrawals (labelled 1992 Base). With Alternatives A, C, D, D' or E roughly 2,000 acres would be withdrawn on which the mineral potential rates as high to very high in addition to the current withdrawals. Alternatives Current/RPA and G(SOHA) would provide the greatest opportunities for locatable mineral development, closely followed by Alternatives B, B' and Preferred.

The second group of management areas in Table 4-39 would have standards and guidelines which impose special requirements on mineral activities. Prescriptions within these management areas might constrain or restrict minerals activities to protect other resources to meet environmental laws such as the ESA. Examples include limited or special access, staged development to limit vegetative openings, seasonal operating restrictions, more complete surface restoration and specific species requirements for revegetation. These restrictions or constraints would not preclude mineral activities, but might increase the cost of exploration, mineral extraction and other mining activities.

As Table 4-39 shows, Alternative G(SOHA) would have the least total acres requiring special restrictions, followed by Alternatives Current/RPA, D, D', Preferred, B, B', C, A and E in increasing order. Even more important, Alternative G(SOHA) would impose special requirements on the least acres with a high to very high potential, followed by Alternatives Current/RPA, A, D, D', B, B', C, Preferred and E in increasing order. These acre estimates include only the RRs which are mapped in the database. For the Preferred Alternative, the actual number of acres with Special Requirements would be higher when intermittent streams are included; a number of these areas may have high to very high mineral potential.

The third group of management areas in Table 4-38 would have few or no special requirements for locatable mineral activities. As Table 4-39 shows, Alternative G(SOHA) has the most total acres and also has the largest number of high to very high mineral potential acres in this group so would provide the best opportunities for mineral exploration and development. Alternative Current/RPA provides the second most opportunities with the second greatest high to very high mineral potential acres with few to no restrictions. It is followed by Alternatives A, D, D', B, B', C,

Table 4-39. Effects on Locatable Mineral Exploration and Development Opportunities by Thousands of Acres

Require-ments	Mineral Potential	Alternatives								
		1992 Base	PFD	CUR/ RPA	A	B & B'	C	D & D'	E	G(SOHA)
Withdrawal from Mineral Entry	High-Very High	32	33	33	34	33	34	34	33	33
	Low-Moderate	226	226	226	226	226	227	226	226	226
	Unknown	124	127	126	129	129	127	128	134	126
	Total	**382**	**386**	**385**	**389**	**388**	**388**	**388**	**393**	**385**
Special Requirements	High-Very High	*	113	82	90	98	104	94	127	66
	Low-Moderate	*	18	5	10	17	29	10	44	7
	Unknown	*	412	424	508	433	448	417	552	269
	Total	*	**543**	**511**	**608**	**548**	**581**	**521**	**723**	**342**
Few or No Special Requirements	High-Very High	*	114	146	137	130	122	133	99	162
	Low-Moderate	*	30	43	38	31	18	38	1	41
	Unknown	*	606	595	508	583	570	600	464	750
	Total	*	**750**	**784**	**683**	**744**	**710**	**771**	**564**	**953**

* Information not available.

Preferred and E in decreasing order for acres rated as high to very high potential.

The alternatives that withdraw and restrict the least acres would provide the least hindrance to developing the mineral and energy resources on the Forest. The alternatives that withdraw and restrict the least acres with a high and very high potential rating would provide the best opportunities for locatable mineral development.

As shown by all 3 groups in Table 4-39, Alternative G(SOHA) would provide the least hindrance and the most opportunities for locatable mineral development, followed by Alternative Current/RPA. While Alternatives A, C, D and D' would withdraw slightly more acres of high to very high potential land; Alternative E followed by Alternative Preferred would provide the least opportunities for mineral development due to the larger number of acres with special restrictions. Mineral development opportunities for the other alternatives with their varying mixtures of withdrawn and special requirement acres would fall somewhere between those of Alternatives G(SOHA) and Current/RPA on the upper end and Alternatives Preferred and E on the lower end.

With all alternatives, the opportunities to develop locatable minerals occur in the same areas. These are the areas with high to very high mineral potential and the least amount of restrictions. The alternatives provide differing acres that are unrestricted in these areas as discussed above. The areas are Empire and Lumgrey Creek, lower Beaver Creek, Humbug and Little Humbug area, Horse Creek, the mouth of the Scott River and the South Fork of the Scott River, Elk Creek, Indian Creek, the Klamath River, the North Fork and South Fork of the Salmon as well as their tributaries particularly McNeal Creek, Matthews Creek and the East Fork of the Salmon River. The opportunities for development with few restrictions occur outside the WSR corridor on those streams which are designated WSRs or proposed as additions to the WSR system in any alternative.

No acres rated as very high to high for leasable mineral development potential would be withdrawn from mineral entry under any alternative. However, the Preferred Alternative would prohibit surface occupancy for leasable mineral exploration and development activities within all RRs where contracts and leases do not already exist, which include about 197,200 acres. The RRs on the eastside and in the Elk Creek area of Happy Camp Ranger District have a moderate to low potential for leasable minerals.

Alternative G(SOHA) would impose special requirements on the fewest acres, only 1,920 acres, for areas rating a very high to high in leasable mineral potential. Alternative G(SOHA) would be followed by Alternative Current/RPA with 4,080 acres, then by Alternative A with 5,680 acres, Alternatives D and D' with 7,760 acres, Alternative C with 7,800 acres, Alternative E with 7,960 acres, Alternatives B and B' with 8,000 acres. The Preferred Alternative would impose special requirements on the greatest number of acres, 9,070 acres, with very high to high leasable mineral potential.

The best opportunities for leasable mineral development occur on the eastern portion of the Goosenest Ranger District west of Fourmile Hill for all alternatives. This is the only area on the Forest with a very high to high leasable mineral potential that would have few to no special requirements.

Limited access opportunities caused by leaving areas unroaded can also affect mineral exploration and development. Road construction generally has a beneficial effect on the minerals resource. As new roads are built, access is improved and mineral exploration and development opportunities are enhanced. Road closures can limit access and discourage mineral exploration.

In general, the alternatives which would construct roads over the greatest area would be the most beneficial to mineral exploration and development. Excluding land allocated to unregulated management areas, Alternatives B and B' would permit road construction on the remaining 52% of the Forest unless otherwise restricted. Alternative G(SOHA) would permit road construction on 50%, D and D' on 44%, A on 42%, Current/RPA on 40%, C on 38%, E on 23% and Preferred on 21%. For the Preferred Alternative, no new roads would be constructed on unroaded portions of inventoried roadless areas within Key Watersheds, about 9% of the Forest. The Preferred Alternative would also reduce overall road density in Key Watersheds, which comprise 41% of the Forest.

Those alternatives which provide for less emphasis on roadless and non-motorized recreational resource management, as well as fewer withdrawn and restricted areas, would have fewer impacts on mineral resource availability. Alternative G(SOHA) would provide the most opportunities for mineral availability as it would have the least withdrawals and restricted areas and would permit road construction on the second largest percentage of the Forest. Alternatives B and B' would have a moderate level of withdrawn and highly restricted acres and would permit road construction on the largest percentage of the Forest.

Alternative E would provide the least opportunities for mineral development as it has the greatest number of restricted acres and would permit road construction on the second smallest percentage of the Forest. Alternative Preferred would provide the second least opportunities for mineral development as it has the second greatest number of acres with special restrictions and would permit road construction on the smallest percentage of the Forest.

Those alternatives which have less emphasis on Retention or Preservation VQOs would tend to have fewer cases of relatively high costs of operating. Alternatives Current/RPA and G(SOHA) would have the least acres in those VQO classes, only 28% of the total Forest, and would be expected to have the lowest operating costs. Alternatives D and D' would have 30%, the Preferred Alternative 31%, Alternatives B and B' 34%, Alternative A 49% and Alternative C 57% of the Forest in those VQO classes and would be expected to have an intermediate level of operating costs. Alternative E would have the most acres, 76% of the Forest, in the Retention and Preservation VQO classes and would be expected to have the highest operating costs for mineral exploration and development.

Prior to any mineral activity involving ground disturbance, a cultural resource inventory must be completed. In addition, adverse impacts on the cultural resources must be mitigated. The cost of mitigating those impacts is the responsibility of the mining operator. Complying with the requirements for inventories and mitigation could result in delays and increased costs to the operator. However, since the rules and regulations for protection of cultural resources are the same for all alternatives, the effects would not vary by alternative.

Those alternatives which propose completing cultural resource inventories of portions of the Forest, either in response to specific projects such as timber harvesting or to enhance the cultural resource database, may also have less adverse impact on the minerals resource, since some of the costs and delays associated with those inventories would be borne by others.

Alternatives Preferred, A, C, D, D' and E would request an increased budget for cultural surveys to help determine the significance of sites. Alternatives B and B' would emphasize completing the cultural resource inventory Forest-wide, but would not program as much money as Alternatives Preferred, A, C, D, D' and E.

Consequences Unique to the Preferred Alternative

Structures, support facilities and roads would be located outside RRs. Where no alternative location exists, these facilities would need to be consistent with Aquatic Conservation Strategy objectives. Reclamation plans and reclamation bonds would be required for all mineral operations that include RRs. These requirements could discourage mineral exploration and development by some small operators who could not afford these special requirements. For leasable minerals, surface occupancy would be prohibited within RRs for new leases. This could discourage the exploration and development of oil, gas and geothermal resources, particularly on the westside of the Forest.

Consequences Unique to Alternatives D and D'

Surface Use

Reclamation bonds would be required on streams that support populations of fish that have been designated

as Sensitive in order to protect resource values and provide for mitigation and rehabilitation. This requirement could discourage mineral development by some small operators who could not afford the required bond.

Checking for compliance with plans of operation would be upgraded from historic levels. An inventory of hazardous mine wastes would be conducted. Restoration efforts would focus on reclamation of abandoned mine sites and abatement of potential pollutants from hazardous wastes.

These alternatives would increase the work load on the Minerals Program, particularly in the areas of checking compliance with plans of operation and in completing an inventory. Because there would not be a corresponding increase in budget, other portions of the Minerals Program such as facilitating mineral and energy resource exploration and development would have to be reduced. Nor would the Forest be able to provide any assistance in developing plans of operations.

Transportation and Facilities Management

Important Interactions

Facilities are an important part of the human environment They are the infrastructure that is required for management and public use of all Forest resources. Facilities are planned, constructed and maintained in support of forest management and resource uses. Roads are planned, constructed, managed and maintained mainly in support of the timber management and recreation programs. However, other Forest functions may benefit from the access they provide.

Forest roads represent 5 to 15% of the total cost of timber production, however the access they provide typically reduces the costs associated with timber production by 50%. Roads represent a significant public investment on this Forest.

Roads like all facilities require maintenance to protect that investment. Road maintenance is generally a function of the amount of use and of weather conditions. The Forest protects the public investment in roads by limiting or restricting use when that use could result in high maintenance costs. The Forest closes approximately 25% of all roads for some time each year to reduce road maintenance costs as well as for the protection of other resource values such as wildlife and watershed.

Facilities that provide access to Forest resources are generally driven by land allocation. Land allocations which support timber harvesting and recreation values will generally require higher average road densities than those allocations that favor wildlife and watershed values. Allocations which emphasize developed recreational use allow for the construction and reconstruction of roads that provide access to campgrounds, picnic sites and trails.

Methodology

The following key indicators were selected to compare how each alternative responds to the facilities issues:

Road system miles:

- by construction
- by reconstruction
- by functional class (local, collector and arterial);
- by management objective
- by maintenance level
- by density
- by open density
- by miles removed/revegetated/obliterated
- by estimated miles of uninventoried/non-system road.
- by miles of collector and arterial road reconstructed

Key indicator values were estimated by several methods. Estimates for future road construction were based on the amount of road needed to efficiently manage regulated acres. Using a mixture of the harvesting systems currently available, a theoretical future road density was computed. This road density was calculated to be 4.5 miles per square mile. The existing road density is 3.26 miles per square mile. These road densities are Forest-wide averages; the actual density on specific areas of the Forest will vary.

The difference between existing road density and theoretical future road densities were used to determine the amount of road construction that would be needed for each alternative. The timing and amount of future road construction varied with each alternative's particular emphasis.

Road densities will be displayed as current, total managed, available and open. Current road density was calculated using current Forest inventory road mileages and gross Forest acreages minus RARE II areas and wilderness. Total managed density uses those acres previously designated as Rare II that are part of a given alternative in addition to acres currently under management. Available road density uses acres in Regulation Class 1, 2 and 3 in any given alternative. Open road density uses acres available for any given alternative and road that is managed in an open classification.

Road reconstruction mileages were based on historical data and modified to reflect reduced timber harvesting levels for this range of alternatives. Alternatives that emphasized recreational values have the arterial and portions of the collector road system

reconstructed to be responsive to anticipated increase in recreational use. Road maintenance, construction and reconstruction costs were based on historical data modified to reflect current construction standards and cost trends.

Environmental Consequences

Consequences Common To All Alternatives

Land allocations which promote public use would cause increased use of roads, trails and other facilities. This increased use would cause some facilities to exceed their capacity.

Forest-wide standards and guidelines for location, design, operation and maintenance of facilities would assure that improvements would be commensurate with their intended use over time.

Non-System Roads

All alternatives would require temporary roads to be revegetated and hydrologic function restored through the use of permits or contracts. As site-specific landscape management opportunities are planned and implemented, roads not currently under management (uninventoried) would be either incorporated into the transportation system for management or revegetated and hydrologic function restored. By the end of the fifth decade, it is estimated that all non-system roads would be disposed of in this manner.

Scenic Byways

The State of Jefferson route was recently included in the Scenic Byways System. This route and any additional routes added to the Scenic Byway System through the nomination process would attract more use to these roads, resulting in higher maintenance costs over time.

OHV Use

All alternatives would continue the current closures for OHV use: wilderness, PCT, Boundary and Clear Creek National Recreational Trails and part of the Kelsey National Recreational Trail. Alternatives Preferred, A, C and E would also close Wild River corridors and RNAs to OHV use. Alternatives Preferred, A and E would close the Backcountry Management Area. Alternatives B and B' would close certain trails. Alternatives Preferred and C would close SIAs to OHV use. Alternatives Current/RPA, D, D' and G(SOHA) would not have any additional closures.

OHV use is a minor portion of the Forest's total recreational use with ample opportunities available to meet projected demand. Therefore, OHV use would only be minimally affected by the constraints any alternative would require. Road Management Objectives developed during project planning would analyze potential OHV use. Areas suitable for OHV use would be identified in those plans as would areas closed to OHV use to meet resource management objectives.

Administrative Facilities

Six administrative offices are leased by the Forest and a seventh is leased jointly with the Six Rivers National Forest. These numbers could change. Leased offices could be replaced by government-owned facilities. Offices could be combined or eliminated as needs change. Facilities would be maintained and replaced as time and use caused deterioration and as available funding allowed. Existing structures with historical significance would require completion of site maintenance plans to maintain their historical values. New facilities would be constructed as demand dictates. New facilities would be designed to be cost efficient and to accommodate access by the physically handicapped.

The 5 existing dams would not change for any alternative.

Comparison of Alternatives

Road Construction/Reconstruction

Table 4-40 displays the estimated average new road construction miles per decade for the first and fifth decade and average miles of reconstruction per decade for the first and fifth decade for each alternative.

The Current Alternative differs from the RPA Alternative in road construction and reconstruction miles. In Alternative RPA, road construction would be limited by the RPA goals to 15 miles per year in the first decade

Table 4-40. Road Construction and Reconstruction Miles by Decade

	New Construction		Reconstruction	
Alternative	Decade 1	Decade 5	Decade 1	Decade 5
Current Situation	235		221	
PFD	100	50	200	400
CUR	227	227	213	213
RPA	150	50	141	47
A	235	235	221	221
B	284	284	267	267
B'	203	203	191	191
C	151	151	142	142
D	227	227	213	213
D'	207	207	194	194
E	119	119	112	112
G(SOHA)	235	235	221	221

and 5 miles per year in the remaining 4 decades, so cannot be realistically compared with the other alternatives. A continuation of the current situation would provide for new road construction at an average of 22.7 miles per year during both the first and fifth decades.

Alternative B would construct and reconstruct the most miles of road. Alternatives A and G(SOHA) would construct and reconstruct the second greatest number of road miles. These would be followed in decreasing order by Alternatives Current, D, D', B', E and RPA. The Preferred Alternative would construct the least number of road miles. No new construction would occur in roadless areas within Key Watersheds, about 9% of the Forest and roads would not be constructed in Key Watersheds unless an equal length of road was closed elsewhere within Key Watersheds. Alternatives with the most proposed miles of construction and reconstruction would have the largest permanent transportation system.

Road Classification

Roads are classified as arterials, collectors or locals. These classifications differ by the kinds and amount of traffic use expected within their design life. Arterial roads offer the user mobility; local roads generally provide access to specific locations. Future road classification ratios will likely be similar to the current ratios and therefore there are no percentage differences by road classification between alternatives. Of course, alternatives which would maintain more miles of road on the transportation system would have more miles of road in all road classifications.

Table 4-41 displays the estimated road miles in each road classification for each alternative

Road Management

Road management objectives would be established and/or modified as part of ecosystem analysis at the landscape/watershed level and of project planning to meet the standards and guidelines for affected resource areas with any alternative. Roads would be closed to meet a variety of resource objectives. Seasonal closures would be used to protect certain wildlife species during critical periods of their life cycles and to limit vehicle use during winter periods or when inclement weather caused road surfaces to be soft and susceptible to road surface damage.

More permanent closures would reduce open road densities to comply with management area standards and guidelines. Many of these closures would limit public use by passenger vehicle but not necessarily by foot travel or certain types of OHV use. Again, road management objectives at the project level would be used to determine which roads to close for what reasons and the type of closure.

Table 4-42 shows the number of miles each alternative would place in each road management objective category in Decades 1 and 5.

There is no significant difference between the number of road miles that each alternative would discourage and eliminate.

Table 4-41. Road Classification Miles

Alternative	Arterial	Collector	Local	Total
Current Situation	157	1,455	3,502	5,114
Alternative PFD				
1st decade	160	1,483	3,570	5,214
5th decade	166	1,540	3,707	5,414
Alternative CUR				
1st decade	164	1,520	3,657	5,341
5th decade	192	1,778	4,279	6,249
Alternative RPA				
1st decade	162	1,497	3,605	5,264
5th decade	168	1,554	3,742	5,464
Alternative A				
1st decade	164	1,522	3,663	5,349
5th decade	193	1,789	4,307	6,289
Alternative B				
1st decade	166	1,535	3,697	5,398
5th decade	201	1,859	4,474	6,534
Alternative B'				
1st decade	163	1,513	3,641	5,317
5th decade	188	1,744	4,197	6,129
Alternative C				
1st decade	162	1,498	3,606	5,266
5th decade	180	1,670	4,019	5,869
Alternative D				
1st decade	157	1,455	3,502	5,114
5th decade	157	1,455	3,502	5,114
Alternative D'				
1st decade	157	1,455	3,502	5,114
5th decade	157	1,455	3,502	5,114
Alternative E				
1st decade	161	1,489	3,584	5,234
5th decade	175	1,624	3,910	5709
Alternative G(SOHA)				
1st decade	164	1,522	3,663	5,349
5th decade	193	1,789	4,307	6,289

Table 4-42. Road Management Objectives in Miles of Road						
Alternative	Encourage	Accept	Discourage	Eliminate	Prohibit	Total
Current Situation	1,287	2,838	4	25	960	5,114
Alternative PFD						
1st decade	1,312	2,894	4	25	978	5,214
5th decade	1,363	3,005	4	26	1,016	5,414
Alternative CUR						
1st decade	1,344	2,964	4	26	1,003	5,341
5th decade	1,572	3,467	5	27	1,173	6,249
Alternative RPA						
1st decade	1,325	2,921	4	26	988	5,264
5th decade	1,375	3,032	4	27	1,026	5,464
Alternative A						
1st decade	1,346	2,968	4	26	1,005	5,349
5th decade	1,583	3,489	5	31	1,181	6,289
Alternative B						
1st decade	1,359	2,996	4	26	1,013	5,398
5th decade	1,644	3,152	5	28	1,705	6,534
Alternative B'						
1st decade	1,339	2,951	4	25	998	5,317
5th decade	1,542	2,957	5	26	1,599	6,129
Alternative C						
1st decade	1,325	2,922	4	26	989	5,266
5th decade	1,477	3,257	5	29	1,101	5,869
Alternative D						
1st decade	1,287	2,838	4	25	960	5,114
5th decade	1,287	2,838	4	25	960	5,114
Alternative D'						
1st decade	1,287	2,838	4	25	960	5,114
5th decade	1,287	2,838	4	25	960	5,114
Alternative E						
1st decade	1,317	2,905	4	26	982	5,234
5th decade	1,437	3,167	5	28	1,072	5,709
Alternative G(SOHA)						
1st decade	1,346	2,969	4	26	1,004	5,349
5th decade	1,583	3,490	5	31	1,180	6,289

Alternative B would encourage and accept use on the greatest number of road miles, although it also prohibits use on a fairly large number of roads miles. Alternatives Current, A and G(SOHA) would encourage and accept use on the second greatest number of road miles while prohibiting use on relatively few road miles. These 4 alternatives would have the best opportunities for unrestricted public use.

Alternatives RPA, B' and C would encourage and accept use on fewer road miles than the preceding group of alternatives, but would also prohibit use on fewer road miles than the first group. These alternatives

would provide the second greatest opportunities for unrestricted public use.

Alternative E would encourage and accept use on fewer road miles than the first 2 groups of alternatives, but would have the least miles where use is prohibited. This alternative would provide good opportunities for unrestricted public use on its transportation system, however, it would have the smallest transportation system of all alternatives.

