CHAPTER III

AFFECTED ENVIRONMENT

INTRODUCTION

This Chapter describes the environment of the Willamette National Forest that would be influenced by the implementation of any of the proposed Alternatives. The environmental factors discussed are those which are significant and pertinent to issues, concerns, and opportunities. This Chapter, like Chapter IV, is organized by environmental component.

The Chapter begins with general descriptions of the environmental components Climate and Geology, which are followed by descriptions of the other physical, social, and economic components of the Forest. The other environmental components, including those of Water, Vegetation, Wildlife, Timber, and Recreation are described in greater detail to reflect important historic trends, current conditions, and future trends.

The expected changes in the environment that would be generated by implementation of any of the proposed Alternatives are discussed in Chapter IV, Environmental Consequences and summarized in Chapter II, The Alternatives.

GEOLOGY

Knowledge of the geologic characteristics of the Forest provides an understanding of the land's capabilities and limitations for managing the various resources and predicting subsequent effects of management activities. The Oregon Cascade Range of the Forest is divided into two major geologic provinces: the Western Cascade Province and the High Cascade Province (Franklin and Dyrness 1973). (See Figure III-B-1, Geologic Provinces and Bedrock Map).

The geologically older Western Cascades are largely composed of 25 million year old to 45 million year old volcanic and pyroclastic formations, particularly the Little Butte Series and the Sardine Formation. (See Figure III-B-1, Geologic Provinces and Bedrock Map.) The Little Butte Series is dominated by tuffs and breccias that weather relatively rapidly to deep, fine textured soils which can be very unstable. The Sardine Formation, which includes flows of basalt and andesite, weathers slowly and has produced well-drained, coarse, stony soils much less subject to mass movement (Legard and Meyer 1973). A long history of repeated glaciations and active stream erosion has produced the highly dissected topography. Ridgetops are typically about 4,000 to 5,000 feet, with a few peaks nearing 5,700 feet.

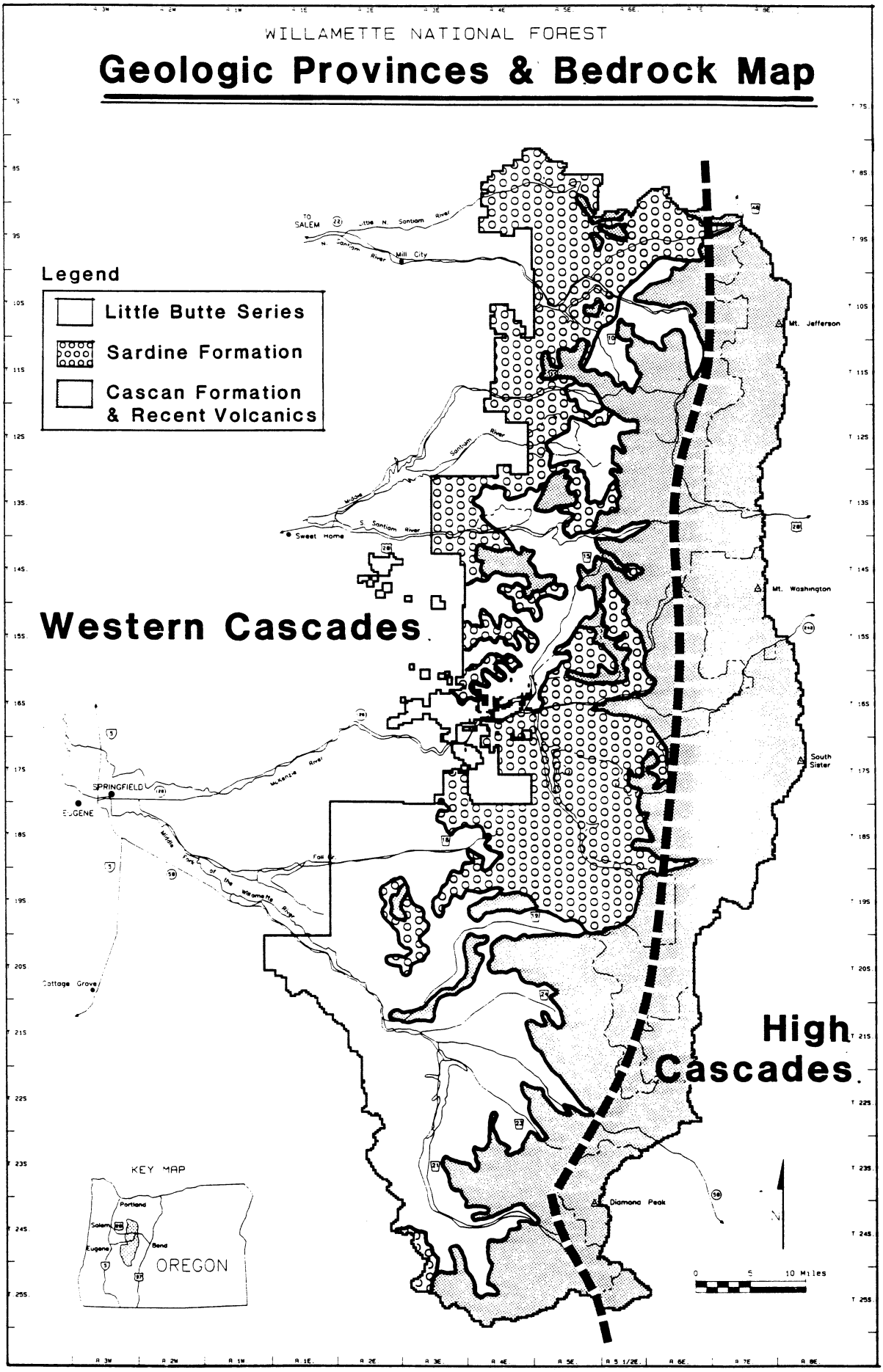
The 13 million-year-old and younger High Cascades occupy nearly one-third of the Cascade Range on this Forest, and are adjacent to the older Western Cascades. These formations have built up from a chain of broad, coalescing shield volcanos (predominantly fluid lava flows), that cover the eroded eastern margin of the Western Cascades. They form gently sloping land, beginning at about 3,500 feet and rising up to a crestal plateau near 5,000 feet. Scattered along the crest are many small volcanic cones along with the well known large composite volcanic peaks which rise another 1500 to 5300 feet above the surrounding terrain. Some of these peaks include Diamond Peak, The Three Sisters, Mt. Washington, and Mt. Jefferson. Soils on the High Cascades are usually immature and often developed in volcanic ejecta.

Glaciers have carved the higher elevation areas repeatedly, even as the mountains were forming. During the retreat of ice in the last glacial period, about 10,000 years ago, the topography was modified to include glacially carved rock headwalls, bowl-shaped cirque basins and their associated lakes, steep U-shaped canyons, and widespread deposits of glacial moraines and outwash materials. Distinct peaks that were highly modified by this glacial action include Mt. Washington and Three Fingered Jack. Present day glacial activity is still occurring on the higher peaks of Mt. Jefferson, The Three Sisters, and Diamond Peak.

Since deglaciation, several factors have acted to change the shape of the land's surface, both in the High and Western Cascades. Pumice from Mt. Mazama (Crater Lake), and deposits of ash, sand, and cinders from local cinder cones buried preexisting soils developed in glacial materials, and recent lava outpouring occurred in the McKenzie Pass and Santiam Junction areas. Large scale, downslope mass movements (landslides) have formed new lakes, altered drainages, and created numerous hummocky, uneven land forms, primarily in the Western Cascades.

Slope stability, (the resistance of natural or artificial slopes to failure by mass wasting), is directly related to geology and topography. Gravity is the most important factor--the steeper the slope, the less stable (Sidle 1984). Water is the next major component (both surface and subsurface)--the more water, the less stable (Brunsden and Prior 1984). Generally, on steep slopes, the thicker the soil the more prone the slope is to failure. This is because thicker soils can become more unstable as they are saturated with water. The rock content of the soil also affects the strength and drainage of soils due to both increased friction and improved water drainage (Huang 1983).

Figure III-B-1.



In the Western Cascades, mass wasting is a particularly important slope-forming process because of the generally steep slopes and areas of low strength soils in this geologic province. Mass wasting is the process of removing rock and soil under the influence of gravity; it includes rock falls, rapid debris slides, slow moving earthflows, and soil creep. Slope failures can involve only a few to several hundred thousands of cubic yards of soil and rock. They can range from small bank failures along drainage courses, to debris chutes where a torrent of water, soil, and rock strips stream channels and banks, to a major slump-earthflow that moves an entire mountainside.

In contrast, mass wasting in the High Cascades Province is relatively minor due to younger, stable volcanic rocks; large earthflows are uncommon. Most of the mass wasting in the High Cascades is confined to debris avalanches along glacially oversteepened canyon walls and in the incised pumice canyons.

Vegetation plays a major role in the complex interactions of slope stability, as well as erosion. It acts to intercept and store significant amounts of precipitation, thereby buffering the effects of storm events. The roots of vegetation physically bind soil particles together; the strength of the roots adds strength to the soil; and the roots may grow to bedrock, forming an effective anchor system. Once precipitation enters the soil it becomes available for the vegetation to remove it through evapotranspiration, which decreases the amount of destabilizing groundwater (Swanston and Swanson 1976).

The relationship between bedrock and soil development directly affects vegetation and vegetative growth. The breakdown of the bedrock provides the growth medium, nutrients, and moisture holding capacity for vegetation. The generally cool, moist climate plays a dominant role in forming the types of soils which will be produced by weathering processes.

The formation of soils is a complex dynamic process which depends upon such things as slope, aspect, climate, elevation, slope position, and rates of weathering, mass wasting and erosion. In general, rocks such as andesites and basalts form shallower, coarse, sandy soils with numerous rock fragments. The more easily weathered ash, tuff, and breccia formations produce deeper, more clay-rich, and finer-grained soils. Some locations, such as recent lava flows and some ridgetops, support little vegetation due to the lack of soil development.

Mineral deposits were formed as a result of a variety of geologic processes including physical and chemical decomposition of rocks at the earth's surface; sedimentation, which is the separation, transportation, and deposition of particles broken down from rocks (important in the formation of placer gold); and hydrothermal processes of alteration and/or mineralization, (important in the formation of lode deposits), where metallic elements such as gold, silver, copper, lead, and zinc occur as or mixed with complex compounds distributed within solid rock. Fracture fillings, commonly called veins, within the hydrothermal fluid channels have been sources of gold and silver in the past. Mineralization of the Western Cascades is of limited extent. The patented claims of the North Santiam District, located in the Little North Santiam drainage, produced small amounts of gold and silver and minor amounts of copper, lead, and zinc. The other mining districts (Blue River, Quartzville, and Fall Creek) produced minor amounts of gold and silver (Weissenborn 1969). (See Chapter III, Minerals and Energy.)

The geological processes which influence the Forest affect almost all management decisions in some way. The increasing demand for recreation, cost of road building, accessibility of timber sale areas for cost-effective logging, the control of fires, the need for clean water, as well as other management activities all require a clear understanding of the geologic environment.

For example, the topography of the region affects the complexity of logging operations. Increased cost in felling, bucking, and yarding are directly related to such things as the number of landings available,

the distance from the landing to the unit boundary, slope steepness and suspension requirements. Cost in road construction and maintenance are directly related to the distance required to haul aggregate to the site, excavation in steep or rocky slopes, difficulty of stream crossings, and necessity for structures. Rock for road surfacing and maintenance is considered a nonrenewable resource. Aggregate costs often influence road standards and operating seasons.

Road construction and reconstruction have both direct and indirect effects on slope stability. Road construction causes permanent alteration of the soil mantle/bedrock/water interactions. Studies by Sidle, Pearce, and O'Loughlin (1984) indicate that road construction on any hillslope will inevitably decrease the site stability because of a number of factors. Cuts and fills on side slopes effectively steepen the slopes and decrease the stability. The slopes may be overloaded by embankment fill. Support of the hillside is lost by the cut-slope excavation. Surface and subsurface water drainage paths are altered and concentrated. The road surface is essentially impermeable; thus, during storms more surface water flow occurs. Culverts which become restricted by sediment and debris may be unable to handle runoff, resulting in road failures.

Roads not only affect the stability of the cut and fill slopes, but also the slopes below the road. Culverts sometimes concentrate water where none previously flowed. The drainage water may be routed into potential of inactive earthflows downslope of the road and decrease their stability. Disposal of drainage runoff into slope depressions and other wet areas, especially on steeper side slopes, can also initiate shallow rapid failures on debris chutes. The stabilizing effects of vegetation are removed from the road alignment. The relative importance of any of these influences on slope failure depends on site conditions, construction design, and construction techniques. For example, sidecast road construction on the older roads in the Forest continues to be a major slope stability problem by causing debris chutes.

Recreation is also greatly influenced by geology and topography. Areas like Hoodoo and Willamette Pass ski resorts rely on the slopes of the High Cascades for all types of snow skiing. Rock formations like the rock spires of the Menagerie Wilderness, and the peaks of Mt. Jefferson, North Sister, and Mt. Washington provide technical climbing opportunities. Dee Wright Observatory on McKenzie Pass provides an inspiring view of the Cascade Range and recent lava flows. Unique formations such as Tumblebug Gorge and Phantom Natural Bridge reflect nature's sculpturing, while rock cuts in the river channels can provide whitewater recreation.

The sections on Soil and Minerals and Energy also contain information regarding the geological component of the environment.

CLIMATE

Climate is important in the development of the Forest environment and, as a consequence, Forest management. Many aspects of the Forest are influenced by the weather. The winter and early spring seasons supply snow for downhill and cross-country skiing, snowshoeing, and off-road vehicle activity. Melting snow brings the water for municipal use and hydro-electric generation, as well as white water recreation and fish migration. Often, when fog persists in the Willamette Valley during the winter months, the Cascade Mountains are sunny. These sunny periods are an invitation to escape from the fog, go sightseeing or enjoy snow related activities. In the dry summer season, many people again come to the Forest from the valley to seek relief from the heat.

Historic Trends/Current Situation

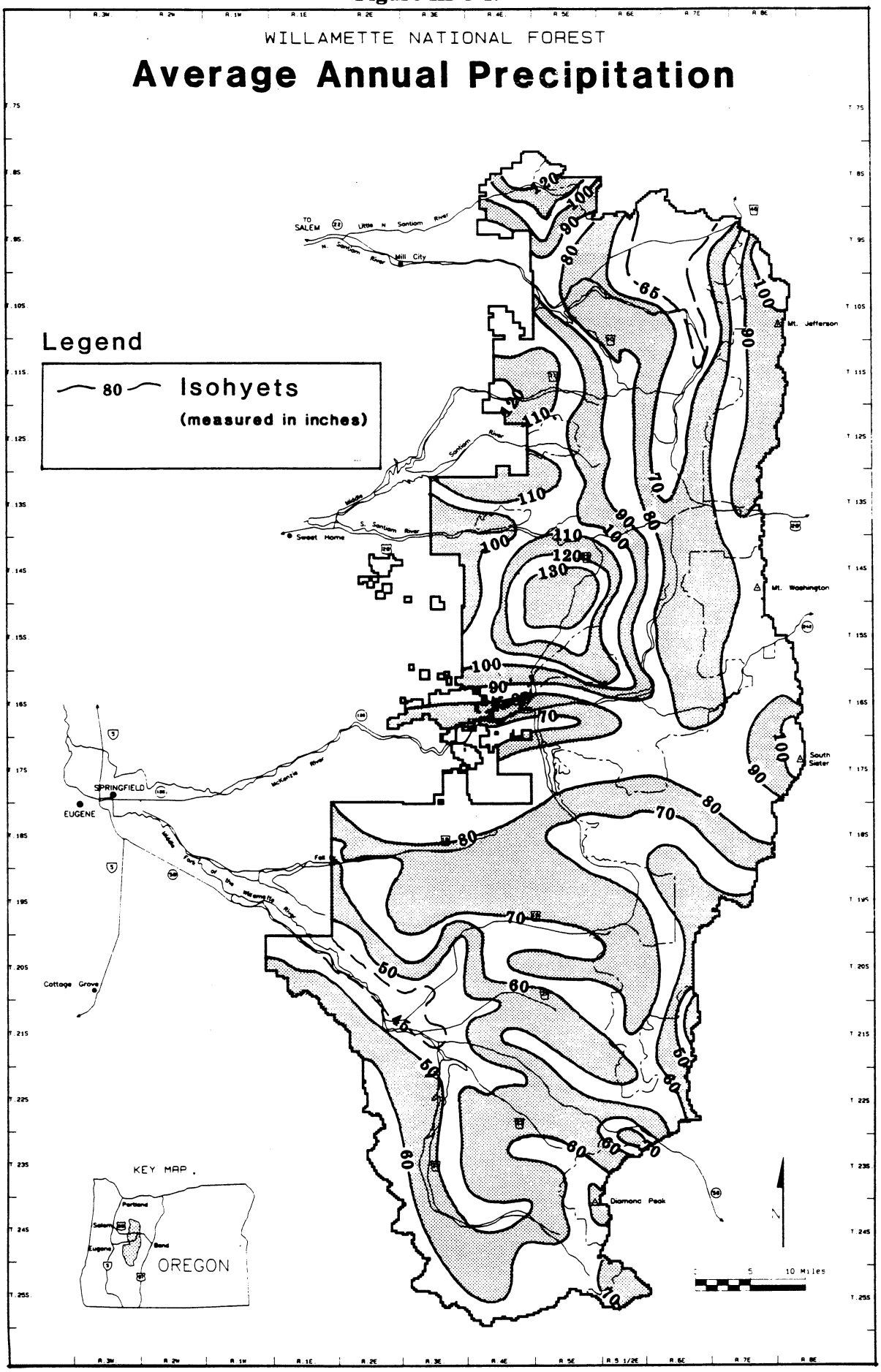
The climate of the Forest is referred to as Pacific Maritime. It is influenced by several factors including the position and intensity of upper level wind currents, the high and low pressure systems over the North Pacific Ocean, and variations in topography. In the summer, high pressure brings fair mild weather to the Forest. As winter sets in, the high pressure moves to the south, allowing the storms to move across the Forest. These frontal systems bring mild rainy conditions to the valleys and lower elevations of the Forest and heavy snows generally above 4,000 feet elevation (Sterns and Gilbert 1960).

