Chapter 3 - Affected Environment

Table of Contents

Table of Contents (cont'd)

Chapter 3 - Affected Environment

Introduction

This chapter describes the physical, biological, social and economic aspects of the environment in and near the Klamath National Forest (Forest). It focuses on current conditions that may be affected by implementing the alternative management strategies for the Forest Plan.

Emphasized here are the conditions discussed during the development of issues presented in Chapter 1. Being familiar with the information in this chapter is essential for understanding the alternatives presented in Chapter 2 and the potential consequences discussed in Chapter 4. It provides the basis for disclosure of the environmental effects.

This chapter contains descriptions of the 25 major resource components that reflect the 60 issue areas listed in Chapter 1 and Appendix A. The format of issues described in Chapter 1 repeats in this Chapter. This format is also followed in the alternative consequence discussions in Chapter 4. This format is followed at the close of Chapter 2, where alternative responses to the issues are presented and compared.

The organization of resource areas intends to reflect the interactions between the physical and biological ecosystems, the resource management programs and the social system. The first group of resources describes the physical environment. The second group of resources describes the biological environment. The third group describes the resource management programs, which include people and their demands and effects as components of the ecosystem. The last group describes the social and economic aspects of the Forest environment.

General Forest Environment

Overview

The Forest is located on the California-Oregon border, east and west of Interstate 5. Located primarily in Siskiyou County, California, a small portion is in south-central Jackson County, Oregon (see Figure 3-1). The Forest's northern boundary is about 30 miles south of Medford, Oregon and Klamath Falls, Oregon. The southern boundary is 90 miles north of Redding, California. The Forest lies about mid-way between San Francisco and Portland and is in the Second U.S. Congressional Districts of both California and Oregon.

Surrounded mainly by other public land, the Forest shares a boundary with 5 other national forests (the Modoc, Rogue, Shasta-Trinity, Siskiyou and Six-Rivers). The Klamath administers 1,680,000 acres. About 207,000 acres of private lands are located within the Forest boundary.

The Forest's renewable resources include fish, forage, recreation, scenic quality, biological diversity, water, wildlife and wood. These resources, and others, provide sustained yields of a variety of goods and services. Most significant are timber for construction lumber and other wood products, forage for domestic grazing and wildlife, habitat for fish and wildlife and recreation opportunities (such as big game hunting, steelhead fishing, white-water rafting, camping, hiking, backpacking and wilderness experiences). Forest rivers and streams supply water for several communities and many individuals.

About 80% of the Forest lies west of Interstate 5, in the rugged Klamath Mountains Province, and is subdivided into 5 Ranger Districts. The Goosenest Ranger District makes up the eastern 20%, in the more open country of the Cascade Range and Modoc Plateau Provinces. These two sides of the Forest will be called "westside" and "eastside" in this document. The distinct differences in their geological and ecological make-up in some cases result in different resource management emphases.

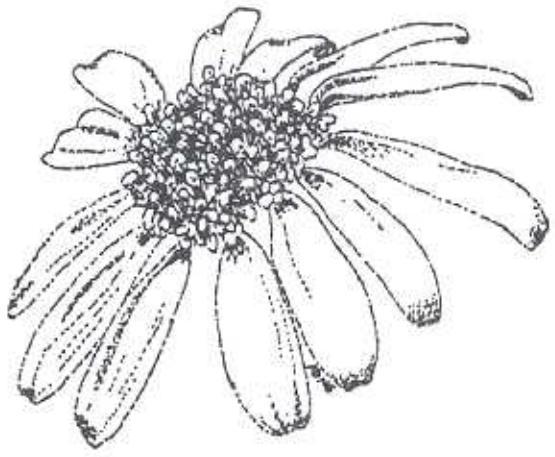
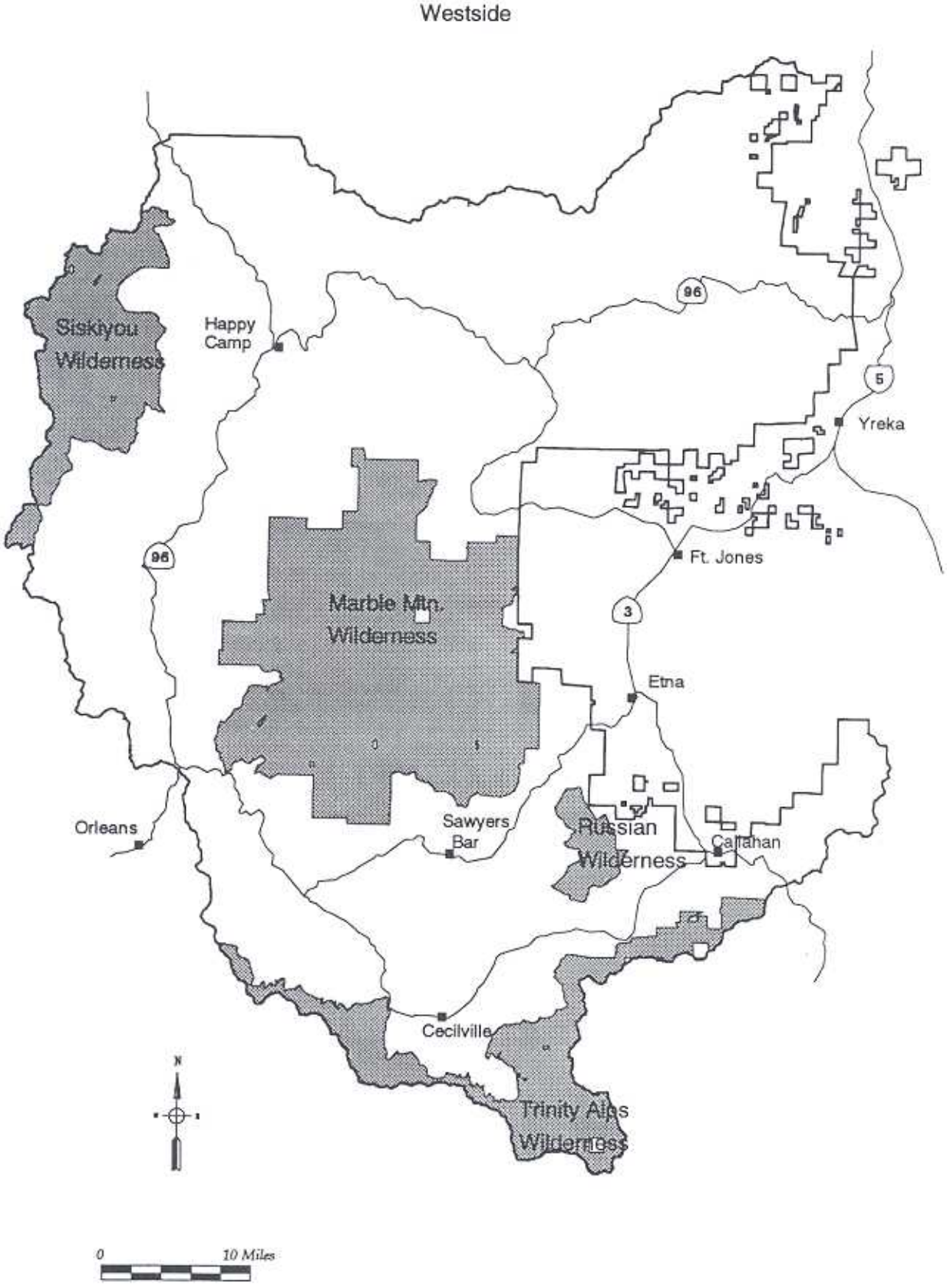
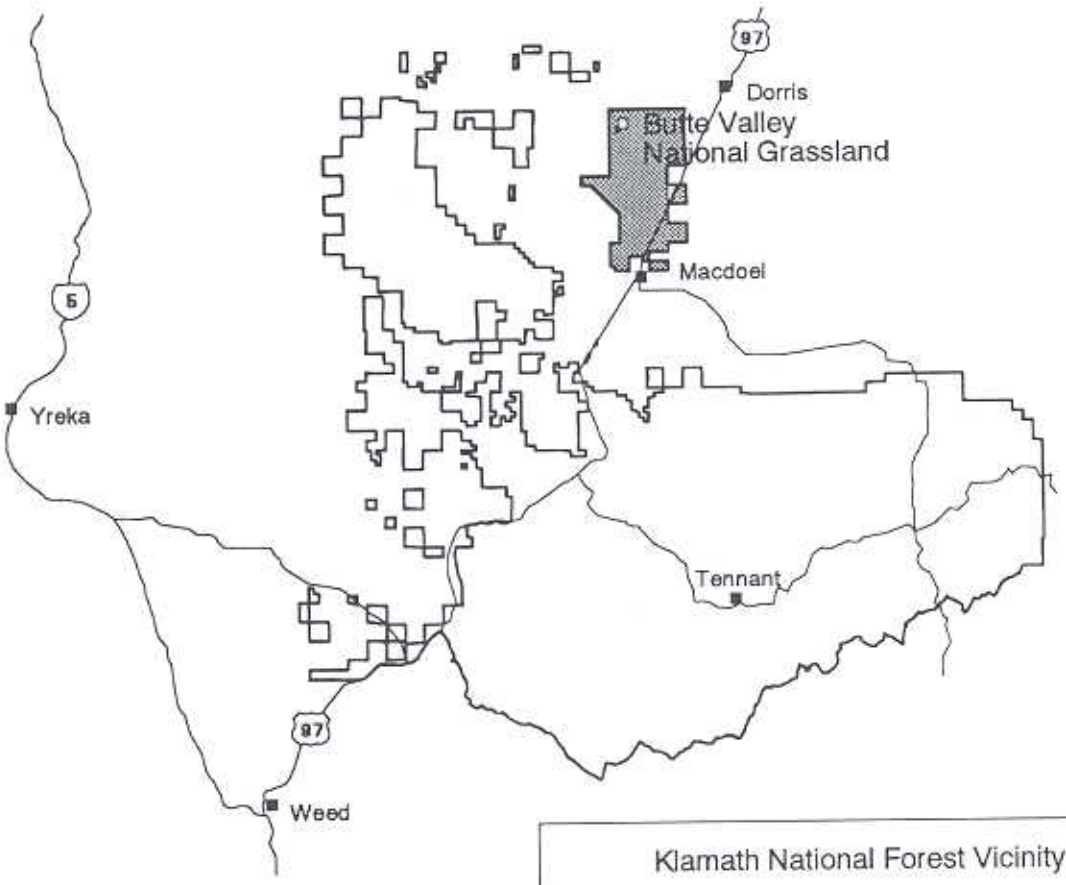


Figure 3-1
Klamath National Forest Vicinity Map




Eastside
97
Dorris
Butte Valley
National Grassland
Macdoel
5
Yreka
Tennant
97
Weed


Klamath National Forest Vicinity
Crescent City
Yreka
Alturas
Eureka
Redding
Reno
Sacramento
San Francisco
Bakersfield
Santa Barbara
Los Angeles
San Diego

Physical Environment

Geology

Description

Provinces

The Forest lies within 3 physiographic provinces: the Klamath Mountains, Cascades, and Modoc Plateau (Norris and Webb, 1976). The Klamath Mountains Province is characterized by rugged terrain formed of intensely folded and faulted Mesozoic and Paleozoic Era rocks.

The Cascade Province is less rugged and consists of Tertiary and Quaternary Period volcanic rocks (about 30 million years old to recent). The Modoc Plateau Province is also formed of Tertiary volcanic rocks and typically exhibits low relief. It is cut by many Quaternary (0 to 2 million years old) faults which have formed closed basins, such as Butte Valley. The distribution of the most common rock types of the Forest is shown in Figure 3-2.

Klamath Mountains Province

The Klamath Mountains Province is structurally complex. Bedrock consists of many distinct geologic terranes that range in age from Cambrian to Jurassic Period (565 to 135 million years old). Each terrane is bounded by faults and exhibits a unique combination of lithologic units, structure and age. These terranes form a pattern of northwesterly belts that are successively younger from east to west (Irwin, 1966).

Typical rock types include metamorphosed marine sediment (marble, chert, slate), metamorphosed submarine lava, ultramafic rock (serpentinite, peridotite) and granitic rock (granite, diorite, gabbro). Mineral deposits, such as gold, copper, mercury, silver and chromium, occur in many of the geologic terranes.

The evolution of the landscape that exists today was strongly influenced by the events of the Pleistocene Epoch over the past 1 to 2 million years. During this time a rapid uplift occurred, causing deep incision by the rivers and the formation of steep mountainous terrane. In addition, several glacial advances occurred and high elevation areas were deeply eroded by mountain glaciers. These glaciers carved broad U-shaped valleys in the headwaters of many streams and rivers, such as Dillon Creek, Elk Creek and the Salmon River.

Exceptionally wet climatic periods between ice advances fostered deep weathering of the bedrock and formation of thick soils on the valley floors and walls. These conditions, with continuing uplift and seismic activity, resulted in the formation of large (up to several square miles) landslide complexes. These landslides occupy about 18% of the westside of the Forest. Most are inactive under the present drier climatic conditions.

Uplift and river incision also led to the formation of stream terrace deposits along valley walls. Terraces are particularly abundant along the Klamath River (from Grider Creek to Orleans) and along the Salmon River. Using the hydraulic mining method, most of these terrace deposits were mined during the late 19th and early 20th century.

Cascades Province

The Cascades Province occupies the eastern part of the Forest and is subdivided into the Western Cascades and High Cascades (Williams, 1949). The Western Cascades consist of Oligocene to Pliocene Epochs (40 to 11 million years old) tuffs, breccia, sandstone and lava. Outcrops of these rocks are limited to a small area immediately east of Shasta Valley and in the Klamath River gorge near Copco Lake.

Rocks of the High Cascades occupy most of the eastside of the Forest. These rocks consist of Pliocene Epoch (11 million years old) to recent basaltic and andesitic lava. They form 2 prominent chains of volcanos. One extends from Mount Shasta northward and includes volcanos such as Whaleback, Goosenest and Eagle Rock. The other extends northeast from Mount Shasta to Medicine Lake.

Modoc Plateau Province

The Modoc Plateau is transitional in character. It lies between the High Cascades Province to the west and the Basin and Range Province to the east. It is the plateau region from Meiss Lake to Lower Klamath Lake.

The Modoc Plateau also has attributes of the two bordering provinces. It is characterized by prominent northwest and north trending normal faults, many that are Quaternary in age (Norris and Webb, 1976). These faults created down-dropped, internally draining basins. Butte Valley was formed in this manner. During the Pleistocene Epoch, this area was occupied by a large lake. Meiss Lake is a remnant of that lake.

One other effect of faulting is the disruption of drainage patterns. An excellent example of this process, though actually in the Cascade Province, is where Antelope Creek was isolated from Butte Creek by faulting and now flows into Antelope Sink.

Geological Hazards and Resources

Hazards, such as landslides, hazardous materials, seismic, volcanic, snow avalanches and land subsidence and collapse, have been identified on the Forest. Flood hazard is addressed in the Water section. The identification of geologically hazardous areas is important so appropriate management direction can be developed. Geologic resources on the Forest include minerals, rock materials, groundwater, oil and gas, geothermal resources and areas of unique geological value (refer to the Geologic Special Interest Area (SIA) discussion).

Landslide Hazards

The term "landsliding" is used to encompass all the processes involving the movement of rock and soil masses in a downslope direction under the influence of gravitational forces. Landsliding is a natural process that has played a dominant role in the evolution of the local landforms, streams and rivers. Started by rare climatic events or earthquakes, landslides transport large volumes of soil and rock from steep mountains down into major streams and rivers. Through this process, they sculpt the mountains and influence stream and river channels by delivering sediment affecting the distribution of pools and riffles, the makeup of channel bottom material and riparian vegetation. Most of the gravel and boulders in stream beds are delivered there by landslide processes.

In relation to other geologic hazards, landslides have a high probability of occurrence on the Forest. This is evident by several damaging landslide episodes occurring in the past 50 years.

In addition, landslide hazards are directly influenced by routine forest management activities, such as road construction and timber harvest. Therefore, landslides make up the most significant of the geologic hazards on the Forest. This is particularly true in the Klamath Mountains Province and in the Cascades Province next to the Klamath River.

It has been estimated that, if the Forest had not been roaded, timber harvested or burned by fires, a moderate intensity storm (10-year event) would deliver 3.8 million cubic yards of landslide material into streams and rivers. The assumption has been made that roads and timber harvest result in greater landslide production. So, if the same storm were to occur under existing disturbance levels (1990), it is estimated that 6.7 million cubic yards would be delivered to the stream system.

The main effect of roads and vegetative removal over large areas is to have landslides occur in response to smaller storms than they would normally. Other effects are increasing the severity of the response and creating landslides that would not have occurred (road fill failures).

Two primary types of landslides have been classified on the Forest: shallow and rapidly-moving and those generally deep and slow-moving. The shallow, rapidly moving type includes debris slides, debris flows and debris avalanches. The deep, slow-moving type includes slumps, slides and earthflows.

Shallow, rapidly moving landslides can affect streams or roads for long distances from their starting point, due to their occurrence on steep terrane. They often mobilize water-charged debris that travels long distances down stream courses, removing riparian vegetation and road crossings.

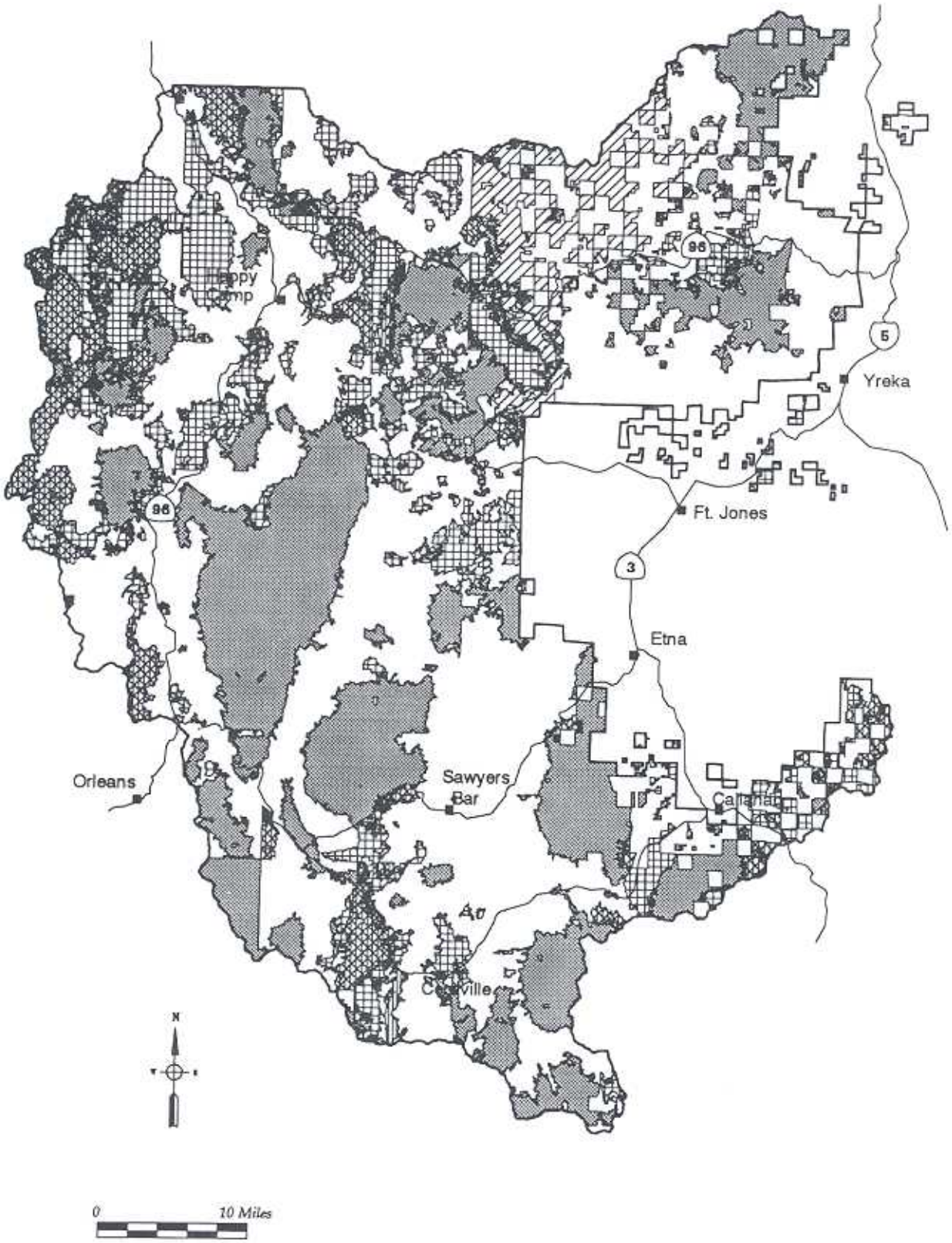
These landslides often occur within the rooting zone. Therefore, tree roots play an important stabilizing role, binding the slope material together and anchoring it to underlying bedrock.

Slow-moving landslides are generally larger than shallow landslides. Adverse effects are usually confined to the area near the slide site, but exceptions are common. The failure plane on such landslides is usually below the rooting depth. As a result, the anchoring effect of vegetation is small. Vegetation helps reduce the risk of such landsliding by removing water through evapotranspiration.

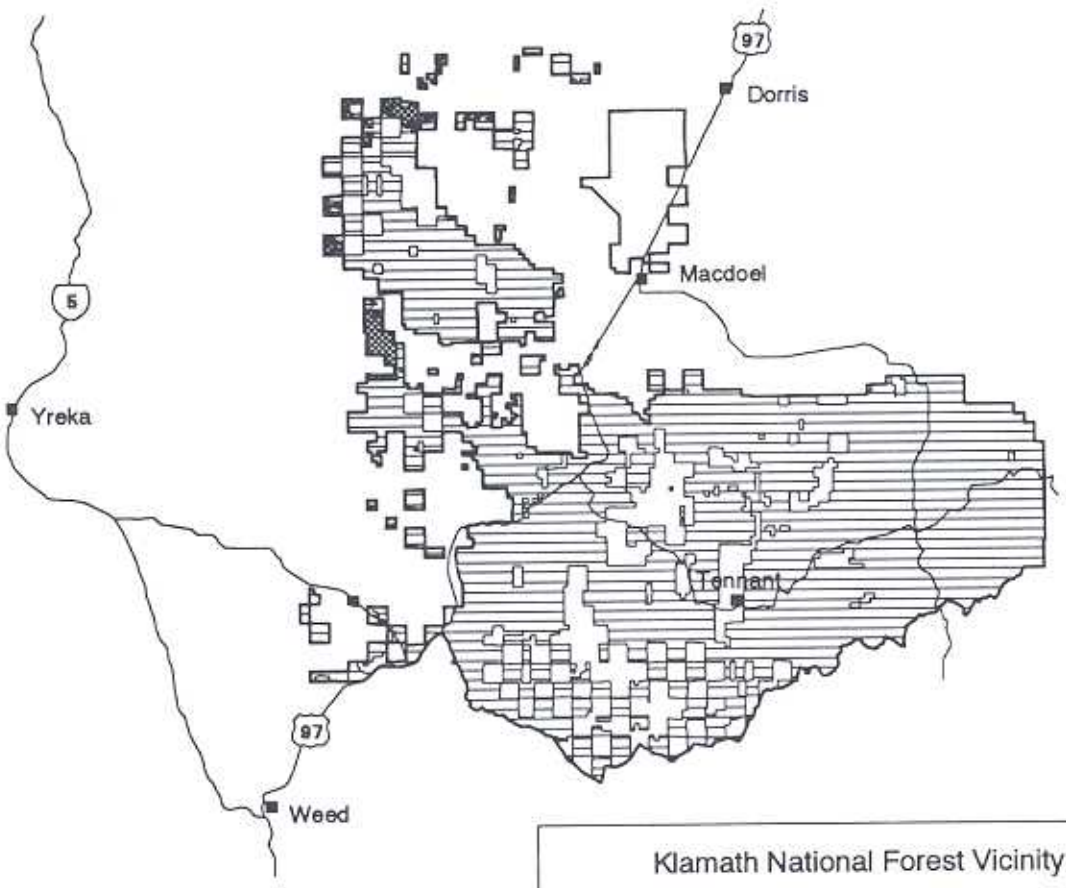
Most historic landslides on the Forest have occurred in response to the addition of water to slopes during intense winter storms, rapid snowmelt or extended periods of high precipitation. The westernmost part of the Forest receives the greatest amount of precipitation. Management activities have increased the risk of landsliding by altering the hydrology of slopes and by changing its mechanical properties. Recent wildfires, and the removal of vegetation over large areas, have made more water available by reducing evapotranspiration. They have also lowered the slope's mechanical strength by reducing root support. Similarly, roads have diverted water flows and restricted water from infiltrating into the ground in some areas. Road cuts and fills change the distribution of mass on the slope, a process that can increase the risk of landslides.

To aid in landslide hazard analysis, the Forest landscape was subdivided into 13 geomorphic terrane types (refer to Table 3-1 and Figure 3-3). Each of these terranes exhibits a different landslide potential.

Figure 3-2
Bedrock
Westside



Bedrock
Eastside



Legend

- Gabbro
- Condrey Mtn. Schist
- Granitic
- High Cascades
- Limestone
- Ultramafic
- Western Cascades

Klamath National Forest Vicinity

Table 3-1. Geomorphic Terranes			
Geomorphic Terrane	Acres	Geologic Sensitivity Class	Geologic Suitability Class
Active landslide	12,700	Sensitive	Unsuited
Slump/earthflow	207,600	Sensitive	Suited
Toe of slump/earthflow	6,300	Sensitive	Unsuited
Inner gorge, unconsolidated	35,800	Sensitive	Unsuited
Inner gorge, consolidated	157,400	Sensitive	Suited
Inner gorge, granitic	41,000	Sensitive	Suited
Inner gorge, non-granitic	116,400	Sensitive	Suited
Glacial deposits	87,100	Non-sensitive	Suited
Mtn. slope, granitic (steep)	104,100	Sensitive	Suited**
Mtn. slope, granitic (moderately steep)	115,700	Sensitive	Suited**
Mtn. slope, non-granitic (steep)	363,600	Non-sensitive	Suited
Mtn. slope, non-granitic (moderately steep)	259,800	Non-sensitive	Suited
Debris basin (headwall)	19,000	Sensitive	Suited
Cascade mtn. slope	296,400	Non-sensitive	Suited

** About 15,000 acres of these geomorphic terranes are not suited for programmed timber harvest. The actual lands are not defined in the geologic layer of the Forest Land Management Planning database.

The geomorphic terranes most prone to landsliding (geologically sensitive) include slump and earthflow deposits, inner gorges, debris basins, active landslides and deeply weathered and dissected areas underlain by granitic bedrock. Descriptions of these terranes follow.

Slump and Earthflow Terrane (Table 3-1) - Slump and earthflow terrane occupies 13% of the Forest and accounts for a large proportion of the natural and management-associated landslides. Slump and earthflow deposits are irregular to hummocky. Topography is usually more gentle than on the surrounding mountain slopes.

This geomorphic terrane, formed by landsliding that occurred in thick residual soils, can range in age from 10,000 to 100,000 years ago (or perhaps even 1,000,000 years ago). It consists primarily of unconsolidated deposits of soil and rock debris, often with a high clay content. The toe zones or margins of these deposits are particularly sensitive and often coincide with inner gorge slopes.

In combined slump and earthflow terrane (common on the Forest), toe zones also may occur in mid-slope positions. This can be a considerable distance from the inner gorge. The toe zones are usually steep (60 to 80%) and often the site of springs. Debris slides occur regularly in these areas due to the steepness of slope, weakness of the soil and rock materials, and groundwater conditions. Soil, rock and organic debris mobilized by these landslides often travel long distances through ephemeral channels and enter perennial streams.

The Forest has classified the toe zones of these deposits as unsuitable for a programmed, sustained timber harvest due to their geologic instability. About 6,000 acres of this terrane type have been identified in the geologic database, but there may be a considerable amount more.

Inner Gorge Terrane (Table 3-1) - Inner gorge terrane occupies 11% of the Forest. This consists of steep (greater than 65% slope) canyon walls that occur along rivers and streams in rugged, mountainous areas (see Figure 3-4). The upslope boundary is usually marked by a prominent slope break separating the inner gorge from gentler slopes above.

Widths of inner gorges range from less than 50 feet to over 1,000 feet on major streams and rivers. This geomorphic terrane was formed by rapid downcutting of streams and rivers in response to a relative uplift during the Holocene Epoch (10,000 years). Debris sliding is the primary process that denudes the slope and maintains a continuously steep slope next to the stream channel as downcutting progresses.

The nature of the underlying soil and rock material is critical in determining the sensitivity of an inner gorge slope to disturbance. When an inner gorge develops in unconsolidated material, such as landslide deposits, it is extremely prone to landsliding. These areas are called "unconsolidated inner gorges."

These are different from those which are incised into bedrock and support a shallow soil cover. The second type is called a "consolidated inner gorge" and is further subdivided by bedrock type (granitic and non-granitic).

The unconsolidated inner gorge occupies about 36,000 acres on the Forest. This area is classified as

not suited for a sustained, programmed timber harvest. The consolidated inner gorge occupies about 158,000 acres, and is classified as suited for a sustainable, programmed timber harvest at a moderate production rate.

Granitic Terrane (Table 3-1) - This terrane occupies about 13% of the Forest. In areas of high elevation it generally supports a thin soil cover and glacially exposed rock outcrops are common. At mid-elevation (1,500 to 4,000 feet), most of this terrane exhibits a dense drainage pattern. Bedrock is weathered to depths of 10 to 30 feet.

It is likely that the deep weathering in this elevation zone occurred in association with broad valley floors that existed during the Pleistocene Epoch. These valley floors were removed by subsequent erosion, leaving only remnants on present valley walls. Soils in these weathered areas are rich in sand, poor in coarse gravels, cobbles, silt and clay, and lack cohesive strength. Removal of vegetative cover can increase debris slide risk by removing root support and altering slope hydrology.

Additionally, due to the steepness of slope and limited amount of clay, removal of vegetation allows dry flow processes to transport sand into small, intermittent channels. These channels then convey the sand to larger channels during winter storm flow. Road and landing fills are difficult to stabilize, due to limited cohesive strength, steepness of slope and subsurface hydrology which operates in granitic terrane.

The Forest has recognized that the most sensitive of granitic terrane is not suited to a sustained, programmed timber harvest. However, this land has not been identified in the geologic database. Based on incomplete inventories, it is estimated that about 15,000 acres of unsuitable granitic terrane is present on the Forest.

Active Landslides and Debris Basins (Table 3-1) - Active landslides occupy about 1% of the Forest. This group includes slumps and earthflows that are prone to future landsliding, as well as recent debris slides. Debris basins, or headwalls, also occupy about 1% of the Forest and are prone to shallow debris slides.

Other Geomorphic Terranes (Table 3-1) - The remaining geomorphic terranes are classified as geologically non-sensitive and occupy about 60% of the Forest. Landsliding occurs in these terrane types, but the frequency is much lower. Road cuts and fills can start landsliding on these terranes. Refer to the Geologic Analysis of the Management Situation (AMS) for further discussion.

Geologically Unsuitable Lands

Active landslides, toe zones of slump and earthflow deposits, inner gorges developed in unconsolidated material and landslide-prone granitic terrane (described above) were classified as not suited for a sustained, programmed timber harvest by the Forest. They are not suited because the technology is not currently available to insure timber production from these lands without irreversible resource damage to soils productivity or watershed conditions.

Except for the dissected granitic terrane, these lands are identified in the Forest geologic data. These lands occupy about 70,000 acres (4% of the Forest) and have produced sediment at abnormally high rates over the past 50 years. This has resulted in considerable adverse effects on watershed values. They occur primarily on the westside of the Forest and are rare on the Goosenest Ranger District.

These lands have been mapped and this information is contained within the Forest's Planning database. A description is also in the Geologic AMS.

Geologically Sensitive Lands

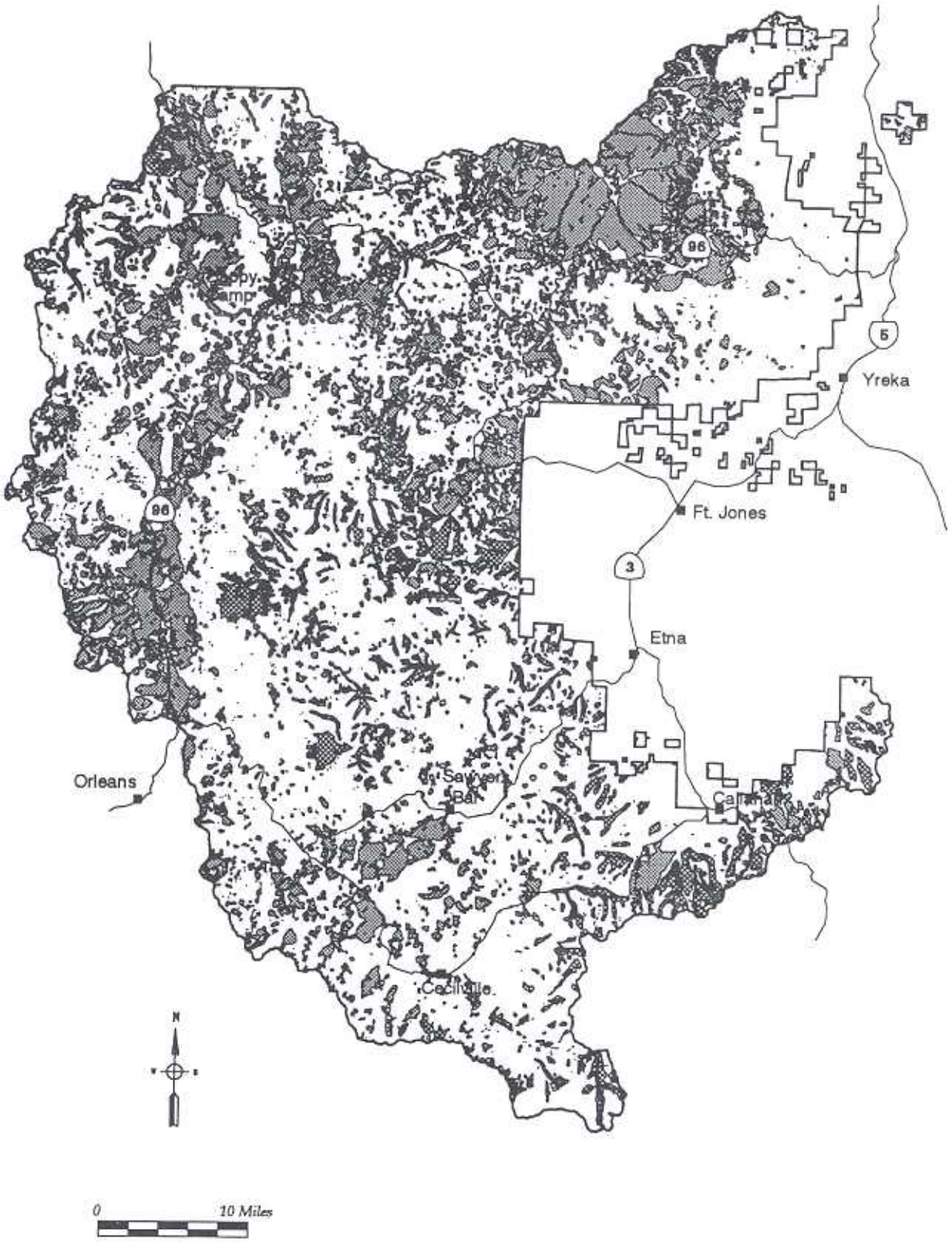
Geologically Sensitive lands are those lands with a high landslide risk. Each of the 13 geomorphic terranes was classified as sensitive or non-sensitive for analysis in the FORPLAN model (Table 3-1). The term "non-sensitive" means that landslide potential is generally lower in these terrane types. It does not mean that it is non-existent. Sensitive lands occupy about 40% of the Forest, and non-sensitive lands occupy the other 60%.

Current Practices

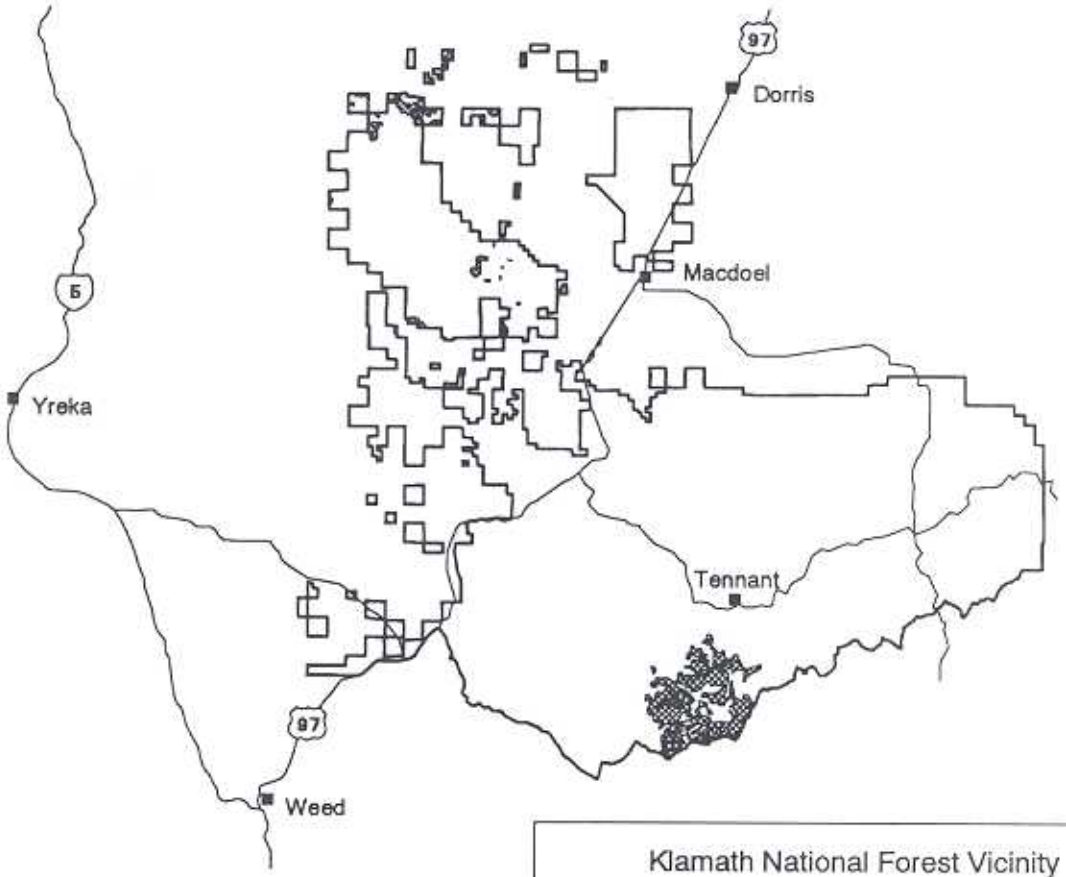
Road construction and timber harvest have occurred on all geomorphic terranes. When planned, roads and harvest units usually avoid active landslides, toe zones of slump and earthflow deposits, inner gorges and the most severely dissected of the granitic terranes. However, roads and timber harvest may have occurred when the decisionmaker felt that the landslide risk could be mitigated to acceptable levels.

Uncompacted earthen fills have been identified as a significant source of sediment on the Forest. Log landings are commonly built in this way. Some road fills and waste areas (disposal sites for excess excavated material) are also built of uncompacted fill. When uncompacted and undrained fill material is placed on steep or wet slopes, a catastrophic failure can occur, generating a debris flow landslide.

Figure 3-3
Simplified Geomorphic Terranes
Westside



Simplified Geomorphic Terranes
Eastside

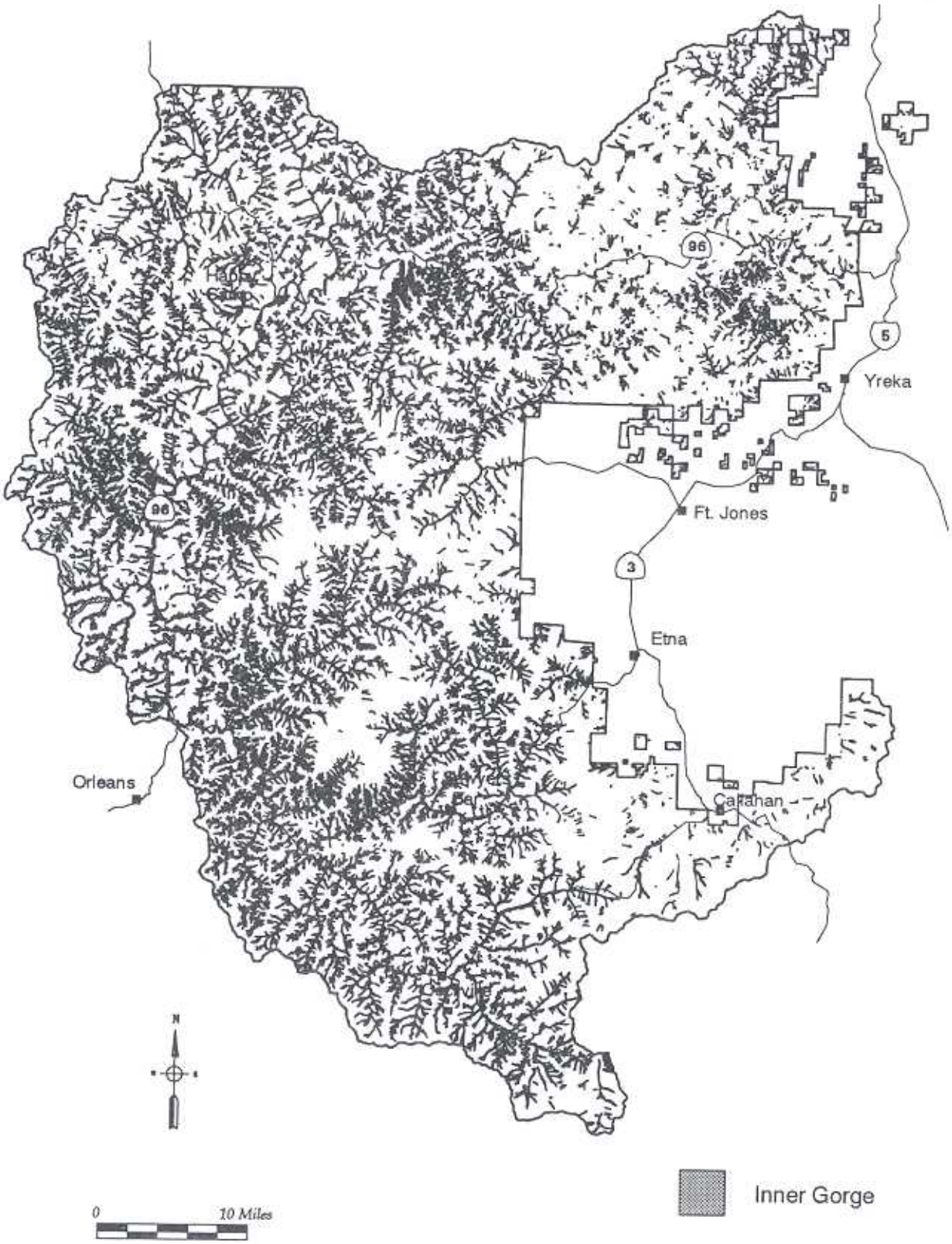


Legend

- Active Landslides
- Dormant Landslides
- Glacial Deposits
- Debris Basins

Klamath National Forest Vicinity

Figure 3-4
Inner Gorge Geomorphic Terrane
Westside



Hazardous Materials

Hazardous materials on the Forest include asbestos, radon and a variety of materials associated with abandoned mines and landfills (such as heavy metals and acid drainage). The issue of hazardous materials has grown larger in the past few years.

Asbestos - Asbestos includes a group of naturally occurring fiberous minerals. These are present in many areas of the Forest. Asbestos is most common in ultramafic rock that occurs on the westside of the Forest.

Asbestos is known as a carcinogen when breathed into the lungs and is a National health issue. The Environmental Protection Agency (EPA) has defined asbestos as a hazardous air pollutant. Asbestos fibers may be introduced into the air by rock quarry operations and by vehicular traffic on unsurfaced roads. There is concern by some public groups and local individuals that asbestos in domestic water also could be hazardous.

Radon - Radon is a naturally occurring radioactive gas that is odorless, tasteless, colorless and nonflammable. It can become concentrated in air or water. Radon is a radioactive decay product of radium which forms by the decay of uranium. Uranium is present in almost all rocks and soils in small concentrations.

Granite produces more radon than most rocks because it commonly contains uranium-bearing minerals. Some granitic rocks in the northeastern United States contain uranium concentrations of 10 to 50 parts per million while others in the western United States contain as much as 500 parts per million (LaFavore, 1986). Metamorphic rocks, some volcanic rocks, and black, organic-rich shales also produce radon (Sprinkel, 1987).

The Forest is underlain by a variety of metamorphic, granitic, volcanic and some sedimentary rocks that have the potential for radon contamination. In the spring of 1988, some monitoring for indoor radon contamination was done in the Somes Bar area. All tests reported negligible amounts of radon.

Abandoned Mines and Landfills - Many abandoned landfills and mines occur on the Forest. Some may contain hazardous materials. These sites are currently being inventoried.

Seismic Hazards

When bedrock ruptures within the earth in response to stress in the earth, large amounts of energy are released in the form of seismic waves. The groundshaking produced by these waves is more commonly known as an earthquake.

Seismic hazards on the Forest are associated with moderate probability events (return periods of 10 to 100 or more years). These events occur with moderate to severe results (such as damage to buildings and disruption of utilities and transportation systems). They generally are not influenced by man's activity. An exception is that large reservoirs have been shown to start seismic activity as a result of the additional loads placed on the earth's crust.

Geothermal development could potentially affect seismic activity. Seismic hazards are important considerations in alternatives that involve changes in population density, construction of permanent structures and embankments or dams. Potential seismic hazards on the Forest include ground shaking and rupture, liquefaction and seismically induced landslides.

Earthquakes from the following two primary sources could affect the Forest: (1) the northern end of the San Andreas Fault and subduction-related faults along the coastal regions of California and Oregon, and (2) faults associated with the Modoc Plateau and Cascade volcanos.

Subduction-Related Earthquakes - The coastal faults can produce the strongest quakes. Similar tectonic settings in other parts of the world have also created strong earthquakes.

Seismic activity, recorded over the past 40 years in the Klamath Mountains, has been small compared to that near the coast. Several earthquakes with a Richter magnitude of 4.0 to 5.0 have occurred along the western boundary of the Forest in the past 40 years (refer to the Geologic AMS). Ground shaking in this steep, rugged portion of the Klamath Mountains has the potential to trigger large debris avalanches and mobilize earthflows like those that occurred in association with the Loma Prieta Earthquake of 1989 (Bedrossian and Sowma, 1991).

Earthquakes In the Cascades and on the Modoc Plateau - Movement of faults associated with Cascade volcanoes and with the Modoc Plateau can produce intense ground shaking and rupture on the Goosenest Ranger District. The area around Mount Shasta is seismically very active in terms of the number of events.

However, the strength of quakes during the period of record has been relatively low. In 1978, a quake with a Richter magnitude 4.6 occurred with its epicenter near Stephens Pass. This produced ground rupture over a distance of about a mile (Bennett, 1979).

Damage associated with this quake was light due to the lack of developments in the area. A swarm of low magnitude quakes, with the epicenter near Tennant, were recorded in 1981. In 1989, another swarm occurred in the Medicine Lake area. Thus, seismic activity is common in this area and is being monitored.

In 1972, the State of California enacted the Alquist-Priollo Special Studies Zone Act. Under this act, the State is responsible for identifying potentially active fault zones in California. Development within Special Studies Zones is subject to certain restrictions (refer to the Geologic AMS). Evaluation of the Northern Coast Range Region (including the westside of the Forest) has been completed. No potentially active faults were identified on the Forest (Hart, et. al., 1983).

However, it is noteworthy that very limited investigations have been conducted in the sparsely-populated Forest areas, and more active faults could be present.

Evaluation of the Cascades portion of the Forest (the Goosenest Ranger District) is now complete. Many active faults have been identified in the Butte Valley Area. An active fault passes near a campground at Antelope Creek. Copies of the fault zone maps are on file in the Supervisor's Office in Yreka, California.

Volcanic Hazards

Volcanic hazards exist on the Goosenest Ranger District. They have a low probability of occurrence, with return periods of 100 to 1,000 or more years.

Volcanic hazards are natural events with severe consequences, not affected by management activities. Hazards include: (1) blasts from eruptions, (2) falling ash (especially to the east of source vents due to prevailing westerly winds in this area), (3) hot dry flows of gas, rock and ash, (4) toxic volcanic gasses, (5) lava flows and domes, and (6) secondary effects (such as debris avalanches, volcanic mudflows and flooding due to melting of a snow pack).

Hazards near Mount Shasta and the Medicine Lake Highlands were assessed by the U.S. Geological Survey (USGS) (Miller, 1980 and 1989). Maps identifying these hazard zones are on file at the Supervisor's Office.

Mount Shasta has erupted three times in the past 750 years. The odds are 1 in 25 or 30 that it will erupt in any given decade (Crandell, 1987). Large flows that extend outward more than 12 miles from the summit constitute the greatest threat.

In the Medicine Lake Highlands, the greatest hazards are from the eruption of small pyroclastic flows of ash and rock, the formation of cinder cones and lava flows. The zone of greatest danger extends outward in a 10-mile radius from Medicine Lake (Miller, 1990).

The USGS and the California Division of Mines and Geology are currently monitoring volcanic and seismic activity near Mount Shasta. The monitoring is for identification of activity that could lead to catastrophic eruption.

Such monitoring does not guarantee that eruptions will be predicted well in advance of the actual event. A recent study of 205 large eruptions around the world revealed that 45% experienced major eruptions within one day of the first sign of activity. Half of those occurred within the first hour (Bloom, 1991). Many Forest Service facilities could be affected by seismic and volcanic hazards.

Snow Avalanche Hazards

Snow avalanches occur when snow and ice accumulate on steep slopes. Avalanches can be triggered by meteorological events, ground shaking and sound waves. The potential for snow avalanches exists in elevations above 4,000 feet where the slopes exceed 60% and the conditions are conducive to snow accumulation. However, the hazard area extends for a considerable distance downslope from where the avalanches start.

Land Subsidence and Collapse Hazards

Groundwater withdrawal can cause land subsidence (sinking of the ground) in areas where natural water tables are lowered by pumping that exceeds recharge. The potential for subsidence exists in Scott Valley, Butte Valley and possibly Shasta Valley, but it is not known to be a problem at present.

The potential for collapse of underground cavities has been a relatively small issue on the Forest. Local incidents of collapse have occurred. The potential for ground subsidence and collapse of underground cavities is considered limited in scope on the Forest. This will be dealt with on a site-specific basis.

Minerals, Oil, Gas and Geothermal Resource

These resources are discussed in the Minerals Management section of this chapter.

Rock Materials Resource

Earth materials and rock resources are presently being used across the Forest, primarily for road surfacing and construction of rock fills. Sources occur in metamorphic bedrock and stream gravels on the westside of the Forest, and in lava and cinder cones on the eastside.

These resources are unevenly distributed across the Forest. Some areas lack them altogether. Some existing rock quarries are experiencing erosion problems, and some do not meet visual quality standards.

Groundwater Resource

Groundwater, a valuable geologic resource on the Forest, occurs in three main types of aquifers. They are valley alluvium, landslide and colluvial deposits, and fractured bedrock.

The largest aquifers occur in the Scott, Shasta and Butte Valleys, mainly outside National Forest boundaries. Most of the source area for these aquifers is on National Forest System land (NFS). A map of NFS recharge areas for these aquifers is being prepared by the Forest. This map will display the major aquifer and recharge areas.

The Scott Valley aquifer is an alluvial deposit several hundred feet thick (Mack, 1958). Recharge to this aquifer is from streams, many of which drain NFS lands. Recharge is also from large alluvial fans that occupy the flanks of the valley, such as at Kidder Creek.

In the Shasta Valley, the most continuous aquifer is the Plutos Cave Basalt that occupies the southeast part of the valley in the Big Springs area. Much of the recharge area is located on lands of the Klamath and Shasta Trinity National Forests.

The most important aquifer in Butte Valley is the Butte Valley Basalt. This aquifer underlies the southeast part of the valley (Wood, 1960). This fractured, highly permeable aquifer is the source of much of the irrigation water used in the valley and is depleted and naturally recharged on an annual basis. Much of the recharge area lies on NFS lands.

Potential sources of pollution to the aquifers include fertilizers, pesticides, hazardous materials transported on roads and highways, artificial landfills, leach lines, well pumps contain hazardous substances in the lubricant and fuel storage tanks. The high permeability of basalt aquifers makes them more susceptible to pollution from surface sources than other aquifers (Medford Water Commission, 1990). The rapid infiltration and irrigation withdrawal that occurs in the Butte Valley basalt makes it particularly sensitive to pollution.

Unique Geologic Areas

Excepting caves, these areas are discussed in the SIA section. The Forest has a rich cave resource. This consists mostly of marble caves in the Klamath Mountains, but also includes lava tubes in the Cascades. Some caves contain rare plants and animals. Refer to the Geology AMS for further discussion of cave resources.

Issues, Projected Demands and Opportunities

Two of the public issues relate to landslide hazards. Identifying unstable lands, not suitable for programmed timber harvest, is one issue. The other issue deals with identifying and mitigating Forest management practices that can cause landslides. Roads, landings and waste areas are of particular concern.

The other issues relate to the other geological hazards and resources. The issue for hazardous materials on the Forest includes asbestos, radon and a variety of materials associated with abandoned mines and landfills.

Another issue relates to seismic hazards present throughout the Forest and to volcanic hazards in the eastern part of the Forest. The amount and purity of groundwater available for use is rapidly becoming a significant issue.

Geologic investigations conducted over the past years have been done to varying standards. Often, documentation has been limited. Information collected by past investigations has not been used effectively to refine the Forest-wide Geologic database. The Forest Land and Resource Management Plan allows the opportunity to establish minimum standards of geologic investigation and to provide direction for establishing and maintaining the Geologic database.

Opportunities exist to stabilize existing landslides and conduct detailed inventories of landslide and snow avalanche hazards. Such inventories would complete the mapping of the geologically unsuitable portion of the granitic terrane and refine the mapping of slump toe zones. The application of standards and guidelines proposed in this document to all new Forest management activities provides the opportunity to reduce greatly future management-related landslides.

One of the best examples of such a standard relates to the construction of stable fills for log landings, roads and waste areas. The technology exists to construct stable fills, and such a standard would facilitate the application of this technology.

Another example would be designating, engineering and landscaping waste areas along major roads through the Forest. This would allow for the disposal of landslide debris removed from the roads during the winter. An additional opportunity exists for monitoring the effectiveness of past and proposed future mitigation measures.

An inventory of roads, landings and quarries built on, or constructed from, asbestos-bearing materials would provide the opportunity to plan safety measures for these areas. Similarly, there is the opportunity to inventory all abandoned landfills and mines so potential problems could be identified.

Monitoring could be conducted to determine levels of airborne asbestos next to quarry operations and along unsurfaced roads through asbestos-bearing rock. Monitoring also could be conducted to determine the concentration of radon within inhabited structures. Completion of inventories and monitoring would provide the opportunity to design and implement mitigation measures.

There is also an opportunity for the Forest Service to assist County and State agencies in preparing disaster response plans for earthquakes, volcanic eruptions and floods. Completion of an inventory of potentially active faults in the Klamath Mountains would provide the opportunity to minimize future adverse affects by avoiding construction of permanent facilities in active fault zones.

Public demand for cave resources is expected to increase. The opportunity exists to inventory all known mine and cave locations. This knowledge would help prevent underground collapse due to road construction or other management activities. This would then prevent damage to structures and resources. Such an inventory would allow development of management plans for significant caves.

Public demand for high quality groundwater is projected to continue at historic or increased rates. In some areas, such as Scott Valley, conflicts exist between irrigation needs and the needs of fish populations in the Scott River. The demand for small groundwater developments within and next to the Forest is expected to increase as new houses are built. The same is true if Forest Service facilities are expanded. On the Goosenest Ranger District, there is a demand for groundwater sources for fire, grazing, road watering and wildlife projects.

There is an opportunity to inventory groundwater resources on the Forest. Another opportunity would be to monitor the effects of irrigation use on river levels and fish populations. This information would allow development of a water use plan that would be responsive to the needs of both farmers and fish. Monitoring the quality of groundwater next to underground tanks, abandoned landfills and mines, leach lines and areas next to pesticide use would allow the identification of pollution problems and the development of mitigation measures.

The demand for rock material resources is likely to continue at historic rates or decrease slightly. As the Forest nears completion of its final road network, the number of new roads constructed will diminish. This will result in a lower demand for rock on new roads.

This trend may be offset by an increase in watershed improvement projects that require rock for armoring the surfaces of existing roads, landslide repair, erosion protection and in-stream fish structures. There will be a concern that asbestos-bearing rock not be used on road surfaces. This will require the abandonment of many existing quarries. There will be a need for new quarries that will not adversely affect watersheds and meet visual standards.

There will be an opportunity to develop a Forest-wide inventory of rock sources that can identify asbestos-bearing pits. This inventory can identify new rock sources in strategic locations where needs are anticipated to be greatest. Such an inventory also would identify existing pits needing rehabilitation for erosion control and visual appearance.

There will be an opportunity to schedule geologic inventories, to include them in the monitoring plan and to seek funding for their timely completion.

Soils

Description

The soils on the Klamath National Forest are variable in physical and chemical properties. This variability is due to differences in parent material, climate, topography, biology and age. Each soil has its own respective characteristics, suitabilities and limitations.

The soils east of Interstate 5 have developed from volcanic parent materials (rhyolite, andesite, basalt and pyroclastic material) with inclusions of alluvium, colluvium, glacial moraines and outwash. The soils west of Interstate 5 have developed from metamorphic, granitic and ultrabasic parent material, with inclusions of colluvium and alluvium.

The geomorphic landforms are dominated by very steep mountains and mountain valleys. The soils on the westside of Interstate 5 are more prone to soil erosion due to steeper slopes and higher rainfall.

Data Sources/Soil Inventory

The data sources for soils information include the Order 3 Soil Resource Inventory (SRI) of the Forest, several Order 2 SRIs across the Forest and the Soil Survey of Siskiyou County, California, Central Part, USDA Soil Conservation Service (SCS) (USDA, SCS, 1983). These are on file at the Forest Supervisor's Office.

The Order 3 SRI for the Forest was completed in 1982. This inventory is used for broad-level land management planning and is not suitable for project-level planning. It is appropriate for evaluating soils and identifying management considerations. Soil potentials, hazards and limitations can be identified. This SRI identified the types of soils and their general location. There are 156 different soil types mapped at the Order 3 level of intensity.

About 200,000 acres of the Forest have been surveyed at the Order 2 level of intensity. The Order 2 SRI is used for project-level planning. This information is used for intensive land uses that require detailed information about soil resources for making predictions of suitability for use and for treatment needs. There is less variability in Order 2 SRI mapping units than in the broader Order 3 SRI soil units.

Soil Productivity

Soil productivity is the capacity of a soil in its normal environment to produce useful biomass in the form of a specified plant, sequence of plants or vegetative community under a specified system of management. Generally, the productivity of a soil depends on soil depth, texture, rock content, climate, aspect and parent material.

The SRI places the different soils into Forest Survey site classes. By this system, Forest Survey Site Classes 1 and 2 can produce greater than 165 cubic feet of wood volume per acre per year. Site Classes 3 and 4 produce between 85 and 164 cubic feet, Site Classes 5 and 6 produce between 20 and 85 cubic feet, and Site Class 7 produces less than 20 cubic feet per acre per year. The SRI shows that about 17% of the Forest is in Forest Survey Site Classes 1 and 2, about 19% in Site Classes 3 and 4, about 44% in Site Classes 5 and 6, and about 20% in Site Class 7.

The soils on the Forest are capable of maintaining productivity over the long-term if: (1) the top soil is not lost through erosion or mechanical displacement, (2) the soil is not compacted when moist, and (3) sufficient organic matter remains after disturbance to allow for nutrient cycling. Organic matter refers to the surface cover of organic litter and duff. This organic matter is important for both erosion prevention and nutrient cycling. It includes the fine organic matter (duff, litter and twigs less than 3 inches in diameter) and coarse woody material (woody material larger than 16 inches in diameter).

Organic matter provides a substantial source of nutrients necessary to maintain long-term soil productivity. Organic material also retains a large quantity of water and supports the nitrogen-fixing activities of micro-organisms through symbiotic associations contributing to plant growth.

Soil productivity under natural conditions is generally increasing except under certain situations. These situations include sites where the soil is removed in a landslide and areas burned by wildfire. Wildfire reduces both the fine organic matter and coarse woody material on a site and exposes soil to accelerated erosion.

Fire suppression can act to increase soil productivity by decreasing the fire frequency on a site. This leads to greater amounts of organic matter and coarse woody material on a site than would be natural. Other management activities, such as timber management, can decrease soil productivity. Past practices have sometimes decreased fine organic matter and coarse woody material in logged areas to below desired levels.

Management activities can maintain soil productivity if mitigating measures are applied. Mitigation measures

currently used on the Forest include restricting heavy equipment operation on soils that are too wet and maintaining prescribed amounts of organic matter, ground cover and coarse woody material following prescribed burning and tractor site preparation.

Soil Erosion Hazard

The SRI is used to classify Forest soils into the following four maximum Erosion Hazard Ratings (EHR): low, moderate, high and very high. The EHR is a relative rating of erosion hazard, considering factors such as soil cover, slope and inherent soil erodibility.

The maximum EHR is the rating a soil would receive if the organic soil cover were removed. About 20% of the Forest is classified with a maximum EHR of very high, 45% as high, 28% as moderate and 7% as low. Generally, a maximum EHR of "very high" occurs on sandy soils derived from granitic bedrock on steep slopes. A "high" rating can occur on most soils on steep slopes and on sandy soils on moderate slopes. "Moderate" and "low" EHR soils occur on gentle slopes.