Alternatives Preferred, D and D' would encourage and accept use on the fewest road miles of all the alternatives and would prohibit use on the most road miles due to aggressive road closure programs and, in the case of the Preferred Alternative, a reduction in new construction miles. These alternatives would provide the least opportunities for unrestricted public use.

Road Maintenance

Table 4-43 shows the miles of road each alternative would maintain in each maintenance level by the end of the decade for Decades 1 and 5.

All alternatives except the Preferred Alternative would have road maintenance levels similar to the current condition. The Preferred Alternative would obliterate 1 mile of road for each mile of road constructed in Key Watersheds. About 41% of the Forest is in Key Watersheds. Alternatives D and D' would obliterate 1 mile of road for each mile of newly constructed road so there would be no net increase in miles to be maintained.

In all alternatives, timber purchasers would be responsible for maintaining the roads they use. Alternatives with high levels of timber harvesting would have higher percentages of the total road system maintained by timber sale purchasers. In alternatives with lower harvest levels, appropriated funds from the benefiting resource would be required to maintain a greater share of the road system. If funds were not available, greater portions of the road system would be placed in lower maintenance levels and more roads would be closed.

Road Density

Where road density exceeds appropriate standards and guidelines for a given resource, road management objectives would be changed from the existing condition to lower the road density. Ecosystem analysis at the landscape/watershed level and project planning would be used to determine which roads to close to vehicular travel. Roads that have no further use as identified in the ecosystem analysis and in project planning would be obliterated. Roads not needed in the short-term would by identified for closure. These roads would be managed to prohibit use and assigned to Maintenance Level 1. Maintenance Level 1 roads are closed by a variety of methods including gates, barricades and signs.

Table 4-43. Road Maintenance Levels By the End of the Decade in Miles of Road

Alternative	Level 5	Level 4	Level 3	Level 2	Level 1	Total
Current	67	92	1,262	2,735	958	5,114
Alternative PFD						
1st decade	68	94	1,287	2,788	977	5,214
5th decade	54	54	704	3,248	1,354	5,414
Alternative CUR						
1st decade	70	96	1,318	2,856	1,001	5,341
5th decade	82	112	1,542	3,342	1,171	6,249
Alternative RPA						
1st decade	68	95	1,299	2,816	986	5,264
5th decade	71	99	1,349	2,921	1,024	5,464
Alternative A						
1st decade	70	97	1,320	2,860	1,002	5,349
5th decade	82	114	1,552	3,363	1,178	6,289
Alternative B						
1st decade	70	98	1,332	2,887	1,011	5,398
5th decade	85	118	1,613	3,494	1,224	6,534
Alternative B'						
1st decade	69	97	1,312	2,843	996	5,317
5th decade	80	111	1,513	3,277	1,148	6,129
Alternative C						
1st decade	68	95	1,300	2,817	986	5,266
5th decade	76	106	1,449	3,139	1,099	5,869
Alternative D						
1st decade	67	92	1,262	2,735	958	5,114
5th decade	67	92	1,262	2,735	958	5,114
Alternative D'						
1st decade	67	92	1,262	2,735	958	5,114
5th decade	67	92	1,262	2,735	958	5,114
Alternative E						
1st decade	68	95	1,292	2,799	980	5,234
5th decade	74	103	1,409	3,054	1,069	5,709
Alternative G(SOHA)						
1st decade	70	97	1,320	2,860	1,002	5,349
5th decade	82	114	1,552	3,363	1,178	6,289

In Key Watersheds in the Preferred Alternative, 41% of the Forest, there would be no net increase in the amount of roads. In the Habitat Linkage Management

Area of Alternative C, total open road density would not exceed 1 mile/square mile at any given time in the future. Alternatives D and D' place special emphasis on maintaining low average open road densities.

Table 4-44 displays the average road density on CAS land in miles of road for Decades 1 and 5 for each alternative.

Alternatives that have the most CAS land (regulated acres) would generally have the lowest road density because road development would occur over a larger area. Alternatives D and D' have the lowest road density because existing roads would be closed as new roads are built.

Alternatives Preferred and E would have the highest road densities. The Preferred Alternative would have more available acres than Alternative E and would construct more miles of road. Alternatives that have high road densities would have greater access, but over a smaller area. Great care should be used when interpreting road densities presented here, they are simply averages. Roads are not currently and in the future would not be distributed evenly over the landscape.

Upgrading selected Forest Roads

Current and future use of the Forest transportation system would change as demand for and use of Forest resources change. It is not practical to construct and maintain the road system to provide for optimal use for every activity. The arterial and collector road system would be evaluated for adequacy of meeting current and future use trends as part of implementing the Forest Plan. Alternatives RPA and E would reconstruct arterial and collector roads to high use areas at a rate of 18.5 miles a year. This reconstruction would focus primarily on road surface and safety improvements. Alternatives Preferred, B and B' would reconstruct Forest Highway 93 from Butler Creek to Cecilville during the first 2 decades.

Table 4-44. Average Road Density Levels in Miles of Road

Alternative	Total Managed	Available	Managed as Open
Current Situation	3.26		
Alternative PFD			
1st decade	3.30	3.39	2.68
5th decade	4.24	3.80	3.09
Alternative RPA			
1st decade	2.97	3.03	2.42
5th decade	3.09	3.22	2.51
Alternative A			
1st decade	3.05	3.13	2.48
5th decade	3.59	3.98	2.92
Alternatives B and B'			
1st decade	2.98	3.03	2.42
5th decade	3.61	3.86	2.93
Alternative C			
1st decade	3.05	2.96	2.48
5th decade	3.39	3.15	2.76
Alternatives D and D'			
1st decade	2.99	2.96	2.37
5th decade	3.25	3.02	2.37
Alternative E			
1st decade	3.33	3.45	2.71
5th decade	3.64	4.24	2.96
Alternative G(SOHA)			
1st decade	3.04	3.09	2.47
5th decade	3.58	3.80	2.91

Timber Management

Important Interactions

Timber is managed on the Forest to provide a continual supply of forest products for sale and create desirable forest conditions. Several factors affect the availability and quantity of timber which can be offered for sale now and in the future. These same interactions also determine what future forest conditions will exist on forest lands.

These interactions include land allocation, intensity of timber management, proposed silvicultural practices and the role of pests (insects and diseases) and fire in the Forest. A change in any of these factors can significantly increase or decrease the current availability of timber, alter long-term forest growth and affect future timber yields.

The sustained production and availability of timber products through time depend largely on the amount of land allocated to timber management and the intensity of management practiced on these lands. A large timber land base provides greater potential for commodity outputs.

Similarly, a greater number of acres that emphasize timber management also generally result in greater timber yields. Each land management alternative proposes a unique timber management land base with a different mixture of management intensities reflective of the objectives and land management emphasis of each alternative.

Proposed silvicultural prescriptions are used to achieve the desired future conditions associated with each of the alternatives. Silvicultural prescriptions are planned treatments to control species composition, age and structure in a stand. They include harvesting operations, reforestation activities and treatments to ensure the future growth and development of forested stands through time.

The effects of fire, drought, forest diseases and forest pests can also significantly alter the timber resource and affect management decisions. Silvicultural practices prescribed to help maintain healthy forest stands can help minimize undesirable biological and/or environmental factors which adversely affect timber stands. Control of competing vegetation, whether through herbicides or other methods, can help to ensure establishment and good growth of tree seedlings. Harvesting practices which control stocking levels (numbers of trees) within a stand and/or remove diseased or dying trees can help ensure continued growth of the remaining trees.

The occurrence and intensity of fire on the Forest can significantly affect timber inventory and timber management practices. Both high and low intensity fires can alter stand composition, structure and size. The occurrence of fire also affects the availability of both standing and down woody material in forest stands.

In some circumstances, prescribed burning and low intensity wildfires can enhance forest health by eliminating excessive vegetation from within a stand without injuring significant amounts of commercial trees. High intensity fires generally result in excessive tree mortality and loss of soil productivity. Salvage operations after a fire can significantly alter planned harvesting operations and increase the need for reforestation activities.

The demand for certain timber products also influences timber management and often can determine what silvicultural techniques and utilization standards are prescribed. Saw logs are the primary wood product with increasing opportunities for utilizing noncommercial wood for firewood, paper, energy and other miscellaneous products.

Methodology

The consequences of implementing the proposed alternatives focus on the following questions:

- How much land will be allocated to timber production?
- At what intensity will these lands be managed?
- What silvicultural systems will be utilized?
- What ASQ is appropriate for the Forest?
- What effect will wildfire have on timber growth and yield?
- How should competing vegetation, forest insects and diseases be managed on the Forest?
- How should other forest products such as firewood and biomass be managed on the Forest?

Two inventories were used to determine forest growth and yields. These inventories are described in Chapter 3 - Timber Management. Using inventory and growth data collected from these 2 inventories, a computerized stand projection model called RAMPREP developed yield tables for each forest type.

Plantations were modeled using an individual tree growth model called PROGNOSIS, which was developed from locally collected data. Stand development information generated through PROGNOSIS was used in RAMPREP to establish potential harvest regimes through time. The plantations used for these projections included a range of site conditions and management intensities. Therefore, the associated timber yields represent an average.

The acre, ASQ, growth and Long-term Sustained Yield (LTSY) outputs were calculated by a resource allocation program called FORPLAN which incorporates the yield tables generated through RAMPREP and balan-

ces timber management objectives with other resource allocations through time. A discussion of the modeling process and assumptions used is included in Appendix B.

Environmental Consequences

Lands Allocated to Timber Management - Proposed Capable, Available and Suitable Land Base

Consequences Common To All Alternatives

Tenative capable, available and suitable (CAS) lands as defined by NFMA include about 744,000 acres. This represents approximately 44% of the total Forest.

During the alternative development process, additional lands were determined to be inappropriate for timber production for each alternative in accordance with the alternative's objectives. This occurred if 1) other land use objectives precluded timber management (for example, for protection of TE&S habitat; SIAs) or 2) meeting timber management objectives would not be cost effective over the planning horizon (for example, non-stocked lands or isolated stands with difficult access). The lands considered suitable for timber production vary by alternative.

Removing land from the suitable land base reduces both potential ASQ and long-term timber growth and yields. While the effect is not linear, the magnitude of the reduction is related to the productivity of the lands removed. The timber production lost is irretrievable, but is not irreversible. If future designation of these lands is changed to allow timber management activities, it would be possible to resume timber management activities.

Where land is dedicated to road construction or development of facilities, minerals or rock excavation, the loss of land for timber production is generally irretrievable and may be irreversible. Similarly, the occurrence of landslides, excessive erosion, intense or repeated fire can significantly degrade soil productivity thus reducing potential forest growth and yield.

Comparison of Alternatives

Table 4-45 displays the amount of land each alternative would designate as capable, available and suitable (CAS) for timber management.

The amount of CAS land would vary from 21% of the Forest in the Preferred Alternative to 52% of the Forest in Alternative B. This significant difference comes from how northern spotted owl critical habitat would be treated. Alternatives Current/RPA, A, B', C, D' and E would establish HCAs which are not CAS lands. The Preferred Alternative would provide for all late-successional species through LSRs which are not CAS land.

Table 4-45. Allocations of CAS Forest Land to Timber Management by Alternative

Alternative	CAS Lands (acres)	Percent of Total Forest Acres
PFD	354,000	21
CUR/RPA	680,000	41
A	710,000	42
B	877,000	52
B'	630,000	37
C	645,000	38
D	741,000	44
D'	634,000	38
E	386,000	23
G(SOHA)	846,000	50

Alternative G(SOHA) would establish spotted owl habitat areas (SOHAs) which are not CAS land and are much smaller than HCAs. Alternatives B and D would include HCAs as CAS land. Inclusion of the HCA as part of the CAS lands explains why Alternatives B and D are among the alternatives with the greatest amount of CAS lands. It also explains why CAS land for Alternatives B and G(SOHA) is greater than tentative CAS land.

Timber Management Intensity

Consequences Common to All Alternatives

By law, the Forest must be managed to ensure a continuous, non-declining, sustained yield of timber products. Since our timberlands are also managed to provide for a variety of other resource values, reasonable constraints on timber harvesting are needed to accurately estimate current and future timber yields.

Suitable forest land is allocated to regulation classes according to the intensity of timber management desired to meet management objectives for that particular area. Because each alternative has a different mixture of resource objectives, the mixture of Regulation Class 1, 2 and 3 lands would be different for each alternative.

Regulation Class 1 lands emphasize timber management. Regulation Class 2 lands co-emphasize timber and other resource objectives. Regulation Class 3 lands limit timber operations to only those which would maintain and enhance resources other than timber management. The mixture of lands in each regulation class determines the future structure and composition of the forest and affects the current ASQ, the long-term forest growth and future timber yield.

Regulation Class 1 lands (timber emphasis) generally have high timber yields. The full range of silvicultural practices are available subject to being consistent with the standards and guidelines designed to provide for multiple uses. These lands are generally managed using even-aged silvicultural systems.

Rotation ages for managed stands occur near culmination of mean annual increment (CMAI), a point where the average net merchantable growth is at its maximum level. The age at which this occurs is dependent on the species, site productivity, stocking and management applied to the stand. On well-stocked, intensively managed stands CMAI can occur as early as 60 years or as late as 120 years.

On Regulation Class 1 lands, forested lands would generally be a patchwork of different sized even-aged stands of various ages. A larger proportion of the total area would be in younger seral stages as compared to lands in Regulation Class 2 or 3. Once these lands become regulated, every age class would be represented by approximately the same number of acres.

Fragmentation of forest cover and vegetation would increase with greater amounts of land allocated to this category compared to other management areas. Because the rotation length on these lands is usually shorter than the rotation length in other regulation classes, the average size of trees harvested from these areas would generally be smaller than trees harvested from other areas.

Regulation Class 2 lands (moderate timber yields) are characterized by reduced yields (70 to 80% of the biological potential). A range of silvicultural systems are utilized to meet both timber and other resource objectives. Management objectives, for example, might include timber production, partial retention visual quality and retention of structural attributes.

These lands may be managed by even or uneven-aged silvicultural systems. Where even-aged systems are utilized, rotation lengths would vary depending on the desired resource objectives. For some stands, the desirable rotation length may be at CMAI. For other areas, rotation lengths might be extended out to 150 years or longer. The average rotation length for even age stands in Regulation Class 2 would typically be longer than in Regulation Class 1 stands.

Even-aged stands on Regulation Class 2 lands would be a mixture of different age classes and size classes. A greater proportion of older stands with larger sized trees and multiple-aged stands would be present than on Regulation Class 1 land. Openings with younger trees, shrubs, forbs and grasses would be present but would constitute a smaller portion of the landscape. Managed stands would be visually apparent, but would vary in size, shape and vegetative cover. Forest openings would be well-stocked with conifers but would commonly be comprised of a variety of different sized and aged tree species.

Regulation Class 3 lands (minimal timber yields) are characterized by significantly reduced timber yields (20% of the biological potential). A variety of silvicultural prescriptions are available. Timber management activities are developed to enhance other resource values. Areas where maintenance of visual quality is important, sensitive riparian areas and habitat for sensitive animal species might be included in this category. Timber harvesting operations would occur less frequently and would commonly blend in with the surrounding forest. Where even-aged systems are used, rotation length will vary, but could extend out to periods of 200 years or more.

Forested lands in Regulation Class 3 would generally have the greatest amount of continuous forest cover with the least amount of forest fragmentation. A variety of vegetation would exist but, over time, a larger percentage of these lands would be comprised of older, larger trees as compared to Regulation Class 1 and 2 lands. Openings with younger trees, shrubs, forbs and grasses would be relatively infrequent and the appearance of distinctly visible managed stands would not be readily apparent, unless necessary to meet the objectives of primary interest.

Unregulated lands have no programmed timber yields. They include lands unsuitable for timber production (refer to Chapter 2 - Management Requirements) and lands managed for non-timber objectives. These lands are not included in the ASQ calculation. However, non-scheduled or incidental harvests might be obtained on some of these lands in all alternatives when vegetation management was an objective. Salvage operations as well as incidental harvesting may be planned on unregulated lands if necessary to enhance other resource values.

Areas of no harvest are those where even incidental harvest would be precluded such as in wilderness and RNAs.

Comparison of Alternatives

Table 4-46 displays how many acres would be managed by regulation class for each alternative.

Significant allocation differences between alternatives include Alternatives Preferred, B, B' and E which would not have any Regulation Class 1 land. Alternatives Current/RPA, A and G(SOHA), on the other hand, propose the greatest amount of lands with timber emphasis. Alternatives B and B' are very similar, as are Alternatives D and D'. In Alternatives B and D where timber harvesting would be allowed in HCAs, the HCAs would be allocated to Regulation Class 3. In all but Alternatives A and B, the greatest proportion of CAS acres would be in Regulation Class 2.

Table 4-46. Regulation Class Acres and Percent of Total Forest						
Alternative	Regulation Class 1		Regulation Class 2		Regulation Class 3	
	Acres	Percent	Acres	Percent	Acres	Percent
PFD	0	0	296,000	18	58,000	3
CUR/RPA	214,000	13	348,000	21	118,000	7
A	273,000	16	201,000	12	237,000	14
B	0	0	366,000	22	511,000	30
B'	0	0	366,000	22	264,000	16
C	125,000	7	367,000	22	153,000	9
D	173,000	10	303,000	18	265,000	16
D'	173,000	10	303,000	18	158,000	9
E	0	0	333,000	20	53,000	3
G(SOHA)	263,000	16	440,000	26	143,000	9

Silvicultural Systems

Consequences Common to All Alternatives

The amount and distribution of different land use areas, along with the silvicultural practices implemented on these lands, would help to shape the future condition of the Forest. The silvicultural systems selected to manage any particular area would be determined through site-specific analysis by an ID team.

The final prescription would depend on factors such as management objectives, current stand and site conditions, management area standards and guidelines, cost effectiveness and the desired vegetative cover. This standard would apply to all alternatives. Refer to Appendix F for a description of silvicultural systems and their biological and managerial aspects.

Both even-aged and uneven-aged systems would be available for use in all alternatives. The amount of acres managed under each system would vary considerably by alternative. For each alternative, the proposed silvicultural systems represent different timber management strategies associated with various land uses. Specific silvicultural prescriptions would be developed during project-level planning.

The proportion of lands proposed for varying intensities of timber management in each alternative is displayed in Table 4-47. In Regulation Class 1 where timber growth and yield is a primary management objective, proposed silvicultural systems might include clearcut, GTR and shelterwood. Priority stands for regeneration in these areas are stands where existing growth is far below the potential for the site (understocked and/or overmature stands). Additional high priority stands include areas with existing or potential forest health problems. Examples are the presence of disease such as mistletoe and tree decay organisms as well as areas with a high risk of insect attack by bark beetles or defoliators.

The appropriate silvicultural system on Regulation Class 2 lands would depend on site-specific stand conditions, resource objectives, technical feasibility and economic feasibility. Where even-age systems are utilized, silvicultural prescriptions would typically include leaving greater amounts of existing vegetation (shelterwood or GTR prescriptions) than would generally be left on Regulation Class 1 lands.

Uneven-aged systems would be employed on Regulation Class 2 lands where resource objectives generally require a more continuous forest cover. The difficulty of successfully implementing individual tree selection systems on steep slopes and of maintaining such stands in ecosystems where fire is common led all alternative groups to propose group selection as the primary prescription where uneven-aged management is desirable. Priority stands for harvest in areas not managed primarily for timber growth and yield would depend on specific resource needs and would differ with each alternative.

On Regulation Class 3 lands, stand maintenance would be the silvicultural technique most often used. Maintenance cutting is not a silvicultural system in itself. The term is used to denote a very low level of timber harvesting on lands managed primarily for

resource values other than timber production. Although maintenance cutting could utilize any one of the silvicultural systems described in Appendix F, selection of the appropriate system would depend on the desired stand composition and structure.

Intermediate harvests include commercial thinning, sanitation and salvage. They would be used in all alternatives on lands in all regulation classes and might also be used on unregulated land if they help achieve the desired condition for the area. Common objectives on regulated land are to improve or maintain forest health, to create desirable stand structures and species composition and to provide periodic timber yields. Specific stand structures such as those which describe "old growth" stands can be achieved or maintained through intermediate treatments. These treatments would increase the growth of individual trees, maintain forest cover, help develop multi-storied stands and artificially create stand decadence if necessary.

In all alternatives, rotation lengths would vary from 60 to over 200 years. The decision to harvest or not harvest a stand would depend largely on the management and resource objectives for the stand as well as on the landscape conditions desired. Refer to the Timber Management Intensity section for a discussion of how rotation lengths may vary by regulation class. By law, even-aged stands must generally have reached CMAI before they can be regenerated. Timber harvesting prior to stand CMAI is allowed by law to salvage mortality, to promote stand vigor and forest health or to achieve desirable stand structure and species composition.

All systems prescribing regeneration cutting would initiate a planned sequence of reforestation and stand tending activities. Because of the inconsistency of adequate cone crops and conditions suitable for seedling survival, the vast majority of these sites would be planted. For areas managed for timber growth and yield, a fairly intensive schedule of treatments would be prescribed to ensure the survival, health and growth of planted seedlings. For areas where timber management is not the primary objective, a less intensive sequence of treatments would more commonly be prescribed.

In all alternatives, reforestation would require adequate site preparation. Site preparation reduces vegetative competition, creates areas that can be planted and removes flammable material from the site reducing the risk of wildfire occurrence and spread. The method of site preparation would depend on the physical and biological attributes of the stand, the technical feasibility and the cost of accomplishing the required preparation for that site. Site preparation methods include mechanical, chemical and manual methods as well as prescribed fire.

All alternatives would adopt standards and guidelines for site preparation activities which would maintain soil productivity (refer to the Soils section earlier in this chapter). In addition, a number of snags and green trees would commonly be left on site. Refer to Chapter 2 - Alternative descriptions, Wildlife, Special Habitat for the number of snags and green trees each alternative would leave.