The heaviest precipitation lasts for 3 months starting in December and accounts for 40 to 60 % of the yearly total. Mean average temperatures range from 30 to 40 degrees in January and average in the 60 degree range in August (Legard and Meyer 1973). The Forest receives the least amount of precipitation between June and October, when temperatures are highest. Thunderstorms occur most often during these months. Refer to Figure III-C-1 for average precipitation over the Forest.

This moisture has been one of the primary climatic factors affecting vegetative growth. The Forest has relatively dry cool summers and mild wet winters which are particularly favorable to evergreen conifers (Waring and Franklin 1977). Native conifers are able to carry on photosynthesis through the winter months while hardwoods are dormant. These conditions have created a magnificent conifer forest on the Forest with trees that grow to be some of the largest and longest living plants on earth. These plant formations are known for creating some of the earth's largest accumulations of biomass.

The vegetative patterns of the Forest are strongly influenced by both climatic and topographic conditions. As the elevation increases, the climate becomes more severe. As a result species composition and size decrease in the higher elevation. Another important factor influencing vegetation is that the south half of the Forest is considerably drier than the north half (Hemstrom et al. 1982). (See figures and discussion in Chapter III, Vegetation.) Thorough accounts of vegetation zones and communities on the Forest are in publications by Franklin and Dyrness (1973), Franklin (1979), Hemstrom et al. (1982, 1985).

Figure III-C-1.



Site specific microclimatic conditions are an important aspect of the Forest environment and often directly affect plant and animal habitat. Although meadows, rocky areas and clearcuts are exposed to the weather, riparian zones along creeks and lakes provide shade, lower temperatures and increased humidity. Changes in microclimate are also caused by activities such as timber harvest and road construction. For example, the removal of a stand of trees by clearcutting can cause local wind patterns to shift, lower humidity, and increased solar radiation. Chapter III, Timber and Appendix F both contain discussions of silvicultural treatments used on the Forest. For additional information on wildlife habitat see Chapters III and IV, Wildlife. Climate has played an important role in developing the forest soils. The weathering, decomposition, sedimentation, and overall mineralization caused by ice, snow, rain, wind, sun, cold, and heat are directly related to the breakdown of the bedrock to form soil. Some soils become very unstable with the effect of water saturation and gravity. These soil conditions are discussed in more detail in Chapter III, Soil and in Chapter IV.

When conditions are warm and dry, periodic thunder and lightning storms can result in the ignition of wildfires, but strong east winds often present more critical fire danger. During the summer and fall seasons, these dry, warm winds may be sustained between 30 to 40 miles per hour with stronger gusts over the higher ridges. During these periods, small smoldering embers can quickly ignite large fires requiring major fire suppression efforts, and as a consequence, industrial operations are restricted and prescribed burning activities are curtailed. In extreme cases the Forest is closed to all uses until rain or humidity lowers the danger.

The weather patterns also affect slash burning activity and the subsequent effects of smoke on air quality. Maritime winds provide good mixing and dispersion of smoke into the upper atmosphere and away from smoke sensitive areas in the populated valley bottoms. It is common to have completely different atmospheric conditions in the western valleys as compared to the distant ridge tops. See Chapter III, Air for additional information.

Weather conditions also influence the construction and use of Forest roads. Because of the wet conditions in the winter and spring, roads need to be constructed to a higher standard to alleviate drainage problems. Some roads are not used at all in the winter because of deep snow, mud slides, and fallen trees. See Chapter III, Roads.

Future Trends

An emerging issue that is gaining attention worldwide is global warming. Concern has been increasing as the following data has been gathered by various scientific organizations:

1. The 1980's decade was the warmest in recorded history.

2. The carbon dioxide level in the atmosphere has increased from 315 ppm to 350 ppm since 1958.

3. The rate of increase in carbon dioxide is faster than at any time during the last 100,000 years.

Climatic change and variability along with stresses from existing and new atmospheric pollutants have undetermined impact on the forest and it's ecosystems. Existing historical data are inadequate for predicting future forest responses.

To deal with the scientific uncertainty about the likelihood and signicance of potential climatic changes, Congress is working on a variety of bills (Global Climate Change Prevention Act - S.1610, and the Urban and Community Forestry Act - H.R. 2144) to stimulate research and develop strategies for adapting to and mitigating the impacts of climate change. In addition, the U.S. has joined 70 other

Nations in a "Declaration on Global Climate Change" which identifies improved forest management as one of eight major areas for international funding.

A 1988 USDA Forest Service report, "Forest Health and Productivity in a Changing Atmospheric Environment" identified three broad questions on the effects of physical and chemical climate changes on forest, range and related ecosystems, for which research is needed:

1. What processes in forested ecosystems are sensitive to physical and chemical changes in the atmosphere?

2. How will future physical and chemical climate change influence the structure, function, and productivity of forest and range ecosystems?

3. What are the implications for forest management, and how must forest management activities be altered to sustain forest health and productivity?

A recent study predicted the average global temperature could increase by 1.5 to 5.0 degrees Centigrade over the next 50-100 years. If global warming results in temperature increases of this magnitude, the following changes would be possible in the West Cascades:

1. Vegetation bands could shift upward by as much as 1,000 feet in elevation. The Forest would resemble the present forests of northern California with more Grand fir, Sugar Pine and Ponderosa Pine, and less western hemlock. At lower elevations near the valley floor, the vegetation would likely change to chaparral and oak woodland.

2. Although total annual rainfall would probably be about the same, it would be concentrated in a few severe storms. Summers would be hotter and drier with lower streamflows and warmer water temperatures. The risk of wildfires would be much higher. Trees would be under more stress and increasingly susceptible to a variety of pathogens.

3. Overall productivity of the forest would probably decline, although there might be an increase at some of the mid to high elevations. Some of the highest mountain hemlock types may change to nonforest shrubs and meadows.

There are many unanswered questions concerning the global warming issue. Data is scarce and sometimes conflicting. However, during implementation of the Forest Plan the following strategies should be considered in preparing for possible changes:

1. Emphasize a diversity of species in plantations including hardwoods.

2. Maintain or enhance this mix through the precommercial and commercial thinning entries.

3. Start selecting some trees in the genetic program for their drought resistance instead of height growth.

4. Increased protection of riparian areas to maintain channel stability and cool water temperatures.

The Forest Monitoring Plan will cover reforestation success/failure by habitat types and be able to track changes in vegetation that might be indicators of a climatic warming trend.

SOIL

Soil is a fundamental component of the environment. It is the growing medium for most plants. Soil absorbs and stores water, releasing it slowly over time; it supplies nutrients for vegetation which in turn supplies habitat for wildlife and resources that people use and enjoy. All renewable surface resources of the National Forest are dependent upon soil. Soil is considered a nonrenewable resource because of the length of time required for its formation.

Historic Trends

Soils of the Forest are diverse, reflecting the influence of climate, time, vegetation, parent material, and topography. Parent material of the Forest's soil is almost entirely of volcanic origin and can be divided into two broad classes: hard volcanic rocks, such as basalts, andesites, and intrusions of various kinds; and soft volcanic rocks, such as breccias, tuffs, and volcanic ejecta. Soils with parent materials consisting of hard volcanic rocks may develop at a rate of approximately one inch per thousand years, while soils with parent materials consisting of soft volcanic rocks may develop at much faster rates. Soils can also form on materials derived from other geologic materials and include deposits of glacial outwash and till, alluvium, loess, colluvium and sediments.

Geologically recent volcanic ejecta (pumice, ash, sand, and cinders) have had a major influence on soil formation in the High Cascades region of the Forest. These rock types are generally found at elevations in excess of 4,000 feet, but in the southeastern portion of the Forest, this material occurs at about 3,000 feet and higher. Because of the short, dry, growing season and high snow pack, vegetative growth and microbial activity are restricted. This makes soil formation much slower than in the more temperate lower elevations. These soils are generally not as well developed, or as fertile as those occurring in the Western Cascades. Refer to Section B, Geology, in this chapter for additional discussion of the bedrock and the soil and mineral forming processes.

An inventory of the soils of the Forest was completed and published by Legard and Meyer in 1973. It is entitled "*Soil Resource Inventory (SRI) of the Willamette National Forest.*" This inventory grouped areas of similar soil, parent material, land form, and vegetation into units called landtypes. These landtypes were the basis for the interpretations provided in the report. The inventory recognized 159 mapping units consisting of landtypes, miscellaneous landtypes, and complexes. The objective of the SRI is to provide soils information in a useful form to land managers as an aid to multiple-use management.

Current Situation

Forest management activities directly affect soil productivity in both the short- and long-term. The concept of productivity includes both the ability to grow vegetation as well as the maintenance of slope stability. The major concerns include the increased risk of soil movement from roading and clearcut timber harvest, reduced growth potential from compaction, nutrient loss from fire, and reduced productivity from loss of large woody material.

Soil productivity varies widely due to varying characteristics such as soil depth, available moisture holding capacity, nutrient status, and site characteristics including elevation, slope, and aspect. The most productive soils for producing wood fiber are found in valley bottoms, toeslopes, and benches.

These include SRI landtypes 14, 15, 22, 23, 25, 35, and their complexes which total approximately 14% of the Forest (Legard and Meyer 1973).

An important component of soil productivity is organic matter content, and related nitrogen availability. Soil organic matter directly affects both water and nutrient holding capacity as well as soil tilth. Organic matter holds many times its weight in water and has a high cation exchange capacity that increases the soil's ability to hold plant nutrients. Organic matter in the form of leaves, needles, and twigs is itself a supply of plant food as it decomposes and releases nutrients, especially in the higher elevation soils. Large woody material (whole downed, rotting trees) supports the life cycle of symbiotic soil fungi which attach to conifer roots, and greatly increase the trees ability to take up nutrients and water. Duff and litter on the soil's surface also act as a mulch and reduces soil erosion due to rainfall impact. Fine rootmats in the surface soil bind the soil together, reducing downslope soil creep and washing. Some Forest soils, for example, have accumulated very little organic matter and are considered sensitive to any organic matter removal by management. These soils generally occur in the upper elevations where the colder climate and short growing season does not generate large amounts of annual vegetative growth.

Timber management can affect organic matter and nitrogen content in several major ways. Logging or wood removal and fuels treatment or prescribed burning can both directly remove organic matter as well as change erosion rates. Surface erosion process are active both during summer drought periods as dry ravel and during winter rainfall events. In timber harvest units, surface erosion rates may exceed natural rates depending on such factors as degree of disturbance, severity of burn, and steepness of the slope. Vegetative regrowth usually forms a protective barrier and binder equal to the original stand within ten years after disturbance (Swanson and Grant 1982). Nitrogen fertilizer, on the other hand, may be applied to soil to increase soil productivity. This results in more and higher quality forage, quicker vegetation responses for shading riparian zones, and more wood fiber in a shorter period of time.

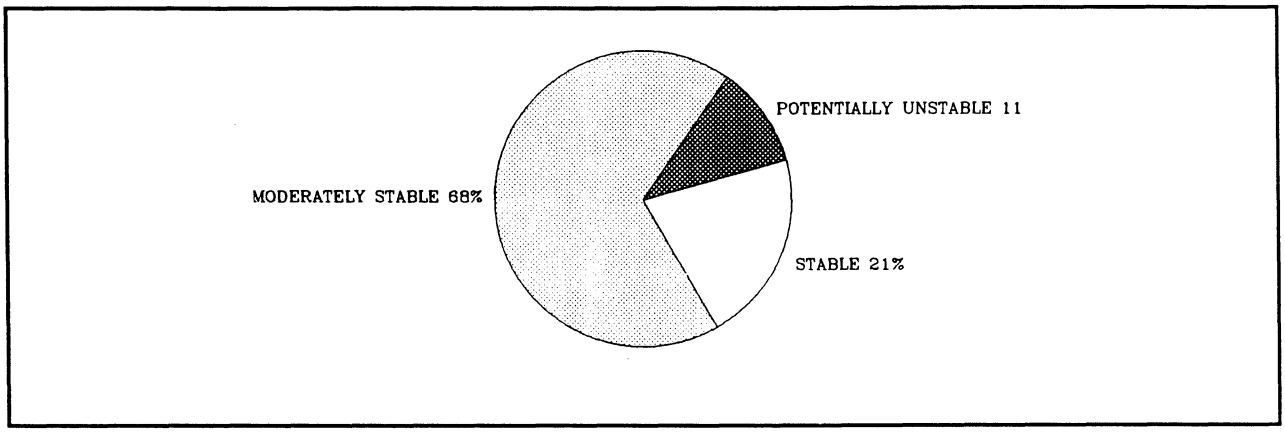
Slope stability is also a fundamental component of soil productivity. Soil stability classes were established for the Forest based on the "Expected Mass Movement as a Result of Man's Activity" rating (Legard and Meyer 1973). Slope stability is also discussed in the Geology section.

Figure III-D-1 shows the relationship of three stability classes to the available land suited for timber production. The three stability classes used in the planning process have been defined as follows:

> Stable--Gentle to moderate slopes (40 to 60%) with hard rocks, and rock with or soil. About 21% of the tenatively suitable forested land is made up of this class.
>
> Moderately Stable--Steep slopes (60+ %) with hard rocks and moderate slopes with soft rocks. About 68% of the tenatively suitable forested land is made up of this class.
>
> Potentially Unstable--Steep slopes and soft rocks. About 11% of the tentatively suitable forested land is made up of this class.

Mass wasting by either debris avalanches or of slump-earth flows are dominate mechanisms for downslope movement of soil. The principal impact of soil movement is on the aquatic environment, but soil productivity is also reduced in the affected area. The delivery of sediment to the aquatic environment is more efficient with mass wasting type processes than it is in surface erosion. This is described in greater detail in the Water section.

Figure III-D-1. Soil Stability Classes for Timber Harvest



Mass wasting can occur on distinctly different land types within the Forest. Deep, plastic, clay soil types formed from tuffs and breccias tend to be dominated by slump- earth flow movement. These types of failures are deepseated by nature and occur predominately on SRI landtypes 25, 33, 35 and their complexes that cover 11% of the Forest. Shallow noncohesive soils over hard bedrock are prone to debris torrents and debris avalanches. These are made up of SRI landtypes 3, 8, 9, 21, 31, 61, 94 and their complexes that comprise about 35% of the Forest. Cost of road construction and maintenance increases within these areas. In some cases, road construction across these landtypes has been prohibited because the risk of resource damage was higher than the benefit. Sidecast of excess excavated material on steep sideslopes (greater than 55-60%) is not considered an option in future road building proposals for any land type, because of the high risk of landsliding.

Future Trends

The demand for the soil resource is that it remain productive. Accelerated surface soil erosion, mass wasting (slope stability), and excessive compaction will continue to be management concerns.

Both total erosion and the delivery of sediment to streams is expected to decrease in the future due to changes in road construction practices and because over 80% of the Forest transportation system is currently in place, although these processes will continue to occur Forest-wide as a result of natural storm events. As previously undisturbed areas of the Forest are entered for timber harvest activities, the slope stability of potentially unstable land flows may be disturbed increasing the potential for mass movement. In localized areas, surges of sediment may exceed average drainage trends. As a consequence, it will become increasingly important to identify, locate, and analyze active and potential slump and debris avalanche areas prior to management activities, and to incorporate site specific analysis in project design and implementation.

WATER

Water draining from the Forest is of high quality and provides many benefits. The Forest furnishes water for municipal and domestic uses, fish hatcheries, electrical power generation, and recreation. Water provides fish and wildlife habitat, and supports one of the most productive vegetative environments in the world. The two basic forms of water on the Forest are surface water, (streams, rivers, lakes, and reservoirs) and subsurface, or groundwater.

The principal issues for water resources on the Forest involve the yield, quality, and use of surface waters, mainly in streams and rivers. Concerns for water quality received the second highest rating in the issue development survey.

Historic Trends

To assess the current condition of Forest water resources, particularly streams, an understanding of the management history is needed. An understanding of the physical and climatic setting is also necessary, particularly as it relates to flood history and potential future, flood occurrence. The infrequent catastrophic floods which occur on the Forest have had considerable influence on current management philosophy and practices.

Before Forest management activities began, natural processes were the sole means of change in the landscape. Catastrophic flood events, recurring at varying intervals, were the dominant forces to change of Forest water resources. In the Cascades, major flood events are caused by storms which deliver large quantities of precipitation in a short time. Rapid snowmelt caused by warm rain also contributes to flood events.

Major flood events occurred in 1861 and 1890 which caused extensive damage in Eugene, Springfield, Salem, and Portland areas. During the 1940s and 1950s, several flood events occurred which also resulted in extensive property loss in the Willamette Valley. The US Army Corps of Engineers conducted extensive flood control studies in the Willamette basin during the 1950s. Subsequently flood control reservoirs were constructed on all the major Willamette River tributaries.