Soils under a conifer vegetation usually have a litter/duff layer that can be 1/2 inch to 3 inches thick. Removal of this cover exposes the soil surface to erosion processes. The removal of soil cover occurs naturally with wildfire and through management activities.

The dominant erosion process is soil particle detachment by raindrop splash and subsequent downslope movement by surface water runoff. Raindrop splash also may form a very thin compacted layer over the soil surface that reduces rain infiltration, resulting in surface runoff. Surface runoff can collect and form rills (narrow channels) 1 to 2 inches in width and depth. These rills may enlarge and form gullies, 18 inches and greater in width and depth. All soils are subject to erosion when exposed to erosion processes.

Soil Effects of Catastrophic Fires

Catastrophic wildfires have significantly affected soil productivity over some large Forest areas. Intense fire resulting from fuel buildup and extreme climatic conditions has severely affected the soils in some areas. The intense fires have consumed organic matter, exposing soil to erosion and, in some cases, created hydrophobic soil conditions. Hydrophobic soil conditions are when soils repel water, resulting in decreased infiltration of rain into the soil, increased runoff and increased erosion.

Conifer Regeneration Potential

The SRI has been used to rate each soil for conifer regeneration potential. Forest soils are placed into the following four groups: high, moderate, low and very low regeneration potential. Regeneration potential provides an estimate of the difficulty of establishing conifer plantations. It is determined by the water holding capacity of the upper 20 inches of soil, seedling water requirements and precipitation.

The conifer regeneration groups are defined as follows. "High" implies that conifer survival is readily obtainable in most years. "Moderate" implies that survival may be reduced unless some special management practices are used. "Low" implies that survival in most years will be poor unless special management practices are used to improve seedling environment. "Very low" implies that nearly every year will result in poor survival rates. About 5% of the Forest is classified as high, 49% classified as moderate, 23% classified as low and 23% classified as very low. About 10% of the Forest is currently forested, but has a low probability of successful regeneration within 5 years of the final harvest.

Plantability and seedling survival are influenced by the amount of rock fragments in or on top of the soil. Some very productive soils can have a low to very low regeneration potential because of a thick overburden of stone, cobble or gravel that makes planting difficult.

Reforestation certification reports (monitoring of seedling survival in plantations) completed by the Forest from 1982 to 1987 show that about 88% of the plantation acreages are successfully restocked with desirable seedlings. The remaining 12% of the plantation acreage fails to meet stocking requirements. These failures are attributed to a combination of poor soil regeneration potential, poor planting stock, vegetative competition and dry weather following planting.

Soil Resources

Soil productivity, permeability and fertility can be maintained by minimizing soil erosion, the loss of organic matter and soil compaction. This is generally done by using standards and guidelines and Best Management Practices (BMPs). These practices include maintaining ground cover to reduce soil erosion, limiting heavy equipment on soils that are moist to reduce soil compaction and using low to moderate intensities fire during prescribed burning to reduce the loss of the organic matter and nutrients. BMPs are currently used across the Forest.

Tractor logging and tractor site preparation can cause a high amount of soil disturbance. It also has a relatively high risk of soil compaction and soil erosion. New techniques are now being tested and used to reduce these impacts. Cable logging has a soil compaction and soil erosion risk for primarily the small areas in the cable corridors. Helicopter logging has a low risk for soil disturbance and soil erosion. Prescribed fire for fuel treatment and site preparation has a variable effect on site disturbance and soil erosion depending on the intensity of the fire and the amount of organic ground cover remaining following treatment.

The existing road system is the primary source of non-point pollution on the Forest. Nearly all the studies associated with timber harvest for California conclude that most of the erosion is related to roads. The erosion problems usually stem from poor road location, design, construction and maintenance. These erosion problems often cause landslides and streambank erosion. They may disrupt drainage patterns that would require costly reconstruction or maintenance.

About 73% of the 3,600 miles of roads on the Forest are unsurfaced (not paved or graveled). These existing unsurfaced roads have a surface and fill material from the local soil. Unsurfaced roads that have soil with less than 80% gravel (by volume) have a high potential to erode and cause non-point pollution. This is especially true of soils formed on decomposed granite parent rock. The opportunity exists to upgrade the unsurfaced roads that have soils with less than 80% gravel content by surfacing with gravel, crushed rock or some other long-term stabilizing material for erosion control.

Existing cut and fill slopes that have not been stabilized with vegetation or other ground cover provide a second source of soil erosion and sedimentation. An opportunity exists to stabilize these eroding areas using vegetative or mechanical measures (BMPs). The existing unsurfaced temporary roads that have not been stabilized with vegetative cover provide a third source of soil erosion and sedimentation on the Forest.

Mitigation measures for reducing surface runoff on non-road areas include maintaining ground cover and constructing waterbars. These are effective erosion control measures. These measures are applied to disturbed areas (such as timber harvested lands, roads, skid trails, landings, fire breaks, etc.).

The soils most sensitive to wind and water erosion are loose sandy and silty soils without ground cover. Vegetative removal has little direct effect on the erosion from these soils. Much more important is the ground cover and organic litter from the vegetation. Soils bare of vegetation, but with 50 to 80% ground cover, are effectively protected from wind or water erosion.

Suitability

Land suitability for timber production has been identified as an issue. The Forest is divided into CAS (capable, available and suitable) lands and non-CAS lands. Land is classified as incapable if it cannot grow a minimum of 20 cubic feet per acre per year of wood fiber (at culmination of mean annual increment). For a more complete discussion of CAS lands, see the Timber section.

The management of "marginally productive lands" has been identified as an issue. There is no technical definition of "marginally productive lands." They can, however, be thought of as capable and suitable but with low productivity and/or relatively difficult regenerability.

These marginal lands on the Forest usually occur on soils that are shallow, droughty and may have a nutrient imbalance (as in serpentine soils). There is no "marginal lands" designation in the Forest database. So, marginal lands are not differentiated from other lands within management areas. Marginal lands can be intensively managed for wood products, although projected yields are low because of the low productivity.

Areas managed for sustained timber harvest may have some reduction of productivity in the areas used for skid trails or landings. However, skid trails and landings are designated in advance. These areas are to comprise not over 15% of an activity area, according to Regional policy for the protection of soil productivity (Region 5 Forest Service Handbook (FSH) 2509.22, Draft Supplement).

Low regeneration potential is due to a combination of effects: (1) low available water capacity in the top 20 inches of soil, (2) low precipitation, (3) soil temperature due to elevation or aspect and, in some cases, (4) soil that has a nutrient imbalance due to pH or mineralogy. Soils located east of Interstate 5, on droughty pumice or cindery volcanic soils, at high elevations and low precipitation have low regeneration potential. The soils west of Interstate 5 with low regeneration potential are droughty, very gravelly, very cobbley or sandy soils, on west or south aspects at low elevation. Shallow soils on serpentine parent material west of Interstate 5 also have low regeneration potential.

Coarse Woody Debris

Regional guidelines require a minimum of 50% cover of surface organic matter (duff, litter and twigs), with a minimum of 5 logs per acre to be retained in harvested areas. An exception is in strategic fuelbreak areas. Desired logs are about 20 inches in diameter and about 10 feet long.

Broadcast burns, hand pile and burn, yarding unusable material and tractor pile and burn can deplete the amount of coarse woody debris on a site. Contract provisions are used to insure that an adequate number of large logs are retained following treatment.

Issues, Projected Demands and Opportunities

The following projections are based on the assumption that current management direction for Forest soil resources will continue:

There will be an opportunity to reduce soil erosion and water degradation on non-gravelled roads.

There will be an opportunity to increase soil productivity in areas through fertilization and sub-soiling of compacted soils. Only 100 acres of land have been fertilized to improve soil productivity on the Forest.

There will be an opportunity to reduce heavy fuel accumulations to prevent future fire damage and degradation of Forest resources, including soils.

Water

Description

Water Resources

The Forest is drained by the Klamath River and three of its major tributaries: the Salmon, Scott and Shasta Rivers. A large part of the Goosenest Ranger District on the eastside is in basins that do not drain into the Klamath or any other river system. In most parts of the Forest, water is adequate for existing uses.

Flows in the Klamath River are regulated by dams and reservoirs from the Iron Gate Dam upstream, but the river is free-flowing downstream from Iron Gate Dam. The Shasta River and its tributaries contain several reservoirs, most notably Lake Shastina. These reservoirs on the Klamath and Shasta Rivers are outside the Forest boundary. The Scott River and its tributaries are subject to several diversions, but essentially remain unregulated. The Salmon River and other tributaries to the Klamath below Iron Gate Dam are completely unregulated.

The Forest is divided into 13 NFS watersheds (Figure 3-5). These large watersheds are a primary basis for analysis. Also used for watershed analysis are smaller watersheds, consisting of compartments, parts of compartments and compartment clusters. The compartment is the basic component of the Forest database. Compartment data is used to analyze the smaller watersheds.

Climate

Climatic conditions on the Forest are characterized normally by cool, moist winters and warm, dry summers. Annual precipitation totals increase from east to west, and with elevation. The range is from about 10 inches in Tennant to nearly 100 inches on Preston Peak, according to the annual precipitation maps of S.E. Rantz. Precipitation typically occurs between September and May, with 80% falling from November through March. At lower elevations (700 to 4,000 feet), this falls primarily as rain, with snow mainly occurring above 4,000 feet.

Cold storms typically leave snow as low as 1,000 feet elevation. However, snow usually melts quickly below about 3,000 feet. There are also occasional winter warm storms where rain falls as high as 7,000 feet. This often occurs on snow accumulated from previous cold storms.

These rain-on-snow events can cause a rapid snowmelt which, when combined with the rainfall, create a rapid release of high volumes of runoff. The most significant cases of this phenomenon in recent memory have occurred in the floods of 1955, 1964, 1971 and 1974. These events have been the catalysts for much of the landslide failure that has occurred historically on the Forest (refer to the Geology Section earlier in this chapter).

Beneficial Uses

Beneficial uses of water occur throughout the Forest. These include municipal and household water supply, agricultural irrigation, stock watering, aquatic and riparian habitat, hydroelectric power generation, recreation and scenic enjoyment.

Municipal water supplies for Happy Camp, Etna and Tennant are provided by Elk, Etna and Antelope Creeks, respectively. There are many other streams and springs starting on the Forest that provide water to individuals and small communities. Most of the

agricultural use occurs in Butte, Shasta and Scott Valleys.

An important instream use is fish habitat. For a more detailed discussion of fish habitat and populations, refer to the Fisheries section later in this chapter.

Hydroelectric development exists at a small scale on a few streams in the Forest. Water-related recreation occurs on many lakes and streams throughout the Forest. These activities include, but are not limited to, rafting, swimming and sport fishing.

Commercial mining operations also use water at different stages of the mineral extraction process. Suction dredging, common on the Klamath River and some tributaries, uses large amounts of water. This process, however, does not remove water from the stream system. Other forms of mining require diverting water out of streams.

Water Rights

Water rights have been adjudicated in the Shasta River Basin, most of the Scott River Basin and on Cold Creek (a tributary to Bogus Creek, a stream that flows into the Klamath River just below Iron Gate Dam). Cold Creek is a small stream that flows through some NF land, but is mostly on private land.

For the Scott River, both surface and groundwater have been adjudicated. For the lower portion of Scott River, where it flows through the Forest, water was appropriated by the Forest for instream purposes to "maintain an adequate fishery." In dry years, the specified minimum flows are rarely fulfilled in late summer and early fall. The Forest also holds several appropriated and reserved water rights that cover uses from domestic supplies for campgrounds to livestock watering.

Water Quality

The quality of water produced on the Forest varies greatly, depending on the season and the location. The sensitivity and condition of each stream, including the associated riparian area and drainage basin, have a strong influence on the water quality of that stream and downstream areas.

Most of the water quality information that is available is interpreted from visual observations. The few monitoring stations on the Forest have short record periods.

There are several physical and chemical parameters of water quality that have not been sampled. Most water quality monitoring has been done for turbidity, suspended sediment and temperature. Routine coliform measurements on campground water sources and measurements of toxic substances following herbicide treatment has taken place.

Sediment discharge and associated turbidity varies greatly, depending on the intensity and duration of storms and the amount of time since the most recent sediment-producing storm. Erosion and sedimentation result primarily from mass wasting processes, with most of the volume produced from deep-seated landslides and highly dissected granitic terrane. These occur on the westside of the Forest.

Secondary sediment source areas are the stream channels themselves. Stream channel-derived sediment occurs particularly in channels that are inherently unstable, subject to increases in storm magnitude or frequency, and/or those that act as conduits for debris flows. Additional sediment is added to streams from surface erosion.

In general, sediment yield in the Forest decreases from west to east. The primary sediment-producing activity varies from area to area.

Drainage from agricultural land and from rural road rights-of-way may carry agricultural runoff. Agricultural runoff can decrease water quality by increasing the turbidity, the nitrogen levels and the dissolved oxygen demand. This is a probable explanation for the higher nitrate and lower dissolved oxygen of the Scott River, compared to the Klamath River.

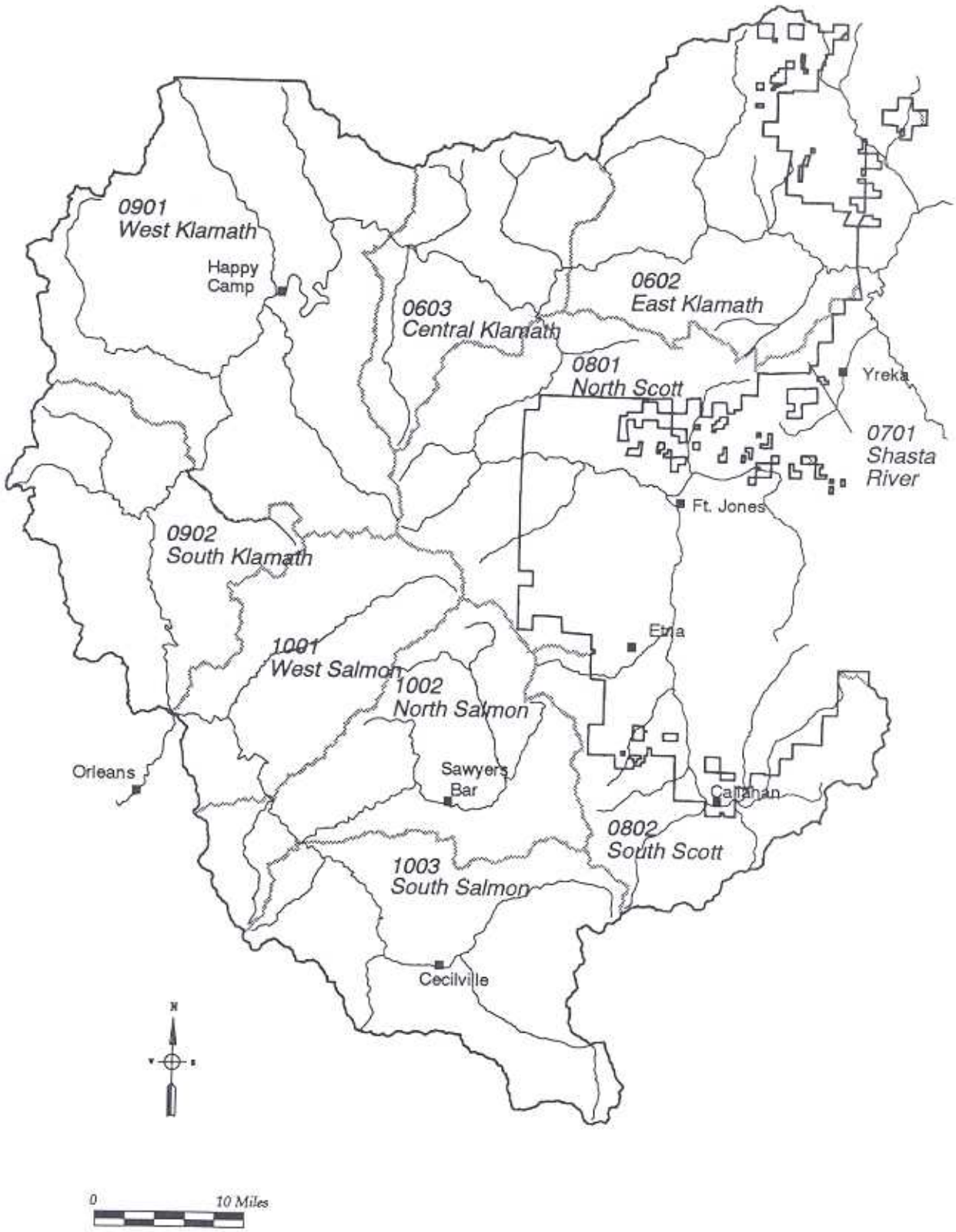
Watershed Conditions

The watersheds that make up the Forest vary widely in condition. Watershed condition is defined as "a description of the health of a watershed or portion thereof in terms of the factors which affect hydrologic function and soil productivity" (FSM 2521.1). Hydrologic function determines the ability of the watershed to produce indefinitely the quality water needed to support beneficial uses. Soil productivity determines the capability of a site to support vegetation.

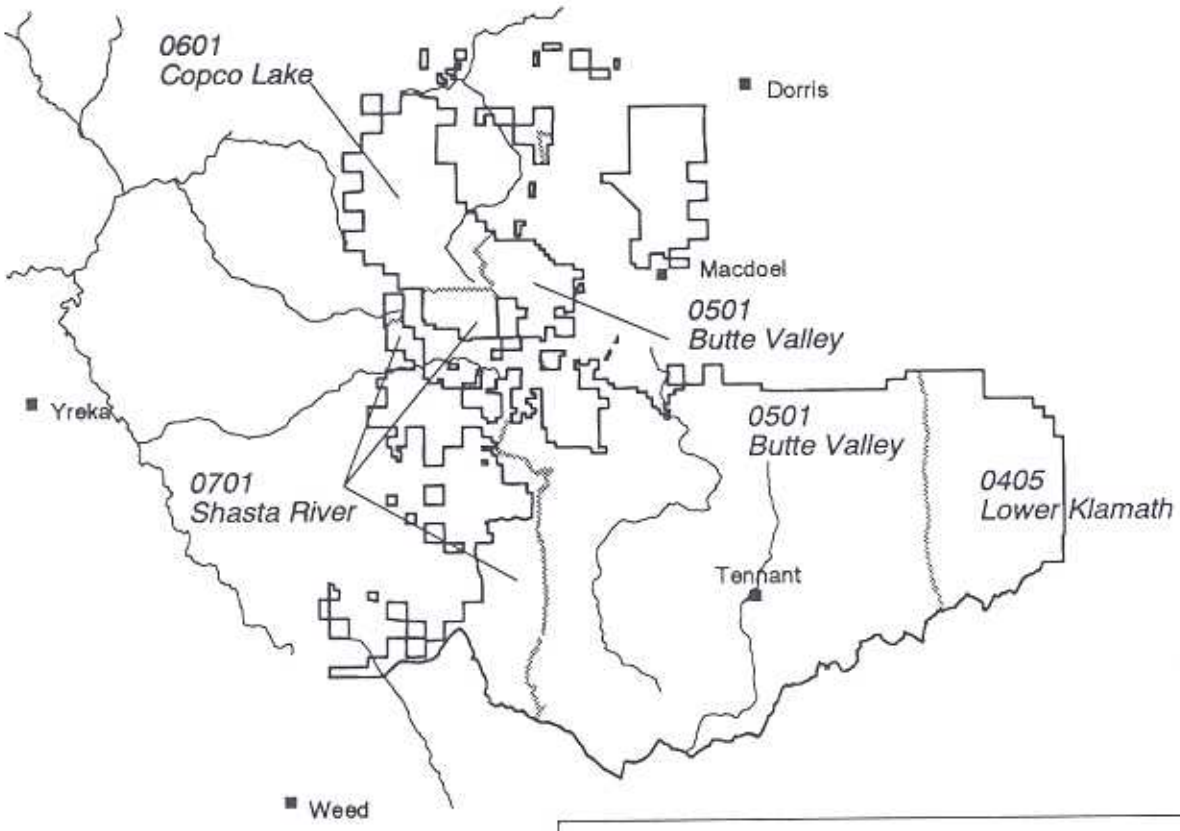
An indicator used for watershed condition is the portion of each watershed in 1 of 3 condition classes "... relative to watershed potential and tolerance" (FSM 2521.1). These classes are as follows:

> *Class 1* - The watershed condition is at or above potential. Potential is defined as "the inherent capability to produce biomass and function hydrologically as determined by physical, chemical and biological factors." These lands are assumed to be able to produce high quality water year-round.

Figure 3-5
National Forest System Watersheds
Westside



National Forest System Watersheds
Eastside



Legend

Watershed Boundary

Major Stream/River

Class 2 - The watershed is below potential, but can be improved by applying management or improvement measures. These lands are assumed to be able to produce high quality water for most of the year. Exceptions occur during winter storms or intense thunderstorms.

Class 3 - The watershed is at or below tolerance. Tolerance is defined as "the point beyond which there is high risk that potential may be permanently impaired through changes brought about by certain management activities or natural events." It is assumed that these lands do not produce water of adequate quality during much of the rainy season.

Portions of watersheds in each class were estimated for purposes of analysis. Since less-than-optimum watershed conditions can result from soil and vegetation disturbance occurring through time, condition was projected according to management and wildfire history in each watershed. Terrane types were used in this estimate, since these vary in their vulnerability to disturbance. Active landslides were assumed to be in a Class 3 condition. Some terrane types were considered resilient to all disturbance, except intense wildfire. These were otherwise considered Class 1. Table 3-2 provides a summary of condition classes for lands within the NFS watersheds.

Table 3-2. Current Condition Class [1]

NFS Watershed (WS) Name	NFS No.	Class 1 WS Total Acres	Class 2 WS Total Acres	Class 3 WS Total Acres
Lower Klamath	0405	46,100	0	0
Butte Valley	0501	191,400	0	0
Copco Lake	0601	29,500	500	100
East Klamath	0602	123,400	800	1,000
Central Klamath	0603	98,600	2,300	1,000
Shasta River	0701	51,500	0	0
North Scott	0801	113,800	1,300	1,000
South Scott	0802	67,000	200	400
West Klamath	0901	319,300	8,400	3,900
South Klamath	0902	138,700	1,800	4,800
West Salmon	1001	126,500	600	900
North Salmon	1002	157,600	2,900	1,900
South Salmon	1003	178,100	3,000	1,800

[1] Acreages have been rounded to nearest 100 acre feet; those less than 50 acre feet show as 0 acre feet.

Riparian and Channel Conditions

Riparian conditions are an element of watershed conditions that are of unique importance to a number of dependent resources. Riparian condition is also important to the ecological diversity of the Forest (refer to the Biological Diversity and Riparian Management Sections later in this chapter).

Riparian vegetation helps provide structure to stream channels through the root structure of living plants. Riparian vegetation also produces coarse wood. Coarse wood influences channel cross-sectional shape and stream meanders, as well as playing a major role in sediment storage and water velocity control. The role of coarse woody material as a key element of fish habitat and the importance of vegetative shade for water temperature regulation is discussed in the Fisheries Section later in this chapter.

The riparian area functions as a sediment filtration system for soil particles that have moved from upland sites. The capability to capture this soil and its nutrients before it is deposited in streams depends largely on the type, vigor and structure of the riparian vegetation. Once in the water, the soil may result in reduced water quality.

Many riparian areas are drastically changed from what they were 50 years ago, as shown by 1945 aerial photos. The changes consist of fewer large trees in the riparian area (especially conifers), and a much greater extent of bare areas now, as compared to the past.

Most of these changes resulted from the 1964 flood. Others are attributed to disturbance by human activity or a combination of floods, fires and human activity. Several streams have experienced debris flows during the 1964 flood and at other times.

These debris flows, which occur during intense thunderstorms as well as during lengthy rainstorms, may be the most important channel-shaping process that occur on the Forest. Channel margins may become stripped of soil and vegetation for miles below the start of the landslide failure. Channels often become wider and shallower.

The resulting mobilization and redeposition of channel material can exceed the initial landslide volume by several times. The particle size of the sediment is usually a mixture of fine and coarse material, with adequate site potential to become quickly revegetated. If the material is sorted, coarse material deposited with a low amount of fine material, low site potential cobble bars can result. For many years, these cobble bars can exist as bare areas. Fine sediment deposited in stream

channels can easily be re-mobilized for a full season or more, which can increase turbidity.

Grazing may produce localized impacts on riparian areas. Trampling of streambanks and loss of vegetative root strength from grazing has destabilized sections of stream channels and lake margins.

Placer mining frequently results in the loss of riparian vegetation and long-term site potential due to removal of topsoil. Roads, bridges, parking areas and other developments can have a detrimental effects on riparian areas, as can the unrestricted use of heavy machinery.

Current Direction

The Clean Water Act establishes water quality standards and specific goals and policies for the Nation's waters. In 1981, the Forest Service entered into a Management Agency Agreement on non-point pollution requirements with the State of California. The State has the authority and responsibility to administer the Clean Water Act. This agreement further defines the Clean Water Act and established roles for the agencies.

The Porter-Cologne Water Quality Control Act, part of the California Water Code, established a State Water Resources Control Board and 9 Regional Water Quality Control Boards as the principal group responsible for the coordination and control of water quality.

The most pertinent state water quality objectives for management and planning on the Forest are in the Water Quality Control Plan for the North Coast Basin, Klamath River Basin (North Coast Water Quality Control Board, 1988). In addition, the State Water Resources Control Board has a Non-Degradation Policy (refer to the Water AMS for more details).

Established to control non-point pollution from management activities, BMPs have been certified by the State and the EPA, under authority granted them by the Clean Water Act.

Cumulative Watershed Effects

The cumulative effects of management activities on watershed condition is an identified water issue. A cumulative effects assessment combines disturbances that, individually may be of little concern, but collectively can cause detrimental effects. A Cumulative Watershed Effects (CWE) analysis assesses watershed disturbances that, when combined, can cause a negative effect on an identified stretch of stream.

The Forest Service currently considers all effects of proposed actions in a watershed, regardless of land ownership. Watershed conditions in several "mixed ownership" (more than one land owner) watersheds is of concern. The overall cumulative effects in a watershed can restrict the amount of activity acceptable on public lands that may be otherwise unconstrained. In the past, this situation has limited opportunities on public land in some watersheds.

Water Quality

Existing laws and policies, such as the Clean Water Act, are meant to assure water quality. At issue is the effectiveness of the current direction. BMPs are intended to be reasonable practices to use in California to protect water quality from negative impacts resulting from land disturbing activities.

The Management Agency Agreement acknowledges that one goal of the agreement is to "implement Forest Service legislative mandates for multiple use...to meet both long- and short-term local...and National needs." The focus of most BMPs is to control erosion or other potential off-site pollutants. The State's North Coast Basin Plan focuses on the maintenance of beneficial uses.

The link between upslope and instream effects is being monitored through a BMP effectiveness monitoring program now underway in Region 5. The link between the implementation of beneficial uses and the maintenance of water quality is more difficult to make.

Table 3-3 displays the volume of water estimated to meet water quality objectives for each NFS watershed. This estimate is based on the water yield for each of the 13 watersheds and by the condition class of the lands within the watershed. Refer to the previous watershed condition discussion for definitions of these classes relating to water quality.

Table 3-3. Current Situation - Water Quality Outputs

NFS Watershed Name	NFS No.	Water Meeting Objectives (In Thousand Acre Feet) 1	Water Not Meeting Objectives (In Thousand Acre Feet) 1
Lower Klamath	0405	Negligible	0
Butte Valley	0501	227,100	0
Copco Lake	0601	53,300	300
East Klamath	0602	188,600	900
Central Klamath	0603	221,600	2,200
Shasta River	0701	32,400	0
North Scott	0801	234,400	1,800
South Scott	0802	101,200	500
West Klamath	0901	1,009,300	11,800
South Klamath	0902	554,500	13,400
West Salmon	1001	426,300	2,200
North Salmon	1002	462,800	4,800
South Salmon	1003	399,000	3,600
	Total	3,910,500	41,500

[1] Acreages have been rounded to nearest 100 acre feet; those less than 50 acre feet show as 0 acre feet.

Table 3-4. Average Annual Yield

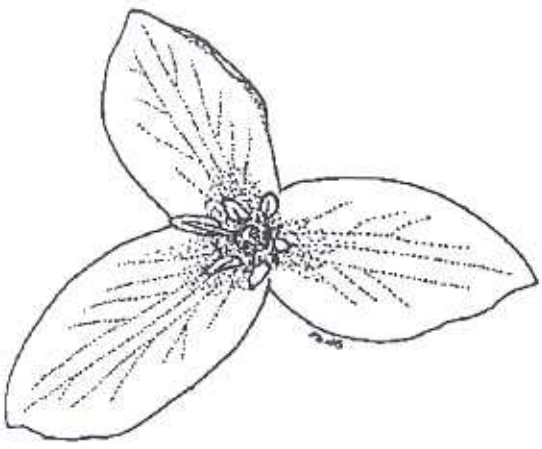
NFS Watershed Name	NFS No.	Water Yield (In Thousand Acre Feet)[1]	Forest Yield (%)
Lower Klamath	0405	Negligible	0
Butte Valley	0501	227,100	5.7
Copco Lake	0601	53,600	1.3
East Klamath	0602	189,500	4.7
Central Klamath	0603	223,800	5.7
Shasta River	0701	32,400	0.8
North Scott	0801	236,200	5.9
South Scott	0802	101,700	2.6
West Klamath	0901	1,021,100	25.8
South Klamath	0902	567,900	14.4
West Salmon	1001	428,500	10.8
North Salmon	1002	467,600	11.8
South Salmon	1003	402,600	10.2
	Total	3,952,000	100.0

[1] Assumes base year of 1987. Figures are based on USGS records where available and prorations of measurements where ungauged. Acreages have been rounded to nearest 100 acre feet; those less than 50 acre feet show as 0 acre feet.

Water Yield

The removal of conifers and other vegetation may increase water yields. Streams and lakes on the Forest generally meet the demand for municipal and rural domestic needs, except for portions of the Scott River, Shasta River and the Butte Valley area.

In shortage areas, agricultural uses may compete with instream uses for limited water supply during normal water years. This is especially true during drought years. The current average annual water discharge for each NFS watershed is displayed in Table 3-4.



Watershed Restoration

Watershed restoration projects provide opportunities to improve degraded conditions that adversely affect beneficial uses. The extent and timing of watershed improvements is dependent on management emphasis and funding. The current situation for watershed improvement can be expressed in terms of needs and accomplishments. The needs are estimated using the watershed condition assessment. This process considers Watershed Condition Class 2 and 3 lands in need of improvement. A portion of these acres are considered feasible for improvement projects.

The Watershed Improvement Needs (WIN) Inventory, an ongoing process of inventorying land for watershed improvement projects, and a Forest ranking of projects are used to prioritize projects. Accomplishments displayed in Table 3-5 are average acres improved annually over the last decade. NFS watershed accomplishments are estimated based on total Forest acres, prorated according to need. The types of work accomplished currently include primarily streambank and streambed stabilization (97%), landslide stabilization (3%), road drainage improvement, erosion control,

and revegetation of degraded riparian and upland sites. Road and riparian work are currently increasing proportionately.

Table 3-5. Watershed Improvement Program

NFS Watershed	NFS No.	Improvement Acres[1]
Lower Klamath	0405	0
Butte Valley	0501	0
Copco Lake	0601	1
East Klamath	0602	3
Central Klamath	0603	17
Shasta River	0701	0
North Scott	0801	6
South Scott	0802	1
West Klamath	0901	71
South Klamath	0902	17
West Salmon	1001	6
North Salmon	1002	12
South Salmon	1003	21
	Total	**155**

[1] Amount per watershed estimated based on area-weighting and estimated need.

Issues, Projected Demands and Opportunities

Water from Forest streams and lakes will continue to be needed to meet the demand for municipal and rural domestic needs. In portions of Scott Valley, Shasta and Butte Valleys, water demand may exceed the resource availability. In these areas, agricultural uses may compete with instream uses for limited water supply during normal and especially during drought years.

The opportunity to develop hydroelectric power is high. The high costs of getting the power to a market may limit its development.

Water quality demands for municipal and domestic needs will remain high.

Good water quality, including adequate quantities to support aquatic-dependant organisms including fish and amphibians, will continue to be both a demand and an opportunity. Greater consideration will be given to water quality relating to the entire aquatic ecosystem rather than just fish species needs.

The demand for Forest-based commodities will continue at a high level. Road construction and landings accessing timber harvest areas, grazing and mineral development projects may continue to produce sediment.

Agricultural runoff will decrease slightly due to recent groundwater legislation and enactment of stricter waste discharge controls.

Federal, State and Forest Service water quality management direction will continue to be implemented. BMP implementation will improve as technology improves.

Riparian area issues will intensify, due to high National interest in water quality and Threatened and Endangered (T&E) species.

Air

Description

Air quality on the Forest is very good. Currently, the Forest meets all National Ambient Air Quality Standards. These standards are set by the EPA to establish the maximum concentrations for pollutants. Air quality standards are regulated by the California Air Resources Board and the Oregon State Smoke Management Plan. Compliance is accomplished through coordination with the Siskiyou County Air Pollution Control District or with the Oregon State Department of Forestry prior to activities that could affect air quality.

To ensure compliance, the Forest adopts mitigations for projects that create particulate matter. Burn Plans are prepared for all prescribed fires, reviewed by the California Air Resources Board and copies filed with the Siskiyou County Air Pollution Control District. The burn plans consider smoke-sensitive areas, atmospheric conditions, best available technology and are designed to comply with air quality regulations.

The Federal Clean Air Act establishes air quality classifications. The Forest has one Class I area, the Marble Mountain Wilderness, and is next to another, the Lava Beds National Monument. Protection of air quality-related values through non-degradation is required in Class I areas. The rest of the Forest, including the other wilderness areas, are identified as Class II areas and have less stringent requirements.

The Clean Air Act establishes a program for the prevention of significant deterioration of air quality. The objective is to prevent areas with clean air from becoming too polluted. The program requires that proposals

for construction and other activities be reviewed and a permit issued by the authorized permitting agency.

Issues, Projected Demands and Opportunities

Clean air, relatively free of chemical pollutants and suspended particulate matter (PM-10), was identified as an important issue. Smoke management was identified as a major factor in retaining air quality.

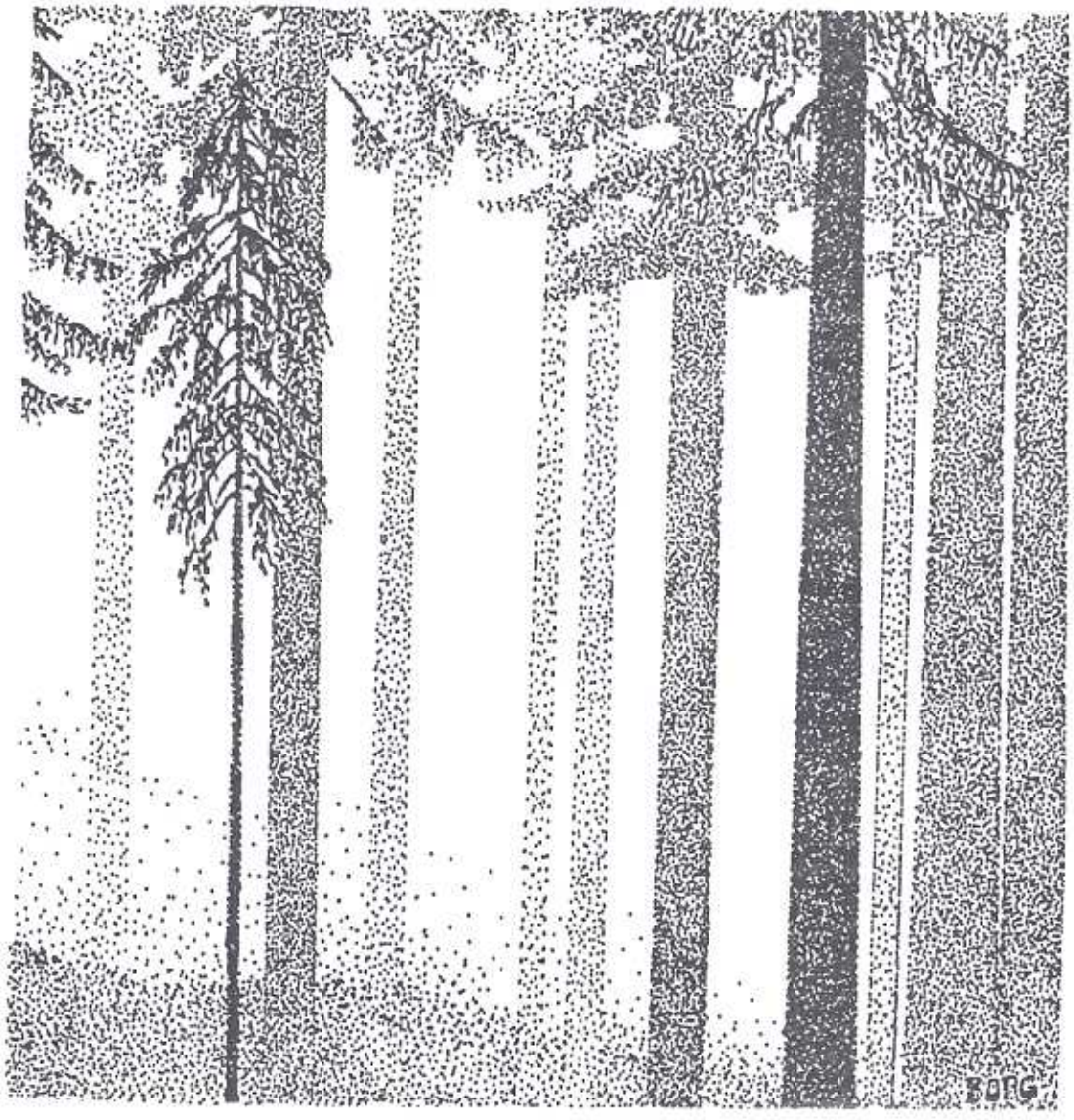
The Forest's air quality is high, compared to most other National Forests in the Nation that are next to large population centers, industrial complexes or large agricultural areas. Forest Service monitoring for the 1990 season showed air quality in the Marble Mountain Wilderness to be in the top 25% of the 42 stations monitored Nation-wide. Air quality in the Marble Mountain Wilderness was significantly better than forests in the eastern half of the United States.

Siskiyou County rates as a non-attainment area for the State standard for PM-10. This is because the only monitoring station for this purpose is located in Yreka, where there is some industry as well as a lot of residential and agricultural burning.

Forest monitoring of visibility, the effects of acid rain in lakes and of lichens has been ongoing within the Marble Mountain Class I area for a number of years. Compilation of the results is in the draft stage. Opportunities are available to expand this monitoring program and, with it, a knowledge of air pollution.

Air quality-related values have been described for the Marble Mountain Wilderness Class I area. There is an opportunity to incorporate these values in the Forest's coordination with other agencies for the protection of air quality.

There is an opportunity to apply for funds to monitor asbestos emissions from roads and trails in asbestos-bearing rock.



Biological Environment

Biological Diversity

Description

Biological diversity, sometimes called biodiversity, is the variety of living things in an area and the ecological processes in which they function as a system. Biological diversity is not viewed in the context of a single resource. It is viewed as the interaction of environmental components, modified by ecological processes, under highly variable conditions.

These interactions and processes result in daily changes to the environment. Most of the changes are not visible unless viewed over many decades. In other cases, where catastrophic events such as fire have occurred, changes are more evident. These changes are continually affecting the mix of resources present, the environmental components present, and the ecological processes that shape the environment.

Ecological systems do not remain static. Historically, these systems have been affected by wide ranging environmental conditions, such as varying weather patterns, site conditions, cumulative and local impacts. Changes in the vegetative and animal diversity of the Forest may be described in terms of resource interactions and ecological processes.

Understanding and assessing biological diversity is important in forest planning for several reasons. A forest that is healthy, resilient, productive and versatile over the long-term is one that will support a wide variety of living things and communities. Mixtures of different plants and animals on land and in the water, living in groups of various sizes and ages, may also be more capable of supplying the needed commodities and desired elements from NFS lands. The National Forest Management Act of 1976 (NFMA) requires the management of National Forests to "provide for the diversity of plant and animal species based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives...."

The Forest is largely within the Klamath Mountains geographic province. This area is at the junction of the Coast Ranges, the Cascade Range and the Sacramento Valley. Therefore, it contains parts of the biological diversity of each of these regions. The eastside of the Forest is part of the Cascades and Great Basin Regions, adding much to the geologic and biological diversity of the Forest (refer to the Geology Section earlier in this chapter).

Most landscapes (groups of small watersheds) within the Forest contain complex vegetation patterns and an unusually rich and varied flora. The geologic age and variety of rock types, the resulting topography, soils, localized climates and the region's central location along the Pacific coast are all factors that contribute to this diversity. Environmental factors, such as landslides, floods, insect epidemics and most importantly fire, shape the patterns of vegetation on a more short-term scale.

A large percentage of the Forest can be generally described as a mixed conifer type forest. The most common plant communities at mid-elevations are of a mixture of Douglas-fir, pine, true fir and hardwoods. This mixture depends upon elevation, aspect and other variables. Some plant communities are unique to the region. Some areas contain an unusually large number of conifer species. There are also stands dominated by Brewer spruce, a species known only in the Klamath Mountains.

Climatic changes and weather trends have affected the mixture of vegetative types on the Forest. Some data indicates that the ponderosa pine type historically occupied more areas than it does today. This type has been replaced by the mixed conifer type.

Early in the last century, the Forest has experienced cooler, moister conditions. This resulted in lower fire intensities and changes in the mixture of seral stages and species composition. Drier periods, like the current one, create conditions that allow increased fire intensities.

Human influences have also influenced the ecology of the Forest. Over the previous century, management activities (such as prescribed fire, the exclusion of fire through wildfire control efforts, and logging) have had important influences on vegetative stand, landscape characteristics and aquatic conditions. Frequent burning by Native Americans before European settlement also shaped the patterns and composition of vegetative stands which, in turn, affected streams.

Many activities have influenced and shaped the structure and ecology of the Forest. Some of these activities are mining, dams, stream channel modifications, introduction of desirable and non-desirable plants, railroad and road construction.

The term "natural" is sometimes used to describe a desired ecological condition. A natural ecologic condition may be unknown on the Forest if this is meant to imply a situation free from human influences. Natural conditions imply a point in time that is somehow preferable to another point in time. To assume that a

single point in the past is the desired condition of a dynamic and continually changing ecosystem may be overly simplistic. In fact, many ecological conditions may be desirable to meet a variety of needs.

Elements of Biological Diversity

Elements of biological diversity are important at the regional (Klamath Mountain Geographic Province), landscape and stand levels. Genetic diversity, species diversity, and community diversity are important at all scales. A biologically diverse forest is one that has viable mixtures of plant and animal species and operates within the range of variability associated with ecological processes.

Managing for ecosystem diversity involves maintaining micro-habitats for some species, large blocks of habitat for other species and quality riparian and aquatic habitat for others. Research indicates that greater habitat diversity allows for greater species diversity (Harris, 1984).

Large genetic diversity in a species assures that a wide array of traits are available, enabling the population to adapt to changes in its environment over time. This is the ultimate requirement for survival. To maintain genetic diversity generally requires a population size large enough for the species to breed within and between populations. Where habitat availability is a limiting factor, the maintenance or improvement of habitat requirements are intended to assure that no species require listing under the Endangered Species Act (ESA).

The measurable aspects of biological diversity have been divided into 3 primary areas. They include 1) compositional elements, 2) structural elements and 3) functional elements. Within each of these overall areas, there are criteria that may be used to determine changes in the diversity of an area. Primarily terrestrial elements are addressed in this section. A more thorough discussion of aquatic elements can be found under the Riparian Management and Fisheries sections.

Compositional Elements of Biological Diversity

Vegetation Types

An unusually diverse mixture of vegetation is found on the Forest. Climate, soil, geography and seed source availability determine the potential type of vegetation occurring within an area.

Vegetation types range from open, dry ponderosa pine forests in the southern Cascade range to high elevation mixtures of more than 15 conifer species near Russian Peak, to grasslands on the eastside of the Forest.

A Forest-wide ecosystem classification is currently in progress. Until it is completed, the Timber Inventory, updated in 1989, provides much useful information. While a great deal of information on tree species size and condition was inventoried, information on stand structural attributes such as snags and hardwoods was also collected.

The Timber Inventory divides forest land into the following vegetative groups: Ponderosa Pine (99,000 acres), Eastside Mixed Conifer (104,000 acres), Westside Mixed Conifer (721,000 acres), Douglas-fir (337,000 acres), Lodgepole Pine (15,000 acres), Eastside True Fir (27,000 acres), Westside True Fir (87,000 acres), and Hardwoods (14,000 acres). These types are discussed below under Seral Stages. The other 276,000 acres of the Forest supporting non-forest vegetation or non-commercial trees is discussed under Rangeland Types.

Seral Stages

The vegetative attributes within stands change over time. Similar attributes and conditions at a given point in time can be grouped by seral stages, also known as successional stages. Seral stages are developmental stages of a plant community in an ecological succession.

The grouping of vegetation into seral stages helps provide a predictable pattern to the environment. However, there is a great deal of variation in the attributes (such as age, structure and composition) for each seral stage. The relative abundance of various seral stages contributes to the diversity of the forest.

Woodlands, riparian vegetation, wetlands, minor conifer species and other vegetative attributes and communities may exist as inclusions within the primary vegetative types, if less than 10 acres in size. Some brush and grass types are included in the early seral stage for each forest type.

Seral stage information is available only for land capable of producing commercial timber, about 1,390,000 acres. This is the best information currently available.

Weather trends and physical events, such as fire, often influence stand attributes and seral stage progression. In some cases, fire has totally replaced a late-seral stage forested area with an early grass and forb dominated-seral stage. In other cases, fire has left certain stands attributes that allow the stand to main-

tain ecological processes typically found in a mid-seral stage.

Management activity influences can be similar to fire's influences on seral stages. The vegetation on about 179,000 acres, 11% of the Forest, has been manipulated to provide wood fiber outputs, salvage fire-damaged trees or improve vegetative conditions for specific resources. Past management practices have been variable in design and implementation, although management practices were generally designed to produce wood fiber outputs. Some of these areas are in an early seral stage. Others are in mid-seral stages.

Planting conifers and performing routine stand maintenance after regeneration harvesting tends to establish trees much faster than depending on natural regeneration. Artificial regeneration can reduce the brush component of the seral stage and shorten the length of time early seral stage vegetation is present on a site.

A description of the current seral stages in the Forest follows (refer to the Seral Stage Map included in the map packet). Table 3-6 provides definitions of the acronyms used.

Grass/Forb - Seral Stage 1

The grass/forb seral stage is found scattered throughout the Forest. Grasses and forbs are the primary vegetation with scattered tree and brush seedlings.

This seral stage occurs: (1) where vegetative manipulations have removed most or all of the vegetation (regeneration cuts, type conversions, brush rehabilitation), (2) where most or all of the vegetation has died, and (3) where a "stand-replacing" fire has removed most or all of the vegetation. The timber inventory identified these areas as "XX," "GX," "BA" and plantations "p1." Currently there are 190,000 acres (11% of the Forest; 14% of total seral stage acres) of Seral Stage 1.

Shrub/Seedling/Chaparral - Seral Stage 2

This seral stage occurs as openings within the forest and woodland types. The vegetation is seedling to sapling size trees and young vigorous brush species. The timber inventory identified these areas as "D1N," "D1G," "M1N," "M1G," "P1N," "P1G," "SX" and plantations "p2" and "p3." Currently, there are 43,000 acres (3% of the Forest; 3% of total seral stage acres) of Seral Stage 2.

Pole Size Trees - Seral Stage 3A (Sparse Canopy)

The 3A seral stage consists primarily of pole size trees with sparse canopies (less than 40%). These areas generally support a large shrub and grass or forb component. The timber inventory identified these areas as "D2S," "D2P," "M2S," "M2P," "P2S," "P2P," "F2S," "F2P" and "LQ." Currently there are 432,000 acres (26% of the Forest; 31% of total seral stage acres) of Seral Stage 3A.

Pole Size Trees - Seral Stage 3BC (Dense Canopy)

The 3BC seral stage consists primarily of pole size trees with canopies generally denser than 40% crown closure. Understory vegetation is generally sparse. The timber inventory included timber types "D2N," "D2G," "M2N," "M2G," "P2N," "P2G," "F2N," "F2G," "HXX" and "WQ." Currently there are 296,000 acres (18% of the Forest; 21% of total seral stage acres) of Seral Stage 3BC.

Medium/Large Trees - Seral Stage 4A (Sparse Canopy)

The 4A seral stage is primarily made up of medium to large size trees with a sparse overstory (less than 40% canopy closure) and may support a secondary canopy of hardwoods or shrubs.

Some of the timber types used to define this seral stage overlap with similar types found in the 4BC seral stages. Also, some timber types are split between seral stages, based on the level of hardwood component that makes up the secondary canopy layer. The timber inventory included timber types "D3S," "D3P," "D4P," "D4S," "M3S," "M3P," "M4P," "M4S," "P3S," "P3P," "P4P," "P4S," "F3S," "F3P," "F4P" and "F4S." Currently there are 203,000 acres (12% of the Forest; 15% of total seral stage acres) of Seral Stage 4A.

Medium/Large Trees - Seral Stage 4BC (Dense Canopy)

The 4BC seral stage is primarily made up of medium to large size trees with dense canopies (more than 40% canopy closure). Secondary canopies of hardwoods or shrubs may be present.

The timber inventory included timber types "D3N," "D3G," "D4S," "D4P," "D4N," "D4G," "M3N," "M3G," "M4N," "M4G," "P3N," "P3G," "P4N," "P4G," "F3N," "F3G," "F4N," "F4G" and "CH." Some of the timber types defining this seral stage are split between seral stages, based on the level of hardwood component that makes up the secondary canopy layer. Currently

there are 29,000 acres (2% of the Forest; 1% of total seral stage acres) of Seral Stage 4BC.

Large Trees - Seral Stage 5C and older (Dense Canopy, Stand Shows Decadence)

The 5C seral stage is primarily made up of large trees with dense canopies (more than 40% canopy closure). Secondary canopies of hardwoods or shrubs are sometimes present.

The timber inventory included timber types "D4S," "D4P," "D4G," "M4G," "P4G" and "F4G." Some of the 4 diameter timber types used to define this seral stage have been split between seral stages based on the level of hardwood component that makes up the secondary canopy layer. Currently there are 197,000 acres (12% of the Forest; 14% of total seral stage acres) of Seral Stage 5C.

Table 3-6. Definitions of Acronyms

Acronym	Definition
Vegetation codes	
D (or DF)	Douglas-fir
M	Mixed conifer
P	Eastside pine
F	True fir
LO	Liveoak
WQ	Oregon white oak
CH	Chinquapin
XX	Clearcuts, not yet regenerated
GX	Grass and herbaceous cover
SX	Misc. shrubs
HXX	Hardwoods
BA	Barren areas
Size class	
1	Seedling and sapling size (less than 6 inches DBH)
2	Pole size (between 6 and 11 inches DBH)
3	Small saw timber (between 11 and 25 inches DBH)
4	Medium saw timber (between 25 and 40 inches DBH)
Density	
S	Less than 20% crown closure and sparse density rating
P	Between 20 and 39% crown closure and poor density rating
N	Between 40 and 69% crown closure and not adequate density rating
G	Greater than 70% crown closure and good density rating
Plantations	
p0	Less than 10 years old
p1	Between 10 and 20 years old
p2	Between 20 and 30 years old
p3	Between 30 and 40 years old

Rangeland Types

The Society for Range Management has recently identified rangeland cover types throughout the nation (Shiflet 1994). Until the Forest-wide ecological classification system is completed, these broad categories provide a good idea of the general categories for other types found on the Forest. Acreage estimates for rangeland types will be available once the Forest-wide ecological classification and inventory project is completed. A discussion of meadow/riparian types found in wilderness can be found in the Range Management section of this chapter.

Western Juniper/ Big Sagebrush/ Bluebunch Wheatgrass are the dominant species of this cover type. Generally more than 80% of the conifer basal area is western juniper. Ponderosa and Jeffrey pine can also be found in minor amounts. Individual communities include a variety of understory brush species such as sagebrush, rabbitbrush and bitterbrush. A variety of grass species is also common. Found on all exposures and topography, the type is usually characterized by semi-arid sites. The cover type is currently expanding probably due to fire exclusion and grazing which reduces competing species.

Riparian Woodlands occur along rivers, streams and creeks. Species composition and structure varies, but is dominated by hardwoods. The dominant species are willow, cottonwood, alder, maple, ash and oak. Vines, shrubs and herbs are common in the understory. In areas with less than 20 inches average annual rainfall, the Riparian Woodland is often the only tree cover. In

areas with higher rainfall, the margins grade into adjacent forest types.

Scrub Oak Mixed Chaparral is dominated by scrub or interior live oak (30 to 100% cover) with a wide variety of associated shrubs and woody vines. Seral stages from 10 to 60 years usually have a high proportion of ceanothus, particularly following fire. As ceanothus declines, longer lived species increase. This type is found primarily in the lower elevations on shallow to moderately deep soils in areas of moderate rainfall. Fire occurrence is frequent and generally causes significant changes in species composition.

Ceanothus Mixed Chaparral is dominated by ceanothus species and can contain a variety of other shrubs and herbs. It occurs on moderately deep to deep soils or on shallow soils on slightly moister sites than those supporting scrub oak mixed chaparral. As stands mature, ceanothus dies out leaving openings supporting herbs. Moderate to long interval fires tend to maintain the type, while frequent fires allow herbs to become established.

Montane Shrubland is dominated by ceanothus species, manzanita species, huckleberry oak or other evergreen shrubs. Understory vegetation is largely absent. Sparse stands or scattered conifer and oak trees may be present. It occurs on shallow to deep soils from mid to high elevations on all exposures. It can dominate on drier sites. It is found locally throughout coniferous forests. Occurrence can be due to soil type or the community may become established after disturbance such as fire, logging or erosion. Shade tolerant tree species such as red fir may come up underneath the shrub overstory. The type is fire adapted. Too frequent fires can favor sprouting shrubs and eliminate seed-dependent species. Foraging on sprouting shrubs can affect structure and ultimately composition. Following fire, herbaceous plants may dominate for up to 5 years.

Bitterbrush is the dominant species in association with big sagebrush, rabbitbrush and other shrub species. Overstory species may include ponderosa pine, Jeffrey pine, lodgepole pine and western juniper. Understory herbs and grasses generally make up less than 10% cover. The type is found on flats and slopes with deep, well-drained soils at most elevations above 3,000 feet. It occurs primarily on the eastside of the Forest, although the type can also be found on the eastern portion of the Oak Knoll and Scott River Ranger Districts. Stands tend to be even-age resulting from fire or other disturbances. The type supports many wildlife species such as deer and pronghorn as well as livestock.

Montane Meadows are primarily grass and grasslike species including sedges and rushes. These areas are rich in species diversity. Meadows are characterized as wet or dry and are associated with a high water table during all or part of the year. They vary in size and shape. Meadows along watercourses are often associated with willows and other aquatic species. They may be surrounded by and interspersed with various forest types. They are relatively stable. Disturbance such as road-building, timber harvesting and severe grazing generally causes a change in water regime.

Alpine Grassland generally includes wet and dry meadows above timberline. Shallow soils produce little biomass. Soils are often talus, cliffs or rocky moraines. Grazing is potentially the primary disturbance.

Wetlands are characterized by frequent flooding and plants which can live in partially submerged conditions part or all of the year. Changes in vegetation types often occur along contours or are due to changes in water levels. These ecosystems are relatively stable in the short-term, although changes do occur over long periods of time.

Community and Species Diversity

Certain groups of plants and animals are commonly found in association with specific vegetative types and seral stages on land and with specific stream or lake conditions in the water. Refer to Habitat Conditions in the Fisheries section for a discussion of elements important for aquatic community and species diversity.

On land, pioneer species that need open habitats are associated with early seral stages for most cover types. These may be replaced by different species as the stand matures. Often structural remnants of previous seral stages remain on the site, providing microhabitats for plants and animals. These remnants may include snags, coarse woody debris (CWD), etc.

Species diversity generally tends to increase during the early seral stages of forest and shrub types until the plants form a closed canopy. When this occurs, many understory plant species are shaded out. Species diversity tends to decrease at intermediate seral stages. As tree stands mature, a more complex structure develops. This results in more niches becoming available for plant and animal species. Generally, the species richness (the number of different species in a given area) increases again during the later seral stages for forest types. Species diversity is also generally higher in more complex stands and communities.

Management activities can alter the diversity of plants or the number of micro-habitats in an area. Using

prescribed fires to prepare sites for reforestation or to improve browse production can reduce species diversity in some cases. However, creating openings can also provide opportunities for invading or adjacent species to become established. These invaders, in addition to the planted species, can maintain or increase the diversity on the site.

At the forest level, species diversity is at its greatest when the maximum number of different habitats are available and the species are able to make use of the habitats.

The abundance and distribution of vegetative types, vegetative attributes and micro-habitat conditions affect the abundance and distribution of wildlife and aquatic species. Maintaining vegetative diversity throughout the Forest will help maintain diverse wildlife and aquatic populations.

Species viability is an important component of biological diversity. To maintain viable populations of plant and animal species designated T&E (USFWS), or as Sensitive (Forest Service designation), the Forest has identified suitable habitat and is managing it specifically for those species. Table 3-7 displays the acres for each species. Acres suitable for one species may also be suitable for others. Acres may be double-counted in Table 3-7.

Table 3-7. Acres of Suitable Habitat for TE&S Species on the Forest

Species	Acres
Bald eagle (Endangered)	7,200
Peregrine falcon (Endangered)	6,300
Northern spotted owl (Threatened)	429,000
Northern goshawk (Sensitive)	14,400
Phacelia cookeri (Sensitive)	13,000
Calochortus persistens (Sensitive)	100

These areas, as well as other areas on the Forest having compatible vegetative or habitat objectives, have been established to meet the Forest's habitat requirements to maintain viable populations of these species. Stream systems important to maintaining viable aquatic species have also been identified. Habitat that supports other Threatened, Endangered, Sensitive (TE&S) or unique species found on the Forest are currently being managed on a site-specific basis. There are 34 species of Sensitive plants on the Forest. There are 7 species of animals and 2 species of fish that are Federally listed as TE&S.

Genetic Diversity

Maintaining long-term viability of all aquatic and terrestrial species, which includes having healthy and vigorous populations, depends partly on having adequate genetic variability within and between populations. The size of populations and their relative distribution will affect their ability to respond to catastrophic or environmental change.

The Forest is currently managing reforestation efforts, including management of the vegetation for genetic improvements, as directed by the Tree Improvement Master Plan for the California Region and individual conifer management plans (for example, Port-Orford-cedar). Management guides that address the viability of several Sensitive plant species, such as *Calochortus persistens*, have also been developed.

Structural Components of Biological Diversity

Stand and Community Structure

Forest stands and communities contain a variety of structural elements. These elements include such things as size and density of vegetation; the number, size and type of snags; the hardwood component; and CWD on the forest floor. These features vary greatly, depending on the frequency and intensity of fires, the vegetation that occupied the site before the fire, the occurrence of disturbance, or past management activities. Variations in horizontal and vertical structure provide a diversity of habitats for species.

Information on these attributes for the Forest shows a great deal of variability. The 1989 Timber Inventory, and work by Jimerson (1990) and Smith (1990), have provided some information.

Vegetation Sizes and Canopy Closure

Table 3-8 summarizes the vegetative size classes and densities on the Forest.

Snags

Snags have been determined to be an important habitat requirement for many species. Table 3-9 shows the snag levels estimated for the Forest using the 1989 Forest Timber Inventory.

Table 3-8. Acres of Vegetative Types by Size Class and Canopy Closure*								
Vegetation Type	4G	4P	3G	3P	p3	p2	p1	NS
Douglas-fir	59,500	94,700	52,900	65,900	4,600	7,000	24,900	27,400
Eastside mixed conifer	3,100	0	38,200	50,400	1,000	2,400	5,800	3,300
Westside mixed conifer	119,700	92,600	176,800	174,000	25,600	25,100	58,800	48,200
Eastside true fir	2,900	1,800	10,200	8,800	400	1,200	1,400	0
Westside true fir	10,800	14,500	18,800	39,400	1,100	0	600	1,400
Ponderosa pine	0	0	13,600	58,700	2,500	6,700	9,900	8,200
Lodgepole Pine and Hardwood Acres - 14,600 and 14,800 respectively. (No data available on size and density.)								
* Refer to Table 3-6 for definitions of these acronyms.								

Table 3-9. Estimated Snags Per Acre on the Forest by Size Class.					
Size of Snag (inches)	11 - 15	15 - 20	21 - 28	28 or greater	Total
Estimate of Snags per Acre	0.66-1.0	0.28-0.42	0.50-0.80	0.40-0.70	1.9-3.8

The inventory was not designed to measure snag densities on the Forest statistically. It does not account for snags in existing plantations or those within burned areas. These estimates assume inaccurately that no snags are left within plantations. Snag densities within burned areas are assumed to be the same as those within the general forest which is not correct. Based on these factors, the snag estimates are probably low and should be used as approximations only. There is no other information currently available that would apply Forest-wide.

Snag densities are also quite variable by vegetative type and location of the vegetation. Specific inventories on "old growth" Douglas-fir, true fir and ponderosa pine types indicate that snag densities may actually be greater than depicted above in the later seral stages. Forest-wide inventories, now underway, will provide additional data on the amounts of snags, CWD and ground vegetation occurring on the Forest.

Hardwood Component

Hardwoods are a major vegetative component in many forest and rangeland types. The presence of hardwoods within an area varies from little or no presence in the ponderosa pine types found on the eastside of the Forest, to about 35% by basal area of the Douglas-fir (D3P) type on the westside of the Forest. In general, the poorer stocked, more open canopy conifer stands support more hardwood species. In the denser canopied conifer areas, the hardwoods have been shaded out by the conifer species.