The difficulty and cost of site preparation activities required for reforestation would vary considerably depending on the silvicultural system and proposed site preparation method. In particular, prescriptions which remove only a portion of the stand and require site preparation for reforestation (GTR and shelterwood) are more difficult and expensive than prescriptions which remove essentially all of the vegetation.

The need to protect reserve vegetation may require costly site preparation measures such as hand piling. Residual protection can also reduce the efficiency of the operation (more complex prescribed burning operations, slower mechanical site preparation). This is especially true on steep slopes with heavy fuel loadings where there are few options except prescribed burning. Unit size and shape can also be a determining factor in successfully achieving site preparation operations, especially if prescribed burning is required. This is discussed below.

The desired vegetative composition of regenerated areas is determined by the management objectives. Where a diversity of tree species is desired, an appropriate mixture of tree species would be planted as well as using natural reproduction where possible. The current practice of planting primarily Douglas-fir, white fir, red fir, cedars, sugar pine, lodgepole pine, ponderosa pine and Jeffrey pine would continue under all alternatives.

In the moister areas, additional natural regeneration would occur within all or a portion of the stand. Hardwoods would become established from sprouts and germinating seeds. Replacement of more shade-tolerant species such as red fir and white fir would use silvicultural systems that encourage natural regeneration such as shelterwood systems.

Genetic diversity would be maintained through the continued use of collected seed from a variety of stands. Collection of seed from trees with desirable physical characteristics and rapid growth rates would contribute to potentially genetically improved timber stands. Planted stands under the Base Level Tree Improvement Program are likely to be more genetically diverse than naturally regenerated stands.

All alternatives propose timber stand improvement (TSI) treatments to assure plantation establishment, to maintain conifer growth and vigor and to control the occurrence of diseases and undesirable insects within

regenerated stands. The intensity of TSI treatments varies between alternatives.

TSI activities include treatments to control competing vegetation (release) and treatments to control stocking and species composition within a stand (precommercial thinning). TSI treatments would help ensure conifer survival and increased growth.

Maintaining trees in a healthy, vigorous condition is also the best defense against insect and disease damage. Depending on the stand management objectives, TSI activities can be prescribed to create a variety of forest conditions. Species selection, spacing and the maintenance of other vegetation through precommercial thinning and release operations can influence biological and structural diversity within these young stands. Selection of fast growing, healthy trees with desirable physical characteristics can also improve conifer growth performance and future wood quality within plantations.

A full range of vegetation management methods are available to successfully treat competing vegetation. These include manual methods, mechanical methods, prescribed fire, the use of biological agents, chemical (herbicide) methods and grazing. Increased amounts of TSI activities could substantially increase conifer growth in plantations and affect future timber yields.

The cost and effectiveness of these different treatments would also vary considerably depending on the stand composition and release method utilized. Where highly competitive plant species like grasses occur, timber yields can be negligible without control of the competing vegetation. Where other less competitive species occur such as gooseberry or snowberry, timber growth losses for most forest types are estimated to be between 0 and 40% if the vegetation is not controlled.

In general, the use of herbicides as a release tool would increase conifer growth by approximately 20 to 40% as opposed to utilizing other treatments (grubbing, matting, cutting, scalping, etc). The cost of manual treatments are also typically 2 to 3 times as expensive as chemical treatments. The use of herbicides as a management tool is further discussed in the section on pest management.

Increased conifer growth from release and precommercial thinning operations would result in a higher future ASQ and LTSY. Because of the difficulty in modeling the effects of different TSI treatments, this increased growth is not modeled in this plan. Future estimated ASQ's could therefore be higher in alternatives proposing a more intensive TSI program than is displayed in this analysis.

The ability to successfully implement proposed silvicultural prescriptions also depends on the economic and technical feasibility of accomplishing the needed silvicultural treatments. Achievement of any of the proposed silvicultural prescriptions requires detailed planning, on-the-ground preparation, successful harvesting operations (including sale administration) and successive years of post-harvest treatments including site preparation, reforestation, plantation protection, release and precommercial thinning. Additional management costs also would include monitoring, evaluation and record keeping. The cost of implementing the different silvicultural systems proposed in the alternatives would vary considerably.

The size and number of harvesting units, proposed logging systems, access to treatment areas, volume per acre harvested and the complexity of proposed silvicultural systems are factors which affect the cost of timber management activities and the technical feasibility.

In all alternatives, clearcut, GTR and seed step shelterwood prescriptions would create openings between 5 and 40 acres in size for all timber types except Douglas-fir which could have openings up to 60 acres in size. The average size would probably be between 10 and 25 acres. Where group selection is proposed, regeneration openings would be less than 2 1/2 acres. Of particular significance is the increased number of units which result where group selection systems are utilized.

In general, smaller units are more difficult and expensive to manage than larger units. More planning and on-site preparation is needed if the harvest volume is spread out over many small units as compared to fewer, larger units. The cost of harvest operations would also increase primarily as a result of the increased moving and set-up costs required to harvest many small units spread across the Forest.

Post harvest activities are also more difficult when many small openings must be located, treated, and monitored over time. Prescribed burning, in particular, is often more difficult to achieve in smaller units. Planning, sale preparation, and sale administration costs for group selection systems are estimated to increase 50 to 100% over clearcutting systems. Site preparation activities for group selection are estimated to increase by approximately 50%. Planting, release and precommercial thinning operations would increase by 10 to 20% as compared to clearcutting systems.

Similarly, lower harvest volumes per acre are less economical because more acres must be treated to obtain any given volume. Increased planning, preparation, and sale administration costs are estimated to be anywhere from 20 to 100% higher depending on the volume per acre harvested, the number of harvesting units and the size of the units.

Planning, sale preparation and sale administration costs for GTR prescriptions are estimated to be 10 to

20% higher than clearcut prescriptions. Site preparation costs are estimated to increase by approximately 50%. Planting, release and precommercial thinning operations should not substantially increase in cost.

Leaving reserve trees in clumps is easier to accomplish and less costly than leaving trees uniformly scattered throughout a unit. The effects on future stand growth and timber yield are also less when these trees are clumped. Estimated timber yield losses (measured in cubic feet) for leaving 8 trees per acre are estimated to be between 5 and 10% when reserve trees are clumped as opposed to 15 to 25% when leave trees are scattered. Where small group selection cutting occurs, it is estimated that timber yield losses will be approximately 20%.

Achievement of these different silvicultural systems is, in part, dependent on the capabilities of the various logging systems available. All the alternatives utilize tractor, cable and helicopter systems. Selection of an appropriate logging system would depend on balancing specific site conditions such as slope, access and needed resource protection with the technical and economical feasibility of accomplishing the desired silvicultural prescription.

Each logging system has very different capabilities and limitations in achieving any given mixture of resource objectives. Generally, tractor logging will be utilized where terrain is less than 35%. Cable and helicopter systems will be utilized on steeper ground. Where access by road is not available or undesirable, logging operations will generally be confined to helicopter systems.

The amount of road construction would vary by alternative (refer to Chapter 4 - Transportation Management). Where more intensive timber management is proposed, increased road construction would likely occur. However, for a given harvesting level, more intensive management generally results in less roading than low intensity management. Helicopter logging systems would be used where access is unavailable, uneconomical or undesirable. Where no road access is available and helicopter use is required, post harvest treatments such as site preparation, planting and release might be costly and difficult to achieve.

Prescriptions which require leaving vegetation on site after harvesting (GTR, shelterwood, commercial thinning) generally have higher logging costs and often are technically much more difficult to achieve than clearcut prescriptions. In general, tractor and helicopter systems are best suited to selective harvest operations.

Tractor operations are fairly economical but are limited by the steepness of the terrain. Helicopter systems can often successfully achieve desired conditions but their high cost can make harvesting operations economically infeasible. On steep slopes a cable system often best meets resource and economic concerns, but leaving undamaged residual trees within a stand is more difficult.

Comparison of Alternatives

Table 4-47 displays an approximation of silvicultural prescriptions and activities by alternative as modeled in FORPLAN. This approximation is an average picture to be used for comparison purposes only and does not reflect the range of treatments or actual amount of land treated that would occur in on-the-ground planning.

Total harvesting acres per year range from 4,040 acres in the Preferred Alternative to 6,790 acres in Alternative G(SOHA). In all alternatives, except Alternative E, regeneration harvesting would comprise the majority of harvest acres. The size of regeneration units and the amount of reserve vegetation left in regeneration units would vary by alternative as discussed above.

Alternatives Current/RPA and G(SOHA) are the only alternatives which would utilize clearcutting in the traditional application of this silvicultural term. Alternatives Preferred, A and E would rely primarily on GTR prescriptions, whereas Alternatives C, D and D' would use primarily GTR, shelterwood and seed step prescriptions. Alternatives B and B' would emphasize group selection systems. In all alternatives, salvage would occur. Because salvage can use any of the prescriptions, salvage acres are included in the other treatment acres. Refer to Appendix F for definitions.

All alternatives would likely use some group selection prescriptions in actual practice. However in Alternatives B and B', it would be the primary silvicultural system and over 2,000 acres per year would be treated. Ensuring a sustained yield of timber through time using uneven-aged systems would be operationally and biologically more difficult than with even-aged systems.

The amount of reserve vegetation retained in regeneration openings would depend on the regulation class as well as the standards and guidelines for each alternative. The harvest acres by regulation class are displayed in Table 4-50 for each alternative. The objectives for maintaining vegetation in regeneration units can be found in Chapter 2 - Alternative Descriptions, Wildlife, Special Habitat Provisions. Hardwood retention ranges from minimal numbers in Alternatives Current/RPA and G(SOHA) to over 10 trees per acre of varying sizes in Alternatives B and E.

In Alternatives A, C, D, and D', green trees maintained in GTR prescriptions would be clumped. In Alternatives B and B' some of the regeneration areas would have green trees clumped and others would have them spaced throughout the openings. In Alternative E, green trees would be scattered throughout regeneration openings and cover about 20% of the area on the

Table 4-47. Comparison of Silvicultural Treatments and Timber Management Activities Average Acres per Year for Decade 1 as Modelled in FORPLAN

	Alternative									
Treatment/Activity	PFD	CUR/ RPA	A	B	B'	C	D	D'	E	G (SOHA)
Clearcut	0	3,060	0	0	0	0	0	0	0	3,030
Green Tree Retention	3,210	0	4,780	1,180	900	2,230	2,800	2,870	4,750	0
Shelterwood/Seed Tree	0	2,150	0	0	0	2,610	2,000	2,020	4,750	3,330
Shelterwood/Removal Step	0	470	430	0	0	420	0	0	0	0
Group Selection	580	0	0	2,270	2,540	340	260	180	560	0
Stand Maintenance	250	400	910	1,530	800	540	700	560	180	430
Total Treated	4,040	6,080	6,120	4,980	4,240	6,140	5,760	5,630	5,490	6,790
Reforestation										
Initial Reforestation	2,580	5,210	4,910	3,450	3,440	5,180	5,860	5,790	1,600	6,360
Failed and/or Burned Plantations	270	690	260	1,560	1,760	1,300	1,500	1,330	1,550	470
Release for growth	1,970	1,360	4,650	1,140	1,150	1,400	1,590	1,550	560	1,630
Plantation Thinning	8,030	3,680	4,460	1,210	930	560	1,180	900	210	700

average. In the Preferred Alternative, both scattered and clumped trees would be left as reserves on at least 15% of the area.

Annual acres of initial reforestation in Decade 1 vary from 6,360 acres in Alternative G(SOHA) to 1,600 acres in Alternative E. The amount of reforestation depends on the amount of regeneration harvesting, the number of acres burned by wildfire and the success of reforestation activities. The estimated number of plantation acres predicted to be lost from wildfires in Decade 1 range from 500 to 910 acres per year. Refer to Fire Effects later in this section for a discussion on fire risks in plantations.

Acres initially planted which would require replanting range from 260 in Alternative A to over 1,760 acres per year in Alternative B'. This range of replanting reflects both the differences in seedling survival associated with harvesting operations in different forest types and the intensity of management applied to individual plantations. The success of reforestation operations in red fir, for example, is less dependable than in the mixed conifer type. Where post reforestation activities such as release are prescribed, there is also a greater likelihood that seedling survival would be significantly greater than in plantations were no follow up treatments are prescribed.

Alternatives Preferred, A, D and D' would reforest suitable timberlands which are currently non-stocked with conifers (for example, brushfields, grasslands). Alternatives Preferred and A propose reforesting approximately 90% of these non-stocked lands in areas where timber management is an objective. Alternatives D and D' propose reforesting approximately 30% of the non-stocked lands; areas where reforesting would help improve watershed conditions would be a priority. Initial reforestation acres in Table 4-48 include acres of reforestation of currently non-stocked lands to be managed for programmed timber harvests. Converting these acres from brush and grass to timber would increase LTSYs on the Forest while providing for other resource needs.

The amount of proposed TSI activities would vary by alternative. Proposed release for growth varies from 4,650 acres in Alternative A to 560 acres in Alternative E. With the exception of Alternatives Preferred and A, all alternatives would plan release treatments on approximately 1/3 of the acres regenerated. The Preferred Alternative would plan release treatments on over 2/3 of the acres regenerated as well as some release treatments on naturally occurring stands. In Alternative A, almost every acre reforested would be released. In areas where release operations do not occur, competing vegetation would dominate the site for longer periods of time delaying the establishment of a forest stand.

Proposed precommercial thinning acres range from 8,030 acres in the Preferred Alternative to 210 acres in Alternative E. Almost all regenerated acres, many naturally occurring stands and many stands on un-

regulated land would be planned for precommercial thinning in the Preferred Alternative. For the other alternatives, the percentage of planted units which would be precommercially thinned range from approximately 95% in Alternative A to 13% in Alternative E.

Allowable Sale Quantity

Consequences Common to All Alternatives

ASQ is the maximum amount of timber that may be programmed for harvest during any decade for regulated land; it is typically expressed as an annual average quantity. Determination of the ASQ is a function of the amount of land available for timber management, the ability of these lands to grow timber, the timber management intensity applied and the mixture of land use objectives.

The ASQ is not the maximum amount of wood the land is capable of producing. Rather, it represents an estimate of available timber consistent with standards and guidelines, based on the most current data available. Changes in the timber land base, timber inventory or silvicultural prescriptions would affect ASQ.

The ASQ is calculated to provide a gradual transition over time from current forest conditions to a regulated forest with higher sustainable yields. Total forest growth is increased and a higher level of harvest may be possible as forest lands managed for timber production are converted to well-stocked, faster growing managed stands. In all alternatives, the ASQ increases over time (non-declining flow). A discussion of forest growth is included later in the Timber section.

As time passes, an increasing amount of the ASQ would be comprised of smaller sized trees compared to those typically harvested in the past. This change in tree size and merchantability standards for harvesting would require a corresponding change in milling technology to accommodate smaller material.

Submerchantable material and hardwoods are not part of the ASQ calculation. Utilization of non-merchantable material as by-products of commercial conifer sales would be permitted and/or encouraged by all alternatives as long as it is consistent with other resource needs for the area. The potential utilization of other wood products is discussed later in this section under Other Products.

Potentially a substantial amount of the ASQ could be comprised of salvage and sanitation harvesting resulting after wildfires and pest infestations. The amount of salvage which contributes to the ASQ each decade is unknown since the occurrence of wildfire, disease and insect attack cannot be accurately predicted. Refer to Fire Effects later in this section.

Comparison of Alternatives

Table 4-48 compares the ASQ in million board feet (MMBF) per year between alternatives for Decades 1 and 5. These same figures are listed in million cubic feet (MMCF) later in this section under Forest Growth and LTSY.

Table 4-48. Average Annual Allowable Sale Quantity in Million Board Feet

Alternative	Decade 1	Decade 5
PFD	51.0	89.2
CUR/RPA	127.9	172.5
A	132.2	178.6
B	116.1	170.2
B'	94.0	131.3
C	118.8	162.4
D	127.3	173.9
D'	123.1	164.0
E	50.7	89.4
G(SOHA)	151.9	205.9

Each alternative would have a unique set of timber land allocations with associated management intensities and silvicultural practices. Although total ASQs may be similar between alternatives, it is important to look at the contribution to ASQ by the different regulation classes. In alternatives where Regulation Class 3 makes a major contribution to ASQ, more acres would be treated, more frequently at a lower intensity as compared to alternatives where Regulation Class 1 makes a major contribution.

Table 4-49 displays an estimate of the contribution to ASQ made by the volume and harvest acres associated with each regulation class for each alternative in Decade 1. The percentages in parenthesis show the proportion of total ASQ these volume and acres represent.

Alternative G(SOHA) would have the greatest number of CAS acres, the greatest proportion of lands in Regulation Class 1 and the highest ASQ. This is due primarily to the use of SOHAs rather than HCAs. Of the alternatives which use HCAs, Alternatives Current/RPA and A would have the highest ASQ. Regulation Class 1 lands would contribute a considerable proportion of the volume and acres to ASQ in these 3 alternatives.

Alternatives Preferred, B' and E would have the lowest CAS acreage, no Regulation Class 1 lands and the lowest ASQ.

Table 4-49. Allowable Sale Quantity and Total Harvest Acres by Regulation Class for Decade 1

Alternative	Regulation Class 1		Regulation Class 2		Regulation Class 3	
	MMBF/year	Acres/year	MMBF/year	Acres/year	MMBF/year	Acres/year
PFD	0 (0%)	0 (0%)	48 (94%)	2,503 (91%)	3 (6%)	246 (9%)
CUR/RPA	55 (43%)	2,721 (45%)	63 (49%)	2,733 (46%)	10 (8%)	522 (9%)
A	76 (58%)	3,651 (60%)	34 (25%)	1,374 (23%)	22 (17%)	1,035 (17%)
B	0 (0%)	0 (0%)	72 (62%)	3,636 (68%)	44 (38%)	1,716 (32%)
B'	0 (0%)	0 (0%)	72 (77%)	3,623 (79%)	22 (23%)	982 (21%)
C	34 (29%)	1,856 (30%)	72 (60%)	3,565 (59%)	13 (11%)	661 (11%)
D	50 (39%)	2,529 (41%)	61 (48%)	2,782 (46%)	16 (13%)	821 (13%)
D'	50 (41%)	2,532 (42%)	60 (49%)	2,793 (46%)	13 (10%)	686 (11%)
E	0 (0%)	0 (0%)	42 (82%)	3,454 (63%)	9 (18%)	2,026 (37%)
G(SOHA)	63 (42%)	3,095 (43%)	78 (51%)	3,511 (49%)	11 (7%)	555 (8%)

The difference in ASQ between Alternatives B and B' and between D and D' reflect the effect of having HCAs in or out of the CAS lands.

Consequences Unique to the Preferred Alternative

Due to the large amount of unregulated land in the Preferred Alternative and the fire ecology of the area, a substantial amount of timber volume, averaging an estimated 20 MMBF per year, would likely be offered from unregulated land. This volume would be primarily from salvage. It would not be part of the ASQ, but would contribute to the local economy. The amount would vary widely from year to year dependent on the amount of tree mortality from fires, insects and disease in areas where tree removal would lead to achieving the desired condition; this would not be the case in all areas.

Forest Growth and Long-term Sustained Yield

Consequences Common to All Alternatives

Most of the existing timber stands on the Forest are beyond CMAI. Timber stands which exceed CMAI are not growing at optimal rates for the site's potential productivity. To achieve maximum site productivity, regeneration of these slower growing stands is needed. In all alternatives, harvesting of mature and "old growth" stands would occur.

However, because a balance of seral stages is desired for all alternatives and only a portion of the Forest would emphasize timber management, many of the existing mature and "old growth" stands on the Forest would be maintained. The relative amounts of younger stands and older stands on the Forest are discussed earlier in this chapter under the Biological Diversity section.

Conifer growth in young stands can be accelerated through silvicultural treatments which control conifer stocking, reduce competing vegetation and protect desirable vegetation from pests and diseases. As a greater proportion of the forest is converted from slower growing stands to stands well-stocked with vigorously growing conifers, total forest growth would be increased.

Since each alternative would prescribe a different harvesting schedule and timber management land base, the conversion period (the time it takes to reach a regulated state) would vary considerably between alternatives. In 50 years, the proportion of the Forest occupied by managed timber stands would range from approximately 27% in Alternative B to 53% in Alternative E.

LTSY is the maximum timber yield that can be sustained indefinitely from lands managed for timber production when all stands have been converted to a managed state. This would vary by alternative according to the timber management strategy proposed. LTSY is a function of the total number of acres allocated to timber management (CAS acres), the management intensity (differences in regulation classes, standards and guidelines and silvicultural systems) and the productive capacity (conifer growth) of these lands.

For all alternatives, growth in the fifth decade would exceed LTSY. The ASQ never exceeds the LTSY during the 160-year planning horizon. None of the alternative harvesting regimes would be limited by forest growth or existing inventory. The proposed harvesting levels (ASQ) in all alternatives are well below the productive capability of the land to grow wood products.

Table 4-50 displays LTSY, ASQ and growth by alternative. Estimated quantities are expressed in MMCF per year. To convert these numbers to MMBF per year, multiply these numbers by 6.67. (There are approximately 6.67 board feet in 1 cubic foot.)

Alternatives that would allocate a greater number of acres for timber management (CAS lands) and/or have more acres under intensive timber management would have the greatest increase in forest growth and LTSY.

Alternative B, which would allocate HCAs to Regulation Class 3, would have the greatest number of CAS lands available for timber harvesting. Alternative G(SOHA) would have the second greatest amount of CAS lands with a large percent of these acres in Regulation Class 1. These alternatives would have the greatest potential forest growth and LTSY. Alternatives D and A would, respectively, have the third and fourth highest LTSY and CAS lands. Alternative A would have more acres in Regulation Class 1 than Alternative D, which would allocate HCAs to Regulation Class 3. LTSY would be lowest in Alternatives Preferred and E. These alternatives would have the fewest acres allocated to timber management and would not have any Regulation Class 1 lands.