Flood control reservoirs located on the Forest, or controlling the off forest flow of streams are: Detroit (North Santiam River); Foster and Green Peter (South and Middle Santiam River); Blue River and Cougar (McKenzie River); and Hills Creek, Lookout Point and Fall Creek (Middle Fork Willamette River). A reregulating dam on the South Fork of the McKenzie below Cougar Reservoir has been authorized but not funded by Congress. This dam would be called the Strube Dam.

During the winter of 1964/65, two very damaging storm events occurred. The December 1964 event was a 100-year flood (one that occurs on average once in 100 years) on all Willamette basin streams. The January 1965 event was approximately a 50-year flood. Other major flood events occurred in 1956, 1957, 1971, 1974, 1978, 1981, and 1986.

Major damage from the 1964 storms was to roads and bridges totalling approximately $12,000,000 within National Forests in Oregon. Damages to fisheries were extensive, though not calculated in terms of dollar value. Of 725 soil and debris slides reported from Oregon National Forests, 78% were associated with roads or logged areas (54 and 24%, respectively). These proportions are consistent with those found on the Forest, which received the most extensive damage of all the National Forests affected by the storms (Region-6 Storm Damage Report 1966). Although infrequent catastrophic events are the dominant source of change to Forest water resources, management related alterations of a

watershed increase the ability of a flood to cause damage to streams, fish habitat, and improvements (Lyons 1981; Grant 1984). The next 100-year flood which strikes the Forest will have potential to cause more extensive damage than the 1964/65 events, because of the twofold increase in total road miles, as well as increase in acreage harvested. This assertion is evidenced by the $1.3 million in damage to roads, bridges, and culverts caused by a 10-year flood event which occurred in late February 1986 (*Willamette National Forest Storm Damage Report, 1986*). A 10-year flood event occurs on average, once in 10 years and produces about half of the water volume of a 100-year event.

In the late 1940s and early 1950s, extensive timber harvest began on the Forest. Initial road construction practices called for side-cast wasting; material in excess of that needed for construction of the road bed was pushed over the side. The result was an accumulation of loosely arranged material and overweighting of the slope below the road. During the major events of 1964-1965, many of these areas slid, causing sedimentation of adjacent streams.

In the late 1960s and early 1970s the hauling of waste material to stable sites began to be required. This practice, along with stabilization of existing road fills, has greatly reduced the volume of sediment entering streamcourses.

Timber harvest practices have followed a similar history. Initially, little or no suspension of logs was required as they were yarded across the slope or through small, unstable Class III and IV streams. The result was sedimentation of streams and an increase in landsliding in small streams within harvest units. Beginning in the 1970's, more sophisticated logging practices have greatly reduced sedimentation resulting from timber harvest. Partial or full suspension of yarded logs, vegetation left to stabilize soils, and improved tree falling techniques have effected a decrease in sedimentation.

Management practices in riparian or streamside areas have undergone a similar transition. Initial practices did not recognize the need for preservation of stream shading vegetation on fish bearing streams, nor that shade removal on nonfish bearing perennial streams could have a cumulative impact to downstream fisheries due to the increase in water temperature. Several streams had daily peak summer temperatures warmed to the low to mid-70 degrees Fahrenheit (Total Resource Inventory, Aquatic Subsystem files).

Beginning in the mid-1970s, analysis of shade requirements, and leaving of necessary shading vegetation was initiated. As a result of these efforts, as well as shade recovery in older harvest units, recent research and Forest monitoring have documented an apparent drop in peak summer water temperatures in Salmon, Fall and Winberry Creeks (Beschta and Taylor 1986) (Total Resource Inventory, Aquatic Subsystem Files).

Another practice common in the 1960s through mid-1970s was the removal of natural woody debris, or downed logs, from streams in and adjacent to harvest units. This practice was initiated because of extreme amounts of damage to culverts and bridges caused by debris carried by the 1964/65 floods (Part II, Region-6 Flood Damage Report, 1966). As a result, the standard design capacity for bridges and culverts was increased.

The actual function of wood in streams was poorly understood at that time. Research now shows large woody debris is the critical link in fish populations and habitat quality, and that it has a similarly critical role in maintaining channel stability. Downed logs have important functions in dissipating stream energy, storing and routing sediment, and so provide for virtually all of the habitat requirements of anadromous and resident fish (Harmon et al. 1986).

Beginning in the early 1980s, the removal of woody debris was curtailed, except where necessary to protect an existing improvement. It is now a standard management practice to plan for the maintenance of the existing woody debris and to provide a source for future deposits of wood into the streams.

In the past, before management activities began, the Forest's watersheds had the capability of producing consistent flow patterns and valuable fish habitat. As management intensified, it was noted that peak streamflow appeared to be increasing in major rivers draining the Forest (Christner and Harr 1981).

Increased peak streamflow may destabilize a stream by altering the balance under which the stream developed, causing an increase in sediment production and a decrease in bed and bank stability. At any given time, stream conditions are a function of both the volume of sediment and water passing through it and the relative ability of its bed and banks to withstand the scouring effect of the water. As flow volume increases a stream's ability to carry sediment increases, as do bed and bank erosion (Heede 1980).

Peak streamflow increases were suspected to be caused by the rapid melt of snow accumulating in harvest units located between 1,500 and 4,000 feet in elevation. It was found that harvest openings collected a deeper snowpack than surrounding timbered areas, and that the snow melted more rapidly, particularly in the presence of wind and warm rain (Christner and Harr 1983).

In the early 1980s, as a result of these interrelationships, the Forest established a management consideration that watersheds should be maintained at approximately 75% hydrologic maturity, to minimize potential increases in peak streamflow and landsliding (Christner 1982).

Undisturbed areas of the Forest generally have soil surfaces which allow water to penetrate at a rapid rate even during lengthy storms of medium intensities. Under these conditions, overland water flow rarely occurs. Subsurface water typically surfaces in springs, streams and lakes and accounts for nearly all streamflow on the Forest. A portion of the subsurface flow penetrates deeper and recharges porous underground strata called aquifers. The distribution and characteristics of ground water occurring in aquifers are complex.

It is hypothesized that the High Cascades mountains in addition to river confluences, and alluvial deposition areas, contribute to recharge areas for aquifers in the Willamette Valley and portions of eastern Oregon immediately adjacent to the Cascades. A large portion of the precipitation which occurs during the winter months above 4,000 feet in elevation in the High Cascades falls as snow. The recent volcanic area of the High Cascades (see Figure III-B-1, Geologic Provinces and Bedrock Map) is largely composed of porous rock formations. As the snowpack melts during the spring and summer months, it significantly influences the seasonal volume of runoff and groundwater recharge.

Current Conditions

The Forest drains the western front of the Cascade Mountains, from southeast of Eugene to east of Salem. All of the river basins on the Forest are tributary to the Willamette River, which enters the Columbia River at Portland. Total water yield from the Forest is 8.9 million acre feet per year (Hubbard et al. 1983). Major river drainages on the Forest are the North and South Santiam, McKenzie, and Middle Fork Willamette. Figure III-E-1 depicts the major watersheds on the Forest.

The Forest contains approximately 9,300 miles of streams. Streams on the Forest have been classified according to use and/or potential use (FSM 2520). Class I streams (426 miles) are comprised of water used for municipal or domestic purposes, or contain large numbers of fish, both anadromous and resident.

Class II streams (940 miles) either contain or have the potential to contain resident sport fish. Class III streams (1,295 miles) are perennial, non-fishbearing streams and Class IV streams (6,621 miles) flow intermittently. Figure III-E-2 depicts the normal classification hierarchy of streams in a "typical" watershed.

The mileage of streams by class, major watershed, and Ranger District is shown in Figure III-E-3. Streams from the Forest produce the high quality water and physical environment necessary for anadromous and resident fish spawning and rearing. See Figure III-I-2 for the amount and type of fish habitat by major watershed (Fish Section, this Chapter).

There are over 390 natural lakes on the Forest, accounting for more than 11,233 acres (17.6 square miles) of surface area. Most of the natural lakes are located in the High Cascades, above 4,500-foot elevation; 74% (289) of the lakes are within Wilderness. The other 26% (101) are in other land use designations. The lakes on the Forest vary widely in size and productivity, but trout are found in the majority of the lakes over 2 acres in size and 8 to 12 feet in depth (Stewart and Skeesick 1982). There are at least 375 fish-bearing lakes between 2 and 50 acres in size, with 15 lakes ranging in size from 50 to 360 acres (Stewart and Skeesick 1982). The surface stream network in the High Cascades where the majority of the lakes are located, is poorly developed. As a result, few of the lakes have spawning habitat available, and only 10% have naturally reproducing fish populations (Stewart and Skeesick 1982).

The gem of the lake system on the Forest is Waldo Lake, the second largest (6,420 acres) and second deepest (maximum 420 feet) natural, nonalkali lake in Oregon. Waldo Lake is truly a world-class water body, being one of the clearest and cleanest lakes in the world (Lider et al. 1980). The Waldo Lake Wilderness, Waldo Lake Recreation Area, and Torrey-Charlton Natural Area are management units of the Forest contributing to the protection of the water quality and aesthetic setting of the lake, while promoting recreation uses.

Water Use

Several categories of use exist for water originating from the Forest. The first category includes off forest domestic and municipal water supply. Other off forest uses are irrigation, recreation, power generation, and fish hatcheries. Manipulation of water releases from the five largest reservoirs on the Forest assures acceptable water quantity and quality during the summer months in the Willamette River at Albany, Salem, and Portland. On Forest use includes fish and wildlife habitat, recreation, and fish hatcheries. Anadromous fish spawned on the Forest contribute to the Columbia River sport and gillnet fisheries. Figure III-E-4 lists current water use in the major Forest watersheds by Ranger District.

The Forest has 37 surface sources for drinking water supply, including 14 municipalities, 7 unincorporated or private suppliers and 13 campgrounds. As displayed in Figure III-E-5, the Forest is the principal source and is defined as greater than 50% of the watershed area above the point of withdrawal for municipal use is on the Forest. This assumes that all of the land in the watershed contributes equally to water yield as measured at the withdrawal site of drinking water for approximately 204,000 people in the Willamette Valley and surrounding communities. The Forest supplies 82% and 72%, respectively, of the water used by Eugene and Salem, which have a combined population of 185,000. The cities of Albany and Lebanon (combined population 35,000) receive approximately 34% of their water from Forest land.

As defined by the USDA Forest Service (FSM 2543, R-6), the Forest potentially has 21 municipal watersheds. For a watershed on Forest to be classified as a municipal watershed, Forest Service management activity must have the potential for having a significant effect upon the quality of water

at the point of withdrawal. In addition, through the point of withdrawal the watershed must meet one or more of the following criteria:

- Serve at least 25 individuals at least 60 days per year.
- Provide at least 15 service connections.

For this purpose, municipal applies to unincorporated or private utilities, as well as incorporated municipalities.

The Forest has no formal municipal watershed agreements, and consequently manages forested watersheds for multiple use purposes and values. None of the watersheds are afforded specific or special management prescriptions for the express purpose of protecting domestic water supplies over and above standard management practices to ensure water quality.

The quality of water delivered to the withdrawal facilities for the watersheds with 100% Forest land has been of sufficient quality that the Forest has not been approached to develop formal municipal watershed agreements. The quality of water delivered to the largest cities; Eugene, Salem, Albany, Lebanon, and Sweet Home depends not only on Forest Service practices, but also several private landowners, the Bureau of Land Management, Oregon State Department of Forestry, and the US Army Corps of Engineers reservoir management programs (see Figure III-E-5).

Currently there are four hydroelectric facilities on the Forest, operated by the US Army Corps of Engineers (COE). These are Lookout Point, Hills Creek, Cougar, and Detroit Dams. Fall Creek and Blue River Dams are being studied for retrofitting with hydroelectric generating capacity. Eugene Water and Electric Board (EWEB) operates a hydroelectric generating system in the upper McKenzie River basin, at Carmen, Smith, and Trailbridge Dams. The Forest supplies greater than 75% of the water used to operate these seven facilities. The combined capacity of the seven facilities generates sufficient power to meet the needs of thousands of households each year.

Passage of the Public Utility Regulatory Policies Act in 1978 encouraged the private development of small power projects. The act requires electric utilities to interconnect with and purchase power from these small sites. Currently one project is on line at Falls Creek on the Sweet Home Ranger District generating 4 megawatts of power. Two additional public projects are operating and three other sites on the Forest are at various stages of study or application for licensing from the Federal Energy Regulatory Commission (FERC). If all of these sites were to be completed, they would produce an estimated 132 megawatts of power.

Figure III-E-1.

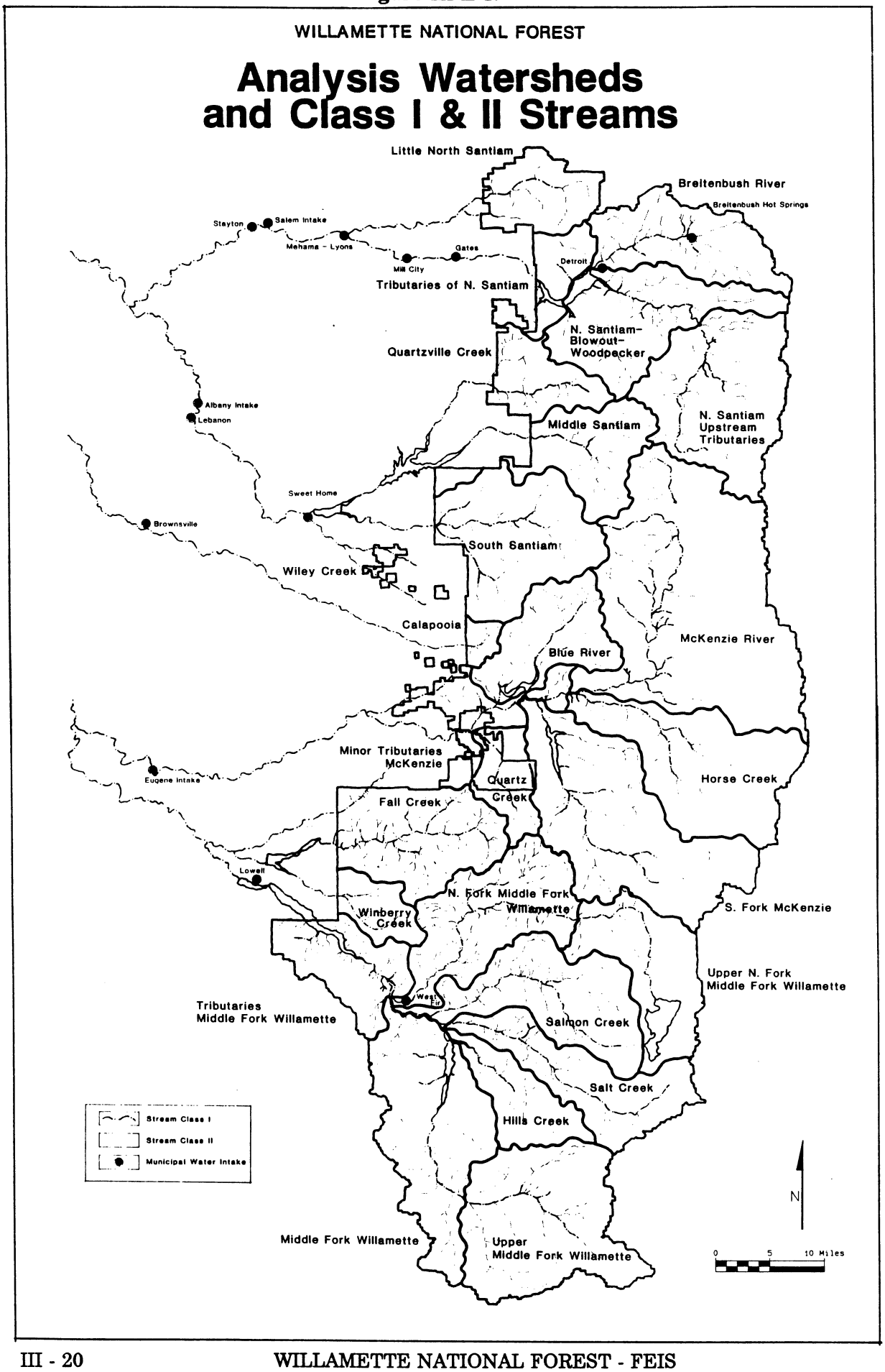
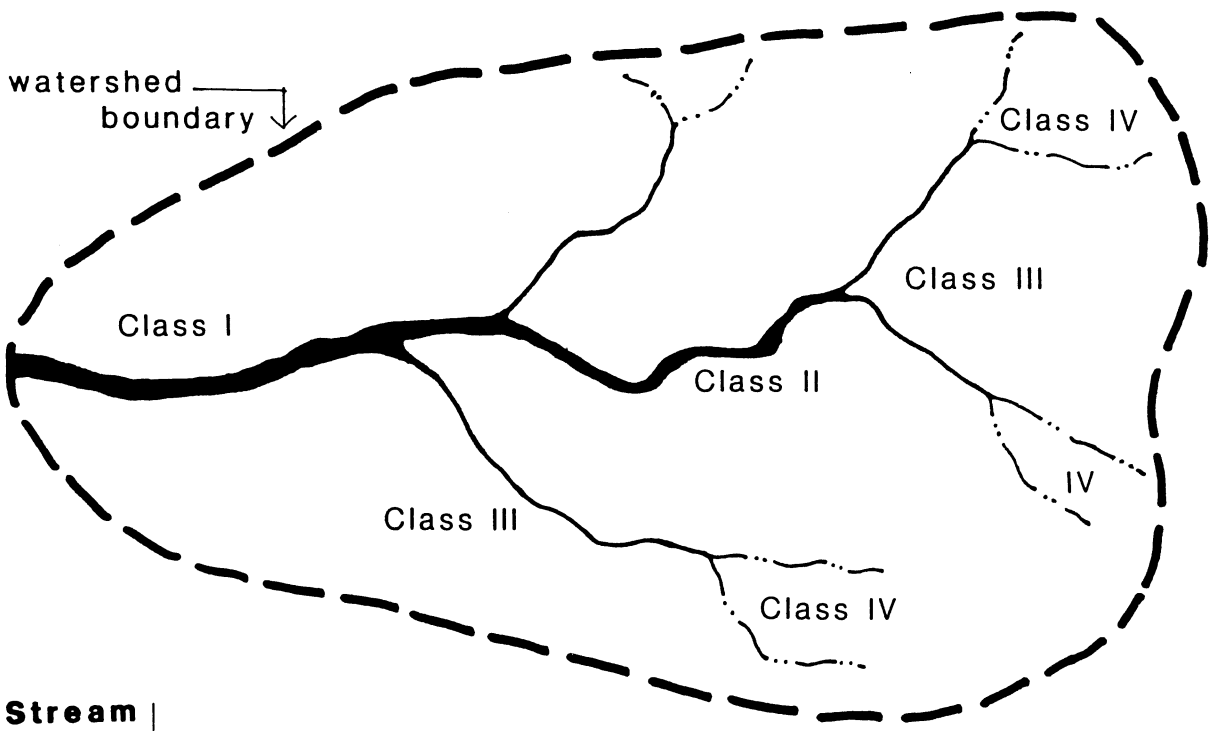


Figure III-E-2 Stream Heirarchy



Stream Class	Qualifying Criteria
I	municipal/ domestic supply, large volume, anadromous fishery
II	resident trout fishery, significant volume to affect Class I
III	perennial stream, no fish present
IV	intermittent flow

The Forest stream classification scheme is based on flow volume and the beneficial uses of a given stream, i.e. municipal/domestic drinking supply, recreation, fisheries.