Stands classified as hardwoods contain more than 40% hardwood species by basal area. There are about 14,800 acres of hardwoods on the Forest.

Coarse Woody Debris Component

CWD is dead or decomposing vegetative material lying on the ground. Information on the amount of CWD on the Forest is scarce. Information from Smith (ponderosa pine) and Jimerson (Douglas-fir, true fir) indicate that 0 - 4 pieces of CWD (20 inches DBH and 20 feet long) may be common in the later seral stages of ponderosa pine. In the later seral stages of Douglas-fir, 9 - 13 pieces of CWD (20 inches DBH and 10 feet long) may be common. The level of CWD is quite variable, especially within later seral stages. Past fire history and occurrences, vegetative canopy and aspect all contribute to the levels of CWD found on a site.

Landscape Vegetative Patterns

Horizontal forest structure, or the vegetative patterns making up a landscape, influence the overall stability and diversity of habitats occupied by plant and animal species.

Vegetation Patterns (Shapes and Sizes)

The size, shape and distribution of vegetative patches determine their function in the overall vegetative mosaic. Patch size can be particularly important to the functioning of forested vegetation as habitat for some wildlife species. This is especially true for those species requiring special, or homogeneous habitat.

Patch size is quite variable. They range from less than an acre to over 1,000 acres on the Forest. This is due to the complexity of geology, soils, topographic features and disturbance (fire) regimes on the Forest. Patch shape tends to be more linear than broad, as many vegetative stands follow patterns along drainages, ridges or geologic features, or along historic burned areas.

Table 3-10. Shape and Size of Vegetative Stands by Seral Stage

Seral Stage	Number of Polygons	Average Acres	Shape Index
Seral Stage 1	1,487	33	0.51
Seral Stage 2	4,856	59	0.45
Seral Stage 3A	5,477	102	0.39
Seral Stage 3BC	6,524	53	0.40
Seral Stage 4A	3,373	69	0.38
Seral Stage 4BC	2,843	45	0.38
Seral Stage 5C and older	1,749	50	0.39

Table 3-10 was prepared from information collected during the 1989 Timber Inventory. The mapped timber types were divided into individual polygons, or vegetative stands. The number of polygons represents the number of individually mapped areas that fell into each seral stage. The acres of each polygon were then determined, as was the shape of the vegetative stand. The shape index is a comparison of the area to perimeter ratio of a polygon with that of a circle. A circle has a shape index of 1.0

The average patch size for late-seral stages on the Forest is between 45 and 50 acres, with a shape index of 0.39. Areas harvested for wood fiber outputs are generally more circular in shape and smaller in size than those which have had little or no human influence.

Fire has a profound effect on the mosaic of the landscape pattern in managed and unmanaged areas. This is due to different burn intensities having different effects on the vegetation.

Over the last 100 years, the objective has been to suppress all fires. This resulted in heavy fuel loadings and vegetative patterns that differ from the vegetative patterns prior to fire suppression.

Examples of these differences include the creation of secondary canopies of white fir within mixed conifer areas, changes to the understory within ponderosa pine stands, and the increase in the densities of conifers within ponderosa pine and mixed conifer vegetation types. Another example is the trend toward larger units of younger seral stages. These are partially a result of fuel build-ups, resulting in larger areas. Lower intensity fires crept through the Forest without completely replacing the vegetation on the site.

As a low intensity fire creeps along a slope burning close to the ground, it occasionally will burn into the stand crown, increasing in intensity and killing the overstory. Fire determines the shape and size of the new stand.

A recent study shows that the average opening size has decreased in areas with little or no management activity over the last 40 years, likely due to fire suppression (Skinner, 1994).

"Old Growth"

Several definitions have been developed to describe "old growth" forests in the Pacific Northwest, coastal northern California, northeastern California and elsewhere in the Nation (Jimerson, et. al., 1991). These definitions vary in how well they represent the forest types on the Forest. For example, Douglas-fir in the wetter areas of California and Oregon look and function differently, in many respects, than Douglas-fir types on the Forest.

"Old growth" forests are ecosystems, distinguished by old trees and a number of related stand characteristics. "Old growth" refers to the later seral stages of vegetation, where a stand has produced the largest amount of total volume and largest tree size possible for that site. The dominant trees have begun to grow at a slower rate and there is little or no net annual growth on the site. Canopy openings, resulting from the death of overstory trees, allow patches of small trees, shrubs and herbaceous vegetation to become established in the understory. The dominant trees may be older than the average life expectancy for that species, given the site conditions and disturbance cycles (Jimerson and Fites, 1989). There are often special structural attributes, micro-climates and conditions associated with these areas.

Different descriptions of "old growth" have resulted in different numbers of acres and a different set of stands

being labeled as "old growth." A stand does not become "old growth" at a specific point in time. Therefore, many of the stands considered "old growth" by chronological age might not have all the "old growth" characteristics. Conversely, many other younger stands will have some "old growth" characteristics.

For this analysis, "old growth" is described in a general way, combining information from many published descriptions of "old growth." Until the completion of a definition specific to "old growth" on the Forest, the following attributes and working definition of "old growth" will be used to manage for "old growth" conditions:

1. Dominant trees are large for their species and site conditions.
   - can be measured by cover and density of overstory canopy.
2. Stand structure is complex.
   - diversity of tree sizes and spacing,
   - canopy gaps, patchiness of reproduction,
   - multiple canopy layers in some types, or where fire has been excluded.
3. Presence of more large, dead CWD than in younger stands.
   - large, tall snags present, and dying trees for future snags,
   - large logs on the ground.
4. Physical attributes of older trees.
   - decay in trunk or roots,
   - broken or deformed tops,
   - cavities in large trees.
5. Ecosystem function.
   - high amount of biomass within the stand,
   - complex energy flow, food web and nutrient cycling,
   - complex underground system of fungi and other microscopic organisms,
   - disease, insect and fire contribute to constant change within stand,
   - modified temperature, humidity and light,
   - system is not influenced by "edge" effects.

On the Forest, stands between 120 and 350 years old meet this definition of "old growth," depending on forest type and site class. "Old growth" stands may differ from younger aged stands in terms of tree size, accumulations of CWD, structural attributes and the ways in which the ecosystem functions. Rates of change in stand structure and composition are slower, and the mixture of species may be different in younger forests.

"Old growth" characteristics may be achieved through management following some human disturbances. Silvicultural techniques and objectives can enhance some existing stands for "old growth" values. Prescribed fire could create functioning "old growth" stands by thinning older stands and reducing fuel loading. This would also reduce the risks of losing "old growth" values to future catastrophic fire.

There are about 226,000 acres of conifer vegetation that can be described as "old growth." This acreage assumes that forest lands, classified as Seral Stages 4B, 4C and 5C, meet most of the criteria described above. About 16% of Forest lands that are capable of producing conifers meet the criteria for "old growth."

"Old growth" stands are found in areas where stand-replacing fires are less common. Such areas are moist north slopes, drainages and cool, damp, higher elevations. Stands that are over 150 years old originated under conditions not influenced by European settlers and miners. However, the influence of Native Americans has been present longer than any existing vegetative type.

Connectivity and Fragmentation

The typical approach to connectivity is that "most plant and animal species are distributed as collections of populations that are linked together by movement between individuals within the population" (Levins 1970). In the Klamath Mountains Province, these assumptions may not always apply due to the fragmentation that typically exists on the Forest. The connecting habitat may not meet all of the species habitat requirements. However, it must allow an individual animal to pass effectively through the area safely.

The "best" connective habitat is that closest to the habitat that meets all of the life requirements of a species. The ability to move into required habitats is especially critical for species with large home ranges (for example, cougar or fisher), or those having different seasonal requirements (for example, mule deer). For plants, the movement of pollen, seed (wind and water born) and seed carriers (birds and mammals) is necessary to maintain viable populations.

Many wildlife species frequently travel along stream courses and along ridge tops. Stream areas often have denser vegetative cover and increased supplies of food and water. Some travel primarily through openings. Others have been determined to disperse randomly (northern spotted owl).

Plant dispersal is frequently wind- or water-related, as seeds and pollen are washed or blown away from an area or carried by birds and animals. Other species are

more specific in the types of habitat they can or will move through and are more sensitive to barriers.

Current management activities provide many opportunities for the movement of plants and animals. Stream courses (200,000 acres of riparian areas) are managed for riparian-dependent species throughout the Forest. The condition of riparian areas on the Forest and their ability to meet these connectivity needs are quite variable.

Other management areas designed to promote such opportunities as Wild and Scenic river values, wilderness, Habitat Conservation Areas (HCAs), visual resource opportunities and T&E species habitat also provide habitat and conditions necessary to meet dispersal needs. This increases opportunities for plant and animal movement.

Each connection should be analyzed individually at the landscape or site scale. The required habitat, or vegetative structure, is the factor which must be considered to determine the usefulness of these areas as connections.

In addition to Forest land allocations, current management direction requires the Forest to "maintain a continuous vegetative cover" and maintain ecological diversity. These management prescriptions further provide opportunities for the movement of plants and animals across the Forest.

The location of vegetative stands within a landscape is also an important factor in the ability of species to move through an area. "Edges" created by sharp contrast in vegetation can function as barriers to some species. Rivers, geologic or soil patterns, elevational changes and steep topography are all natural factors that can decrease connectivity for plant and animal populations.

The high degree of endemism (species found on the Forest but nowhere else in the world) in this region is evidence that natural connectivity for some species on the Forest is low due to rivers, topography or other barriers. The complex vegetative mosaic on the Forest results in a fragmented landscape pattern (refer to the Seral Stage Map in the map packet).

Function of Forest Ecosystems

Seral Stage Changes

Wildfire is one of the most prominent processes on the Forest that alters and replaces forest stands. Wildfire frequency rates are very high. Low intensity wildfires have been shown to occur every 8 to 25 years. The average acreage burned by wildfire over the last 30 years is about 16,600 acres per year. Of these, 23% were moderate to high intensity stand-replacing fires.

Due to past fire suppression activities, fuel loadings appear to be accumulating. This could result in a higher percentage of stand-replacing fires in the future, as shown by recent fires in 1987 and 1994. This fire suppression activity has affected the historical burn patterns on the Forest.

The timber inventory and fire history information also reflects a relatively short turn-over rate for vegetation on the Forest. The average age of unmanaged sites for each vegetative type on the Forest are shown in Table 3-11.

Table 3-11. Average Age of Unmanaged Stands on the Forest

Species	Average Stand Age	Species	Average Stand Age
Douglas-fir		*Eastside Mixed Conifer*	
4G	185	4G	115
4P	180	3G	130
3G	140	3P	95
3P	190	*Westside Mixed Conifer*	
True Fir		4G	160
4G	155	4P	150
4P	160	3G	120
3G	155	3P	110
3P	175	*Ponderosa Pine*	
		3G	90
		3P	90

There are younger and older trees within any of these stands. The ages of the individual trees are quite variable. Some older trees have reached ages of about 450 years.

Nutrient Cycling

Wildfire also plays a critical role in cycling of nutrients and maintaining productivity of forest soils. Historically, frequent low intensity wildfires were common on the Forest. As CWD accumulates on forest floors and begin to decompose, fire consumes some of it, making organic material and nitrogen available. Fire prevention and suppression has altered this ecosystem function.

The rapid suppression of low intensity wildland fires has decreased the amount of organic material recycled into forest soils in the recent past. This may

affect site productivity in the future. Of the wildfires in the last 30 years on the Forest, about 64% of the acreage burned was at low intensities.

Broadcast burning after timber harvest puts some nutrients stored in organic material back into the soil, but much of it is removed during timber harvest. Site preparation techniques that emphasize piling and burning do not spread the recycled nutrients evenly over the site.

The amount of CWD, in some areas, may be high (such as moister, highly productive sites that produce high levels of biomass). These areas tend to have higher productivity as a result of more nutrients being recycled back into the soil, and also a higher level of moisture.

Certain species of plants have the ability to absorb nitrogen from the air and return it to the soil. These nitrogen-fixing plants (for example, ceanothus and alder) are usually associated with mycorrhizal fungi in the soil. They enhance the establishment, growth and survival of many forest plant associations.

Nutrient cycling is also important in aquatic ecosystems. Management practices and intense fires that remove vegetation along streams can reduce the amount of nutrients introduced to the stream system lowering stream productivity.

Species Diversity

Plantation management decreases the amount of early seral vegetation (for example, brush and grasses) through various reforestation and vegetative release techniques. These areas may contain fewer early seral species for a shorter time than would other stands. If stand development is artificially hastened, some species may not occur on the site.

Some harvesting techniques eliminate a large number of structural features from the site. This can result in less available habitat. Therefore, the number of different species that inhabit the site may be lower. Silvicultural prescriptions that involve leaving large trees, snags, hardwoods and logs can contribute to the development of more complex stands and greater subsequent species diversity.

The species diversity of aquatic and riparian communities is a product of natural processes and can be altered by human activities. The cumulative effects of human disturbance include simplified biological communities, increasing fragmentation and homogeneity of habitats as well as a reduction in the habitat elements which aid in post-disturbance ecosystem recovery (Sedell et.al., 1991).

Timber harvesting may affect the structure and composition of juvenile anadromous salmonid communities (Reeves et.al., 1991). The critically low population levels existing for several Klamath River anadromous fish stocks may be partially in response to declines of habitat diversity. If these fish stocks are lost, the diversity of the Klamath River fishery would be decreased.

Genetic Diversity

Maintenance of habitat diversity, with adequate numbers and spacing of populations of plants and animals, should provide adequate long-term genetic diversity. Genetic diversity of conifer trees, in particular, is directly influenced by timber management programs.

Timber harvest and reforestation techniques determine the genetic makeup of a managed forest through the seeds and seedlings selected for reforestation. Genetic diversity within a stand or over a larger landscape can be decreased or increased, depending upon seed sources and collection strategies.

Genetic conservation has an important role in conserving fish stocks. The genetic diversity of fish populations determines the ability of a species to adapt to changing conditions. The currently depressed levels of anadromous fish stocks limits their adaptability.

In principle, habitat and watershed restoration provides a means to rehabilitate depressed fish stocks, however, off-Forest activities also affect the success of restoration efforts.

Ecosystem Health

A healthy ecosystem is one in which stucture, composition and function ensure the maintenance of biological diversity, biotic integrity and ecological processes over time.

Fire, insect infestations and diseases are a part of functioning forest, rangeland and aquatic systems. They play an important role in shaping the vegetative diversity. Trees within a stand die and return the stand to an early seral stage in response to disturbances.

Dead trees become snags and logs that are important for fish and wildlife habitat (refer to the Fisheries and Wildlife sections later in this chapter). Decomposing wood of all sizes returns organic material to the soil and maintains soil cover (refer to the Soils section earlier in this chapter). Fire kills some vegetation, causes others to re-sprout, germinates seeds and may reduce decrease harmful insect populations.

Dense stands of vegetation have developed due to past fire suppression. The resulting stress on stands

from drought and competition for light and nutrients increases susceptibility to insect damage.

The quantity and quality of forest stands have been influenced by fire exclusion over the last several decades. Heavy accumulations of slash on the ground and dense understory vegetation resulting from fire exclusion, have resulted in stands facing increasingly high risks from fire and drought stress. Fires that might have otherwise been low intensity ground fires, now become more intense due to the denser understory vegetation. This dense understory creates a "fuel ladder" and allows fire to enter the crown of mature stands.

One of the effects of low to moderate intensity fires is a natural stand thinning process. Excluding fire from a stand prevents this thinning. This creates stress within the stand from increased competition for water and nutrients. This stress can increase susceptibility to insects, disease and fire. These and many other factors influence the amount and distribution of "old growth," and therefore the overall diversity mosaic of the Forest.

Refugia

Areas of contiguous habitat, or habitat attributes upon which some species depend, may serve as refuges for some species. These areas ideally contain large numbers of species or high concentrations of plants or animals from which populations can expand into other areas. This is the basis of the "refugia" concept.

Maintaining large reserves with inter-connecting dispersal routes is one way to maintain biological diversity. Other options to this strategy include managing small areas of "good or excellent habitat," and managing for "moderate habitat" around those areas.

By managing habitat this way, the surrounding moderate habitat provides a buffer, helping to maintain the high quality habitat. The surrounding habitat is even more beneficial if it is managed to maintain attributes that have similar characteristics to the excellent habitat. Threats to this management scheme may occur from fire, insect infestations and catastrophes.

The location and distribution of habitat areas, which accommodate the dispersal and maintenance of a species, also play a large role in assuring that the species requirements have been meet. These requirements may include the distance between the "islands" of habitat, the quality of the "island" habitat and the ability of the species being considered to withstand a catastrophic event. The appropriate distance required between islands varies by species. Threats to this management scheme also may occur from fire, insect infestations and catastrophes.

Due to the fragmented landscape resulting from the ecological processes occurring on the Forest (refer to the Connectivity and Fragmentation Section earlier in this section), there may be major modifications to the operation of the refugia concept in the Klamath Mountains. Refugias are applicable to terrestrial habitats in all seral stages as well as to aquatic habitat.

Issues, Profected Demands and Opportunities

Maintaining biological diversity means working towards conditions that provide a healthy, resilient, productive ecosystem in the long-term.

Ecology is a developing science with many unanswered concerns and varying opinions. The maintenance of biological diversity does not imply preservation, or "locking up," of NFS lands. To meet many ecosystem goals, strategies involving active management may best achieve desired future conditions. In other cases, less active approaches may be more appropriate. Continual change due to ecological processes should be accounted for in planning and implementing projects.

Biomass has been accumulating on the Forest for several years. As timber harvests are decreased and fires suppressed, additional biomass will accumulate.

Late-seral stages will be difficult to protect on the Forest. Wildfires burn at higher intensities due to the high accumulations of slash and multi-layered vegetative canopies.

Drying trends contribute to greater numbers of catastrophic, stand-replacing fires which may modify later seral stage habitat and affect the suitability for late-seral stage-dependent species. Management activities, such as thinning or underburning, may be necessary to prevent loss of habitat through future catastrophic wildfires.

The large, wild tracts of lands on the Forest may lend themselves to an assertive prescribed natural fire (PNF) and prescribed fire program. The reintroduction of fire into the ecosystem may reduce the high intensity fires that have been more predominant in recent history.

A diversity of management approaches may be a key to successful Forest management.

Basing management strategies on ecosystem and landscape approaches is gaining favor in scientific communities.

Riparian Management

Description

A riparian ecosystem is the transition between the aquatic ecosystem and the adjacent terrestrial ecosystem. It is identified by distinctive soil characteristics, vegetative communities and associated animal life found near perennial and intermittent streams, watercourses, wetlands, seeps, bogs, springs, wet meadows, ponds and lakes. The ecosystem exists because the water supplied is more than that available to the adjacent uplands, and is sufficient for the growth of water-loving vegetation, such as willows and alders.

About 196,000 acres of RMZs currently occur throughout the Forest. This acreage was approximated, based on acres of stream inner gorges in the Forest database.

There are about 28,000 acres of riparian vegetation and many ponds and lakes on the Forest. Most wet meadows occur at elevations between 3,500 and 6,000 feet and vary in size from 5 acres to more than 30 acres. Meadows are extremely rich in vegetation and contain a large number and variety of plant species. Ponds and lakes vary in size, from less than 1 acre to more than 20 acres.

Riparian-Dependent Resources: Riparian-dependent resources include aquatic and semi-aquatic invertebrate and vertebrate species, wildlife species, T&E species, Sensitive native plant species, water quality, visual quality and aesthetic riparian values.

Wildlife, water, fisheries and native plant species and communities are the primary dependent resources in riparian areas (refer to the Wildlife, Water, Fisheries and Sensitive Plant Sections in this chapter). Riparian areas provide habitat for more wildlife species than do other habitat types. At least 250 wildlife species use riparian areas for breeding, feeding and resting. In addition to food, cover and water, riparian areas generally provide wildlife species with cool microclimates, increased vertical and horizontal layering of vegetation, increased edge effect, travel lanes and connectors between habitat types.

The interface of riparian and other vegetation types contributes to the Forest biological diversity. The number of wildlife species using an area tends to increase as layering and variety of vegetation increase.

Riparian areas are also important to aquatic habitat (refer to the Fisheries and Water Sections in this chapter). Riparian vegetation provides shade for temperature control, maintains channel and bank stability and provides cover through roots and overhangs.

Downcutting through streambank erosion can lower water table levels, resulting in loss of riparian vegetation. In some areas, desirable non-native vegetation has been established. Both native and non-native vegetation can play a role in providing bank stability and temperature control.

CWD accumulates in the riparian areas. This material is important in dissipating stream energy, storing and routing sediment, depositing needed spawning gravels, scouring pools and providing for stream complexity and diversity.

CWD, such as downed trees and limbs, is also an important factor in whether sediment input affects channel stability and aquatic habitat. A stream lacking in CWD tends to be more uniformly broad and shallow, with fewer pools and spawning gravel accumulations. This stream is more prone to channel scour by flood flows. Riparian areas protect water quality by filtering sediment and providing vegetation needed to stabilize stream banks.

Other Riparian Uses: In addition to providing aquatic and wildlife habitats, riparian areas are also the focus of water-related recreation uses, such as fishing, hunting, camping and hiking.

Some riparian areas on this Forest are generally undisturbed. However, conditions of riparian areas vary based on impacts due to timber harvest, road construction, recreation, mining and livestock grazing.

Wildfire has a significant role in shaping existing riparian conditions. In some cases, wildfire has played a role in maintaining early seral stages in open meadows by preventing encroachment of conifers and maintaining water table levels.

Vegetation removed during an intense wildfire, as occurred in some areas after the 1987 wildfires, contributes to heavy sedimentation and impacts to beneficial uses downstream.

Grazing can be beneficial or detrimental to riparian health (refer to the Range Management Section later in this chapter).

The role of the floodplain in stream maintenance is to provide energy relief during high flows. This prevents channel scouring and loss of spawning gravels. The storage capacity and vegetation of the floodplain help to reduce the water's velocity by spreading the flow out over a large area. Reduced flows over a floodplain typically result in sediment deposits, which in turn increase the fertility of the floodplain.

Wetlands and RMZs are currently managed to provide for wildlife, fish, water and other riparian-dependent resources. Other management activities are permitted if riparian-dependent resources are not adversely affected.

Current management of RMZs is directed by many laws and policies, designed to protect the resource. Prominent ones are Executive Order (EO) 11988 on Floodplain Management and EO 11990 on Protection of Wetlands. Government agencies are directed to avoid adverse impacts on and to protect, preserve and enhance wetlands and floodplains. Rules implementing the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA) and NFMA in 36 CFR 219.13(e) require that special attention be given to riparian areas. No management practices are permitted that cause detrimental changes in water temperature or chemical composition, blockages of water courses and deposits of sediment which seriously and adversely affect water conditions or fish habitat.

Issues, Projected Demands and Opportunities

There is a need for comprehensive riparian area inventories, particularly in areas where there has been significant disturbance. Coordinated efforts between range, wildlife and watershed programs have occured to a limited extent in some areas on the Forest. They are successful examples which should be used on a larger scale.

Riparian area inventories have been incorporated into the range allotment management planning process, fish and watershed inventories. These inventories are critical in determining funding priorities. These inventories, and others in conjunction with project planning activities, need to be used to develop strategies for restoration and enhancement of key riparian areas.

Sensitive Plant Species

Description

The area within the Forest consists of complex vegetation patterns and an unusually rich and varied flora. Factors contributing to this diversity are the geologic age and variety of rock types, the resulting topography, soils, localized climates and the region's central location along the Pacific coast. As stated before, the Forest is largely within part of the Coast Range, Cascade Range and the Sacramento Valley, and contains parts of the biological diversity of these regions (refer to the Biological Diversity Section earlier in this chapter).

A variety of environmental conditions has allowed for a variety of plant communities. Species have slowly adapted over time to fit into specific niches in various habitats. Some species can only grow in wet meadows and depend on the quantity and quality of water flowing through the meadow for their continued existence. Other plants adapted to the chemistry or texture of a specific soil or rock type and will only grow where those conditions are present. Other species have specific requirements for shade or sun, or can only thrive when associated with another specific species of plant, animal or underground fungus. Many plant species have temperature tolerances which determine the elevations and aspects at which they can grow.

Many plant communities on the Forest, as elsewhere in California, are well adapted to or depend on the processes of fire. Some species need fire for seed dispersal and germination, while others respond to the physical environmental changes a fire creates (such as bare soil and ash or openings with few surviving plants to compete for moisture and sunlight).

Some of the habitat needs of plant species are so specific that a slight change in their environment can threaten their continued existence. Many species are tolerant of a wide range of conditions and are therefore more common or widespread than those with more specific requirements.

There are hundreds of combinations of ecological factors and environmental conditions that affect plants. These combinations are responsible for the diversity of species on this Forest. Ecological study of plant associations on the Forest is just beginning.

Many of the plant species found on the Forest have restricted distributions. The unique characteristics of the region are not duplicated in the adjacent Coast Range, Cascade Range, Sacramento Valley or Great Basin, or apparently anywhere else in the world.

The ancient geologic history has provided a long vegetative history as well. The evolution of new species can take thousands of years as plants adapt and re-adapt to changing conditions. Many plant species evolved in the Klamath Mountains and have never spread to other regions. Other species here were once more widespread, but are now found in only a few isolated spots in the Klamath Mountains.

It is believed that some species have become re-established in the Klamath region since the last glacial age (recently, in terms of the geologic age of the region). They are now slowly spreading their range

again. The Forest contains several plant species not found elsewhere in the world. Of the many species unique to our area, some are so rare that they require special management to ensure their continued existence.

The U.S. Fish and Wildlife Service (USFWS) monitors and prescribes management for Federally listed T&E plant and animal species. There are no plant species currently listed as T&E on the Forest.

On the Forest, 33 species of plants have been listed by the Regional Forester as Sensitive. Species are listed as Sensitive for a number of reasons, including natural rarity due to limited habitat, reproduction problems or threats by human activities. Occasionally Sensitive plants or their habitat can be threatened by Forest uses and management activities, such as timber harvest, reforestation, recreation, road construction, mining and livestock grazing activities.

The Sensitive plant species found on the Forest inhabit many different types of habitats. Nearly 40% require a specific soil chemistry and can only grow on serpentine or other ultramafic soils. About 15% are found growing only on rock outcrops, while 12% require streamside, riparian or meadow habitat conditions. Other specific habitat requirements for some species include 1) disturbed, "ashy," volcanic soil, 2) high elevation ridgetops and 3) openings in conifer forests. Some Sensitive species' habitat requirements are still not understood.

Most of these Sensitive species (about 88%) are found on the westside of the Forest in the Klamath and Siskiyou Mountains. The remaining 12% are associated with the eastside volcanic geology and soils typical of the Cascade Range. (Refer to Table 3-12.)

The number of populations or plants known to exist for each species varies. The range includes a species known from only one population in the world (*Calochortus persistens*). Other species, whose range includes scattered, small populations in 5 counties in northern California and southern Oregon (for example, *Sedum laxum var. flavidum* and *Lewisia cotyledon var. howellii*), occur. Also, other species appear to be quite common on the Forest, yet are endemic to this area and found nowhere else (*Trillium ovatum ssp. oettingeri*).

Table 3-12 lists the Sensitive plant species known on the Forest.

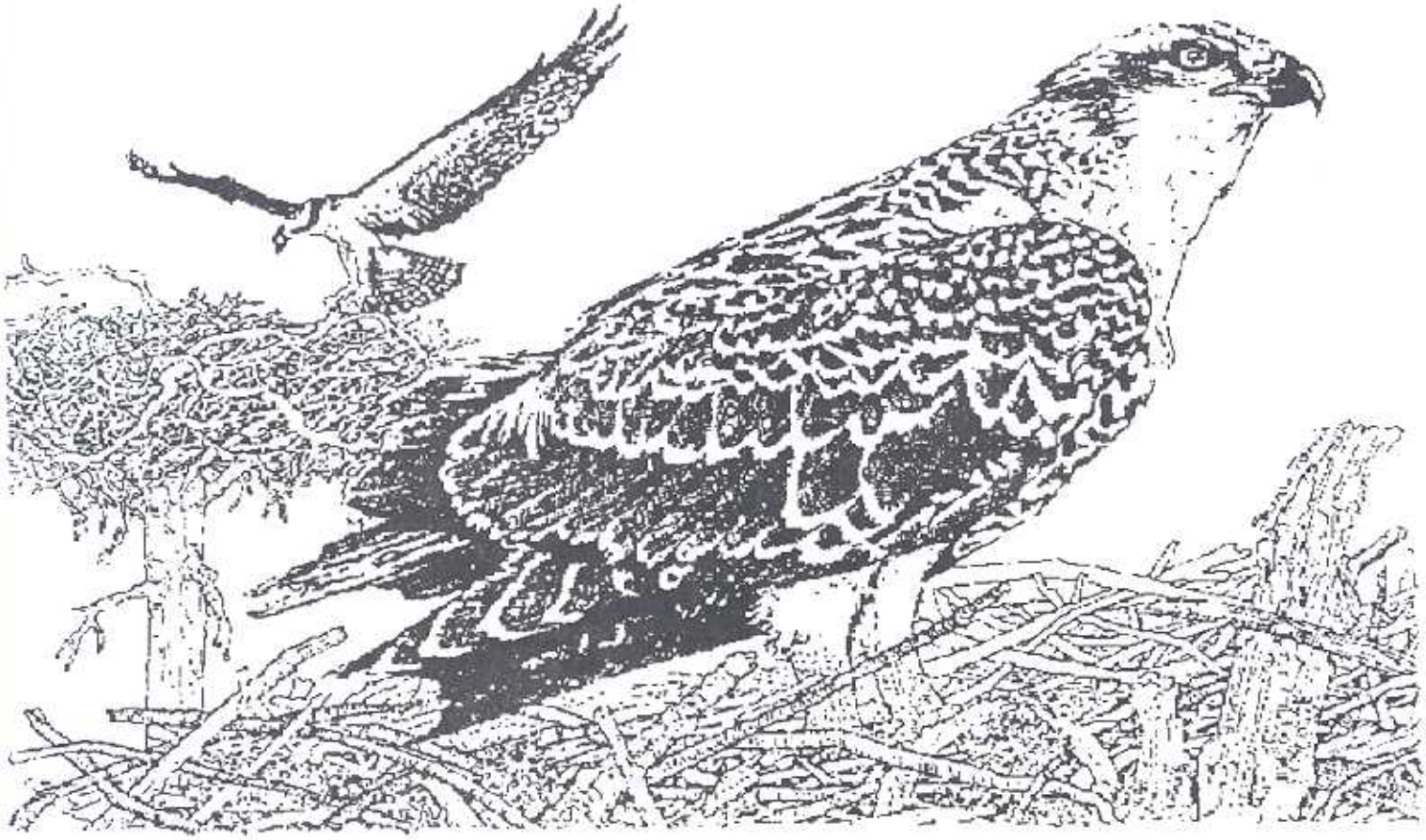


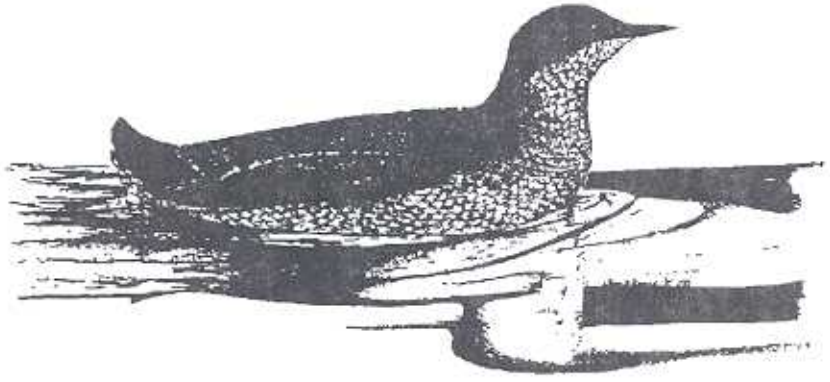
Table 3-12. Sensitive Plant Species

Species Name	Habitat	Distribution and Rarity	Management Sensitivity
Arabis aculeolata Waldo rock cress	Rocky serpentine slopes of high metal content, between 1,000 to 6,000 feet.	Klamath Mountains endemic. Siskiyou and Del Norte Counties and southwest Oregon. Populations on Forest: less than 3.	Tolerance to disturbance unknown. Information lacking or incomplete. Due to the rarity of this species, all populations should be protected.
Arabis serpentinicola Preston Peak rock cress	Rocky serpentine slopes greater than 5,700 feet.	Klamath Mountains endemic. Known from only 3 locations in the Siskiyou Wilderness.	Tolerance to disturbance unknown. Information lacking or incomplete. Occurs in area with little or no resource or land-use conflict. Due to the rarity of this species, all populations should be protected.
Arctostaphylos klamathensis Klamath manzanita	Mid- to high-elevation chaparal and open conifer forests.	Scott Mtns south to Shasta-Trinity National Forests. Not uncommon within this range. Populations on Forest: 1.	Tolerance to disturbance unknown. Information lacking or incomplete.
Calochortus greenei Greene's mariposa-lily	Dry open areas within woodland and forest sites between 2,000 to 5,000 feet.	Modoc and eastern Siskiyou County and southeastern Oregon. Only known from 3 populations in 2 areas on the Forest.	Due to the rarity of this species, all populations should be protected. Most populations are unprotected on private lands.
Calochortus persistens Siskiyou mariposa-lily	Dry, rocky, exposed ridgetop.	Known only from one ridgetop. Endemic to Forest. Populations on Forest: 1, discontinous .	Due to the rarity of this species, all populations should be protected as per Species Management Guide.
Campanula wilkinsiana Wilkin's harebell	Rocky, more or less open, mid-elevation streamsides in conifer forests to above timberline.	Mt. Shasta and Trinity Alps. Populations on Forest: 1.	The wet environment this species occupies is usually sensitive to mechanical disturbance.
Castilleja elata Siskiyou paintbrush	Wet bogs, seeps, meadows and streamsides.	Western Klamath region, So. Oregon, Del Norte County. No verified populations on Forest.	Information lacking or incomplete.
Collomia debilis var. larsenii Talus collomia	Volcanic peaks and cinder cones greater than 7,000 feet.	Cascade Range. No populations known on Forest.	Information lacking or incomplete.
Draba aureola Golden draba	High elevation rocky peaks, greater than 7,000 feet.	A few peaks in southeastern Oregon and 3 peaks in California. Population on Forest: 1	Occurs in areas with little or no resource or land-use conflicts.
Draba carnosula Mt. Shasta draba	Rocky slopes and cliffs, greater than 6,000 feet. Red fir and subalpine forest.	Endemic to Eddy and Scott Mountains. Populations on Forest: 4.	Due to the rarity of this species, all populations should be protected. Occurs in areas with little conflicts.
Epilobium siskiyouense Siskiyou fireweed	Rocky, open ultramafic slopes greater than 5,000 feet.	Trinity and Siskiyou Counties and adjacent Oregon. Populations on Forest: 11.	Occurs in areas with little or no resource or land-use conflicts.
Eriogonum alpinum Trinity buckwheat	Loose ultramafic gravel, open subalpine forest, less than 7,000 feet.	Local endemic. Two populations on Cory Peak (and Mt. Eddy, Shasta-Trinity National Forests).	Due to the rarity of this species, all populations should be protected. Occurs in areas with little/no resource or land-use conflicts.

Table 3-12. Sensitive Plant Species

Species Name	Habitat	Distribution and Rarity	Management Sensitivity
Eriogonum hirtellum Klamath Mountain buck-wheat	Serpentine outcrops or gravelly slopes and ridges between 2,000 to 5,500 feet.	Local endemic. Northwest Siskiyou County near Humboldt County and Oregon borders known on Forest. Populations on Forest: 29.	Some historic populations have apparently been destroyed by past logging activities. A Species Management Guide has been developed.
Galium serpenticum ssp. scotticum Scott Mountain bedstraw	Open, serpentine slopes. Jeffery pine woodland/forest 3,500 to 6,000 feet.	Scott Mountains. Populations on Forest: 15. Information incomplete.	Tolerance to disturbance unknown. Information lacking or incomplete. May be sensitive to grazing impacts.
Horkelia hendersonii Mt. Ashland horkelia	Dry, open, gravelly slopes and ridges. Greater than 6,500 feet.	Siskiyou Crest. Less than 10 populations known. Populations on Forest: 2.	Tolerance to disturbance unknown. Information lacking or incomplete. Occurs in areas with little resource or land-use conflict, although some high recreational use at some sites.
Ivesia pickeringii Pickering's ivesia	Seasonally wet spots or dry edges of wet meadows, ultramafic soils, little or no canopy, 2,500 to 4,500 feet.	Scott Mountains. 10 populations known. Populations on Forest: 8.	Due to the rarity of this species, all populations should be protected. Species is probably sensitive to surface water changes. Slight soil disturbance may create potential habitat.
Lewisia cotyledon var. heckneri Heckner's lewisia	Rock outcrops, more or less mesic environment. Low to mid-elevations.	Trinity, Siskiyou and Humboldt Counties. Populations on Forest: 3.	Generally easy to protect, as rock outcrop habitat is easily recognized.
Lewisia cotyledon var. howellii Howell's lewisia	Rock outcrops, more or less mesic environment. Low to mid-elevations.	Shasta County to Southern Oregon. Populations on Forest: 60.	Generally easy to protect, as rock outcrop habitat is easily recognized.
Lomatium peckianum Peck's lomatium	Pine/oak woodland, some populations on disturbed sites.	Dry foothills around Shasta Valley. Less than 15 populations known. Populations on Forest: 3.	Due to the rarity of this species, all populations should be protected.
Lupinus aridus ssp. ashlandensis Mt. Ashland lupine	Siskiyou Crest open, rocky ridgetops, greater than 6,000 feet.	Mt. Ashland area endemic. Population on Forest: 1.	Due to the rarity of this species, all populations should be protected.
Pedicularis howellii Howell's lousewort	Edges of openings or in shade within conifer forests, 4,000 to 6,500 feet.	Restricted Siskiyou Mountains endemic. Populations on Forest: 20 or more.	Species Management Guide being developed.
Penstemon tracyi Tracy's beardtongue	Exposed, rocky outcrops, 6,500 to 7,500 feet.	Only 2 known populations. Trinity Alps, Shasta-Trinity National Forests, adjacent to the Forest.	Due to the rarity of this species, all populations should be protected. Occurs in wilderness in areas with little or no resource or land-use conflicts.
Perideridia leptocarpa Narrow-seeded yampa	Dry, open sites within mixed evergreen forest, usually serpentine soils; many on disturbed sites.	Salmon Mountains to Southern Oregon. Populations on Forest: 80 or more.	Species Management Guide directs protection for designated, significant populations. Less management concern for others.

Table 3-12. Sensitive Plant Species			
Species Name	**Habitat**	**Distribution and Rarity**	**Management Sensitivity**
Phacelia cookei Cooke's phacelia	Loose sandy-ash soils on old mudflow at the base of Mt. Shasta. Disturbed or open sites with no vegetative competition.	Known only from area near Military Pass Road and Highway 97. Populations on Forest: 1 (large).	Species Management Guide developed. Species is an annual, therefore extremely sensitive to habitat conditions.
Phacelia dalesiana Scott Mtn. phacelia	Openings in ultramafic conifer forests between 5,300 to 7,000 feet. Some on disturbed sites.	Scott Mountains to southern Eddys. 50 populations, mostly on Shasta-Trinity NFs. Populations on Forest: 3.	Scott Mountain campground population is the "type" locality. High scientific value.
Phacelia greenei Scott Valley phacelia	Bare serpentine ridges and openings in Jeffrey pine and red fir.	Siskiyou County endemic. Populations on Forest: 15.	Species is an annual and therefore extremely sensitive to habitat conditions.
Phlox hirsuta Yreka phlox	Open, rocky serpentine ridges and slopes.	Only 2 known sites, on hills near Yreka, part of 2 populations on the Forest.	Due to the rarity of this species, all populations should be protected.
Potentilla cristae Crested potentilla	High elevation, open rocky scree near and above timberline, on ultrabasic parent materials.	Only 3 known sites on the Forest; 1 on Shasta-Trinity National Forests; Cory Peak, Marble Mtns, Mt. Eddy ,China Peak.	No current threats to species but, due to rarity, all populations should be protected.
Raillardella pringlei Showy raillardella	Wet meadows and streamsides, ultramafic soils, 4,200 to 6,800 feet.	Scott and Eddy Mtns, Trinity Alps. 20 or more populations. Populations on Forest: 2.	Sensitive to grazing impacts.
Sedum laxum ssp. flavidum Pale yellow stonecrop	Rock outcrops, sometimes ultramafic.	Northwestern California. 40 or more populations. Populations on Forest: 16.	Probably more common than known, but hard to identify.
Silene marmorensis Marble Mountains catchfly	Yellow pine to Douglas-fir forests, predominantly openings with little competition. Less than 4,500 feet.	Salmon and Marble Mountains. Populations on Forest: 40 or more.	Information incomplete. Species may be able to tolerate some disturbance. Species Management Guide being developed.
Tauschia howellii Howell's tauschia	Exposed, dry ridges. 6,500 to 7,500 feet, red fir forests.	Marble Mountains and Siskiyou Crest. Populations on Forest: 4.	Due to the rarity of this species, all populations should be protected. Occurs in areas with little or no resource or land-use conflicts.
Trillium ovatum ssp. oettingeri Salmon Mountains wake-robin	Moist shady riparian zones in heavily forested areas. Generally north-facing slopes between 4,000 to 6,500 feet.	Salmon Mtns, Trinity Alps and McCloud River drainage in Shasta-Trinity National Forests and Goosenest Ranger District. Populations on Forest: 100 or more.	Populations easily damaged or destroyed by disturbance. Plants take years to reach flowering maturity. Species Management Guide developed.



Data Sources

Ongoing botanical surveys throughout the Forest determine the abundance, distribution and habitat requirements of Sensitive plant species. These surveys are on file at the Forest Supervisor's Office. Information about these species is also received from adjacent NFs, the Bureau of Land Management (BLM), California Department of Fish and Game (CDFG) Natural Diversity Data Base, Siskiyou County and various universities, colleges and herbaria.

Legal Framework

Pertinent Legislation

The Endangered Species Act (ESA) of 1973 directs all Federal departments and agencies to conserve T&E species and to "...implement a program to conserve fish, wildlife and plants." Subsequent Department of Agriculture Regulation 9500-4 directs the Forest Service to manage "habitats for all existing native...plant...species" and to "avoid actions which may cause a species to become threatened or endangered."

Forest Service Direction

Section 2670 of the Forest Service Manual (FSM) reiterates and expands on the above laws and regulations. It adds direction to review programs and activities to determine potential effects, and analyze its significance, on Sensitive plant populations, habitat and species viability. National Forests are directed to develop management objectives for Sensitive plant species and to implement practices that insure that species do not become T&E because of Forest Service activities.

The Region 5 T&E Plants Program Handbook FSH 2609.25 gives specific procedural direction for Sensitive plant species program management activities.

Forest Management Direction and Activities

Current Forest management direction for Sensitive plants is based on the previously described legal framework. Species Management Guides have been written for several Sensitive plant species on the Forest. Guides for other species are in the process of being developed. These guides give species-specific information and Forest-level direction for managing the populations and habitat of each Sensitive species.

Issues, Projected Demands and Opportunities

Botanical surveys are conducted throughout the Forest. They provide data needed to determine the significance of specific populations of a species. Activities which may threaten the continued existence of any plant species may be deferred or modified to provide adequate protection for the plants. Depending on the species, this may not require the protection of every individual plant or population.

Habitat Enhancement

Enhancement or rehabilitation projects for Sensitive plant habitat are undertaken when a species' needs can be determined and it is felt that its natural habitat can be successfully imitated. The number of projects and acres involved varies from year to year with available knowledge, opportunity and funding.

Habitat enhancement efforts will vary depending on the species, but include 1) mechanical soil disturbance to eliminate temporarily competition and encourage seed germination, 2) fencing to protect plants from grazing or other disturbance and 3) seed collection and dispersal into suitable habitat. Complete knowledge of all Sensitive species habitat needs is not available, making it difficult to prescribe enhancement measures for all species. There are still potential enhancement opportunities to explore, including 1) prescribed burning, 2) planting willows or other species to create shade and 3) competitive weed control.

The following trends/demands reflect the previously described indicators for Sensitive plants. These forecasts are based on the assumption of continuation of current Forest management direction.

As knowledge about the flora of this area increases, it is probable that some species of plants will be added and others removed from the Sensitive list. Some species will be found to be more rare or threatened than currently thought, while others will be determined less rare or threatened.

It is probable that new plant species will be discovered in the area, since the Klamath and Siskiyou Mountains have still not been completely studied botanically.

Changes in land uses could affect the abundance or threatened status of Sensitive and other plant species on the Forest.

Increasing public awareness of this area's special botanical values may increase the demand for Sensitive plant protection.

Wildlife

Description

The wide mixture of physical and biological conditions found on the Forest provides for a multitude of wildlife species. The Forest is home to 372 species of wildlife, including 92 mammals, 237 birds, 20 amphibians and 23 reptiles, which live in a wide array of habitats. Each requires a particular combination of food, water and shelter to exist. Some wildlife species use several habitat types on the Forest, while others are very limited in their habitat needs.

It would be nearly impossible to describe the habitat and management needs of all Forest wildlife species. Therefore, this section discusses the current situation of wildlife species which will be considered in the analysis of the alternatives. They include Federally listed T&E and proposed species, Federal Candidate species, Forest Service Sensitive species, Forest-selected management indicator species (MIS) and Game Species.

Management Direction

Under its directives, the Forest Service is responsible for maintaining suitable habitat that will support well-distributed, viable populations of native and desired non-native wildlife (36 CFR 219.19). Through a Memorandum of Understanding (MOU) with the CDFG, the Forest Service in Region 5 is responsible for managing wildlife habitat, while CDFG manages wildlife populations. Habitats and populations, however, are intertwined. This is due to the diversity of vegetation and habitat components that determine the kind and amount of wildlife that will occupy a specific area.

The USFWS has the authority to list wildlife and plant species as T&E under the ESA. Endangered species are those at risk of extinction throughout all or a significant portion of their range. Threatened species are those likely to become an endangered species within the foreseeable future throughout all or a significant portion of their range.

The Forest Service is mandated under the ESA to "conserve" T&E species and to utilize its authorities in furtherance of the purposes of the act. As a Federal agency, the Forest Service is required to insure that any action it authorizes, funds or carries out is not likely to jeopardize the continued existence of any listed species or results in the destruction or adverse modification of critical habitat. FSM direction states NFS habitats and activities are to be managed for T&E species to achieve recovery objectives so special protection measures provided under the ESA are no longer necessary.

There are 2 other Federal classifications related to the ESA that can affect Forest Service management activities: proposed and candidate. Proposed species are those that have been proposed by the USFWS for listing as T&E. Candidate species are those that, in the opinion of the USFWS, may become T&E.

Forest Service proposed actions that "may adversely affect" a proposed species must undergo conference with the USFWS. Candidate species receive no special protection under the ESA. However, the USFWS encourages project leaders to consider the impacts to candidate species when planning resource management activities.

Sensitive species are those plant and animal species, identified by the Regional Forester, where population viability is a concern. Direction on the management of Sensitive species includes the development and implementation of management objectives for populations and or/habitat to insure that they do not become T&E. Also each proposed project must have its potential impacts to TE&S species and their habitat analyzed in a Biological Evaluation.

MIS are animal species or groups of species, communities or special habitats selected for emphasis in planning. They are monitored during Forest Plan implementation to assess the effects of management activities on their populations and the populations of other species with similar habitat associations that they may represent. Given the complexity of animal populations and wildlife-habitat relationships, it is unlikely that any given set of organisms will be representative of the habitat needs of a large proportion of species occurring on the Forest. Population size, distribution and habitat associations of most species, particularly invertebrates, are poorly known. MIS monitoring can, however, provide information on species with known habitat associations and allow assessment of trends in specific habitat components important to many species. Use of the MIS species concept is mandated under NFMA.

T&E Species

Four Federally listed species are found on the Forest: bald eagle, peregrine falcon, northern spotted owl and marbled murrelet.

Bald eagle and peregrine falcon are classified as Endangered in the State of California.They are managed in accordance with their recovery plans (USFWS, 1986 and 1982, respectively). Region 5 of

the Forest Service allocated population goals for the bald eagles and peregrine falcons to each National Forest recovery plan, as their respective contributions toward recovery.

The recovery plan for the Threatened northern spotted owl is currently being prepared. The marbled murrelet is classified as Threatened under the ESA. Once completed, these recovery plans will be implemented on the Forest.

Bald Eagle: Bald eagles nest in open, uneven-aged mature forest stands, and usually select large emergent ponderosa pine as nest trees. Bald eagle territories are typically associated with rivers and lakes where prey (fish and waterfowl) are available. On the Goosenest Ranger District, nests may be located away from water where other prey resources such as ground squirrels in agricultural fields are abundant.

Bald eagles are very sensitive to human disturbance during all phases of the breeding season (January through July), but particularly during courtship and nest establishment. During winter, bald eagles may use communal roosts containing several to over 200 individuals. These roosts occur in a variety of forest stands and typically afford protection from adverse weather conditions. Proximity to food sources is another important factor determining roost location. Common winter food items include waterfowl, ground squirrels and a variety of carrion.

The Pacific Bald Eagle Recovery Plan (USFWS, 1986) lists the Klamath River and portions of the Klamath Basin as key management areas. Bald eagles are also know to winter along the Salmon and Scott Rivers.

Historic populations and distribution are not well known. Currently on the Forest, the wintering population is estimated to be 200 individuals, while the nesting population is 6 pairs. An additional 2 pairs nest on adjacent private land and are monitored by Forest Service personnel. A total of 7,200 acres are managed as nesting and roosting habitat. Forest Service direction calls for conservation and recovery of the species and their habitat, as well as protection from harm or harassment.

As they are located, all nest and roost sites are protected. The recovery goal for the Forest is 5 nesting pair of eagles.

Peregrine falcon: Peregrine falcons nest primarily on large, rock cliffs, usually associated with lakes, wetlands and riparian habitats. Foraging habitat includes forested areas, open grasslands and bodies of water. Peregrines feed almost exclusively on birds, taking a wide variety of species including rock doves, mourning doves, band-tailed pigeons, gulls and woodpeckers. Like bald eagles, peregrines are sensitive to disturbance during the breeding season (January through July).

The Forest is included within several management units specified in the Recovery Plan for the Peregrine Falcon, Pacific Population (Pacific Coast American Peregrine Falcon Recovery Team, 1982). Management direction includes 1) protection and enhancement of essential breeding habitat, 2) prevention of habitat disturbance and direct human interference at nest sites, 3) development of management plans to protect and enhance known breeding habitat and 4) inventory breeding habitat and monitor breeding population status.

The Regional Planning Handbook assigned the Forest a peregrine falcon population recovery goal of 9 breeding pairs. Based on current State averages for occupation rates and reproductive rates, the Forest recovery objectives for the peregrine falcon will provide for the maintenance and protection of 14 suitable nesting sites.

Historical populations in California are not well known, since State-wide searches did not begin until the 1970s. As of 1994, known breeding pairs in the State total around 130, with 14 occurring on the Forest. Nest failure rates are high on the Forest, partially due to eggshell thinning and embryotoxicity. Evidence of eggshell thinning suggests that peregrines are still receiving high doses of DDT, a contaminant which interferes with eggshell development. Some embryos may be dying due to other environmental contaminants.

Through the establishment of management zones, 14 nest sites receive full protection. Within the primary zone, surrounding vegetation is to be maintained or enhanced and human disturbance is to be minimized. Within the secondary zone, noise-generating activities are minimized during the nesting season and management for enhanced prey base and foraging habitat is emphasized. All nest sites are monitored annually. Nest ledge enhancement has been conducted at a few of the sites. A number of potential cliff sites are surveyed annually on the Forest.

Northern spotted owl: Habitats selected by northern spotted owls typically exhibit moderate to high canopy closure, a multi-layered, multi-species canopy dominated by large overstory trees, and a high incidence of large trees with cavities, broken tops and other signs of decadence.

These attributes are usually found in mature and "old growth" forests. However, younger forest stands may provide some of the necessary structure. This is especially true if they contain remnant large trees, patches of older (and larger) trees from previous stands, or occur as codominants with hardwood species. In such instances, some of the important attributes, such as multiple layer vegetative canopy and mistletoe clumps or old goshawk nests serving as nest platforms, may be present to make the stand "suitable" for spotted owls.

Spotted owls feed mainly on small mammals, particularly flying squirrels and woodrats, although birds, insects and other types of small mammals are also taken.

The USFWS classified the northern spotted owl as a Threatened species on June 23, 1990. A number of recovery strategies and conservation plans have followed this listing designation in the effort to ensure population viability of spotted owls through time. From 1989 through 1993, the Forest Service maintained Habitat Conservation Areas (HCAs), as identified in the Interagency Scientific Committee's (ISC) report, *A Conservation Strategy for the Northern Spotted Owl* (Thomas, et.al., 1990). In addition to the HCAs, this strategy called for management of dispersal habitat through the "50-11-40" rule.

A Final Draft Recovery Plan was issued in December 1992. Similar to the ISC strategy, the Recovery Plan recommended large areas of land containing suitable habitat and outlined management guidelines for Federal lands inside and outside these areas. Unlike the ISC strategy, it also accounted for the needs of other species occurring within the range of the northern spotted owl.

Ongoing controversy surrounding northern spotted owls and the management of public lands resulted in numerous court rulings, litigation, appeals and public protests. Issues evolved from protection of the owl to provision for all species dependent on "old growth" habitats and ecosystems in general. The Forest Summit Conference was organized by President Clinton with the purpose of attempting to seek solutions to the public debate over public land.

The result of the Forest Summit Conference was the preparation of the *Final Supplemental EIS on Management of Habitat for Late-successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl* (FSEIS).

The Record of Decision (ROD) selecting Alternative 9 of the FSEIS was signed April 15 and published in the Federal Register April 18, 1994. This decision took effect May 20, 1994, and supercedes the March 3, 1992 ROD. This document establishes coordinated management direction, amends all existing land and resource plans within the range of the northern spotted owl and provides management direction for completing the Klamath Forest Plan. As described in the ROD, the selected alternative blends a number of recommendations from previous conservation efforts to develop a strategy for management of late-successional ecosystems on Federal lands using comprehensive ecosystem management.

Critical Habitat was proposed by USFWS on May 6, 1991 with a final ruling published on January 15, 1992. It is expected that a proposal to modify Critical Habitat boundaries will be made in the future by the USFWS based on provisions of standards and guidelines described in the ROD for the FSEIS.

As of 1994, a total of 217 pairs and 38 territorial single spotted owls are known to occur on the Forest. Forestwide, there are about 400,000 acres of high or moderate quality nesting, roosting and foraging habitat. These acres include habitat within Forest Seral Stages 3B/C and older (refer to the Biological Diversity section earlier in this chapter).

Marbled Murrelet: The marbled murrelet is a small seabird which feeds in the ocean, but nests in large conifers inland. Nesting birds are difficult to locate. In fact, only a few nest trees have been described in North America.

Much still needs to be learned about the species. Data gathered over the past 10 years show the murrelets to be closely associated with "old growth" coniferous forests near the coast in the southern part of its range (Paton, et al, 1990).

On September 28, 1992, USFWS classified the marbled murrelet as a Threatened species under the ESA. At this time critical habitat has not been proposed. The Forest will consult with the USFWS on all activities that may affect the species. Marbled murrelets have been detected on the western portion of the Forest (Happy Camp Ranger District).

Forest Service Sensitive Species

Sensitive species were identified by the Regional Forester due to concerns for the viability of their populations. These concerns were evidenced by significant current or predicted downward trends in population numbers, density, and/or habitat quantity and quality.

The following Region 5 Sensitive species are known or suspected to occur on the Forest.

American Marten: The preferred habitat of marten is typically characterized as high elevation (above 4,000 feet), closed canopy, multi-storied, mature to "old growth" coniferous forests with a high number of large snags and down logs. Cavities in large trees, snags, stumps or logs are used for denning cover.

High quality habitat is near dense riparian corridors used as travelways. It includes an interspersion of small (less than 1 acre) openings, with good ground cover used for foraging (Freel, 1991). Prey species include small mammals (chipmunks, mice, shrews, rabbits and hares), birds and insects.

Marten research in California is limited to a few studies in the central Sierra Nevada range (Simon, 1980; Hargis, 1984; Martin, 1987). These researchers found that a marten reproductive unit (a single male overlapping 2 female territories) has an average home range of about 2,100 acres of suitable habitat. There are few areas on the Forest outside of wilderness that meet high quality habitat requirements described by Freel.

The Forest has been conducting surveys for marten over the last several years utilizing track boxes and camera stations. The Forest intends to continue this inventory program for marten.

Numerous sightings exist for the Forest, covering the last 20-year period. Most of these have occurred on the Goosenest Ranger District within 5 miles of the Klamath-Shasta National Forest boundary. These sightings were in white fir, red fir and lodgepole pine/mixed conifer forest stands. Sightings from the westside are scattered, although about half are from the Marble Mountain Wilderness.

An estimated 274,000 acres of high and moderate marten habitat exist on the Forest within the red fir and portions of the mixed conifer forest types. However, these figures do not account for spatial distribution and habitat fragmentation. According to the Region 5 marten and fisher literature review, high to low quality territories range from 1,400 to 2,500 acres (50 to 25%, respectively). These territories are made up of stands of large trees with dense to moderate canopy closure. However, this model has yet to undergo field verification. (Refer to Appendix I for the marten habitat capability model.)

Current management direction does not allocate lands specifically for management of marten. However, habitat within wilderness and T&E species habitat may provide 57 low to high quality marten territories.

Pacific fisher: Fisher occupy multi-storied, mature and "old growth" conifer forests with moderate to dense canopy closure and a high number of large snags and down logs. Hollow logs, trees and snags are especially important for denning.

High quality habitat areas are near dense riparian corridors, saddles between major drainages or other landscape linkage patterns used as adult and juvenile dispersal corridors. Also included are interspersed small (less than 2 acre) openings with good ground cover used for foraging (Freel, 1991). Prey include small mammals (rabbits, hares, squirrels, mice, porcupines), birds and carrion. Subterranean fungus may be an important food item as well.

The USFWS was petitioned on June 5, 1990 to list the fisher as Threatened in the Klamath Province of California and Endangered in Washington, Oregon and the Sierra Nevada Province of California. It was determined that available information was insufficient to justify protection under ESA. The petition to list was concluded to be unwarranted by the USFWS.

To date, only 1 fisher study has been completed in California. It occurred on the Shasta-Trinity National Forests. Data collected indicated that optimum fisher habitat in the study area is "old growth" mixed conifer forest with a small hardwood component in the understory. The home range of a fisher reproductive unit (1 male and 2 females) in northern California averages about 9,800 acres of suitable habitat (Buck, 1983). A habitat use study is being conducted in the Pilot Creek area of the Six Rivers National Forest.

Comprehensive surveys for fisher have not been conducted on the Forest. As mentioned before, some ranger districts are experimenting with the use of camera stations to determine presence of fisher in specific areas. Fisher have been documented in several areas using this method.

The Forest has been conducting surveys for fisher over the last several years utilizing track boxes and camera stations. Numerous detections of fisher have resulted from this survey strategy. The Forest intends to continue this inventory program with the possibility of determining densities in some areas on the Forest as well as validating the Regional habitat capability models.

Suitable habitat exists within Seral Stages 3BC, 4A and 4BC, seral stages of the mixed conifer and Douglas-fir forest types. An estimated 596,000 acres of high and moderate fisher habitat exist on the Forest. However, these figures do not account for spatial distribution and habitat fragmentation. According to the

Region 5 marten and fisher literature review, high to low quality territories range from 6,000 to 11,300 acres (70 to 50%, respectively). These territories are made up of stands of large trees, with dense to moderate canopy closure. Refer to Appendix I for fisher habitat capability model. This model has yet to undergo field verification.

Current management direction does not allocate lands specifically to be managed for fisher. However, habitat within wilderness and T&E species habitat provides 14 low to moderate quality territories.

Northern goshawk: Goshawks typically nest in mature to "old growth" coniferous forest stands with open understories and moderate to high canopy closure. Their nests are usually within 1 mile of water.

Goshawks nest at all elevations on the Forest, but appear to be more common at moderate to higher elevations over 4,000 feet. Goshawks in the Klamath Mountains and California Cascades Provinces are non-migratory, but may move to lower elevation habitats during the winter. Foraging habitat is quite variable, ranging from brush and open hardwood areas to mature coniferous forest. Edge habitat may also be important, due to the abundance of prey usually associated with edges. Prey includes birds (jays, woodpeckers, thrushes, etc.) and small mammals (ground squirrels, tree squirrels, chipmunks, hares, etc.).

Spatial arrangement of habitats used by nesting northern goshawks is divided into 3 levels: nest stand, post-fledging family area and home range (USDA Forest Service, 1992). *Nest stands* are forest stands containing occupied or alternate nests. A goshawk territory may contain several alternate nests and nest stands.

The *post-fledging family area* is a larger area, averaging 540 acres. This area contains the nest stand(s) that provides cover for the goshawk family throughout the breeding season. This area is particularly important during the post-fledging dependency period, when young goshawks are flying but still dependent on the adults.

The *home range* is the entire area used by a pair of goshawks for foraging. In northern California, home ranges of northern goshawks averaged 4,800 acres (Austin, 1993).

Goshawk research has been conducted on this Forest (Woodbridge et.al, 1988; Austin, 1993; Woodbridge and Detrich, in press; Detrich and Woodbridge, in press) and on the adjacent Six Rivers National Forest (Hall, 1984) and the Shasta-Trinity National Forests (Saunders, 1982). In addition, 3 graduate research projects involving goshawk habitat use and preybase are currently underway.

Goshawks exhibit relatively low fidelity to a given nest tree and will commonly use up to 8 alternate nest sites in different years.

Woodbridge and Detrich (1993) compared nest stand occupancy to stand size and documented a decline in occupancy rates from 96% in stands of 161 to 200 acres, to about 30% for stands less than 120 acres. This relationship probably reflects the importance of the post fledging area surrounding the nest sites.