Since only a small proportion of total Forest acres would emphasize timber production in any alternative, the ASQ would be well below potential forest growth and LTSY. The Forest would grow more timber than is harvested. This would result in an increase in timber inventory compared to the current condition. However, the inventory could vary substantially due to the influence of wildfire and associated salvage and reforestation on forest growth and LTSY. The above analysis assumes a fairly aggressive salvage and reforestation policy. The potential effects that wildfire might have on these estimates is discussed below.

Fire Effects

Consequences Common to All Alternatives

The occurrence of both low and high intensity wildfire would continue to shape vegetative patterns and influence management decisions. Land management decisions including land allocation and vegetation manipulation (or the lack thereof) can affect how wildfire behaves in the ecosystem.

Management operations which increase the risk of high intensity wildfires occurring would have the most significant impact on the timber resource. Unfortunately, because the occurrence and behavior of wildfire depends on many complex factors (many of which cannot be controlled), it is impossible to predict where or how these fires might affect the Forest. Although planning for fire events is difficult, all alternatives include fire salvage and sanitation operations as part of the timber management program.

The large numbers of dead standing trees left from the recent drought and wildfires combined with an in-

Table 4-50. Long-term Sustained Yield, Allowable Sale Quantity and Growth in MMCF/year and Percent of Total

	PFD	CUR/ RPA	A	B	B'	C	D	D'	E	G(SOHA)
Long-term Sustained Yield	19.2	38.9	43.5	46.4	34.1	38.0	44.4	39.3	19.6	46.9
ASQ										
Decade 1	7.6	19.2	19.8	17.4	14.1	17.8	19.1	18.5	7.6	22.8
Decade 5	13.4	25.9	26.8	25.6	19.7	24.4	26.1	24.6	13.4	30.9
ASQ (Decade 5) (% of LTSY)	70%	67%	62%	55%	58%	64%	59%	63%	68%	66%
Growth										
Decade 1	15.9	30.4	34.7	45.7	31.6	30.7	34.7	29.9	19.4	36.9
Decade 5	17.7	43.6	48.3	57.9	40.6	42.8	50.7	43.1	23.2	52.3
ASQ as a % of Growth (Decade 5)	76%	59%	55%	44%	49%	57%	51%	57%	58%	59%
Growth (Decade 5) (% of LTSY)	92%	112%	111%	125%	119%	113%	114%	110%	118%	118%

crease in down CWD and on-site vegetation has increased the risk of high intensity fire occurring in many parts of the Forest. The potential for widespread tree mortality from insects and diseases as has been common throughout other parts of California and Oregon also exists on this Forest. The amount and juxtaposition of high risk stands across the Forest could significantly affect fire spread and behavior. Where prescribed burning or other fuel treatments are not implemented, the potential for high intensity wildfire and loss of timber inventory and plantations would increase.

In all alternatives, fire recovery planning would use an ID process which would address all resource concerns and values affected by the wildfire. Timber harvesting resulting from fire events would depend on resource objectives. Salvage activities would be consistent with the management direction for the burned area. Silvicultural prescriptions developed for burn areas would follow standards and guidelines for the normal timber program and/or those specified for salvage operations. The amount of fire salvage that occurs after a wildfire would vary by alternative.

In all alternatives, timber salvaged from CAS lands would be part of the planned ASQ, not an addition to the normally scheduled timber harvest program. Timber harvesting would be redirected to burned areas instead of areas previously scheduled for timber harvest. The short- and long-term effect on ASQ would depend on how many acres within the timber land base are salvaged and/or how many acres are reforested.

Salvage from lands outside of wilderness but not part of the timber land base would be allowed except where prohibited by standards and guidelines for a given management area. Salvage of this timber would not be a part of the ASQ.

Table 4-47 shows an estimate of the silvicultural treatments that might occur in the first decade for each alternative. Fire salvage activities may use any silvicultural prescription and are included in the treatments listed. The type of prescription used would depend on the management objectives of the area burned and the intensity of burn.

The risk of high or moderate intensity wildfire occurring on any given stand would vary depending on the vegetative composition, structure, amount and arrangement of flammable material present within and adjacent to the stand. High risk stands would include multiple-storied stands, stands with large amounts of standing or down dead material and young plantations. The risk of wildfire estimated for each alternative is discussed in later in this chapter under the Fire Management section.

Forest plantations pose a significant fire risk problem, especially where flammable materials resulting from harvesting, release and precommercial thinning operations are left untreated. Studies after the 1987 fires indicate that where flammable materials are removed within and around plantations, the risk of burning is significantly less. It is likely that some plantations would be partially or completely burned before they reach rotation age. This risk could be reduced by scheduling release and precommercial thinning operations at an early age to reduce the amount of fuels created and by treating fuels within plantations and in surrounding stands.

Because wildfires often leave stands understocked and/or in need of reforestation, the occurrence of both high and moderate intensity fires can affect total forest growth and LTSY. High intensity wildfires would generally result in complete or near-complete stand mortality. Moderate intensity fires could burn significant numbers of trees affecting both standing green inventory and forest growth. Low intensity fires may result in the mortality of individual trees, but commonly have little or no effect on timber inventory or growth.

Although the number of acres burned by wildfire would vary considerably from year to year, historically the average annual acres of wildfire on the Forest are estimated to be approximately 17,000 acres per year. It is likely that between 3,000 to 7,000 acres of high intensity wildfire and an additional 8,000 to 12,000 acres of moderate intensity wildfire would occur per year. Where these fires occur on lands managed for timber production, both standing timber inventory and forest growth could be affected.

When fire leaves stands understocked on land managed for timber production, prompt reforestation is imperative in order to maintain forest growth. The effect on timber yield is dependent on how quickly these productive forest lands are reforested. Total acres to be reforested after a fire would vary depending on the management objectives and the standards and guidelines for the burned area. In all alternatives, where regeneration harvesting is scheduled after a wildfire, these lands would be reforested. Where intense and moderate wildfires leave stands understocked or non-stocked and where no regeneration is planned, natural regeneration would be relied on to reforest these lands. Potentially, many acres could be converted from forested stands to brushfields.

Periodic updating of the timber inventory, either as a result of wildfire (as was the case in 1987) or as normally scheduled for updating the Forest Plan, would adjust any significant differences in inventory, ASQ and LTSY due to fire.

Comparison of Alternatives

Alternatives vary as to the amount of reforestation proposed on CAS lands currently left under-stocked or non-stocked as a result of past wildfires. Refer to the

discussion on reforestation under Silvicultural Systems.

Although the fire risk is currently the same for all alternatives, the risk for each alternative could change considerably in both the short and long-term future by alternative based on natural processes and management activities. The effect of wildfire on timber growth and yield depends on the amount of high and moderate intensity wildfire that occurs each decade, whether these fires occur on lands managed for timber and on the salvage and reforestation policy applied to these lands.

Alternative A proposes the most aggressive salvage and reforestation program. Where fires occur, attempts would be made to salvage burned timber and regenerate non-stocked and understocked stands on all lands managed for timber production. As fires occur, a major portion of the ASQ would be comprised of fire salvage. Non-stocked lands suitable for timber management would be the priority for reforestation. Alternatives B and B' propose the least aggressive program; an estimated 50% of burned acres would be salvaged and reforested. Proposed salvage operations for other alternatives are fairly aggressive in Regulation Class 1 and 2 lands but limited within Regulation Class 3 lands.

Predicting wildfire occurrence, location and needed salvage and reforestation activities is very difficult. For this assessment, it was assumed that the wildfire acres and intensities would occur randomly across the Forest.

Table 4-51 displays an estimate of the CAS acres which would not be reforested or where significant timber inventory would be lost by alternative for Decades 1 and 5.

In the first decade, Alternatives E and A would have the least number of non-stocked CAS acres. Alternative E would have the fewest acres because it has the lowest number of acres in the timber land base as well as a fairly aggressive salvage and reforestation policy. Alternative A, which has a relatively large timber management land base, proposes the most aggressive salvage and reforestation program. Alternatives B and B' would have the highest potential for increases in non-stocked acres since the salvage program is not emphasized.

Alternatives E, B', Current/RPA and G(SOHA) would have the greatest increases in land left non-stocked between Decades 1 and 5. These alternatives have the most high intensity burn acres estimated. The Preferred Alternative would have a decrease in acres left non-stocked between Decades 1 and 5 on both high and moderate intensity fire acres due to the aggressive fuel management program. By Decade 5, Alternatives Preferred, A and E would have the least amount of non-stocked CAS acres, while Alternatives B and B' would have the most.

Table 4-51. Effects of Wildfire on Lands Managed for Timber Production (Decade 1 and Decade 5)

Alternative	Decade	High Intensity Fire, Acres Not Salvaged or Reforested (Acres/Decade)	Moderate Intensity Fire, Acres Not Salvaged (Acres/Decade)
PFD	1st decade	3,200	9,800
	5th decade	3,000	7,500
CUR/RPA	1st decade	3,900	13,700
	5th decade	6,700	9,600
A	1st decade	2,700	9,400
	5th decade	3,000	7,600
B	1st decade	8,300	29,100
	5th decade	13,700	22,000
B'	1st decade	5,600	20,700
	5th decade	10,000	15,400
C	1st decade	3,000	10,600
	5th decade	4,300	8,100
D	1st decade	4,000	14,700
	5th decade	5,600	11,500
D'	1st decade	3,500	12,400
	5th decade	4,800	9,600
E	1st decade	1,560	7,700
	5th decade	3,100	5,100
G(SOHA)	1st decade	4,600	16,400
	5th decade	8,100	12,500

The acres of moderate intensity wildfires are predicted to decrease as high intensity wildfire acres increase. Therefore, the acres of moderate intensity wildfire which would have reduced timber stocking would decline from Decade 1 to Decade 5. Many of these stands would be salvaged and/or regenerated.

In all alternatives, however, a portion of these stands would not be salvaged and timber inventory would be lost. It was assumed that the timber inventory loss would range from 1/3 to 2/3 of the pre-fire inventory.

During Decade 1, the estimated acres experiencing timber inventory loss would range from 7,000 acres in Alternative E to 29,000 acres in Alternative B. During Decade 5, the acres would be reduced and range from 5,000 to 22,000 acres. The effect on future forest growth and yield is highly variable depending on the stocking of the initial stand and the amount of inventory lost by fire.

Based on the wildfire predictions presented in the Fire Management section of this chapter, it is estimated that forest plantations would have a 22% chance of being destroyed by wildfire.

Table 4-52. Estimated Burned Plantations in Acres per Year										
Alternative	PFD	CUR/ RPA	A	B	B'	C	D	D'	E	G(SOHA)
Decade 1	380	720	700	700	650	720	890	720	500	910
Decade 5	750	1,200	1,080	780	780	1,160	1,140	1,140	360	1,430

Table 4-52 shows the acre estimates of plantations that would burn by alternative.

As the percentage of forest land under active timber management increases, the likelihood that a fire would occur within this area increases. Although plantations would continue to be a high risk vegetation type, the amount of damage caused by wildfires in both plantations and older managed forest stands would depend, in large part, on the amount and effectiveness of the prescribed fuel treatments in and around these stands. If fuel treatments are effective, the risk of high intensity wildfire within many of these managed stands could be significantly reduced.

Pest Management and Forest Health

Consequences Common to All Alternatives

Forest health is defined as a condition where the risk of present and future damage by both natural and human-caused stressors is minimized. Forest health at both the stand and landscape level is characterized by vegetative conditions which are likely to meet site-specific management objectives through time.

The presence of insects, diseases, wildfire and other natural processes which alter vegetative patterns within the forest is part of a healthy, naturally functioning ecosystem. However, forests are considered unhealthy where loss of plant vigor, mortality, undesirable changes in species composition and structure, or increased risk of fire jeopardize meeting resource objectives.

Where lands are managed for timber production, forest conditions which reduce conifer growth, increase conifer mortality, or increase the risk of moderate to high intensity fires are generally undesirable. The build up of both down and standing dead material throughout the Forest poses a potential risk for moderate and high intensity fires of particular concern.

An integrated pest management approach would be a part of all alternatives. This would include pest and disease prevention, surveillance, detection, evaluation, suppression and monitoring. All available control methods including silvicultural, mechanical, biological and chemical would be utilized.

Management practices can strongly influence the occurrence and prevention of pests and diseases within the Forest. Whereas some silvicultural practices would enhance forest growth and development, others may have a more detrimental effect. The decision to exclude timber vegetation management activities from portions of the forest may also affect long-term forest health.

Silvicultural practices which increase stand vigor and reduce susceptibility to pest and disease damage include, but are not limited to, TSI activities, use of prescribed fire, commercial thinning and stand regeneration. Practices which control the amount of vegetation (including the number of trees) and help to increase growth of individual plants would decrease the susceptibility to pests and diseases. Many of these treatments have been discussed previously in this section and are addressed in more detail in Appendix F.

In general, control of forest pests and preventing physical and biological injury within stands is easier under even-aged systems. More potential forest health problems result from selective harvest operations which often require repeated entries. With even-aged systems, it is easier to manage species and stand composition as less harvesting entries are required. Selective harvest can shift a stand to shade-tolerant species which may not be well adapted to the site. Experience has shown that this shift in species composition often results in increased pest and disease activity (root rots, defoliators).

Subsequent release of shade-tolerant species might also cause shock, sun scalding and increased vulnerability to disease and insect damage. In these situations, the use of prescribed fire could reduce the amount of shade tolerant species in the understory and potentially increase stand vigor.

Both even-aged and uneven-aged systems prescribe selective or intermediate treatments where a portion of the stand would be removed. With these harvesting operations, there is an increased risk of mechanical scarring of trees left within the stand. Tree wounds would increase exposure to disease and insect damage. Freshly cut stumps could provide entry for root diseases such as blackstain and *Heterobasidium* root rots. The risk is increased with silvicultural systems which require more frequent cutting intervals. The greater the number of trees to be retained within a stand, the greater risk of damage. Other factors which would affect the amount of damage incurred include logging systems, terrain and size of material to be removed.

Where timber operations are minimal or excluded altogether, many forested stands would likely be overstocked and competition for water and nutrients more intense. The presence of insect and disease problems such as root and bole decay organisms, bark beetles and mistletoe would likely continue and could potentially get worse.

Stands with significant disease or health problems which are currently declining in growth would likely not be regenerated. Increased amounts of mortality could be expected as a greater proportion of older, less vigorous trees are maintained on the Forest. The risk of intense wildfire occurring in these stands would increase.

Port-Orford-cedar root disease has not been found on the Forest. The fungus is soil-borne and spreads by water and soil movement. All alternatives would include standards and guidelines developed to prevent the introduction of this fungus into uninfested areas.

The introduction and spread of white pine blister rust has caused significant mortality and loss of vigor in sugar pine throughout the Forest. Reforestation using rust resistant sugar pine would be used to minimize the loss of this species. All alternatives would include standards and guidelines developed to ensure the future survival of sugar pine.

There is considerable controversy over the use of herbicides. Based on the Regional Forester's decision in February 1989 in a Vegetation Management for Reforestation EIS, herbicides are one of many appropriate methods to control competing vegetation. Herbicide use would be limited to situations where their use is necessary to achieve the land management objectives. The use of herbicides would be considered necessary when other methods would not be effective or when the costs of other methods would be unreasonable. All alternatives would consider the use of herbicides on a site-specific basis.

The benefits of releasing trees from competing vegetation are discussed in the section on silvicultural systems. Control of competing vegetation (grass and forbs) can also reduce desirable habitat for some forest pests (for example, gophers, rabbits and squirrels) which can injure or kill trees. No single release method is appropriate for all species of competing vegetation which occur on the Forest. With some species, a variety of release tools have been shown to be effective. Because of their high cost, some of these methods would be impractical. With many plant species, the use of herbicides might be the only economically feasible or biologically effective tool for control.

The use of pesticides could occur under any of the alternatives, but would require additional site-specific environmental analysis and documentation. Pesticides could be utilized to protect trees from insect and disease attack, control damaging forest pests, or control the spread of insect and/or disease problems.

Comparison of Alternatives

Changes in forest health, like wildfire, are difficult to estimate because they are the result of many factors. Many of these factors, such as drought, are impossible for forest managers to control. Since proposed silvicultural and fire protection treatments in all alternatives would have an objective of maintaining or improving forest health, alternatives that propose more active vegetation management strategies are likely to result in increased forest health.

Table 4-47 displays the total number of acres that would be treated per year on CAS lands for each alternative. A limited amount of vegetation management might also occur on non-CAS lands unless such activities are prohibited by law or by standards and guidelines.

Other Products

Consequences Common to All Alternatives

Silvicultural techniques are tailored to meet the objectives for a desired end product. The amount of trees planted, the spacing between trees, the species planted, rotation lengths and the utilization of by-products throughout the planned sequence of treatments all influence stand composition and the forest products which could be derived from the stand. All alternatives vary with the desired future condition and product objectives.

In all alternatives, utilization of noncommercial wood products would depend on the standards and guidelines for each management area, the demand for different potential products and the local opportunities available. No commercial timber products other than saw logs are scheduled under any alternative.

Opportunities to utilize noncommercial wood products would be determined on a project level basis. Although the availability of other wood products would likely be the greatest in alternatives which allocated more acres to timber emphasis, the total amount of noncommercial wood potentially available is currently unknown.

In all alternatives, firewood would be available for personal use. Cutting of hardwoods, standing dead trees and down dead trees would be permitted in designated areas only. Although areas open to firewood cutting vary by ranger district, firewood cutting is generally restricted in LSRs and HCAs, along many major roads, near wet areas, in riparian areas and in other areas where increased amounts of standing and down, dead material is needed to meet management objectives.

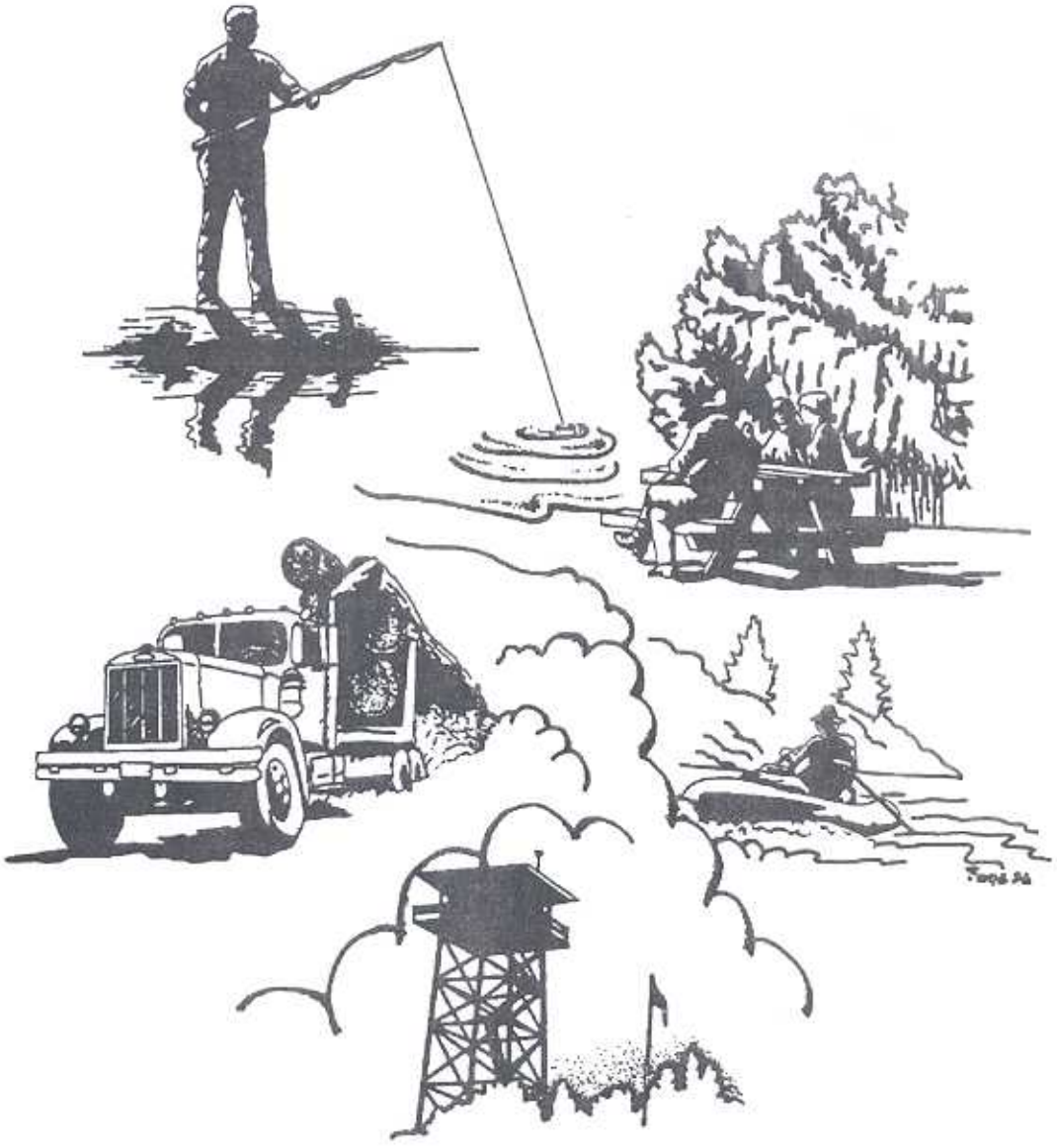
Table 4-53. Annual Cords of Firewood Available from Timber Harvest Activities by Alternative										
	PFD	CUR/ RPA	A	B	B'	C	D	D'	E	G(SOHA)
Cords of Firewood	1,210	2,380	2,660	2,160	1,740	2,210	2,300	2,230	770	2,830

Opportunities to utilize noncommercial wood within timber sale contract areas would be available for personal and/or commercial use. Since alternatives differ in estimated harvest acres, the amount of firewood available from harvesting activities would vary. Alternatives with more harvest acres would likely provide more firewood.