For a complete discussion see FSM 2526 Willamette Supplement 3 5/81.

Table T001. Stream Class Mileage (III-E-3)

District	Watershed Name	I	II	III	Total
Detroit	Little North Santiam	9.7	20.2	29.9	59.8
	Breitenbush	17.6	47.5	39.6	104.7
	North Santiam	41.4	103.8	127.7	272.9
Sweet Home	Quartzville Creek	9.7	22.0	21.1	52.8
	Middle Santiam	20.2	47.5	54.6	122.3
	South Santiam/Canyon	19.8	44.9	46.6	111.3
	Calapooia/Wiley Creek	2.6	6.2	7.0	15.8
Blue River	Blue River	22.0	59.9	44.0	125.9
	South Fork McKenzie	29.9	66.0	75.7	171.6
	Lower Tribs. McKenzie	2.2	9.7	7.0	18.9
	Quartz Creek	2.2	5.3	11.4	18.9
McKenzie	McKenzie	40.9	9.7	19.3	69.9
	Horse Creek	18.5	8.8	13.2	40.5
Lowell	Fall Creek	37.0	76.6	96.8	210.4
	Winberry Creek	6.6	25.5	19.4	51.5
	Tribs. Middle Fk Willamette	10.1	56.3	46.6	113.0
Oakridge	North Fk Middle FK Willamette	47.5	88.8	126.8	263.1
	Salmon Creek	28.2	50.2	102.1	182.2
	Salt Creek	26.4	37.8	67.7	132.0
Rigdon	Hills Creek	6.2	25.5	51.0	85.4
	Middle Fk Willamette	27.3	128.4	242.0	439.1

Table T002. Current Water Use (III-E-4)

District	Watershed Name	Domestic Water Supply	Hydro Electric Power	Anadro-mous Fish	Resident Fish	Fish Hatch-ery
Detroit	Little North Santiam	X		X	X	
	Breitenbush	X	X		X	X
	North Santiam	X	X		X	X
Sweet Home	Quartzville Creek	X	X	X	X	X
	Middle Santiam	X	X	X	X	X
	South Saniam	X	X	X	X	X
	Calapooia/Wiley	X	X	X	X	
Blue River	Blue River	X		X	X	X
	So. Fork McKenzie	X	X	X	X	X
	Minor Tribs. McKenzie	X		X	X	X
	Quartz Creek	X		X	X	X
McKenzie	McKenzie	X	X	X	X	X
	Horse Creek	X	X	X	X	X
Lowell	Fall Creek	X		X	X	
	Winberry Creek			X	X	
	Tribs. Middle Fk Willamette	X	X		X	X
Oakridge	North Fk Middle FK Willamette	X	X		X	X
	Salmon Creek	X	X		X	X
	Salt Creek	X	X		X	X
Rigdon	Hills Creek	X	X		X	X
	Middle Fk Willamette	X	X		X	X

Table T003. Surface Water Sources[1](III-E-5)

Location	Use Type [2]	Number Users [3]	Intake Location (Miles) [4]	Water Source	Source Area % (>50% USFS)	Watershed
Salem	A	85,667	27	N.Santiam River	72	NS BI DT LS US BL
Detroit	B	336	On Forest	Breit/Mackey	100	BI
Breitenbush Hot Springs	B	220	On Forest	Mansfield Creek	100	BI
Breitenbush	C	150	On Forest	Short Creek	100	BI
Detroit Lake	C	1,560	On Forest	Tumble Creek	100	BI LS BL
Gates	A	452	8	N.Santiam River	90	BI DT LS US BL
Mill City	A	1,522	13	N.Santiam River	82	BI DT LS US BL
Lyons	A	836	20	N.Santiam River	70	NS BI DT LS US BL
Mehama	B	--	20	N.Santiam River	70	NS BI DT LS US BL
Stayton	A	4,373	27	N.Santiam River	72	NS BI DT LS US BL
Turner	A	1,658	27	N.Santiam River	72	NS BI DT LS US BL
Marion Forks	B	72	On Forest	(Unnamed Tributary)	100	US
Marion Forks	D	75	On Forest	Horn Creek	100	US
Marion Forks	C	F	On Forest	Marion Creek	100	US
Riverside	C	185	On Forest	(Unnamed Tributary)	100	LS
Whispering Falls	C	55	On Forest	(Unnamed Tributary)	100	LS
Humbug	C	110	On Forest	Cliff Creek Trib.	100	BI
Camp Pioneer	B	120	On Forest	Pine Ridge Lake	100	SU
N.Sant.Sports Club	B	150	On Forest	(Spring)	100	NW
Stahlman	B	280	On Forest	(Unnamed Tributary)	100	NW
Sweet Home	A	6,722	12	South Santiam River	59	QA MS SS CA
Foster	D	--	11	South Santiam River	59	QA MS SS CA
Eugene	A	101,096	24	McKenzie River	82	BR SM MM QC MK LH UH ST DR LK
Ice Cap	C	120	On Forest	Ice Cap Creek	100	MK
Big Lake	C	150	On Forest	Big Lake	100	MK
Clear Lake	C	55	On Forest	Clear Lake	100	MK
Lowell	B	655	6	Dexter Reservoir	98	MF LN UN SC SL HI LM UM
Big Pool	C	25	On Forest	(Unnamed Tributary)	100	FC
Broken Bowl	C	115	On Forest	(Unnamed Tributary)	100	FC
Westfir	A	200	On Forest	N.F.Md.F.Willamette	100	LN UN
Oakridge	D	F	On Forest	Salmon Creek	100	SC
Blue Pool	C	140	On Forest	Warner Creek	100	SL
Sand Prairie	C	170	On Forest	Md. Fork Willamette	100	LM UM

[1]More than 25 users
[2]A = Municipal, B = Uninc/Private, C = Campground, D = Fish Hatchery.
[3]City populations from 1980 Census; Recreation site users from RIM PAOT capacity.
[4]Approximate river miles from the Forest boundary to the intake.

	CODE	WATERSHED	CODE	WATERSHED
KEY	NS	Little North Santiam River	QC	Quartz Creek
	BI	Breitenbrush River	UH	Upper Horse Creek
	DT	Detroit Tributaries	LH	Lower Horse Creek
	DR	Deer	SM	South Fork McKenzie
	LS	Lower North Santiam	CA	Canyon
	US	Upper North Santiam	FC	Fall Creek
	HA	Hackleman	WC	Winberry Creek
	SS	South Santiam River	MF	Tributary of Middle Fork of Willamette
	MK	McKenzie River	LN	North Fork of Middle Fork of Willamette
	CW	Wiley Creek/Calapooia	SC	Salmon Creek
	QA	Quartzville Creek	SL	Salt Creek
	MS	Middle Santiam	HI	Hills Creek
	BR	Blue River	LM	Lower Middle Fork Willamette
	MM	Lower Tribuatries McKenzie	UM	Upper Middle Fork Willamette
	BL	Blowout	UN	Upper North Fork of Middle Fork of Willamette
	ST	Scott Creek	WL	Wilderness Lakes
	LK	Lookout		

There are three fish hatcheries located on the Forest, and five other fish production facilities located within 5 to 15 miles of the Forest boundary (Stewart and Skeesick 1982). The eight facilities consist of seven hatcheries and one catch/release site and were developed either as required mitigation for construction of the flood control reservoirs, or to augment natural fish production. Marion Forks and Willamette salmon and trout fish hatcheries are located on Forest land and operate under special use permits.

Without the suitable quality water produced from the Forest, the eight facilities would not be able to operate in an economically efficient manner and still meet their mitigation obligations (Stewart and Skeesick 1982). The quality of the water at Marion Forks and Willamette salmon and trout hatcheries is directly attributable to Forest practices and land use activities; at the other five facilities the activities of private landowners and the operation of upstream reservoirs also affect the quality of water received.

Approximately 71.5% of Forest recreation is water oriented, generating an estimated value of $17,359,000 annually. Figure III-E-6 lists water oriented recreation use by various categories.

Table T004. Water Related Recreation Use (III-E-6)

	Developed Use (MRVDs)	Dispersed Use (MRVDs)	Wilderness Use (MRVDs)	Total Use (MRVDs)	Percent of Forest Use
Camping	812.8	154.6[1]	60.3	1027.7	35.6
Organized Camping	69.2	--	--	69.2	2.4
Picnicking	103.4	20.8[2]	--	124.2	4.3
Fishing	11.8	234.4	14.5	260.7	9.0
Swimming	81.1	49.6	17.0	147.7	5.1
Boating	98.2	127.5	0.6	227.3	7.8
Hunting[3]	--	4.0	--	4.0	0.1
Drive/Sightseeing[4]	8.0	196.8	1.8	206.6	7.2
Percent of Use Type	83.2	62.0	48.9	2067.4	71.5

Use is expressed in Thousand Recreation Visitor Days (MRVDs).

[1]Assumes 90% of dispersed site camping is associated with streamside area.
[2]Assumes 50% of dispersed site picknicking is associated with streamside areas.
[3]Assumes 5% of hunting is associated with streamside areas.
[4]Assumes 50% of driving/sightseeing is associated with streamside areas.
[5]All other values represent 100% of the respective activity.

Water Yield

Streamflow from the Forest forms the headwaters of the North and South Santiam, McKenzie, and Middle Fork Willamette rivers, and reflects the precipitation regime of the Pacific Northwest. The regions' maritime climate is characterized by a distinct winter rainy season, when 90% of the 40 to 90 inches of precipitation falls from October to May. Approximately 85% of annual runoff occurs during the 5 months between November 1 and March 31. Annual runoff is measured on the basis of "water years", which begins October 1, runs through September 30 of the succeeding year. Current demand for water in the other 7 months of the year is being met with only 15% of the annual water yield. This includes during the summer low flow period (July-September), when streamflow is less than one-tenth of the average winter flow.

Water yield, or the volume of runoff from the Forest, is the result of the balance between precipitation and physical characteristics of the land. The type, amount, distribution, and timing of precipitation, as well as land form, vegetative cover and soil type influence the volume and timing of runoff. Total water yield from the Forest was estimated at 8.9 million acre feet per year by Hubbard (1983). Annual water yield by watershed is listed in Figure III-E-7.

Table T005. Water Yield by Watershed (III-E-7)

		Area		Water Yield	
District	**Watershed**	**Acre**	**Sq. Mile**	**AcFt/SqMi**	**AcFt/Year**
Detroit	Little North Santiam	38,117	59.56	5,070.7	302,011
	Breitenbush River	62,262	97.28	4,072.5	396,173
	North Santiam	213,812	334.49	11,103.9	1,222,029
Sweet Home	Quartzville Creek	35,621	55.66	5,149.4	289,616
	Middle Santiam	57,676	90.12	4,517.9	407,153
	South Santiam/Canyon	92,124	143.94	3,479.6	500,854
	Calapooia River/Wiley Creek	10,430	16.30	5,041.4	37,494
Blue River	Blue River	54,690	85.45	4,047.9	345,893
	South Fork McKenzie	138,837	216.93	2,957.3	641,527
	Lower Tributary McKenzie	26,918	42.06	1,955.8	82,260
	Quartz Creek	16,232	25.36	1,955.8	49,599
McKenzie	McKenzie River	225,245	351.95	3,738.8	1,315,871
	Horse Creek	103,557	161.81	3,738.8	604,975
Lowell	Fall Creek	79,817	124.71	2,628.4	327,788
	Winberry Creek	22,631	35.36	2,059.8	72,835
	Tributary Middle Fork Willamette	49,998	78.12	2,059.8	160,912
Oakridge	North Fork Middle Fork Willamette	154,450	240.33	4,821.6	581,798
	Salmon Creek	84,722	132.38	2,861.6	378,819
	Salt Creek	68,725	107.38	2,537.0	272,423
Rigdon	Hills Creek	41,402	64.69	2,213.0	143,159
	Middle Fork Willamette	221,469	346.05	4,420.0	764,909
TOTAL		1,798,735	2,809.93	3,166.7	8,898,098

Water Quality

Protection of water quality and quantity on the Forest is required by the laws which created the National Forests, by the Clean Water Act, the Federal Water Pollution Control Act (FWPCA) and amendments, and most recently by the National Forest Management Act. The FWPCA permits the States to enforce State and local water quality laws on Federal land, and the National Forest Act states that National Forest lands will be managed "to prevent detrimental changes in water flow and water quality." In addition, many Federal and State laws regulate the establishment and existence of water rights on National Forest land. For additional information on relationships with the plans and policies of others see Chapter IV, Water.

Water flowing from the Forest in the four major river basins is generally of high quality, and supports a variety of uses. Principal water quality concerns are water temperature, turbidity, sediment, introduced chemicals, and bacterial contaminations. Specific water quality concerns on the Forest vary by time of year. High turbidity and suspended sediment concentrations are primarily associated with storm runoff, and peak during the autumn and winter months. Water temperature peaks occur during the summer minimum flow period. Peak concentrations of bacterial contaminants generally occur during the summer months in conjunction with warm water temperature and high recreation use. Introduced chemical concentration occurs by chance at virtually any time of the year, either by accident during application or transport on the highways or railroad which bisect the Forest.

Water temperature is a critical parameter for the fish that populate Forest streams, and is directly related to the amount of stream surface area exposed to direct solar radiation. Since water temperature is an important factor affecting the beneficial uses associated with Oregon's salmon and trout fisheries, the State of Oregon has established a water quality standard for water temperature. The standard requires the maintenance of water temperature at 58 degrees Fahrenheit or less, or at existing temperature if naturally greater than 58 degrees Fahrenheit.

The Forest is far enough south that long daylight periods and low summer stream flows may result in critical stream temperatures. Maximum daily water temperatures in July and August in streams draining watersheds with elevations predominantly below 4,000 feet, can reach the mid 60 degrees Fahrenheit to low 70 degrees Fahrenheit. These temperatures may be detrimental to salmon and trout, whose optimum feeding, rearing, and spawning activity takes place between 50 degrees Fahrenheit and 57 degrees Fahrenheit.

Salmon Creek and Fall Creek are two watersheds in which water temperature is of particular concern as compared to most of the watersheds on the Forest. The Oregon Department of Fish and Wildlife operates two hatcheries on water withdrawn from Salmon Creek. Water temperature is critical in terms of optimizing the economic efficiency of the hatcheries; an increase of a few degrees in water temperature can dramatically increase the cost per fish produced. Fall Creek, along with principal tributaries, Little Fall Creek and Winberry Creek, contains an important population of wild winter steelhead trout. The Fall Creek watershed tends to have lower minimum flows than other watersheds of similar size on the Forest. As a result, Fall Creek and its tributaries are more sensitive to activities which remove shading vegetation and potentially increase water temperatures. Past forest management activities and flood events have removed riparian vegetation resulting in increased summer peak stream temperatures in some streams on the Forest. Recent research and Forest monitoring have documented an apparent drop in peak summer water temperature in Salmon, Fall, and Winberry Creeks (Beschta and Taylor 1986), (Total Resource Inventory, Aquatic Subsystem files). This decline is attributed to the shading effect of recovering riparian vegetation.

The most visible characteristic of water quality is suspended sediment which affects the clarity of water. Sediment concentrations and resultant turbidity (clarity), are the water quality attributes most readily and frequently influenced by natural events and human activity. Sediment is primarily eroded soil transported to the stream system, originating from a variety of natural and human-induced sources. There is a natural amount of sediment in streams, which is a necessary and vital part of the aquatic ecosystem. Salmon and trout, for example, require gravel and cobbles of specific sizes and amounts to reproduce.

Sediment is made up of two main components that are defined as follows:

- Suspended sediment--material that the stream carries within the column above the bed or bottom of the stream.