Comprehensive surveys for northern goshawks have been conducted on the Goosenest Ranger District with 30 territories located. Survey work on the westside of the Forest has been less complete. A total of 38 nest sites have been confirmed within the past few years on the Forest. Many sightings are reported annually.

Densities of goshawk territories on the Forest are known for 40-square mile study areas on the Goosenest Ranger District. In mixed conifer habitats on the western portion of the District, territory density was 1 territory per 2,500 acres. In true-fir dominated habitats on the eastern portion of the District, density was 1 territory per 4,300 acres. Distance between territories ranged from 0.9 to 3.8 miles, and averaged 2.03 miles (Woodbridge and Detrich, in press).

An estimated 429,000 acres of high and moderate quality nesting habitat exists on the Forest in Seral Stages 4A, 4BC and 4BC of most conifer types.

The USFWS was recently petitioned to provide protection under the ESA for the northern goshawk in the western United States. The petition was based on assertions that populations may be declining due to habitat loss and modification. On January 7, 1992, USFWS published a notice of initiation of status review on the northern goshawk and elevated it to Category 2 status.

Great gray owl: Great gray owls are closely associated with meadows bordered by stands of mature or "old growth" forest. The stands are primarily ponderosa pine, lodgepole pine and mixed fir. Meadow habitat is used primarily for hunting. Forest habitat is used primarily for roosting and nesting. Prey consists mainly of voles and, to a lesser extent, pocket gophers.

Populations in California have suffered declines as a result of habitat loss, urban expansion and livestock grazing (Miller, 1990) and CDFG has listed this species as Endangered in California. No comprehensive surveys have been conducted throughout the Forest.

In 1989, 4 meadow areas on the Goosenest Ranger District meeting the general description of great gray owl habitat were surveyed and assessed for habitat quality. They were compared with the known occupied sites, 45 miles north near Fort Klamath, Oregon. Forest habitat parameters (canopy closure, snags per acre, number of mature and "old growth" conifer trees per acre, etc.) did not differ significantly. The meadows on the Forest differed significantly from the Oregon sites. The differences were that the meadows had reduced grass/cover and height, fewer small mammals, greater soil compaction and were slow to drain in the spring (Miller, 1990).

Reliable sightings and audible detections have been reported on the westside of the Forest, although no nests have been confirmed. The most recent detections have occurred within the Marble Mountain Wilderness, the Trinity Alps Wilderness and along the Siskiyou Crest.

Willow flycatcher: The willow flycatcher is a summer resident in North America. It tends to nest in willow thickets near rivers, streams, lakes and montane meadows. Once a common flycatcher throughout much of the State, the species has been reduced to around 200 breeding pairs. This reduction is largely as a result of loss of nesting habitat (Steinhart, 1990).

An undetermined amount of high to moderate quality habitat exists on the Forest. Some of these areas have been surveyed with positive results. A singing (possibly denoting territory defense) willow flycatcher was detected in willow thickets near Juanita Lake, on the Goosenest Ranger District in 1987. Surveys conducted recently have detected willow flycatchers along tributaries to the Klamath River and at the Siskiyou Crest. Numerous juveniles have been captured in mist net stations near Seiad Valley. Surveys and monitoring for willow flycatcher will continue.

At this time, no special mangement direction has been implemented for the willow flycatcher. This is mainly because verification of individuals occurred only recently. Application of riparian management direction, in some cases, may provide for their habitat needs.

Western pond turtle: This species occurs in both permanent and intermittent aquatic habitats such as rivers, streams, lakes and ponds. On the Forest, western pond turtles are most frequently reported in the Klamath River system, as well as in montane ponds. Adult turtles use partially submerged logs, rocks and vegetation mats as basking sites. Nests are excavated at distances of 50 to 1,200 feet from water, typically in grassy or herbaceous habitats. Young turtles are frequently eaten by introduced bullfrogs and largemouth bass, as well as raccoons and other predators.

Candidates For Federal Listing

Candidate species are species under consideration for possible listing as Endangered or Threatened. Candidate species have no protection under the ESA. The USFWS encourages project leaders to consider the impacts to candidate species when planning resource management activities.

The following candidate species are known or suspected to occur on the Forest.

Siskiyou Mountain Salamander: The Siskiyou Mountain salamander is a fully terrestrial salamander that has completely abandoned an aquatic larval stage. However, it is highly dependent on moist microhabitats for survival. It occurs in talus slopes and other areas of rock rubble where there is considerable depth to the rocky area. Habitat is usually located on north- or east-facing slope in areas of dense vegetative cover. Optimal habitat seems to be stabilized talus in "old growth" stands (Nussbaum, 1974).

The complete distribution and population levels for this salamander are not known. Currently known distribution is very limited. It is based on information from 37 sites, including Seiad and Horse Creek drainages (CDFG, 1987). Siskiyou Mountain salamander is closely related to Del Norte salamander. They may represent 2 geographic variants of 1 species. Further research is being conducted to determine taxonomic status.

Del Norte Salamander: The Del Norte salamander is a terrestrial salamander, closely associated with moist talus or rock rubble areas, primarily in mature and "old growth" coniferous forest. This salamander has restricted mobility over the landscape and appears to have very specific habitat requirements. These attributes contribute to its sensitivity to resource management activities that remove suitable habitat.

It is one of the most geographically restricted members of the lungless salamander family. It occurs only in northwestern California and southwestern Oregon. Random sampling conducted in 1989 by Hartwell Welsh (Pacific Southwest Forest and Range Experiment Station) found individuals at 2 sites on the very western portion of the Forest. There are no current population estimates available.

Ferruginous Hawk: The Ferruginous hawk is an uncommon winter migrant in the Butte Valley. Winter populations (late September through mid-April) range from 5 to 20 birds.

Wintering birds feed mainly on pocket gophers, but will also take black-tailed jack rabbits and ground squirrels. It is not clear whether the Butte Valley is on the fringe of the breeding range, or if nesting birds are attempting to expand into the Valley. Nesting had been documented as close as Lakeview, Oregon. In 1988, a pair did attempt to nest in the Butte Valley.

Loggerhead shrike: The loggerhead shrike is found in open habitats with scattered shrubs or small trees. It breeds in savannah, pine-oak woodlands and chaparral habitat types. It feeds in areas of widely spaced big sage with large openings of grass and bare ground. It feeds mainly on insects, but will also take small mammals, birds and reptiles. This species has been recorded as breeding in low numbers on the Butte Valley National Grassland (BVNG), but little is known about its distribution and abundance on the remainder of the Forest.

Pacific western big-eared bat: The Pacific western big-eared bat is found throughout California, but the details of its distribution and population levels are not well known. Once considered common in California, recent surveys indicate serious declines. It is a cavity-roosting, colonial species which makes use of a wide variety of natural and human-made cavities including tunnels, spaces in buildings, caves, mines and snags.

In the fall, this species migrates locally to caves and mines in search of micro-climates of high humidity and low temperatures (above freezing) to hibernate. Roosting sites are the most important limiting resource for this species and are highly sensitive to disturbance.

There is no current management plan on the Forest for this bat. However, Federal Code provides for protection and management of caves and cave resources on all Federal lands. There are known occurrences of Pacific western big-eared bat on the Forest, including a large maternity colony and several hibernation caves on the Goosenest Ranger District.

California wolverine: The wolverine uses a variety of habitats and appears to prefer large undisturbed areas. It hunts and scavenges for carrion, sometimes ranging great distances within a home range that may encompass over 100 square miles. Carrion, especially in the form of large ungulates, is believed to be an important component of the diet, particularly during the winter.

The wolverine is often regarded as an animal of high elevation habitats. However, data collected by CDFG over the past few decades indicate that the species inhabits a variety of habitat types, generally between 1,300 feet and 6,500 feet. There is a record of wolverine at the 14,200 foot elevation from the South Sierra Region.

The wolverine was classified as a protected furbearer in 1970. The species is now listed as State Threatened. This listing is due to increasing timber harvesting, mining, summer home and ski development, and back country recreation, known to adversely affect the animal's habitat (Steinhart, 1990).

Currently, sighting information indicates that the species extends from Del Norte and Trinity Counties, north-eastward through Siskiyou and Shasta Counties, and then south along the Sierra Crest to Tulare County. About 10 reliable sighting records within the last 20 years exist for the Forest. The most recent was in 1989 on the Scott River Ranger District. A Statewide wolverine study is underway with CDFG and University of California, Berkeley and will include survey stations on the Forest.

Karuk Indian snail: The Karuk Indian snail is associated with moist areas under riparian vegetation. Its distribution is very restricted. Surveys conducted in 1978 located individuals on the extreme western part of the Forest from Reynolds Creek to Nantucket Creek. Studies conducted in the late 1970s suggest the subspecies is a variation of a more common species (Hunt and DiMartini, 1979). Little is known about the distribution and abundance of this animal on the Forest.

State-listed Species

In addition to Federally listed TE&S species, there are a number of wildlife species on the Forest that are of concern to the CDFG. These species may be endemic in California or may have population problems within the California portion of their range. These species receive special consideration in land management planning and monitoring where they occur on the Forest.

Greater Sandhill Crane: (*California Threatened*) This migratory species breeds in large, seasonally flooded montane meadows and other wetlands. It feeds on insects and small vertebrates in meadows, grasslands and agricultural fields. The species is sensitive to changes in flooding patterns in wetlands, particularly the effects of drought and water diversions. Adequate flooding in April and May is required to protect nest sites from mammalian predators such as coyotes, raccoons and skunks. Breeding pairs have been monitored in 6 montane meadows on the Goosenest Ranger District, where reproductive success has been very low due to low water levels and subsequent mammalian predation.

Swainson's Hawk: (*California Threatened*) The Swainson's hawk breeds in open grassland, shrubsteppe and agricultural habitats. It winters in similar habitats in South America. Swainsons's hawk populations in California have declined dramatically in the past 40 years (Bloom, 1980), but the causes of the decline remain unclear. It is likely that loss of both breeding and wintering habitat, shooting and use of pesticides in Latin American wintering grounds have all contributed to this species' decline (Bloom, 1980).

On the Forest, Swainson's hawks are restricted to the BVNG and adjacent areas. The Butte Valley population consists of about 75 territories, 9 of which occur on the BVNG. Most nests are constructed in western juniper trees in sagesteppe patches or along agricultural field edges. The population is strongly dependent on Belding's ground squirrels and montane voles in cultivated alfalfa and perennial grassland habitats as primary prey during the breeding season (Woodbridge, 1991).

Currently, dense sagebrush and rabbitbrush provide low-quality foraging habitat for Swainson's hawks on the BVNG. Management of Swainson's hawks on the BVNG focuses primarily on maintenance and expansion of open, grass-dominated habitats where prey is abundant. Brush reduction, burning, seeding with perennial grasses and seasonal wetland developments are management techniques currently in use on the BVNG to achieve this goal.

Burrowing Owl: (*California Special Concern*) This small owl lives in open grassland and agricultural habitats. It is unique in its use of mammal burrows as nest and roost sites. On the BVNG, abandoned badger burrows are commonly used. Burrowing owls feed on insects and small mammals, foraging in areas of low vegetative cover. Dense shrub habitats and juniper woodland are avoided. Burrowing owl nest sites are often found in loose colonies with several territories within a 1/4- to 1/2-mile radius.

Burrowing owl populations in California have declined during the past 15 years, primarily due to commercial and residential development of native habitat, agricultural practices (pesticide use, 'clean' farming) and encroachment of native grassland by shrub habitat. It is not known whether the low numbers of burrowing owls on the BVNG are normal or related to past management in the area.

There are 6 known burrowing owl territories on the BVNG. The primary limiting factors identified in this area are 1) excessive coverage of dense sage and rabbitbrush and 2) predation by badgers in limited areas of open habitat. Artificial nest burrows have been installed on the BVNG, but have rarely been used by nesting owls. Habitat management goals for burrowing owls are similar to those for Swainson's hawk. The goals include expansion and maintenance of open grassland habitats.

Management Indicator Species

Six individual MIS species and 6 multi-species assemblages were selected to gauge the effects for each alternative proposed in this EIS and to monitor the effects of Forest Plan implementation. These species are listed below. Each species within the multi-species assemblages will respond somewhat differently to various management activities that may occur.

Monitoring several species, with similar or overlapping habitat needs, will provide a better reflection of the range of responses by all wildlife species associated with a given habitat or habitat element. Monitoring multiple species is not expected to add significantly to the cost, because most survey techniques (for example, bird censusing) are designed to detect multiple species.

Habitat associations of each MIS species are briefly discussed in Table 3-13.

Table 3-13. Management Indicator Species

Individual Species	Snag Species
Northern spotted owl Northern goshawk Black bear American marten Pacific fisher Black-tailed deer	Red-breasted sapsucker Hairy woodpecker White-headed woodpecker Vaux's swift Downy woodpecker Pileated woodpecker Black-backed woodpecker
Hardwood Species	
Acorn woodpecker Western gray squirrel	
River/Stream Species	**Grassland/Shrub-steppe Species**
Rainbow trout Steelhead Tailed frog Cascades frog American dipper Northern water shrew Long-tailed vole	Pronghorn Montane vole Loggerhead shrike Swainson's hawk Sage thrasher Burrowing owl
Marsh/Lake/Pond Species	**Mature Ponderosa Pine Forest Species**
Northern red-legged frog Western pond turtle	Flammulated owl White-headed woodpecker Pinyon jay

Individual Species

Northern spotted owl: The habitat associations of the northern spotted owl are discussed in detail in the T&E and Proposed Species section of this chapter. The spotted owl is expected to be sensitive to habitat changes since it is fairly specific in its habitat needs. Also, the owl represents other wildlife species which require mature and "old growth" forest habitat for all or part of their life cycle.

The northern spotted owl is also a species of special interest. The Forest has accumulated survey information since the mid-1970s. Intensive surveys, following established protocols, have been conducted on the Forest since 1988. A demographic study of color-marked spotted owls has been conducted on the Goosenest Ranger District since 1989.

Northern goshawk: This species is discussed in detail in the Forest Service Sensitive Species section of this chapter. The northern goshawk is associated with mature forest habitat in all coniferous forest types on the Forest, including eastside types not typically inhabited by northern spotted owls. This species prefers mature forest habitats with open understories characteristic of drier, frequent fire return ecosystems, and may be a better indicator of mature forest conditions in eastside habitats and at higher elevations than the owl.

Black bear: The black bear occurs throughout the Forest and utilizes a variety of habitats and seral stages. The species dens and rests in mature, dense forested habitats which provide snags, stumps, uprooted trees or large, hollow tree cavities.

Early and late seral vegetation communities provide food for this omnivorous species. It feeds on grasses, forbs, fruits, nuts, insects and carrion. Bear can also become accustomed to seeking out human refuse in areas, such as campgrounds and dump sites.

In 1989, there was a moratorium on black bear hunting. The 1990 bear season, however, was reported be similar to the 1988 season. The 1990 season reflected a continued high interest in bear hunting. In 1990, an estimated 1,600 hunters, representing 9,500 Wildlife and Fish User Days (WFUDs), took 120 bears from the hunting zones on the Forest.

Black bear was selected as an MIS due to its habitat associations with early and late seral stages and its need for large down logs. It is also a special interest species, due to its demand as a game animal.

American marten: The habitat associations of American marten are discussed in detail in the Forest Service Sensitive Species section earlier in this chapter. Marten is a good indicator of habitat quality since 1) it is uniquely associated with true fir vegetation types, 2) it is habitat specific and 3) it requires large logs for resting and denning. Marten is also a species of special interest.

Pacific fisher: The habitat associations of fisher are discussed in detail in the Forest Service Sensitive Species section earlier in this chapter. Fisher is a good indicator of habitat quality because it is habitat specific in its denning and resting needs. Fisher is also a species of special interest.

Black-tailed deer: Deer utilize all successional stages at some part of their life. Early to mid-seral stages provide quality forage, while later seral stages provide thermal cover. Within any of these seral stages may be patches of habitat that help to provide forage or cover needs, such as the case with hardwood stands that provide a desirable forage source and also provide thermal and escape cover. Almost all fire-dependent vegetative types also provide both cover and forage needs including chaparral, mountain mahogany, hardwood and ponderosa pine types. Natural or man-made disturbances may also improve habitat in other vegetative types by stimulating the growth of brush and grass species.

The Forest currently provides about 1,100,000 acres of moderate to high quality foraging habitat. Most of the habitat is declining, however, due to decadence or overstory encroachment. This estimate also does not take into account the juxtaposition of the habitat, thus making the overall forage condition and availability rating difficult. Various studies conducted on the amount of openings within the Forest indicate a decline in the amount and size of openings, thus a reduction in the levels of available forage.

Escape and thermal cover are also important parameters of healthy deer populations. Escape cover can be provided by topography, brush or trees. Optimum thermal cover conditions are associated with seral stages 3BC, 4A, 4BC and older seral stages on the Forest.

Throughout most of California, deer herds have been declining over the last 20 years. Populations appear to have stabilized recently, but continue to face many challenges. Although the actual cause of the decline is not known, the declining forage and cover conditions on deer winter ranges, declines in the quality and quantity of summer forage, the increased level of open roads, urban sprawl into some winter ranges and increased predation and poaching are concerns. The CDFG has been managing the annual hunting regula-

tions in an attempt to help stabilize or improve herd levels.

Black-tailed deer are one of the most commonly hunted animals on the Forest. The Forest provides 10 to 15% of the State-wide deer hunt for California. The 1990 estimated demand for deer on the Forest, measured in WFUDs (1 WFUD equals 5 hours of hunting) was 101,500. About 2,000 animals are harvested annually. Use is expected to increase across the Forest, with demand already exceeding supply on the Goosenest Ranger District.

The McCloud Flats, Klamath and Happy Camp herds are the primary deer herds found on the Forest. Black-tailed deer are the predominant deer species occurring on the Forest. However, small populations of mule deer overlap in the McCloud Flats herd area and often intermingle with the black-tailed deer.

The McCloud Flats herd is currently estimated to be 29,000 animals, far below the population targets displayed in the McCloud Flats Herd Management Plan. Recreational demand currently exceeds available population levels in that area.

Population levels of the Happy Camp and Klamath deer herds are estimated at 45,000 to 50,000 animals. The herd management plans for these areas are out of date. Recreational demand does not currently exceed the capability of these herd areas.

The Forest Service and CDFG are working together on updating deer herd management plans for the 3 herd areas. These plans will help to identify and schedule specific management actions that are needed to improve or maintain quality habitat. They will also help to focus on critical areas such as deer winter ranges, fawning areas and summer ranges.

Current and future habitat improvement projects include water developments, managing open road densities as well as crushing and burning brush. Hardwood management, and co-emphasis with timber management in key winter areas, can also increase habitat capability.

Black-tailed deer commonly are associated with early- and mid-seral stage vegetation types and were selected to help the Forest determine the overall trend of wildlife species associated with these habitats. It is also an important game species for the Forest.

Multi-species Assemblages

Hardwood Species: Oaks, especially California black oak and Oregon white oak, are important vegetation types and habitat components. The main reason is the acorns they produce provide an abundant and highly nutritious food resource for many wildlife species.

Oaks are also an important source of natural cavities, vital to species which need existing cavities for some aspect of their life history. Two species were chosen to represent this habitat type and element: acorn woodpecker and western gray squirrel.

Acorn woodpeckers live communally in groups of 5 to 6 birds. They excavate holes in live or dead oak or dead conifers. Large conifer snags are used as 'granary sites' where acorns are stored in small individual holes. Acorns are an important food source from late summer through winter. Diversity of oak species is an important habitat factor, buffering acorn woodpeckers from periods of low acorn production by any single species.

Western gray squirrels are fairly common locally in mature stands of most conifer, hardwood and mixed hardwood-conifer habitats on the Forest. Their diet varies seasonally, dominated by acorns from late summer through winter and by hypogeous fungi during spring and summer. Gray squirrels use mature tree stands for cover and require cavities in trees and snags for winter nest sites.

Current timber management direction states hardwoods should be marked as leave trees whenever possible. Pure stands of hardwoods are not intended to be managed as a part of the timber component (FSM 2405.14, Klamath supplement).

River/Stream Species: Indicator species for this habitat fall into 2 groups: 1) aquatic species associated with the actual watercourse and directly affected by features such as water quality, instream woody debris, bottom substrate and water flows, and 2) terrestrial species associated with riparian vegetation including stream canopy closure, riparian deciduous vegetation density and grass/forb density. Moving, open water and its associated riparian vegetation is used by wildlife species disproportionately more than any other habitat (Thomas et.al., 1979). There are an estimated 2,500 miles of perennial rivers, streams and creeks on the Forest.

Existing management direction for riparian habitats requires consideration of riparian-dependent resources occurring within 100 feet of the channel or body of water. The 7 fish and wildlife species representing this habitat type were chosen for their sensitivity to channel conditions (water temperature, clarity, etc.) and quality of riparian vegetation.

Aquatic Species

Rainbow trout and *steelhead* - refer to the Fisheries section of this chapter.

Tailed frogs are found in perennial montane streams with dense vegetation. Adults seek cover under submerged rocks and logs in the stream. Tadpoles require swiftly flowing, cool streams (59° F or less) with smooth-surfaced stones. Tailed frogs are found on the westside of the Forest.

Cascades frogs are found in higher elevation streams (over 3,000 feet) on the eastside of the Forest. This species is active during the day, foraging for insects in grassy streamside vegetation.

American dippers are found near cold, swift, perennial streams. They nest over water in sites not accessible by mammals (such as crevices on rock walls, beneath bases of trees overhanging streams or on logs laying in the water). Forage items include insect larvae and adults, small fish, amphibians and snails.

Terrestrial Species

Northern water shrews are largely restricted to riparian habitats and depend on dense grass/forb cover and woody debris for food and shelter. This species is sensitive to reduction of vegetative cover and channel-cutting. Water shrews prey on earthworms, slugs and other invertebrates.

Long-tailed voles inhabit mesic habitats and are closely associated with density of riparian vegetation, particularly grasses, forbs and low shrubs.

Other small mammals such as *Shrew-moles* and *Western jumping mouse* are also associated with streamside or meadow vegetation and will likely be sampled along with the selected MIS species.

Marsh/Lake/Pond Species: Standing, open water and its associated vegetation provides unique habitat for many species. Many ponds, lakes and wet meadows occur throughout the Forest. The 2 species chosen to represent this habitat type were chosen for their sensitivity to physical aquatic conditions and CWD.

Northern red-legged frogs are associated with shallow wetlands, ponds and streams with emergent vegetation. Adults use dense riparian vegetation for hiding cover. Introduced warmwater gamefish act as predators on tadpoles and have a negative effect on frog populations.

Western pond turtles are associated with permanent, or nearly permanent, water in a wide variety of habitats. They require basking sites, such as partially submerged logs, mats of floating vegetation or mud flats. Eggs are laid in nests constructed in the soil, sometimes up to 300 or more feet from water.

Snag Species: Snags are standing dead trees. Many wildlife species on the Forest depend upon snags for feeding, breeding or resting. Large snags are particularly valuable for wildlife because they provide cover for larger-bodied wildlife species and a greater abundance of prey. Seven species, depending on snags for all or part of their life cycle, were chosen to represent this important habitat element.

Woodpeckers are particularly important as habitat indicators because they provide an important resource (cavities) for many other species. For example, western gray squirrels and Douglas squirrels both require cavities for winter den sites; these species in turn are important prey for northern goshawks. Flying squirrels, primary prey of northern spotted owls, also require cavities as den sites. Many other bird species including saw-whet owl, pygmy owl, screech owl, flammulated owl, red-breasted nuthatch and mountain bluebird depend on woodpecker-excavated cavities as nest sites.

Red-breasted sapsuckers are found in mid- to late-seral stages of mixed conifer forest, mixed evergreen forest and riparian deciduous habitats. They excavate cavities in sound snags, with a minimum DBH of 11 inches. This species is considered to be a "keystone species," a species that has a disproportionate effect on other species. Sapsuckers drill holes (sapwells) in trees and feed on the sap that collects in the wells. Many other species including warblers, squirrels, hummingbirds, mice, butterflies and other insects also feed at the sapwells, which provide an important food resource.

Downy woodpeckers are found in riparian deciduous habitats. They excavate cavities in dead or advanced rotten branches of dying trees.

White-headed woodpeckers are found in ponderosa pine and high elevation mixed conifer forests. This forest woodpecker excavates cavities in soft wood of trees, usually 24 inches DBH or greater.

Hairy woodpeckers have habitat needs similar to that of the Downy woodpecker, although they require larger trees for cavities.

Black-backed woodpeckers inhabit high-elevation fir and lodgepole pine forests. They excavate nests in sound snags over 17 inches DBH.

Pileated woodpeckers are associated with late-successional coniferous forests. They require large snags

(24 or more inches DBH), in early stages of decay, for nesting.

Vaux's swift do not excavate their own cavities. They are found in late-successional forests and use large hollow snags for nesting.

According to timber inventory data, the density of snags within Forest stands is highly variable. They range from an average of 0.10 snags per acre in some ponderosa pine stands to 15.3 snags per acre in some eastside mixed conifer stands. Actual densities are probably higher due to the drought.

Current timber management direction includes provisions for snags on lands regulated for timber harvest. Maintenance of 40% of the optimum habitat levels of snag-dependent species is directed through the retention of 2 snags per acre. The preferable size of these snags is 1 greater than 20 inches DBH and 1 greater than 12 inches DBH.

Optimum habitat refers to the estimated snag densities needed to maintain high population levels of snag-dependent species. A mixture of sizes and decay classes is essential to fit the mixture of needs of the variety of wildlife associated with snags. Retention of green trees is a technique used to provide for future snags within a shorter period, rather than letting them come about naturally. Current timber management direction calls for maintenance of 1 green tree per acre to provide for future snags on project sites.

Grassland and Shrub-steppe Species: The grassland and shrub-steppe habitat is found primarily on the BVNG. Habitats in this area were formerly dominated by perennial grassland, seasonal wetlands and open sagebrush-steppe vegetation. Farming, grazing and flood control projects dramatically altered the natural vegetation and ecosystem processes in the area in the early part of this century, resulting in a dry environment supporting dense sagebrush, rabbitbrush and exotic weedy plants. Indicator species for the BVNG were selected to represent coverage of perennial grasses, increased mesic conditions and development of a diverse sagebrush/grasland mosaic.

Pronghorn inhabit grassland and shrub-steppe habitats on the BVNG and also use adjacent agricultural lands. This species forages on forbs and several brush species including sagebrush. Pronghorn prefer habitat with low vegetation and 5 to 20% shrub cover. Fawning habitat is variable including sagebrush clumps, alfalfa fields and tall grass.

Montane voles are highly dependent on residual grass cover and relatively high plant moisture content. They inhabit complex 'runways' or tunnel systems in the surface litter layer and feed primarily on green grasses and forbs. Montane voles are very important prey species for many small predators including long-tailed weasels, coyotes, gopher snakes, hawks and owls. Results of small mammal sampling on the BVNG show a strong association with grass cover, particularly in late summer.

Swainson's hawk (refer to State-listed species) prey on montane voles and other small mammals and strongly prefer perennial grassland habitats for foraging habitat on the BVNG.

Loggerhead shrike (refer to Proposed species) nests in tall basin bigsage plants and western junipers. It forages for insects, lizards and some small mammals in grassy or barren openings. This species is associated with diverse shrub-steppe habitat and avoids large expanses of dense sagebrush or rabbitbrush.

Sage thrashers inhabit moderately spaced sagebrush for nesting and cover. Nesting typically occurs in low sagebrush plants that are less than 3 feet tall.

Burrowing owls (refer to State-listed species) utilize abandoned burrows of ground squirrels and badgers in very open habitat. On the BVNG, burrowing owls fly considerable distances (0.5 to 1.3 miles) to forage on the margins of seasonally flooded wetlands. They feed on insects and small mammals. These small owls depend on visual detection of predators and avoid areas of dense brush cover or tall grass.

Mature Ponderosa Pine Forest Species: Ponderosa pine occurs as a component of mixed-conifer forests over much of the Forest. Only on the eastern portion, particularly the Goosenest Ranger District, does it occur in extensive stands. On the eastside of the Forest, much of the mature ponderosa pine was removed during railroad logging in the early 1900s. Ponderosa pine stands are typically associated with dry conditions and short fire return intervals. Under natural conditions it exhibits an open stand structure, often with a brushy or grassy understory.

White-headed woodpeckers are associated with mature ponderosa pine stands, provided soft snags at least 24-inch DBH are available. This woodpecker forages for insect larvae in deeply furrowed bark of mature trees; it also feeds on ants, cones and seeds.

Flammulated owls inhabit mature conifer stands over much of the Forest, but are the only small owl commonly found in eastside pine habitats. Secondary cavity nesters, these owls require snags, usually associated with groups of mature trees with interlocking crowns, for nesting. Flammulated owls typically forage in grassy

or brushy understories for moths and other medium-sized insects.

Pinyon jays are found in eastside pine and pine/juniper habitats. This species occurs in flocks, feeding on seed crops of ponderosa pine and juniper. Important components of nesting habitat include moderate density of mature, cone-producing trees with sagebrush or bitterbrush in the understory. Juniper may be an important food resource during periods of low cone production by pines.

Game Species

The Forest supports a host of species that are commonly hunted, providing recreational opportunities and revenue to the State and County. Game species found on the Forest include waterfowl, grouse, quail, turkey, antelope, bear, deer (mule and black-tailed), elk and dove. Deer were discussed earlier under MIS. Elk habitat requirements are often similar to those of deer with the exception of the forage requirements. Cover, the juxtaposition of forage and cover, and road density concerns all apply equally to elk habitat.

Issues, Projected Demands and Opportunities

Viability of wildlife populations (especially Federally listed T&E and Candidate Forest Service Sensitive and "old growth"-dependent species) is an important public issue. Current management for T&E, candidate and Forest Service Sensitive species was discussed earlier in this chapter. Through land allocations, such as wilderness and T&E species habitat, the Forest provides habitat for other late-successional Forest species. However, the needs of other "old growth" associated species, such as marten and fisher, might be better met through allocation of additional areas.

Selection of MIS emphasized important habitats, special habitat components or species which may be sensitive to resource management activities. Rationale for the selection of these species, as well as management direction for them or the habitats they represent, were discussed earlier in this chapter. The species monitored and techniques used are likely to change as new information on habitat relationships and population dynamics of wildlife species on the Forest is obtained.

Current and future management of Roosevelt elk has been an issue of great interest since animals were first re-introduced on the westside of the Forest beginning in 1985. Additional releases have occurred since then and the westside population is estimated to be around 125 individuals. A small population of around 70 to 100 individuals occurs on the eastside.

Current management includes monitoring animals to determine movement patterns and habitat use and assessing habitat quality in known key areas. Future management will likely focus on habitat improvement and public awareness. Also, future management will focus on the potential need to address road management and interactions with grazing on private lands.

At this time, the Forest has no plans for re-introductions of other species. If opportunities do arise, coordination with CDFG and the public will be required.

Public lands offer the greatest opportunity for hunting in Siskiyou County, since few people have access to private lands. The Forest provides hunting opportunities for local residents, as well as persons from out of state. Hunting and trapping are a means of recreation, a source of food and a source of incidental income to many people. Local communities also derive economic benefits from those who purchase equipment, food or lodging. Current and predicted trends in demand vary with each game species.

Non-consumptive use of wildlife has been increasing over the years. Some visitors come to the Forest solely for the purpose of photographing or viewing wildlife. For others who come to the Forest to hike, drive, raft, camp or ski, viewing wildlife is often an additional highlight to their recreation experience. It is expected that non-consumptive uses of wildlife will continue to increase.

There are many opportunities for partnerships in wildlife management and research on the Forest. The Challenge Cost-Share Program, initiated by Congress in 1986, promotes cooperative efforts with conservation groups, private enterprises, individuals or other public agencies. Partnerships on the Forest have included CDFG, Rocky Mountain Elk Foundation, Audubon Society and local school groups. National and Regional emphasis programs are in place, which highlight management of deer, elk, snag-dependent species, non-consumptive wildlife uses and neo-tropical migrants. It is expected that these cooperative efforts, especially within these emphasis areas, will become more crucial to the Forest's wildlife program in the future.

Projects, specifically designed to benefit wildlife, have traditionally been targeted at game species. Examples of past and current management activities are burning, crushing and pruning brush to improve deer forage habitat and installation of guzzlers. These activites have been undertaken by the Forest and CDFG.

Fencing to exclude cattle from sensitive wet meadow habitat, creation of snags and riparian habitat restoration are examples of past activities which have been conducted primarily for the benefit of non-game wildlife. It is expected that future management will place greater emphasis on non-game wildlife, especially Federally T&E, Forest Service Sensitive, and "old growth" species. This will require inventory and monitoring for many wildlife species to gain a better understanding of where they occur, their abundance and what their site-specific habitat needs are. Working closely with silviculturists and fire ecologists, developing techniques to create and maintain "old growth" forest characteristics, will also be an important opportunity.

Another opportunity is movement from single-species management to wildlife community management. This concept has been addressed in various management strategies including *Alternatives for Management of Late-Successional Forests of the Pacific Northwest* (Johnson et.al., 1991).

Fisheries

Description

The fish species that occur on the Forest can be categorized into 2 major groups: anadromous and resident. The anadromous group includes salmonids, shad, lamprey, eulachon and sturgeon. The anadromous salmonids are an emphasis group for the Forest and include the fall- and spring-run chinook salmon, coho salmon, as well as fall-, winter- and summer-run steelhead. The resident or inland salmonids include rainbow trout, eastern brook trout, golden trout, cutthroat trout, brown trout and Arctic grayling. The non-salmonid group includes various warm and cold water fish (refer to Table 3-14).

Of the total spawning and rearing habitat within the Klamath drainage (excluding Trinity River), the Klamath National Forest contains about 60% of that utilized by chinook salmon, 56% of the coho salmon habitat and 51% of the steelhead habitat. There are about 872 miles of anadromous habitat and a total of 1,166 miles of cold-water fish habitat on the Forest (Forest data, 1994). Additional aquatic habitat, not usable by fish but available to other aquatic species exists in the upper most reaches of streams.

Table 3-14. Fish Species Found on Klamath National Forest

Common Name	Scientific Name
King salmon	*Oncorhynchus tshawytscha*
Coho salmon	*Oncorhynchus kisutch*
Steelhead *	*Oncorhynchus mykiss*
Rainbow trout	*Oncorhynchus mykiss*
Eastern brook trout	*Salvelinus fontinalis*
Brown trout	*Salmo trutta*
Golden trout	*Salmo aguabonita*
Cutthroat trout	*Salmo clarki*
Arctic grayling	*Thymallus arcticus*
Green sturgeon	*Acipenser medirostris*
White sturgeon	*Acipenser transmontanus*
Eulachon	*Thaleichthys pacificus*
Pacific lamprey	*Lampetra tridentata*
Pit-Klamath Brook Lamprey	*Lampetra lethophaga*
American shad	*Alosa sapidissima*
Brown bullhead	*Ictalurus nebulosus*
Yellow perch	*Perca flavescens*
Largemouth bass	*Micropterus salmoides*
Green sunfish	*Lepomis cyanellus*
Pumpkinseed	*Lepomis gibbosus*
Klamath largescale sucker	*Catostomus snyderi*
Klamath smallscale sucker	*Catostomus rimiculus*
Marbled sculpin	*Cottus klamathensis*
Klamath tuichub	*Siphoteles bicolor bicolor*
Golden shiner	*Notemigonus crysoleucas*
Speckled dace	*Rhinichthys osculus*
Three-spine stickleback	*Gasterosteus aculeatus*

* Includes spring-, fall- and winter-run steelhead. Spring-run are more commonly called summer steelhead.

Threatened and Endangered Fish Species

There are currently no known aquatic species listed under the ESA on the Forest. Petitions to list coho salmon and coastal steelhead (which would include both summer- and winter-run steelhead on the Forest) are being reviewed by the National Marine Fisheries Service for listing as Threatened or Endangered.

Forest Service Sensitive Species

Summer steelhead and Klamath River Spring chinook salmon occur on the Forest and are classified in Region 5 as Sensitive Species. The designation is due to concerns for the viability of these stocks as evidenced by current downward trends in population numbers, densities and habitat quality or quantity. Sensitive species designation requires that habitat for summer steelhead and spring chinook salmon be maintained or enhanced. Annual surveys coordinated with CDFG, USFWS, local Tribal members and community volunteers are conducted to estimate the summer holding populations. Characteristics and habitat requirements for these stocks are discussed below.

Species Associations

The Forest has designated 2 group of species to gauge the effect of Forest Plan implementation on the aquatic ecosystem. Where information is available, the associations are used to evaluate the effects of the various alternatives. The species for the River/Stream Association are summer- and winter-run steelhead, rainbow trout, tailed frogs, Cascades frogs, the American dipper, northern water shrew and long-tailed vole. The species for the Marsh/Lake/Pond Association are the northern red-legged frog and the Western pond turtle.

It is difficult to use anadromous fish as indicator species because all salmonid stocks on the Forest are either at-risk, with very low population numbers, or are influenced by CDFG hatchery programs. The anadromous species are also directly affected by off-Forest factors (commercial, sport and subsistence fishing; ocean and climatic conditions; and hatchery practices). Therefore, changes in population number may not reflect habitat conditions on the Forest.

The chosen species associations have the best potential to indicate aquatic habitat conditions. The provisions of adequate habitat requirements for all life stages of each of these associations should also provide for the needs of anadromous salmonids and other species within the aquatic ecosystem.

At the present time steelhead populations are the only species within the associations for aquatic conditions that are consistently monitored. Habitat conditions are inventoried and monitored to provide information on the effects of management activities on habitat conditions.

Emphasis Species

Species listed under the ESA, designated as Forest Service Sensitive, or used as indicators for aquatic condition associations are emphasized on the Forest. Additionally, all anadromous species are considered emphasis species for the Forest because of their cultural, biological and economic values and because of their recent population declines. Although the Forest emphasis is upon anadromous fish habitat, resident trout streams with high angler usage or special characteristics and amphibian species habitat are also evaluated for habitat improvement potential. Restoration work considers the requirements of other riparian-dependent species such as turtles, frogs, toads and salamanders. As more data becomes available, habitat improvements to optimize invertebrate diversity and abundance will be implemented.

Fish Populations

The 2 basic groups of fish on the Forest, anadromous and resident, are discussed below. Information for the non-salmonid anadromous fish on the Forest is not available in detail.

Anadromous Fish Populations

The primary fishery resource on the Forest is the anadromous fish production of the Klamath River and its tributaries between Iron Gate Dam and the confluence of the Klamath and Salmon Rivers. The current population levels of chinook salmon in Forest rivers and streams are so low that there is little economic yield from the remnant fisheries.

The management of these reduced populations dictates that the fishery be restricted for all stocks subject to commercial and sport fisheries in the ocean. In 1993, ocean commercial salmon harvest was closed from just north of San Francisco to the Canadian border, with only minor exceptions. The sport fishery was closed in Northern Oregon and Washington and subjected to severe quotas from central Oregon to just north of San Francisco. Quotas were also imposed on in-river fisheries for salmon. Steelhead are harvested only by sports anglers in freshwater and do make a substantial contribution to the economies of communities near the rivers. Locally important fisheries include resident trout (primarily rainbow and brown), green sturgeon and American shad in the Klamath River and warmwater fish in Juanita Lake.

Indian Tribal fisheries are an integral part of the management of the anadromous fisheries in the Klamath River system. The fishery, both commercial and subsistence, is focused mostly on the fall chinook salmon, which occurs primarily downstream of the Forest on the Yurok and Hoopa reservations. A small subsistence fishery occurs near Ukonom is carried out by the Karuk Tribe. The Indian harvest is subject to a

quota, devised annually in conjunction with ocean harvest restrictions to allow approximately one-half of the returning natural fall chinook to spawn. The Indian subsistence fisheries have also been subject to severe constraints, due to the current low population levels. There is a much smaller tribal fishery for steelhead and green sturgeon.

Anadromous fish are defined by the characteristics of spawning in freshwater, emigrating to the ocean after a few months to several years, dependent upon species, and growing to adulthood in the ocean in 1 to 5 years. The production of anadromous fish, then, is governed by both the freshwater and marine environments.

The strong homing tendency of anadromous fish leads to the evolution of sub-populations or "stocks" which develop specific adaptations to their native environment (Ricker, 1972). Nehlsen et al. (1991) emphasizes that it is at the stock level that conservation and rehabilitation of salmon must take place if it is to be successful.

In 1991 the American Fisheries Society identified 159 stocks of anadromous fish in the Pacific Northwest as being at moderate to high risk of extinction (Nehlsen et al., 1991). Another 54 stocks were listed as being of special concern. A total of 39 stocks in California were listed. Higgins et al. (1992) evaluated the anadromous stocks in only northern California and identified 20 stocks at high risk of extinction, 3 at moderate risk, and 26 of special concern. Seven of the high or moderate risk stocks have habitat on NFS land.

The Forest watersheds make a major contribution to the anadromous fishery of the Klamath River. The Salmon River watershed contributes the largest portion of anadromous habitat. Various watersheds have been identified as Key Watersheds because of the presence of anadromous stocks of fish at-risk and the overall good quality habitat by various groups.

The continued existence of at-risk stocks is threatened by a combination of hydro-electric development, overfishing, habitat conditions and influence of hatchery fish on both disease resistance and genetic fitness of native stocks. Ocean conditions in the northern hemisphere may be adversely affecting local anadromous fish populations as well.

A lack of high quality near-shore habitats and variable ocean conditions makes freshwater habitat more crucial for the survival and persistence of anadromous salmonid stocks in the northwest region than for stocks in the Canada-Alaska region (USDA Forest Service et. al., 1993). Therefore, high quality habitat on NFS lands are essential to conserving many of the "at risk" stocks. Enlightened management of anadromous fish habitat will be important to the recovery of these stocks, even though the primary reasons for the decline may not be related to degradation of habitat.

Summer and Winter Steelhead. Steelhead provide the major sport fishery in the Klamath River system. Reported angler success has been very low in the past several years. The steelhead fishery is primarily supported by the "half-pounder." The "half-pounder" is found in only 3 rivers in the world, the Klamath and Eel in California and the Rogue in Oregon.

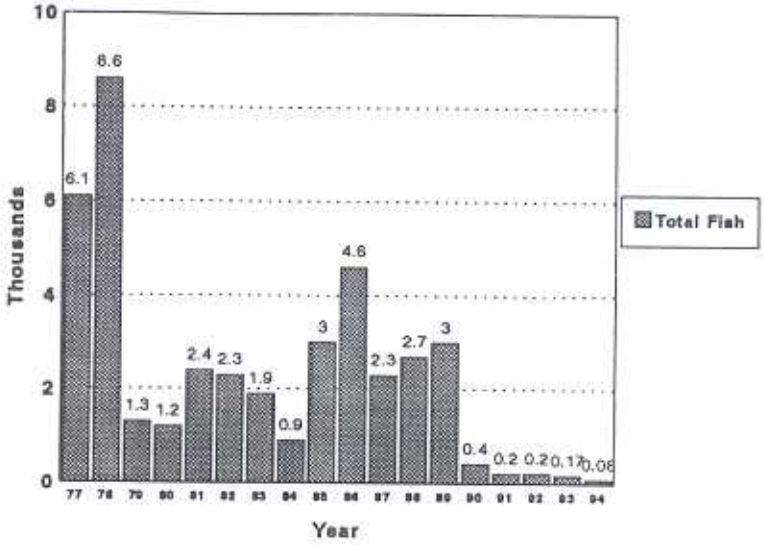
The "half-pounder" is a steelhead of 10 to 16 inches in length, that returns to freshwater after only a few months in the ocean. After living about 8 months in freshwater, they return to the ocean, grow there for 1 to 2 years and immigrate up-river again to spawn. They are eagerly sought, especially by fly-fishers, because of their fighting ability and aggressiveness in taking a fly. The apparent abundance varies, but they are very numerous in some years. The "half-pounder" provides a major share of the sport fishery of the Klamath River system. In 1980, the Klamath River produced about 30 to 35% of the California steelhead population. In 1990, the Klamath River produced around 20% of the population.

Summer steelhead in the Klamath River basin are in such low numbers that the American Fisheries Society has noted the population as being at moderate risk of extinction (refer to Figure 3-6). A State-wide steelhead management plan is currently being developed by the CDFG in conjunction with the Forest Service and other concerned agencies and organizations. Current management direction for summer steelhead is provided by the Forest Service regional guide (U.S. Forest Service, 1986). Biological evaluations are required for all proposed projects that have potential to affect summer steelhead or their habitat.

Spring Chinook. Adult spring chinook return from the ocean in the spring months when sexually immature. They hold in low velocity pool or run habitats greater than 1 meter deep with cool summer temperatures, substantial day-long shade, absence of human disturbance and available cover near the pool bottom. When cool water is not readily available, adults as well as juveniles are often found in areas below cold tributaries.

They remain in freshwater until they spawn that fall, usually mid-September through late October. Spring chinook have an elevated natural mortality over fall chinook related to the length of time they reside in freshwater. Water temperature, water quality, habitat quality and poaching all have significant effects on

Figure 3-6. Total Annual Summer Steelhead Runs
Extrapolated From Adult Counts



these fish. First emergence is observed in March and extends until early June. Juvenile residence has been found to extend into November. Spring chinook are found throughout the Salmon River system, however the primary stream reach that they utilize is the South Fork Salmon River. In low water years, barriers exist that segregate the spring from the fall-run chinook. The spring chinook reaches consist of South Fork Salmon River above French Creek and North Fork Salmon River above Mile 12.

Current freshwater habitat problems now faced by the spring chinook include a large amount of fine sediments in the South Fork system, high water temperatures (often exceeding 20°C), drought, historical mining effects and poaching. The sediment is a result of extensive deposits of weathered granitic rock upriver from Petersburg and in the Trinity Alps Wilderness.

A watershed condition inventory implemented in 1991 found that the river channel, between Petersburg and Big Flat campground, contains large quantities of granite sand "dry ravel" and numerous granitic debris slides which deliver sediment directly to the stream. High water temperature conditions have long existed on the Salmon River. In addition to poor riparian area establishment after the 1955 and 1964 floods, the orientation of the North Fork and South Fork Salmon River influences the summer water temperature (West, 1991).

Drought conditions of the past 7 years have affected the salmon and steelhead fisheries over the entire Klamath Mountains Province. The low water decreases the system's ability to flush fines, causes water temperatures to be above normal and makes less habitat available. Historical mining effects include channel alteration, riparian ecosystem degradation, large sediment input (at that time) and increased water temperatures resulting from these effects. With the low numbers of returning adult salmon, poaching has become more prevalent as a reason for declines. Currently the Forest has a program to educate the public and decrease this activity.

Surveys for adult spring chinook have occurred in the Salmon River and its tributaries for the last several years. Populations estimates show a general downward trend since 1988. Estimates in 1988 were almost 3 times more than the 1992 population estimates of 362 adult spring chinook. 1993 and 1994 estimates were greater than 1992 (refer to Figure 3-7).

Fall Chinook. Fall chinook salmon provide fishing opportunities, but are also declining in numbers. The conditions for fall-run chinook are discussed for the Klamath-Trinity River System because the regulations and expectations that are applicable to the system as a whole affects the Klamath River also. Spawning escapement levels for fall-run adult chinook salmon in the Klamath-Trinity basin between 1980 and 1993 has ranged from 11,000 to 21,000. The Framework Plan of the Pacific Fisheries Management Council calls for a minimum escapement of 35,000.

A low population level has occurred in spite of severely constrained fisheries in both the ocean and river. The natural escapement in 1992 was estimated at only

Figure 3-7. Spring Chinook Adult Escapement to Salmon River Sub-basin Holding Habitat

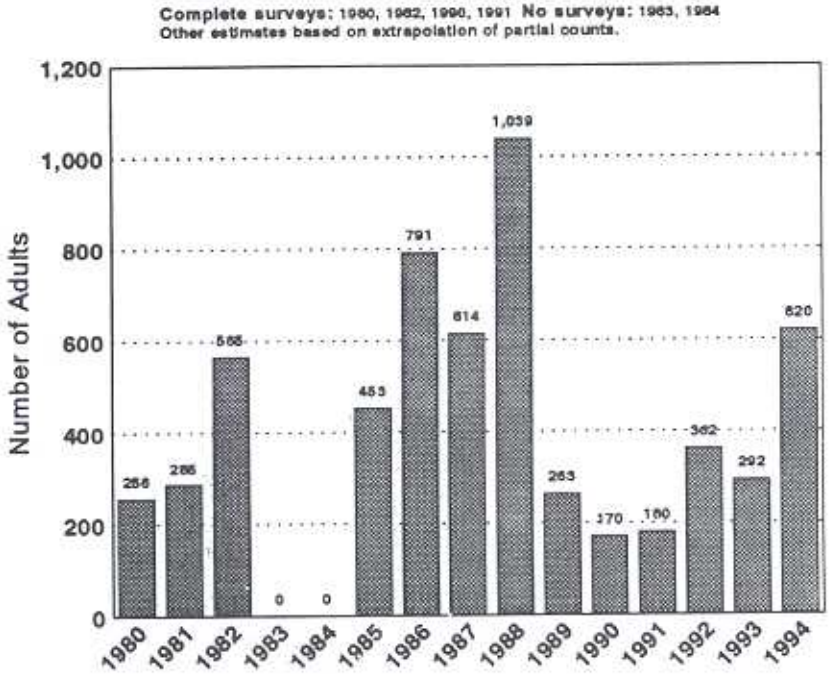
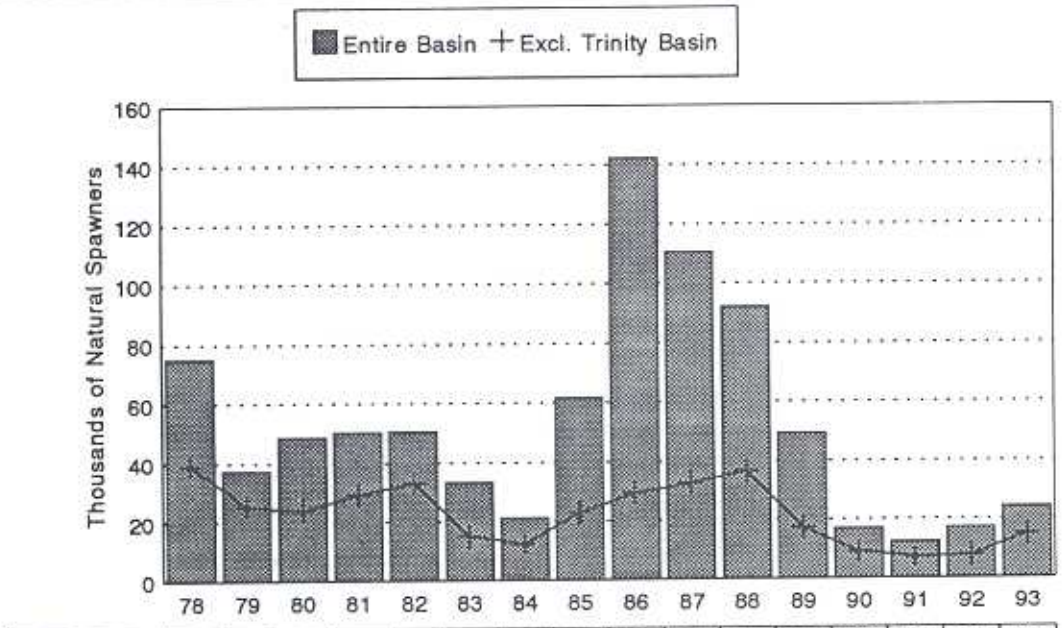


Figure 3-8. Fall Chinook Spawner Escapement

For the Klamath River Basin



	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93
Entire Basin	74.9	37.4	48.5	50.4	50.6	33.3	21.3	61.8	142.3	110.5	91.9	49.4	16.9	12.4	17.2	24.1
Excl. Trinity Basin	39.1	25.4	23.9	29.1	33.2	15.2	12.3	23	28.3	32.6	36.7	17.4	9	7.1	7.5	15.1

Compiled by CDFG, December 1993

Year

11,000 fish, the lowest return in the last 20 years. The natural escapement in 1986 was 113,000. Historic levels of fall chinook may have exceeded 500,000 (as estimated by the CDFG). Refer to Figure 3-8.

Fall chinook spawning escapement has shown a trend for an increased portion of hatchery spawners. This indicates a need to emphasize escapements of wild chinook. Research has shown wild stocks to be better adapted, physiological and genetically, to stream habitat and climatic changes. Natural spawners would be more capable of rebuilding genetically diverse runs.

The CDFG estimates that an escapement of as much as 106,000 fall-run chinook salmon are needed to adequately occupy the currently available spawning habitat in the Klamath-Trinity River system (Hubbell and Boydstun, 1985). Although both quality and quantity of available spawning habitat have declined, (for example, the current habitat would not support the historic level of spawners), the very low number of fall chinook salmon returning to spawn is presently the dominant issue in the recovery of this population. The lack of adults salmonids to fully utilize the available spawning habitat on NFS lands will continue until there is an increase in the escapement of Fall chinook and off-Forest constraints are reduced.

Coho salmon. Coho salmon populations have declined so precipitously along the Pacific coast that they are currently being evaluated by the National Marine Fisheries for listing under the ESA. Coho occur only in very low numbers in the Klamath River watersheds on the Forest. The number of coho is so low that it is unlikely that the quantity or quality of habitat on public or private lands is currently limiting the population. Coho escapement is estimated to be made up of 80% Iron Gate hatchery fish. In 1994 an extensive effort to identify the current range of coho salmon within California was begun by the Forest Service.

Table 3-15 displays the cold water stream habitat and salmonid outputs for 1991.

Table 3-15. Cold Water Stream Habitat and Salmonid Outputs in 1991

Species	Acres of Habitat	Number of Smolts	Number of Adults	Pounds
Steelhead	4,200	514,400	38,600	123,500
Chinook	3,900	801,900	30,500	310,800
Coho	3,700	295,400	6,200	39,100
Rainbow trout	3,900	NA	475,200	237,600

Resident Fish Populations

A variety of resident fish inhabit Forest waters. Resident rainbow trout are present in most headwater streams on the Forest, primarily in stream sections not available to anadromous fish because of natural barriers and throughout streams on the Eastside of the Forest. Populations of resident brown and brook trout are present in local areas. The contribution of resident trout to sport fishing on the Forest is small in comparison with that for steelhead and salmon. The small-stream trout resource, however does provide ample opportunity for those anglers who seek smaller trout. The resident trout fishery is an under-used resource and has a much greater capacity for use than is currently expended by the angling public.

There are about 60 acres of warmwater fish habitat and 1202 acres of coldwater habitat within lakes and ponds on the Forest. At present, 168 lakes on the Forest support trout populations, most of which were introduced by past stocking activities. Species found in the lakes are rainbow trout, brook trout, brown trout, golden trout and Arctic grayling. Currently, 43 lakes on the Forest contain no fish populations.

Recreational Fishing

In 1989, a total of 49,800 anadromous fish user days (FUDs) were attributed to the Forest. Of this total number of FUDs, 45,400 occurred on Forest, 3,900 occurred in the Klamath River system below the Forest boundary and about 500 occurred in the ocean sport fishery. In addition, on-Forest warm water fisheries accounted for about 450 FUDs and cold water resident fisheries accounted for 29,700 FUDs. As anadromous fish populations have declined, the recreational fishing has also declined. If steelhead gets listed under ESA, recreational fishing may further decline. As fish populations increase, an increase in recreational fishing should result.

Management Direction

Under its directives, the Forest is responsible for maintaining suitable fish habitat that will support well-distributed, viable populations of native and desirable non-native fish. The CDFG has the role of managing fish populations, stocking levels and fishing seasons. The USFWS has the role of assuring that the coordinated efforts of the habitat management agency and the population management agency maintains a viable population of native and desired non-native fish. Management of the stocks of anadromous stocks while they are in the ocean is done, in part, by the National Marine Fisheries Service (Department of Commerce).

Congress has long recognized the importance of the fisheries resource and its dependence upon high water quality. Specific laws important to the management of the fisheries resource include the Clean Water Act, the Multiple-Use Sustained Yield Act, the NFMA and the ESA. Additional legislation has provided management direction in specific areas.

The Clean Water Act, and its subordinate implementing regulations at the Federal and State levels, set point and non-point water pollution standards. These standards are monitored, in part, based on impacts to "beneficial uses" of the waters. Fish are specifically listed as a beneficial use in these laws.

Water quality affects and can determine the quality of the fisheries habitat within the stream. The impacts of a proposed management activity are often assessed by determining changes to the watershed and then, ultimately to the fishery within that watershed. Standard management activities are then implemented during project implementation, including soil and water quality management guidelines based on the geologic sensitivity. These are applied as BMPs.

The ESA was passed "to provide a means whereby the ecosystems upon which Endangered and Threatened species depend may be conserved, to provide a program for the conservation of such Endangered and Threatened species, and to take such steps as may be appropriate to achieve the purposes of the treaties and conventions set forth...."

Habitat Conditions

Ecological Processes

Several ecological processes affect fish habitat. In a broad sense, the climate, geology, hydrologic processes, vegetative cover and wildfire activity affect the habitat.

Steep stream gradients in many basins and the relatively young geological setting of the Klamath Mountains dictate high natural landslide rates (refer to the Geology Section, earlier in this chapter, for a description of the geology on the Forest).

Climate also influences fish habitat and production levels. Recently, a series of drought years has altered the flow and water temperature of many streams, affecting the quality and quantity of habitat.

Flooding has also occurred over the last century. Flooding of extreme magnitudes occurred in December 1955, December 1964 and February 1974. The only similar flood intensity to be documented occurred in 1861-62. These large-scale flood events often create large-scale changes in fisheries habitat. The 1964 flood removed a lot of CWD from channels, denuded riparian vegetation, established broad sediment-filled flood plains and turned much of the diverse habitat into chute-like races with greatly reduced structural cover for fish. Substantial fine sediment was also delivered to streams, filling many pools.

The rehabilitative efforts following flooding placed considerable emphasis on the removal of logs that blocked streams. This made worse the CWD shortages created by the flood. Habitat, degraded as a result of these floods, has yet to recover in many basins and stream reaches.

Precipitation levels also play an important role in the ecological cycle of a stream. Periodic storm events tend to recruit needed spawning gravels and structural elements such as boulders, cobble and large wood, into streams. This maintains the habitat quality for the fish and other aquatic species that evolved within the dynamic system. As precipitation levels increase, the delivery of sediment into the stream tends to increase. With this, the ability of the stream to move sediment through the system increases, except in degraded systems or in extreme events.

Sediment routing and deposition within streams are also dependent on site-specific factors, such as gradient, channel morphology, sediment size, substrate composition and flow regime.

Fire can affect fish habitat by altering riparian vegetation and adding CWD to the stream. Low to moderate intensity fires can benefit watershed conditions by stimulating vegetative growth, removing large fuel accumulations and increasing flow levels. A severe fire in a watershed can degrade fish habitat by reducing shade and bank stability from fire-killed trees and adding sediment to the stream from erosion. The vegetative patterns and fire effects are documented in the Biological Diversity, Timber Management and Fire Management Sections of this chapter.

Habitat Components

Existing habitat conditions have been, and will continue to be, shaped by ecological processes and events such as fire, floods, landslides and drought as well as past and present management activities. Factors affecting habitat quality may vary from stream to stream. However, the overall quality of fisheries habitat can be broken into 5 components. These components are important within the aquatic, semi-aquatic and surrounding riparian area. They are also continually changing as ecological processes within the water-

shed modify and reshape the habitat. These components include:

1. Overall watershed conditions including upslope, riparian and instream conditions.
2. Water quality and quantity.
   a) water temperature.
   b) sediment levels.
   c) instream flows (amount and timing).
   d) stream nutrient levels.
3. Stream channel integrity.
   a) bank stability.
   b) sediment transport, aggredation and scour.
   c) substrate composition (includes the level of fines, sediment and embeddedness in spawning areas).
   d) habitat composition including primary pool frequency.
   e) water table level.
4. Vegetation.
   a) native and desired non-native plant communities and interactions
   b) CWD and recruitment potential.
   c) stream canopy cover.
   d) riparian area ground cover
5. Animal communities, populations and interactions.

Habitat criteria have been identified for the measurable elements associated with these habitat components. Refer to Table 3-16.

Data for some of these criteria was collected and summarized from existing stream survey data on 19 anadromous fisheries streams (refer to Table 3-17). These streams are representative of a variety of stream conditions found on the Forest. They include streams that have sustained extensive management activities and impacts from floods and fires as well as streams that have been essentially undisturbed by any management-related impacts, such as Wooley Creek.

The current habitat condition data are summarized for entire stream (or survey) lengths. Geomorphic influences on habitat conditions have not been incorporated into the evaluation of habitat conditions.

The information represents data collected from approximately 200 of the 872 miles of anadromous

Table 3-16. Fisheries Habitat Criteria

Parameter	Criteria
Water Temperature	Do not exceed a maximum summer temperature of 69°F or the site potential.
Instream Flows	Maintain flows to maintain aquatic ecosystem processes.
Nutrient Levels	Maintain at background levels. Background may be determined by sampling in wilderness streams or other suitable reference waters.
Stream Channel Integrity	Maintain or restore stream channel integrity and channel processes to protect aquatic resources.
Fines	Maintain less than 15% fines (mm) as the area-weighted average in spawning habitat (pool tail-outs and glides).
Embeddedness	Maintain less than 20% embeddedness as the area-weighted average in riffle areas.
Pool Frequency	Maintain 1 pool every 3 to 7 channel widths (bankfull widths). In anadromous reaches, these pools should occupy at least 50% of the low-flow channel width and have a maximum depth of at least 36 inches.
Plant Communities	Maintain or restore native and desired non-native plant community diversity and productivity.
Coarse Woody Debris	Manage for an average of 20 pieces of large wood per 1,000 lineal feet (100/mile) or to achieve site potential in perennial and fish-bearing streams. Westside minimum length 50 feet and diameter 24 inches; eastside minimum length 35 feet and diameter 12 inches.
Stream Canopy Cover	Provide 80% stream surface shading in summer or achieve the site potential.
Riparian Ground Cover	Provide 85 trees/acre with a minimum basal area of 250 square feet/acre of which at least 90% are conifers, or achieve the site potential.