Table 4-53 shows the estimated cords of firewood which would be available for each alternative.

For all alternatives, management of Pacific yew would be consistent with direction provided in the interregional EIS and ROD which should be completed by 1993. In the meantime, interim guidelines to maintain the genetic viability of yew and provide for needed taxol collections would be implemented under any alternative.

The availability of forest vegetation for Native American cultural uses would be similar in all alternatives for the first few decades. As the proportion of older to younger stands and managed to unmanaged stands changes over time, the availability of vegetation would change. However, since all alternatives provide a balance of different aged stands with a variety of stand compositions and structures, the availability of a diversity of plants for other product uses is expected to continue.



Fire Management

Important Interactions

Fire is an integral component of the forest environment. The fuel element (material that burns) is the only factor associated with fire that humans can affect. Topography and weather are important factors, but cannot be manipulated by humans.

The aging of the forest with fire suppression increases fuel quantity which can increase wildfire intensity. Past control of wildfires has eliminated the role that fire played in controlling the quantity of fuels on the ground. The absence of fire has aided in the development of intermediate layers in the forest which allow ground fires to reach the crown, making wildfires more difficult to control and more destructive.

The large fires of the past 2 decades have had a significant effect on management activities. High intensity fires occurred where, historically, low to moderate intensity fire probably occurred. This has affected timber management activities as well as fisheries, soil productivity, watershed integrity, etc. These fires have forced the Forest to divert its workforce to both the suppression of these fires as well as all of the recovery activities associated with the wildfires.

Human activities such as timber management, powerline placement, recreational site development and road construction also create fuel quantities. Most of these activities collect funds to treat the fuels. When human created forest fuels are reduced, it diminishes the potential destructive effects of future wildfires.

Meeting future goals is especially dependent upon the funding requirements of the fuel reduction program and fire suppression organization. The Forest's ability to achieve desired conditions is dependent upon the Forest receiving the funds necessary for financing the most efficient initial attack fire organization as well as a fuel management program. The success of returning fire to its role in maintaining ecosystem health will be dependent upon the budgets received and the priority by which funding is allocated and spent.

Methodology

Alternatives were evaluated by issue using the following methods and key indicators:

Smoke Management

Evaluation was based on the requirements of the Clean Air Act to abide by the regulations established by the States of California and Oregon.

Fire Suppression

The Initial Attack Assessment Model of the National Fire Management Analysis System (NFMAS) was used to compare the effectiveness of each alternative in its initial attack on fires. The model is based on minimizing the cost of suppressing fire while minimizing resource values lost. It is a computer-based predictive system developed and maintained for evaluating initial attack (fire suppression) effectiveness and for analyzing past fire occurrence.

The Initial Attack Assessment Model evaluates the cost of various fire organizations against the potential loss of resources. The optimum situation is where the expected cost of suppressing wildfires plus net resource value expected to be lost is minimized. The results indicate the most efficient initial attack fire organization and the budget needed to finance this organization.

The model assumes that all initial attack modules are at their bases and available. It also assumes that the forest fuel composition is constant over time.

Prescribed Fire and the Fuel Management Program

Avoiding the effects of catastrophic fire is a paramount concern in all alternatives. Fuel treatment or reducing forest fuel quantities by fire is an important consideration. Other activities will also be considered as appropriate. Reducing fuels on the forest floor through prescribed fire or other actions would reduce the adverse consequence of large, intense wildland fires.

Reinforcing the role of fire in the environment is a growing concern. Estimates of the average number of acres each alternative proposes to treat by prescribed fire or other fuel reduction methods was tracked in several categories:

a) by timber-related activities,
b) by fire hazard reduction (natural or activity areas), and
c) by wildlife or other resource which would benefit.

In many cases there was little difference between alternatives by resource type. Acres of timber-management-related fuel treatment depended on the activities prescribed by each alternative. Alternatives also prescribed different fuel treatment intensities that dictated the type of site preparation required. Acres of fuel treatment for hazard reduction (timber sale and non-timber sale related), wildlife habitat improvement or other uses of prescribed fire were estimated based on each alternative's intent for fire use.

Fire Risk and Plantation Survival

A 22% plantation loss factor was used in the FORPLAN model for all alternatives. Differences in total acres lost is due to differences in the number of acres forested and reforested by each alternative.

Effect on Future Fires

The wildfire hazard for each alternative was compared to the existing situation. The relative number of high, moderate and low intensity burn acres was estimated.

The relative number of high and low intensity acres is important in determining the effects of future wildland fires. An important objective is to reduce the number of acres that burn at a high intensity.

Wildland fire acres projected to burn were predicted using the Fort Collins based Fire Data Occurrence Library. The analysis is based on the Forest's fire history from 1970 through 1988. The historical occurrence is analyzed using the same factors used to determine the daily fire danger.

Environmental Consequences

Smoke Management

Consequences Common to All Alternatives

Smoke is an inevitable by-product of a fire-evolved ecosystem. Smoke would be produced from wildland fires occurring during the drier fire season months and from prescribed burning accomplished during periods with lower potential loss levels.

The Forest must abide by the laws and regulations of both Oregon and California including the State Implementation Plan being developed by California (refer to the Air section earlier in this chapter). Prescribed burning would be accomplished only when permitted by the responsible local or state level regulatory agency. Generally, the effects of prescribed burning have a short duration of no more than 3 to 5 days. Wildfires similar to those in 1977 and 1987 could affect valleys for several weeks.

Fire Suppression

Consequences Common to All Alternatives

The wildland fire detection, prevention and initial response organization is designed so that individual fire starts can generally be controlled on a 90 percentile day (hot, dry, windy days experienced typically in mid to late August). The organization is not designed to control multiple fire starts on 90th percentile days. It is economically infeasible to develop an organization that would control all fires all of the time.

There would be circumstances for which the organization cannot reasonably plan. Multiple fire starts from lightning storm events would always present control difficulties when fire danger is very high. Severe weather patterns, irrespective of the number of fires, would also make control more difficult. There would be regionally assigned air tankers, smoke jumpers and Hotshot crews (professional 20 person fire-fighting crews) available as needed for severe wildfire situations.

Another possible impediment to initially controlling fires is the occurrence of fires in other parts of the state or country. There have been occasions when Northern California has been a lower fire priority than Central or Southern California. When severe fire situations occur elsewhere, it is difficult to maintain the full initial attack organization. There is no indication that this situation would change in the future.

The many miles of road on the Forest act as fuel breaks during fires in addition to the constructed fuel breaks. Many fuel breaks were built to aid past fire suppression especially in 1977 and 1987.

A shift in wildfire suppression responsibilities occurred in January of 1992 as a result of a State-wide effort to balance protection responsibilities among all wildfire suppression agencies. The California Department of Forestry and Fire Protection (CDF) assumed the protection responsibility for 137,000 acres that the Forest used to have. The Forest lost CDF funding for 4 engines or the equivalent of $347,000 per year. The areas most affected by this change are the southern end of Scott Valley, the eastside of the Oak Knoll Ranger District and the westside of the Goosenest Ranger District. The analysis for all alternatives analyzes the overall need for a fire-fighting workforce without regard to the funding source. However, the organizations described below include only those resources funded by the Forest Service.

The per acre value of resources such as timber and T&E species habitat have increased. This increase in value places an increased importance on protecting these values from destruction by wildland fires.

All alternatives would consider minimum impact suppression methods in all areas.

Consequences Unique to the Preferred Alternative

The fire suppression organization for the Preferred Alternative would specify 15 engines. This would replace the funding lost from CDF and fund 3 additional engines. Five 5 person crews would be funded with 1 at every district except the Ukonom Ranger District. The organization would include 2 helicopters, 19 fire prevention technicians, 9 lookouts, the air attack aircraft, the Siskiyou County airtanker reload base and the Emergency Communication Center.

This suppression organization, coupled with an aggressive prescribed fire and fuels treatment program is projected to hold the average number of acres burned to approximately 110,000 acres each decade. The success of the initial attack organization is expected to increase significantly over the current situation. This is due to the relatively low number of acres projected to burn at high intensities. Low intensity fires are easier to suppress and would have a higher success rate.

Consequences Unique to Alternatives Current/RPA and G(SOHA)

Alternatives Current/RPA and G(SOHA) specify an organization of 14 engines, 2 helicopters, 1 air attack aircraft, 9 lookouts and 2 fire prevention patrols per

Table 4-54. Projected Number of Fuel Reduction Acres Per Decade										
	Alternative									
	PFD	CUR/RPA	A	B	B'	C	D	D'	E	G(SOHA)
Site Preparation	31,830	52,980	48,730	37,770	34,380	54,250	61,180	60,090	20,640	63,600
Fire Hazard Reduction	93,750	4,000	40,000	20,000	20,000	20,000	20,000	20,000	20,000	4,000
Wildlife	43,000	0	20,000	5,000	5,000	5,000	5,000	5,000	5,000	0
Range	5,000	0	5,000	5,000	5,000	5,000	5,000	5,000	5,000	0
Wilderness Prescribed Fire	80,000	0	15,000	15,000	15,000	15,000	15,000	15,000	1,000	0
Cultural	2,500	100	1,000	100	100	100	1,600	1,600	100	100
Watershed	15,000	0	10,000	400	400	400	5,000	5,000	400	0
Total	**271,080**	**57,080**	**139,730**	**83,270**	**79,880**	**99,750**	**112,780**	**111,690**	**52,140**	**67,700**

district. An airtanker reload base at Siskiyou County Airport and the centralized dispatch function shared with CDF in Yreka would also be included.

Four of the engines were funded from State (CDF) cooperative funds in the current situation (base year 1987). To project these alternatives into the future and implement them, that funding would need to be sought and obtained.

The model projects that the acres burned in wildfires would average 189,810 acres each decade with this organization.

The current direction to suppress all wildfires in all management areas would be continued. Control would continue to increase in difficulty. Fire severity is increasing as the forest fuels accumulate with the absence of fire as a control for the buildup as well as from inadequate fuels treatment especially during intermediate timber management activities.

Consequences Common to All Alternatives Except Alternatives Preferred, Current/RPA and G(SOHA)

The projected Forest initial attack fire organization would see a reduction in fire engines from the current 14 to 12 engines and a reduction from 9 lookouts to 7. The 2 helicopters, 1 air attack aircraft and 2 fire prevention patrols per district would remain the same. Two 5-person handcrews would be funded as well as 4 water tenders. The air tanker reload base at Siskiyou County Airport and the centralized dispatch function shared with CDF in Yreka would be maintained.

The model projects that the acres burned in wildfires would average 203,370 acres each decade with this organization.

Prescribed Fire and the Fuel Management Program

Consequences Common to All Alternatives

All alternatives would pursue the marketing of biomass (wood fiber) in a secondary market as an alternative method of treating fuels created by timber management activities. It is very likely that the acres of timber-related activity fuels treated by prescribed fire and other methods would decrease over time as new markets are developed.

Comparison of Alternatives

Table 4-54 displays projections of the number of acres that would receive fuel reduction treatments each decade for each alternative and shows how these acres would be distributed by funding source. Site Preparation treats activity-created fuels from timber sales, while Fire Hazard Reduction generally reduces natural fuels. In all alternatives, prescribed fire would be a primary tool used for fuel reduction activities. Site preparation has traditionally had a high emphasis of treatment by prescribed fire. As markets are developed for secondary wood products, there will be a decline in the use of fire for site preparation.

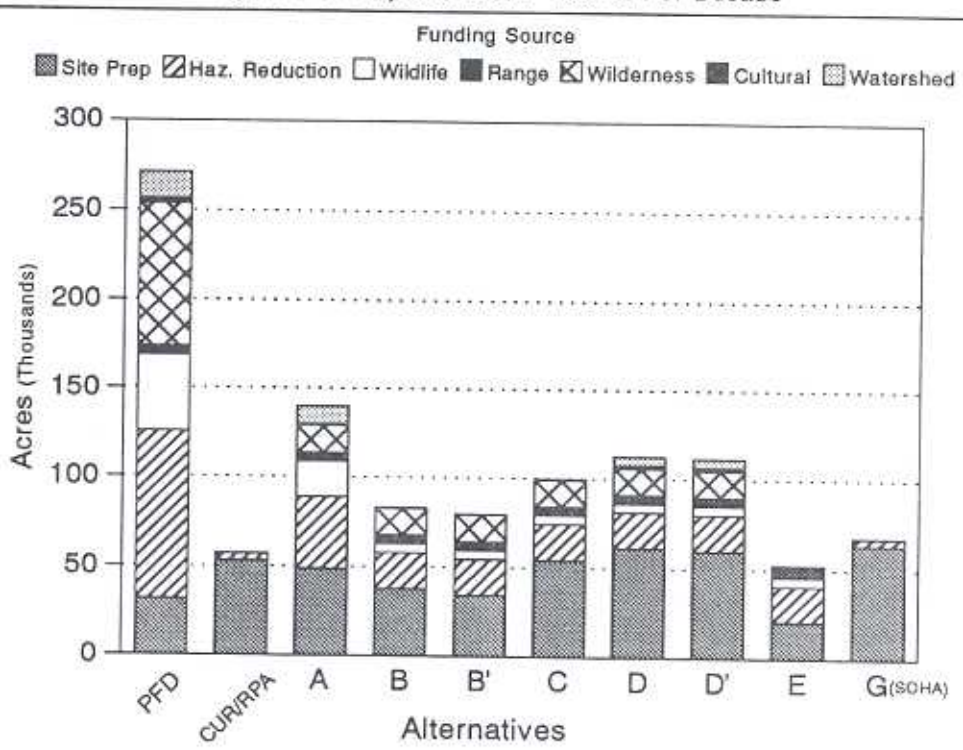
Figure 4-9 displays the same information as Table 4-54 in a bar graph.

It is difficult to accurately project the number of acres that would ultimately be treated to reduce fuels by prescribed fire and other methods. This difficulty is due to the new air quality regulations being developed by the State of California in its State Implementation Plan and to the biomass opportunities in the counties.

All alternatives except Current/RPA, E and G(SOHA) propose a substantial increase in the number of acres treated to reduce fuels for objectives other than site preparation. Using prescribed burning to improve forest health and return fire to the environment could conflict with society's desire for smoke free air.

Prescribed Natural Fire (PNF) is the use of prescribed fire from a natural (lightning) ignition. All alternatives would use PNF except for Current/RPA and G(SOHA). Alternative E would permit only 100 acres per year; Alternatives A, B, B', C, D and D' would permit 1,500; and the Preferred Alternative would permit up to 8,000 acres per year. PNF would primarily be used in wilder-

Figure 4-9. Projected Acres Treated Per Decade



ness. It would also be used in the larger LSRs and HCAs in Alternatives Preferred, B and D and in the Backcountry Areas in Alternatives Preferred and A (refer to Wildlife and Wilderness sections in this chapter).

Consequences Common to Alternatives Preferred, B and D

Alternatives Preferred, B and D would use prescribed fire within LSRs or HCAs. Fire would be used to reduce fuel quantities and to keep the quantity of intermediate trees from becoming a dominant feature. This treatment would help to keep ground fires from becoming crown fires, thus protecting the structure needed by northern spotted owls and other late-successional species.

Consequences Unique to the Preferred Alternative

The Preferred Alternative would reduce fuels on more acres per decade than any other alternative. This reflects the desire to restore fire to its regulating role in the ecosystem. The Forest is capable of achieving this goal, but it would require a tremendous effort. Prescribed burning and other fuel reduction methods would have to occur during fire season as well as during every available opportunity in the fall, winter and spring.

Consequences Unique to Alternatives Current/RPA and G(SOHA)

The number of acres to have fuel reduction work as part of site preparation would be directly linked to the ASQ and to timber management prescriptions. No appreciable increase would be forecast for the future in the number or types of acres treated.

There would be little scheduled or predicted use of prescribed fire for other objectives such as wildlife habitat and range improvement.

PNF would not be authorized. There would be no scheduled use of any type of prescribed fire within wilderness.

Consequences Unique to Alternative A

Alternative A would reduce fuels on more than twice as many acres as in the current situation. This would be the second largest program of all the alternatives. The intent of the program is to return fire to the ecosystem to achieve biological diversity objectives, to improve watershed and wildlife habitat conditions as well as to protect timber and other resource values from destruction by future wildfires.

Consequences Unique to Alternatives B and B'

These alternatives would reduce fuels on the second least acres but could treat the greatest number of timber stands. Many acres would be treated by group selection which would create stands less than 2 1/2 acres in size. This would create 2 to 3 times as many stands as the current situation would for the same number of acres. Prioritizing treatment needs and timing for this many stands would provide a challenge

for managers. Small cutting units tend to increase costs as well as the complexity of fuel treatment.

Consequences Unique to Alternatives D and D'

These alternatives would reduce fuels on the third highest number of acres with prescribed fire. These acres are primarily associated with timber removal. These alternatives would treat the second highest number of timber-related acres. These alternatives would prioritize areas for treatment with prescribed fire according to watershed condition.

Fire Risk and Plantation Survival

Consequences Common to All Alternatives

Although the acres of land programmed for timber management would vary considerably between alternatives, all would treat timber residues in the same way. Treatments such as release and pre-commercial thinning need new and innovative strategies to assure that a significant number of stands make it to rotation. Projections for plantation loss are estimated at 22%. Only 78 of every 100 acres of plantation are projected to reach rotation. This estimate may be low as there is little historical experience with plantation-like fuel complexes.

Consequences Common to All Alternatives Except the Preferred

Fire hazard and ultimately plantation loss from wildland fire would steadily rise in all alternatives with the exception of the Preferred. Although prescribed fire would be used, it would not be on the scale needed to meet all resource needs. New technologies and encouraging biomass utilization would be a high priority.

Consequences Unique to the Preferred Alternative

Because this alternative would have the most aggressive fuel treatment program; targeting 271,080 acres per decade; it would significantly reduce the probable number of acres projected to burn in the high fire intensity category (refer to Figure 4-10). This reduction would mitigate the effects of wildfire on soil, wildlife, watershed, fisheries and timber. The experiences of 1987 showed that the failure to treat fuels could yield severe soil damage as in the case of Crapo Creek or high plantation losses such as that seen in the Yellow and King-Titus Fire Complex Areas of the Salmon River and Happy Camp Ranger Districts.

Consequences Unique to Alternatives Current/RPA and G(SOHA)

Based on the continued practice of full control of wildland fires, a gradual rise in the amount of burnable material in the forest is predicted. The consequence would be an increase in severe fires such as experienced in 1977 and 1987.

Timber management areas would remain vulnerable to high intensity fires especially in areas with little to no fuel treatment. In areas where fires occur once every 7 to 20 years, stands would have only a slight chance for reaching rotation age.

The absence of fuel treatment in adjacent stands would also decrease the likelihood of plantations reaching maturity. Studies indicate that adjacent stands with high fuel loadings would tend to carry a destructive fire into plantations with greater ease than those with lighter fuel loadings. This would increase the likelihood of plantation loss.

Consequences Unique to Alternative A

Alternative A would have the second largest fuel reduction program, about 140,000 acres per decade. These acres would be prioritized based on resource values. Areas adjoining plantations and critical fire control breaks would receive high consideration. Release for growth and survival would occur early so as to reduce the flammability of a plantation.

Consequences Common to Alternatives Preferred, B and D

LSRs and HCAs, like plantations, pose a special challenge from a fire hazard standpoint. High fuel loadings coupled with an intermediate layer of trees help guarantee that fire flames could reach the tree crowns of all tree layers even on benign days. Crown fires are generally very destructive, especially in late summer when the moisture content of the needles is low.

Alternatives Preferred, B and D would begin to treat the problem of long-term survival of these late seral stands. These alternative would allow the use of prescribed fire to keep fuel loading low which would increase the likelihood of low rather than high intensity fires occurring. With these low intensity fires, the flames would be much less likely to reach the crowns of the older trees. The future viability of LSRs and HCAs would be much more likely with fewer high intensity fire acres.

Effect on Future Fires

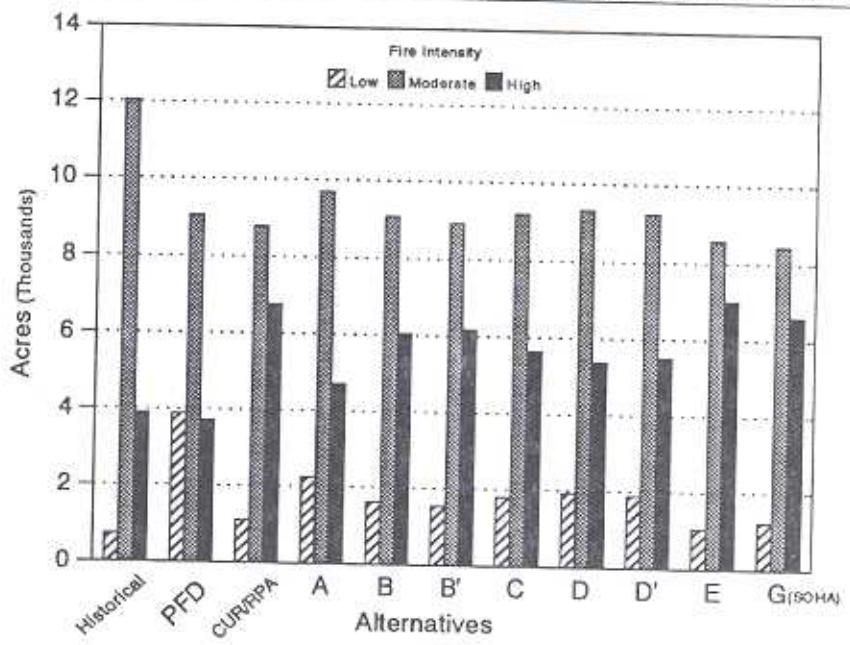
Comparison of Alternatives

Figure 4-10 displays the acres projected to burn each year with low, moderate and high intensity fires by the fifth decade for each alternative and shows the historical situation for comparison.