- Bedload sediment--material, ranging in size from sand to gravel and boulders that is moved at or just above the bed of the stream.

The amount of sediment in a stream at any given time is dependent on stream flow and sediment supply. The sediment supply is a function of the amount, type, timing, and location of ground disturbing activities and natural events which expose soil to erosion. Of equal importance is the efficiency of the watershed in transporting the eroded soil to and through the stream system.

High turbidity and/or suspended sediment may cause reduced potability, increased domestic use treatment costs, and reduced aesthetic quality, angler success, and fishery productivity.

Sediment thresholds are difficult to discern, tend to be watershed specific, and are unique to the use in question. The potential significance of sediment elevated above natural levels is well documented by research (Swanston et al. 1986; Triska et al. 1982; Martin et al. 1981).

High bedload and deposited fine sediment may result in reduced fish habitat quantity and quality, reduced pool volumes, fish spawning success, and fish prey base. High bedload and deposited fine sediment may also result in reduced channel stability due to reduced channel capacity; increased water temperature, due to shallower, more readily heated channels; increased rates of sediment deposition in reservoirs, and increased cost of hatchery operations.

For eroded soil to be of consequence to water quality, it must be delivered to the stream channel. All watersheds are not equal in ability to transport eroded soil to a stream.

Thirteen watersheds have areas of channel instability or sediment related effects. They are Fall, Winberry, Quartz, Quartzville, Wiley and Hills Creeks and the Breitenbush, South and Middle Santiam, Calapooia, Middle Fork Willamette, Upper Middle Fork Willamette, and North Fork Middle Fork Willamette rivers. Seven of these watersheds are heavily influenced by other ownerships; Quartz and Wiley Creeks, and the Middle Santiam, South Santiam, Calapooia, Middle Fork Willamette and Upper Middle Fork Willamette rivers. All 13 of these watersheds currently support a wide variety of uses, ranging from domestic water supply to anadromous fisheries (see Figure III-E-4).

The presence or absence of large woody debris such as downed logs and limbs is an important factor in whether sediment inputs affect channel stability or aquatic habitat. If sufficient large woody debris is present, a stream may be able to accommodate an increase in sediment without suffering a decline in fish habitat (Heller et al. 1983).

Large woody debris provides a stream a means to dissipate the waters' energy; store needed sediment and fish spawning gravels; and scour pools (Keller and Talley 1979).

Large woody debris pushes flood water on to adjacent floodplain areas reducing the amount of damage to the stream channel. A stream that is lacking in large woody debris tends to be more uniformly broad and shallow with fewer pools and spawning gravel accumulations and is more prone to channel scour by flood flows (Keller and Talley 1979). A bedrock confined channel without large woody debris may scour down to an underlying bedrock pavement becoming devoid of habitat for most aquatic organisms.

In general, the mature stands of trees along the fish-bearing Class I and II streams on the Forest contain trees of sufficient size to provide large woody debris. Due to past practices, however, the amount of large woody debris within the streams has been reduced. Merchantable wood was salvage logged from streams and/or nonmerchantable material was removed to improve fish passage, minimize bank

erosion, and protect improvements such bridges and culverts. In addition, standing timber and snags, which would have been the most likely to fall into the stream to become large woody debris were salvage harvested particularly if they were in close proximity to a road (Stewart and Skeesick 1982).

As of 1981, approximately 39% or 1,313 miles of perennial Class I, II and III streams were adjacent to harvest units or roads (Stewart and Skeesick 1982).

As a result of these practices, most streams and rivers on the Forest are considered to be deficient in large woody debris volume and distribution. As a consequence, many have experienced channel scour and bank erosion during flooding and have reduced fish habitat quality and quantity compared to natural levels.

The Breitenbush River is currently being studied to determine the effects of past management of large woody debris and the options for future management. The Breitenbush River has a sensitive channel system comprised of small bedload material. Recently the river has tended to migrate across its floodplain, eroding streambanks, and causing damage to property and fishery values.

Two other areas on the Forest have exhibited similar tendencies. In 1983, Lyons and Beschta documented that deposition of sediment in the Upper and Middle Fork Willamette River above Hills Creek had resulted in the destabilization of the channel and that the effects still persisted. Wiley Creek and the Calapooia River have a similar problem; these two drainages contain only small proportions of Forest land.

In the Quartzville Creek, South and Middle Santiam River watersheds, aquatic habitat has been degraded in the main channel as well as in many tributary streams. Stretches of stream with sediment deposition and channel migration are common resulting in greatly reduced pool volume (Stewart and Skeesick 1982; stream surveys in Total Resource Inventory, Aquatic Subsystem Files; DEQ Report 1978).

Fall, Winberry, Hills, and Quartz Creeks and the North Fork Middle Fork Willamette River differ from the other drainages cited in that deposited sediment is not generally evident. In these drainages the presence of bedrock control on the channel, combined with a limited amount of large woody debris, has apparently provided a mechanism by which sediment is flushed from the stream system. These streams have higher turbidity levels and tend to be deficient in pool volume, as well as spawning gravel.

Future Trends

The greatest potential for increasing the usable supply of water at points of principal demand is through the increase in storage capacity of reservoirs. This approach allows for the delay of runoff until the time of greatest demand. The potential for additional water storage on the Forest does exist if new dams were to be constructed.

Existing dams could be upgraded to increase the production of electrical power (Klingeman 1980). In addition, an estimated 2,300 megawatts of power could be available 50% of the time with the installation of low head hydro-projects on many of the Forest's smaller rivers and streams (Klingeman 1979).

Recreation use of the surface waters is expected to increase by 10 to 25%. As a result, a shift in the distribution of experience level would occur because of an increase in the density of recreation users.

Water use potential is contingent upon water supply availability, development of water structures, and changes in the distribution of recreation experience levels. On-Forest water supply is expected to exceed

demand well beyond the planning horizon. Off forest, much of the water has been legally claimed, though it is likely that the claimed water rights exceed the actual use.

AIR

Air directly affects plant, animal and fish habitat, and contributes to the scenic and recreational attributes of the Forest and nearby communities. Clean air is a renewable resource, influenced by a number of factors including the weather, topography, and emission sources. The mountainous Forest lies approximately 80 miles east of the Pacific Ocean, between the Willamette Valley and the desert plateau of Central Oregon. The airshed is generally under the influence of maritime westerly winds.

Historic Trends

The condition of the airshed over and adjacent to the Forest has always been affected by smoke and odor from fires and to a lesser degree by dust from roads and unvegetated fields. Early in this century, many of the large catastrophic fires in Western Oregon had their origin in logging slash. In response to these timber operations related fires, the State of Oregon enacted stringent laws requiring private landowners to abate the slash resulting from logging activities. Thus, slash burning became an early forestry practice in Oregon.

Since the 1940s, prescribed fire has been extensively used to dispose of slash created from logging activities on the Forest and on lands adjacent to the Forest. Prior to the 1970s, broadcast burning during the fall was the predominant use of prescribed fire. Burning of machine and hand piled slash was also done to a lesser degree, but there was little use of prescribed fire to meet other land management objectives besides hazard reduction and site preparation.

Residents of the Willamette Valley expressed objections to the reduced air quality in the late 1960s and early 1970s. Burning of grass fields in the Willamette Valley was the original concern, but since most of the Forest slash burning was done in the fall and impacted the air quality of the Willamette Valley, it was also recognized as a contributor to the air quality problem. This concern resulted in State laws and smoke management practices which affected use of prescribed fire on forest lands including National Forest land.

The Oregon Smoke Management Plan was adopted by the Oregon Department of Forestry, federal land management agencies, and the Department of Environmental Quality (DEQ) in January of 1972. The objective of the Plan is "to keep smoke resulting from burning on forest lands from being carried to or accumulating in designated areas or other areas sensitive to smoke." The State Forester is responsible for the coordination and control of the Oregon Forest Smoke Management Plan.

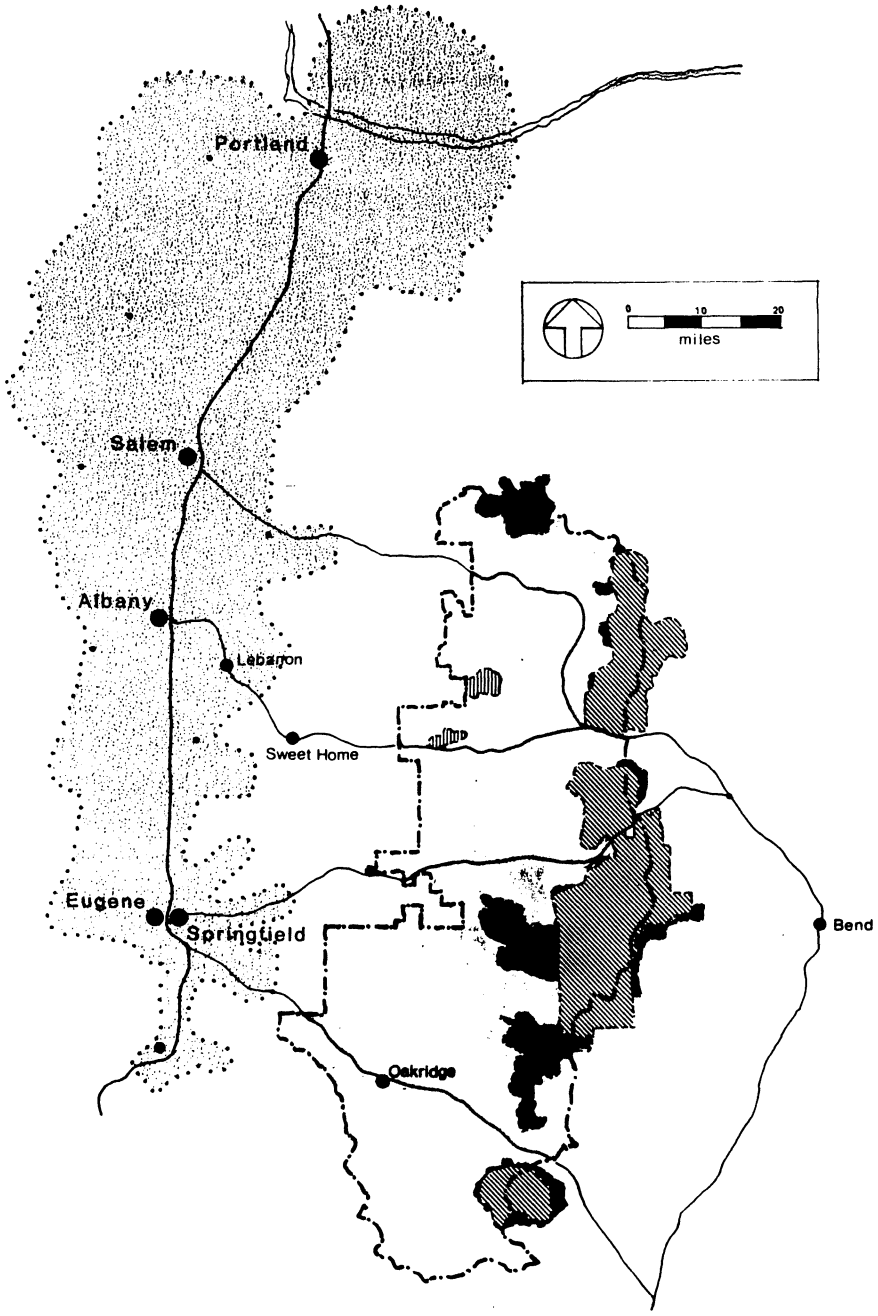
The Clean Air Act designated all National Wildernesses established before August 7, 1977, as Class I. Examples of the Wildernesses that are Class I are Mt. Jefferson, Mt. Washington, Three Sisters, and Diamond Peak. All other lands in the state including any Wilderness additions made after August 7, 1977, are assigned Class II status with the state having redesignation authority. Figure III-F-1 shows the Federally mandated Class I areas, new Wildernesses eligible for Class I re-designation and smoke sensitive areas adjacent to the Forest.

The Clean Air Act, as amended in 1977, directs Federal agencies to comply with state and local regulations directed at preventing and controlling air pollution. The 1977 Amendment includes provisions to prevent significant deterioration of air quality in Class I areas. Class I allows the least increase in air quality deterioration, while Class III allows the pollution levels up to the National Ambient Air Quality Standards to be considered acceptable. The baseline concentrations for particulate matter and sulfur dioxide are being established. There are no Class III areas in the state.

Figure III-F-1.

WILLAMETTE NATIONAL FOREST

Areas of Air Quality Concern



LEGEND

WILDERNESS:
Federally mandated Class I area.

WILDERNESS ADDITIONS:
Federally mandated Class II -- eligible for redesignation to Class I.

WILDERNESS ADDITIONS:
Class II areas 10,000 acres -- not eligible for redesignation.

DESIGNATED AREA:
Oregon Smoke Management Plan

Outside of the Designated Areas populated communities in the Willamette Valley and in Central Oregon are also considered smoke sensitive areas.

The identification of unacceptable impacts is accomplished through the formal process associated with the Prevention of Significant Deterioration requirements of the Clean Air Act Amendments of 1977. This law targets Class I areas for protection and preservation of the area's air quality from fixed point pollution sources. The Air Quality Related Values (AQRVs) are features or properties of a Class I Wilderness that are affected in some way by air pollution. These can include, but are not limited to, odor, fauna, flora, water, and visibility. The Forest has the responsibility to protect these values. Visibility and the deposition of acid rain in the high lakes are currently of concern. Both are being monitored to determine the level of acceptable change associated with protection of AQRVs. Very little information is available about the affects of acid rain on the Forest.

Current Situation

Smoke from prescribed burning causes the most notable impact to air quality over the Forest. Other agencies and private land owners including the Forest contribute to this temporary condition. Although these are recurring activities, the impacts are generally temporary in nature because of the prevailing wind patterns that cleanse the air in the valleys and mountains on a regular basis. Air quality impacts from other Forest management activities are also temporary in nature and may result from dust and vehicular emissions from logging operations, public travel on Forest roads, or chemicals used for the control of insects, diseases and vegetative management. In addition to the impacts generated by Forest activities, the air quality of the area is also impacted by field burning smoke and by wind-borne dust from lands located off Forest.

Figure III-F-2 displays the number of acres treated by burning, the estimated tons of fuel burned, and estimated tons of total suspended particulates (TSP) in the resulting smoke. Since 1979, the amount of fuels treatment has averaged 14,170 acres a year. Since 1981 the decline in acres burned has paralleled the decline in timber harvest. During this same period an increase in spring burning and various specifications for the piling of unmerchantible material have also contributed to a reduction in TSP emissions by reducing the total amount of material burned on harvest units.

Several areas outside the Forest are identified in the Oregon Smoke Management Plan as smoke sensitive or "Designated Areas" within the influence of the Forest. The Smoke Management Plan calls for minimizing smoke intrusions into high population centers of air quality concern such as the Willamette Valley and Roseburg. The Willamette National Forest prescribed burning program is also managed to avoid intrusions into the Bend and Redmond population centers. In addition, during the months from mid-July to mid- September, a priority burning system is implemented in Western Oregon. This reduces the amount of prescribed burning on Forest land during the time when the most acreage of grass seed fields is being burned in the Willamette Valley.

Visibility is monitored on a continuing basis in a cooperative effort by the DEQ, National Park Service, and the Forest Service. It is measured by atmospheric discoloration and change in visual range. Instruments located on Black Butte and near Big Lake monitor visibility for the Mt. Jefferson, Mt. Washington, and the Three Sisters Wildernesses. Air Quality in the Diamond Peak Wilderness is monitored at Cinnamon Butte. Data from this monitoring program indicated that prescribed burning was a significant contributor to visibility impairment. As a control strategy the Oregon State Implementation Plan imposes a prohibition on prescribed burning in the Central Oregon Cascades from Lane County north, except under specified conditions, from July 4 through Labor Day. The Forest has implemented a policy of no prescribed burning during this period without the prior approval of the Forest Supervisor. This prevents significant deterioration of the airshed during the heavy use period in the Mandatory Class I areas.

Table T007. Acres Treated by Burning (III-F-2)

Year	Broadcast Burn Acres	Pile & burn Acres	Total Acres	Tons Consumed [1]	Tons TSP [2]
1979	6,235	10,123	16,358	654,320	16,358
1980	7,038	13,056	20,094	803,760	20,094
1981	7,741	8,781	16,522	660,880	16,522
1982	4,803	7,497	12,300	492,000	12,300
1983	6,939	4,700	11,539	461,560	11,539
1984	6,706	4,171	10,877	435,080	10,877
1985	7,808	3,711	11,519	460,760	11,519
TOTAL	47,270	51,939	99,209	3,968,360	99,209
AVERAGE	6,753	7,420	14,173	566,909	14,173

[1]Based on Forest estimate of 40 tons/acre consumed for broadcast and pile burning.
[2]Based on 50 pounds of total suspended particulate (TSP) emissions per ton of fuel consumed (Ward, McMahon, and Johansen 1976).

Visibility is measured by atmospheric discoloration and change in visual range. Monitoring of the Diamond Peak Wilderness indicates that the visual range is quite good. Median summer ranges of visibility were from 90 to 102 miles. More study is required from this site. The other three Wildernesses showed a median visual range of 92 miles (DEQ 1985). Detailed monitoring data and other information about air quality is available through the DEQ Air Quality Division or at the Forest Supervisors Office in Eugene.

Air quality impacts from woodheating are different than those associated with prescribed burning of logging slash. Most of the wood that is burned as firewood comes from the surrounding forested lands. Wood is made available to residential woodheating users from logging residues, rather than being burned in a prescribed fire. As a consequence, air quality impacts shift to the urban setting. While slash burning generally creates a visibility issue over and adjacent to the Forest, woodstoves contribute to air quality impacts which are a human health concern. Smoke particles emitted from incomplete combustion of wood may have relatively high concentrations of compounds that are known and suspected carcinogens.