Table 3-17. Current Forest Stream Conditions

Stream	Temperature * (° F)	% Noon Shade	% Average Fines	% Average Emedded-ness	Ratio of Pools to 6 Stream Widths	No. Green Trees (greater than 12")	No. of Large Logs per 1,000 feet**
Beaver Creek	63	27	16	5	0.60	7	0.25
Elk Creek	72	19	5	11	1.50	6	0.79
Grider Creek	61	38	4	6	1.00	9	0.75
Indian Creek (Happy Camp)	75	25	14	12	0.75	6	0.18
No. Fk. Salmon River	80	11	17	3	1.00	13	0.43
Nordheimer Creek	70	24	20	5	1.00	10	0.58
So. Fk. Salmon River	79	20	14	13	1.00	8	0.46
Scott River	84	2	17	20	1.00	9	0.01
Black Bear Creek	66	64	21	41	0.86	13	0.03
Indian Creek (Salmon River)	66	56	20	18	0.67	13	0.02
Knownothing Creek	66	57	7	13	1.50	12	0.19
Methodist Creek	66	60	21	33	1.00	6	0.23
Taylor Creek	NA	93	12	26	0.55	9	0.33
Dillon Creek	75	20	9	11	2.00	11	0.03
No. Fk. Dillon Creek	61	31	1	5	1.50	6	0.22
Copper Creek	NA	24	16	20	0.67	10	0.92
Rock Creek	61	33	8	13	1.20	6	1.11
Negro Creek	68	20	36	50	0.46	8	0.04
Wooley Creek	71	6	1	11	1.50	NA	0.30

* Maximum temperature recorded during habitat assessment surveys ** Logs 50 feet long and 24 inches DBH. NA = Data Not Available

streams on the Forest. The level of habitat information available from stream surveys for resident fish and warm-water fisheries is minimal. Most of the survey data represents a point in time. Therefore, habitat trend data needs to be determined through selected reach monitoring.

The determination of desirable levels of each component or criteria is based on a 1988 Draft Proposal For Managing and Monitoring Streams For Fish Production by James Sedell, Pacific Northwest Range and Experiment Station, local data and current literature. Sedell's proposal was intended to provide direction for forest plan application in Oregon and Washington Forests in the Columbia River Basin. These may be adjusted as additional information is obtained at the watershed and site levels.

Water Quality and Quantity

Water Temperature

Stream temperatures are influenced by the surrounding landforms and geology, the ambient air temperature, climate regime (rain versus snow), the vegetative cover (insulation and shading), by the width to depth ratio of the stream and the amount of flowing water within the stream. These factors vary in a given stream.

Riparian vegetation provides a thermal cover, or microclimate, around streams. This modifies air temperatures. Without the vegetative cover, the summer water temperatures of many streams would exceed lethal levels for rearing and spawning salmonids.

In the winter, evergreen vegetation blocks the downcanyon flow of extremely cold air. This provides a thermal blanket that keeps stream-adjacent temperatures warmer than the surrounding air. The warmer

water temperatures reduce the formation of anchor ice. Anchor ice can fill in intergravel spaces, displacing and killing overwintering juvenile steelhead.

The amount of water that flows within a creek also has an effect on water temperatures. Higher levels of water will generally exhibit more stable temperatures, depending on where the water originated. Low water flows are more susceptible to influences from weather factors. In the summer months, low water may be very warm.

The combination of these factors on Forest streams may result in water temperatures that are lethal to salmonids during the summer months. Depending on the salmonid species, 78° to 85° F constitutes a lethal or debilitating water temperature. Where waters are this warm, salmonids are forced to collect in deep pools and areas where tributaries introduce cooler water into the streams to survive. This makes the fish susceptible to predation, fishing pressure and disturbance. Water temperatures are above desired levels, and close to lethal levels during the summer months in some streams on the Forest.

The Klamath River enters the Forest at temperatures exceeding the criteria value. Data from habitat typing and thermographs indicate the maximum temperature of record exceeds the recommended value for at least 8 of the 19 fisheries index streams, with data not available for 2 of the streams (refer to Table 3-17).

Instream Flows

Instream flows are often not adequate to provide high quality habitat. The Forest is currently in the seventh year of drought. These low flow conditions limit the amount of available habitat and worsen the suitability of accessible habitat. Holding pools, cool water, cover and access, all crucial habitat components, become much more scarce during low flows.

Consumptive uses and natural fluctuations in water supply combine to reduce summer flows in Forest streams. Some streams have low flow problems caused by drought and irrigation use. Refer to the Water section earlier in this chapter for a more in-depth discussion of stream flows.

Stream Nutrient Levels

No data has been collected on nutrient levels within the Forest. However, the Regional Water Quality Control Board has identified concerns over the discharge of agricultural drainage from some areas. The Klamath and Shasta River (not within the Forest boundary, but drains into the Klamath River just upstream of the Forest) were identified as having higher nutrient levels than most other rivers in northern California (Klamath River Basin Fisheries Task Force, 1991). Concern for nutrient concentrations has also been expressed by Forest fisheries biologists. Warm water temperatures and high nutrient content has combined to increase biomass production to relatively high levels.

Stream Channel Integrity

Channel erosion produces sediment that is delivered directly into the stream system. Instability may modify desirable habitat features, such as hiding cover, pool quantity and riparian vegetation.

Sediment Loads

The level of stream sedimentation is important to feeding fish, fish reproduction and the survival of fish eggs. Two of the most important factors influenced by sediment are riffle embeddedness and fine sediment in spawning areas.

When delivered sediment exceeds the stream's transport capacity, it often accumulates in spawning gravels. This blocks open spaces between gravel particles. This alters the water flow through the gravel, decreasing the amount of oxygen available to eggs and emerging fry and allowing the build-up of ammonia and carbon dioxide. The sediment layer may also trap emerging fry, eliminating the availability of suitable winter rearing habitats. Salmonids tend to avoid spawning in areas of high embeddedness. The overall effect of excess sediment deposition into streams is a reduction in fish survival and smolt production and may affect other aquatic species such as frogs and salamanders.

Table 3-17 shows the data for riffle embeddedness collected from the 19 streams surveyed. Table 3-18 shows a summary of the channel conditions of the streams surveyed on the Forest. Additional information on channel conditions can be found in the Water section earlier in this chapter.

Table 3-18. Channel Rating of Forest Streams.

Number of Streams	Channel Rating
2	Very Poor
12	Poor
74	Fair
21	Good
1	Excellent

Pools

Pool volumes are an important habitat parameter. Primary pool depth determines the suitability of stream reaches for holding and resting anadromous fish. Primary pools are defined as those having low flow residual depths of greater than 3 feet and comprise habitat in over 50% of the low flow wetted channel width. The deeper pools provide a measure of cover from some predators. They are often occupied by summer steelhead and spring chinook salmon to escape warm water temperatures.

These pools can be crucial to fish survival during summer low flow periods when other habitat is very limited. Residual pool volume can be significantly reduced by sediment deposition.

Pool frequencies of one pool per 3 to 7 channel widths are considered desirable. Table 3-19 shows the stream survey data, collected on 19 streams, as it relates to pools per 6 channel widths. The majority of survey streams have less than 1 pool per 6 channel widths.

Table 3-19. Pool Frequencies for 19 Forest Streams

Number of Streams	Pools per 6 Channel widths
0	0.00 - 0.25
1	0.26 - 0.50
5	0.51 - 0.75
7	0.76 - 1.00
6	1.10 and above

Not all streams have the geomorphology to produce deep pools. Streams, unable to transport sediment through the stream system, may be void of pools due to excessive sediment loads. Analysis at the watershed-scale should indicate stream reaches that have the potential for the expected pool frequency.

Water Table Levels

No Forest-wide data is available on water table levels. More detailed information must be obtained at site-specific levels.

Vegetation

Native and Desired Non-native Plant Communities

Refer to the Biological Diversity and Riparian Management Sections of this chapter for information on native and desired non-native plant communities.

Coarse Woody Debris

Large organic debris and fallen trees influence the physical and biological characteristics of streams. CWD provides important cover to rearing juvenile salmonids, in all seasons of the year. Large wood reacts with stream flow, modifying instream habitat to favor salmonid production. Salmon production is enhanced by trapping sediment, scouring pools, providing "backwaters" for cover and low velocity interstices important for winter rearing. Smaller wood pieces, common in some forest riparian zones, are less stable than larger wood in streams.

The amount of CWD present within streams is influenced by flooding (both delivery and removal), the surrounding vegetation (presence of large material) and past management actions. Table 3-20 shows the current level of CWD within streams.

Table 3-20. Level of CWD in 19 Forest Streams

Number of Streams	Number of Logs per 1000 feet
10	0.00 - 0.25
4	0.26 - 0.50
2	0.51 - 0.75
2	0.76 - 1.00
1	1.10 and above

Sedell, based on his proposal for the Pacific Northwest, has recommended an optimum level of CWD at 20 pieces of large wood (50 feet long and 24 inches in diameter) per 1,000 lineal feet of stream (or about 100 pieces per stream mile), within the channel. All 19 Forest streams surveyed are below optimal accumulations of woody cover (Olson and West, 1990).

Stream Canopy Cover

Riparian vegetation and its ability to shade the stream varies due to the aspect of the stream, the size and morphology of the stream and the type of riparian vegetation present. Shading is also influenced by past

flooding which, in many areas, has created wide unvegetated floodplains. Where floodplains are wide, the effectiveness of the vegetation to shade water surfaces is reduced.

In addition to flood events, riparian communities have also been affected by fires (such as in 1987) and mining since the 1870s. These cumulative effects have tended to reduce the amount of shade provided to streams from the adjacent riparian canopy.

None of the 19 streams surveyed meet the average noon shade criteria of 80% of the stream surface. To reach the criteria, an aggressive revegetation program would have to be followed in addition to the retention of sufficient trees to buffer the stream surface from direct solar radiation.

Forest-wide data indicates that within Douglas-fir areas, stream shade is 96% of its potential. However, within ponderosa pine areas, potential stream shade is 55%. Much of this difference is based on the ecology of the vegetative types.

Removal of streamside vegetation also reduces the amount of available CWD and standing trees for future recruitment into the stream.

Riparian Area Ground Cover

Riparian vegetation buffers streams from a portion of the upslope sediment delivery and stabilizes stream banks and is important for invertebrate production. The density of the vegetation and the species present affect how vegetation filters sediment and stabilizes stream banks.

On the Forest, 18 streams were surveyed to determine the vegetative composition within riparian areas. These surveys extended to the edge of the riparian vegetation. Of these streams, 9 supported less than 20% conifers, 5 supported 20 to 40% conifers, and 4 supported more than 40% conifers. The surveys indicate that the average composition of conifers is 25% with a range of 1% (Indian Creek) to 58% (North Fork Salmon River).

Surveys also documented data on the number of conifers (over 12 inches DBH) per acre. These were categorized into 1 of 4 classes: 0 trees, 1 to 11 trees, 12 to 15 trees, or over 15 trees per acre. Of the 18 streams surveyed, only 15% supported more than 15 trees (over 12 inches DBH) per acre.

Table 3-21 shows the expected conifer densities, based on a Forest-wide review of the vegetation within riparian areas (approximated by inner gorges). In addition, an estimated 40,000 acres of riparian areas are rock, barren or vegetated with non-commercial species.

Sedell's proposal for the Pacific Northwest recommended an optimum 250 square feet basal area per acre of conifers, or 85 trees/acre over 6 inches DBH within riparian areas. According to Sedell, a 90% conifer composition is optimum.

Table 3-21. Conifer Densities in Riparian Areas on the Forest.

Species *	Acres Within Riparian Areas	Basal Area per Acre of Conifers (over 6 inches DBH)
DF 3G	29,800	190
DF 3P	9,400	124
DF 4G	16,700	226
DF 4P	23,200	129
JM 3G	700	136
JM 3P	800	104
JM 4G	300	216
JM 4P	100	ND
MC 3G	25,200	69
MC 3P	19,200	76
MC 4G	20,200	185
MC 4P	13,600	130
F 3G	800	275
F 3P	1,200	175
F 4G	300	113
F 4P	500	158
H XX	2,100	55
LP XX	400	69

* DF - Douglas Fir; JM - Mixed Conifer (eastside); MC - Mixed Conifer (westside); F - True Fir; H - Hardwoods; LP - Lodgepole Pine. XX - No size class determined; 3 - Conifer species mean diameter less than 24 inches DBH; 4 - Conifer species mean diameter greater than 24 inches DBH. G - Conifers provide greater than 40% canopy closure; P - Conifers provide less than 40% canopy cover. ND - No data. This data reflects primarily (80%) natural forest cover.

Native and Desired Non-native Fish Communities

Refer to the Fish Population section earlier in this chapter.

Issues, Projected Demands and Opportunities

The short- and long-term effects of Forest management activities on the anadromous and resident fisheries resources is an important issue. The level of management emphasis, changes in fish outputs, changes in fish habitat, opportunities for habitat improvements and the costs of management were all identified as parts of the issue.

Other important issues include species diversity and viability of native stocks of wild salmonids. Species diversity is an important indicator of stream system health. The number of all native fish species present in several age classes should mimic the assemblage found in an undisturbed natural system.

The Forest planning process presents an opportunity to evaluate the appropriate level of program emphasis, based on multiple-use impacts, costs and returns. The program emphasis may contain all or parts of the following:

- Emphasize retaining the overall integrity and diversity of aquatic communities and habitat, versus a primary emphasis on anadromous fish.
- Modify management emphasis to highlight conservation of high quality anadromous habitat and restoration of damaged habitat. Fisheries restoration projects are coordinated with other disciplines, especially geology, hydrology and soil sciences.
- Focus on "wild" fish population management, and reduce the level of hatchery fish stock. This emphasis would require close coordination with the CDFG, since they have the responsibility to manage fish populations.
- Educate the public about the values of high quality habitat. Encourage enjoyment and appreciation of riparian-dependent species.

The future commercial, sport and Native American demand for fish will probably exceed the current productive capabilities of the Klamath River system. Increases in production may be accomplished through habitat improvement. Opportunities for the Forest to increase production levels is also dependent on off-Forest harvest and conditions. Environmental factors, such as drought, ocean conditions and floods, could also affect production levels.

The current level of in-stream construction of habitat improvement projects is 50 structures. The potential to increase fish production from these improvements is about 8 smolts per structure per year, based on structure effectiveness monitoring. The number of 8 smolts increased per structure may not support the use of instream structures to enhance production. Structural improvements within the stream can lead to improved channel integrity and function that has benefits to the aquatic system overall. The benefits may not be measurable simply in increased smolt numbers, but may need to be measured in habitat diversity and stream channel morphology.

The current level of stream-adjacent or upslope fish habitat acres planted is 53 acres. Information is needed regarding potential smolt production from restored acres. The benefits derived from this type of habitat restoration are not immediate. Rather, it is a long-term investment to provide shade, large woody cover and a healthy riparian area. If an assumption is made that revegetation of 8 riparian acres will restore 1 acre of in-stream habitat, then 1990 riparian projects could produce an additional 1,620 smolts.

To restore fish habitat and increase productivity, there are currently an estimated 6,300 acres of riparian areas on the Forest identified for revegetation. The estimated cost is $4,244,000. In addition, an estimated 9,600 in-stream structures have been proposed to recover habitat and increase the pool and cover components. These projects are planned to extend over a 50-year period, for a total cost of around $10,548,000. Investigations are currently refining the number of fish expected to be produced from Forest restoration activities. The results of watershed-scale analysis are being used to verify or adjust the number of acres and structures planned.

Fire may be used as a tool, emulating its historical role in reducing heavy fuel loadings in watersheds. Controlled burns can be of use to protect fish habitat by planning for low intensity fires under favorable conditions, containing them outside riparian areas and reducing the fuel accumulation so future fires in a treated drainage will be less severe.

Opportunities

The Forest planning process presents an opportunity to manage fish habitat with an emphasis on retaining the integrity and diversity of aquatic communities, rather than only increasing the productivity of individual species (refer to the Biological Diversity section). Fish habitat management could highlight conservation of high quality habitat and restoration of damaged habitat. Fisheries restoration projects could emphasize the use of natural on-site materials to mimic the undisturbed stream habitat components of large woody cover, pools and shade.

The opportunity to improve and restore anadromous and resident fish habitat might include placing in-stream and bank structures, revegetating riparian acres and addressing potential sediment sources upslope. Projects designed to provide in-stream structure could be located through intensive surveys of stream habitat and fish use. Upslope improvements could prevent aquatic habitat from becoming degraded.

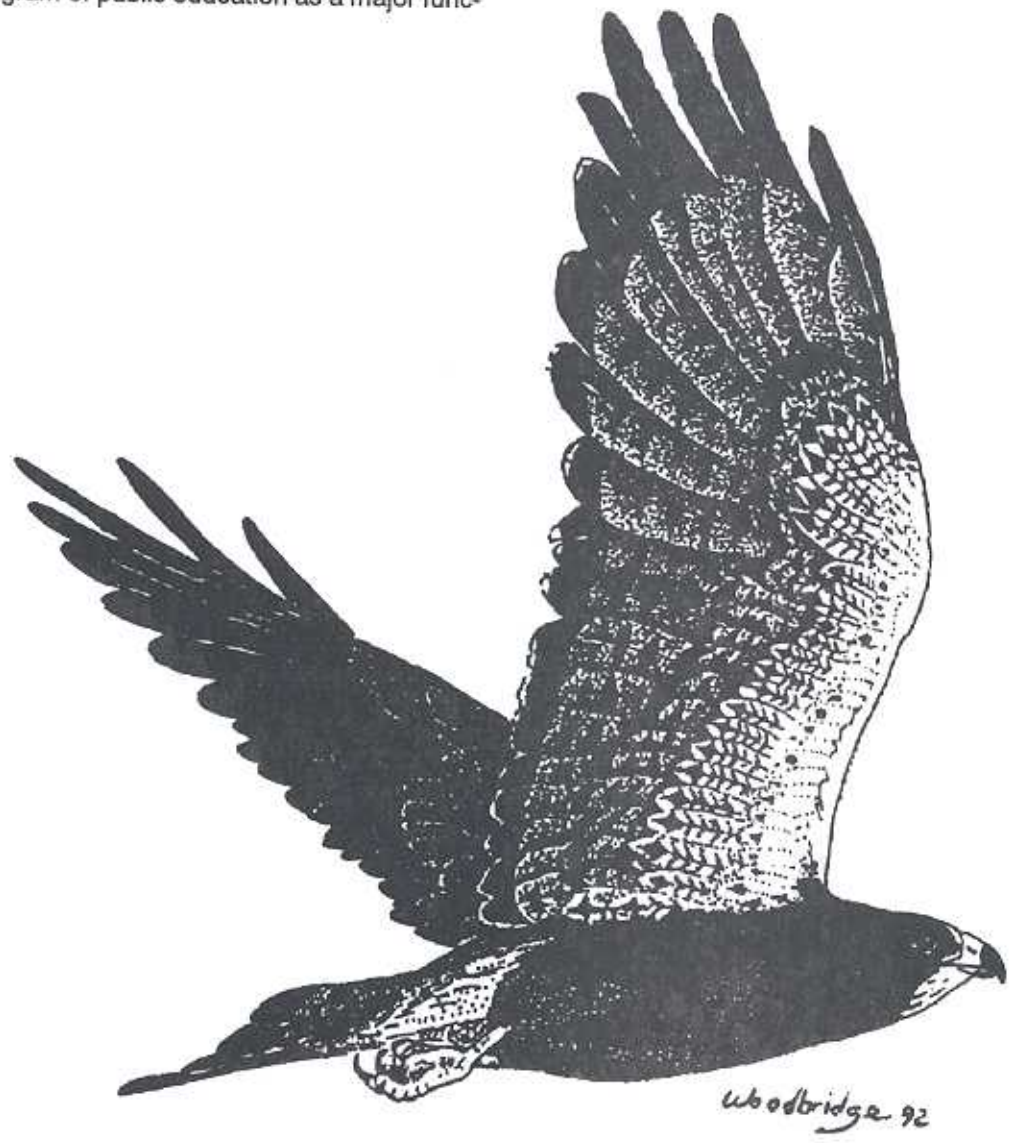
Ecosystem analysis at the watershed-scale and river basin analysis would provide an opportunity to adjust desired conditions for habitat components in addition to identifying the types of restoration work necessary to improve habitat conditions for aquatic species.

Opportunities exist to participate in restoration programs for anadromous fish at scales larger than the Forest scale and to cooperate with other agencies, local tribes, community groups and individuals.

Another opportunity would be that of building an aggressive program of public education as a major function of the fisheries program. This would include interpretive signing, project tours, volunteer help and community public school presentations and programs. Partnerships with user and interest groups could play a major role in all aspects of the program.

Opportunities exist to emphasize non-consumptive fisheries. The opportunity to view spawning fish and to experience catch and release fishing could be part of this.

Freshwater fishing in the Western United States is expected to double its present level by 2030. In local areas, because of the type of fishing available (such as the opportunities in the lower Klamath River), the Forest may benefit from these increases. Whether or not the growth in the sport fishery can be sustained will depend on general economic conditions and fish populations. Opportunities to increase the number of FUDs on the Forest could be realized by improving population levels.



Resource Management Programs

Visual Resource Management

Description

Americans highly value scenery, or visual quality, within their National Forest. Natural-appearing forests offer scenes, valued as recreational settings and living environments. Such settings contribute to the well-being of many individuals in today's complex and fast-paced society. Conservation of the naturally established scenic character of these settings is the primary goal of visual management on all National Forests.

The Forest scenery is known for its diversity, ruggedness and primitive character. An abundance of scenic river canyons, mountain crests and pristine (undisturbed) land offers a high-quality setting for a growing number of recreational pursuits. Such pursuits include sightseeing from motor vehicles, river rafts or while hiking.

About 60% of the Forest's land is visible from areas where users are expected to have a high concern for scenic values. Of the Forest's landscapes, 22% are classified as highly attractive. These landscapes generally occur in mountain ranges above 5,000 feet elevation, river canyons, large wet meadows or many other of the Forest's prominent geologic features. The majority of the Forest consists of mostly pleasing, yet common landscapes located on moderately steep slopes and ridges or on fairly level terrain (refer to Table 3-24).

The Forest has a high proportion of lands with moderate to steep slopes and soil colors that can sharply contrast with its green forests and other more subtle vegetative patterns. Thus, its overall capability to retain a natural appearance when altered is relatively low.

Forest landscapes have been altered by both human activities and by natural processes. Impacts from human activities are primarily the result of past logging, road building and, to a lesser extent, mining activity. The effects of fire are also noticeable on the landscape. Wildfires are positive elements that have contributed to the Forest's natural landscape character, patterns and diversity. At present, 74% of the Forest has a natural-appearing character, while the remainder appears altered. Most of the strong visual contrasts occur either in the background distance zone or out of sight of major highways, trails and recreation areas.

Management Direction

Scenery is a resource that must be considered with all other resources. Pertinent laws and regulations, along with Agency direction that includes the Visual Management System (VMS), combine to provide the framework for management of visual resources on the Forest.

Created in 1973, the VMS was an outgrowth of legal mandates. It is composed of four major components used to determine the existing and potential visual quality of the Forest.

Three inventories: variety class, distance zone and sensitivity level, combine to form the first major component, called Inventoried Visual Quality Objectives (IVQOs). IVQOs, approved through the Forest Plan, are called Adopted VQOs. These objectives are used to define the amount of acceptable landscape alteration for a particular project.

The second component, Existing Visual Condition (EVC), is a measure of how natural the Forest appears today. This is a baseline condition. The third and fourth components, Visual Absorption Capability (VAC) and Visual Quality Index (VQI), are used in Forest planning. The Forest's capability to undergo change and still look natural is what VAC measures. VQI is a relative measure of the cumulative visual effects of alternative proposals and their differences. Descriptions of these four components are provided below. More detailed descriptions are in the Visual Management AMS.

Visual Quality Objectives

Inventoried and Adopted Visual Quality Objectives are derived from a combination of variety class, distance zone and sensitivity level attributes. A range of 5 VQOs is used. Each VQO specifies to what degree management activities may visually contrast with surrounding natural character and still satisfy the average person's preferences for scenic quality.

The 5 VQOs defined below are "visual yardsticks" used to evaluate both project impacts and Forest-level effects of planning alternatives. (These VQOs are also depicted in the simulations included in the enclosed map packet.)

Preservation (P) - Changes resulting from ecological processes or which result from very low visual-impact activities.

Retention (R) - Management activities are generally not evident to the casual forest visitor. Visual changes from the existing condition may only repeat the form, line, color, texture and sizes of openings commonly found in the surrounding landscape.

Partial Retention (PR) - Activities are slightly evident, but subordinate to the characteristic landscape.

Modification (M) - Activities attract attention and may dominate the characteristic landscape but repeat form, line, color and texture from the surrounding landscape character. They appear natural when viewed in foreground or middleground.

Maximum Modification (MM) - Activities dominate the landscape, yet appear natural when viewed at background distances.

The Forest IVQOs, interim standards for the management of visual resources, provide current Forest management guidance until approval of the Forest Plan. As management guidelines, IVQOs should be given strong consideration in the decision-making process. However, if other resources exhibit higher values and needs, then line officers may adjust VQOs.

The Adopted VQOs, a product of multiple-use tradeoffs, will become management direction upon approval of the Forest Plan.

VQOs are based on a combination of variety class, distance zones and sensitivity levels:

Variety Classes - Three classes are used to measure scenic attractiveness of NFS land in terms of the natural variety of land form, vegetation, and water form:

(1) Class A - Distinctive, and has the most natural variety (for example, river canyons). This is where visitors are likely to take photographs.

(2) Class B - Common, yet pleasing landscapes (Like conifer forests on steep slopes) represent most of the Forest.

(3) Class C - Minimal variety are uniform and less interesting lands (like extensive conifer forests on gentler ground).

Distance Zones - There are 3 zones, based on distances from any point of observation (road, trail, river, etc.):

(1) foreground - 0 to 1/2 miles

(2) middleground - over 1/2 and up to 3 to 5 miles, and

(3) background - beyond 3 to 5 miles.

Sensitivity Levels - Three levels, determined by amount of use and visual sensitivity of the user, are used to express public concern for National Forest scenic quality. The 3 levels are determined by amount of use and visual sensitivity of the user.

(1) Level 1 is high use and/or concern (for example, Highway 96, Interstate 5, the Pacific Crest Trail (PCT)).

(2) Level 2 is moderate (for example, Red Rock Road, Elk Creek Road) and

(3) Level 3 is low (for example, Doggett Creek).

Existing and Future Visual Condition (EVC and FVC) - This is a measure of how the Forest landscape looks today, or might look in the future, in terms of 6 levels. The levels are untouched, unnoticed, minor disturbance, disturbance, major disturbance and drastic disturbance. These provide baseline-condition levels, measured against estimated FVC. The first 5 levels correlate to the 5 VQOs.

Visual Absorption Capability (VAC) - This is a measure of landscape capacity to sustain changes and retain a natural appearance. The three VAC classes (high, intermediate and low) are based on 4 biophysical factors (slope, vegetative screening/pattern, site recoverability and soil-color contrast).

Visual Quality Index (VQI) - This is used to rate visual conditions of the Forest on a scale of 0 to 100. It combines Forest-wide degrees of natural appearance and inherent scenic values, but does not consider how visible the lands are from public-use areas. A VQI of 100 means the entire Forest would meet the Preservation VQO. A score of 0 means it would all meet the Maximum Modification VQO.

Regional guidelines for Forest-level planning range between 3 to 7% of the Forest's total land base in Maximum Modification acres. Regional implementation requirements for the Forest require a minimum VQO of Partial Retention in the foreground and middleground visual corridors of Eligible State Scenic Highways. These highways are Highways 3, 263, 96 and 97, and Interstate 5.

Current Visual Quality

The following description, including Tables 3-24 to 3-26 below, display the current visual quality on the Forest in terms of variety class, IVQOs, EVC and visual rehabilitation.

Table 3-24 displays the amount of Forest land in each variety class. Most of the Forest's Variety Class A landscapes are found in open, craggy mountain tops above 5,000 feet, river canyons, large wet meadows and other prominent geologic and vegetative features. Variety Class B lands consist mainly of conifer and hardwood forests on moderately steep slopes. Variety Class C lands are found only on the eastside of the Forest. These consist of open, valley floors with little vegetative variety.

Table 3-24. Variety Class

Variety Class	Acres	Percent
A - Distinctive	371,400	22
B - Common	1,278,200	76
C - Minimal	30,700	2
Total	1,680,300	100

Table 3-25 shows the IVQOs for the Forest. The Preservation IVQOs are applied to the Forest's 5 wilderness areas, proposed RNAs and the immediate river vicinity of the proposed Wild rivers. The Retention and Partial Retention IVQOs are applied to roads, rivers and trails with moderate to high visual sensitivity. The Modification and Maximum Modification IVQOs are located in areas with moderate to low visual sensitivity.

Table 3-25. Inventoried Visual Quality Objectives

Name	Acres	Percent
Preservation	385,300	23
Retention	165,200	10
Partial Retention	664,000	39
Modification	414,200	25
Maximum Modification	51,600	3
Total	1,680,300	100

Table 3-26 displays visual conditions on the Forest as they exist today. Society's cumulative undertakings over the past 150 years (grazing, logging, mining, etc.) have resulted in visually dominant alteration of almost 26% of the Forest's lands. These numbers could increase over the years if similar-type activities continue. Currently, there are about 739,000 acres of untouched landscapes. These are mostly wilderness areas on the westside of the Forest and other smaller areas primarily next to wilderness. Areas where drastic disturbance has occurred include timber harvest, road building and mining activities and represent around 157,000 acres (9% of Forest's land base).

Assuming that the entire Forest was completely developed, but still met IVQOs, the minimum VQI would be 45.0. The current Forest VQI is 80.0. Assuming that in 1850 the entire Forest was in a Visual Condition Class I (appears essentially untouched), the maximum VQI would be 100.0. This number provides the benchmark used to compare the change in the VQI since the turn of the century (see Figure 3-9). If this trend were projected, the overall visual quality of the Forest landscape would continue to decline.

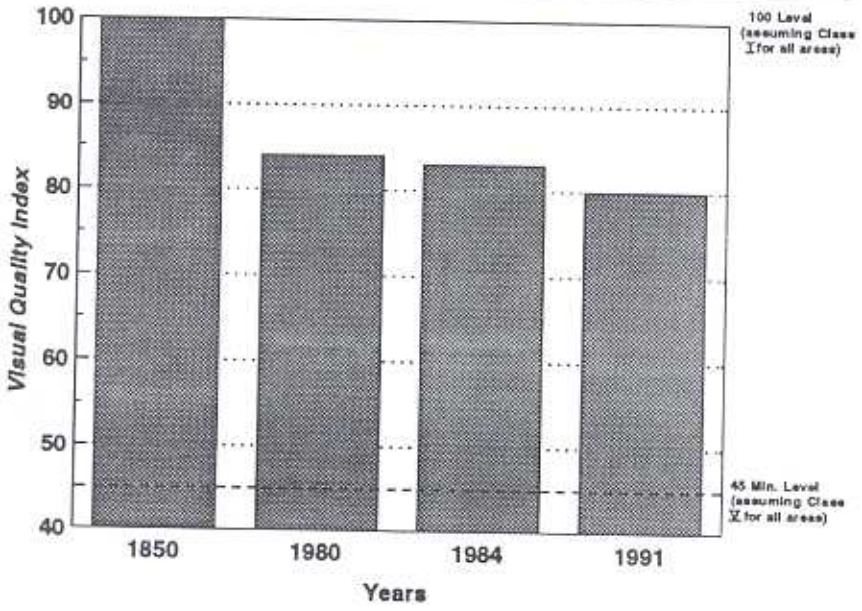
Table 3-26. Existing Visual Condition

Class	Name	Acres And Percent By Variety Class			
		Class A	Class B	Class C	Total
I	Untouched Landscapes	288,700 (17)	449,600 (27)	1,000 (0)	739,300 (44)
II	Unnoticed Alterations	23,200 (1)	248,000 (15)	24,500 (2)	295,700 (18)
III	Minor Disturbances	19,700 (1)	183,700 (11)	2,400 (0)	205,800 (12)
IV	Moderate Disturbances	23,300 (2)	154,500 (9)	1,900 (0)	179,700 (11)
V	Major Disturbances	4,800 (0)	97,300 (6)	300 (0)	102,400 (6)
VI	Drastic Disturbances	7,900 (0)	149,400 (9)	100 (0)	157,400 (9)
	Total	367,600 (21)	1,282,500 (77)	30,200 (2)	1,680,300 (100)

Currently, 9% of the Forest land base (around 157,000 acres) needs visual rehabilitation. Most occurs as a result of timber harvest activities that do not meet any IVQOs. (The EVC Type VI lands is identified above as "Drastic Disturbance.")

Current Forest visual resource conditions, as described above, are based on three database layers developed in 1989 (EVC and IVQOs) and the 1989 sensitivity-level inventory. All three are on file at the Forest Supervisor's Office (for further detail, refer to the Visual Management AMS, available at the Forest Supervisor's Office).

Figure 3-9. Visual Quality Trend



Issues, Projected Demands and Opportunities

The preservation of natural-appearing landscapes and the amount, location and quality of scenic resources are important issues. The following future demand and opportunity projections reflect these issues. They are based on the public's growing desire for solitude in a natural setting and awareness of current environmental problems, impacts and losses on a National, Regional and local scale.

The value of the Forest's scenery will increase in economic importance to counties and communities within its influence. Siskiyou County, in particular, should continue to experience a growing need to diversify its economic base by expanding the recreational-services sector. Expected is an increasing demand for tourism, whitewater rafting, sport-fishing and backcountry opportunities.

Increasing the amount of land, where recreational pursuits and other resource objectives (like wildlife, fisheries and watershed) tend to limit visually disturbing activities, will slow the rate of scenic decline on the Forest.

There is an opportunity to retain the Forest's long-term visual integrity with standards and guidelines that would facilitate meeting Adopted VQOs at the project-level.

Recreation Management

Description

The Forest offers visitors many recreational opportunities in a variety of settings. Forest attractions include highly scenic landscapes, abundant wildlife and many lakes, rivers and streams. The Forest has over 152 miles of Wild and Scenic Rivers (WSRs) and 381,000 acres of wilderness.

The most popular recreational activities are boating, camping, fishing, hiking, backpacking, horseback riding, hunting and winter sports. Access is provided by the Forest's road and trail systems. The major travel routes to the Forest are Interstate 5 and Highways 96 and 97. From these highways, the Forest road system branches out to many points of interest and recreational opportunities. The trail system branches out from the road system to backcountry and undeveloped opportunities.

Recreational Experiences

Developed Recreation

Developed recreation occurs at permanent sites developed specifically for recreational purposes, such as campgrounds, picnic grounds and trailheads. About 20% of present recreational use on the Forest occurs at developed sites.

Developed recreational sites on the Forest consist of 30 campgrounds, 2 picnic grounds, 9 trailheads, 3 observation sites and 7 visitor information sites. These sites are easily reached by road. They are used as a base of operations for fishing, boating, swimming, hunting, hiking and other activities. Most are located along the Klamath, Scott and Salmon Rivers, in natural-appearing, yet roaded, surroundings. All developed sites are currently managed at low standard levels.

Standard-level management for developed recreational sites attempts to meet perceived visitor expectations, as well as public health and safety needs. Cleaning and policing, hazard removal, maintaining potable water, waste water treatment and disposal, and refuse and garbage disposal are provided.

Improvements can be maintained at the standard of the original construction or to that of later improvements or modifications. Standard intensity management provides for meeting rehabilitation needs and for removing architectural barriers that limit use or enjoyment of recreational attractions. Low standard management does not meet one or more of the objectives that have been established for standard management.

Forest campgrounds and picnic areas vary in age. They range from the 1930s Civilian Conservation Corps era up to the mid-1960s. Some are being renovated to meet today's needs. Most need at least some work to attain a fully acceptable condition.

Several of the Forest's older campgrounds are functionally obsolete. These facilities need to be relocated or significantly redesigned to accommodate current visitor preferences.

Kangaroo Lake Campground, a 25-mile drive from Interstate 5, was recently renovated. Fishing and camping facilities for the physically challenged are now available. In addition, fishing platforms and a barrier-free access trail have been installed at Juanita Lake Campground, a short drive from Highway 97.

Currently, there are 21 recreational residences on the Forest with permits for exclusive private use. Appraisals are conducted by the Forest every 20 years to ascertain fair-market-value permit fees for these residences. The next appraisal period is scheduled for 1998. The residences will continue to be permitted unless "future use determination" studies determine that the sites are needed for a higher public use.

Dispersed Recreation

Dispersed recreation is outdoor recreation that involves relatively low density use and occurs over broad expanses of land or water. Dispersed recreational activity accounts for 80% of Forest recreational use. Most dispersed activity occurs during the summer and fall months. All dispersed areas are currently managed at low standard levels.

Standard management for dispersed areas provides quality recreational opportunities. Developments, structures and facilities are provided to enhance recreational opportunities and to meet perceived visitor expectations. Better trailheads, improved river access spots, better maintenance of access roads and improved sanitation facilities at staging areas can contribute to a quality recreational experience.

However, low standard management provides only minimal support facilities. The quality of the recreational experience may be reduced, and expectations may not be met, since the funding level does not allow for any mitigation of the impacts on the natural resources due to the users.

Popular activities include fishing, hunting, whitewater pursuits, swimming, camping, hiking, bicycling, snowmobiling, cross-country skiing and automobile travel. Deer, bear, antelope, upland birds and waterfowl are popular game animals. The most sought after fish are steelhead, king salmon, silver salmon and rainbow trout. Photography and bird watching are popular non-consumptive wildlife activities. Except for whitewater activity, most of this use is not directed by guide services.

The WSRs on the westside are a major recreational attraction (refer to the Wild and Scenic River Management Section later in this chapter). The Klamath, Scott and Salmon Rivers, as well as several of their larger tributaries, provide outstanding whitewater boating opportunities.

The season of boating use for the Scott and Salmon Rivers is from early spring to about the end of June when water levels are high enough to make them negotiable. Clear, Dillon, Elk, Indian and Wooley Creeks are similar, except the season may end even sooner.

The Klamath River, in contrast, is dam-controlled above the Forest boundary. It is usable throughout the year. Most floating on the Klamath occurs between Memorial Day and Labor Day. Presently, about 80% of whitewater rafting is directed by 64 commercially-permitted whitewater guides.

Cross-country skiing, ski touring and snowmobiling are popular winter sports. There is also a small amount of "walk up, ski down" alpine skiing. The Goosenest Ranger District receives most of the winter sports activity.

The use of off-highway vehicles (OHVs) on the Forest is managed according to the 1976 Off-Road Vehicle Plan. OHV use is allowed where it is not (1) legislatively restricted, (2) causing unacceptable resource damage or (3) in conflict with other activities. The objective is to restrict use only where there is a demonstrated need.

Over 70% of the Forest is currently open to unrestricted OHV use. Exceptions are wilderness areas, the Pacific Crest Trail and some sensitive areas, with restrictions to protect soil, vegetation and wildlife. Wilderness areas on the westside account for 90% of the Forest's closures. However, there is very little OHV activity on the westside due to its steep, rugged terrain and dense stands of timber.

The eastside, with its more open, gentle terrain, gets most of the OHV use in the form of snowmobiling. It has two snowmobile parks, located at Deer Mountain and Four Corners. These are about 158 miles of snowmobile trails. No other roads, trails or areas are designated specifically for OHV use on the Forest. Due to the steep terrain on most of the Forest and the distance from urban areas, OHV use remains a relatively insignificant recreational activity.

Trail Management

The Forest trail system provides access for dispersed recreational activities. The westside of the Forest has an extensive network of over 1,330 miles of trails. There are over 150 miles of National Recreation Trails including the Pacific Crest Trail, Clear Creek Trail, Kelsey Trail and Boundary Trail.

The current trail network has evolved over the past 150 years, starting from historical needs to provide access to remote areas for prospecting, grazing and fire control. Many of the trails were primary transportation routes in the days before roads.

For the most part, the system was neither designed nor constructed with recreational needs or objectives in mind. Resource damage has occurred along poorly located portions of trails that receive heavy recreational use. Many trails need reconstruction work, some need re-routing. Some trailhead facilities need to be improved or relocated.

Trails can be maintained at the standard level or at less than the standard level. Standard maintenance is generally adequate to meet the established management objectives. Relocation and reconstruction is performed as needed in a timely manner. Resource damage is repaired.

Less than standard maintenance may not meet the established management objectives. Some work may be deferred. Necessary relocation and reconstruction work may not be accomplished. Rehabilitation of resource damage may not occur.

Issues, Projected Demands and Opportunities

Public demand for high quality recreational experiences over a variety of uses is an important issue. Improving the quality of recreational experiences, by evaluating and improving the trail system, is also an important public issue.

Current Supply

The Forest is surrounded by other National Forests and by State parks which provide similar recreational opportunities located closer to population centers. This has been a factor in keeping recreational use on the Forest relatively low on a Regional scale.

Many areas on the Forest receive little use. Often during the peak of the recreation season, there are still spaces available in the Forest's campgrounds and picnic areas. The Forest's recreational resources provide many opportunities for those seeking uncrowded conditions and a wide range of experiences.

The primary purpose of managing National Forest recreational resources is to provide a range of opportunities that provide satisfying recreational experiences. Supply is the quantity of recreational facilities or settings available for visitor use. Recreation capacity is a measure of the maximum potential supply. Developed recreation supply is expressed by site or facility capacity.

For dispersed recreation, supply is expressed as a mix of settings conducive to various activities. The recreation opportunity spectrum (ROS) is used to describe the settings offered. The supply of recreation settings is expressed as the inventoried acres within each ROS class. It can be also measured in persons-at-one-time (PAOT) and in potential use in recreation visitor days (RVDs).

The ROS is a system that identifies and classifies the opportunities available on a given area of land, based on its size, distance from roads and degree of development. The ROS classes pertinent to the Forest are: primitive (P), semi-primitive non-motorized (SPNM),

semi-primitive motorized (SPM), roaded natural (RN) and rural (R) (refer to the Glossary under ROS for definitions).

Recreation capacity in PAOT is the number of persons a facility or area can support, at a given time, without damaging structures and resources or adversely impacting the experience. The capacity of developed facilities is based on the number of sites. Each site has a 5 PAOT capacity.

The capacity of ROS classes for dispersed use is based on a "practical maximum" capacity, an effective upper limit that takes the theoretical capacity and adjusts for certain factors. These factors can be unusable acres, weekend versus weekday use and occupancy rates that affect recreational use patterns.

Recreation use is measured in RVDs. RVDs quantify recreational use in terms of person-hours. One RVD equals 12 person-hours. Due to budget constraints, use in RVDs is only monitored currently at developed sites, such as campgrounds and picnic areas. Recreational use in dispersed areas is estimated and has no statistical reliability.

Current inventoried ROS acres, maximum practical capacity in RVDs and capacity in PAOT are shown in Table 3-27. The capacity in RVDs is based on the practical maximum capacity of each ROS setting.

Table 3-27. Recreation Supply and Capacity

ROS Class	Inventory (acres)	Maximum Practical Capacity in RVDs	Capacity in PAOT***
Primitive (P)*	208,000	31,000	100
Semi-primitive Non-motorized (SPNM)*	340,000	295,000	1,100
Semi-primitive Motorized (SPM)	36,000	15,000	300
Roaded Natural (RN)**	802,000	2,325,000	26,100
Rural (R)	294,000	2,530,000	24,600
Total	**1,680,000**	**5,196,000**	**52,200**

* Most of these ROS settings (nearly 75%) are in wilderness.

** Includes developed site use and capacity.

*** Based on "usable" acres (for example, slopes less than 35%).

Projected Demand

Anticipating recreational demand is very difficult. It varies with economic factors, recreationists' preferences and available ROS settings. One sign of future demand is current recreational use. Recreational use Nation-wide is currently increasing at a rate similar to that of population growth.

The 1989 RPA Assessment projections for National outdoor recreation use identify 11 activities expected to have the greatest increase in demand through the year 2040. Ten of them are pertinent to the Forest

In descending order of projected demand, they are: (1) walking for pleasure, (2) driving for pleasure, (3) picnicking, (4) stream, lake or ocean swimming, (5) family gatherings, (6) wildlife observation and photography, (7) other outdoor photography, (8) boating, (9) bicycle riding and (10) day hiking. Of these categories, the Forest offers many opportunities. Many of them are in dispersed recreational settings.

Demand projections are based on population growth and current recreational use. Overall recreational use is expected to rise from 12% of maximum practical capacity to 14% by the first decade (Table 3-28). By the fifth decade, total projected use would still be only about 20% of maximum practical capacity. The ROS classes projected to come closest to reaching their maximum capacities by 2040 are Primitive and SPM with 41 and 47% use, respectively.

Table 3-28. Maximum Practical Capacity and Projected Demand

ROS Class	Acres	Maximum Practical Capacity	Projected Demand (RVDs)		
			Current	Year 2000	Year 2040
P	208,000	31,000	8,000	9,000	13,000
SPNM	340,000	295,000	63,000	69,000	101,000
SPM	36,000	15,000	4,000	4,000	7,000
RN	802,000	2,325,000	504,000	555,000	812,000
R	294,000	2,530,000	79,000	87,000	127,000
Total	**1,680,000**	**5,196,000**	**658,000**	**724,000**	**1,060,000**
Dispersed	1,297,700	4,062,900	569,000	623,000	940,000
Developed	1,500	934,000	150,000	165,000	242,000
Wilderness	381,100	199,100	71,000	78,000	116,000
Total	**1,680,300**	**5,196,000**	**790,000**	**866,000**	**1,297,000**

Currently, 1 in 8 Americans live in California. Population pressure will continue to increase the demand for NFS resources. Traffic on Interstate 5 has increased more than 50% in the past decade (California Department of Transportation traffic counts).

Crowding in recreational areas near urban areas could cause recreational use of the Forest to increase above the projected estimates in the future. Local increases in traffic may be a sign that this is already occurring. Traffic on Highway 96 has doubled over the past decade, while traffic on Highway 97 has increased over 60%.

Siskiyou County experienced only a modest 10% growth rate in the 1980s, while surrounding areas grew more rapidly. The demand for recreational opportunities located within a 100 miles of population centers is on the rise. The population of Redding (90 miles to the south) increased from around 45,000 to 66,000 during the past decade. Medford, Ashland and the Rogue Valley (40 to 50 miles north), are experiencing similar booms. The coastal cities of Eureka and Arcata (2 hours west) were also growing rapidly.

These areas are all within easy driving distance of the Forest. Much of the appeal, leading to the growth of these areas, relates to quality of life (including recreational opportunities). As a result, the Forest could receive greater use from these populations.

However, a trend off-setting this is the potential reduction in population in Siskiyou County and the surrounding areas due to less available timber than in the past. Reductions in timber product jobs also would affect the industries that supply services to timber workers (refer to the Social and Economic Environment later in this chapter).

The following trends in recreational use are projected for the Forest over the next decade.

1. There will be a steady increase in traditional activities, as well as in activities that have recently gained popularity. These include camping, fishing, whitewater boating, horseback-riding, hiking, hunting, nature watching and photography.
2. As the post-World War II baby boom generation becomes older, recreational activities that are less physically demanding, such as day hiking, walking for pleasure and RV camping, will gain in popularity.
3. The demand for special purpose sites and facilities will increase. These include (1) "barrier-free" facilities for the physically challenged, (2) trailhead development, (3) improved river access area and (4) staging areas for bicycle trips and equestrian trips.
4. Many existing sites and facilities will need to be relocated, modified or upgraded to adequately meet changing demands, such as RV hook-ups and barrier-free facilities. Full-service facilities near major travel routes might serve as "central staging areas" for dispersed activities.
5. There will be an increase in demand for dispersed opportunities, such as mountain biking, cross-country skiing, snowmobiling and mountaineering.
6. "Non-snow" OHV use is expected to remain relatively insignificant.
7. "Recreational" mining will continue to create some degree of conflict between dredgers and other river users.

Management Opportunities

It is anticipated that the timber supply in the area will no longer sustain traditional levels of employment and economic stability. As the area becomes less timber-dependent, people may look to other Forest resource opportunities to meet their economic needs.

Greater interest in recreation-oriented enterprises has traditionally followed declines in commodity-based economies. Local communities and businesses could offset some of the timber-related economic decline by actively marketing the Forest's considerable recreation potential, and so promote tourism.

The social and economic changes affecting this rural area set the stage to forge new and better partnerships. Local marketing and promotional efforts could generate more partnership opportunities to help expand and diversify the economic base. These could involve cooperative efforts of private enterprise and public agencies (such as County, State and Federal), particularly along the major travel routes.

Establishing Scenic Byways is another opportunity to market the Forest's scenic resources and encourage tourism. The "State of Jefferson" Scenic Byway was established in 1992. This byway starts at Yreka and heads north along Highway 263 to Highway 96. It then follows Highway 96 to Happy Camp and heads north over Grayback Road into the Illinois Valley. The byway ends at O'Brien, Oregon and the junction with Highway 199.

In addition to scenic attributes, many types of Forest management activities and recreational opportunities occur along the river corridor. Byway designation serves as a communication "vehicle" to increase public awareness of ecosystems and resource management through interpretive site development along the Klamath River.

There is also an opportunity for better integration of recreational objectives with other resource management activities and with other agencies to reduce conflicts and maximize recreational values.

There is potential for developing an alpine skiing facility on the Forest. A potential site on the Forest has been proposed by an individual proponent.

This site was analyzed in the Final Supplement to the Final EIS for the Mt. Shasta Ski Area. The area is near West Haight Mountain on the Goosenest Ranger District, approximately 45 road miles north and east of Mt. Shasta City. All formal proposals for development of ski areas would require an in-depth, site-specific analysis to determine the environmental effects, feasibility and compliance with laws, regulations and policies.

Opportunities also exist to promote the Forest's image as a willing host of special events, such as whitewater rodeos and bicycle races, and to manage creatively the effects (including publicity values).

Opportunities exist to establish pro-active Forest direction, encouraging more partnerships with the private sector in developed recreation. Private development of full-service facilities on NFS land, nearer to major travel routes like Interstate 5, could stimulate both developed and dispersed use.

An increase in developed use should generate an increased awareness of the Forest's dispersed settings as attractive alternatives to the more heavily used settings nearer urban areas.

Wilderness Management

Description

A significant portion of the Forest is in wilderness. This includes all of the Marble Mountain Wilderness (223,500 acres), all of the Russian Wilderness (12,700 acres), nearly half of the Siskiyou Wilderness (70,100 acres), part of the Trinity Alps Wilderness (74,900 acres) and a 5-acre portion of the Red Buttes Wilderness (see Figure 3-10).

These wildernesses are all on the westside of the Forest. Their total area represents almost 23% of the Forest's land base (over 381,000 acres). About 3,800 acres remain in private ownership.

The Pacific Crest Trail crosses 3 of the wildernesses within the Forest (Marble Mountain, Russian and Trinity Alps). For individual wilderness descriptions, refer to the Recreation AMS (available at the Forest Supervisor's Office).

Management of wilderness is primarily governed by legislative direction in the 1964 and 1984 Wilderness Acts. It is supplemented by the regulations in 36 CFR 293 and direction in FSM 2320. The 1984 California Wilderness Act designated over 180,000 acres of additional wilderness on the Forest. It directed that the second Roadless Area Review and Evaluation (RARE II) study was sufficient consideration of wilderness suitability for this round of planning. It also directed that released roadless areas should be considered for multiple-use management.

All roadless areas on the Forest, not designated as wilderness by the 1984 Act, were released. For information on these areas, refer to Appendix C in this EIS.

Current fire management policy requires immediate action to suppress all fires in wilderness, regardless of location or how they were caused. The wilderness objectives defined in 36 CFR 293 state that "natural ecological succession will be allowed to operate freely to the extent feasible..." where there is no threat to life, property or resource values in or outside the wilderness.

Currently, the exclusion of fire in wilderness has resulted in an accumulation of fuels and an increased risk of high intensity wildfires (refer to the Biological Diversity and Fire Management sections of this chapter).

While wilderness provides excellent recreational opportunities, wilderness is managed for other values as well. It provides a near-pristine environment that allows ecological processes to work with minimal disruption from human activity. This environment provides essential habitat for many fish and wildlife species.

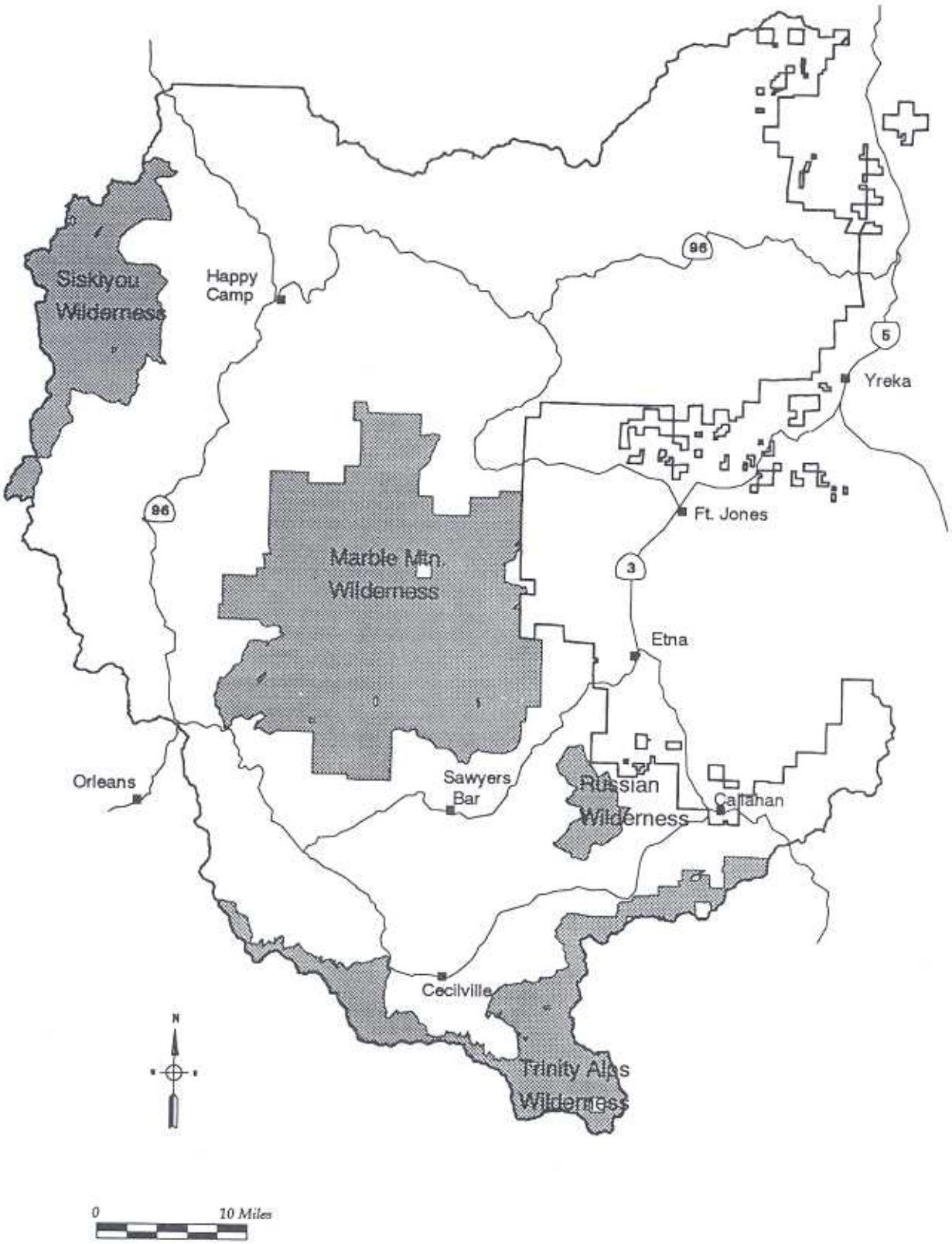
Issues, Projected Demands and Opportunities

There is an opportunity to use both prescribed natural fire and planned ignition in wilderness to reduce, to acceptable levels, the risks of wildfire (refer to the Biological Diversity and Fire Management sections of this chapter).

Over 1,000 miles of the Forest trail system is in wilderness. Some of the more heavily used trails need to be rerouted or reconstructed to prevent further resource damage. The utility and scope of the out-of-wilderness trail and trailhead system needs to be expanded.

Pressures against livestock grazing in wilderness will continue.To reduce conflicts between people and cattle, pro-active range management will be required.

Figure 3-10
Wilderness



Released Roadless Area Management

Identified as an important issue was the determination of the appropriate land use and the capability for each area released from potential wilderness designation by the California Wilderness Act of 1964. Appendix C summarizes the history and the capabilities of each released area that still meets the original RARE II inventory criteria for roadless areas.

Wild and Scenic Rivers Management

Designated Rivers

Description

Parts of the Klamath River system were designated as components of the California Wild and Scenic Rivers System by the State Legislature in 1972. In 1981, at the petition request of Governor Brown, Secretary of Interior Cecil Andrus included these components in the National Wild and Scenic Rivers (WSRs) System. The Federal designation was based on their "outstandingly remarkable" anadromous fishery values.

The Wild and Scenic Rivers Act (WSRA) of 1968 (as amended in 1986 and 1988) provides for the preservation of those rivers (and their immediate environments) that have outstandingly remarkable values. Such values are scenic, recreation, geologic, fish and wildlife, historic, cultural or other similar values.

These rivers are to be preserved in a free-flowing condition and protected for the benefit and enjoyment of future generations. To accomplish this, the WSRA established the National WSR System, designated its initial components and prescribed the methods, standards and time frames for recommending additional components.

The 1986 Amendment to the WSRA requires "...for all rivers designated before January 1, 1986, all boundaries, classifications and plans be reviewed...within 10 years through regular Agency planning processes." The classifications of the Forest's designated rivers have been reviewed according to the 1986 amendment.

Two segments of the Klamath River and 1 segment of the South Fork Salmon River have been identified as potentially qualifying for reclassification. Refer to Table 3-29 for detailed descriptions and classifications of these segments.

FSM 2354 and FSH 1909.12 provide additional direction for management of designated National WSR components. FSH 1909 also includes the process for identifying and evaluating potential candidates within National Forests for inclusion in the Federal system. For more detail, refer to the WSR AMS located in the planning records at the Forest Supervisor's Office.

Management plans for each WSR component are to be written after approval of the Forest Plan and tiered to its direction. Interim river management will follow laws, regulations, manual direction and the standards and guidelines in the Forest Plan.

Detailed final boundaries for each of the designated rivers will be established in the Forest Plan process (refer to Appendix J in this EIS). Current interim guidelines require managing a quarter mile-wide corridor, from the ordinary high water mark on each side, for each component.

Wild and Scenic River Designations and Segment Classifications

The Klamath River and 3 of its tributaries on the Forest (Scott River, Salmon River and Wooley Creek) make up 200 miles of the National WSR System. All 3 classifications (Wild, Scenic and Recreational) are represented. Table 3-29 lists the currently designated components on the Forest with segment-by-segment descriptions and classifications.

Table 3-29. Designated WSR on the Klamath National Forest by Segment Descriptions and Classification

	River Segments and Descriptions	Classification
Klamath River		
1.	From the Forest boundary near the Ash Creek confluence to the Forest boundary with Six Rivers National Forest	Recreational
Scott River		
1.	From Shackleford to McCarthy Creek	Recreational
2.	From McCarthy Creek to Scott Bar	Scenic
3.	From Scott Bar to Klamath River confluence	Recreational

Table 3-29. Designated WSR on the Klamath National Forest by Segment Descriptions and Classification

	River Segments and Descriptions	Classification
Salmon River		
Main Stem:		
1.	From Forks of Salmon to Lewis Creek	Recreational
2.	From Lewis Creek to Wooley Creek	Scenic
3.	From Wooley Creek to Klamath River	Recreational
North Fork:		
1.	From pre-1984 wilderness boundary to Mule Bridge Campground	Wild
2.	From Mule Bridge Campground to Forks of Salmon	Recreational
South Fork:		
1.	From Cecilville to St. Claire Creek	Recreational
2.	From St. Claire Creek to Matthews Creek	Scenic
3.	From Matthews Creek to Forks of Salmon	Recreational
Wooley Creek:		
1.	From pre-1984 wilderness boundary to 1/2 mile upstream of Salmon River confluence	Wild
2.	From 1/2 mile upstream to confluence with the Salmon River	Recreational

The following are detailed descriptions of the designated segments. The National WSR designations are based on anadromous fishery values. For the non-designated portions, refer to Appendix E of this EIS. Refer to Table 3-30 for river miles by classification.

Klamath River - Eighty miles of the 107-mile designated stretch within the Forest flows through NFS land. The entire stretch, including 27 miles of private property, is well-known not only for its steelhead fishing, but also for whitewater rafting. The average rapid classification is Class 2. There are many Class 3, and a few Class 4, rapids that can be rafted year-round by rafts, kayaks and canoes.

The Klamath River canyon appears relatively natural overall, except for Highway 96 that parallels the river for the entire 107 miles. This highway is often visible from the river. Other visible human improvements include several riverside communities, river-access points, side-roads, bridges and buildings. Also evident are past and present evidence of grazing, mining and timber harvest activities.

Scott River - The Scott River is a major tributary of the Klamath River with headwaters in the Scott Mountains. The Scott River flows through Scott Valley before meeting the Klamath River near the community of Horse Creek. Of the Scott River's 23 miles of Recreational and Scenic classifications, 15 wind through NFS land. This stretch offers excellent whitewater opportunities in the spring. It has several Class 3 and 4 rapids, with a few Class 5 rapids.

Since a significant amount of river water is used by Scott Valley ranchers and farmers, its suitability for most boating activities is limited to the high flows of spring runoff through mid-June. The corridor remains relatively natural-appearing, with some evidence of human modification (such as bridges and buildings). Also evident is past and present timber management and mining activity.