Consequences Common to All Alternatives

The uncertainty of the future makes it difficult to project what the wildland fire situation on the Forest would be. A potentially changing climate, National budget deficits placing restrictions on Federal spending and shifting priorities would all interact producing varying effects. Despite the uncertainty of predictions, the effects of

Figure 4-10. Projected Annual Burn Severity from Wildfire in the Fifth Decade



future wildland fires are very important because of fire's integral role in the Forest ecosystem.

It is very likely that fires in the future would continue to get larger and be more severe especially if the warming trend in the climate continues. Fuels management is the only activity the Forest has that can be used to mitigate the potential effects of future fire to avoid catastrophic damage similar to that in 1987.

Consequences Common to Alternatives Current/RPA, E and G(SOHA)

These alternatives would not have a fuel management program for non-timber resources. Fuels would accumulate more rapidly than if the fuels were treated. These fuels would be susceptible to hot, intense and destructive wildland fires. The probability of high intensity wildland fires occurring in the future would be high.

Consequences Common to All Alternatives except Current/RPA, E and G(SOHA)

All Alternatives except Current/RPA, E and G(SOHA) would have substantial fire hazard reduction programs and fuel treatment programs to meet non-timber resource objectives. These treatments would reduce the probability of future high intensity fires occurring.

The overall objective of a fire hazard reduction program is to manage for a situation that would minimize the number of acres that burn at high intensity and increase the acres that would burn at lower intensities. Wildland fires that burn in the low intensity range are the easiest to suppress as they burn slower and the low flame lengths facilitate direct attack.

Consequences Common to Current/RPA and G(SOHA)

Ecosystem studies indicate that the average age for "old growth" trees on the Forest is approximately 180 to 350 years. Many of these studies concluded that these stands reached this age under the periodic natural occurrence of low to moderate intensity fire.

With Alternatives Current/RPA and G(SOHA), dead fuels would increase due to the suppression of fire. These alternatives would not adequately treat these accumulating fuels. This would increase the chances for a wildland fire to escape initial attack and be destructive. Timber value would be lost, while soil productivity, wildlife habitat and geologic stability would all be affected. Figure 4-10 indicates that these alternatives would have the highest number of acres burned by high intensity fire.

This trend indicates the possibility that these later seral stage forests in the future could have a younger average stand age. With the possibility of more frequent high intensity fires in the future, many stands might not reach the age of 250 but would be replaced on a shorter interval. This could affect biological diversity by altering the maximum stand age.

Consequences Unique to the Preferred Alternative

The aggressive fuels treatment program would help to mitigate the accumulation of forest fuels. The increased initial attack organization would enable the Forest to more quickly respond to fires. This alternative would have the least risk of high intensity future fires

and the greatest likelihood of protecting resource values.

Range Management

Important Interactions

Activities related to the management of timber, fire and fuels, wildlife habitat, water quality, soils, biological diversity, riparian areas, cultural resources, recreation and wilderness affect the range resource. Timber management activities on suitable rangelands can produce transitory forage for grazing animals. Harvesting methods and site preparation techniques affect the quality of forage produced on transitory range. Fuel management has the potential to affect the quality and quantity of forage available on rangelands. Type conversions which utilize prescribed fire and/or mechanical methods to convert timber and/or brush to earlier seral stages can increase the available forage.

Permitted livestock and wild horses compete with each other and with wildlife for available forage. Interactions with wildlife occur mainly within riparian areas and within deer and elk habitat areas.

Grazing itseld can affect the range resource. Primary direct effects on range ecoystems are selective plant defoiliation and trampling. Heavy grazing can reduce the vigor of preferred species and may even eliminate them from the community, especially those sensitive to forage utilization. Compaction, accelerated erosion and changes in the water table can alter rangeland productivity. Exotic species may be introduced with livestock which outcompete native forage species. Wet areas and meadows are particularly suseptible.

Potential conflicts between livestock and other resources on Forest lands include those with wildlife, Sensitive plant species as well as aquatic and semi-aquatic species, particularly in riparian communities. Some Forest visitors perceive a conflict between recreational and livestock use, especially in wilderness where wilderness values appear to conflict with livestock use of those areas.

Methodology

Predicted consequences resulting from various alternatives are based on historical information, existing data, literature and professional judgement of those currently managing the rangeland resources on the Forest. Direct, indirect and cumulative effects will be discussed by alternative in terms of the following key indicators:

1) Animal Unit Months (AUMs) and Cost per AUM;
2) Changes in condition and trend of permanent range and riparian areas;
3) Structural and non-structural improvements; and
4) Transitory range acres.

Rangeland condition and trend will also be discussed for each alternative. Satisfactory condition includes rangeland in fair condition with an increasing trend as well as rangeland in good or excellent condition with a static or increasing trend. The objective is for rangeland currently in fair, poor and very poor condition with a static trend to be in an upward trend by the end of the fifth decade. The projected condition and trends for each alternative will be compared to the objective.

Environmental Consequences

Consequences Common To All Alternatives

The current overall supply of forage and suitable rangeland on the Forest exceeds current demands for grazing permits. There are some vacant allotments on the Oak Knoll and Scott River Ranger Districts which have not been filled. Demand may exceed supply in localized instances, however overall there would continue to be an excess of suitable forage in the future.

Effects of recreational stock - Permitted livestock use and use by commercial pack and saddle stock are administratively controlled uses through terms and conditions issued in permits. Recreational use of stock is not closely monitored or controlled on the Forest and the potential effects differ. Recreational pack and saddle animals are often tied, picketed or hobbled in meadow and riparian areas near lakes or streams near preferred campsites. Confining animals could cause localized heavy grazing, trampling and compaction.

Season of use for recreational users cannot be controlled and animals might be turned out into forage areas early in the season when soil moisture levels are too high to sustain trampling by animals and plant phenology is such that plants are adversely affected by defoliation.

Comparison of Alternatives

Transitory Range - In all alternatives, the 56,700 acres of transitory range currently available on the Forest would change in both numbers and location over time due to successional changes. The currently available transitory range produces an estimated 2,000 AUMs per year, a relatively small proportion of the overall range program.

Regeneration cutting provides utilizable forage. As regenerated stands mature and develop closed canopies, additional acres must be cut to replace the transitory forage. With the reduction in regeneration acres in all alternatives, it is anticipated that there would be fewer acres of transitory range available for livestock from timber harvesting activities in the future.

Alternatives with more planned regeneration acres would provide more transitory range from this source in

the future. Alternative G(SOHA) would provide the most acres of transitory range from timber harvesting. It would be followed by Alternatives E, Current/RPA, C, D', D, A, B, B' and Preferred in decreasing order.

In all alternatives except Current/RPA and G(SOHA), there would be little or no use of the clear-cutting method. In the future, all alternatives but Current/RPA and G(SOHA) would provide transitory range from timber harvesting in smaller openings or in areas in which an overstory of trees remains due to reliance on the GTR, shelterwood and group selection cutting methods. The quality and quantity of the forage would likely be reduced in these areas due to competition for moisture and nutrients from overstory trees.

Transitory forage also becomes available due to successional changes after fires. While all alternatives are expected to have the same amount of acres burned in wildfires in the future, the amount of prescribed burning planned varies by alternative. Alternative Preferred plans to treat the most acres with prescribed fire and PNF and would therefore provide the largest amount of transitory forage from this source. It would be followed by Alternatives A, D, D', C, B, B', G(SOHA), Current/RPA and E in decreasing order.

Utilization of transitory range is largely incidental except in isolated situations. Use varies significantly depending on traditional livestock use patterns, permittee participation, accessibility and access to water. Intensive grazing strategies and permittee participation would be used in all alternatives, but Current/RPA and G(SOHA).

Consequences Common To Alternatives Preferred, A, B, B', C, D and D'

AUMs - With any of these alternatives, the number of AUMs would not change significantly in the first decade from the current numbers. Forage productivity and livestock utilization would not necessarily remain the same in individual localized areas, however, overall livestock numbers would not increase or decrease on the Forest.

These alternatives would emphasize shifting concentrated livestock use away from sensitive areas such as riparian areas to better utilize other areas such as transitory range. This would require a more proactive approach to managing the program than has occurred in the past.

Cost per AUM - Costs would probably increase due to the measures specified in each alternative for increased protection, resource restoration and restriction of livestock use in areas such as WSRs, RNAs and SIAs. If increased funding is not feasible, funds would need to be redistributed to emphasize restoration of damaged areas rather than pursuing opportunities to expand or enhance the existing program via range improvements.

Condition and Trend - Implementation of the proposed standards and guidelines would result in incremental improvements starting in the first decade and continuing throughout the planning period. However, change in overall ecological status is very slow and the change would not be significant in the first several decades.

Riparian and wet meadow community types would respond most rapidly in upward trend. There would likely be noticeable improvements in the first decade. Other permanent rangelands would not respond as rapidly. Dry, sagebrush community types would be almost static.

The process of improvement of most rangeland ecosystems requires change in competitive interactions among species, decline in abundance of weedy non-natives, and replacement by native or non-aggressive desirable, non-native plants. Soil coverage by live plants and litter must increase to show improved ecological status. The 50-year prediction of universal improvement in ecological status is conservative but realistic given the recurring drought cycles experienced since the mid-1970s.

The scientific literature indicates that cheatgrass invaded sagebrush-grass communities will not improve for a very long time. The strong competitive effects of this annual grass for soil water make it nearly impossible to restore native grasses back into this community due to their relatively weak seedling vigor.

The eastside of the Forest has considerable acreage of this community and it is not expected to improve in condition without extraordinary cost such as herbicide treatment, seeding and fencing. Research in the Great Basin is investigating the options for restoring millions of acres of cheatgrass invaded range in eastern Oregon, northeastern California, northern Nevada, southern Idaho and western Utah. Much of the previous work indicates that no economically feasible options exist. Long-term exclosure studies have shown that removal of livestock provides no speeding of decline in cheatgrass dominance or increases in recovery of native perennial grasses.

This is why removal of livestock would do little to help at this point for this invaded community type. However, following cheatgrass eradication, which is close to impossible, management of livestock becomes crucial in the recovery of reintroduced (seeded) native perennial species.

Structural and Non-structural Improvement - Restoration of damaged sensitive areas not currently meeting objectives would likely be the first priority. Structural improvements would include fencing of sensitive areas and creating water developments to redistribute livestock use. Nonstructural improvements would include reseeding areas lacking sufficient

cover and using prescribed fire to rejuvenate areas where the vegetation is no longer utilizable by foraging animals.

Intensive grazing strategies - The use of more intensive herding practices in these alternatives would spread animal utilization pressure more evenly over an allotment so that locally over-utilized areas would be minimized or eliminated. With enhancement of more highly productive portions of an allotment, other areas could be deferred grazed (grazed after seed set when plants are less affected by grazing) or rested to provide targeted improvement in portions of an allotment.

Frequent herding of animals over the grazing season would decrease the selectivity of livestock so grazing has less impact on favored forage species. It also could allow plants to optimize leaf area and capture of sunlight, thereby producing more plant productivity for forage. On the Forest, intensive grazing probably would have its greatest role on the BVNG where formerly seeded wheatgrass can especially benefit from intensive grazing practices. Fenced pastures already exist to facilitate this option for management.

These alternatives would continue the permittee training program instituted in 1994 to promote self monitoring of utilization in addition to agency monitoring. While it is known to be difficult to modify grazing habits of livestock, much greater efforts on the part of permittee is possible on most allotments. By training permittees on how to recognize utilization levels before they become too severe, substantial enhancements in productivity could be realized.

Many potential foraging areas repeatedly go ungrazed by livestock each year. Considerable buffer of available forage exists on most allotments to make up for the reduced utilization allowed in riparian areas. Although it would take more permittee time and money, the opportunities for increased utilization exist because most allotments are conservatively stocked at the present time.

As permittees are required to do more animal management to reduce utilization levels in riparian areas, even with some reductions in AUMs, greater impacts are probable for upland areas. Some of these impacts would be beneficial and some adverse. Both would be monitored and the adverse ones mitigated. Some shifting of livestock browsing pressure onto aggressive shrubs on forest sites would be very desirable for forest health as well as for fire hazard reduction.

Reductions in ladder fuel structures due to a decadent shrub understory can, to an extent, help in controlling buildups of dead fuels in chaparral. Palatability and availability of some shrubs (eg., antelope bitterbrush, curl-leaf mountain mahogany and several of the ceanothus species which are presently very decadent) for wildlife would be improved following greater browsing pressure by livestock.

Where livestock trampling effects on uplands increase due to more movement between riparian watering points and upland grazing areas, water may need development in uplands as a mitigation measure so that movement back and forth becomes unnecessary. Restoration of native grasses in low-condition range uplands could also be used to increase the grazing capacity of uplands. In this case, both the grazing and watershed resources would be improved.

Consequences Common to Current/RPA Alternative and Alternative G(SOHA)

AUMs - AUMs of approximately 34,000 per year would not change significantly within the first decade under a continuation of current management or with Alternative G(SOHA). Forage productivity would decline by the end of the fifth decade in localized areas including some westside mountain meadows and riparian areas which do not have plans for improving animal distribution or for protecting and rehabilitating damaged areas. Decreased forage productivity and subsequent increased utilization would decrease the potential number of AUM's.

Cost per AUM - Cost per AUM would be $6.21.

Condition and Trend - No change would be projected in the estimated 52% of the rangeland in satisfactory condition and the 62% in a static or upward trend on permanent range types on the eastside of the Forest. At the end of the fifth decade a decline is projected in localized areas including westside mountain meadows and many riparian areas. The areas which are not in satisfactory condition and/or are in a declining trend would continue to decline if localized livestock use continued uncontrolled. Ultimately, these areas might draw significant attention and pressure might be applied to have them closed to livestock use.

The current level of extensive management would continue. There would be no provisions for improving livestock distribution through temporary exclusions or through reductions in use in localized areas. The cumulative effects of heavy use in these local areas would be a decrease in forage production. This would lead to a long-term downward trend and poor range conditions in these areas. This effect would be most prevalent in riparian areas.

Structural and Nonstructural Improvements - An average of 15 structural improvements would be constructed each year. About 100 acres of non-structural improvements per year would occur. These would be sufficient to maintain existing ecological condition and AUMs in the short term. The number of improvements would not be sufficient to offset the projected decline in AUMs and ecological condition by the fifth decade

on the westside. This might mean an ultimate reduction in the size of the Forest range program.

Structural improvements such as fencing and water developments can help to achieve better livestock distribution and utilization. In some cases, structural improvements can be used to protect areas which are subject to localized resource damage, allowing recovery to take place. Non-structural improvements such as type conversions and seeding can improve range condition in localized situations and increase or help maintain current carrying capacity.

Consequences Common to All Alternatives Except E

Livestock operations established prior to the congressional designation of each wilderness would continue pursuant to Sec. 4 [d] [4] [2] of the Wilderness Act and subject to provisions of 36 CFR 293.7.

Consequences Unique to Alternative E

AUMs - This alternative would not permit livestock in wilderness which would reduce AUMs by 5,166 to 28,834 AUMs per year. Due to the large number of acres which would be allocated to special uses which are not compatible with range management, the number might be even lower. An option would be to direct existing range funds to more intensive range management strategies as described earlier on the remaining allotments outside of special emphasis areas such as the eastside. This might offset the reduction in AUMs. Under current laws this would not be an implementable alternative.

Cost per AUM - Costs would probably remain the same as in the current situation. Some funding would be necessary for restoration work in areas which do not currently meet management objectives, even in the absence of grazing. The lower AUMs would not account for a significant reduction in costs in the first decade.

Condition and trend - Condition and trend would be similar to that of Alternatives Preferred, A, B, B', C, D and D', except riparian areas within wilderness would be expected to improve more rapidly, most noticeably in the later decades.

Wild Horse Management

Important Interactions

Wild horse interactions include competition for available forage with permitted livestock and wildlife species such as deer and elk. Extension of the wild horse range would continue to adversely affect private lands through the destruction of crops, competition for forage and impacts to property including fences, gates and domestic horses. Activities related to the management of timber, fuels, wildlife, soil, biological diversity, cultural resources, riparian areas and water resources can affect wild horse management. These interactions are similar to those described for permitted livestock in the Range Management section of this chapter.

Methodology

The consequences predicted to result from implementation of the alternatives are based on historical information, existing data, literature and professional judgement of those currently working in the rangeland resource area on the Forest. Direct, indirect, and cumulative effects are discussed by alternative in terms of the following indicators:

1) How management meets the intent of the Wild Horse and Burro Act,
2) Number of horses managed,
3) Number of herds managed, and
4) Whether there are impacts to private land.

The intent of the Wild Horse and Burro Act is to maintain populations in thriving ecological balance in areas they inhabited on NFS land on or after December 15, 1971.

Environmental Consequences

Consequences Common to Alternatives Preferred, D, D', E and G(SOHA)

These alternatives would maintain 1 herd of approximately 15 head in the Three Sisters area. Actual populations would vary from 10 to 20 head depending on opportunities and funding for capture and removal. This would provide for 1 horse population in ecological balance with other resources and within the established territory boundary. Impacts to private land and landowners would be minimal as animals could be managed year round on NFS land.

Consequences Common to Alternatives Current/RPA, A, B and B'

These alternatives would maintain a herd of 15 head in the McGavin Peak area and a herd of 10 head in the Three-Sisters area. Actual populations would vary from 15 to 25 head in the McGavin Peak area and from 10 to 20 head in the Three Sisters area depending on opportunities and funding for capture and removal.

The Three Sisters Herd could be maintained in balance with current livestock and wildlife population levels within territory boundaries. As the population increased, bands would venture outside the established territory and possibly impact private land. This situation could be corrected by periodic removal of individuals to meet population goals for the herd.

The McGavin Peak Herd would continue to impact private land during winter months. Population levels could not be maintained in balance with other uses on

NFS lands. Forage available for wildlife and permitted livestock would decrease as population levels increase above the target levels. Range condition would be in a downward trend which would not meet the range objectives described in the Range Management section of this chapter. Stray horses from intermingled private land would continue to interact with the herd and affect population numbers and herd status. Complaints from private land owners and requests for the Forest Service to remove animals would likely continue. Populations at any level would continue to adversely impact soil and forage resources of these lands.

Consequences Unique to Alternative C

Alternative C would maintain 1 herd of 50 animals in the Three Sisters territory. This would be 40 animals more than the population in the approved herd management plan. This level could not be maintained in balance with other demands of the forage resources. Reductions in wildlife populations and/or permitted livestock might be required. Range vegetation and soil conditions would be adversely impacted. The herd would separate and sub-herds would venture outside established territories onto private land. Complaints from private landowners would increase.

Cultural Resources Management

Important Interactions

Areas allocated to General Forest, Scenic Rivers, Recreational Rivers, Riparian Management, Retention VQOs and Partial Retention VQOs would have the potential to significantly affect cultural resources. The level of significance of the cultural resource, its suitability for scientific research or interpretive opportunities, its value to a community or ethnic group, its accessibility and the level of compatibility with other management activities are all important factors.

Methodology

The following key indicators were used to determine how each alternative would affect cultural resources:

1) The emphasis of the proposed Heritage Resource Program, and
2) The treatment of Cottimien, Inam and Helkau sacred areas.

Actions Which Are Common to All Alternatives Except Alternative G(SOHA)

A cultural resource survey would be required before any site-disturbing activities could occur. The purpose of the survey would be to locate, inventory and nominate any significant prehistoric and historic sites to the National Register (EO 1159.3, 36 CFR 800, PL 91-190). Consultation with SHPO and the Advisory Committee on Historic Preservation would also be required before any site-disturbing activities could occur (36 CFR 800).

Adverse impacts to significant or unevaluated sites would be mitigated (PL 87-665, PL 96-95).

All recorded sites would be monitored (PL 100-555, PL 96-95). Significant sites would be stabilized as needed (36 CFR 800; PL 87-665). Interpretive and National Register sites would be enhanced (36 CFR 800, PL 91-90).

An agreement would be made for Forest history materials and materials recovered from the Forest to be stored in the Siskiyou County Museum (36 CFR 79). The curation responsibilities of the Museum for Forest materials and the cost involved in maintaining these materials would be part of the agreement.

Plans and cooperative agreements for sites and area management would be developed (PL 95-341, PL 74-272). Partnerships with Federally Recognized Tribes and other history and pre-history interest groups would be developed (PL 95-341, PL 100-588).

Training and awareness sessions for employees would be conducted on an on-going basis (PL 96-95). A public outreach program consisting of talks, slide shows and publications would be developed which includes working with schools (PL 100-588).

Plans for continuation and improvement of the Heritage Resource program would be developed (PL 100-588, PL 100-555).

The goal of the Tribal Government Program would be to improve relationships between the Forest Service and Indian people. The program emphasis would include increasing understanding, communications and partnerships between the Forest and Indian tribes, organizations and communities as well as implementing the Service-wide policy.

Environmental Consequences

Consequences Common to All Alternatives

Ground-disturbing activities and increased access to remote areas would generate potential effects to historic and prehistoric sites under all alternatives. In general, activities that cause greater ground disturbance have the highest potential for causing adverse impacts on Prehistoric and Historic Properties (sites).

Table 4-55 shows the type of cultural resource that would be affected by various management activities and by wildfire. The Activity column indicates whether the activity would create a direct or an indirect effect.