Winter air stagnation resulting in air pollution from woodstoves is an increasing problem in the populated valleys of the region. Firewood is usually burned in the winter during periods when colder air and temperature inversions occur. The location of burning shifts from generally higher altitudes, which are more favorable to dispersion and remote from other air pollution sources, to lower elevations with less dispersive conditions and in proximity to other pollution sources.

The Lane Regional Air Pollution Authority estimated that 92,000 cords of wood were burned locally in the Eugene-Springfield area in 1984. This was an increase of 30% over 1982 estimates. Two areas, Oakridge and Northwest Eugene, experienced violation of the secondary Federal standard of total suspended particulates in 1984. In December of 1985, there were violations of the primary standard (health-related). As of July 1, 1986, State law requires stringent emission controls on all wood burning stoves sold within the Oregon.

Future Trends

Since the mid-1970s there has been an increasing interest in utilizing residues as an alternative energy source or for other products. As a result, there has been some criticism of current slash burning practices because the perception is that a valuable resource is being wasted. The fossil fuel equivalent of the slash created on the Forest annually is around 3.4 million barrels of oil, which does represent a significant potential energy resource. In response to this issue and to internal concerns, the Forest, in cooperation with other government agencies and industries has initiated several pilot projects and studies to determine the feasibility and technology necessary to utilize wood residues economically. Utilization of logging residues is expected to increase as it becomes more economically feasible, thus reducing the amount of residue requiring removal. Utilization will continue to be balanced with the need to have vegetative material on site to ensure nutrient recycling and continued site productivity.

The number of acres treated through prescribed fire may be reduced in the future due to limitations imposed by air quality considerations. As a result of a reduction in burning, other more costly treatment methods may be necessary to reduce the amount of logging residues for site preparation and hazard reduction.

Smoke from residential woodheating will be more of a concern as more people use wood to heat their homes. This wood smoke along with automobiles and industrial emissions will continue to create health hazards during periods of air stagnation.

In the near future, there will be regulations covering fine particulates, redesignation of Wilderness Class II to Class I, inventories of values associated with AQRVs, air pollution source identification, pollution damage determination, and establishment of limits of acceptable change in air quality. Research will determine how to reduce emissions.

Visibility will improve by implementation of current regulations and as regulatory smoke management requirements become more strict. Overall, emissions from prescribed burning are expected to remain at or below current levels.

VEGETATION

The vegetative cover of the Forest provides habitat for wildlife and protection to streams and rivers while stabilizing soil, producing oxygen and humidity, and serving as a vast storehouse of energy. Plants modify the air temperature by providing protection both from the summer heat and the winter cold and wind. The lush richness on the plants on the WNF provide an outstanding array of recreational settings.

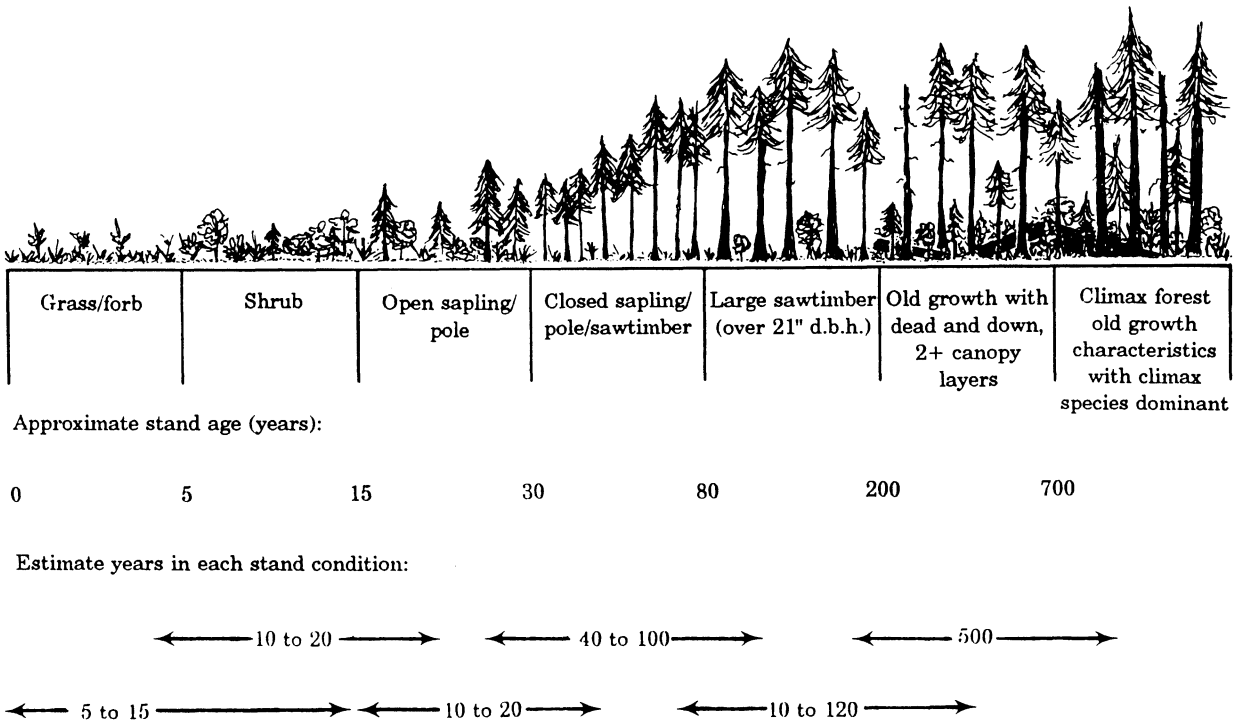
Plant populations which have existed on a site for a long period have come into balance with, and are useful indicators of, their environment. Classification of long-term, stable plant communities, combined with soils information, is a tool for evaluating site productivity and determining future implications for management.

This section of Chapter III discusses plant communities, riparian zones, old-growth, and threatened, endangered and sensitive plant species on the Forest. Timber and its use as a commodity resource is described in Chapter III, Timber.

Plant Communities

There are a number of plant communities on the Forest including those within coniferous forests, meadows, subalpine and alpine parklands and wetlands. Succession is the natural process by which one plant community or stand condition changes into another. (See Figure III-G-1, Successional States.) As Forest tree species develop and mature, whether they are deciduous or coniferous, the canopies close and herbs and shrubs that require direct sunlight start disappearing. Temperature, moisture, light, and available nutrients are the factors which determine those plants which can most effectively occupy a site. After a relatively long, disturbance-free period, only those plants which can grow and reproduce in competition with their neighbors remain. On the WNF old growth conditions may develop in undisturbed stands long before development of a climax forest occurs. Unless modified by disturbance, the growth of vegetation continues until the climax stage is reached. Climax forests rarely occur in the Pacific Northwest. Although catastrophic natural disturbances are relatively infrequent pioneer conifer species can be very long lived (Hemstrom 1979, Henderson and Peter 1981, Burke 1979, Morrison 1984).

Figure III-G-1. Successional States



Successional pattern of stand conditions after clearcutting and broadcast burning.

The vegetation of the Forest can be grouped into five major coniferous series and several other series which are dominated by grasses or shrubs. The coniferous series are characterized by both trees and understory vegetation. Within each series, there may be several plant communities or associations. These plant associations are indicators of distinct vegetative response and site productivity. For a detailed description of plant associations and their implications for resource management reference the *Preliminary Plant Association and Management Guide* for the Forest (1987).

The following descriptions of the vegetative series on the Forest rely on Hemstrom, Logan, and Pavlat (1987) and Franklin and Dyrness (1973). Plant distribution is dependent upon a number of factors including species characteristics, precipitation, temperature, and landscape patterns.

The Douglas-fir series occurs on warm, relatively dry sites across the Forest. This series is a northern extension of the Sierran mixed conifer forests common in the southwestern Oregon Cascades, Siskiyou Mountains, and Sierra Nevada Range (Franklin and Dyrness 1973). The Douglas-fir series is rare north of the McKenzie River, occuring only on steep, south-facing slopes with thin, rocky soils (Means 1980). South of the McKenzie River, climax Douglas-fir sites are relatively common at lower elevations on southerly exposures, especially in the Rigdon Ranger District. The major climax tree species include incense cedar and grand fir, but Douglas-fir generally dominates both the canopy and regeneration layer. Western hemlock is scarce or absent. Important species include: Douglas-fir, incense cedar,

sugar pine, ponderosa pine, big leaf maple, oceanspray, poison oak, tall Oregon grape, dwarf Oregon grape, salal, whipple vine, grasses, snow queen, yerba buena, and others typical of Southwestern Oregon.

The Douglas-fir series occupies the driest environments capable of supporting closed forests on the Forest (see Means 1980 for a more extensive discussion). High summer temperatures increase environmental stress. Precipitation is relatively low (45 inches from November to May). Winter snow is usually transient. These factors add up to a long, dry, warm growing season. On the driest sites, conifer canopies give way to open woodlands of Douglas-fir, Oregon white oak, pines, and grasses.

On slightly more moist sites, the Douglas-fir series melds into the western hemlock series. In this transition area, grand fir and western hemlock are co-climax on many sites south of the McKenzie River. This transition area comprises the grand fir series. Franklin and Dyrness (1973) did not consider grand fir climax types separately from the rest of the mixed conifer zone in Southwestern Oregon. Several grand fir plant associations were separated from the Douglas-fir and western hemlock series because grand fir appears to be the dominant climax species and grand fir series have often been described in Southwestern Oregon (Atzet and Wheeler 1984) and east of the Cascade Crest. Climatic information is generally not available, but conditions should be intermediate between the Douglas-fir and western hemlock series.

The grand fir series most frequently occurs on relatively dry, south-facing slopes and excessively well-drained river terraces. It extends into upper elevations south of the McKenzie River, where it mixes with the Pacific silver fir series. Important species include a mixture from the Douglas-fir series, the western hemlock series, and the Pacific silver fir series.

The bulk of lower elevation forests fall into the western hemlock series. In the Cascades, the western hemlock series extends from British Columbia south to the divide between the North and South Umpqua rivers (Franklin and Dyrness 1973). Important species include: Douglas-fir, western hemlock, western redcedar, big leaf maple, vine maple, dwarf Oregon grape, salal, rhododendron, swordfern, vanilla leaf, oxalis, twinflower, and redwoods violet.

Climatic conditions of the western hemlock series reflect a strong maritime influence, with mild, wet winters and relatively dry, sunny summers. Temperatures range from slightly below freezing in winter to 90 to 100 degrees Fahrenheit in summer. Precipitation amounts vary from about 60 to over 100 inches per year, mostly falling as rain or snow in the winter. Winter snowpacks are not usually deep nor long lasting.

The Pacific silver fir series occurs on the western slopes of the Cascade Range from British Columbia south to near the southern end of the Forest (Franklin and Dyrness 1973). The Pacific silver fir series dominates upper-slopes (3,000 to 5,500 feet) on the Forest mixing with the mountain hemlock series at the higher elevations. Important species include: Douglas-fir, noble fir, Pacific silver fir, mountain hemlock, western hemlock, lodgepole pine, vine maple, dwarf Oregon grape, big leaf huckleberry, Alaska huckleberry, rhododendron, grouse huckleberry, Cascades azalea, foamflower, false solomon's seal, queencup beadlily, dogwood bunchberry, sidebells pyrola, and beargrass.

Most of the annual precipitation in the Pacific silver fir and mountain hemlock series falls in winter and accumulates as a deep snow pack at upper elevations. Mean maximum air temperatures usually occur in August and range from about 75 degrees Fahrenheit to about 63 degrees Fahrenheit at the transition to the mountain hemlock series. Growing seasons are short at upper elevations and summer frost frequently occurs in openings, particularly on gentle topography (Halverson and Emmingham 1982). Moisture stress can be higher in seedlings planted in cold soils because root growth and function are impeded (Halverson and Emmingham 1982).

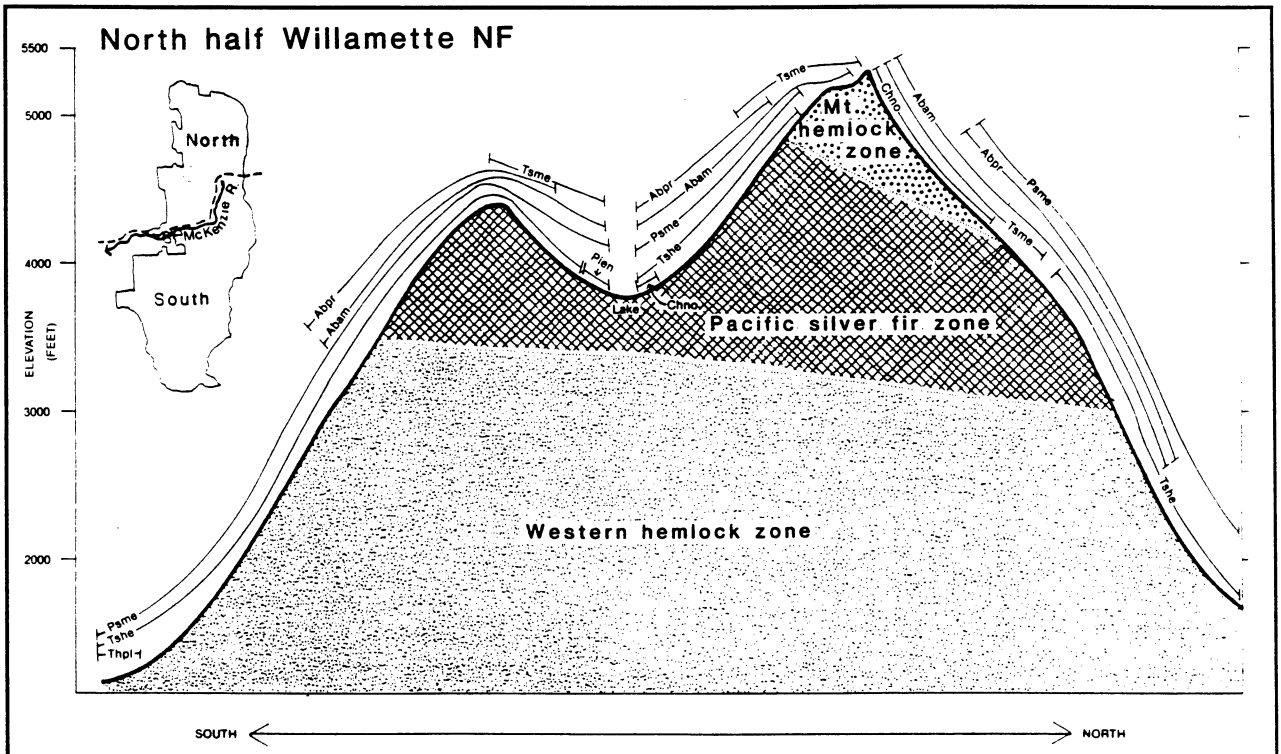
Shrub and herb distributions change gradually from the north to the south end of the Forest. Fool's huckleberry and Cascade azalea are uncommon south of the North Santiam River and rare south of the McKenzie River. Devil's club is not widespread south of the McKenzie River (except in the Little Fall Creek drainage on the Lowell Ranger District) but is relatively common on the Detroit and Sweet Home Ranger Districts. Species characteristic of dry sites in the Douglas-fir series are locally common on the Rigdon and Oakridge Districts but rare farther north. Most notable among these are ponderosa pine, sugar pine, incense cedar, tall Oregon grape, poison oak, and whipple vine.

Nonforest types vary from small meadow openings in a forest matrix to rock cliffs, avalanche chutes, and extensive alpine and subalpine parklands. In general, stable nonforest communities indicate extreme environmental conditions: extremely rocky substrates, extremely dry or wet areas, extremely severe winter conditions, etc. Some nonforest openings are the result of disturbance in otherwise forested conditions. In these cases, down logs, abundant charred wood or other signs of the previously existing forest are usually present. Some openings may be the result of heavy domestic livestock grazing; others were caused by humans who controlled the tree or shrub vegetation. Historically their primary use was to feed livestock, particularly sheep (i.e., Mutton Meadows and Rigdon Meadows). Now elk and deer feed in these meadows.

There are two kinds of wetland communities. Soils supporting these communities are saturated with moisture a major part of the year. Herbaceous wetlands have less than 60% woody cover and are generally dominated by rushes, sedges, and grasses. Hardwood and shrubby wetlands have more than 60% woody cover commonly dominated by alder, bigleaf maple, willows, or black cottonwood. The amount of woody vegetation is an important wildlife habitat characteristic. (See Riparian in this section.)

The north half of the Forest has a distinctly different distribution of conifer species from that south of the McKenzie River. (See Figure III-G-2.) At the south end of the Forest, species representative of the Sierran mixed conifer zone (Franklin and Dyrness 1973) become common. Most species shifts relate to precipitation and temperature patterns. For example, vegetation of the Oakridge and Rigdon Ranger Districts reflects significantly drier climatic conditions than those farther north. The Pacific silver fir series is not as widespread on these Districts and is often replaced by grand fir and Douglas-fir series on south-facing slopes. Alaska cedar is restricted to high elevation cirques and cold air drainage areas at the south end of the Forest but is more widespread on the Detroit Ranger District.