Salmon River, Main Stem - Most of the designated portion is on NFS land. The main stem has 3 segments. The first and third are classified as Recreational and the second is Scenic. In addition to its high quality anadromous habitat, the main stem of the Salmon River is considered among the most challenging whitewater in California. The main stem is suitable for whitewater rafting during the spring and early summer runoff periods with rapids commonly in Class 3, 4 and 5.

County Road 2B01 follows the Salmon's main stem for the entire length, but is seldom visible along the Scenic section of river. The river canyon retains a natural character with limited evidence of structures, roads, bridges and other land-disturbing features or activities. Views from the river are often framed by the canyon.

North Fork, Salmon River - The North Fork of the Salmon River flows 35 miles from the headwaters in the Marble Mountain Wilderness before joining the South Fork at the main stem. The upper 8 miles were not included in the original designation. They were, however, considered in this Forest Plan for eligibility for inclusion in the National WSR System. All but 2 of the 28 miles currently designated flow through NFS land. The initial 4-mile stretch within the wilderness is classified as Wild, while the remainder is Recreational.

The river canyon is natural-appearing overall. County Road 1C01 parallels it for over 75% of the way. Other noticeable signs of civilization include the community

of Sawyers Bar, scattered buildings, and timber management and mining activities.

South Fork, Salmon River - From its origin in the Trinity-Alps Wilderness, the river flows 35 miles before meeting the North Fork. The upper-most 19 miles were not included in the original designation, but were considered in this Forest Plan for eligibility for inclusion in the National WSR System. Of the 16 miles currently designated, 13 flow through NFS land. The remaining 3 miles flow through private land. The South Fork has 3 segments: the first and third are classified as Recreational and the second is Scenic.

The river canyon retains a natural appearance overall, even though County Road 1C02 parallels the river for nearly 70% of its length. Other visible evidence of civilization includes the community of Cecilville, occasional structures and timber management and mining activities.

Wooley Creek - Wooley Creek is a major tributary of the Salmon River. The majority of its 19 mile length is within the Marble Mountain Wilderness. The upper 12 miles were not included in the 1981 river designation, but are under study in this Forest Plan for eligibility for inclusion in the National WSR System.

The lower 8 mile designated stretch has 2 segments. The first 7 1/2 miles within the 1984 wilderness addition are classified as Wild. The lower 1/2 mile (outside of wilderness) above the Salmon River confluence is classified as Recreational.

Table 3-30. Forest National WSR Classifications By Land Ownership (miles)

River	Classification	NFS Lands	Private	Totals
Klamath River	Recreational	80.0	27.0	107.0
	Total	80.0	27.0	107.0
Scott River	Recreational	9.8	7.4	17.2
	Scenic	5.0	1.1	6.1
	Total	14.8	8.5	23.3
Salmon River	Recreational	9.0	2.0	11.0
(Main)	Scenic	8.2	0.0	8.2
	Total	17.2	2.0	19.2
Salmon River	Recreational	7.2	3.0	10.2
(South Fork)	Scenic	6.2	0.0	6.2
	Total	13.4	3.0	16.4
Salmon River	Recreational	22.2	2.0	24.2
(North Fork)	Wild	4.3	0.0	4.3
	Total	26.5	2.0	28.5
Wooley Creek	Recreational	0.5	0.0	0.5
	Wild	6.4	1.0	7.4
	Total	6.9	1.0	7.9
	Grand Total	158.8	43.5	202.3

Classification Review

Three designated segments have been identified for potential reclassification review per the 1986 amendment to the WSRA. All 3 segments meet the guidelines for a Scenic classification and qualify for reclassification from Recreational.

The 2 segments on the Klamath River are from Seattle Creek to the private land boundary at Williams Point, and from Ti Bar to the mouth of the Salmon River. The segment on the South Fork Salmon River is from Cecilville Bridge to St. Claire Creek. Refer to Table 3-31 for descriptions and mileage.

A recommendation or non-recommendation on reclassification is required by the WSRA. The planning decision would be based on the relative resource trade-offs of reclassification. Refer to the Wild and Scenic River Management section in Chapter 4 for a discussion of effects.

Table 3-31. Forest Designated Rivers Qualifying for Potential Reclassification

River	Segment Description	Current Classification	Potential Reclassification	Mileage
Klamath	Seattle Creek to Williams Point	Recreational	Scenic	6.5
Klamath	Ti Bar to mouth of Salmon River	Recreational	Scenic	15.1*
So. Fork, Salmon River	Cecilville Bridge to St. Clair Creek	Recreational	Scenic	1.9*
			Total	23.5*

* Mileage totals include an undetermined amount of private land acreage.

Issues, Projected Demands and Opportunities

Public awareness of and sensitivity to WSR designation is increasing. Management activities probably will continue to be an issue until the appropriate level of management for the viewsheds beyond the 1/4 mile corridor is determined. An implementation plan must be written to further refine the goals and objectives of the Forest Plan.

Increasing demand for WSRs is expected. The Chief of the Forest Service has publically stated that the Agency will take an active role in seeing that 200 additional rivers are recommended for WSR designation by 1993. This National policy statement reflects the public's desire to see more designations.

There is an opportunity to resolve current conflicting uses within WSR corridors by establishing final boundaries for designated rivers. Problems associated with undefined corridor boundaries and management direction would decrease.

Boundary establishment also presents an opportunity to aid down-river community expansion (refer to the Lands Program Management section later in this chapter).

Potential Additions to the National WSR System

In addition to those rivers currently designated, a Forest-wide review of rivers and streams was conducted for their WSR eligibility potential. Thirteen have been determined eligible (refer to Table 3-32). To be eligible, a river (or some portion of it) must meet criteria of the WSRA, as supplemented by the "Final Revised Guidelines for Eligibility, Classification and Management of River Areas," September 7, 1982. It must be primarily free-flowing and possess one or more "outstandingly remarkable" values. See Appendix E for a detailed description of the Forest's WSR eligibility determinations and suitability analysis.

Table 3-32. Klamath National Forest Eligible WSRs*

River or River Segment	Miles
1. South Fork, Salmon River	19.3
2. North Fork, Salmon River	8.4
3. Wooley Creek	11.9
4. Kelsey Creek	6.6
5. Clear Creek	22.9
a. West Fork	4.5
b. Tenmile Creek	6.8
6. Grider Creek	15.8
7. Dillon Creek	13.6
a. North Fork, Dillon Creek	10.0
8. Ukonom Creek	8.7
9. South Russian Creek	5.9
10. Elk Creek	21.0
a. Granite Creek	4.5
b. Burney Valley Creek	3.4
c. Tom's Valley Creek	2.5
d. Rainy Valley Creek	3.0
11. French Creek	2.9
12. Antelope Creek	1.9
13. East Fork, South Fork, Salmon River	12.7
Total	186.3

* **Note:** Primary rivers and streams are identified and numbered. Tributaries are listed below the appropriate rivers or creeks. Mileage figures represent NFS land only.

(Data sources for the above text and table figures are: 1) the Administrative layer, 2) WSR boundaries layer and 3) WSR viewshed layers for both designated and eligible rivers of the Forest Database, and the WSR eligibility evaluation described in Appendix E. Database information is available for review at the Forest Supervisor's Office.)

Specially Designated Area Management

Research Natural Areas

Description

Research Natural Areas (RNAs) are part of a National network of reserved areas on public lands, representing a diversity of North American ecosystems. These areas provide opportunities for research and ecological study.

They also provide important knowledge of how our ecosystems function that can be applied to forest management. RNAs can be used as comparison areas for monitoring effects of forest management. They also contribute to the biological diversity of the Forest by protecting examples of natural plant and animal communities, genetic diversity and, in some cases, habitat for TE&S species.

A Regional program has identified major types of forest vegetation that should be represented in the National RNA network. Also identified were gaps in the current network for the Klamath Mountains and Cascade Mountains areas within the Forest. There is also a growing need to identify and manage examples of important shrubland, grassland, other vegetative and aquatic ecosystems. Evaluation of the Forest will continue for appropriate RNA opportunities as target elements are identified.

Currently, there are no established RNAs on the Forest. Thirteen areas, representing various elements, have been evaluated as candidates for RNA status by the Forest. Four have been dropped from consideration by the Regional RNA Committee. The remaining 9 have been recommended by the Committee and the Regional Forester for establishment.

Following is a brief description of each of the 9 candidate RNAs with an estimate of acres rounded to the nearest 100 acres.

Crater Creek: This 500 acre site lies at the northern end of the China Mountain and Cory Peak Crest Zone on the Scott River Ranger District. The area contains a large stand of old-growth curl-leaf mountain mahogany (*Cercocarpus ledifolius*). The area also contains a high diversity of pine species. These include western white pine (*Pinus monticola*), Jeffrey pine (*Pinus jeffreyi*), foxtail pine (*Pinus balfouriana*) and whitebark pine (*Pinus albicaulis*). Pure stands of mountain hemlock (*Tsuga mertensiana*) also occur in the area.

Sugar Creek: This 3,200 acre drainage is located within the Russian Wilderness on the southwest edge of the Scott River Ranger District. It is next to the Duck Lake Botanical SIA. The area is known for its remarkable conifer species diversity. It may have been a "glacial refugium" for several species, including subalpine fir (*Abies lasiocarpa*) and Engleman spruce (*Picea englemanii*). Other conifer species of interest include Brewer spruce (*Picea breweriana*), foxtail pine and whitebark pine.

Marble Caves: Located within the Marble Mountain Wilderness in the Happy Camp Ranger District, this 2,000 acre area represents an example of a high-elevation limestone ecosystem. Several rare plant species are known from the surface of the area. Little is known, however, of the underground biology of the system.

Limestone Bluffs: This 900 acre site is an example of low elevation limestone geology along the South Fork Salmon River. It is forested with black oak (*Quercus kelloggii*), knobcone pine (*Pinus attenuata*) and montane chaparral.

Antelope Creek Lakes: This 500 acre site includes several high-elevation and subalpine plant communities. Of special interest are the large number of wet meadows in the area and the extensive stands of Shasta red fir (*Abies magnifica var. shastensis*), mountain hemlock and whitebark pine.

Stove Spring Canyon: Located northwest of Meiss Lake, this 100 acre area lies at the southern end of the Cascade Range. It is an excellent example of both the foothill oak woodland and white oak plant communities.

Bridge Creek: This 1,700 acre area is a representative example of an "old growth" Pacific Douglas-fir forest within the Marble Mountain Wilderness. Giant chinquapin (*Castanopsis chrysophylla*) is the major hardwood species in the area. Some of the chinquapin trees in this area are among the tallest in the world. A wet meadow system add to the diversity of the area.

Haypress Meadows: This 3,100 acre site is located within the Marble Mountain Wilderness. Soils in the area are primarily of granitic origin. The area is floristically rich. Twelve conifer species and 200 other vascular plant species have been observed. Of this area, 80% is dominated by "old growth" red fir forests. The remaining 20% is predominantly white fir (*Abies concolor*).

Rock Creek Butte: This 500 acre site is an example of the Siskiyou conifer forest ecotype. The area also contains representative examples of montane chapar-

ral. The most notable feature of this area, however, is a large stand of Brewer spruce (138 acres). This stand contains trees ranging from seedlings up to specimens 48 inches in DBH and 130 feet tall.

Special Interest Areas

Description

Areas on the Forest that pose outstanding or especially interesting natural, scenic or cultural features may be highlighted and managed as SIAs. These are established to protect areas on the Forest with unique characteristics.

The goal is to interpret the surroundings for public enjoyment and increased understanding of natural resources compatible with the values for which they were established. SIAs can be established to highlight areas with scenic, botanical, geologic, historic, zoological, paleontological or other special values.

Scenic areas are recommended for exceptional views of a variety of landforms and vegetation.

Botanical areas are recommended for outstanding examples of some part of the Forest flora. These might include sites with unique types of habitat or plant communities, or areas that contain a large number or unusual combination of plants species growing together.

Geological areas are recommended for unique or outstanding features that demonstrate the earth's development and processes. These might include evidence of movement and formation of the earth's crust, such as fault zones and volcanic activity. Land forms shaped by the powerful movement of glaciers, water and soil can be highlighted. Also, early plant and animal life that have been preserved as fossils are of interest.

Since the Forest contains such an exceptional amount of natural diversity, many areas have been evaluated for SIA potential. Enough information has been collected to propose 52 areas as potential SIAs. One has been proposed for scenic values, 6 for both botanical and geologic values, 18 for botanical values and 27 for geologic values.

The Medicine Lake Glass Flow was established as a Geological SIA by the Modoc National Forest and about 30 acres are within the Klamath National Forest boundary. No other SIAs have been designated on the Forest. Four areas, currently in the nomination process, are being managed as SIAs. These candidate Botanical SIAs are Little Shasta Meadow, Lake Mountain Foxtail Pine, Seiad Baker Cypress and Indian Creek Brewer Spruce.

All candidate SIAs are managed to protect their special interest values. These proposed areas receive light recreation use, due largely to lack of public awareness. Most of the proposed areas have little or no timber values. No timber harvest is currently planned in any of the areas.

A brief description of each proposed SIA follows. The acre estimates are rounded to the nearest 100 acres, with those less than 50 acres rounded to the nearest 10 acres.

Scenic Area

Siskiyou Crest Zone Scenic Area: The Siskiyou Crest Zone provides some of the highest, easily accessible viewpoints on the Forest. A 47-mile long area along the crest road provides distant views of California and Oregon landmarks. Several landmarks are visible including Pilot Rock, Mt. Bachelor to the north, and Mt. Shasta and the Marble Mountains to the south. Within the 15,000 acre area itself is an exceptional diversity of plant species and features, such as large meadows, rock outcrops and high-elevation forest stands. Recreational opportunities within the area include hiking on the Pacific Crest Trail, two- and four-wheel drive roads and cross-country skiing.

Several separate SIAs were also proposed within the larger crest zone. Refer to descriptions for Cook and Green Pass, Mt. Ashland-Siskiyou Peak, Observation Peak, Red Mountain, White Mountain and Condrey Mountain Blueschist.

Botanical and Geologic Areas

Black Lava Butte and Callahan Lava Flow Botanical and Geologic Area: This 2,800 acre site is located in the northeast corner of the Goosenest Ranger District, next to the Lava Beds National Monument. This site represents very recent basalt flows that are nearly devoid of vegetation. The black flows are in striking contrast with the surrounding volcanic rocks that are lighter in color and support vegetation. The flow surrounds several older, vegetated cinder cones. It contains spatter cones, lava tubes and caves. The area also contains many features that provide insights into the flow dynamics of this type of lava flow.

China Mountain Botanical and Geologic Area: This 900 acre area lies in the central portion of the China Mountain and Cory Peak Crest Zone and includes portions of both peaks. This area contains high-elevation ultramafic soils, and, as a result, harbors many

rare and Sensitive plant species. Whitebark pine is an example of a species with limited distribution on the Forest. It is seldom found below the 8,000 foot elevation. This area contains the oldest rocks, Cambrian in age, in the Klamath Mountains sub-Province.

Cook and Green Pass Botanical and Geologic Area: This 200 acre site is located within the Siskiyou Crest Zone and contains a mosaic of plant communities. It is considered to be the dividing line between the eastern and western Siskiyou Mountain Range. This area has a high concentration of native plant species, with possibly as many as 300 species present. The area also contains a large stand of Siskiyou Cypress (*Cupressus bakeri ssp. matthewsii*). This area contains many unique outcrops of peridotite (a rock rich in iron and magnesium minerals that originated deep in the earth's crust), amphibolite schists and marble that reveal a complex geologic history. Scenic outcrops of white marble can be seen in fault contact with red peridotite.

Cory Peak Botanical and Geologic Area: This area lies at the south end of the China Mountain and Cory Peak Crest Zone from 6,700 to 7,700 foot elevation. The 400 acre site is dominated by high-elevation ultramafic soils that have a limited distribution on the Forest. These are inhabited by a high concentration of rare or endemic plant species. This area has been sculpted by glacial processes, forming outcrops of a variety of ultramafic rock. This includes dunite, a rock comprised almost entirely of the mineral olivene. Olivene is an iron/magnesium silicate. Glacial features include moraines (rubble transported by glaciers) and cirques (glacially carved hollows). A large landslide and possible rock glacier are present on the northeast flank of Cory Peak.

Kangaroo Lake Botanical and Geologic Area: This 400 acre site, located on the Southeast edge of the Scott River Ranger District, varies in elevation from 6,000 to 6,800 foot. It provides a diversity of plant habitats, ranging from wet seeps and meadows to rock walls. The high habitat diversity is associated with a high botanical species diversity. Sensitive plant species present include *Phacelia dalesiana* and *Epilobium siskiyouense*. The area is easily accessible and is near a developed campground facility. Kangaroo Lake is in a glacial cirque. The dam along the downslope edge is a glacial moraine. Bedrock consists of a variety of ultramafic rock (peridotite) and gabbro.

Preston Peak Botanical and Geologic Area: This 3,800 acre area is located within the Siskiyou Wilderness and lies at the western edge of the Siskiyou Crest Zone. This botanically diverse area is especially rich in conifer species. Preston Peak is the highest mountain (7309 feet) in this part of the Forest and dominates the landscape. This area contains many interesting glacial features (moraines, cirques, tarns). Most of these are well-exposed, due to the generally light vegetative cover.

Botanical Areas

Bear Peak Botanical Area: This 500 acre site, located within the Siskiyou Wilderness, varies in elevation from 4,000 to 5,700 feet. It is a representative example of both mixed conifer and true fir forest types on glacial granite.

Digger Pine Botanical Area: Located along the north edge of the Trinity Alps Wilderness along the South Fork of the Salmon River, this 400 acre site represents the northern-most extension of digger pine (*Pinus sambiniana*). It is one of a few locations on the Forest where this species is found.

Duck Lake Botanical Area: Located within the Russian Wilderness, this 3,600 acre conifer forest contains the richest diversity of conifer species in California. This includes the only known population of subalpine fir in the State, and 1 of 2 known populations of Engleman spruce in California. The area also supports several populations of Brewer's spruce, endemic to the Klamath Mountains, and stands of both whitebark pine and foxtail pine. Two high-elevation glacial cirque lakes are also found in the area.

Elk Hole Botanical Area: Lying on the northwest boundary of the Ukonom Ranger District, Elk Hole is within the Siskiyou Wilderness. This 200 acre site contains the southern-most known population of Alaska yellow cedar (*Chamaecyparis nootkaensis*).

Horse Creek Botanical Area: The 200 acre area encompasses about 2 miles of low elevation "old growth" riparian forest dominated by Douglas-fir, bigleaf maple and Oregon ash. The dense, multi-layered vegetation at this site provides a high degree of biological diversity. It serves as good habitat for many species of fish, aquatic invertebrates and insects, as well as birds and other wildlife species.

Indian Creek Brewer Spruce Botanical Area: This 100 acre site, located in the northwest corner of the Happy Camp Ranger District, represents a healthy, vigorous stand of Brewer spruce, a species found only in the Klamath Mountains. Along a major road, this stand provides good access and interpretive opportunities.

Lake Mountain Foxtail Pine Botanical Area: This 100 acre site, located just west of Lake Mountain fire

lookout, represents the northern-most extension of foxtail pine. The area also supports stands of western white pine.

Little Shasta Meadow Botanical Area: Located on the Goosenest Ranger District, this 700 acre site varies as an example of both dry and wet high-elevation meadows in the Cascade Range. The 390 acre area contains several stands of quaking aspen (*Populus tremuloides*) as well as a population of Greene's mariposa lily (*Calochortus greenei*), a Sensitive plant species.

Mt. Ashland/Siskiyou Peak Botanical Area: This 800 acre area is about 6 miles west of Interstate 5 at Siskiyou Summit. It is located along the Siskiyou Crest Zone, next to the Mt. Ashland Ski Area and the McDonald Peak Botanical Area on the Rogue River National Forest. The soils are of decomposed granite and support a subalpine flora. The area is dominated by open glades and rocky brushfields. Mt. Ashland, the highest peak on the Siskiyou Crest Zone (7533 ft.), lies at the northeast end of this botanical area. Siskiyou Peak, about 2 miles southwest of Mt. Ashland, supports 1 of only 3 known populations of *Tauschia howellii* on the Forest. This area, along with the rest of the Siskiyou Crest Zone, supports a large native grassland. The most notable grass species in the area is greenleaf fescue (*Festuca viridula*), which forms pure stands in several areas.

Observation Peak Botanical Area: This 500 acre area is also located along the Siskiyou Crest Zone, about 8 miles southwest of Mt. Ashland. This area includes part of Dutchman Peak and is next to two botanical areas on the Rogue River National Forest. It ranges in elevation from 5,700 to 7,400 feet and has a complex geology of peridotite mixed with granitic and metasedimentary rock. The subalpine flora has several endemic species. Over 170 species of plants can be found in this area, an example of the high degree plant species diversity in the crest zone.

Poker Flat Botanical Area: Near the crest of the Coast Range, this 100 acre area lies within a zone of extremely high rainfall. This area is an example of a mid-elevation (5,200 foot) serpentine meadow and harbors several Sensitive and rare species. Poker Flat consists of a large, poorly drained meadow in a basin created by prehistoric landsliding and glacial action. Serpentinite is one of the most common rock types in the area. The soil that develops on this rock contributes to the formation of unique soils and associated plant communities. These soils also may contain a stratigraphic record of post-glacial climate.

Red Mountain Botanical Area: Located within the Siskiyou Crest Zone, this 400 acre area is about 1 1/2 miles southwest of Siskiyou Peak. Dominated by peridotite soils and rock outcrops, it is forested with Jeffrey pine and several serpentine endemics. The area also contains a large stand of the native bunchgrass red fescue (*Festuca rubra*).

Rhododendron Patch Botanical Area: This 100 acre site is located in the northwest corner of the Happy Camp Ranger District. It represents the only large stand of rhododendron known to occur this far inland. The rhododendron is inter-mixed with other shrub species, including California hazel (*Corylus cornuta*).

Rock Fence Creek Botanical Area: The 100 acre area, along 1 mile of Rock Fence Creek, consists primarily of riparian vegetation within a mixed conifer forest. There are many mid- to high-elevation meadows in the area. The ultramafic soils in the area are habitat for species such as the California pitcher plant (*Darlingtonia californica*) and Jeffrey pine.

Scott Mountain Botanical Area: This 500 acre site is on the north side of the Scott Mountain campground on the Scott Mountain Crest Zone. It extends north to the southwest edge of Little Carmen Lake. The area represents an example of a mid-elevation (4,000 to 6,000 feet) ultramafic forest type.

Seiad Baker Cypress Botanical Area: Located about 4 miles northeast of Seiad Valley, this 1,000 acre area contains a stand of the rare Baker Cypress. Part of the area was burned in the 1987 fires. This triggered the germination of cypress seeds, lying in the soil for years. The hundreds of seedlings growing there now make this the healthiest stand of Baker cypress on the Forest.

Sutcliffe Creek Botanical Area: This 100 acre site, located in the upper Indian Creek drainage of the Happy Camp Ranger District, contains a stand of "old growth" Port-Orford-cedar (*Chamaecyparis lawsoniana*). This stand is unusual because of its distance from the coast and fairly high-elevation.

White Mountain Botanical Area: Also located on the Siskiyou Crest Zone, this 100 acre area is 2 miles northeast of Cook and Green Pass. Varying in elevation from 5,400 to 6,400 feet, it contains diverse vegetation on schist and ultramafic geology.

Geologic Areas

Antelope Sink Geologic Area: This area occupies about 30 acres on the Goosenest Ranger District, 7 miles north of Tennant at the foot of Cedar Mountain. It occupies an additional 80 acres on private land,

immediately to the north. Antelope Sink consists of a closed basin, or sink, into which Antelope Creek flows.

Ash Creek Butte Rock Glacier Geologic Area: This 300 acre area is located in the southern-most portion of the Goosenest Ranger District. The rock glacier occupies about 60 acres, 16 of which are on NFS land. The remaining 44 acres are on private land to the south. It is located in the head of a north-facing glacially carved valley, or "cirque." The Ash Creek Butte cirque was formed by a large glacier that extended more than 2 miles down the north flank of the mountain. This glacier was also responsible for forming Surprise Lake. The presence of ice deep in the deposit allows it to flow periodically like a glacier, hence the name "rock glacier." Such features are rare on the Forest.

Bloomer Debris Avalanche Geologic Area: This 30 acre area consists of a large debris avalanche that occurred on the southwest bank of the Salmon River during the 1964 flood. This debris avalanche temporarily dammed the river. This debris avalanche is the best example of a landslide that dammed a river on the Forest. Additionally, it is an excellent example of a debris avalanche that involves both soil and bedrock.

Cabin Meadow Creek Pillow Lava Geologic Area: This 20 acre site consists of an excellent exposure of well-formed pillow structure in volcanic lava, deposited on the floor of an ancient sea. It is, by far, the best example of this structure that is known to exist on the Forest. Pillow structure is so named because it looks like a pillow in the rock. It is formed when lava flows into and cools in water. Pillows are a valuable aid to geologists in deciphering the origin of rocks by providing clues to the amount of tilting and deformation they have experienced.

Caesar Peak Perennial Icefield Geologic Area: This site occupies about 200 acres in the Trinity Alps Wilderness. It is located in the headwaters of the South Fork Salmon River. The site consists of several glaciers or perennial icefields on the north-facing slopes of Caesar Peak.

Cement Banks Geologic Area: This feature occupies about 200 acres in the Boulder Creek drainage, tributary to the South Fork of the Scott River (Scott River Ranger District). It is a distinctive, barren ridge that is formed of cemented gravels and supports little vegetation.

Coffee Creek Stream Capture Geologic Area: This area occupies about 200 acres in the Trinity Alps Wilderness. The upper 5 miles of Coffee Creek were captured by the Salmon River system. The capture was made possible by glacial moraines in the Coffee Creek Valley, and by easterly headward erosion by the South Fork of the Salmon River.

Condrey Mountain Blueschist Geologic Area: This area is dispersed across 500 acres in the Siskiyou Crest Zone. It consists of several outcrops of blueschist, a metamorphic rock formed under high pressure and relatively low temperature. Folds in the rock, along with the types and arrangements of mineral grains within it, reveal that it was formed by the deformation and metamorphism associated with plate subduction.

Condrey Mountain Schist Type Section Geologic Area: This site occupies about 50 acres on the south side of the Klamath River. It is the "type section," or locality where this important rock unit was described by Preston Hotz (geologist, USGS), in 1979. The Condrey Mountain Schist consists of graphite-rich quartz-muscovite schist along with some actinolite-chlorite greenschist.

Deer Creek Landslide Geologic Area: This 20 acre feature is located along Deer Creek, in the northwest corner of the Goosenest Ranger District. It consists of a large, active landslide that occurs in the volcanic rocks of the Cascade Range. The site is an excellent example of a transitional bedrock landslide that is situated along the contact between the rocks of the Western Cascades and the High Cascades.

Elk Lick Geologic Area: This site occupies about 100 acres in the South Fork of Indian Creek Watershed. It consists of a small scenic lake, about 400 feet in diameter, which contains abundant lily pads and diatomite deposits. It is surrounded by riparian vegetation and conifers. The closed depression, where the pond is located, was formed by the movement of large landslides. The USGS and many universities are presently studying similar sites. This site offers an opportunity to enter in cooperative studies between this agency and universities.

Fourmile Hill Tree Molds Geologic Area: This area occupies about 10 acres near the eastern boundary of the Goosenest District, 4 miles north of Medicine Lake. It consists of several cylindrical hollows in the ground, a few feet in diameter, formed by the burning of conifer trees engulfed by lava flows. These hollows often contain ice in late summer. This is the only known example of such a feature on the Forest.

Hole in the Ground Geologic Area: This 200 acre site is located in the headwaters of Harris Creek, in the western part of the Goosenest Ranger District. This site is an excellent example of volcanic neck, a lava-filled conduit of an extinct volcano, exposed by

erosion. It is the best example of such a feature known on the Forest.

Little Glass Mountain Geologic Area: This 100 acre site is located in the southeast corner of the Goosenest Ranger District, about 4 miles west-southwest of Medicine Lake. It occupies 100 acres on the Forest and 1,500 acres on the Shasta-Trinity National Forests. This feature consists of a spectacular obsidian glass flow that was erupted onto relatively flat terrain. This formed a steep-sided, flat-topped land form, somewhat resembling a pancake with irregular edges.

Little Grider Debris Avalanche Geologic Area: This site occupies about 30 acres in the Little Grider Creek Watershed (Happy Camp Ranger District). It consists of a large debris avalanche that occurred in the steep headwaters of Little Grider Creek during the 1964 flood. Several miles of the stream were stripped of vegetation, and the channel was profoundly altered by this landslide.

McCash Creek Debris Avalanche Geologic Area: This site occupies about 20 acres in the McCash Creek drainage (tributary to Ukonom Creek) on the Ukonom District, 12 air miles northeast of Somes Bar. It consists of a debris avalanche, about 250 feet wide and 1,000 feet long, in an area of granitic bedrock. This landslide occurred before the 1964 flood.

Medicine Lake Glass Flow Geologic Area: This glass flow along the eastern boundary of the Goosenest Ranger District, a mile north of Medicine Lake, was established as a SIA in the Record of Decision for the Modoc National Forest Plan. The majority of this 600 acre flow is within the Modoc National Forest boundary, with about 30 acres within the Klamath National Forest boundary. It consists of a pancake-shaped lava flow, slightly elongated in a north-south direction that was extruded onto relatively flat terrain near the center of the Medicine Lake Volcano. The flow is a good example of a glassy dacite lava, with steep margins that formed as a result of its high viscosity.

Murderers Bar Landslide Geologic Area: This site occupies about 50 acres on the southwest side of the main stem Salmon River (Ukonom Ranger District). It consists of a large complex landslide, involving translational, slump and debris flow processes. This feature offers opportunities to learn more about the uplift history of the area, and about the relationships between bedrock features and landsliding.

North Russian Landslide Dam Geologic Area: This feature occupies about 40 acres on the east side of North Russian Creek (Salmon River Ranger District). It is a landslide within the inner gorge of North Russian Creek, which dammed the stream and caused the formation of a temporary pond.

Pumice Craters Geologic Area: Located on the northwest flank of the Medicine Lake Volcano, this 800 acre site is 2 miles northeast of Medicine Lake. It consists of a variety of volcanic features. The most prominent are 4 obsidian flows. The glass flows are some of the youngest in the Cascades (less than 1,000 years old) and provide excellent examples of flow structures in viscous lavas (Julie Donnelley-Nolan, 1990). Evidence of violent eruptive processes is present in the form of two craters. Finally, the site contains a cinder cone that has been offset by a recent fault, with the fault being well-exposed. This site has been described in several geologic publications.

Rainbow Mountain Geologic Area: This area occupies about 300 acres in the Antelope Creek Watershed (Goosenest Ranger District). It consists of a highly scenic mountain crest, centered about Rainbow Mountain (7,600 feet elevation). Bedrock consists of lava and pyroclastic rocks of the High Cascades.

Scorpion Caves Geologic Area: This cave formation is about 30 acres in size on the Happy Camp Ranger District.

Spees Peak Debris Avalanche Geologic Area: This site occupies about 10 acres in the Indian Creek watershed. It is a large, 1964-era debris avalanche on the southwest flank of Spees Peak. It is visible from several vantage points to the southwest, including the Grayback Road. This avalanche stripped vegetation from the valley walls along several miles of Green's Creek, and conveyed rock, soil and woody debris to the Indian Creek floodplain, where much of it was deposited.

Sulfur Spring Geologic Area: This site occupies about 1 acre in the Elk Creek Watershed (Happy Camp Ranger District), 10 air miles south-southwest of Happy Camp. It is a hot spring that enters Elk Creek from the west. This is the only known hot spring in this portion of the Klamath Mountains.

West Fork Waterfall and Landslide Geologic Area: This site is about 300 acres within the Happy Camp Ranger District. It lies along the West Fork of the Little South Fork of Indian Creek between Big Buck and Little Buck Ridges, 8 miles northwest of Happy Camp. The most prominent feature is a spectacular 300 foot waterfall (59 acres), formed by glacial erosion.

Whitney Creek Volcanic Mudflow Geologic Area: This site is about 10 acres in the southwest corner of

the Goosenest Ranger District, where Whitney Creek flows beneath Highway 97. Whitney Creek is an intermittent stream, with its source at Whitney Glacier, high on the northwest flank of the Mt. Shasta Volcano. When rapid glacial melt or intense summer showers occur, mudflows are generated from the slopes immediately below Whitney Glacier.

Wooley Creek Batholith Roof Zone Geologic Area: This area occupies about 800 acres and consists of a corridor a few hundred feet in width along the Salmon River Road (County Road 2B01) on the Ukonom Ranger District. This area is of geologic interest because it coincides with the western margin of the Wooley Creek Batholith, the second largest body of granitic rock in the Klamath Mountains. The roof zone is where granitic rock was injected into overlying country rock.

Other Potential Geologic Areas

The following sites may possess unique geological values, but not enough data exists to recommend classification as SIAs at this time. Inventories will be completed for these areas by 1995.

Ash Creek Tufa Deposits - about 1 acre on the Oak Knoll Ranger District.

Black Rock Geologic Area - about 150 acres on the Scott River Ranger District.

Boulder Creek Debris Avalanche - about 50 acres on the Scott River Ranger District.

Crawfish Gulch Mineral Springs - about 4 acres on the Oak Knoll Ranger District.

Franklin Gulch Fault - about 50 acres on the Scott River Ranger District.

Franklin Gulch Mineral Spring - about 4 acres on the Scott River Ranger District.

Hotelling Travertine Spring - about 1 acre on the Salmon River Ranger District.

La Honda Lava Tube Area - about 50 acres on the Goosenest Ranger District.

Marble Rim - about 100 acres on the Scott River District.

McGuffy Creek Debris Avalanche Deposit - about 50 acres on the Scott River Ranger District.

Sandstone Monolith - about 2 acres on the Oak Knoll Ranger District.

Sniktaw Earthflow - about 1,000 acres on private land within the Scott River Ranger District.

South Fork Matthews Creek Travertine Spring - about 1 acre on the Salmon River Ranger District.

West Fork Beaver Creek Mineral Spring - about 1 acre on the Oak Knoll Ranger District.

Williams Gulch Mineral Spring - about 1 acre on the Oak Knoll Ranger District.

Issues, Projected Demands and Opportunities

The Forest has a high degree of natural diversity that is Regionally, and in some cases Nationally, valued. Establishing SIAs can address the issue of protecting and/or enhancing these values. Establishing SIAs could contribute to the maintenance of biological diversity on the Forest by protecting a variety of ecosystems, some with a high degree of species richness. are protected.

SIAs would also provide recreational and educational opportunities on the Forest. Other areas are being evaluated for potential as special wildlife viewing areas and historical areas.

Butte Valley National Grassland

Description

The Butte Valley National Grassland (BVNG) was designated by the Secretary of Agriculture on February 28, 1991. It consists of around 18,400 acres of Federal land, located near the eastside of the Forest. Before designation, the area was managed by the Forest as the Butte Valley Land Use Project.

The objectives for managing the BVNG are:

1. To promote the development of the grassland, agriculture and sustained yield management of the soil, water, forage, fish and wildlife resources.
2. To demonstrate sound and practical principles of land-use to favorable influence nearby areas and economies.
3. To encourage user groups to assist in administration of the BVNG, and
4. To demonstrate management flexibility and innovation in the design and implementation of resource management activities on the BVNG that will promote improvement in resource management on similar lands in other ownership.

Making up a large portion of the Butte Valley, the grassland is surrounded by agricultural lands and adjoined by the 13,000 acre CDFG's Butte Valley Wildlife

Area. Management of the BVNG both affects and is affected by its neighbors. To facilitate this management, the Butte Valley Coordinated Resource Management and Planning effort was started in 1986. This partnership includes the Forest Service, SCS, CDFG, Butte Valley Resource Conservation District (RCD), Butte Valley Irrigation District, grazing permittees and adjacent landowners.

The RCD has maintained grazing privileges on the BVNG since 1950 through a grazing agreement. Under this agreement, the RCD directors select permittees, issue grazing permits, collect fees and generally administer the management of livestock on the BVNG. This, in turn, reduces the cost to the government. The cost of conservation practices and restoration work accomplished by the RCD can be used in lieu of payment of grazing fees.

Past fire suppression efforts and grazing practices have limited re-colonization by native perennial grasses. This has allowed communities of dense sagebrush, rabbitbrush and cheatgrass to dominate the area.

The BVNG also provides habitat for a variety of wildlife species including bald eagles, golden eagles, prairie falcons, Swainson's hawk, burrowing owl and pronghorn. Since much of the private land surrounding the BVNG has been converted from a big sage-juniper type to irrigated alfalfa fields, these species rely heavily on the BVNG for forage, resting, nesting, thermal cover and hiding cover. Refer to Grassland and Shrub-steppe Species in the Wildlife section of this chapter.

Projected Demands and Opportunities

There is a potential to develop wetland habitat and reclaim a portion of the original lake bed, drained by homesteaders, in the BVNG.

Lands Program Management

Description

Administration of the Lands Program covers a broad spectrum of activities. This includes coordinating with adjacent private landowners and governmental agencies, adjusting land ownership, locating property lines, addressing title claims and encroachments, authorizing special uses, acquiring rights-of-ways and recommending withdrawals. Maintaining the integrity of NFS land through proper law enforcement is another important responsibility directly related to the successful administration of the Forest's Lands Program (refer to the Law Enforcement Section later in this chapter).

Landownership

The Forest manages about 1,680,000 acres of NFS land. In addition, there are over 200,000 acres of land within the Forest boundaries that are in other ownership. Most of the private land is in a "checkerboard" pattern (every other section in private ownership) across Oak Knoll, Scott River and Goosenest Ranger Districts.

This checkerboard pattern resulted from the railroad land grants of the late 1800s. Most of the remaining private land resulted from homestead patents and mining patents. These are scattered along rivers and streams in a more random pattern. Today, only the General Mining Laws and Indian Allotments offer opportunities to patent public lands. Land administered by the State of California and the BLM also lies within the Forest boundaries.

Inter-mingled ownership can impede management of both NFS land and private land. Program objectives can become difficult or impossible to achieve. Administrative costs are greater, due to the need for property boundary line establishment and maintenance, rights-of-way acquisition, trespass and title claim resolution and granting special use permits. Fire protection and general administration also can be more costly. Improving ownership patterns through landownership adjustments can reduce these problems.

The landownership adjustment program involves changes in ownership to facilitate management, achieve management goals and to reduce administrative costs. Proposed adjustments must consider current and future needs, land suitability, use trends and possible limitations to use. Land exchange is the method most often used to adjust ownership patterns. Under the current program, an average of 3 to 5 exchanges are handled each year. Other methods include donations, purchases and sales. However, Forest Service authority to sell public land is very limited.

Occasionally, individuals claim title to public land. These claims must be investigated and the legitimacy determined.

Property Boundary Location and Encroachments

The property boundary location program supports the resource programs and the landownership adjustment program. National direction requires that the Forest Service or the proponent of a project mark and post boundaries to legal standards before any action is

taken next to those boundaries. The property boundary program uses licensed cadastral surveyors to locate, mark and post about 70 miles of property boundaries per year.

The location of property boundaries can lead to the discovery of encroachments on public land. Encroachments are situations where adjacent owners have improvements over property boundary lines or are otherwise using NFS lands without benefit of an authorization. These vary from minor uses to significant improvements. Many innocent encroachments qualify and are being resolved under the Small Tracts Act of 1983.

Under current Forest direction, the goal is to resolve all identified innocent encroachment by the year 2020. Legal proceedings may be necessary to resolve willful trespass on public land.

Special Uses

The Forest can authorize use of NFS land through special use authorizations, easements, leases, contracts and plans of operations.

Current Forest direction for special use authorizations limits the encumbrance of public land by private parties. These limitations are to only those uses that cannot be reasonably placed on private land, do not conflict with Forest management activities and are compatible with Forest objectives. In 1991 there were 825 special use authorizations administered by the Forest, as shown in Table 3-33.

Table 3-33. Special Use Authorizations

Number	Type of Use
196	Easements
187	Water Transmission Lines, Irrigation Ditches
113	Private Roads
102	Outfitter Guides
39	Electronic Communication Uses
23	Pastures
22	Recreational Residences
21	Agricultural Residences
21	Mineral Materials
19	Powerlines
82	Incidental Uses
825	Total

An electronic communication site is a building, tower and/or other physical improvement built, installed or established to house and support authorized communication use. The following sites currently have authorized use under special use permits: Slater Butte, Herd Peak, Gunsight Peak, Eddy Gulch, Round Mountain, Baldy Gap, Mahogany Point and Whisky Peak. These uses include radio relays, television translators, microwaves and satellites.

Some areas have only a single use accompanied by a single special use permit. Others may have multiple uses and several associated permits. Mt. Ashland is an important site, as it provides the most expedient communications link between San Francisco and Portland. It is administered by the Rogue River National Forest.

The powerline permit category includes utility corridors. A utility corridor is a land-use designation identified to determine if a linear facility (such as a corridor) is compatible with adjacent land allocations. It does not imply entitlement of use. Project-level environmental analysis and review must be conducted before occupancy can occur.

There are currently 3 existing, occupied, utility corridors on the westside and 2 on the eastside that cross NFS land. The Western Regional Corridor Study in 1986 identified a potential need to expand these existing corridors. They also identified a potential need for two additional corridors on the eastside of the Forest.

Rights-of-Way Acquisition

The Forest acquires easements, permits or licenses across private property, when needed, to access NFS

land for management activities and to provide public access. Under the current program, the Forest averages about 5 new rights-of-way acquisitions per year.

Construction and Use Agreements allow the Forest and the landowner to share the costs of road construction and maintenance. Currently, the Forest has cost-share agreements with Fruit Growers Supply Company and Sierra Pacific Industries.

Withdrawals

The Wilderness Act of 1964 and the California Wilderness Act of 1984 withdrew all wilderness on the Forest from all forms of appropriation under the mining laws. These also withdrew wilderness from disposition under all laws pertaining to mineral leasing, subject to valid existing rights.

The WSRA does the same for designated WSR corridors classified as Wild, and for any future designations of Wild rivers. The WSRA also withdraws all public land within the boundaries of the National WSR system and any future designations from entry, sale or other disposition under the public land laws. Congressional withdrawals total over 400,000 acres, 24% of the land base (refer to the Minerals Management section later in this chapter).

Thirty-four sites, consisting of about 1,500 acres, have been withdrawn from mineral entry. These were withdrawn for use as administrative sites and developed recreation sites through application to the BLM. Any future withdrawals from mineral entry to protect administrative sites, developed recreation sites, cultural sites and RNAs would be made through the same process of application to the BLM.

About 15,000 acres of acquired land have also been withdrawn from mineral location, but are open to leasing. Lands also can be recommended for withdrawal from mineral entry for power projects. There are no proposals currently for power developments on lands administered by the Forest. However, several acres were withdrawn from mineral entry for power site reserves and Federal power applications and are still on the BLM books.

In compliance with PL94-579 (Section 204), the Forest has completed a review for the current 20-year period to determine the appropriateness of existing administrative withdrawals. The findings are currently being reviewed by the BLM, the designated representative of the Secretary of the Interior.

Issues, Projected Demands and Opportunities

Important issues, related to the Lands Program, include the resolution of innocent encroachments, community expansion and the location of utility corridors. Innocent encroachments can be resolved under the Small Tracts Act. Some communities within the Forest boundaries have expressed interest in expanding their boundaries. Planning utility corridor locations that are compatible with other resource needs is an important issue.

Opportunities

Continuation of a planned, coordinated program of land adjustment can optimize administrative effectiveness and net public benefit. Acquisition could focus on wilderness areas, WSR corridors, river access areas, critical wildlife habitat or on consolidating NFS lands (especially in areas of checkerboard ownership).

The Small Tracts Act provides the authority to resolve many innocent encroachments, dispose of unmanageable mineral fractions and dispose of abandoned road rights-of-ways.

The Small Tracts Act, the Townsite Act and the General Exchange Program provide opportunities to resolve the townsite expansion issue.

The opportunity to identify utility corridors, compatible with land allocations, can facilitate coordination with utility companies on future proposals.

Opportunities for coordination with adjacent forests will increase as more issues become regional in scope. Opportunities for inter-agency cooperation also will increase as forest budgets continue to decline.

Law Enforcement

Description

The Forest Management Act of 1897, as amended, (known as the Organic Act) allows the Secretary of Agriculture to make such rules and regulations as necessary to govern the use and occupancy of the national forests and to preserve them from destruction. It is the policy of all Federal agencies to maintain a fully trained law enforcement force with full discretion in the use of protective equipment, including the defensive use of handguns.

Law enforcement objectives are to assure compliance with laws and regulations, to protect Forest resources and property, and to protect Forest Service employees

and the public. In achieving these objectives, the Forest cooperates with the Siskiyou County Sheriff's Department, the Jackson County Sheriff's Department, the Oregon State Police, the California Highway Patrol, the CDFG, the California Department of Forestry and Fire Protection (CDF), the Department of Justice and the Federal Bureau of Investigation.

Coordinated law enforcement activities include preventing violations by informing the public of the law and its consequences, protecting public property and resources, investigating suspected violations, prosecuting violations and determining legal liabilities.

Issues, Projected Demands and Opportunities

Preventing vandalism of prehistorical, historical and contemporary use cultural sites is an important issue mandated by law. The resolution of unauthorized uses is also an important issue.

Informing the public of the importance of protecting non-renewable cultural resources and of the requirements of appropriate laws (such as the Antiquities Act of 1906 and the Archaeological Protection Act of 1979) can help reduce vandalism of cultural sites. Training employees and the public to recognize vandalized sites and report them to law enforcement agencies also will help resolve this problem. Successful prosecution can deter vandalism. Any vehicles and equipment used in the destruction of cultural sites can be seized.

Occupancy trespass, forest products trespass, production of illegal drugs and the illegal disposal of hazardous waste are the primary unauthorized uses that occur on the Forest.

In 1987, there were over 200 occupancy trespass cases associated with mining claims on the Forest. Due to action taken by the Forest and cooperating law enforcement agencies, this number was reduced to 34 in 1991. Only 8 of these were residential. Occupancy trespass cases can be resolved through land exchange, authorization of special use permits and by using regulations, laws and the court system.

Forest products trespass includes the illegal cutting of logs, Christmas trees, boughs, cedar bolts, cedar shakes and firewood. Efforts to prevent or reduce the amount of forest products trespass include the use of standard clauses in sale contracts that impose penalties, spot checking loads of logs at mill yards and periodic checking of third party scalers. Also, Forest employees watch for suspicious activities and report them to law enforcement officials for investigation.

The production of illegal drugs includes cultivating marijuana and operating methamphetamine laboratories. A law enforcement presence and an increased emphasis on cooperation with other Federal and State agencies can reduce drug production on NFS land.

Enforcement occurs through cooperative efforts with other agencies and includes surveillance, arrest, prosecution and eradication. Both State and Federal courts are used for prosecution. Any monies and properties seized in connection with drug production goes to the local jurisdiction for additional enforcement and protection.

The production of methamphetamine creates a by-product that is highly toxic and damaging to the environment. Cleaning up a dump of this hazardous waste can be very expensive and time consuming. A law enforcement presence that allows for the early detection of illegal dump sites of hazardous chemicals would help to minimize adverse effects on the environment.

Training employees to recognize and respond to potential chemical hazards also would help minimize potential dangers to the Forest user. Any real and personal property used in drug production can be seized through successful prosecution. This property goes into a State fund used for clean-up of these wastes. If State and local funds are not adequate for the clean-up, Federal funds are sought.

Opportunities

Continued use of the methods described above can help minimize vandalism, destruction and unauthorized uses on the Forest.

The opportunity exists to increase our cooperation with other agencies in law enforcement efforts.

The opportunity exists to resolve occupancy trespass by obtaining special legislation from Congress to allow the user to purchase the site. However, this is outside Forest Service authority.

Minerals Management

Description

The geology of the Forest is quite diverse, containing a variety of mineral deposits. Mineral commodities are classified by law into three groups: locatable minerals, leasable minerals and mineral materials. Disposal, management and the authority of the Forest Service to control exploration and development varies by commodity group.

Generally, the westside of the Forest contains areas rich in locatable mineral resources. The eastside contains leasable mineral resources.

Locatable Minerals

Locatable minerals may be acquired through compliance with the General Mining Laws of 1872, as amended. Locatable minerals include gold, silver, platinum, chromite, copper and other minerals having unique and special values.

Gold has been found on the Forest, in both placer and lode deposits. Most of the placer deposits occur on the westside along major streams. Platinum group metals have been recovered as a by-product of placer gold mining in some areas. Placer deposits will continue to be of interest, especially for the small-scale miner, in the years ahead.

Lode gold deposits occur commonly in quartz veins and are generally worked underground. Silver is sometimes produced as a by-product. The less common gold-sulfide replacement deposits are targeted by many of the larger mining operations on the Forest.

Chromite and copper are found on the westside of the Forest. Much of the chromite and copper production occurred during wartime.

Leasable Minerals

Leasable minerals are commodities that may be acquired under the Mineral Leasing Act of 1920, as amended. They include oil, gas and geothermal energy. All minerals located on acquired lands, except common variety mineral materials, are also leasable under the Weeks Law Act of 1911, as amended, or the Acquired Lands Act of 1947.

The most significant potential for oil and gas development is on the northern portion of the Goosenest Ranger District. Additional exploration is necessary to determine the extent of the resource.

The Glass Mountain Known Geothermal Resource Area (KGRA) lies partially within the Goosenest Ranger District. This KGRA is considered capable of generating about 500 megawatts of electricity, with an estimated life of 30 years. About 34,000 acres of this 130,000-acre KGRA is administered by the Forest.

BLM has identified the remainder of the Goosenest Ranger District as having the potential for geothermal development. The Sulphur Springs area, south of Happy Camp, has also been classified as having possible geothermal value.

Mineral Materials

Mineral materials on the Forest are primarily common varieties of rock, gravel, sand, stone and volcanic cinders. These may be disposed of under the Materials Act of 1947, as amended, through a contract of sale. In general, these minerals are of widespread occurrence, of relatively low unit value and are generally used for construction, agriculture, road building or landscaping purposes by either the public or the Forest Service. Rock, gravel and sand are located mainly along rivers and streams on the westside of the Forest. However, opportunities for rock-crushing sites occur Forest-wide. Cinders are found exclusively on the Goosenest District. (Refer to the Geology section earlier in this chapter).

Mineral Management

The prospecting, location and development of mineral resources within the Forest is authorized by the Organic Act of June 4, 1897. The Act also allows the Secretary of Agriculture to set out rules and regulations to mitigate impacts on the surface resources and to define procedures related to operations authorized by the mining law. The Onshore Oil and Gas Leasing Reform Act of 1987 was authorized the Secretary of Agriculture to develop regulations governing leasing for oil and gas (including reclamation and bonding) on NFS lands. The regulations regarding mineral operations are found in 36 CFR 228.

Before starting any operations that might cause disturbance to surface resources, the operator is required to submit a notice of intent to operate to the district ranger with jurisdiction over the affected area. If the district ranger determines that the proposed operation may cause significant disturbance to the surface resources, a proposed plan of operations will be required.

The regulations for reclamation related to locatable mineral activities are found in 36 CFR 228.8. They require the operator to reclaim all land affected by the mining operation during the operation, if feasible, or within a year after the operation ends. Reclamation procedures include (1) control of erosion, landslides and water run-off, (2) removal and control of toxic substances, (3) rehabilitation of fisheries and wildlife habitat and (4) re-shaping and revegetation of disturbed areas where reasonable.

The BLM, as authorized by the Secretary of the Interior, is responsible for administering the general mining laws on NFS lands. The Forest Service and BLM have memorandums of understanding to coordinate surface management by the Forest Service and administration of the mining laws by BLM. The Forest Service retains

authority for the management and disposal of mineral materials.

Current Forest Service policy is to encourage and facilitate the exploration and development of mineral and energy resources. Any activities incidental to mineral extraction must be conducted in an environmentally sound manner. Any resulting land disturbance must be reclaimed for other productive uses.

Disposal of common variety mineral materials is encouraged when not detrimental to the public interest and when the benefits exceed the cost and associated resource impacts. An inventory of mineral materials is maintained to assure an adequate supply for internal needs before allowing for disposal for external use.

Prospecting and mining on the Forest is generally unrestricted, although subject to mitigation and to reclamation of surface impacts. Exceptions are acquired lands and areas withdrawn from mineral entry. Acquired lands are not open to mineral entry for locatable minerals, but are leasable.

By 1991, about 23% of NFS land on the Forest had been withdrawn from mineral entry (refer to Table 3-34). These withdrawals include designated wilderness, Wild segments of WSR (all within designated wilderness), administrative sites and some developed recreational sites. These withdrawals are subject to valid existing rights.

Table 3-34. Acres of Land Currently Withdrawn from Mineral Entry By Locatable Mineral Potential

	Total	High/ Very High	Moderate/Low	Unknown
Marble Mountain Wilderness	223,000	18,000	171,000	34,000
Trinity Alps Wilderness	75,000	11,000	55,000	10,000
Siskiyou Wilderness	70,000	3,000	0	67,000
Russian Wilderness	13,000	700	0	12,000
Administrative and Recreational Sites	1,600	600	0	1,000
Total	**382,000**	**32,000**	**226,000**	**124,000**

As of 1990, about 650 acres of land on the Forest had the mineral rights in question or reserved to private parties. Of these 650 acres, about 360 are outstanding oil and gas rights on the Goosenest Ranger District that may be exercised over the next decade. The remaining reserved rights cover an assortment of mineral categories and have a very small chance of the rights being exercised within the next 10 years. There are also about 1,000 acres of land with mineral rights retained by the Federal government, but with surface rights conveyed to private use. The chance of these rights being exercised is also very small.

Surface uses are permitted on NFS land, when thought reasonably necessary and required for mineral exploration, development and production. The most controversial surface-use is residential occupancy. A determination of the need for residential occupancy considers what is reasonable in the local area.

In California, both the logging and construction industry use about a 2-hour one-way commute as the decision point for a request to set up a temporary camp. Seasonal work may require seasonal camps, but motel accommodations are preferable to camping out. Permanent fixed structures are seldom used even for long-term (1 to 2 year) projects. Tents and trailers are most commonly used, even for shops and storage. If watchmen are hired, they also commute.

Issues, Projected Demands and Opportunities

The development of mineral and energy resources on the Forest has been identified as an important issue. The regulation and reclamation of mining activities and its related surface-use is also an important issue. Of particular importance on the Forest is the sub-issue of when residential occupancy as a surface-use would be allowed in association with mineral activities. A related issue, resolution of unauthorized occupancies, is discussed in the Law Enforcement section.

In 1987, there were about 250 approved plans of operation for locatable minerals on the Forest. These covered everything from hard-rock mines and exploratory drilling to small dredging operations. Such activity had dwindled to about 100 approved plans of operation in 1991. These are mainly exploratory work or seasonal dredging.

Large groups of "recreational dredgers," such as "the New 49ers" on the Klamath River near Happy Camp, are being handled under an "umbrella plan of operations" which covers mitigation of surface resource disturbance and reclamation requirements for the entire group.

Gold is the principal mineral extracted from the Forest. Although there has been some exploration for chromite and copper recently, future production from the Forest is uncertain. Chromite production is unlikely

to occur in peacetime, as it cannot compete with foreign supplies.

Asbestos, chromite, copper, lead, manganese, mercury, the platinum group metals, silver and zinc are considered strategic locatable minerals nationally. Some other valuable locatable minerals found on the Forest include gold, iron, pyrite, jade and rhodinite.

The potential for locatable mineral development was mapped in 1980 and updated in 1984. The mapping was based on available information, such as known mineral occurrences, past and present mining activities, mining claim locations and geologic structure.

Development potential has been divided into 3 categories. The *High to Very High Category* is defined as a capability area where mineral development will occur within some part during the planning period. Areas rated as "high" have been, or are being, prospected. "Very high" areas are being developed. About 387,500 acres (23% of the Forest) is in this category, including areas with active and inactive mines. All these areas are on the westside of the Forest. The areas along the Klamath River, the Salmon River and most of their major tributaries are included.

The *Medium to Low Category* has 487,900 acres, 29% of the Forest. Mineral development is expected to occur in "medium" potential areas, and may occur in "low" potential areas, during the planning period. These areas are on the westside of the Forest. Included are the Marble Mountain Wilderness, the Trinity-Alps Wilderness and most of the Orleans Mountain Released Roadless Area.

The *Unknown Category* has 804,600 acres, the remaining 48% of the Forest. In these areas, there was not enough data to determine the potential. The process records contain maps showing the location of all 3 categories.

Future demand is difficult to predict, as it is dependent on market value and the National and world-wide supply of locatable minerals.

Although filing for oil and gas leasing has occurred on nearly 175,000 acres of the Goosenest Ranger District in the past, there has been limited exploration. There has been a fairly steady decline in the number of active cases and acres over the last 10 years, with a peak in 1983. Cases refer to the number of applicants. There may be multiple lease applications under any single case. As of 1992, only 2 cases, covering about 7,700 acres, are active.

The Forest, in cooperation with the BLM, will schedule an analysis of Forest lands for oil and gas leasing as funding and scheduling permit. This will be done as an amendment to this plan or as a separate EIS.

Since 1974, 139 lease applications for geothermal exploration have been submitted, covering about 187,660 acres on the eastside of the Forest. In the last 10 years, the active leases increased from 50,200 acres in 1982 to a peak of 102,000 acres in 1985 and 1986. They have been decreasing each year since, to a low of 22,200 acres in 1992.

About 13,400 acres of the Goosenest Ranger District within the KGRA have been leased. Some portion of these lands will likely be utilized when development of the geothermal resource begins within the KGRA.

The potential for leasable mineral development was mapped in 1989. The mapping was based on known occurrences, past and present activities, mineral leases and geologic structure.

Leasable mineral potential falls in 3 categories. The *High to Very High Category* has 21,500 acres, 1% of the Forest. A "very high" rating indicates that some development will occur within the planning period. A "high" rating means there is a 50% chance of some development occuring within the planning period. The only areas in this category are on the eastern border of the Goosenest Ranger District, in the area next to the Medicine Lake Glass Flow.

The *Medium to Low Category*, which has 346,600 acres (21% of the Forest), has a 25% chance of development occurring. Most of the Goosenest Ranger District, the northwest portion of the Marble Mountain Wilderness and the upper reaches of Elk Creek are in this category.

The *Low to No Potential Category* has 1,312,200 acres, the remaining 78% of the Forest. This category has a 10% chance of development. The planning records contain a map showing the location of the 3 categories.

The future demand for leasable minerals is also difficult to predict. It depends on the National supply and the relative costs of alternate energy sources.

Refer to the Timber Management, Other Products section for a discussion of non-mineral energy resources.

The use of mineral materials varies widely from year to year. Overall use, during the past 14 years, has been declining. Total use for all mineral materials for all uses, including sold permits, free permits and Forest Service use, reached a high in 1978 at 399,000 tons and a low in 1991 at 44,000 tons. The average use for the years from 1978 to 1984 was 264,000 tons, while the

average use from 1985 to 1991 was 96,900 tons. Breakdowns for these years by each type of mineral material are in the planning records.

Mineral materials are available throughout the Forest, except volcanic cinders that are found primarily on the eastside. Future demand for these materials is expected to continue to decline as the amount of road construction declines from past levels. Most of the use was for construction aggregate and is expected to continue so in the future.

Transportation and Facilities Management

Description

Current Forest facilities include the transportation system and other facilities, such as dams and administrative sites (for example, buildings). The transportation system provides public access and facilitates for Forest use and management activities, such as recreation, mining, law enforcement, timber production, and fire prevention and suppression.

Ranger stations, work stations, lookouts, electronic sites, etc., represent the "other facilities" used for Forest administration and management activities. The trail system primarily supports recreation use. This is discussed in the Recreation Management section earlier in this chapter.

The total Forest road system includes over 6,000 miles of road. Included are Forest development roads, County roads and State roads. Forest development roads are constructed for the administration of NFS lands and are not classified as public roads.

However, public use is allowed by the Secretary of Agriculture. This system is currently maintained and reconstructed as use and conditions dictate, within available budgets. According to present inventory, the development road density on the Forest averages about 3.3 miles per square mile.

A large portion of the Forest administrative facilities are old and many need repair or replacement. Leased facilities represent a relatively small portion of the Forest's administrative sites. These facilities, because of their high annual cost, have a disproportionate effect on the Forest's fiscal management.

Forest Development Roads

Forest development roads currently total 5,100 miles of the total road system. These roads are categorized into 3 functional classes: arterial, collector and local (refer to the Glossary for definition of road classes). (Table 3-35.)

Table 3-35. Miles Of Forest Development Roads By Functional Class

Arterial	Collector	Local	Total
160	1,500	3,500	5,100

Traffic management strategies have been established to minimize resource-use conflicts. These conflicts may include special wildlife considerations, or erosion-related water quality concerns. Mitigation measures may include specific road management requirements, such as road surfacing, special drainage requirements, road closures or other traffic control measures.

The Forest development road surface classifications include: 160 miles of paved surface roads, 1,170 miles of aggregate surface roads, 3,720 miles of native material surface roads and 50 miles of primitive surface roads.

Five traffic strategies are used. They range from encouraging traffic to prohibiting traffic. Table 3-36 displays the number of miles of road under each management scheme.

Table 3-36. Current Traffic Management Class Mileage

Encourage	Accept	Discourage	Eliminate	Prohibit
1,300	2,800	4	25	1,000

Relatively few development roads were constructed on the Forest before the mid-1970's. Later, road construction accelerated, approaching 200 miles of construction in some years. Under the current Timber Management Plan, 95 miles of road construction per year until the year 2000 was anticipated as necessary to access lands identified as available for timber harvest.

From 1980 to 1990, new road construction averaged 40 miles per year, while reconstruction averaged 70 miles per year. Currently, the direct cost of new construction averages about $45,000 per mile. Reconstruction averages $7,000 per mile.