Table 4-55. Relationship Between Activities and Affected Cultural Resources

Activity	Affected Cultural Resources (Site Types)
Recreation Development (*Direct*) Recreational Use (*Indirect*)	Prehistoric village sites, campsites and food-procurement sites; historic trails; mining features and homesteads occurring in areas common to this activity. Sites could be affected by recreationists particularly along the Klamath, Salmon and Scott Rivers.
Trail Construction (*Direct*)	Same as above with the addition of potential quarry sites and Vision Quest sites. Sites might be affected by trail construction particularly in identified high probability areas and known cultural areas.
Road Construction (*Direct*) Timber Harvest (*Indirect*)	Historic trails, ditches and prehistoric campsites when road construction and harvesting occur in an area with a high probability for cultural sites. Base rock sources for road construction when they occur in prehistoric quarries. An increase in acres and activity in these areas would also increase the possibility of vandalism.
Minerals, Geology and Energy Use (*Indirect*)	Historic mining sites, prehistoric village sites, hunting camps and tool-making sites.
Wildfire, Prescribed Fire and Grazing (*Direct*)	Potential to destroy above-ground cultural resources, such as log cabins and other historic and prehistoric structures. Fire may also alter our ability to accurately analyze obsidian artifacts. May also reveal cultural sites previously overgrown with dense vegetation.

Consequences Common to All Alternatives except C

The sacred areas of Cottimien, Inam and Helkau would be managed as Special Management Areas through a Memorandum of Understanding with the Karuk Tribe of California. These areas would be unregulated and not have any planned timber harvesting.

Comparison of Alternatives

Table 4-56 displays a comparison of Cultural Resource activity levels.

Consequences Unique to the Preferred Alternative

Cultural Resource procedures would be implemented for all Federal undertakings, Federally funded undertakings and undertakings requiring Federal permits with this alternative.

All cultural sites would be protected and no projects would be implemented until the significance of the sites are determined. This alternative proposes increasing the cultural budget by $50,000 per year over existing levels for a decade. This would facilitate the determination of significance of previously recorded unevaluated sites.

Consequences Unique to Current/RPA Alternative

The Heritage Resource Program for the RPA Alternative would emphasize monitoring of known sites. Increased emphasis would be placed on access, use and integrity of Native American traditional use sites and ceremonial areas.

This alternative would require the Forest Heritage Resource Program to operate at a level which would be very close to violating legal mandates. Funding would allow programmed project surveys to be completed, while unprogrammed surveys would be completed on a case by case basis as time and funding allowed. Monitoring would be funded at such a low level that it might be subject to legal challenges for adequacy. Site nomination, interpretation and enhancement would be very rare. Public outreach and the development of partnerships would be funded at a very low level.

Consequences Unique to Alternative A

Alternative A proposes that $50,000 each year for 10 years, above normal operating costs, be used to determine the significance of unevaluated sites. The use of controlled burning would also be used to enhance Native American plant collection. Legal mandates would be met.

Programmed and unprogrammed surveys for projects would be completed. Very little funding would be available for surveys of the general Forest. Consultation would occur at a minimal level. Public outreach and partnerships would also be given little emphasis. Curation of materials would be minimal as would nomination, enhancement and interpretive activities.

Consequences Unique to Alternatives B and B'

These alternatives would achieve a fairly well-balanced Heritage Resource Program. They would emphasize a Forest-wide program rather than a project-driven one. Programmed and unprogrammed surveys necessary for projects would be completed as well as a small amount of survey directed towards the Forest's overall inventory. Legal mandates would be met.

Table 4-56. Cultural Resources Management Activity Level Comparison by Alternative per Year

Category	PFD	CUR/RPA	A	B & B'	C	D & D'	E	G(SOHA)
Survey (ac)[1]	12,500	12,000	12,500	10,000	12,000	11,500	13,500	Project-Driven
Consultation[2]	+	+	+	+	+	+	+	+
Monitor (%of sites)[3]	15	5	15	20	15	15	25	@
Evaluate[4]	25 or more	-	25 or more	25	25	15	25 or more	-
Training[5]	+	+	+	+	+	+	+	@
Interpret (sites)[6]	+	1	+	+	+	-	+	-
Enhance[7]	+	-	+	+	+	-	+	-
Nominate[8]	+	-	+	+	-	-	+	-
Plans[9]	2	1	2	+	-	1	2	-
Analysis[10]	-	-	-	-	-	-	+	-
Stabilize[11]	+	-	-	-	-	-	+	-
Curate[12]	1	1	1	1	1	1	1	-
Public Outreach[13]	+	+	+	+	+	+	+	-
Partnership[14]	1	-	-	+	-	-	+	-
Budget (M $)[15]	550	350	450	500	400	375	600	200

+ = adequately meets direction | - = doesn't meet direction | @ = occasionally

Category Explanation:

[1] **Survey** acres of the Forest (E.O. 11593).

[2] **Consult** with SHPO and the Advisory Committee on Historic Preservation (36 CFR Part 800).

[3] **Monitor** 10% of recorded sites per year (Public Law (PL) 100-555; PL 96-95).

[4] **Evaluate** recorded sites.

[5] Conduct **training** and awareness sessions (PL 96-95).

[6] **Interpret** new sites and improve past interpretation.

[7] **Enhance** interpretive sites and National Register (NR) sites (36 CFR Part 800; PL 91-90).

[8] **Nominate** eligible site to the NR (36 CFR Part 800; PL 91-190).

[9] Develop **plans** and co-op agreements for site and area management (PL 95-341; PL 74-272). Develop plans for continuation and improvement of the Heritage Resource Program (PL 100-588; PL 100-555).

[10] **Analysis** and synthesis of existing data.

[11] **Stabilize** significant sites as needed (36 CFR 800; PL 87-665).

[12] **Curate** Forest history materials and materials recovered from the Forest (36 CFR 79).

[13] **Public Outreach**:talks slide shows , publications andwork with local schools (PL 100-588).

[14] Develop **partnerships** with Federally Recognized Tribes and other history and pre-history interest groups (PL 95-341; PL 100-588).

[15] **Budget** (in thousands of dollars) for the Heritage Resource and Tribal Government Programs on the Forest.

Monitoring of sites would be increased from the current level as would mitigation, if it proved necessary. Monitoring would be funded at a level higher than the current program, but lower than Alternative E. Interpretation of significant sites would be emphasized, but would be limited by funding as would site enhancement. Curation would occur at a level that just meets the legal requirements. Public outreach and the development of partnerships would occur only as time and funding permitted. Only Alternative E would have a higher level program.

Consequences Unique to Alternative C

The Heritage Resource Program for Alternative C would focus on interpretation, monitoring and forest inventory. Alternative C proposes that $50,000 per year, above normal operating costs, be used to evaluate previously recorded sites.

A Memorandum of Understanding would be developed between the Karuk Tribe of California and the Forest for managing Cottimien, Inam and Helkau Ceremonial Areas as with the other alternatives. However, these areas would be managed for minimal timber outputs in recognition of the need for local employment within the Native American community in Alternative C.

Programmed and unprogrammed surveys for projects would be completed as time and funding allowed. Very little funding would be available for surveys of the general Forest. Legal mandates would be met. There would be very little flexibility in the program so project needs would take precedence. Site monitoring would be emphasized, but funding would keep it at the minimum required by law. Interpretation and enhancement of cultural sites would be determined by funding and time availability. Public outreach and the development of partnerships would be at risk.

Consequences Unique to Alternatives D and D'

The Heritage Resource Program for Alternative D and D' would emphasize enhancement of Native American use of the forest. The Forest would develop provisions to facilitate the gathering of dedicated materials to meet local Karuk needs and desires. Interpretative material including signs, handouts and videos would be developed to help the general public appreciate the local Karuk customs and lifestyles as funds permitted. These interpretative efforts would also emphasis the contributions that Native Americans have made to the nation.

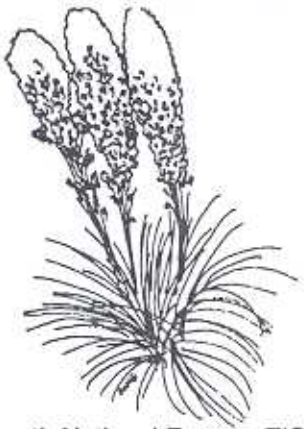
Alternatives D and D' propose that $50,000 a year for 10 years, above normal operating costs, be used for inventory, survey, interpretation and program improvement. These alternatives would allow programmed project surveys to be completed. Legal compliance would be at the absolute minimum. Management risk-taking would not be uncommon. Monitoring would take place, but not systematically and may not meet future demands. Evaluations of sites would be deferred. Known sites would be protected through avoidance. Site nomination, interpretation, enhancement, curation and public outreach would all be doubtful.

Consequences Unique to Alternative E

This alternative would provide for the best balanced Heritage Resource Program of the alternatives. It would allow the most acres per year to be surveyed. This would include surveys for project-driven activities as well as surveys of the general forest. Alternative E would fully meet the legal mandates. It proposes that $50,000 a year for 10 years, above normal operating costs, be used to determine the significance of previously recorded sites. Alternative E also proposes a Heritage Resource Program budget larger than the current one to enhance monitoring and interpretation of the forests cultural history. Curation of materials, public outreach and development of partnerships are integral in this alternative. Alternative E would meet the spirit as well as the letter of the law.

Consequences Unique to Alternative G(SOHA)

Programmed project-driven surveys would be completed most of the time. However, the quality might be such that they could not sustain a legal challenge for adequacy. The Heritage Resource Program would emphasize locating and avoiding sacred areas and other sites until funding and staff is available to determine their significance. No enhancement work would be funded; monitoring would be chancy. This alternative would not meet the legal requirements listed in the Actions Common to All Alternatives section. It would not allow the Forest to be in compliance with the laws, regulations and Forest Service direction relating to cultural resources.



Social and Economic Environment

Introduction

This resource section of Chapter 4 describes the consequences of the alternatives considered in detail on the social and economic environments. The impacts on the physical and biological environments and on existing management programs discussed in the 3 previous sections as well as the management strategies proposed in each alternative are analyzed to identify the cumulative impacts on the social environment. Several measures of economic efficiency are used to display the economic consequences of each alternative.

Social

Important Interactions

Forest resource management and its potential impact on local and regional lifestyles and cultural values is an important social issue. The impacts on lifestyles, attitudes and community cohesion are important factors of the social situation.

The potential for conflict over Forest resource use arises when a) expectations of 2 or more groups differ significantly or b) alternatives have different effects on various social groups.

Efforts to meet diverse and growing human needs for products such as timber, livestock forage, recreation, game, water and energy are increasingly viewed as conflicting with environmental values such as wildlife diversity, healthy native forests and water quality. Many citizens do not see any economic benefit in amenity values such as wilderness designations. However, if wilderness areas generate increased use by hikers and outdoor recreationists, there can be a financial benefit to local businesses.

The Forest provides a biologically diverse environment that can sustain outputs for a broad range of economic, cultural and social values. A socially diverse community can more easily respond to changing National Forest program emphasis. A more diverse economy can absorb more changes as well. Potential social and economic impacts to the community can be moderated by diversity.

Timber harvest reduction, substantial increases in recreation, wildlife and fisheries resource use and increases in minerals activity (RPA, 1990) have the greatest potential for social effects. Residents within National Forest boundaries will most likely be affected by such changes in resource management program emphasis.

Methodology

Social analysis is an assessment of impacts to lifestyles, attitudes, community structure and community cohesion that is important to the Forest planning process (refer to Chapter 3 - Social). This qualitative analysis identifies the effects on 4 major social groups within the Forest's 7-county area of influence. The groups, as explained in Chapter 3, are Long-term Residents, New Rural Residents, Destination Recreationists and Native Americans. People who share similar interests and issues or who have similar linkages to the forest have been grouped into these 4 social groups. Individuals may fit in more than 1 group or not fit in any group. These groups include minorities, women, handicapped persons, the elderly, all ethnic origins and those for whom English is a second language.

The social variables of lifestyle, values, community stability and cohesion were identified in Chapter 3. They will be used as key indicators to determine the consequences of implementing each alternative. Each alternative will be discussed in terms of its effect on these key indicators.

These variables have been analyzed within the framework of social variables or linkages for each user group as described below.

Assumptions About User-Group Preferences:

1) The lifestyles, attitudes, beliefs and values of Long-term Residents will be best supported by alternatives with a high ASQ and with few restrictions on the timber land base.
2) The lifestyles, attitudes, beliefs and values of New Rural Residents will be best supported by alternatives which emphasize high visual quality and other amenity resources and which restrict where timber management may occur and what management tools may be used.
3) The lifestyles, attitudes, beliefs and values of Destination Recreationists are best supported by alternatives which have a high amount of developed and undeveloped recreational opportunities and which have high VQOs.
4) The lifestyles, attitudes, beliefs and values of Native Americans will be best supported by alternatives which protect culturally-used resources. Alternatives which keep management activities away from traditional use areas and sacred sites during those uses, which ensure high visual quality and which ensure employment are in this category.

Environmental Consequences

Consequences Common to all Alternatives

None of the alternatives are expected to have a substantial effect on the overall population growth within the Forest's area of influence. Based on employment data and population trends, the gradual increase in population projections for the 7-county area should continue at a steady rate. Most of the population growth within the area of influence is expected to occur in the major urban population centers. Many of the small communities may experience limited population loss over the long-term.

The Forest is committed to equal treatment of all individuals and social groups in providing services, opportunities and jobs. None of the alternatives are expected to have discriminating effects on civil rights.

Rural development opportunities would be emphasized in all alternatives. This program would provide for economic diversification assistance to local communities that are eligible for such aid under Subtitle G of the 1990 Farm Bill. This rural development package directs the Forest Service, the Department of Agriculture and State Governments to cooperate with local rural authorities to develop economic diversification projects.

The Human Resource Program is expected to continue to grow in all the alternatives. The goal would be to develop the potential of the program through active involvement by emphasizing social responsibility in public lands forestry.

Lifestyles, Attitudes, Beliefs and Values

Consequences Unique to the Preferred Alternative

Long-term Residents would probably find the land allocations for LSRs, TE&S species, RRs, WSRs and Backcountry and the corresponding low ASQ incompatible with their lifestyles, attitudes, beliefs and values. There is a possibility of personal hardship for this group related to loss of employment. Effects suggested by sociologists include loss of control, anger and depression. These effects can result in higher rates of juvenile delinquency, substance abuse, domestic violence, divorce and suicide (Lee, 1990). People might leave the area to search for employment in urban areas.

New Rural Residents would probably find the emphasis on the riparian, wildlife, fisheries and recreational resources compatible with their values, especially the Aquatic Conservation Strategy which includes the identification of Key Watersheds. Recommended additional WSRs designations would also be favored.

Destination Recreationists would probably find the emphasis on recreation compatible with their lifestyles and values. This would include the Backcountry designation which provides semi-primitive recreational opportunities, the recommendations for WSRs, improved access and the opportunities for fishing, hunting, wilderness use and whitewater rafting. Although RR standards and guidelines could reduce water-related opportunities in some areas, the emphasis on maintenance of water quality would likely be favored. Their lifestyle may benefit from the visitor information program which would emphasis recreational opportunities.

Native Americans would probably find the designation of a special management area for Inam, Cottimien and Helkau sacred sites which prohibits harvesting in these areas compatible with their lifestyles, beliefs and values. Native Americans employed in timber-related jobs might not support the decreased timber output associated with this alternative.

Consequences Unique to Alternative Current/RPA

This alternative would have mixed effects on the attitudes, beliefs, lifestyles and values of Long-term Residents. Although the alternative would have a relatively high ASQ, timber outputs would be considerably lower than historical levels. Continuation of current management practices such as the treatment of visual resources may be compatible with values held by this group.

New Rural Residents may favor the treatment of visual resources, but would probably not find the intensive timber management allocations compatible with their values. The loss of opportunity to designate additional WSRs would not be favored.

Destination Recreationists would probably find the treatment of visual resources compatible with their attitudes, beliefs, lifestyles and values, but would find the loss of opportunity to designate additional WSRs incompatible.

Native Americans would probably find the designation of a special management area for Inam, Cottimien and Helkau sacred sites which prohibits harvesting in these areas compatible with their lifestyles, beliefs and values. Native Americans employed in timber-related jobs might favor the level of timber outputs.

Consequences Unique to Alternative A

Long-term Residents would probably find the opportunities related to timber production and use compatible with their attitudes, beliefs, lifestyles and values. Timber outputs would be slightly higher than under current management, while amenity resources would be provided at near current levels.

The New Rural Residents would probably find this alternative the least compatible of the implementable alternatives based on its high ASQ. The alternative's treatment of WSRs would probably be favored, since it would propose designation of all eligible Wild Rivers but the North Fork of Dillon Creek. The treatment of visual quality along designated State and County Scenic Highways with additional proposals to the National Scenic Byway System would probably also be favored, the treatment of visual quality in background distance zones might not. The allocation of some areas to Backcountry would probably be favored.

The Destination Recreationist would probably find the treatment of WSRs and the additional opportunities for semi-primitive recreation offered by the areas which would be designated as Backcountry compatible with their values. The treatment of visual resources might not be compatible because evidence of management activities would be allowed within viewsheds of travel routes used by recreationists. Their lifestyles may benefit from an active educational and interpretive program.

Native Americans would probably find the designation of a special management area for Inam, Cottimien and Helkau sacred sites which prohibits harvesting in these areas compatible with their lifestyles, beliefs and values. Native Americans employed in timber-related jobs might favor the level of timber outputs.

Consequences Unique to Alternatives B and B'

Long-term Residents would probably find the low timber outputs associated with emphasizing visual resources incompatible with their lifestyles, attitudes, beliefs and values. While the emphasis on prescriptions which use partial cutting may be favored, the reduced timber outputs may offset that support.

New Rural Residents would probably find the special emphasis on visual quality, the limitations on clearcutting, the emphasis on uneven-aged management and the recommendation of a large number of WSRs at their highest potential designation compatible with their values.

Destination Recreationists would probably feel that the additional opportunities for developed recreation, including better access and the emphasis on visual quality, and the recommendations to the WSR system support their values and lifestyle. Their lifestyle may benefit from the visitor information program which would emphasis recreational opportunities.

Native Americans would probably find the designation of a special management area for Inam, Cottimien and Helkau sacred sites which prohibits harvesting in these areas compatible with their lifestyles, beliefs and values. However, Native Americans employed in timber-related jobs might not favor the low timber outputs.

Consequences Unique to Alternative C

Long-term Residents would probably find the allocation of blocks of land for habitat linkage and the emphasis on visual quality which would result in low timber outputs incompatible with their lifestyles and values.

New Rural Residents would probably find that allocating blocks of land for habitat linkage and the other provisions for enhancing biological diversity as well as the special emphasis on visual quality would support their beliefs and values.

Destination Recreationists would probably find the recreational opportunities for fishing, hunting, wilderness use and whitewater rafting and the emphasis on visual quality compatible with their lifestyles and values.

Native Americans would probably find that the minimal timber yields that would be programmed from the sacred areas of Inam, Cottimien and Helkau are not compatible with their lifestyles, attitudes, beliefs and values.

Consequences Unique to Alternatives D and D'

Long-term Residents would probably find commodity outputs which are close to current levels and the balance with amenity values compatible with their lifestyles and values. While favoring the treatment of visual resources, the effect of the wide RMZs and refugia on timber outputs might not be viewed favorably.

New Rural Residents would probably find the treatment of visual resources and emphasis on water quality through the use of wide RMZs and refugia compatible with their beliefs and values. The intensive timber management proposed in other areas might not be compatible with those values.

Destination Recreationists would probably find the treatment of visual resources, wide RMZs and refugia compatible with their values. However, they might not favor the loss of fishing opportunities in some areas to ensure genetic conservation of fish populations.

Native Americans would probably find the designation of a special management area for Inam, Cottimien and Helkau sacred sites which prohibits harvesting in these areas compatible with their lifestyles, beliefs and values. They would probably also support a timber output that would be close to current levels while providing a balance of amenity resources.

Consequences Unique to Alternative E

Long-term Residents would probably find the small amount of CAS land and the low ASQ incompatible with their lifestyles, attitudes, beliefs and values. The possibility of personal hardship related to loss of

employment is even greater than with the Preferred Alternative. The effects of loss of control, anger and depression would probably be more severe with this alternative than with the Preferred as more people would lose their employment. The indirect effects of higher rates of juvenile delinquency, substance abuse, domestic violence, divorce and suicide could also be more severe than with the Preferred Alternative. More people might leave the area to search for employment in urban areas.

New Rural Residents would probably find the emphasis on "old growth," visual resources, wildlife resources and backcountry recreation compatible with their values. It is less likely that direct personal hardship would be experienced by this group, but there could be indirect effects related to changes in timber and forest management-related employment.

Destination Recreationists would not likely be affected by the changes in the social climate. This group would probably find the emphasis on recreation, especially the Backcountry designation for all released roadless areas which would provide semi-primitive recreational opportunities, compatible with their lifestyles. The elimination of grazing in the wilderness would be compatible with the values of those who feel that the effects of grazing and the sight of livestock detracts from the wilderness experience.

Native Americans would probably find the designation of a special management area for Inam, Cottimien and Helkau sacred sites which prohibits harvesting in these areas compatible with their lifestyles, beliefs and values. However, Native Americans employed in timber-related jobs might not favor the low timber outputs.

Consequences Unique to Alternative G(SOHA)

This alternative might have mixed effects on Long-term Residents. Although it would use the management practices current prior to 1987 and have the highest ASQ, timber outputs would still be lower than historical levels due to changing environmental laws and policies which limit CAS land (refer to Chapter 2 - Direction Common to All Alternatives).

New Rural Residents would probably find the lack of emphasis on amenity resources such as visual quality, wildlife and fisheries incompatible with their lifestyles and values. The lack of special designations for "old growth," WSRs, RNAs and SIAs would not be favored. The use of management practices with which they disagreed in the past would not be favored.

Destination Recreationists would probably find the opportunities for fishing, hunting, wilderness use and whitewater rafting compatible with their lifestyles and values. They would probably find the lack of emphasis on amenity resources such as visual quality, wildlife and fisheries incompatible.