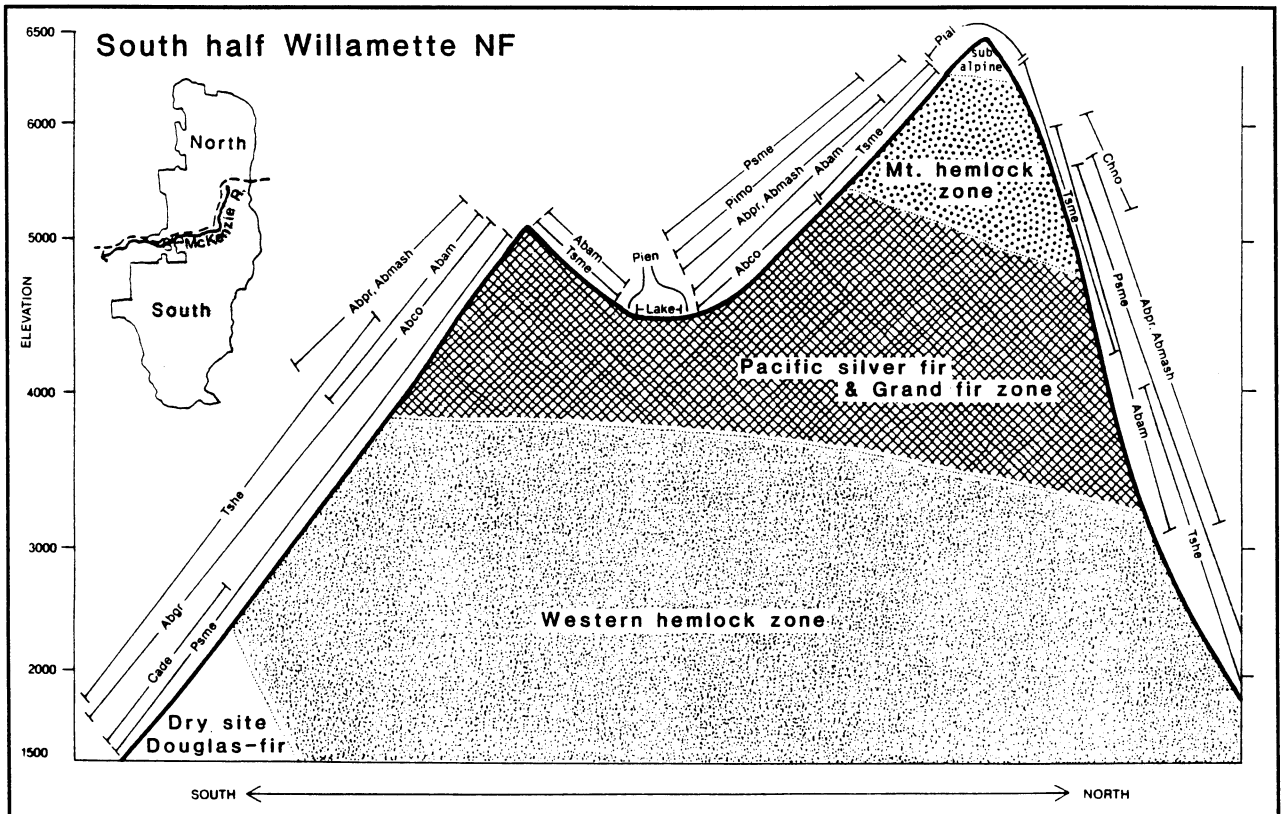
Figure III-G-2. North/South Vegetation Variation



Distribution of important conifers on south-facing and north-facing slopes at different elevation

Codes	Scientific Name	Common Name	Codes	Scientific Name	Common Name
ABAM	Abies amabilis	Pacific silver fir	PIEN	Picea engelmanii	Engelmann spruce
ABCO	Abies concolor	White fir	PIMO	Pinus monticola	Western white pine
ABGR	Abies grandis	Grand fir	PSME	Pseudotsuga menziesii	Douglas-fir
ABPR	Abies procera	Noble fir	THPL	Thuja plicata	Western redcedar
CHNO	Chamaecyparis nootkatensis	Alaska cedar	TSHE	Tsuga heterophyiia	Western hemlock
PIAL	Pinus albicaulis	Whitebark pine	TSME	Tsuga mertensiana	Mountain Hemlock

Figure III-G-2 Cont. North/South Vegetation Variation



Distribution of important conifers on south-facing and north-facing slopes at different elevations

Codes	Scientific Name	Common Name	Codes	Scientific Name	Common Name
ABAM	Abies amabilis	Pacific silver fir	PIAL	Pinus albicaulis	Whitebark pine
ABMASH	Abies magnifica shastensis	Shasta red fir	PIEN	Picea engelmannii	Engelmann spruce
ABCO	Abies concolor	White fir	PIMO	Pinus monticola	Western white pine
ABGR	Abies grandis	Grand fir	PSME	Pseudotsuga menziesii	Douglas-fir
ABPR	Abies procera	Noble fir	TSHE	Tsuga heterophylla	Western hemlock
CADE	Calocedrus decurrens	Incense cedar	TSME	Tsuga mertensiana	Mountain hemlock
CHNO	Chamaecyparis nootkatensis	Alaska Cedar			

Disturbance, or lack of it, may be the determining factor in the development of a plant community toward climax but more often it affects the structure of that community. Wildfires started by lightning and trees blown down by severe isolated windstorms have always been a part of the natural cycle affecting the structure of plant communities on the Forest. Flooding, landslides, volcanic activity, and snow avalanches are other natural disturbances that have significant but more local impacts on plant community structure. Although such events may appear catastrophic at the time they occur, they too are a part of the natural cycle responsible for the plant communities that exist on otherwise undisturbed areas.

In Western Oregon, and on the Forest, the mix of plant communities and stand conditions within communities varies considerably, often over relatively short distances (Maser et al. 1981). Outside of designated Wilderness much of this variation results from timber production and harvest activities.

Human activities have created a mosaic of different aged vegetation and altered plant structure over vast acreages.

The structure of a plant community may be determined either by the physical growth characteristics or by the size and age of plant species making up the community. For example, a grassland plant community provides completely different habitats than does a Douglas-fir community in its mature stage, but the same forest community in the grass/forb condition with fully stocked Douglas-fir regeneration provides habitats very similar to the grass land plant community. Forest plant communities, when altered by timber management programs, exhibit a variety of stand conditions.

Stand condition is the size, density, and species composition of a plant community after disturbance and at various time intervals following the disturbance. The grass/forb stand condition follows clearcutting or intense wildfire; trees such as Douglas-fir, are only 1- to 5-years old. The open sapling/pole stand condition may have many of the same plant species as the grass/forb stand condition, but it has trees larger than 1 inch d.b.h. (diameter breast height) and less than 60% crown cover. (See Figure III-G-1) Also see Figure III-W-9, Tentatively Suited Acres by Size Class, for tree size classification.

The following descriptions of stand conditions and time intervals are based on conditions that normally develop after broadcast burning clearcut units. Modifications of these descriptions may be required when used with other silvicultural treatments or plant communities.

The grass/forb stand condition lasts 2 to 5 years and occasionally 10 years. After timber harvest and/or slash removal, a unit may be largely devoid of vegetation for the first growing season. Resident herbs and new plants quickly dominate the site and give the unit a grass-forb appearance. Invading pioneer species are often non-native plants. The spread and establishment of noxious weed species is often associated with activities which result in the exposure of mineral soil. Shrubs and trees that sprout or are planted are not yet dominant. Seeding for erosion control or forage production may alter the species composition typically found in this stage. The grass/forb stage may also be prolonged where seeding of preferred species occurs. Brush species that colonize disturbed areas from seed may also be reduced.

The shrub stand condition often lasts 3 to 10 years but may remain for 20 to 30 years if tree regeneration is delayed. Shrubs become the dominant vegetation, providing a different habitat type for wildlife. Tree regeneration may be common, but trees are generally less than 10 feet tall and provide less than 30% of the crown cover. Past management has included reducing competitive vegetation to allow conifers to grow. Some shrub species may be pruned to produce more browse during this period.

The open sapling/pole stand condition occurs when trees exceed 10 feet in height but still have less than 60% crown closure when they reach 1 inch d.b.h. A dominant shrub understory is common. This open sapling/pole condition is very different from closed sapling/pole where crown closure exceeds 60% at one inch d.b.h. or larger. The open sapling/pole stage may be bypassed if initial tree densities exceed 400 trees per acre. In addition, open sapling/pole can be the first stand condition after overstory removal in shelterwood regeneration. The grass/forb and shrub stand conditions may be bypassed because residual tree cover does not create adequate openings, and broadcast burning is rarely used to set succession back. Thus, little mineral soil is usually present for the establishment of herbaceous vegetation. On the other hand, the open sapling/pole stand condition can be maintained or created with thinning. Length of time in this condition depends on crown closure and subsequent stand treatment. It may last from 8 to 20 years.

Closed sapling/pole/sawtimber stand conditions have one item in common - very little ground vegetation because of a closed canopy. Tree crown closure will exceed 60% and often reaches 100%. Length of time in this stand condition can range from 40 to 100 years. The time is determined by rotation age

and thinning treatment. If stands are thinned and long rotations used, this stand condition can change to large sawtimber or eventually old-growth.

The large sawtimber stand condition is characterized by trees with an average d.b.h. of 21 inches or larger. Conifers usually exceed 100 feet in height, and crown closure is generally less than 100%, permitting the development of ground vegetation. With this stand condition under intensive timber management, diameters of trees may approach diameters of old-growth but the very large snags and high volumes of large down material characteristic of old-growth will be lacking. Natural large sawtimber stands can have nearly as much standing and down woody material as old-growth stands. Duration of this stand condition in managed forests is determined by rotation age and thinning treatments. If mortality and decay are regularly prevented by thinning, this condition lasts for many years; but such a stand will lack the snag component necessary for cavity nesters and the down woody material essential to long term soil productivity and habitat for many wildlife species.

Old-growth stand conditions are characterized by decadence of live trees, snags, down woody material, and replacement of some of the long-lived pioneer species such as Douglas-fir by climax species such as western hemlock. Stands often have two or more layers with large diameter overstory trees commonly older than 200 years. Crown closure is normally less than 100% (Franklin et al. 1981). This definition and reference is consistent with the Regional Guide and is presented in more detail under number three, Old-Growth, later in this section.

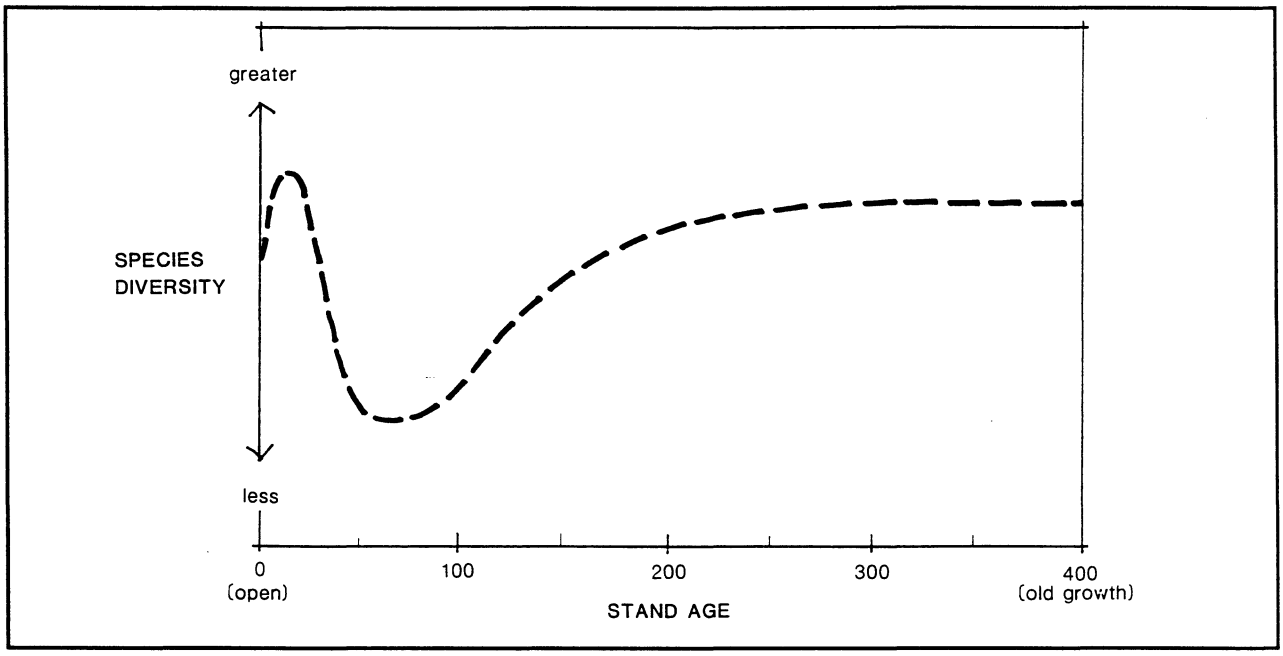
Shelterwood cutting generally does not generate the same kind of vegetative response as does clearcuting. A shelterwood is often designed to modify the microclimate of a site by retaining tree cover to enhance tree regeneration. This type of treatment is used more often in the Douglas-fir series where shading and seed fall are important to regeneration; and Pacific silver fir and mountain hemlock series where cold temperatures and soil are limiting. In some cases, advanced tree regeneration of climax species may comprise a majority of the seedlings. The shelterwood overstory is removed before the residual vegetation reaches the open sapling/pole stage, completely bypassing the grass/forb stage. As trees and vegetation grow and develop they display different characteristics. For example: between the open sapling/pole to the closed sapling/pole stage both plant and animal diversity sharply decrease; then as the trees and vegetation reach the large sawtimber and old-growth stages both plant and animal diversity again increase.

Vegetative Diversity

Diversity can be discussed in terms of richness (i.e., the variety of species) and evenness (i.e., the relative population levels of each species). In general, the early successional stages (grass/forbs) have the greatest diversity of plant species, but are dominated by a few species that are adapted to open conditions. The old-growth stands also have a variety of species present, but are dominated by species adapted to that environment. Stands of smaller trees around 50 years old have the least variety of species.

Figure III-G-3 shows the general relationship of species diversity and stand age. As a stand moves from an open condition into the grass/forb/shrub stage, there is an increase in the number of species. As shrubs and young trees begin to dominate, the canopy begins closing and blocks out the sunlight reaching the ground. This results in a fairly rapid decrease in the number of species as the less shade tolerant species die out. Management practices, such as commercial thinning, can mitigate this decrease by opening up the canopy and allowing more light to reach the ground. As a forested stands age and develop into the large mature tree stage, the canopy starts to open up. Diversity increases through this stage and then maintains a consistent, high level through the old-growth stage.

Figure III-G-3. Diversity by Stand Age (From Figure IV-4-1)



From a forest-wide standpoint, the greatest diversity would occur with a mix of old-growth and forest openings. This would provide habitat for species adapted to old-growth, and species adapted to all other stages, as well as those species that are adapted to the mixed environment of habitat block edges. The current Forest condition has about 36% of the forest in old-growth and mature stands of timber.

Riparian Zones

In the Forest, most riparian zones occur along streams and rivers. Riparian ecosystems, aquatic ecosystems, wetlands, lakeside zones, and floodplains will be jointly referred to as riparian zones. The terms "riparian zones" and "riparian areas" are used interchangeably in this chapter, but by strict ecological definition, they may not be the same in all instances. Figure III-G-4 displays the estimated acres of riparian habitat on the Forest.

Table T008. Riparian Habitat (III-G-4)

Stream Class [1]	Total (Miles/No.) [2]	Average Width (ft.)	Water Surface Area (ac.)	Riparian Width (ft.) [3]	Riparian Habitat (ac.)
I	426	42	2,168	400	20,650
II	940	14	1,595	200	22,800
III	1,295	[4]	[4]	200	31,400
IV	6,621	[4]	[4]	[5]	[5]
Lakes	270/391	--	11,233	150	4,910
Reservoirs	8	--	11,250	[5]	[5]
Wetlands [6]	--	--	--	--	23,950
TOTAL	--	--	26,246	--	103,710

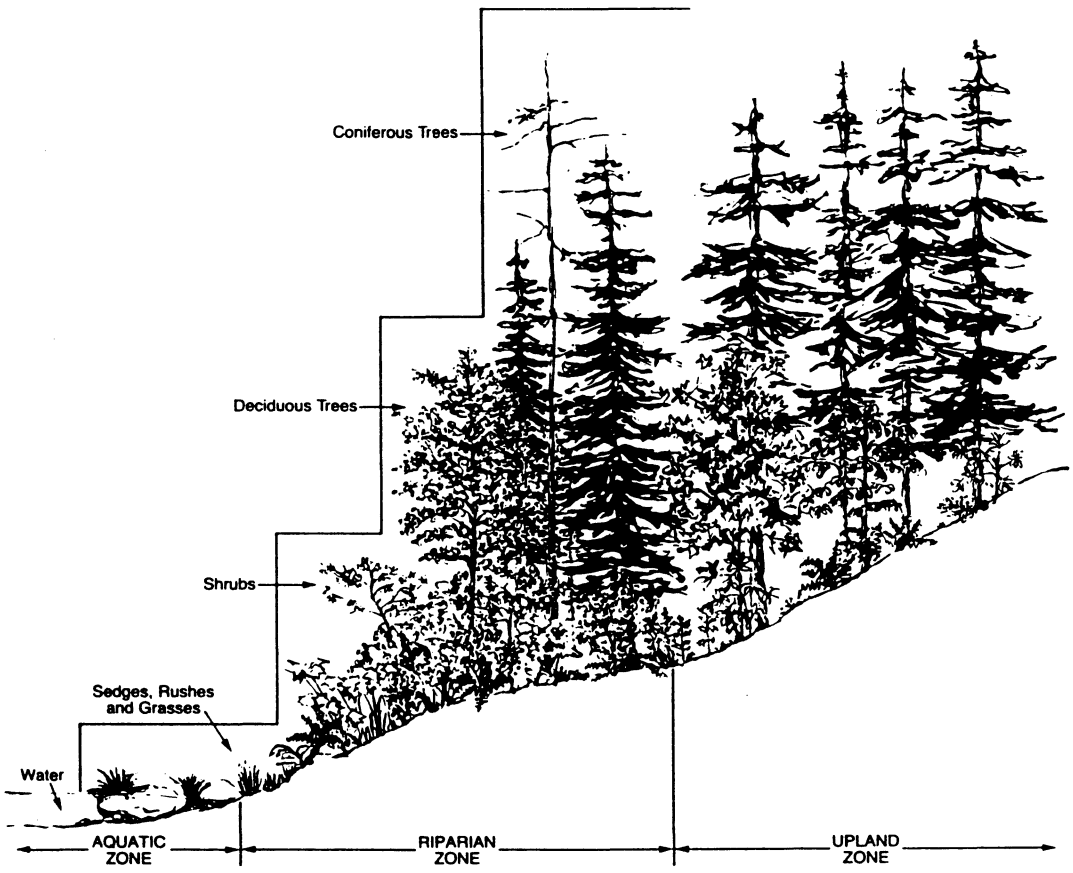
[1] Refer to Chapter III Water for Stream Class descriptions.
[2] Stream miles from FORPLAN data base. Lake length is for shoreline.
[3] Riparian widths were taken from the riparian area process paper, Land and Resource Management Planning, March 4, 1983.
[4] These streams are less than 5 feet in width on the average and no surface area was computed.
[5] Value not determined.
[6] Area of wetlands is taken from the Soil Resource Inventory (SRI) layer the Land and Resource Management Planning Data Base for Soil Resource Inventory, soil type 6.