Road construction and reconstruction are financed primarily through the use of purchaser credits. This process allows timber sale purchasers monetary credits equal to the cost of specific road projects. These credits can then be applied against timber volumes under terms of the sale contract.

It is estimated the Forest has about 200 to 500 miles of uninventoried roads. There are 104 bridges that currently support the road system on the Forest. Fifteen of these will not carry a legal load and need replacement.

Forest Highways

Forest highways are specially designated roads that qualify for funding under the Federal Lands Highway Program. There are 4 of these on the Forest (Table 3-37). Forest Highway (FH) 93, from Callahan to Somes Bar, has been the main focus of recent Forest highway project funding. Large sections of FH 93 and FH 102 (Etna to Forks of Salmon) are functionally deficient from a current use standpoint. Problems range from poor horizontal alignment and sight distance to inadequate width.

Siskiyou County has jurisdiction over these roads. The Forest has responsibility for recommending changes in FH designations. The planning process for these roads is a joint effort between State road agencys, Forest Service, County Road Departments and the Federal Highway Administration.

Table 3-37. Forest Highways

Designation	Description	Jurisdiction	Miles
FH 93	Callahan to Somes Bar	County	70
FH 102	Etna to Forks of Salmon	County	40
FH 113	Indian Creek to Grayback Rd	County & Forest Service	20
FH 5	South Fork Scott River to Trinity County	State	10
		Total	140

Federal/State Highways and County Roads

The California Department of Transportation has jurisdiction over 244 miles of Federal and State highways (Interstate 5 and Highways 3, 96, 97 and 263) that cross or are next to the Forest. These highways serve as arterials.

Interstate 5 is located between the east- and westsides of the Forest. It provides the primary north-south Forest access. Interstate 5 also significantly influences Forest traffic levels, transportation and local market areas. Siskiyou County has jurisdiction over 547 miles of road that influence transportation on the Forest.

Road Maintenance

Road maintenance on the Forest is accomplished in several ways. It is done through timber sale contract requirements, Forest Service crews, service-contracts or cooperative-agreement maintenance.

Road maintenance budgets have been steadily declining in proportion to total system needs as a result of inflation. Consequently, available funding must be used for preventing or repairing damage to prevent road use or damage that might pose a serious threat to other resources. As a result, the road system is steadily deteriorating. Eventually, substantial investments will be necessary to return Forest system roads to a condition where they can function as originally intended.

Over one-half of the Forest's annual road-maintenance expenditures (about $2 million) go to timber purchasers in the form of appraisal allowances and direct payments (refer to the Glossary) for road maintenance activities. About one-quarter of the expenditures are for Forest Service crew projects. The remainder is applied to service contracts, payments to cooperators, road management and general administration.

Cooperative agreements have been established with several private entities who have transportation needs common to Forest needs. These agreements allow for cost sharing of road construction and betterment, as well as maintenance. The Forest also enters into cooperative maintenance agreements with Siskiyou County on an "as needed" basis. Traditionally, this has been in response to catastrophic fire events and associated salvage and hauling needs.

Forest development roads are grouped into 5 maintenance levels (see Glossary). As shown in Table 3-38, most of the Forest road system (over 70%) is maintained at Level 1 or 2. This means that less than 30% of the road system is maintained for standard passenger car traffic.

Table 3-38. Current Road Maintenance Level Mileage

Level 1	Level 2	Level 3	Level 4	Level 5
1,000	2,700	1,300	100	70

Roads in Maintenance Level 1 are closed to vehicular travel on a permanent or seasonal basis to protect resources and road investments. Important objectives include minimizing road-surface damage, erosion and sedimentation, and disturbance to wildlife. An additional 250 miles of road have intermittent restrictions to prevent conflicts with commercial use.

Air Transportation

There are 6 airports (1 municipal, 5 County) near to or within the Forest. All 6 are improved with asphalt

concrete runways. They play an important role in fire suppression activities on the Forest by facilitating more effective Forest-wide reconnaissance and air-attack efforts.

The Siskiyou County Airport has runway facilities adequate for large airline use. The Forest maintains and operates an air-tanker reloading base here. It also operates heliport bases at Scott Valley and Happy Camp Airports (both County facilities). These bases support helitack fire-suppression efforts, occasional reconnaissance flights and prescribed fire activities.

Other Facilities (Buildings, Utility Systems and Dams)

The Forest leases and operates 6 administrative sites. These include the Salmon River, Scott River, Oak Knoll, Happy Camp and Goosenest Ranger District offices and the Supervisor's Office in Yreka. The Ukonom Ranger Station is co-located with the Orleans Station on the Six Rivers National Forest.

The Forest uses about 288 buildings and related facilities that support various administrative and management activities. These include offices, shops, warehouses, residences, barracks and equipment shelters. Total value of these structures is about $17 million.

There are presently 35 water-delivery systems and 5 dams on the Forest. The water systems supply water to campgrounds, as well as administrative sites. Ongoing monitoring is required to assure compliance with the Safe Drinking Water Act. Only 2 of the dams are owned and inspected by the Forest Service. The other 3 are inspected by the State.

The database for the above information is maintained in the Forest's Transportation Inventory System at the Supervisor's Office. There is no transportation-related layer in the Forest's planning database.

Laws and Management Direction

Direction for the planning, development and maintenance of the Forest transportation system and other facilities is detailed in FSM 7700. This direction is based on pertinent laws and regulations. Some of the more relevant laws are the Highway Safety Act of 1966 and the Surface Transportation Assistance Act of 1982.

Development and maintenance of transportation and administrative facilities is necessary for the management and public use of Forest resources. Consequently, the ultimate goal is to eventually have facilities systems in place that will meet all current resource needs.

Location and design of all facilities must be responsive to future needs and objectives for the area. The design of projects will consider life cycle costs to minimize expenditure of public funds. The primary access objective is to construct a maximum-economy road network. Maximum-economy road design must consider long-term needs to minimize present-value costs of all transportation costs.

Issues, Projected Demands and Opportunities

Issues are focused on the cost and feasibility of improving parts of the Forest road and trail systems, and of repairing the many Forest-owned administrative facilities that are old and/or worn out. Public use and demand for all Forest resources, along with adequate access systems and other structures (for example, campgrounds) to facilitate this use, will continue to increase. The following is a list of projected demands and opportunities for the Forest's road, trail and administrative facilities.

Effective control of Forest traffic will become more critical, as public use and demand for all resources increases. Increased weekend dispersed recreation and OHV uses represent a potential conflict with other resource uses. This conflict will be managed by implementing the Road Management Objectives for those conflicting areas.

The Forest has roads currently nominated for the Scenic Byway designation, with 1 designated (State of Jefferson Scenic Byway). In the future, more roads will need to be studied as opportunities for Scenic Byways.

There will be a need to implement Road Management Objectives to determine how the road system should be managed for public and agency use. Availability of funds will have an impact on the feasibility of all future changes in the existing transportation system.

To have access to Forest resources for visitor use and forest management activities, the long-term bridge replacement frequency of the Forest will need to average about 2 bridges per year.

The Forest has between 200 and 500 miles of uninventoried roads. As projects are planned in areas containing these roads, Road Management Objectives will be established and or updated to determine whether to add them to the development road system or obliterate them.

Since a large portion of the facilities owned and operated by the Forest are old, repair and/or replacement costs in the future will be significant.

Timber Management

Description

There are about 25 species of conifers and 43 species of hardwoods found on the Forest (a complete list of tree species on the Forest is available at the Forest Supervisor's Office). The predominant conifer species on the Forest are Douglas-fir, ponderosa pine, red fir, white fir, sugar pine (*Pinus lambertiana)* and incense cedar (*Libocedrus decurrens*). The predominant hardwood species are California black oak, canyon live oak (*Quercus chrysolepis*), tan oak (*Lithocarpus densiflorus*), madrone (*Arbutus menziesii*) and Oregon white oak (*Quercus garryana*). Table 3-39 shows a breakdown of the primary tree species found on the Forest.

Table 3-39. Percent Species Composition (based on basal area per acre)

Species	Percent
Douglas-fir	35
Ponderosa pine	12
Jeffrey pine	nominal
Sugar pine	7
Western white pine	7
Lodgepole pine	1
White fir	8
Red fir	11
Port-Orford-cedar	nominal
Pacific yew	nominal
Brewer spruce	nominal
Mountain hemlock	2
Incense cedar	3
Bigleaf maple	1
California black oak	4
Canyon liveoak	6
Tanoak	6
Madrone	3
Total	100

(Data source: 1988-89 Forest inventory)

The Forest is comprised of 7 major forest types. These types are distinguishable by the primary conifer species present and the average site productivity (refer to Table 3-40). The 7 forest types are Douglas-fir, westside mixed conifer, eastside mixed conifer, true fir, ponderosa pine, lodgepole pine and hardwood.

Table 3-40. Site Productivity of Forest Lands -- Dunning Site Class Table

Dunning Site Class	Mean Annual Growth (Cubic Feet/Acre)
I	120+
II	85-119
III & IV	50-84
V	20-49
VI (non-commercial)	< 20

Mixed conifer (east and west) is the most common forest type. It comprises about 50% the Forest lands. Mixed conifer stands are found at mid-elevation zones (between 2,500 and 5,000 feet elevation), on both the east- and westside of the Forest. This forest type is divided into eastside and westside mixed conifer to recognize differences in ecological conditions and the average site productivity.

Both east- and westside mixed conifer contain various proportions of tree species (ponderosa and Jeffrey pine, Douglas-fir, white fir, sugar pine and incense cedar). Other conifer species are present in minor amounts.

The proportions of these various species differ between the eastside and westside mixed conifer types. The eastside type also has significantly lower conifer growth rates and stocking, compared to the westside type. In the westside mixed conifer type, there is an additional component of hardwoods. Such hardwoods include California black oak, madrone, canyon liveoak and bigleaf maple. The productivity of these lands varies considerably, but the average is a Dunning Site Class 3 on the eastside and Site Class 2 on the westside (Table 3-40).

The Douglas-fir type is found only on the westside of the Forest (most commonly on the Ukonom and Happy Camp Ranger Districts). At low- to mid-elevations, Douglas-fir occurs primarily associated with sugar pine and the hardwood species tanoak, madrone, chinquapin, California black oak and canyon liveoak. At higher elevations, the hardwood component is replaced by white fir. Additional species are present,

but represent a minor part of this forest type. About 20% of the Forest is comprised of the Douglas-fir type. The average Dunning Site Class is 2.

Most of the ponderosa pine type is found on the Goosenest Ranger District. This type consists of stands of pure, or nearly pure, ponderosa pine. It represents about 6% of the total Forest. The average Dunning Site Class is 4.

The true fir type grows at elevations above 6,000 feet. True fir stands consist of almost pure stands of red fir, mixtures of white and red fir or, at higher elevations, mixtures of true fir with lodgepole or mountain hemlock. The true fir type is found in both the east- and westside of the Forest. The type is slightly different in species composition in these 2 locations. The true fir type represents about 7% of the Forest. The productivity is variable, but averages a Dunning Site Class 4.

The conifer species, Pacific yew (*Taxus breviflora*), exists as a minor component within forest stands on the Forest. This species has received National attention because it contains a cancer-fighting substance known as taxol (refer to the Other Forest Products/Biomass Utilization Section later in this section).

Pacific yew is primarily found in the mixed conifer and Douglas-fir forest types. It is more scarce in the true fir type and absent from the ponderosa pine forest type. Pacific yew is typically found at the bottom of slopes, in or near streamside areas. It is scattered and generally in the form of a small tree or shrub, having an average diameter of about 6 to 12 inches. A Regional survey of Pacific yew is in progress to determine the extent of its distribution and size.

A nominal amount of Port-Orford-cedar is also found on the Happy Camp and Ukonom Ranger Districts. It is being carefully monitored for a root disease that kills this commercially valuable species. Currently, this disease has not been detected on the Forest. Like Pacific yew, Port-Orford-cedar is typically found in moist areas, such as along creeks, north-facing slopes or other areas, where increased amounts of water collects. It occurs both as scattered trees within Forest stands and in small, relatively pure groups of trees.

About 97,700 acres, or 6%, of the Forest is non-productive forest land. This land is comprised of non-commercial conifer species (like knobcone pine, digger pine, etc.) or hardwoods. The remaining 178,100 acres (11%) of the Forest is non-forested (water, rock, urban areas, natural grasslands and brushlands) and incapable of growing conifers.

Past Timber Management and Logging Activities

Timber harvesting began on the Forest in the early 1900s. Most of this early logging was done by railroad to remove high value pines from the most accessible portions of the Forest.

Concern for a planned timber harvest schedule and sustained yield of timber prompted the inventory and mapping of the Forest in 1919. Developed in the 1950s, the first formal timber management plans followed an inventory of the Forest. This inventory was based on permanent plots installed in the late 1940s and early 1950s.

Timber harvest operations, including the practice of clearcutting, increased during the 1950s and was at its peak in the late 1970s and early 1980s. Except for the major effort to salvage timber after the 1987 wildfires, the amount of timber offered for sale has decreased since the mid-1980s.

Current Management Direction

Current timber management direction on the Forest is guided by many laws, regulations and resource plans. The primary direction for timber management is provided in the Klamath National Forest Timber Management Plan (TMP) and EIS signed September 30, 1974. This plan was amended in 1979 to reflect RARE I & II wilderness recommendations. It was amended again in 1985 to reflect the 1984 California Wilderness Act. This plan set an annual potential timber yield for the Forest, based on a timber inventory done in the 1960s.

Additional direction is provided in the 1972 Multiple-Use plans. These plans designated special resource areas where management objectives specified enhancement of resources other than timber production. "Travel Influence Zones" are an example of one of these designated areas where timber management activities are prescribed to enhance scenic values along roadways.

Lands allocated to Timber Management (Capable, Available and Suitable [CAS])

The NFMA requires forests to do an assessment of lands that are capable, available and tentatively suitable (CAS) for timber production. **Capable** lands are defined by the Pacific Southwest Regional Land Management Planning Direction as land where at least 20 cubic feet of commercial wood products can be grown per acre per year. Of the 1,680,000 acres of

NFS lands on the Forest, about 1,486,000 acres (88%) are classified as capable.

Available land is defined as lands administratively available for timber management. Wilderness is considered unavailable and has been removed from the timber land base.

Suitable land is defined as land where timber harvesting activities could occur without causing irreversible damage to soil or watershed. Active landslide areas, slumps and unstable inner gorge slopes are classified as unsuitable. These areas are also removed from the timber land base. A more in-depth description of these lands is included in the Geology Section earlier in this chapter.

Table 3-41 provides a breakdown of lands tentatively suitable for timber management. Of the total 1,680,000 acres, 1,051,000 (63%) are classified as tentatively CAS. Acres that fit more than 1 category are counted in the category closest to the top of the list to avoid double-counting. These lands are shown by major forest type in Table 3-42.

Table 3-41. Timberland Classification

Classification	Acres	Percent of Forest
Total National Forest	1,680,000	100
Non-forest lands and non-capable lands (includes water, meadows, barren areas, rock and non-commercial species)	276,000	16
Capable Forest lands, currently withdrawn from timber production by Act of Congress, Secretary of Agriculture or the Chief of the Forest Service*	299,000	18
Land physically unsuitable for timber production	54,000	3
Tentatively CAS Forest Lands	1,051,000	63

* This does not include designated Scenic and Recreational Rivers (these areas may be available for timber management).

Table 3-42. Timber Inventory by Diameter Class for CAS Lands

Diameter Class (Inches)	Million Board Feet (MMBF)	Percent of CAS Inventory
11 - 17	1,700	10
18 - 24	3,000	18
25 - 29	4,300	25
30 - 39	3,800	22
40 +	4,300	25
Total	17,100	100

Included in these Forest lands are about 80,000 acres of non-stocked land and over 320,000 acres of understocked land. These lands are capable of growing commercial conifer forests. These non-stocked lands are primarily a result of a long history of fires on the Forest. Most of these lands are now brush fields, requiring brush removal, treatment with herbicides or prescribed burning to establish conifers on the sites. Understocked lands are a product of wildfires and past management practices, particularly selective harvesting.

About 360,500 acres of tentatively CAS lands are currently considered unsuitable for timber management activities. These lands include habitat for TE&S plant and animal species, cultural sites, proposed RNAs and other special areas set aside for resource protection or enhancement.

Timber Management Intensity

Timber management objectives in the TMP direct the Forest to provide a maximum supply of wood products on regulated commercial forest land, consistent with other resource values (refer to Appendix F for a discussion of regulated land). The current Multiple Use Plans and TMP (after amendments) provided for 672,000 acres of Standard Component land (intensive timber management), 63,000 acres of Special Component land (moderate to low intensity timber management with emphasis on other resource values), and 264,000 acres of Marginal Component land (low intensity of timber management due to economic considerations or physical condition).

These are the lands (about 56% of the total Forest) available to produce a regulated, sustained flow of forest products. Other parts of the Forest, not considered part of the timber land base, include wilderness (381,000 acres), areas set aside to protect special resource values, such as scenic travel ways

and Sensitive plant habitat (11,000 acres), non-forested lands (110,000 acres) and lands considered incapable of growing commercial forests (276,000 acres).

Today, several of the assumptions on which the potential yield calculations of the TMP were based have changed. New laws, regulations and policy changes have reduced the amount of land where timber may be harvested. Intensive timber management practices have been further restricted by the need to provide for other resource objectives.

Silvicultural Systems

Timber management activities on the Forest have utilized both even-aged and uneven-aged silvicultural systems. Appendix F of this EIS includes a description and discussion of the different silvicultural systems used on the Forest. The 1974 TMP and EIS selected the even-aged system as the preferred method on the Forest.

Even-aged harvest methods include clearcut, seed-tree, shelterwood, overstory removal and various intermediate treatments (including thinning, sanitation and salvage). Recently, in response to public and other resource concerns, these traditional even-aged silvicultural methods have been modified to provide for additional resource values.

The Forest Service is following a new approach, called "Ecosystem Management," which blends multiple-use goals and expands silvicultural options over landscape and Regional scales. These silvicultural options emphasize maintaining the structural diversity by retaining green trees, snags and large down logs after harvest. Historically, the use of uneven-aged harvest methods, including both individual tree selection and group removal harvesting, has been limited on the Forest.

Experience and silvicultural literature support the selection of even-aged system as the preferred silvicultural system for commercial forest types in this area. This is especially true when timber growth and yield are a primary management objective.

The even-aged system most closely mimics the ecological processes that created this forest environment. The periodic fires that occurred throughout this Forest created a patchwork of relatively even-aged stands of various ages. These larger openings, averaging 50 acres (although quite variable), allow for regeneration of species, such as ponderosa pine and Douglas-fir, which are relatively shade-intolerant.

Even-aged cutting methods are economically and operationally more efficient than uneven-aged methods. They allow for greater monetary returns per acre and require lower administrative costs.

The steep rugged terrain, typical of this Forest, has made it both operationally difficult and expensive to remove selected trees from within stands. Past harvest practices, where portions of the stand have been removed, have commonly resulted in understocked stands, excessive damage to residual conifers and an unacceptable build-up of flammable forest residue. Due to of the variety of tree sizes, irregular spacing and frequent cutting cycles required with single tree selection systems, this system has been the most difficult system to achieve on steep ground.

On Standard Component lands, the TMP prescribes even-aged management with a "rotation age" (age to which managed stands would be grown) of 140 years. Most of regeneration harvests have been clearcuts. Recent emphasis has changed from clearcutting to green tree retention (previously regeneration with reserves). Current practices keep a range of green trees after harvest for structural diversity. These trees may be clumped together or evenly distributed throughout the unit.

Priority stands for regeneration have been understocked or overmature stands, where existing growth is far below the potential growth for the site. Reforestation of harvested areas, followed by vegetation management, stocking control and integrated pest management, has produced fast-growing, healthy stands.

The TMP provided direction to maximize timber yields on a sustained yield basis by regulating the forest. The objective of a "regulated" forest is to create a mosaic of even-aged stands, ranging in age from newly planted to 140 years of age.

A forest is considered regulated when there is equal acreage of each age class, and so creating a sustained yield of forest products. Commercial thinnings were planned in these stands, beginning at merchantable size (average about 50 years). Thinnings would occur every 10 to 20 years until final harvest. These new stands were generally 10 to 20 acres in size (the maximum was set at 40 acres, except the Douglas-fir type where the limit was 60 acres without approval of the Regional Forester).

When planting began on the Forest, new stands were planted primarily with pine. Over time, as seed collection and nursery capabilities increased, the species mix was expanded to include a wide variety of conifer species, reflecting the mixture found on the site.

Natural seeding from a variety of species has also helped contribute to the species diversity found in regenerated stands.

Hardwood trees are commonly retained in the stand, or re-sprout from the cut stumps. Plantation treatments in these stands maintain the diversity of tree species, emphasizing the conifer component. A variety of shrubs, forbs and grasses are present within these plantations, but diminish with time as the tree canopy shades out this vegetation.

On Special and Marginal Component lands on the Forest, where resource objectives often preclude even-aged management and the intensity of timber management is less, uneven-aged harvest methods have been used. Where appropriate, even-aged methods have also been used, but rotation lengths were extended beyond 140 years.

These lands are comprised of the same variety of tree species found on Standard Component lands. However, vegetative diversity is less due to the relative absence of the young seral stages, dominated by shrubs, forbs and grasses.

A variety of site preparation treatments, including burning, mechanical and hand treatments, are used on the Forest to prepare harvested areas for regeneration. The amount of snags and coarse woody material left in regenerated areas varies depending on the method of site preparation and the management objectives.

NFMA requires plantations to be successfully stocked within 5 years of final harvest. Reforestation failures are infrequent on the Forest, especially if all silvicultural techniques are available. Planting failures, requiring starting over with site preparation and re-planting, average less than 5% on the westside and less than 15% on the eastside.

Reasons for plantation failure are usually the result of a combination of factors. Such factors include incomplete or poor site preparation, poor planting procedures or seedling condition, extreme weather conditions or the inability to effectively treat any competing vegetation.

Logging operations on the Forest use a variety of logging systems, including tractor, cable and helicopter systems. Cable logging is the most prevalent system used on the Forest. Tractor yarding, which is limited to slopes less than 35%, is most common on the eastside of the Forest. Helicopter systems are used in areas inaccessible by roads or where resource concerns limit road building or other ground yarding systems.

Allowable Sale Quantity (ASQ, Inventory and Forest Growth)

The programmed annual timber sale volume is determined by the TMP (as amended) to reflect lands deferred under RARE II and those reserved by the California Wilderness Bill of 1984. The average annual volume harvested from 1979 through 1989 was about 200 million board feet (MMBF).

Actual sale program levels have varied, depending upon budget and other constraints. After the 1987 fires, an interim sale program of about 172 MMBF was established. This was set to allow for timely harvest of catastrophic timber losses, resulting from the fires, and to maintain a network of lands set aside for the northern spotted owl.

Table 3-43 lists the amount of timber offered, sold and cut each year and the total timber receipts collected since 1978.

Table 3-43. Timber Volume Offered, Sold and Harvested and Total Receipts, 1978 -1993

Year	Timber Volume Offered (MBF)	Timber Volume Sold (MBF)	Timber Volume Harvested (MBF)	Total Timber Receipts (Millions of Dollars
1978	267,700	238,800	227,300	28.6
1979	279,300	286,700	229,400	20.4
1980	259,500	255,300	232,800	19.2
1981	251,500	280,200	168,400	17.3
1982	219,500	243,700	89,100	6.9
1983	231,700	230,700	122,700	9.5
1984	226,800	128,700	190,800	16.4
1985	210,800	189,600	153,300	8.4
1986	157,600	173,600	222,900	21.3
1987	185,700	182,100	238,100	20.2
1988	306,700	311,700	248,600	16.2
1989	194,700	168,700	298,200	25.6
1990	168,100	99,800	214,300	20.4
1991	52,500	43,000	105,500	8.8
1992	29,600	27,900	88,800	15.5
1993	30,600	32,500	22,700	3.2

Two inventories, both completed in 1989, were used in compiling the existing Forest timber inventory. A Forest-wide inventory determined the amount of timber and the growth rates for existing stands. A planta-

tion inventory determined stocking and growth of future stands. The timber inventories are calculated in both cubic and board feet. The inventory methodology is discussed in Chapter 4, under the Timber Management section (ASQ, inventory, growth and yield). The inventory modeling process is discussed in more detail in Appendix B of this EIS.

Another inventory was also conducted for the 1987 fire area to evaluate impacts upon forest yields. Lands that burned at moderate or high intensities were assumed to have no live inventory. In areas burned at light intensities, plots were installed randomly in each of the timber stratum. No significant reduction in yields were found to warrant using separate yield tables in the FORPLAN model.

The Forest is one of the few National Forests to actually survey plantation growth. Plantations were inventoried to project growth and timber yields for future stands. All existing plantations created before 1980, whether the result of reforestation following wildfires or from management activities, were included.

The plantation inventories indicate that future trees will reach merchantable size as much as two decades later than originally thought. This is due to overstocking and competing vegetation that reduced tree diameter growth. Fortunately, this new information is incorporated into the projected future yields in the Forest Plan.

According to the 1989 and 1990 inventories, the Forest has about 17.1 billion board feet of standing timber on lands classified as tentatively suitable for timber production. In addition, there are 170,900 acres (16% of the total tentative suitable landbase) in conifer plantations between the ages of 0 and 40 years. Table 3-42 summarizes the current situation for the timber resources on the Forest, including inventory volumes, suitable acres and growth for each timber strata.

The current size and age class distribution of the Forest's commercial conifer timber is not in a regulated condition. A fully regulated forest, using even-aged silvicultural systems, would have approximately equal numbers of acres in each age class. The distribution of the current CAS timber inventory, by average tree diameter and age class, is displayed in Tables 3-42 and 3-44.

Table 3-44. Timber Stand Age Classes for CAS Lands

Average Stand Age (years)	Acres	Percent of CAS Inventory
0 - 5	47,200	4
5 - 15	50,800	5
15 - 25	40,600	4
25 - 40	32,300	3
40 - 80	nominal	nominal
80 - 120	268,500	25
120 - 160	359,800	34
160 - 200	189,400	18
200+	nominal	nominal
Non-stocked	76,600	7
Total	**1,065,200**	**100**

Most of the stands on the Forest are not growing at optimal levels for timber production. These stands have culminated in mean annual increment (mean growth for the stand is declining). A significant portion of these stands are over-mature and no longer realize any net growth (mortality is equal to, or greater than, growth).

Conifer stocking in most of the forest stands is less than the potential for the site. These stands are growing at a rate far less than the site's capability and are not fully utilizing site potential for timber production. Where stands are over-stocked, or where excessive amounts of competing vegetation exist, conifer growth and merchantable timber yields are similarly reduced. In these stands, controlling the amount and distribution of vegetation could substantially increase conifer vigor and merchantable timber yields.

Conifer yields also can be affected by the occurrence of insect and disease problems that affect conifer growth and survival. Maintenance of stand vigor is the best preventive measure to protect trees from insect and disease attack. Removal of diseased trees, or treatment of vegetation with pesticides, can decrease the risks of introducing and spreading insect and disease problems in Forest stands.

The 1988-1989 Forest inventory indicates that, on CAS lands, mortality from the last 5 years is about 404 MMBF (or 400 board feet per acre). An estimated 83% of this mortality is salvageable.

This mortality is, in part, a result of natural stand succession. However, it is also the result of increased insect and disease problems, recent drought conditions and changing forest stand conditions on the Forest.

These numbers do not represent timber killed from the 1987 fires. Therefore, total salvage opportunities are potentially much higher than these estimates, although many of these lands are not allocated for timber management. Opportunities in areas considered appropriate for timber management have also been limited by recent litigation.

Fire Effects

The composition and structure of lands within the Forest are the product of natural processes and human activity. The role of fire, as a major disturbance factor, has helped create the variety of forest stands existing today.

Fire will continue to affect vegetative patterns on the Forest into the future. The frequent occurrence of both high and low intensity fires has created a range of timber stands of differing age and size. The effects of these fires vary, depending on the fire intensity and topography.

Where high intensity fires occur, most of the trees are burned and killed. Individual large trees may be left surviving, or pockets of timber may survive in wet or other protected areas. Lower intensity fires may destroy a portion of the standing trees or burn only the material on the ground. These lower intensity fires often reduce the number of trees on a site by eliminating the trees more susceptible to fire damage (such as true fir), smaller understory trees (brush, hardwoods and conifers) and the dead, dying trees from within a stand. In a large fire event, a range of fire intensities typically occurs over the landscape, resulting in a patchwork of large and small openings.

Although wildfire has, and will, continue to play a major role in the successional development of forest stands, fire exclusion has also shaped the composition and structure of the Forest. In the past 40 to 50 years, Forest managers have been fairly successful in suppressing wildfires throughout the Forest. As a result, many of the understory trees, brush, grass and forbs that would have burned in periodic low intensity fires, have survived and become a part of many forest stands.

Reforestation of burned lands on the Forest has been variable. While many acres were manually reforested, many other acres were left to revegetate naturally. In the past 30 years, between 52 and 95% of the lands burned in major forest fires have been reforested.

Where manual reforestation activities were not planned, trees commonly re-established these burned areas from seed or sprouting over a period of a few years. This created a new stand about the same age as the fire event.

In areas where available seed was scarce or other environmental factors prevented successful regeneration, these burned-over lands became occupied with brush and hardwoods species. Once established, it was difficult for conifers to reoccupy the site. Due to this variability in site conditions, weather and seed production, conifer stocking in these naturally regenerated stands has been highly variable. About 89,600 acres of brushfields exist on the Forest today as a result of repeated fire events.

In the fires of 1987, about 240,000 acres were burned on the Forest. This included 19,000 acres of Forest plantations. Of the 70,000 acres needing reforestation following the 1987 fires, about 75% have been replanted or have naturally re-seeded. Constraints on prescribed burning, difficulties in accomplishing adequate site preparation in areas with established brush, and recent appeals and litigation have prevented the remainder of these areas from being reforested.

One billion board feet of timber burned outside of wilderness areas. Since 1987, over 90% of the timber sold on the Forest was made up of salvage from these fires. To date, over 500 MMBF of merchantable timber has been salvaged, but most of the lands have been left unsalvaged. The current Forest inventory was updated after the 1987 fires to reflect the timber losses.

Pest Management and Forest Health

The interaction of plants with insects, diseases, animals and other plants can influence the growth and development of forest vegetation. Where these interactions result in an undesirable loss of vegetative vigor or mortality, the damaging organisms are considered forest pests. Damage which affects timber management includes conifer mortality, wood decay, reduced growth, foliage loss, top-kill and loss of seed and cones.

Major pests include competing vegetation (grasses, forbs, shrubs and hardwoods), vertebrate animals (pocket gophers, bear, deer, porcupines and squirrels), diseases (annosus root disease, dwarf mistletoe and white pine blister rust), and insects (engraver beetles, pine beetles, wood, tip and shoot borers, grasshoppers and reproductive weevils). There is also

potential for the gypsy moth, European pine shoot moth and Douglas-fir tussock moth to become insect pests on this Forest.

Similarly, the occurrence and spread of Port-Orford-cedar root disease has potential to become a pest problem. This disease, currently existing in Oregon and in other parts of northern California, has not yet been found on the Forest.

Damage often occurs as a result of a pest complex, rather than the action of a single insect or disease. Pest complexes often involve, in addition to the pests, the condition of the vegetation (age, stocking density, species composition), environmental factors (drought, heavy storms, flooding) and the effects of management activity.

In general, unhealthy weakened trees and stands are more susceptible to pests. Silvicultural prescriptions that maintain stand vigor can reduce the probability of these pest complexes occurring or minimize their spread within or between stands.

The Forest continues to implement an integrated pest management approach to reduce or maintain pest damage at acceptable levels. This approach calls for the integration of pest management activities into resource management planning and decision-making. This includes pest management activities like prevention, surveillance, detection, evaluation, suppression and monitoring.

Under the integrated pest management approach, the level or intensity of pest management practiced will vary depending on the specific resource objectives and needed resource products. The selection of particular pest management methods are based on biological effectiveness, economic efficiency and the effects on all resources.

Treating competing vegetation in plantations is a significant part of the Forest pest management program. Successful control of this competing vegetation helps insure conifer survival, maintain a healthy stand and provide growth rates needed to sustain a high level of conifer growth and yield.

These Timber Stand Improvement (TSI) activities include treating competing non-coniferous vegetation (release), as well as thinning young stands of excess competing conifers (precommercial thinning). Between 1980 and 1990, an average of 4,000 plantation acres were released each year and 5,000 acres precommercially thinned.

Release and thinning treatments are normally accomplished by manual, mechanical, livestock or chemical methods. The treatment method selected for any given site depends primarily on the effectiveness, treatment cost and protection of other resource values.

Until 1984, most of the release treatments accomplished on the Forest used herbicides. After 1984, when a moratorium prohibited the use of herbicides, release treatments have been accomplished using non-chemical methods.

Without the use of herbicides as a method to control competing vegetation, conifer survival and growth in many plantations has been reduced. On non-stocked lands, where the use of herbicides is considered essential for conifer re-establishment, reforestation activities have been deferred. Currently there are 42,000 plantation acres on the Forest needing release.

In February 1989, an Environmental Impact Statement (EIS) for Vegetation Management for Reforestation was completed and signed by the Regional Forester. A variety of techniques, including herbicides, are available for controlling competing vegetation. Direction in the EIS allows the application of herbicides only where its use is essential to achieve land management objectives for the site.

Other Forest Products/Biomass Utilization

Forest lands offer a variety of forest products. These include, but are not limited to timber, firewood, biomass for energy production, Christmas trees, florist and basket-making materials, mushrooms, acorns and vegetation used for medicinal purposes. Management policies and practices on these forested lands can affect the availability and utilization of these products.

The demand for hardwoods has recently increased. The primary use is for heating homes. However, other uses (including wood chips for pulp and electricity) have gained a lot of interest in the past few years.

Current firewood policy allows for removal of dead and down material throughout the Forest (except in wilderness areas). It restricts the cutting of standing snags or live hardwoods to designated areas only. Personal firewood, sold under permits from 1986 to 1991, ranged from 2,500 MBF (5,000 cords) to 4,500 MBF (9,000 cords).

In addition to these permits, many commercial firewood operations occur annually throughout the Forest. Data for specific amounts sold commercially is not available.

Markets for both hardwoods and non-merchantable conifer logs, for uses other than firewood, currently exist in the areas of Medford, Redding, Eureka and

east of the Forest in Burney. In response to the recent interest in utilizing these other wood products, an increasing number of Forest projects are being proposed and implemented to meet this demand. Current projects include removing non-merchantable wood from within harvest units, from along roadsides and utilizing cut trees from precommercial thinning operations.

On the Forest, about 14,700 acres (1%) are comprised of relatively pure stands of hardwoods (stands where conifers are less than 10%). Hardwoods are also a major component of commercial conifer stands, especially in areas where conifer stocking is low. Although large quantities of hardwoods are present on the Forest, most is located on steep slopes with long hauling distances to mills. As a result, the demand for hardwoods for commercial purposes has been variable from year to year, depending on the market conditions.

Forest products used by Native Americans include beargrass, willows, salal and oaks. These products come from varying types of forest stands, including burned-over lands, hardwood and mature timber stands. Commonly, Native Americans return to specific areas year after year to collect these materials.

As mentioned before, the importance of Pacific yew for a source of taxol has become a National concern within the past few years. Taxol is being developed as a cancer-fighting drug. Potentially, many millions of pounds of yew tree material (bark, needles and wood) may be needed from NFS lands to maintain research and use of taxol as a treatment drug. An inter-regional planning effort is underway to facilitate the collection of Pacific yew and maintain viable, genetically diverse populations where yew occurs (Washington, Oregon, California, Idaho and Montana). Although yew trees are relatively scarce and small in size on the Forest, current management guidelines restrict the harvest of Pacific yew until conservation and management guidelines are approved.

Issues, Projected Demands and Opportunities

The Forest has been among the major timber producing forests in California. The Klamath, Shasta-Trinity, Six Rivers and Plumas National Forests have accounted for about one-half of the potential yield and timber sale volume from the all the National Forests in California.

The Forest supplies timber to mills in northern California and southern Oregon. This helps to satisfy local, Regional and National demands for lumber and other wood products. Timber harvest levels from this Forest have a significant economic effect on local communities.

Demand for timber is relatively high, since mill capacity exceeds the Forest's annual sell volume. This leads to highly competitive bidding on most sales. Demand for the Forest's wood products is expected to increase. Although conifer growth on NFS lands exceed timber harvesting by 30%, California currently imports more than 60% of its forest product needs.

Due to the high demand for timber, all timber offered for sale on the Forest in recent years has been sold. Sales typically sell for amounts several times more than advertised rates. Timber sale receipts normally exceed the cost of preparing and administering sales, re-planting the trees and building roads. The chance exists for individual timber sales to be below cost. However, below-cost sales have been rare on the Forest.

Although timber prices on the Forest have fluctuated over the past few decades, long-term trends in prices show a steady increase in timber prices. Prices range from below $60 per MBF in the 1970s, to over $200 per MBF in 1990. This increased price trend reflects the increasing scarcity of timber in relation to demand.

Demand for the major conifer species on the Forest is reflected in their relative stumpage values. Sugar pine and ponderosa pine are high value species, while Douglas-fir and incense cedar are moderate value species. The true firs, red and white fir, are low value species. A few species, such as Port-Orford-cedar, command very high values due to specialty markets.

Opportunities

Many timber management opportunities exist in terms of timber products and other resource values. Timber management operations can increase conifer growth and yields available for harvest and help maintain healthy forest stands. In areas where timber growth and yields are not emphasized, silvicultural prescriptions can help to create desired forest conditions to enhance wildlife habitat, stand diversity or other resource objectives.

Opportunities to increase forest growth and yield can help to provide high levels of sustainable forest products on the Forest. Replacing poorly stocked and over-mature stands with stands fully stocked with thrifty conifers would help to increase both conifer growth and timber yields.

Timber management activities also can help to enhance forest growth and vigor by controlling the

amount and the distribution of vegetation within forest stands. Commercial thinning, sanitation and salvage operations can help to minimize the effects of damaging insects, diseases and fires that can cause substantial losses in timber yields.

Opportunities to control competing vegetation in young stands can help to insure establishing conifer regeneration and provide for healthy, rapidly growing conifer stands. The ability to control the conifer and hardwood stocking within young stands will help maintain forest health. This also will produce stand structures desired for wood product production, wildlife habitat and other resource values. Increased opportunities for a more active IPM program will help reduce the level of loss to forest pests.

Opportunities also exist to improve forest health and growth through the genetic tree improvement program. Both intra- and inter-species diversity are important considerations in forest management. Genetic diversity is the base for genetic change, whether it be through natural evolution and processes or artificial selective breeding programs. The goals of the tree genetics program in Region 5 are to maintain or enhance genetic diversity and to improve tree growth and disease resistance.

Silvicultural prescriptions can be utilized to achieve a wide variety of stand conditions and management objectives. Silvicultural treatments are a tool to maintain, create or enhance desirable stand structure, composition and landscape conditions.

Harvest operations, reforestation and stand-tending activities can help create forest stands over the landscape through time to meet a variety of resource objectives. Clear statements of objectives for a stand, within the context of the landscape, are important. This will allow the development of prescriptions that are ecologically sound, technically feasible and socially and economically acceptable that will meet the objectives.

Increased opportunities to provide firewood, biomass and other forest products exist throughout the Forest. Utilization of non-commercial wood products can help to meet a variety of resource objectives. These include fire protection, site preparation, maintenance of stand health and vigor. Managing for a variety of stand structures and diversity of plant species could help to meet the demand for many other forest products.

This round of planning allows the Forest to balance the opportunities for a sustained yield of timber, along with other important Forest resource requirements and opportunities. The 1990 RPA proposed an annual timber harvest of 145 MMBF for the Forest. Opportunities and alternative ways to meet this target will be examined during this planning process.

Fire Management

Description

For ages, naturally occurring wildfires have shaped and reshaped the vegetative patterns and structure of what is now the Forest. This is shown by the present mosaic of stand age and composition. Fire has been a dominant force in natural regeneration, arresting succession, controlling stand density and stocking levels and continually molding the landscape's cover.

Forest inventory data suggests an average high intensity, stand-replacing fire frequency of less than 200 years in all forest types. The eastside frequency seems to be 80 to 140 years, while the westside is 110 to 180 years. This is based on the average age of the dominant and codominant trees that comprise most of a stand. There are areas where stand-replacing fires have visited less frequently. These would be found in the cooler, damper north slopes, higher elevations and some riparian areas.

Evidence of low intensity fires is showing up as frequently as 8 to 12 years in some westside vegetation types (Boothe, 1991; Taylor, 1991). High intensity fires replace stands (except for occasional fire-surviving dominants) and eliminate most of the accumulated downed, woody material. Such wildfires reduce and recycle organic surface material.

In the interim, frequent low intensity fires keep fuel build-up in check until stand deterioration provides enough fuel for another hot, stand-replacing fire. This historical cycle is substantiated by the frequent high intensity lightning storms that produce numerous fires most years and the accumulating research that demonstrates fire's frequent appearance on the landscape.

From 1950 through 1990, the Forest averaged 170 fires a year. These burned 12,000 acres on an average annual basis. Although the total area burned during this 40-year period was over 452,000 acres, 60% (nearly 275,000 acres), is from the fires of 1987. Refer to Figures 3-11 and 3-12. It is estimated that perhaps as many as 800,000 acres burned per decade, not necessarily evenly distributed over the years.

An analysis of the wildland fires over the past 20 years on the Forest indicates that less than 5% of the acres burned at low intensity. Low intensity fires (less than 4

Figure 3-11. Annual Fire Occurrence

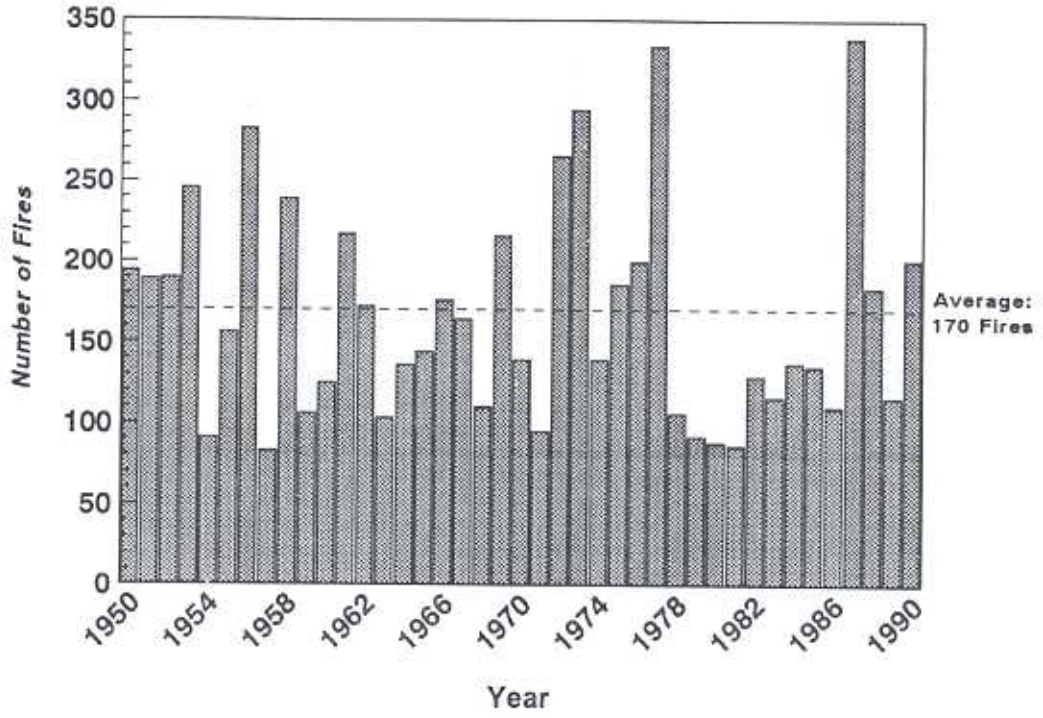
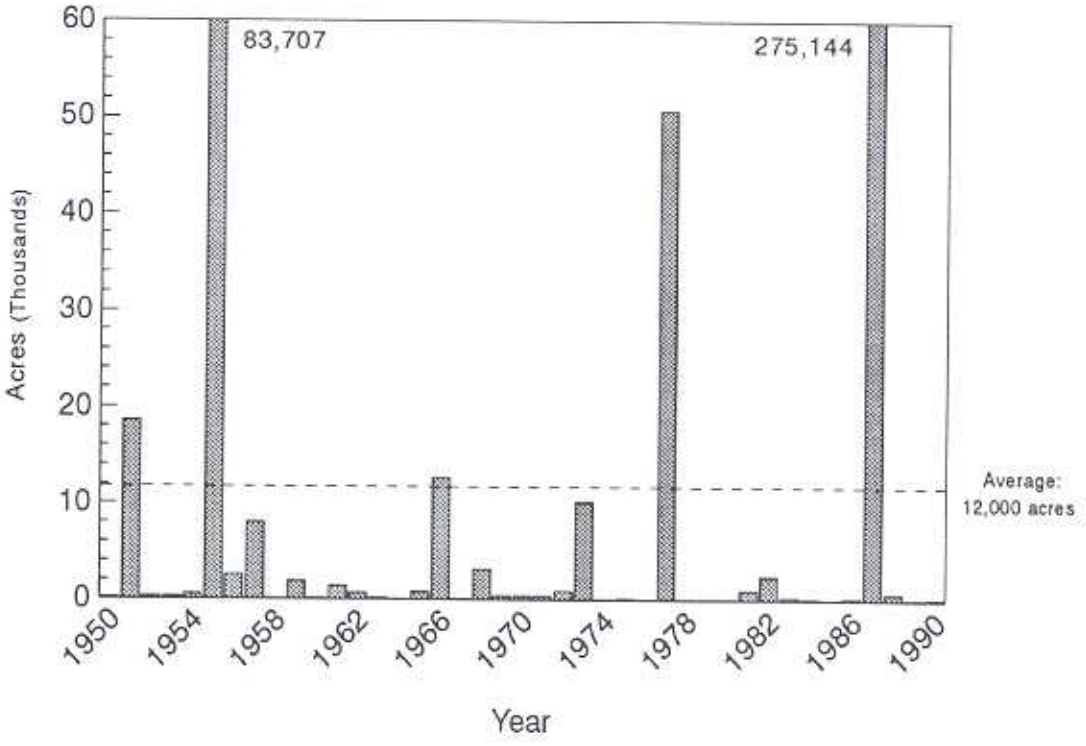


Figure 3-12. Acres Burned by Wildfire



foot flame lengths, hence the low acreage) generally burn more slowly and are more easily controlled through initial attack effort.

Moderate intensity fires (4 to 11 foot flame lengths) comprise about 72% of the total burn acreage. These fires are more difficult to contain. Large equipment on slopes less than 40% are effective, as well as aircraft and engines. Reduction of organic material and cover vegetation can be on one- to two-thirds of the area affected. Generally vegetation is killed in small patches, but larger patches should be expected.

The Forest's high intensity fires burn about 23% of the acres affected by wildfire. Fires that burn under these circumstances are the most destructive and are frequently associated with stand replacement. Vegetative loss can be expected from two-thirds to total loss. Flame lengths are over 11 feet in height. These fires are not successfully controlled during initial attack. They are typically contained on ridge tops and/or valley bottoms.

Lightning is the most common source of wildfire starts on the Forest. It has accounted for nearly 75% of the starts and 95% of the total area burned. Large fires can be attributed to a relatively high number of ground strikes during lightning storms, coupled with dry fuels on a steep, rugged forest terrain. Lightning is an uncontrollable source of ignition.

Humans have been responsible for the remaining starts and acreage burned. Escaped debris and slash burning fires are common causes. Campfires, cigarettes, children and arson remain persistent problems.

Fire Behavior and Suppression

The 3 factors that determine how, when and where a fire burns are topography, weather and fuels. Any 1 of these factors, when changed, can alter a fire's potential intensity and rate of spread. For example, a 20% increase in slope percent will generally double the spread rate. The steep slopes of the Forest's westside are a fact of topography that cannot be mitigated.

The Forest's fire season, usually beginning in late May and lasting through mid-October, is defined by local weather conditions. These conditions are characterized by periods of extreme heat with no moisture. Weather features are typical of the Mediterranean-type climate. These include warm-to-hot summers and mild winters, moderated by marine influence, concentrated winter precipitation and extremely dry summers with extended periods of sunny weather (McCutchan, 1977).

When winds are westerly, they bring in ocean moisture and tend to be cooler, making fires easier to control. North and easterly winds portend control problems. Dry thunderstorms bring the most devastating fire conditions to the Forest, especially during severe droughts like those of 1977 and 1987. Such conditions present a multiple fire-start situation that is nearly impossible to control.

The uncontrollable nature of Forest topography and local weather patterns leave only the third factor, fuels, to be managed with any success. Fuels are classified as being living or dead. The dead wildland fuel component influences fire behavior on the Forest the most. When dead fuels are dry, they are more susceptible to ignition and rapid fire spread (Countryman, 1971). Conversely, damper fuels are less susceptible to ignition and spread more slowly.

The small and fine dead material is influenced by daily fluctuations of atmospheric moisture and heating. This, in turn, affects fuel moisture, ignition and fire spread rates. The larger dead material (for example, logs) is the main source of fuel for higher intensity fires, although they require more time to dry out. Areas with high quantities of dead fuels are more susceptible to greater fire intensity and damage, evidenced by the plantations destroyed or damaged in Oregon and California during the 1987 fires (Agee, 1989; Weatherspoon and Skinner, 1989).

The live fuels (mainly brush, plantations and understory), although able to retain moisture for longer periods, can become a behavioral factor by mid-to-late summer and during droughts. Young plantations and brushfields are very susceptible to fire damage. This danger increases dramatically when large, continuous amounts of dead woody material are on or near the site. Their open nature subjects them to higher temperatures and generally drier conditions (Countryman, 1955). They are also more affected by wind, thus dry quicker than closed stands.

High intensity wildfires are not uncommon on the Forest. A major contributing factor is the steep terrain and deeply incised canyons of the Forest's westside. These steep slopes accelerate fire spread and hinder fire control activities.

Rapid, effective control of wildfires through active fire suppression efforts over the last several decades has resulted in an accumulation of down woody material and other organic debris in forested stands. Frequent low to moderate intensity fires historically kept forest materials in low quantities before the era of aggressive fire control programs. By not allowing natural ignitions to play this role, forest fuels have an increasing poten-

tial to contribute to large, high intensity wildfires if ignition occurs within these areas.

Accumulated fuels also act as a ladder for fire to spread from the ground to the intermediate vegetation layer and into the canopy. Historically, fire kept encroaching species out, thus perpetuating continual low intensity fires that rarely reached the crowns. Crown fires are the most spectacular and devastating to the forest. The high intensity fires in the last 10 to 15 years on the Forest have been a result of this phenomenon (Martin, et al 1989).

The Forest has the responsibility for protecting 1,678,000 acres of Federal land and 330,300 acres of private or State-owned land. These lands have been divided into 5 areas of similar fire history, behavior and response (see Figure 3-13).

The inter-mingling of public and private ownership makes fire prevention and protection tasks more difficult than those in an area of single ownership and management philosophy. Logical protection boundaries were developed in cooperation with the CDF. CDF, in turn, protects 164,400 acres of Federal land within its responsibility boundary.

Initial attack forces are distributed throughout the County, with each agency responsible for their agreed-upon area. Under the "closest forces concept," however, when a fire breaks in an area near the responsibility boundary, the closest initial attack resource will respond and be responsible for that fire, irrespective of jurisdiction.

Fuels Treatment and Utilization

Prescribed fire is the primary tool used to reduce management-related fuels. Annual burning accomplishments depend on the length of the fire season and moisture content of the fuels. The most common burning methods are broadcast burns, underburns, hand piles and tractor piles.

The Forest uses slash treatment requirements in timber sale and some precommercial thinning contracts to reduce accumulated fuels. However, several factors have contributed to a build-up of forest fuels over the past few decades: (1) effective fire prevention and suppression practices, (2) unusable material (cull logs, branches, etc.) and (3) slash left from precommercial thinning.

Another way of reducing fuels is using them to generate more useful energy, such as fuel for power plants. Currently, their primary use as a source of energy is for firewood to heat homes. However, use in wood-fueled, electrical power plants is increasing.

Air Quality and Smoke Management

Smoke emissions from management-ignited prescribed fires are managed through the Air Resources Board of California in Sacramento. The Sacramento Air Resources Board produces daily advisories for burning, based on prevailing and predicted weather conditions. From an air quality basis, the Siskiyou County Air Pollution Control Board has the ultimate authority for granting permission to burn. (Refer to Air section earlier in this chapter.)

Primary sensitive areas include populated areas such as Yreka, Weed, Mount Shasta, Etna, Fort Jones, Happy Camp and Dorris. Other smaller communities are considered, like Somes Bar, Forks of Salmon, Klamath River and Seiad Valley. As mentioned in the Air Section of this chapter, the Marble Mountain Wilderness and Lava Beds National Monument are Class I areas. These could be affected by smoke and require particular consideration.

Management Direction

Under current Forest management direction, all fires on the Forest are suppressed fully, using the most appropriate suppression response. A centralized automatic dispatch system in Yreka is used to dispatch all resources. During multiple lightning starts, however, each district dispatches their own resources, based on their pre-determined priorities. No naturally ignited prescribed fires are permitted to burn.

Current Resources and Activities

In 1987, the primary Forest initial attack resources included 14 wildland fire engines, 2 helicopters and 5 hand crews. The Forest also maintains an air-attack craft and an airtanker reload base. There were also prevention patrols and 8 fixed lookouts. For a detailed breakdown of these resources by district, refer to the Fire and Fuels Management AMS, located in the Forest Supervisor's Office.

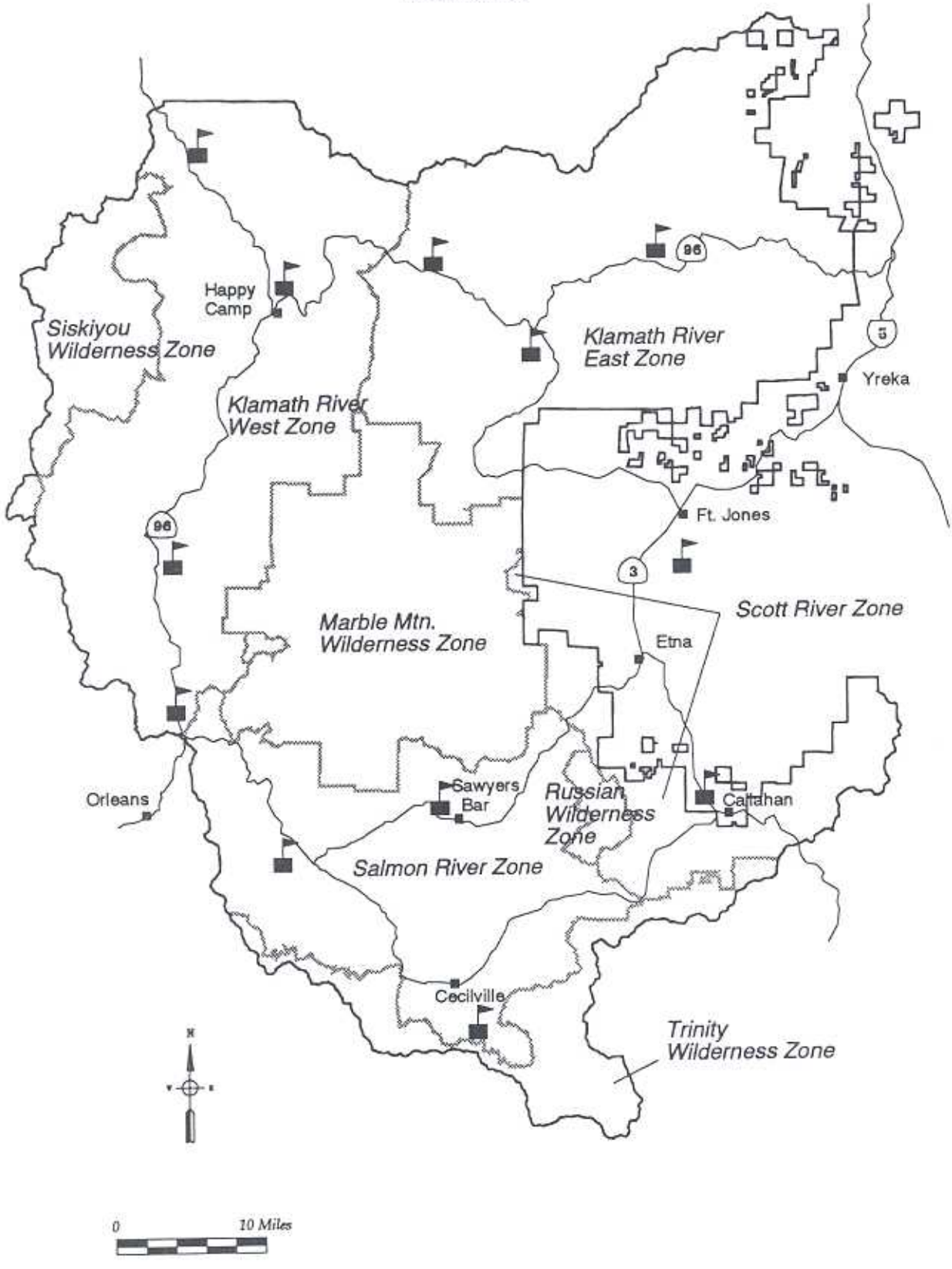
The CDF and the Forest Service modified "paid protection boundaries," areas where each agency has primary fire suppression responsibilities. The Forest shifted protection responsibilities for 137,000 acres to CDF in January, 1992.

There presently is no maintained system of fuel breaks. In some areas, segments of road systems can act as fuel or fire breaks. However, their position is not always the best for fire suppression work.

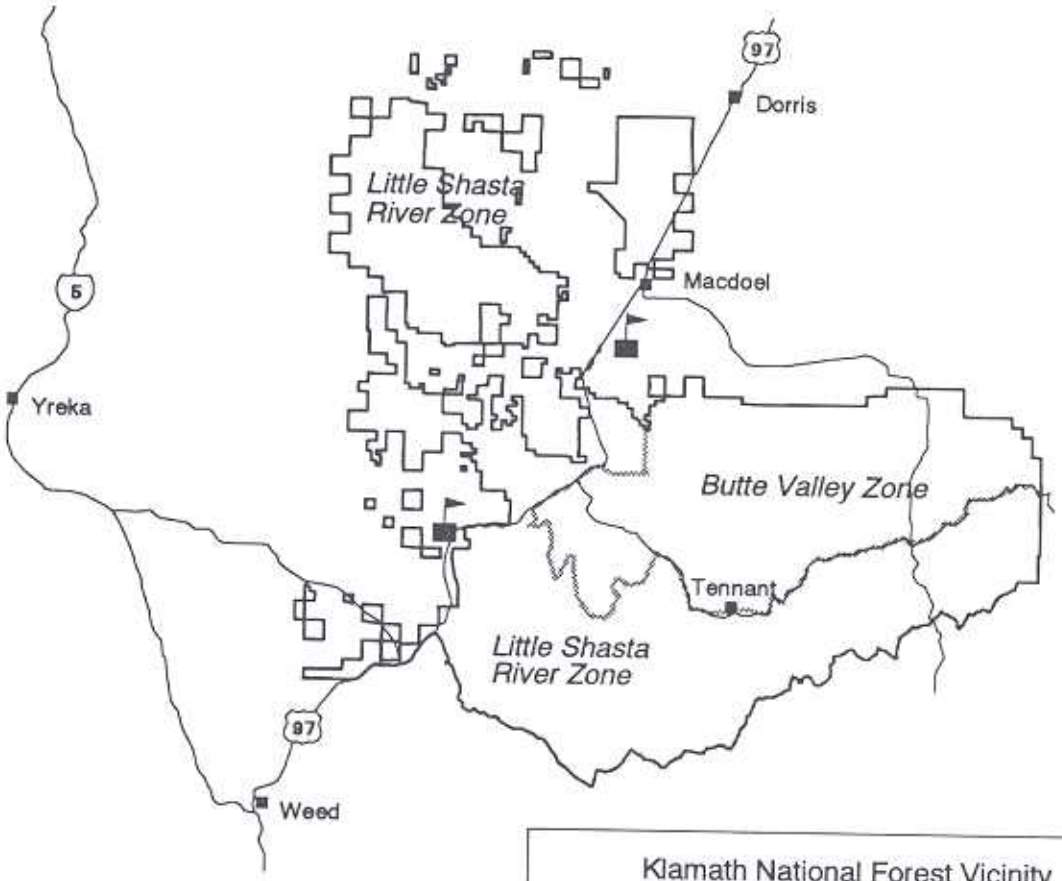
During fire emergencies, the Forest often employs the skilled services of private operators and their special-

Figure 3-13

Fire Management Analysis Zones
Westside



Fire Management Analysis Zones
Eastside



Legend

Fire Management Analysis Zone Boundary

USFS Initial Attack Fire Stations

Klamath National Forest Vicinity

ized equipment (like pick-ups, bulldozers and water trucks). The public is also encouraged to commit their services and any equipment that can be used for fire-fighting purposes. If a fire escapes initial attack efforts, equipment and personnel are also available through the Regional and National Mobilization Centers in Redding, California, and Boise, Idaho, respectively.

Each year, from 5,000 to 6,000 timber management acres on the Forest are treated for fuel reduction. This represents about one-third of the acreage being actively managed for timber. Timber sales generate the funding to treat these fuels. Brush disposal funds are used to reduce sale-generated fire hazards. When fire is prescribed to benefit other resource management purposes (for example, wildlife habitat and watershed improvement), their funding sources are used.

The statistical data for the wildfire information presented above is maintained in the National Fire Occurrence Data Library, located at the Computer Center in Kansas City, Missouri. The 19-year period was used for several reasons. One was its availability for computer analysis. Also, although the total 1987 burn acreage may be an anomaly, the actual number of fires was not. Another reason this period was used was there is strong evidence in Morford's work and other research indicating that large, catastrophic fires will continue to periodically occur in the Klamath and Siskiyou Mountains (Morford, 1984).