Native Americans would probably find the designation of a special management area for Inam, Cottimien and Helkau sacred sites which prohibits harvesting in these areas compatible with their lifestyles, beliefs and values. Native Americans employed in timber-related jobs might favor the level of timber outputs. The large amount of the Forest that would be available for commodity production and other public uses might result in conflicts with some Native American uses. Coordination with tribal representatives to resolve these potential conflicts over future site developments would need to occur more frequently in the future.

Community Stability and Cohesion

Community stability may be affected by sudden changes in lifestyles for a portion of a community. Policies which impose attitudes, values or beliefs that are in opposition to those held by some segment of society can also affect stability and cohesion. No one wishes to see people lose their livelihoods, however people may accept that possibility if they believe it will ensure long-term forest health (Fortmann et al., 1990).

Community cohesion changes can often be attributed to national and international social trends. The Forest's area of influence and many similar areas in the Nation are currently being affected by changing social values. Although the Forest has minimal influence on these changes Nation-wide, it has a great effect at the local level. The Forest has the opportunity, as a major land management entity, to moderate social change by managing the land in a way which minimizes adverse effects on the local community whenever possible.

Community cohesion would be enhanced by alternatives which are viewed as a fair compromise by the various social groups affected. Social polarization, law breaking and social conflicts could increase if a land management position is chosen which is considered "extreme" by certain segments of the public (for example, extensive land allocation to timber management or to preservation).

Economics

Important Interactions

Land allocations, management standards and guidelines and program budgets are used by the Forest Service to generate tangible and intangible forest products desired by the public. The level and mixture of goods and services available for public use varies by alternative.

Changes in the levels of outputs, especially commodity outputs, affect the local economy. However, change is occurring on the local and regional scene whether the Forest chooses a new emphasis or not. A change in the mixture of outputs would directly affect the number of Forest Service jobs and contracting opportunities as

reflected in the different levels of proposed budget. Local wood products jobs also fluctuate with market conditions, changes in technology, the cost of capital and how competitive each site might be. The Forest Service has little or no influence on these factors.

Economic consequences can be direct, indirect or cumulative. Direct effects are the estimated government expenditures for each alternative. As a result of these expenditures, the public uses forest products (goods and services) creating indirect effects. Indirect effects include the estimated number of jobs, the associated income, generation of benefits and county revenue sharing supported by Forest outputs.

Cumulative effects on the human environment reflect the net effect of Forest Service programs on the community and regional levels of economic activity. Examples of these effects include opportunity costs measured by changes in PNV and the effect on lifestyles, attitudes and community cohesion which were covered in the Social section of this chapter.

Methodology

A number of key indicators were chosen to display the consequences of each alternative.

Costs - The Forest budget is the total annual cost of managing the Forest under each alternative excluding the cost of fighting fires. Forest expenditures are funded through appropriated dollars, activity generated funds such as KV, and monies from other state and Federal agencies designated for specific projects. Cost estimates are based on past experience. Standards and guidelines, the Forest's response to social demands and resource emphases all change by alternative, so the estimated cost of doing business varies.

Employment and Income - Production of goods and services from the Forest affects the economy of the local area by generating employment and income. Employment is expressed as the number of jobs, part-time and full-time. Personal income estimates include the total of wages and salaries and are directly proportional to employment levels. The analysis uses the following relationships estimated from the IMPLAN model. IMPLAN is an input/output model used for estimating economic effects. The following assumptions were used:

a) Timber outputs generate 10 jobs per MMBF.
b) Recreation, hunting, fishing and other wildlife activities generate 600 jobs per million RVDs, million WUDs and million FUDs.
c) Range outputs generate 34 jobs per 100,000 AUMs.
d) Forest expenditures generate 31 jobs per million dollars (including Forest Service employment).
e) Each job represents average wage or salary income of $21,075 per year.

Benefits - Benefits are based on proposed output and activity levels for each alternative. Total benefits are not to be confused with actual cash receipts. Quantifiable benefits include all positive effects such as estimated dollar values of increased water quantity, dispersed recreation values and other outputs not captured in actual cash receipts. Water quantity, recreation and wildlife activities contribute heavily to total benefits.

County Revenues - The Forest contributes to county revenues directly by receipt sharing and indirectly through timber yield taxes. Siskiyou and Jackson Counties receive 25% of the total annual Forest receipts. Total Forest receipts, or gross returns to the U.S. Treasury, include cash receipts for timber, recreation use, range permits and special use permits. The counties also receive yield tax revenues generated through the harvesting of public and private timber. Timber yield taxes are paid by the purchaser at a percentage of assigned timber values, currently 2.9%. The California State Board of Equalization, Timber Tax Division assigns average stumpage values based on species, size, quality and harvesting system that may differ from the timber selling values used in the analysis process. Yield tax values here are 2.9% of the estimated timber receipts used in the PNV calculations. So the yield tax values presented here represent an approximation of the revenues to be generated, providing only a basis for relative comparison of the alternatives.

Present Net Value - PNV is a measure of relative economic efficiency. It is defined as the sum of discounted benefits, both market and nonmarket, minus the sum of discounted costs over the planning horizon. The alternative that produces the highest PNV is known as the most economically efficient solution. The reduction of PNV compared to the most economically efficient solution for any alternative is the economic tradeoff, or opportunity cost, of achieving that alternative. The specific effects of each alternative on PNV is described in Chapter 2.

For cumulative effects, the total PNV of each alternative reflects certain items that have negative PNVs, such as net value change from estimated acres burned. The cost of stewardship for resources that do not have quantifiable outputs are also included in PNV calculations. Soil inventories and air quality programs are examples. Program areas such as recreation or range may have a negative PNV due to costs for improving the quality of the resource which exceed the expected value of the projected output demand. This is consistent with our mission of stewardship.

Information on how values and costs used in the economic analysis were generated is presented in

Appendix B. The FORPLAN and IMPLAN models are also described.

Environmental Consequences

Consequences Common to all Alternatives

Recreational and range use are not expected to vary significantly between alternatives. Therefore, benefits and jobs generated would also not vary between alternatives. For the Forest as a whole, both recreation and range capacity exceed current and foreseeable future use. Money spent in these program areas would generally be used to improve the quality of the resources on a site-specific basis.

For all alternatives, 481,000 RVDs of dispersed recreation, 165,000 RVDs of developed recreation and 78,000 RVDs of wilderness recreation are projected annually in the first decade. The benefits associated with these recreation outputs would be $7.4 million each year for the first 10 years.

Approximately 97,000 FUDs and 59,000 WUDs are projected annually in the first decade. The benefits associated with the wildlife and fish outputs would be $8.7 million each year for the first 10 years.

Background water quantity is 3,952,000 acre-feet per year for the first decade valued at $72.70 million per year. This is the expected average amount of water which would flow from the Forest regardless of the management emphasis chosen. However, additional water flow may result from alternative schemes of vegetative management and this additional amount is discussed for each alternative in the Water section of this chapter.

With increasing restrictions and legal constraints, unit costs will increase in the future for the same work. The amount of increase is not known as it is not simply implementing new silvicultural systems or Sensitive species protocols, but trying new mixtures of approaches. However, real costs will also increase significantly.

Under the Rural Development Program, the Forest would pursue opportunities to use currently underutilized resources. This may include selling forest products other than timber or providing resources for value-added manufacturing. Partnerships would be used to create new job opportunities in service or stewardship contracts.

Comparison of Alternatives

Range use is expected to be 34,000 AUMs per year in the first decade for all alternatives except Alternative E. The benefits associated with these AUMs would be $0.21 million per year for the first decade. Because Alternative E would not allow grazing in the wilderness, range use would be 29,000 AUMs per year in the first decade with associated benefits of $0.18 million per year for the first decade.

Costs and benefits would vary among alternatives due to different emphases on improving the quality of the various resources.

Table 4-57 displays the estimated annual program costs (budget), the average annual economic benefits (benefits with a dollar value) and the average annual PNV for each alternative during the first decade. The employment and income figures shown in Tables 4-57 and 4-58 include direct, indirect and induced income and employment for the 7-county area of influence.

The Preferred Alternative would require the largest total budget. Alternatives D and D' would require the second highest budget, followed by Alternatives A, B, B', C, E, G(SOHA) and Current in decreasing order.

Table 4-57. Annual Average Economic Indicators for Decade 1 Millions of Dollars (1987 Dollars)

	Alternative									
Indicator	PFD	CUR	A	B	B'	C	D	D'	E	G(SOHA)
Budget	40.6	29.0	37.0	37.0	36.0	33.0	38.0	38.0	31.0	29.0
Personal Income	48.7	57.0	63.2	60.2	54.6	57.9	63.2	62.1	42.0	62.3
Return to Treasury	14.0	23.0	24.0	21.0	17.0	22.0	23.0	22.0	9.0	28.0
County Revenues										
25% Receipts	4.0	6.0	6.0	5.0	4.0	5.0	6.0	5.0	2.0	7.0
Yield Tax	0.4	0.7	0.7	0.6	0.5	0.6	0.7	0.6	0.3	0.8
Discounted Benefits	2,662.9	3,006.1	3,029.2	2,955.9	2,775.4	2,947.6	3,000.9	2,953.7	2,540.9	3,174.3
Discounted Costs	964.0	670.8	904.7	874.8	835.7	809.0	942.5	930.0	776.6	681.4
Present Net Value*	1,700.0	2,335.3	2,124.5	2,081.1	1,939.7	2,138.6	2,058.5	2,023.7	1,764.3	2,492.9

* PNV is net of minimum level value

Table 4-58. Average Annual Employment for Decade 1										
	Alternative									
	PFD	CUR	A	B	B'	C	D	D'	E	G(SOHA)
Number of Jobs	2,310	2,700	3,000	2,860	2,590	2,750	3,000	2,950	2,000	2,960

Alternative G(SOHA) would provide the greatest return to the Treasury. Alternative A would provide the second greatest, followed by Alternatives Current and D, C and D', B, B', Preferred and E in decreasing order. Alternative G(SOHA) would also provide the most revenues to the counties, both in 25% receipts and in yield taxes. Alternatives Current, A and D would provide the second highest revenues to the counties, followed by Alternatives B, C and D', then by Preferred and B' in decreasing order. Alternative E would provide the least return to the counties.

Alternative G(SOHA) would have the highest PNV. Alternative Current would have the second highest, followed by Alternatives C, A, B, D, D', B', E and Preferred in decreasing order. Alternatives with a higher PNV would have a greater return for each dollar spent and would be more cost-efficient than those with lower PNVs.

Table 4-58 displays the jobs that would be generated in the first decade for each alternative.

Alternative D would generate the most jobs. Alternative A would generate the second most, followed by Alternatives G(SOHA), D', B, C, Current, B', Preferred and E in decreasing order.

Consequences Unique to the Preferred Alternative

The Preferred Alternative would have the highest budget and the lowest PNV of all alternatives. It would generate moderate county revenues and returns to the Treasury. The number of jobs generated is low relative to other alternatives.

Consequences Unique to Alternative Current/RPA

This alternative would have the lowest budget of all the alternatives. It would have the second highest PNV, only lower than Alternative G(SOHA).

This alternative would provide the second highest county revenues and the third highest return to the Treasury of all the alternatives, but would provide only a moderate number of jobs.

Consequences Unique to Alternative A

Alternative A would have the third highest budget and the fourth highest PNV. It would provide the second highest return to the Treasury and the second highest county revenues. It would generate the highest number of jobs relative to the other alternatives.

Consequences Unique to Alternatives B and B'

Alternatives B and B' would have relatively moderate budgets, county revenues, returns to the Treasury, PNV and numbers of jobs.

Consequences Unique to Alternative C

Alternative C would have a relatively low budget. County receipts and PNV would be in the high range, while returns to the Treasury and jobs generated would be in the moderate range.

Consequences Unique to Alternatives D and D'

Alternative D would generate the highest number of jobs. Alternatives D and D' both would have relatively high budgets and county revenues. PNVs for both would be in the moderate range.

Consequences Unique to Alternative E

Alternative E would have the second lowest budget, following Current/RPA and G(SOHA). County revenues would be in the moderate range. Returns to the Treasury, jobs generated and PNV would be relatively low.

Consequences Unique to Alternative G(SOHA)

Alternative G(SOHA) would have the lowest budget and the highest PNV. It would be the most economic solution of all the alternatives considered in detail. It would provide the highest return to the Treasury and the highest county revenues. It would generate a high level of jobs and personal income in the community.

Means to Mitigate Adverse Impacts

Geology

A broad range of mitigation to reduce landslide potential is possible with road construction. A much smaller range of mitigation is possible with regeneration harvesting (refer to Geology section of this chapter).

Soils and Water

BMPs and other mitigation measures would be applied to mitigate the effects of management activities (refer to Geology, Soils and Water sections of this chapter).

Fisheries

Habitat restoration can mitigate the cumulative effects of past and proposed activities on fish populations to

a small extent. Fish run sizes could increase within the limits of available habitat to a small degree depending on the increased survival of spawning fish. Increasing the adequacy of summer holding habitat should show a corresponding increase in the survival of Sensitive species during the summer holding period before spawning begins. Also, poaching on the Forest can be reduced through increased patrolling of wardens, the use of citizen monitors and through increased public education.

Visual Resource Management

Adverse effects to the visual quality of the Forest can be partially mitigated at the project level during the ID team process. Recommendations of site-specific mitigation techniques from the visual quality specialist could be incorporated into some project proposals. However, inevitably some residual adverse visual impacts would remain. These impacts would last approximately 30 years, the time required for plantations to reach a height sufficient enough to blend in with the surrounding vegetation.

Adverse Environmental Effects Which Cannot Be Avoided

Geology

Timber harvesting and road construction will cause increased landslide potential on the Forest even after mitigation measures are applied. The actual amount of increase depends on the type amount, timing and location of proposed activities. This is an unavoidable effect of harvesting timber and building roads in steep, wet, mountainous terrain such as the Klamath Mountains. However, in most of the Goosenest Ranger District it is not a problem.

Air Resource

The air quality standards could be exceeded in the short-term in localized areas on a small percentage of days due to the cumulative effects of wildfire, prescribed burning and intrusions from agricultural burning or other non-Forest burning.

Visual Resource Management

There will be short-term adverse effects to visual quality due to vegetative management and road construction activities.

Relationship Between Short-term Uses and Long-term Productivity

Geology

Surface disturbance associated with yarding or site preparation is usually short-term, but it can also have long-term effects on site productivity depending on the intensity of disturbance.

Irreversible or Irretrievable Commitment of Resources

Irreversible is a term that describes the loss of future options. It applies primarily to the effects or use of nonrenewable resources, such as minerals or cultural resources, or to those factors, such as soil productivity, that are renewable only over long periods of time.

Irretrievable is a term that applies to the loss of production, harvest, or use of natural resources. For example, some or all of the timber production from an area is lost irretrievably while an area is serving as a winter sports site. The production lost is irretrievable, but the action is not irreversible. If the use changes, it is possible to resume timber production.

The irreversible and irretrievable commitments of resources identified in this chapter would not actually occur until site-specific projects were implemented. Implementation of site-specific projects would have to be preceded by project-level environmental analysis and documentation as required by NEPA in which the site-specific effects of the proposed actions would be disclosed.

Geology

The construction of rock pits would constitute an irreversible commitment of resources.

Land subsidence caused by long-term withdrawal of groundwater in excess of recharge rates from groundwater basins generally constitutes an irretrievable effect. This is due to the disruption of drainage patterns and to the consolidation of the aquifer which reduces the water storage capacity.

Soils

New road construction would constitute a irretrievable loss as those acres would not be available for other uses such as growing timber. Construction of new roads could also constitute an irreversible loss of soil productivity due to soil compaction.

Fisheries

Management activities which reduce the quality of fish habitat in the Scott River drainage or any critical habitat for Sensitive species could lower fish numbers to levels which may not be recoverable. If fish populations are lost, loss of the contribution of the vigorous wild genomes in these stocks would decrease fish diversity and weaken the resiliency of remaining salmonids to environmental and physiological stressors. These would be irreversible and irretrievable effects.

Visual Resource Management

The visual impacts from the implementation of all alternatives would create irretrievable effects to the visual quality of the Forest. In those areas that are untouched or pristine, developmental activities would cause both an irretrievable and irreversible loss of that

character. Developmental activities proposed in areas that are near-natural or modified would create an irretrievable but not an irreversible loss of visual quality until such time as the impacts were revegetated sufficiently to previous conditions.

Released Roadless Area Management

The allocation of an area that currently meets the original definition for a roadless area to a Management Area that would have a regulated timber harvest would be an irreversible commitment of resources. Once developmental activities occurred, those areas would lose their roadless character.

Wild and Scenic River Management

Designation of rivers as Recreational that are currently eligible as Wild could constitute an irreversible effect. Once management activities occur in these areas, there would be a loss of future options

Specially Designated Area Management

Some areas potentially suitable as RNAs, but not yet identified, might be rendered unsuitable during the planning period through the implementation of resource projects. This would be an irreversible and irretrievable loss of potential RNAs.

Mineral Management

There would be an irretrievable loss of options to develop mineral potential in management areas that were withdrawn from mineral entry and leasing.

Timber Management

Removing land from the suitable timber land base reduces both potential allowable timber harvest and long-term timber growth and yields. The magnitude of this reduction depends on the relative productivity of the lands removed. The timber production lost is irretrievable, but not irreversible.

The dedication of land to road construction, development of facilities, mineral development or rock excavation would constitute an irretrievable loss for timber production.

Possible Conflicts With Federal, Regional, State and Local Land Use Plans

Fisheries

Other agencies with jurisdiction over fisheries and water resources in the Klamath River Basin and on the Forest include an array of government agencies such as the Klamath River Task Force; the County Governments of Jackson, Siskiyou and Humboldt; the Tribal governments for Hoopa Valley, Karuk and Yurok tribes; CDFG; Oregon Department of Fish and Wildlife; state Water Resources boards; USFWS; National Marine Fisheries Service and the U.S. Bureau of Reclamation.

Local government agencies, State and Federal agencies and interest groups presently work together under the auspices of the Klamath River Basin Restoration Program to resolve conflicts of management direction. The continuing dialogue among the groups involved has resulted in coordinated management planning for aquatic and fisheries resources of the basin. Cooperation among the participant parties for future management should serve to minimize conflicts in management direction and program implementation.

Visual Resource Management

1) Shasta-Trinity National Forest Draft Forest Plan

   VQOs along common Forest boundaries are consistent with one minor exception. The Military Pass Road has been identified as a moderate sensitivity road on the Klamath National Forest with a VQO of Partial Retention. The Shasta-Trinity draft identifies it as a low sensitivity road with a Modification VQO.

2) Six Rivers National Forest Draft Forest Plan

   VQOs along common boundaries with the Six Rivers National Forest are consistent.

3) Siskiyou National Forest Final Forest Plan

   VQOs along common boundaries with the Siskiyou National Forest are consistent.

4) Modoc National Forest Final Forest Plan

   VQOs along common boundaries with the Modoc National Forest are consistent.

5) Lava Beds National Monument

   VQOs along common boundaries with the Lava Beds National Monument are consistent.

6) California State Scenic Highways

   Managing for a Retention VQO in the foreground and middleground distance zones of eligible California State Scenic Highways 3, 96, 97, 263, and Interstate 5 and for a Partial Retention VQO in the foreground and middleground zones of the BVNG along Highway 97 is consistent with the California State Scenic Highways Master Plan.

Energy Requirements and Conservation Potential

Energy is consumed in the administration and use of the natural resources of the Forest. Major energy sources are gasoline, diesel fuel, liquified petroleum, electricity and wood.

Energy consumption is related to the level of activities. The primary activities on the Forest which consume energy are timber harvesting and recreational use.

Timber - Energy is consumed by timber management activities, logging, road construction and maintenance, log transport to mills, log processing, transport to the consumer and building construction. Energy consumption would be proportional to the ASQ for each alternative. Alternative G(SOHA) would use the most energy, an estimated 2.4 billion British Thermal Units (BTUs) per year. It would be followed in decreasing order by Alternatives A with 2.1 billion BTUs, Current/RPA, D and D' with 2.0 billion BTUs, C with 1.9 billion BTUs, B with 1.8 billion BTUs, B' with 1.5 billion BTUs, Preferred with 1.3 billion BTUs and E with .8 billion BTUs per year.

Energy would be generated through the use of timber residue for fuel and by saving from the construction use of energy-efficient materials.

Recreation - Energy is consumed by the operation, maintenance and construction of recreational sites, transportation to and from recreational sites and by use such as OHV travel. All alternatives would consume similar amounts of energy for these purposes, an estimated 1.5 billion BTUs per year.

The amount of energy consumed in the following categories would be similar for all alternatives and would be very, very small compared to the first 2 categories.

Range - Energy is consumed through forage and structural improvements, livestock transport and the travel of permittees. Energy would be produced through red meat production.

Biomass - Energy can be consumed by removing logging residue, chipping, chip transportation, fuelwood cutting and fuelwood transportation. Energy would be yielded in home fuelwood use and from electrical generating plants.

Non-fuel Minerals - Non-fuel mineral energy is consumed in the extraction of crushed rock to be used as base material on roads.

Fire Management - Fire management involves energy consumption in suppressing wildland fires and treating fuels. Both types of fire consume wood energy.

In an effort to reduce energy consumption, all alternatives would use fuel efficient vehicles, reduce travel and provide for car pooling where possible. Flexible work schedules would be available to reduce employee travel to the work site.

All alternatives would design timber sales to reduce the energy required for logging and transporting timber. The transportation plan would be designed and periodically reviewed to provide efficient access. Roads would be designed to require as little maintenance as possible.

Firewood would be available in all alternatives (refer to Timber Management section in this chapter). All alternatives would encourage the use of biomass and the development of new markets (refer to Fire Management section of this chapter).