Issues, Projected Demands and Opportunities

The following projections focus on fire and fuels management issues and related Forest concerns identified at the close of Chapter 1 of this EIS. These projections are based on the assumption that current management practices would continue. Key points of issue are (1) optimum level of fuels treatment and utilization that will reduce fire hazard and (2) proper integration of natural fire and management strategies.

The fire hazard will continue to increase. Adverse weather and topography will continue to present uncontrollable challenges to fire managers. Increasing amounts of organic material will lead to higher intensity fires.

The fires of 1977 and 1987 created large stands of trees with similar age classes. This equates to large, continuous brush-like fuel components. The Forest will have to contend with this for at least another 30 years. Areas where fuels are treated or minimally treated will become increasingly susceptible to high intensity, stand-replacing fires.

Large high intensity fires will continue to occur at least every 10 years, based on fire history for the past 60 to 100 years. The fuel accumulations experienced now and into the future will be an important factor. Initial attack forces will have more difficulty fighting fires with heavier fuel loadings. These fires will become large more quickly and have higher intensities.

Initial attack configurations will change in the coming years. Budgets and re-assessments of the values at risk will determine initial attack force locations, quantities and types.

The timber harvest slash disposal program should peak in the next decade. High timber production from the 1987 fire salvage program and regular green sale programs will return to lower levels. There are other opportunities for use of fire and these need to be explored. Opportunities include wildlife enhancement, silvicultural applications and watershed improvement by maintaining fuel loadings at desirable levels. Hazard reduction through prescribed fire is a key management tool that needs to be analyzed.

Thinning slash from plantations will be a major fire hazard. This intermediate timber management activity occurs with minimal or no hazard reduction. As these areas proliferate in high risk areas, more frequent high intensity fires can be expected.

Use of the river system within the Forest boundaries has increased dramatically as recreationist's demands for rafting and fishing increase. This potentially poses a threat to the natural resource, as more people can mean a higher potential for fire ignition sources. River bottom fires are very devastating, since they have more fuel and are located on the bottom of very steep, long slopes. This could put valuable timber, archaeological sites, mining interests, WSR areas and other natural resources at risk.

Another human-related problem will come from pressure for community expansion. The urban interface is the encroachment of human dwellings into the forested and brushy regions of the Forest. These areas pose a special challenge because fires near the urban interface deplete resources needed to protect the forest resources. Life and real property are the first 2 priorities for protection, leaving protection of watersheds and timber resources third.

Regional and National demands for fire-fighting resources could keep initial attack resources for the Forest at less than optimal levels. Reduced National fire suppression budgets, along with the ability to mobilize resources more quickly, draws on experienced and trained fire fighters.

The days that are available to burn slash or for other management-desired uses of fire are dwindling. Pressures limiting this availability come from extended fire seasons, requiring the use of personnel that otherwise could be used for burning. Other pressures are the air restrictions from the State, reduced budgets or hiring limitations that make fewer people available for burning and smaller unit sizes that require as much effort to burn, but allow fewer acres to be treated per action. These, in different combinations with each other, will reduce the number of acres that can be treated with fire.

Habitat designated for the northern spotted owl cannot be guaranteed to be sustained. This desired habitat is in multi-storied stands with typically high fuel quantities. These vegetative situations, over large expanses, are atypical for the Klamath Mountains and are prone to intense fire activity. Given the hot, dry summers and number of potential lightning starts, these stands were probably more open than they are currently.

Prescribed natural fire (PNF) is a way of permitting fire to return to its role in the environment. Large contiguous blocks of land are the easiest to manage. So, wilderness and backcountry areas are the most appropriate place for PNF to occur. PNF also could work in the larger northern spotted owl habitat areas.

Range Management

Description

Historically, the Forest Service range management program has focused on livestock production. Over the last 10 to 15 years, the agency has been expanding the concept of range management beyond livestock management to vegetation management for livestock, wildlife habitat enhancement and general multiple use benefits. Today the range management program includes, but is not limited to, the use of livestock, prescribed fire, mechanical vegetation treatment, restoration of riparian areas, prescribed grazing for wildlife habitat improvement and plantation management.

Grazing of domestic livestock has occurred on the Forest since the mid-1800s, well before the establishment of the National Forest in 1905. Data is limited on the number of livestock and effects of early grazing on the Forest. It is known that historic livestock numbers were once far greater than current permitted use. Peak numbers occurred before establishment of the NFS and later during World Wars I and II. Some historical information is available, which discusses early use and indicates heavy use and deterioration in certain areas.

Grazing and Range Management

Today, rangelands on the Forest provide a variety of forage and habitats for grazing livestock and wildlife. Many ranchers depend on grazing allotments to provide forage for their stock seasonally.

Range vegetation consists of grasses, grass-like plants, forbs and shrubs. These provide forage values primarily to grazing ungulates, either as nutritional forage or a habitat component (for example, cover). Rangeland on the Forest is most commonly associated with ecosystems found in both natural and created forest openings, narrow riparian areas and similar settings. On the eastside of the Forest, extensive sagebrush-steppe and montane browse rangelands are common.

The Forest also has dense forested foothill areas and brushland (other than sagebrush types) supporting herbaceous or browse plants for grazing animals. These areas represent the Forest's chaparral resource, covering 150,000 acres or 9% of its land base.

The Forest produces about 34,000 Animal Unit Months (AUMs) of livestock forage annually. An AUM is the amount of forage (1,200 pounds) a mature cow and calf consume over a 30-day period. This production comes from 60 range allotments, made up of NFS land and "waived" private land. This waived land is within or next to public land. Exclusive grazing use is waived to the Forest to administer during the lifetime of the permit. The waived land is administered by the Forest, under cooperative agreements with private landholding companies (like Fruit Growers Supply Company and Sierra Pacific Industries).

The 70 permittees now using these range allotments depend on forage from public land to varying degrees. Livestock grazing on public land (primarily National Forest, with some BLM) accounts for 25% of the seasonal grazing in Siskiyou County.

Cattle and horses are currently the only permitted livestock on the Forest, though before the 1940s sheep were grazed at the higher elevations. A typical situation is a cow/calf operation, where ranchers run cows with calves on Forest lands in the summer. Yearlings are shipped to stockyards in the fall. Operations range from 25 to 1,000 head of cattle, while allotments range in size from 1,000 acres to over 60,000 acres.

Most of the permittees have their base of operations in the Scott, Shasta or Butte Valley areas. Accessibility

of the base ranch to the allotment varies. Some operators can turn their livestock out from their home ranches, where they either drift or are driven to the allotment. Many ranchers must drive their herds long distances or haul them to the allotment by truck, increasing the cost of their operation.

Dependency on National Forest grazing permits is based partially on the size of the operation, as well as number of permitted livestock. Smaller operators may need supplemental income. Most permittees depend on moving their stock to public rangeland in the summer and produce hay on their home ranches for winter needs.

The Forest's season of use varies. Some allotments on the westside have spring forage available as early as April. Range readiness depends on soil moisture, phenological stage of plant development and available forage biomass. Most allotments on the Forest have a season from June or July through September or October.

Forage allocation has been based on range analysis, as part of individual allotment management planning processes. Forage allocation is validated and monitored through utilization studies. Necessary adjustments are made in livestock numbers and/or season of use.

The east- and westsides of the Forest are considered separately in terms of their rangeland resources for several reasons. The eastside of the Forest has a drier climate. This produces vegetation types, such as mixed conifer (eastside pine or juniper), associated with various montane shrubs, sagebrush or perennial bunchgrass. The non-timber rangeland is comprised of perennial grasslands, dominated by Idaho fescue (Festuca idahoensis), and interspersed with wet and dry meadows.

On some eastside allotments, intensive management strategies have been used. These strategies use range management technology to achieve objectives. Vegetation manipulation and grazing strategies that optimize forage resource use, as well as fencing and water developments, are employed.

Westside rangelands consist primarily of mountain meadows that are subalpine or interspersed with commercial timberland, as well as shrub types and some oak woodland and annual grasslands. Transitory range accounts for about 14% of the forage base at any given time.

Range management on the westside is more extensive. Permitted livestock are released onto grazing allotments and allowed to drift, or they are periodically pushed into areas of forage production. Improvements (structural and non-structural) are minimal. Livestock distribution is achieved through permittee participation, including moving livestock on horseback and strategic placement of salt and water developments.

Current Activity and Productivity

Forage outputs are displayed in terms of AUMs. Most output indicators are displayed in terms of suitable rangeland, including permanent and transitory rangeland.

"Suitable rangeland" is an area that produces accessible forage or has inherent forage-producing capability (50 pounds per acre or more). This area can be grazed on a sustained-yield basis, in harmony with other resource management goals.

Permanent rangeland (including primary and secondary range) is suitable rangeland, capable of sustained forage production under proper management. Transitory rangeland, as the name implies, produces forage for a limited time after complete or partial removal of the overstory vegetation. Timber harvest and fire most commonly produce this range type.

Primary range is suitable, permanent rangeland where livestock naturally graze. Usually accessible to water, it can be over-used if cattle distribution is managed inadequately. Secondary range is usually accessible and capable of forage production. However, this range is grazed lightly, or not at all, under current management. It could become primary range under a different management and improvement program.

Livestock grazing allotments cover approximately 965,000 acres. Approximately 405,700 acres are suitable as permanent rangeland. Within these allotments are about 251,500 acres of primary range and 154,000 acres of secondary range.

About 56,800 acres are transitory rangeland. Transitory rangeland acres change in amount and location over time. There will likely be less transitory range acres in the future due to reductions in timber harvesting and less reliance on the practice of clearcutting. There are approximately 18,000 acres of wet meadows and riparian areas within range allotments.

The best available Forest data, compiled in the early 1980s, indicate that 52% of the Forest rangeland is in satisfactory condition or better. 62% of the rangeland is in a static or upward trend. Satisfactory condition rangeland includes those lands (1) in fair condition with an upward trend, (2) good condition rangeland with a static or upward trend and (3) excellent condition ran-

geland with a static trend. Any rangeland in a downward trend is unsatisfactory.

Other rangelands that are unsatisfactory are (1) lands in fair condition with a static trend, (2) poor condition rangeland with an upward or static trend and (3) very poor condition rangeland with and upward or static trend. The Forest is collecting ecological data for rangeland ecological types. This information is not yet available on a Forest-wide basis. This information will change the way vegetative condition and trend are measured and described in the future.

Under current management direction, an average of 15 structural improvements and 100 acres of non-structural improvements are constructed each year. Structural improvements include drift fences, water developments, improved livestock distribution controls and projects to protect sensitive areas. Non-structural improvements may include re-seeding a denuded area to restore the forage-producing capabilities and riparian restoration efforts, including willow and aspen planting.

Sources of information for this description of the Forest's current range situation are partially from data maintained in the range analysis files for each grazing allotment. There are also "Actual Use" records available, updated annually for each allotment. These are used to compile the Annual Range Statistical Report for the Forest and Region. These data sources are on file at the Forest Supervisor's Office.

Ecological Types

Forest-wide

A discussion of Rangeland Types can be found in the Biological Diversity section of this chapter.

Wilderness

In addition, meadow/riparian plant community types and associations in the Marble Mountain Wilderness have been described (Van Sickle, 1994). These are likely similar to meadow/riparian communities in all wildernesses on the Forest. Community types believed to be near potential natural plant communities are called associations. Community types include Kentucky Bluegrass/Yarrow/Cinquefoil, Dry Sedge/Needlegrass, Wet Sedge Seral, Oatgrass/Clover and Angelica/Other Forb. Associations include Idaho Fescue/Buckwheat, Thin Bentgrass/Davis' Knotweed, Wet Sedge, Tall Forb/Bromegrass/Wildrye, Willow/Forb and Alder/Forb.

Deer use generally tends to be concentrated near shrub cover such as willow and alder. Deer use appears to be lower in primary livestock use areas. Deer use seems to be lowest where there is no livestock grazing or recreational livestock use, but where bear numbers are greatest.

Total live plant cover appears to increase with livestock grazing in wet and mesic mountain meadows. There is generally less live plant cover on all dry meadow sites as compared to wet and mesic meadows. Livestock grazing is sometimes associated with reduced cover on dry sites.

Plant species richness and diversity of wet meadows tends to be somewhat higher with livestock grazing. Recreational packstock use appears to reduce plant species richness and diversity the most in mesic sites. Richness and diversity of dry meadows does not appear to be significantly affected by livestock use, although both are highest with seasonal livestock grazing. Examples of some of the grazing relationships by plant community type are discussed below.

Both Kentucky Bluegrass/Yarrow/Cinquefoil and Oatgrass/Clover Community Types tend to form sod mats with frequent summer grazing by packstock prior to the next livestock grazing season. Remnant bluebunch wheatgrass and meadow barley plants in the Bluegrass Type indicate that these species have been displaced to a degree on dry and wet sites, respectively.

These types are quite productive even with seasonal, heavy grazing and the majority of the forage is palatable to wildlife and livestock. Bluegrass Communities with greater abundance of yarrow and cinquefoil indicate poorer condition. The Oatgrass/Clover Community Type is limited in extent and frequently receives the heaviest grazing use by both livestock and packstock. These 2 types show the greatest effects of livestock grazing of all the type described.

The Wet Sedge Seral Community Type is a result of disturbance of the Wet Sedge Association. This shift results in the greatest increase of plant species diversity of any of the wilderness meadows. Dominance by wet sedges and litter buildup are reduced with grazing disturbance, increasing the number of resident plant species on the site, both native and introduced. Topographically raised areas within the Wet Sedge Association allow ingrowth of willows, alpine timothy and Kentucky bluegrass. Rushes are usually found on lowest areas where water may stand all summer.

Issues, Projected Demands and Opportunities

Major concern exists over the effects of grazing on riparian areas. Few studies have measured the impacts of grazing on the Forest's riparian areas and ecological integrity. There is concern that damage is occurring locally. Recent studies (Van Sickle, 1994) indicate that vegetative species diversity may be increased through grazing in wet meadows in the Marble Mountain Wilderness.

The opportunity exists to use the classification system described for wilderness meadow/riparian types to identify the landscape relationships among plant communities such as hydrology and use linkages to make management recommendations. Recommendations might include selection of certain plant species and community types to monitor depending on desired future outcome or direction of management. By better knowing site capability, there is a better likelihood of feasible projects and successful planning.

In the Marble Mountain Wilderness, wet meadows and riparian areas are the primary rangeland. These riparian zones are relied upon as sources of feed for domestic livestock. Some wildlife species are also dependent on these areas for food and habitat needs. Opportunities exist to reduce these riparian conflicts. Improved livestock distribution during the summer grazing period reduces streambank erosion and browsing pressure on willow and aspen woody plants. Browsing can help arrest meadow encroachment by alder. However, for willow and aspen, deer hiding cover may be a concern.

Control over livestock distribution in riparian areas is especially important for good range management programs. Fish and wildlife values can be compatible with livestock use if adequate livestock distribution controls are followed.

Conflicts with timber management activities exist on the eastside, where timber harvest and intensive forestry practices may reduce forage quality for livestock and wildlife. Range capacity is based, in part, on eastside timberlands. These lands consistently produce a utilizable forage understory. Any activity reducing this capacity can impact range program objectives.

On the westside, conflicts with timber management are fewer. There is a concern that livestock may damage young trees if concentrated in newly established plantations. Under strict time-control plantation grazing programs, livestock use of competing grasses can enhance growth and reduce mortality of seedlings.

Potential also exists for conflicts between livestock grazing and Sensitive plant habitat. Grazing can be modified in areas containing Sensitive plants. Once Sensitive habitats are identified, additional herding and other livestock distribution controls can be designed and implemented.

Maintenance of big game habitat is an important factor to consider when developing livestock management strategies. Livestock use is managed to provide for wildlife needs, especially in areas used by big game during winter.

Grazing on Forest rangeland will undoubtedly continue into the future. However, cost-efficiency and environmental compatibility factors will play a larger role. Special emphasis will be placed on managing riparian areas, improving unsatisfactory rangeland and removing livestock from areas unsuitable for grazing. Activities, such as increased permittee responsibility and participation for area management planning, monitoring the resource, range improvement construction and maintenance, will become necessary.

Transitory range currently produces 2,000 AUMs on about 56,000 acres. Timber harvest activities and, to a lesser extent, wildfires affect the amount of transitory range produced. Given a constant harvest level, the amount of transitory range remains fairly constant, changing in location over time. Much of the transitory range on the Forest is not easily accessible. This makes it difficult for operators to manage their livestock efficiently within the framework of an existing operation.

Effective utilization of transitory range is fairly labor intensive. This requires fencing or constant riding to keep livestock in these less-preferred areas and out of the primary range and key areas. Incidental use by livestock passing through areas of transitory range, on the way to traditional use areas, is more common. A program on the Oak Knoll, Scott River and Salmon River Ranger Districts have utilized livestock to release plantations from competing vegetation. There are opportunities to expand this program in appropriate areas as the need arises.

On the eastside of the Forest, current demand for range exceeds supply. There is an opportunity to increase existing livestock operations by implementing more intensive grazing strategies. Intensive grazing does not mean heavier utilization or heavier grazing. Intensive grazing means more management of grazing animals to achieve better distribution of livestock through greater inputs of time and manpower. The justification for a permittee to practice more intensive grazing is to produce more animal gains either on a

per head or per allotment basis. The justification for an agency to work with a permittee to practice intensive grazing is to enhance the productivity of part of a range allotment such that the allotment as a whole has improved management.

Opportunities to increase AUMs are somewhat greater on the eastside. Most of the operations are larger and generally more stable, and the terrain is more accessible to the bases of operation. To make any expansion possible, capital investments would be required. This would depend on funding for the program, as well as permittee willingness to participate.

There are some vacant grazing allotments on the westside of the Forest. Some westside permittees are interested in expanding their permits to utilize the transitory range more fully. Much of the transitory range on the Forest is scattered and in isolated patches. It is not easily accessible from suitable rangelands on existing allotments.

For the range management program, the National direction is to display desired future condition for rangelands by ecological status. As the Forest continues to collect ecological data for rangeland ecological types, information on vegetation composition and diversity and age class will be available. Management will be directed toward achieving a desired ecological status by ecological type.

Wild Horse Management

Description

Information dealing with wild horses on the Forest is limited and subject to considerable interpretation. Historically, many domestic horses escaped or were released by ranchers, miners and soldiers. Many of these animals mixed with existing herds, leading to the development of several large herds in the area. Until the early 1950s, these herds were historically found near Tennant, Bray, Mt. Hebron, McGavin Peak and Three Sisters.

Local sources indicate that horses have been common throughout the area in the past. There are currently 2 wild horse herds found on the Forest, the Three Sisters Herd and the McGavin Peak Herd. All other herds were eliminated during the 1950s and 1960s. The information available on population parameters and actual herd area boundaries are the result of biannual census and observations, started in 1971.

Under the Wild Horse and Burro Act of 1971, wild horses or burros that were "unbranded or unclaimed as of December 15, 1971" on Federal lands, became the jurisdiction of the BLM and Forest Service. These horses became "wild horses," as described in the Wild Horse and Burro Act.

The intent of the Wild Horse and Burro Act is to provide for the protection of wild horses and burros. This act also insures that the populations would be managed in a manner consistent with multiple-use management concepts and as a symbol of the old west.

A great deal of controversy resulted from this act, primarily over the ownership of these animals. Many were thought to be horses belonging to local ranchers. A "claiming period" was extended until 1978 to try to resolve the issue of ownership of the horses and burros. During that time, claimants who provided proof of ownership could claim the horses for the price of grazing fees since December 15, 1971.

Future management actions will be consistent with the Wild Horse and Burro Act.

McGavin Peak Wild Horse Herd

At one time, the McGavin Peak herd numbered in the hundreds. This herd ranged over an area from the Klamath River through the Sam's Neck area, and into Butte Valley. This herd included a considerable mixing of blood lines. Indications are that, in the 1930s, some American standard breeds mixed with the existing herd.

In the past, horses were released to improve the genetic viability of the herd. Recently, several animals have strayed into the herd from inter-mingled private land. These animals remained with the herd for several years before they, and most of their off-spring, were removed.

Current population estimates for the McGavin Peak herd, range from 18 to 50 head. A 1986 survey confirmed 26 adults and 4 foals. In 1987, 36 animals were observed. Based on biannual herd sightings, the annual foal production has been estimated from 10 to 20% per year.

The McGavin Peak herd currently ranges over about 16,000 acres. Of these lands, 11% are managed by the BLM, 24% by the Forest Service and 65% are privately owned. The home range for this herd was determined in the 1974 herd management plan. Current observations indicate that the home range is expanding outside the original boundary.

Forage quality and quantity within the territory varies. Wildlife, permitted livestock and horses currently compete for forage resources. Daily and seasonal herd movements often result in horses foraging on private

lands. Federal lands provide suitable forage from late spring through fall. Private lands and the State wildlife area provide winter habitat.

The Forest has received frequent complaints from private land owners to remove the wild horses from their lands. These complaints were based on the interactions with private stock (fighting, breeding) and the use of private pasture by the wild horse herd. Property owners are currently hesitant to enter into cooperative agreements for the management of the wild horse herd.

In 1987, 19 horses were captured. Of these 19, 6 were claimed as domestic horses. Since 1984, periodic removals have occurred in an attempt to maintain the herd at population levels set in the 1974 management plan.

Three Sisters Wild Horse Herd

Herd development in this area was similar to that in other areas on the Forest. Local sources indicate that in 1950, a thoroughbred stud was released in the area to improve blood lines. The population decline of this herd closely paralleled other herds in the area, although the cause of the decline is not known.

The Three Sisters herd population is currently estimated at 24 head. Recently, the population appears to be increasing. This may be due to speculation increases, or interactions with horses off the Modoc National Forest. The herd is estimated to increase from 10 to 20% per year.

The anticipated territory is about 26,000 acres in size. Most of this territory is on Federal lands. In 1985, 18 head of horses were sighted in an area thought to be outside the herd territory. These horses may have been ranging from a herd area on the Modoc National Forest to the Three Sisters on the Forest. No information is available on the movement of these horses. However, the herd appears to be wintering in the Bonita Lake-Lairds Well area, and then disperses both north and south.

In 1986, the Forest captured 13 head of horses from the herd. These were thought to be horses that ranged outside the established territory on to the Modoc National Forest.

Forage quality and quantity within the territory varies. Wildlife, permitted livestock and horses compete for forage resources. Presently, there is sufficient forage to sustain the current population levels of horses.

Adjoining private lands have been impacted slightly by the existing herd (forage consumption and fighting with domestic stock). About 10 domestic horses were said to be abandoned and have strayed onto the Modoc National Forest from private land. These animals have frequently interacted with wild stock.

Issues, Projected Demands and Opportunities

The status of the horses, in relation to the Wild Horse and Burro Act, continues to be questioned. This is because the horses, found on Federal lands in December 1971, were first believed to belong to local individuals. Since these horses were never claimed, by definition of wild horses within the Act, they would become protected under it.

Currently, forage demands of the herds appear to be very low. Additional forage may be necessary to support more horses if the herds expand. Current information is available to support an upward population trend.

Opportunities exist to revise population levels that balance horse use within existing herd ranges. Population trends and land capability information needs to continue being collected. Once collected, this information will help on decisions for the viability of the herds and in better addressing their needs.

Cultural Resources Management

Description

Cultural Resource Management is coordinated through the mandates of the Heritage Resource Program and the Tribal Government Program. The Forest contains evidence (artifacts, structures and sites) of a long history of human use. These are cultural resources. They include valuable works of art, architecture and engineering. Cultural resources are used to aid in learning about the people who made them and, in some cases, for their role in the practices of living cultures. Most cultural resources represent conditions of life and ways of doing things that no longer exist. They are not renewable. The Forest Service and Forest users are responsible to see that these resources are managed wisely.

The Forest has a rich cultural heritage. There is evidence that Native American use of this area began over 8,000 years ago. This use continues today for contemporary Shasta and Karuk people. Euro-american entrance began with the fur trappers of the 1820s, and accelerated with the gold rush of the 1850s. Other ethnic groups (for example, Chinese, Hawaiian or Portuguese) were attracted by the gold rush as well. Current evidence of Native American and

gold rush era activities are found as artifacts, archaeological sites, and traditional secular and religious practices maintained by the inhabitants of the area.

For detailed information on the research of the cultural history and setting of this area, refer to the Cultural Resource Management AMS and "Cultural Resources Overview" (McDonald, 1979). These documents also include extensive bibliographies and are available for review at the Forest Supervisor's Office, as are copies of the Tribal Government Program Agreements.

Native Americans still use certain Forest sites and many of its resources. These include sacred areas used in maintaining their traditional culture. These people, along with descendents of european settlers, are often employed in jobs and activities dependent on current Forest commodity production, which is historically linked to economic development, customs and cultures of the area, especially timber production. Grazing and mining also remain important aspects of the area's historical legacy.

Cultural Resource Inventory

To date, most data collection done on the Forest has followed a cultural materialism and theoretical orientation. This process is examining artifacts and sites by relating them to what is known of the culture that created them. Focus has been on physical entities, though intangibles such as expansive ceremonial areas have not been ignored. The diversity of cultural resources on the Forest, coupled with the presence of contemporary Native American peoples, require a multi-disciplinary approach to the task of data collection. These resources fall into 2 major types.

1) *Sites* - An archaeological site is any place where traces of humans have altered the natural environment. A site may include both surface and subsurface elements and may be historic or prehistoric. The physical remains may derive significance from aesthetic values, association with important past events or persons, or the scientific information potential.
2) *Activity Areas* - These locations include 2 types of use: (1) "Procurement areas," where food (for example, acorns and mushrooms) and other raw materials (like basketry fibers) are collected by local Indians. These are usually historical family gathering sites that remain in use. (2) "Ceremonial areas," areas used by Karuk and Shasta peoples for practicing their traditional religious beliefs.

Significance Determination and Coordination

Management of cultural sites includes significance determination, as well as preservation aspects. Site significance is determined through testing and contextual evaluation. A percentage of like sites will then be preserved, tested further or returned to multiple-use considerations.

For railroad logging sites, the Regional Railroad Logging Programatic Memorandum of Understanding is used. This memorandum allows the release, nomination or protection of the sites or systems, and allows sites to be placed in a Regional framework.

Where sites are found to lack significance, no further cultural resource management is necessary. Significant sites, identified by this process, will have a representative sample nominated to the National Register of Historic Places. To preserve nominated sites, a management plan will be developed.

As part of the present Heritage Resource Program (previously Cultural Resources Program), local Native American tribes and the State Historic Preservation Officer (SHPO) are consulted on Forest project proposals that have an EIS or Environmental Analysis (EA) prepared for them. SHPO is also asked to review each proposal's cultural survey reports and has a right to challenge its adequacy. If SHPO isn't satisfied with a report's adequacy or if a proposal could impact a significant property, further consultation with the President's Advisory Council on Historic Preservation must occur (Section 106, National Historic Preservation Act, 1966).

In assessing property significance and National Register eligibility of Forest cultural sites, the Register's criteria for evaluation are followed (36 CFR 60.4, Part 259). Eligible properties are those that:

1. are associated with events that have made a significant contribution to the broad patterns of our history,
2. are associated with the lives of persons significant in our past,
3. embody the distinctive characteristics of a type, period or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction, and
4. have yielded, or may be likely to yield, information important in prehistory or history.

These are not the sole criterion of significance. However, they do represent the legal basis for significance determination.

Program and Data Deficiencies

The major deficiency in the cultural resource database is that it does not represent the entire Forest land base. Nearly all data collection has come from areas that have been considered for timber harvest. This could lead to the assumption that, where there are commercial timber values, there are cultural resource values. This is a biased and incorrect assumption, but one strongly suggested by the present database.

In 18 years of active cultural resource management on the Forest, 40% has been surveyed. The surveys, however, have varied greatly in intensity and generally have been biased toward timbered lands. The cultural program needs to expand into other areas of investigation. A broader, more balanced program could correct present database shortcomings.

Site inventory and protection continues. To date, 910 historic sites and 434 prehistoric sites have been identified. Most of these have been protected by avoidance. Due to time, budget and staffing limitations, very few recorded sites have been evaluated for National Register eligibility. To date, only 2 have been placed on the National Register: the Sawyers Bar Catholic Church and White's Gulch Arrastra. Of the 3 major ceremonial areas identified on the Forest, 2 of the largest have had their significance confirmed by the Palmer Study (Palmer, 1980).

The current project-driven aspect of cultural resources management has made survey and compliance efforts dependent primarily on Forest timber production. This narrow focus is due to insufficient funding and staffing to conduct a more balanced program.

The primary goal of the program is to insure that all Forest activities meet legally-mandated cultural resource direction. A second goal is to manage wisely the identified significant cultural values. The current objective, to expand the program to a more balanced Forest-wide scope, should provide a comprehensive inventory and more effective management of the Forest's non-renewable cultural resource values. See the Cultural Resources Management AMS and "Cultural Resources Overview" (McDonald, 1979) for further detail and recommendations on Forest cultural resource direction.

Issues, Projected Demands and Opportunities

There has been a resurgence of Native American ritual use of the Forest. This use is likely to continue, with a strong desire to perpetuate traditional Indian culture, particularly among the Karuk Tribe. To be responsive to the desires of local Indians and meet the intent of the law, the Forest's cultural resources program must evolve beyond its current project-dependent state. This is the major thrust of the cultural issues and concerns presented in Chapter 1 of this EIS.

There will be increasing conflicts between users of the Forest's cultural resources. It is also likely that conflicts will increase between cultural resource management and other Forest resource activities (for example, fish, timber and forage), when such activities take place near cultural sites.

Cultural resource management opportunities can be summarized in 5 categories:

1. There is an opportunity for more contact with Native American groups. This could promote a mutual understanding and help avoid or resolve conflicts. Through sensitive management of ceremonial areas, Native American needs and desires can be enhanced rather than ignored or denigrated.
2. Management of cultural resources will improve as the Forest moves beyond judgemental approaches and into a more scientific site-location and type-analysis process.
3. Once identified, significance of site factors (for example, type and location) can be evaluated and monitored. Process efficiency should increase as more sites are recorded.
4. Site evaluation procedures could be improved through better application of the State's Cultural Resource Plan and associated Regional Research Designs. Plans and designs developed by Region 5 and the Forest could also be more effectively used.
5. When attributes of various site types become known, a more effective site-value assessment will be possible with a multi-disciplinary objectives approach. Only then will it be possible to begin true management of the Forest's rich and diverse cultural legacy.

Social and Economic Environment

Social

Description

The area immediately surrounding the Forest is predominantly rural. This area is currently dependent upon the Forest's natural resources for much of its social and economic well-being. These resources link the people and communities of this area to the Forest, through employment and incomes. This can affect the lifestyles, population and quality of life of the region. So, issues relating to nearly all aspects of Forest management are also the focus of social concern as well.

The 3 main issues that define the social climate are: (1) protection of the environment, (2) stability of the economy and (3) protection of contemporary Native American cultural activities and values.

Efforts to meet diverse and growing human needs for products (such as timber, livestock, forage, recreation, game, water and energy) are increasingly viewed by many residents as conflicting with environmental values. Examples of conflicting environmental values include wildlife diversity, healthy native forests and water quality. Social change, with regard to human concepts of forests, appears to be accelerating.

The main area of influence of the Forest takes in the 7 surrounding counties. Siskiyou County is the most directly affected. The other counties are Shasta, Humboldt and Del Norte Counties in California, and Jackson, Josephine and Klamath Counties in Oregon. These counties have been identified as the Forest's primary sphere of socio-economic influence (Deloney and Hansen, 1980).

Many different lifestyles exist within the 7-county area. Residents range from Native Americans to retirees (refer to the Social Groups and Lifestyles Section later in this chapter). Yet they have one thing in common - their lifestyles are intrinsically linked to the land and natural resources.

This tends to reinforce their strongly held, but often divergent value structures. Resource conservation and the concept of a "land ethic" are values often expressed side-by-side with the value of efficient commodity resource production (for example, timber, range) to the local economy and community well-being.

The result of resource decisions (for example, the northern spotted owl), legal and political actions is a greatly reduced land base suitable for timber production. Tensions in the local socio-political environment are heightened as timber-dependent interests fight to have these decisions modified or overturned while environmental interests struggle to insure their enforcement and possible expansion. Consequently, how the remaining lands will be managed is of great concern to all social groups in the area.

Affected Population

Total population within the Forest's area of influence is about 600,000 (Table 3-45). Only four large population centers (Medford, Klamath Falls, Redding and Eureka) are within 100 miles of the Forest boundaries. During the 1970s and 1980s, this area experienced accelerated growth by in-migration. This can be attributed to people moving from urban areas to less-populated rural areas.

Population growth in this area, generally, has not been rapid. Population projections by the California Department of Finance and Portland State University's Center for Population Research show a slow continued growth for some portions of the area over the next 10 years (Table 3-45 and Figures 3-14 and 3-15). These population estimates are extrapolated in part from the 1990 census. In the next 10 to 15 years, the area's population should rise to at least 720,000.

Table 3-45. Projected Population - Area Of Influence

	1990	1995	2000
California:			
Siskiyou	43,800	46,300	48,400
Shasta	148,800	168,700	186,500
Humboldt	119,800	127,100	130,200
Del Norte	24,500	29,600	31,200
Oregon:			
Jackson	146,400	161,500	174,900
Josephine	62,800	74,800	82,600
Klamath	57,800	66,500	69,800

Figure 3-14. Projected Population Growth
Area of Influence

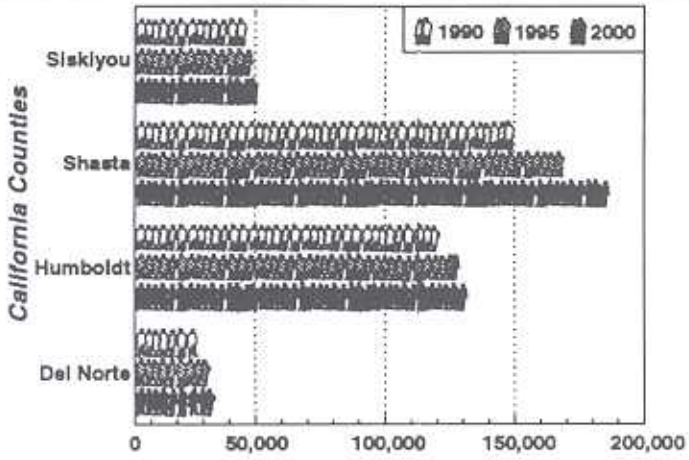
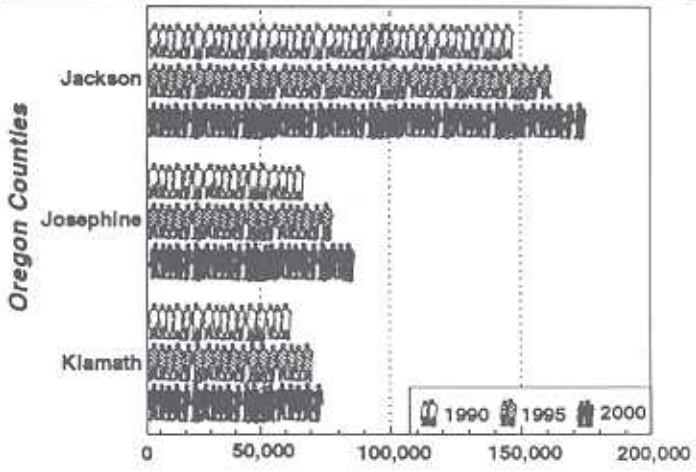


Figure 3-15. Projected Population Growth
Area of Influence



Minority populations are small in the 7-county area. The largest minority being African American, followed by Hispanic and Native Americans (Table 3-46). African American and Hispanic Americans originally came to the area to work in the lumber mills and on the railroad. The Native Americans are indigenous to the area.

Social Groups and Lifestyles

A wide range of social groups live in the Forest's area of influence. These groups have been identified according to their historical and projected trends of use and their public input, by newspaper articles, informal interviews, census data and other social research literature. They include miners, loggers, wood-products manufacturing workers, Native Americans, ranchers, hunters, sport and commercial fishermen, wilderness and whitewater enthusiasts, government employees and the new rural residents (refer to the New Rural Resident section later in this chapter). Similar types of these groupings exist in all 7 counties.

Four major groups have been identified within the social structure of the 7-county area: long-term residents, new rural, destination recreationists and Native Americans. These 4 groups, as described below, are not mutually exclusive (for example, individuals may be included in more than 1 group at a time). They are somewhat generalized for the purposes of comparison.

Table 3-46. Racial/ethnic Populations by County and Percent (1990)

County	Total	White	African American	Indian	Other *
Siskiyou	43,600	38,200 (87.9%)	700 (1.6%)	1,700 (3.9%)	3,000 (6.7%)
Shasta	147,000	134,000 (91.1%)	1,000 (.7%)	3,600 (2.5%)	8,300 (5.7%)
Humboldt	119,100	104,700 (87.9%)	1,000 (.8%)	6,200 (5.2%)	7,300 (6.2%)
Del Norte	23,500	18,300 (78.0%)	900 (3.6%)	1,400 (6.0%)	2,900 (12.3%)
Jackson	146,400	140,200 (95.8%)	300 (.2%)	1,900 (1.3%)	4,000 (2.8%)
Josephine	62,600	60,700 (97.0%)	100 (.2%)	900 (1.4%)	1,000 (1.4%)
Klamath	57,700	53,200 (92.2%)	400 (.7%)	2,400 (4.1%)	1,800 (3.1%)
California	333,100	295,200	3,500	13,000	21,500
Oregon	266,800	113,900	900	5,000	6,700
Grand Total	**599,900**	**550,100**	**4,400**	**18,000**	**28,200**

* Asian/Pacific Islander/Hispanic

Long-term Residents

Long-term residents make up a large portion of the local population. Many of them are employed in timber-related industries, mining, ranching, commercial fishing and support services. Timber-related occupations include loggers, mill workers, managers and large and small business operators.

Their tendency to be conservative and demand fewer services in part stems from their slower-paced rural living. They generally have a strong sense of individualism and independence, partially from living in this rural atmosphere. Strong ties to family and community, as well as a sense of community cohesion, are also important values.

A large portion of this group is oriented toward lumber and the wood products industry. They are highly dependent on Forest resources for employment and businesses. Many jobs are seasonal and depend on market demand, along with timber resources, on both private and National Forest lands.

Timber industry workers perceive Forest land management as strongly affecting their economic well-being and lifestyle (refer to the Economics AMS located in the Forest Supervisor's Office). Timber industry workers favor intensive and efficient timber production and development of Forest commodity values. In addition to this, they value local recreational opportunities, especially hunting and fishing.

Recent decisions dealing with land management allocations (such as listing the northern spotted owl as a T&E species) have increased this group's political involvement in the local area. Public meetings, rallies and parades have brought this group together in a unified manner to voice their views on such issues.

New Rural Residents

The lifestyles of this group range from a level of self-sufficiency to those with all the modern conveniences. It includes some professionals, such as teachers, doctors and lawyers, who are particularly representative of urban migration.

For the most part, this group tends to be more interested in amenity resources (such as wildlife, recreation, scenery and open space) than the long-term residents are. Most moved here seeking a more healthful environment at a lower cost of living. In addition, however, they bring with them a desire for more services and community benefits than rural communities can sometimes provide.

Non-rural residents profess differing attitudes and priorities about the production of forest commodities than the long-term residents. Many of these people feel that forest management needs to incorporate a more ecological approach than has been apparent in the past in order to protect these non-commodity resources. A few question the viability of intensive forest management, seeing human intervention in natural processes as intrusive.

Retirees and second-home owners are also a part of this group. They do not depend on local employment. They tend to favor protection of Forest amenity values. Most are concerned with limiting further population growth and maintaining their rural lifestyle. This group tends to value and desire better health services.

Destination Recreationists

Visitors and recreationists include another important element of the Forest's social make-up. These are the hunters, sports fishermen, wilderness and whitewater enthusiasts, OHV recreationists, cyclists, skiers, etc.

Many do not live within the primary area of influence. They typically come from the San Francisco Bay Area, Central Valley, Sacramento area and even southern Oregon. They generally have higher education levels and greater disposable income than long-term residents.

In general, this group has a common interest in public policy. They place a high value on their resource interests. The group includes politically and socially active people concerned with protection of the natural environment. Many have a keen interest in conserving the Forest's non-commodity values (visuals/recreation, fish/wildlife, plants/water, air quality and cultural) rather than on developing commodity resources.

Native Americans

Native Americans affected by Forest management include the Karuk and Shasta people, whose local combined population is roughly 5,200. The vast majority are Karuk (96%), with only a few hundred of the Shasta people remaining in the area.

This group is very diverse and includes a variety of perspectives. The values unique to this group concern spiritual uses and resource gathering. While a good portion may value commodity production as an income base, they also have concerns about careful stewardship of the land, stemming from their traditional and spiritual beliefs. They typically see themselves and the practice of their traditional lifestyles as being linked to their environment.

The Karuk have become increasingly vocal over preservation of their cultural heritage and protection of their traditional religious sites. They have expressed a

strong desire to continue their traditional culture and pass it on to newer generations.

Common Ground

What these diverse groups seem to have in common is a value for small communities, an appreciation for the beauty of forest lands and an ethic of stewardship for the land. However, the groups vary considerably in their views of what "good stewardship" actually means (Fortman, 1990). All value the quality of life available in this northern California location and desire to see it maintained.

Also common, however, is a burgeoning cynicism within the region about the Forest Service's management policies. The growing view is that politics, not the best management practices, are driving land management decisions (Lee, 1990).

Issues, Projected Demands and Opportunities

The entire spectrum of public issues, demands and management opportunities surrounding the development of a forest plan relate to the social groups within the human environment. This includes the management of all Forest commodity and amenity values. The management strategy eventually adopted as the Forest Plan has the potential to impact the local economy, community lifestyles, stability/cohesion and cultural values, along with the values of the Forest visitor.

Social Variables

The following social variables apply to the various social groups. These variables are described below:

Lifestyles - The ways in which people live, work patterns, leisure activities, customs, traditions and inter-personal relationships are often most visibly reflected by employment conditions and economic security.

Attitudes, Beliefs and Values - Preferences, expectations and opinions people have about Forest management, and particular areas in the Forest, shape attitudes concerning land management practices and their basic principles. Differing values and expectations have resulted in polarized perceptions that either: (1) a healthy environment requires protection of lands from human influence, or (2) increased attention to environmental quality poses a threat to employment, economy or lifestyle.

Community Stability and Cohesion - Community stability is affected by social change that cannot be effectively absorbed or assimilated in the existing community. The rate change is introduced will affect the community's ability to assimilate it. Community cohesion, or the degree of unity and cooperation between community groups, is usually reduced when people of diverse backgrounds enter the community.

Increased public-use places increased demands on Forest resources, possibly resulting in inter-group tension and conflict. Some conflicts may be resolved if competing demands can be mediated or compromised.

Rural Development Opportunities

Rural development is the management of human, natural, technical and financial resources needed to improve living conditions, provide employment opportunities, enrich the cultural life and enhance the environment of rural America. In the Forest Service, rural development is accomplished through partnerships. This program was established by the "National Forest-Dependent Rural Communities Economic Diversification Act of 1990."

The Forest is currently working with Siskiyou County on developing natural resource based opportunities and enterprises. These will contribute to the economic and social well-being of the community. The work focuses on economic strength and diversity and the social well-being of the community by pursuing partnerships within segments of Siskiyou County.

Human Resource Opportunities

The Forest has been involved in several human resource training and employment programs in recent years. The Forest Service has the authority to carry out programs under the umbrella of Human Resource Programs. These programs are designed to provide human and natural resource benefits by administering and hosting programs in work, training and education for youths, the unemployed, the under employed, the elderly and others with special needs.

As a result of this involvement, the Forest Service and local communities have received benefits through projects. For example, projects that have led to timber stand improvements, recreation facilities, offices, warehouses, roads and other capital improvements. In selecting projects, the needs of Human Resource Program enrollees and objectives of the work projects are considered. Human Resource Programs enrollees do not displace currently employed workers or impair existing contracts.

The current role of the Forest Service in providing human resource opportunities revolves around 4 basic

programs. Two of the programs, the Job Corps and the Senior Community Service Employment Program, are funded under the Department of Labor. Two others, the Youth Conservation Corps and the Volunteers in the National Forests, currently are unfunded, though they are authorized and directed by Congress through appropriation bill language.

Economics

Description

The Forest provides a variety of resources to the communities in the area of influence. The region's rich natural resources support traditional timber-related industries and varied recreation activities.

The area has a high degree of dependence on lumber and wood products manufacturing. This manufacturing accounts for as high as 18% of all wage and salary employment in Klamath County to as low as 5% in Shasta County. About 8% of the 7-county area's harvested volume comes from the Forest.

Agriculture, government, recreation, wildlife activities and Indian tribes also play major roles in the area's economy. The Forest provides important resources, including firewood, livestock forage for grazing permittees, quality water for household and agricultural uses and pleasing recreational settings. Residents, in many area communities, depend on the Forest for employment. Local tribes rely on the Forest for food and ceremonial substances and as a place of spiritual and cultural experience and history.

About 40% of Siskiyou County's harvested timber volume is from Forest-managed lands. Lumber and wood products manufacturing accounts for 12% of all wage and salary employment in Siskiyou County. Forest employees account for nearly 5% of all wage and salary employment in Siskiyou County. Activities of other Federal agencies, as well as activities of extensive private commercial forest land holders, also have a considerable impact on the structure of the County's economy.

The area economy has progressed through several eras. In the 1800s, the economy was influenced primarily by the explorer-fur traders and gold-seeking adventurers. At the turn of the century, agriculture and timber became the primary source of income. Irrigated agriculture on a large scale developed during the first 3 decades of the 1900s.

Employment data for the last 5 decades reveal changes in the area's economy as shown in Table 3-47. In 1940, employment in wood product manufacturing and agriculture accounted for 39% of all employment. The most current information shows that these jobs now account for 14% of employment. Services and government accounted for 20% of employment in 1940 and have risen to 40%, mostly due to society's desire for increased health care and improved education.

Table 3-47. Seven-County Area -- Long-Term Wage and Salary Employment by Economic Sector (% of employees)

	1940	1950	1960	1970	1980
Agriculture, Forestry and Fisheries	18	13	8	7	4
Mining and Construction	12	8	7	6	4
Manufacturing	24	28	28	21	17
Lumber and Wood Prod ucts	21	24	23	16	12
Other	3	4	5	5	5
Transportation, Communications and Utilities	8	9	8	7	6
Wholesale and Retail Trade	16	20	21	23	23
Finance, Insurance and Real Estate	2	2	3	4	4
Services (lodging, repair, health, etc.)	17	17	21	27	18
Government (Federal, State, Local; includes Education, 1980 and later.)	3	3	4	5	24
Total Wage and Salary Employment (% employed)	100	100	100	100	100

The 7-county area manufacturing base is dominated by lumber and wood-related industries. In addition, there is a growing "export sector" consisting of retirees (whose income comes from outside the area), non-local tourism and Federal (and some State) operations whose operating money originates in taxes mostly collected outside the area.

The "residentiary sector" primarily sells goods and services to consumers within the area. Most of this activity can be described as internal cash transfers not

adding significantly to the net growth of the local economy.

Tables 3-48 and 3-49 show recent employment by key industry sectors. Trade, government and services together provide over two-thirds of the current jobs in the 7-county area.

Table 3-48. Seven-County Area: Short-Term Wage and Salary Employment by Economic Sector (% of employees)

	1983	1984	1985	1986	1987	1988
Agriculture, Forestry and Fisheries	4	4	4	4	4	3
Mining and Construction	3	3	4	4	4	4
Manufacturing	17	17	16	16	16	16
Lumber and Wood Products	11	11	11	11	11	11
Other	6	6	5	5	5	5
Transportation, Communications and Utilities	6	6	6	6	6	6
Wholesale and Retail Trade	24	24	25	25	25	26
Finance, Insurance and Real Estate	4	4	4	4	4	4
Services	20	20	20	20	20	21
Government	22	22	21	21	21	20
Total	**100**	**100**	**100**	**100**	**100**	**100**

Travel and tourism, which include developed and dispersed recreation as well as wildlife-related activities (like hunting, fishing and bird-watching), make up a large and growing part of the area's economy. Tourism-related employment is spread through a variety of economic sectors, including service (meals and lodging), trade (gas and tackle) and transportation. This is not readily tracked in a single economic sector.

Trade, both wholesale and retail, is the number-one job producer in the area. This sector is the heart of the residentiary sector. Generally, when the economy is healthy, trade and services are expanding. The trade sector also brings in money from outside when travelers buy supplies for recreation on the Forest. Trade and services will grow to meet the needs of population expansion and increased disposable income.

Government is a large and growing sector of the economy. It accounts for about one-fifth of area jobs. Nearly two-thirds (or about 1 job in 7) of these are local government and education employment. Increased job opportunities are tied to population growth and a desire for improved education.

Service is a major sector. It responds to increased tourism and wildlife-related activities (for example, hunting and fishing), population growth and increased demand for health care and leisure activities. Federally recognized Indian tribes also provide multi-million dollar service programs.

Table 3-49. Siskiyou County: Short-Term Wage and Salary Employment by Economic Sector (% of employees)

	1983	1984	1985	1986	1987	1988
Agriculture, Forestry and Fisheries	9	8	8	7	6	6
Mining and Construction	3	3	3	4	4	4
Manufacturing	10	13	13	13	15	14
Lumber and Wood Products	8	11	11	11	12	12
Other	2	2	2	2	3	2
Transportation, Communications and Utilities	7	7	7	7	6	6
Wholesale and Retail Trade	21	22	22	22	22	22
Finance, Insurance and Real Estate	3	3	3	3	3	3
Services	17	16	16	16	16	16
Government	30	28	28	28	28	29
Total	**100**	**100**	**100**	**100**	**100**	**100**

The area-wide trends are fairly constant and consistent with the 50 year trends. State employment department economists expect employment growth to show continuing expansion of services-producing industries and contracting of goods-producing industries.

Timber industry jobs are expected to decrease for a variety of reasons. Some reasons include increased mechanization in harvest and production processes

and reduced outputs on public and private lands. While other manufacturing employment is projected to increase, the jobs created may not exceed job loss for the wood products subsector.

Table 3-49 focuses on Siskiyou County. State of California Employment Development Department analysts forecast a weak decline in goods production with a continued slow growth in trade, services and government. The forces of recession, market instability and environmental concerns are expected to lead to further declines in lumber and wood products employment. Trade and services are expected to generate moderate employment growth. All levels of government will face budget constraints. While population growth will increase demand for local government services (especially education), budget considerations may limit job formation.

Unemployment

Average annual unemployment rates for 1988 range from 12.2% in Del Norte County to 6.5% in Jackson County. Siskiyou County had a 10.5% annual unemployment for 1988. Events outside the authority of the Forest, such as impacts related to the listing of the northern spotted owl, play a large role here. Other factors of employment within Siskiyou County are not growing enough to compensate completely for possible losses.

As shown in Figure 3-16, the unemployment rate shows distinct seasonal fluctuations. These fluctuations were as much as 10 percentage points, rising to a peak in the midwinter months. This is due to the seasonality of logging and agriculture employment, as well as reflecting tourism patterns. Unemployment averages 2 to 6 percentage points above State averages. This is common for primarily rural areas that lack economic diversification.

Issues, Projected Demands and Opportunities

Generally, economic issues relate to cost-efficient management of the Forest, effects of Forest management on the local economy and how the Forest can enhance economic opportunities and generate revenue.

National Forest management affects the local economy in several ways:

- A portion of the budget is transferred to the local economy in the form of salaries and purchases.
- National Forest outputs stimulate private-sector firm and individual spending, generating Forest revenues and changes in number of jobs.
- Receipt sharing, yield taxes and payments in lieu of taxes to local counties.

Forest Employment and Expenditures

The administration of the Forest impacts the local economy. This is especially true in smaller towns where Ranger District offices are located. The Forest operating costs are about 33 million dollars annually. About $16 million is spent on salaries. Most of this is re-spent in the local area. The Forest spent about $2.5 million on contracts for goods and services. Most contracts are with firms and individuals in the 7-County area.

There is concern that this large amount of taxpayer money be spent wisely. The maximization of present net value (PNV) is the criterion used to help insure that each alternative considered is the most economically efficient combination of outputs and activities needed to meet the objectives established for that alternative. Partnerships with other agencies or groups, stewardship contracts and other opportunities might be created to fund Forest activities while creating local economic diversity.

During the last decade, permanent full-time employment has ranged from 400 to 560 employees annually. The average is 480 per year. Temporary or seasonal employment, during the last 3 years, has averaged 175 employees.

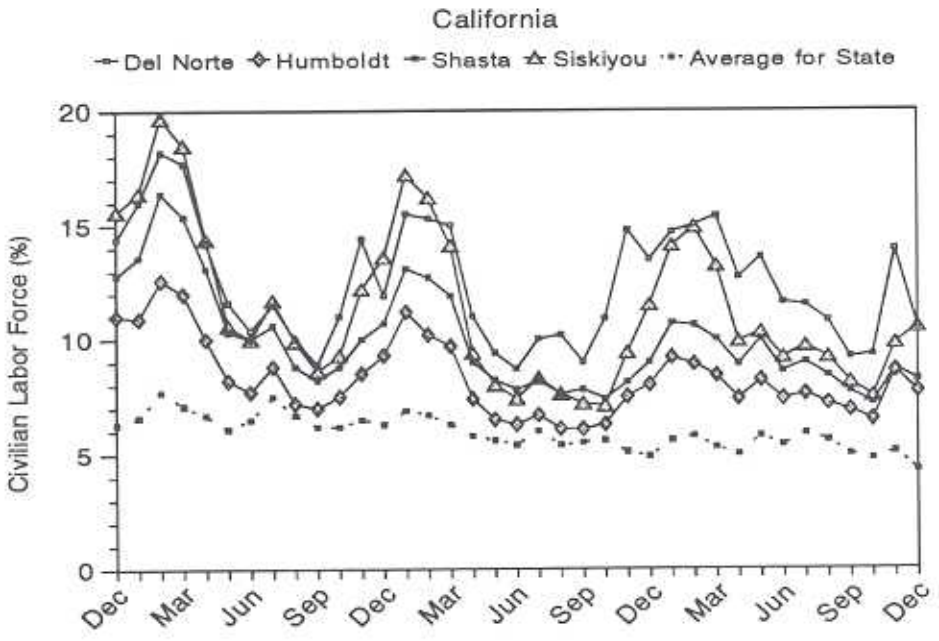
The Forest is undergoing a reorganization. The anticipation is that there will be a significantly reduced number of full-time and temporary employees. Due to the reduced workforce, there may be additional opportunities to contract work out to local communities.

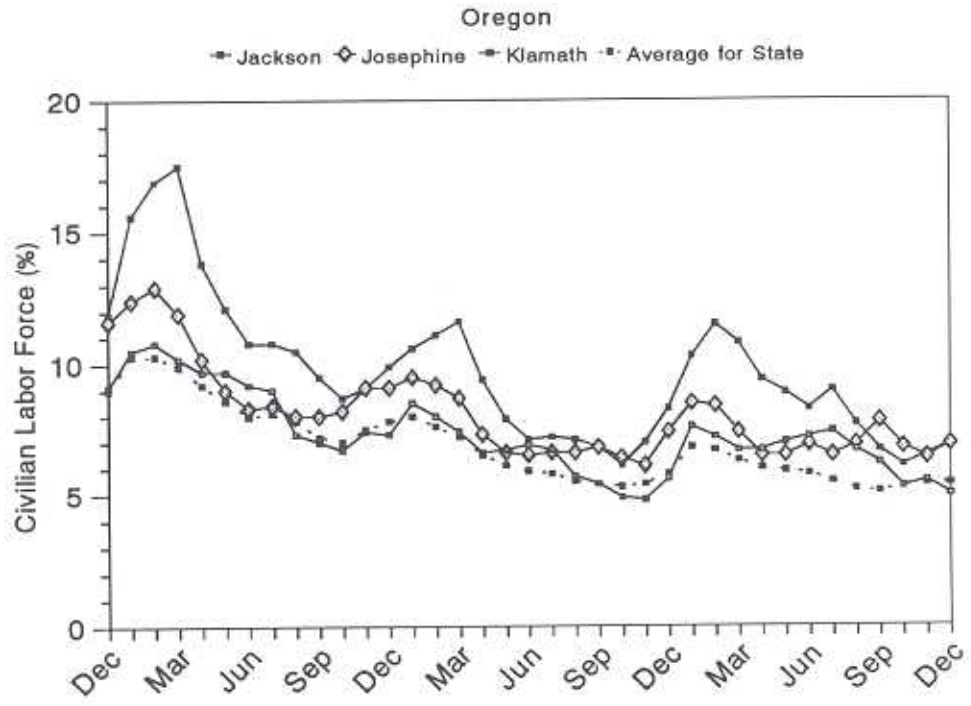
The Forest also influences local employment through its human resource programs. The Forest has an active Senior Community Service Employment Program, funded by the Department of Labor. Youth Conservation Corps and Volunteer in the National Forests programs are currently unfunded but offer opportunities in the future.

Forest Outputs

The Forest provides several outputs that contribute to the local economy. Many jobs are tied to the Forest by its resource programs. Timber-related activities have the largest economic impact within the area. Next are grazing and special use permits, followed by recreation.

Figure 3-16. Average Seasonal Unemployment Patterns, 1986 - 1988





Sources:

CA Data - State of California, Employment Development Dept., Employment Data Research Annual Planning Information

OR Data - State Of Oregon, Employment Division, Dept. of Human Resources Resident Labor Force, Unemployment and Employment

In addition, use of other forest products has been increasing. There is an increasing demand that timber outputs be stabilized at historical levels. This demand conflicts with increasing environmental protection demands.

Exploration of value added manufacture and use of other forest products are opportunities to be examined. Opportunities may exist to increase out-of-area spending in the destination recreation area. Other future opportunities may exist, relating to elk reintroduction and non-game wildlife activities. These "new" areas offer scope for creative partnerships with other agencies and local communities to enhance diversity and stability of the economy.

The economic value of some Forest outputs can easily be quantified using market values or Forest usage fees. The value of timber, range, and to some extent recreation, can be measured this way. Other uses, such as sport fisheries, hunting and most recreation uses must be assigned proxy values to determine economic values. Proxy values are theoretical estimates of what consumers would be willing to pay if active markets existed. Both market and proxy values are used to estimate total benefits. Market values are used to estimate Forest Service revenue.

Forest Revenue

Forest Service management decisions impact the revenue producing Forest programs. The resultant Federal government receipts, collected and passed on to local governments, are affected as well.

Employment and Income

Local effects of industrial activity (for example, timber, recreation, range and Forest Service budget) are estimated through the use of multipliers. The sum of the direct, indirect and induced effects is the total local economic impact.

Services have a direct effect through the effort of the primary producer. That is, the manufacture of lumber has a direct effect in terms of employment at the mill. There is also an indirect effect, accounting for employment in service industries serving the mill. These industries might include local machine shops, steel and machine suppliers, chemical and fuel suppliers, etc.

Finally, there is also an induced effect that is driven by wages. Wages, paid to workers by the primary and service industries, are then circulated throughout the local economy as income. These expenditures are for food, housing, clothes, transportation and other living expenses. Partnerships developed under the Rural Development program may offer ways to encourage diversity and job formation.

Receipt Sharing

Counties within the Forest's area of influence rely, in varying degrees, on revenues from National Forest Fund receipts and Oregon & California land payments from all National Forests in the area. Counties receive 25% of gross revenues of all National Forest activities.

National Forest Fund receipts must be used for the counties' road and public education systems. The payments are variable from year to year. This is because they are tied directly to the level of timber harvest that is largely dependent on construction activity, particularly the multi-year housing cycle.

This variability of receipts makes the counties' fiscal management job difficult. National Forest Fund payments to the 7 counties in 1988 totaled over $59 million. The Forest's National Forest Fund payments to counties in 1988 amounted to $4.1 million. Of this, 98% was paid to Siskiyou County and the remaining to Jackson County. About 97% of the total receipts for the Forest came from timber stumpage sales. The balance came from range allotment payments, recreation user fees and special use permit fees. The total payment Siskiyou County received in 1988 was $6.7 million (refer to Table 3-50).

Receipts have historically tended to increase or decrease as harvest levels or timber values increase or decrease. Receipts are not directly proportional to harvest levels, as changes in the Regional and National markets affect the market value of stumpage. Since 1980, payments have averaged $4.0 million dollars annually on an average annual harvest of 190.4 MMBF.

Table 3-50. Klamath National Forest Harvest and Payments to Counties, 1980-1993			
Fiscal Year	Harvest (MMBF)	25% Funds to counties ($)	25% Funds to Siskiyou County ($)
1980	232.8	4,795,000	4,747,000
1981	168.4	4,345,000	4,301,000
1982	89.1	1,744,000	1,719,000
1983	122.7	2,397,000	2,362,000
1984	190.8	4,129,000	4,069,000
1985	153.3	2,120,000	2,089,000
1986	222.9	5,344,000	5,267,000
1987	238.1	5,078,000	5,005,000
1988	248.6	4,083,000	4,024,000
1989	298.2	6,418,000	6,325,000
1990	214.3	5,121,000	5,047,000
1991	105.5	4,687,000	4,619,000
1992	88.8	4,661,000	4,593,000
1993	22.7	3,314,000	3,266,000

Payments In Lieu Of Taxes

Counties also receive revenue from in-lieu-of-tax fees (disbursed by the BLM) for each acre of Federal land within the county. The counties can use this payment for any governmental purpose. The current rate for the Forest's land is 10 cents per acre, regardless of use.

Yield Tax

Another funding source is yield tax revenue. Timber purchasers pay taxes on timber harvested to the California Franchise Tax Board. The Board allocates the proceeds back to the counties. The current rate is 2.9% of value as estimated by the Tax Board.

Allocation of yield tax revenues is based on the amount of timber harvested in a given county. Yield tax receipts for Siskiyou County have averaged $425,000 annually, calculated on all timber harvested on public and private land.