There are five important elements that define the character and function of the riparian zones. They are topography, vegetation, surface water, soil, and local climate.

Topography often determines the space available for the development of riparian or wetland plant communities. It is a primary indicator of the type, frequency, and magnitude of erosion/deposition processes occurring in an area. It may have a major influence on local climate, particularly sunlight, temperature, and wind. Topography may strongly influence the occurrence and relative effect of various upslope disturbances such as wind-thrown trees, or landslides. Topography also determines the capability of the riparian zone to support many types of uses.

Figure III-G-5 illustrates the structure of riparian zone vegetation. In small streams on the Forest the dense riparian vegetation consists of deciduous shrubs and small trees and develops in 1 or 2 decades. Beyond that point in development, upslope conifers begin to overtop the deciduous streamside vegetation. Stands that are 50 to 150 years old have a dense canopy of deciduous trees with little understory vegetation. Older stands have a multilayered structure, and more light penetrates to the stream. Pioneer species include willows on gravel bars and red alder on mineral soil.

Figure III-G-5. Riparian Zone Vegetation



Riparian zones have vegetation that requires large amounts of free or unbound water and are transitional between aquatic and upland zones.

There is great variability in both the size and vegetative complexity of riparian zones because of the many possible combinations between stream gradient, elevation, soil, aspect, topography, water quantity and quality, type of stream bottom, and plant community (Campbell and Franklin 1979, Odum 1971, Swanson et al. 1981. Walters et al. 1980). Numerous habitats and niches occur within most riparian zones because of these varying conditions. Any of the plant communities found on the Forest can occur in riparian zones. The natural succession of vegetative types following major disturbances such as floods, fires, or logging, determines the kinds of vegetation occurring in a riparian zone at any given time.

Vegetation has numerous functions in riparian zones and wetlands. The number and type of wildlife habitats present in riparian zones are determined to a large degree by vegetative characteristics. For example, where riparian zones are dominated by deciduous vegetation, they provide one type of habitat in late fall and winter after leaf fall, and a different type of habitat during late spring and summer when in full leaf. Such species as the yellow-bellied sapsucker, downy woodpecker, ruffed grouse, and

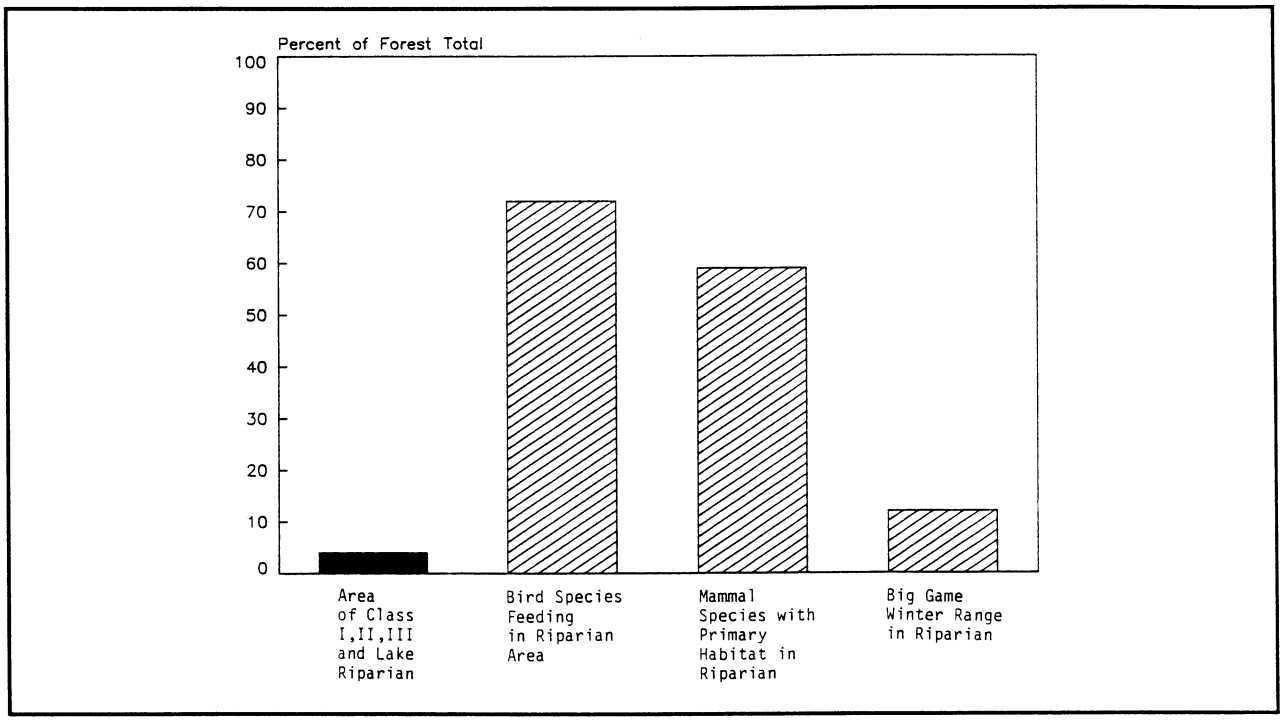
red-breasted nuthatch are highly dependent on deciduous riparian areas. Vegetation also stabilizes soil and streambanks and provides nutrients to the soil. On small to moderate-sized streams, leaves and debris (litter) provide the primary source of energy for the aquatic system (Franklin et al. 1981). Large dead and down trees store nutrients, provide seed beds for various tree species, provide habitat for various wildlife and, when incorporated into the stream, enhance channel stability (Franklin et al. 1981, Swanson et al. 1976). Large downed trees provide a stream a means to dissipate the water's energy; store needed sediment and spawning gravels for fish and, scour pools (Keller and Talley 1979). Large downed trees push floodwater on to adjacent floodplain areas, reducing the amount of damage to the stream channel. Large downed trees are the principal source of aquatic habitat diversity (Harmon et al. 1986). Productive fish habitats and good water quality depend on well-developed vegetative communities in riparian zones.

The presence of surface water during all or part of the year is a common characteristic of riparian zones and wetlands. The character of the surface water--whether standing (lakes, ponds, marshes, etc.) or running (streams and rivers), and whether perennial or intermittent--plays an important role in the function of these areas. The character of surface water directly controls the type of aquatic habitat, the composition and diversity of vegetation, and its potential use by wildlife, livestock, and people. Due to increased humidity, a higher rate of transpiration, shade, and greater air movement, riparian zones have different microclimates from surrounding coniferous forests. These conditions are preferred by some wildlife species, as well as by people, during hot weather.

Although riparian zones occupy only a small part of the overall area of the Willamette National Forest, they are a critical source of diversity within the forest ecosystem. The presence of multiple vegetation layers provides a variety of nesting sites, cover areas, and food sources associated with vertical diversity. Riparian areas often create distinct habitat zones within the drier surrounding areas. In addition, riparian zones are elongated (horizontal diversity) in shape with very high edge-to-area ratios (Odum 1979). They therefore possess a high degree of connection with other habitat types and function as effective transport systems for water, soil, plant seeds, and nutrients to downstream areas (Ewl 1979). Riparian zones also serve as important travel routes for the movement or dispersal of many wildlife species. Wildlife and livestock utilize vegetation in riparian zones more heavily than in other areas because they concentrate here for water, shade, and succulent forage. Figure III-G-6 displays the proportion of wildlife use in riparian areas.

Riparian zones are important for many other types of land use. Highly productive timber sites frequently occur along streams and around wetlands or lakes. Riparian zones are used for road locations, particularly in mountainous, rugged terrain. Rock and gravel for building roads have been taken from streambeds and their banks as well as from floodplains. Recreationists concentrate their use in wetland and riparian areas where scenic values are high. Up to 80% of the Forest's dispersed recreation use occurs in the riparian zone (Clark et al. 1984). Riparian zones are preferred for recreational developments such as campgrounds and summer home sites. Because of these conflicting uses, riparian zones are recognized as critical areas in multiple-use planning.

Figure III-G-6. Proportion of Wildlife Use in Riparian Areas

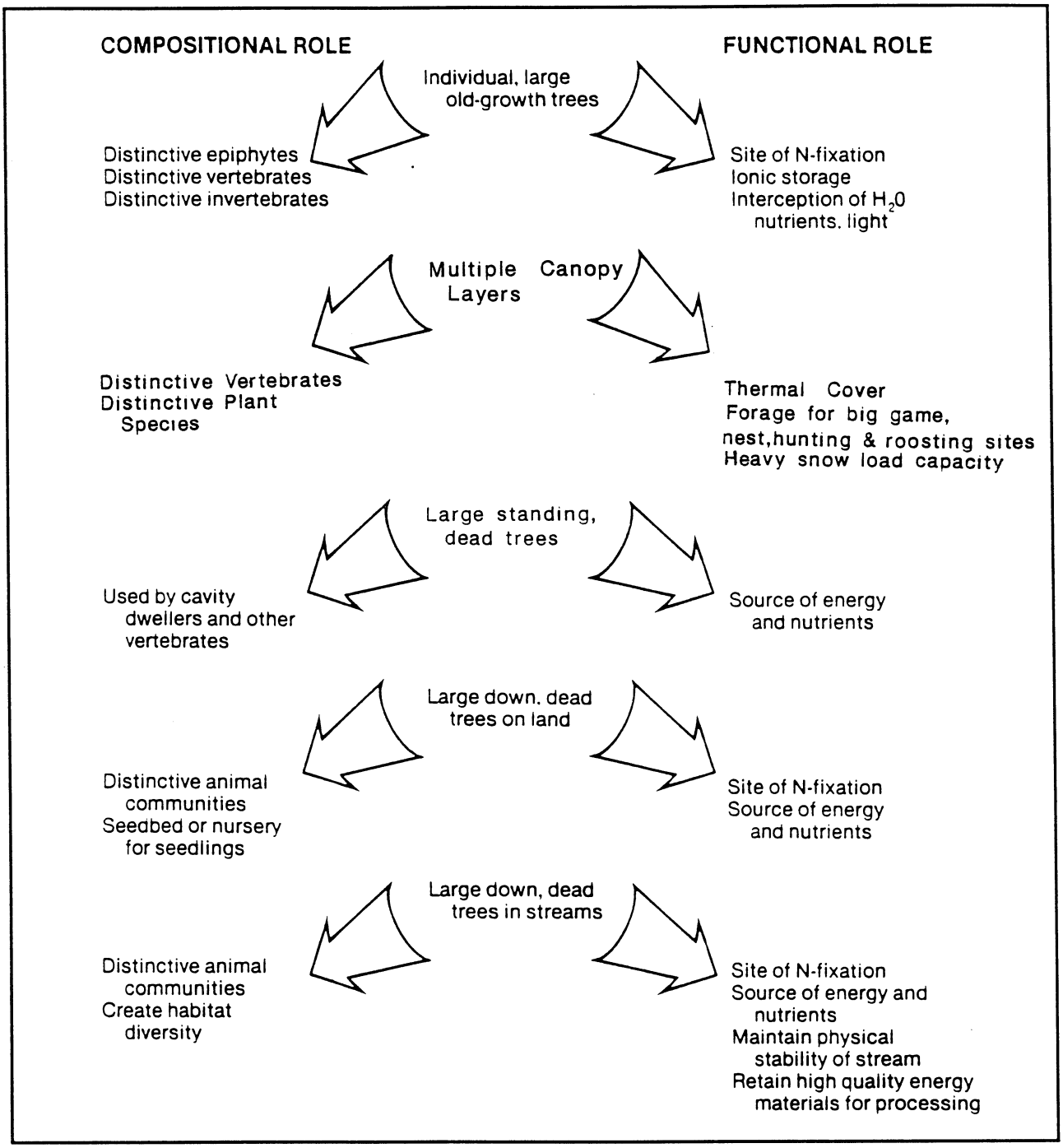


Old Growth

Each tree within an old-growth stand plays a progression of roles, from the time it matures until the tree becomes a decaying contributor to the forest floor. Examination of the data from the 1988 Mature and Over Mature Survey (MOMS) indicates that about 594,800 acres of the Forest are covered by old-growth under the Regional Guide definition. This accounts for 36% of the total Forest. Of the total acres of old-growth trees, 78% is in the low elevation Douglas-fir type and the remaining 22% is split among the three high elevation types as follows: Douglas-fir/true fir and true fir combines for about 16%; and mountain hemlock equals 6%.

Five structural components are of key importance in an old-growth stand. These are the individual, live, old-growth trees; the multilayered understory of younger trees; the large, standing dead trees or snags; the large, dead, down trunks or logs on the land; and those that are a part of the stream ecosystem. It is these structural features that are unique to an old-growth forest ecosystem, setting it apart from young growth and, especially from managed stands. Most of the unique or distinctive compositional and functional features of old-growth forests can be related to these structural features. (See Figure III-G-7.) These structural components make possible much of the uniqueness of the old-growth forest in terms of flora and fauna (composition) and the way in which energy and nutrients are cycled (function).

Figure III-G-7. Structural Components of Old-Growth



The old-growth ecosystems are represented mostly in the western hemlock series and the Pacific silver fir series. The Douglas-fir old-growth stand is the intermediate stage of the western hemlock series and is the most common form of old growth on the Forest. It is defined by the Regional Guide, R-6 (1984) as any stand generally containing the following characteristics:

1. Two or more species with several age classes.

2. Five or more overmature trees per acre, with at least some Douglas-fir that are bigger than 32 inches in diameter.

3. Stands will usually contain a multi-layered canopy.

4. Two or more conifer snags per acre.

7. Thirty or more tons per acre of down logs.

In addition to stand characteristics, there are other forest characteristics that affect the quality of old growth. Old growth values vary with stand size. Large, contiguous blocks will have core areas that are not affected by edge effects and serve as higher quality old growth habitat. These stands will contain a higher diversity of old growth typical species and will be less susceptible to catastrophic events like blowdown. Small, isolated clusters of old growth serve as important gene pools and seed sources that are site specific. They may also serve as valuable "stepping stones" for wildlife species dispersing from other old growth blocks.

Fragmentation is the increasing amount of edge, loss of contiguity and increasing isolation of habitat patches following disturbance. With old growth this is shown by the number of isolated blocks, the amount of edge/total area within individual blocks and the distance between blocks. Wilderness and roadless areas tend to be less fragmented than general forest, due to limits in logging activities, however the smaller, high elevation timber types found in many wilderness areas on the Forest may be highly fragmented by terrain, extreme weather conditions and other natural disturbances.

A third forest characteristic that directly affects old growth is isolation. This involves the distance between patches and the condition of the intervening stands. Landscape patterns that result in "stepping stones" and corridors minimize isolation. This is important for genetic interchange, wildlife dispersal and movement and increased habitat diversity at the local level.

Large organic debris from old-growth forests has a major influence on the physical characteristics of the small stream (Class IV see Water) systems. Large accumulations of woody debris have resulted in complex aquatic environments of riffles, pools, runs, glides, and side channels. The debris has added stability to stream channels and retarded the rate of downstream flow.

In Class III streams (see Water) large woody debris is common and may cover from less than 25% up to 50% of the channel area. The canopy in the undisturbed state provides continuous shading. Energy of water flowing in the channel is continually dissipated by woody material and vegetation, reducing erosion and leading to deposition of organic and inorganic material. As streams get larger, there is less direct influence of old-growth (Franklin 1981).

Optimum wildlife habitat in old-growth stands as described by Franklin et al. (1981), specifically requires a component of pioneer Douglas-fir mixed with western hemlock. The old-growth Douglas-fir has crown and bark characteristics quite different from western hemlock. These features of Douglas-fir are highly significant as habitat for certain wildlife species (see Wildlife) such as bats and the western red-backed vole.

Harvesting of old-growth stands has been of major importance to the timber industry in the Pacific Northwest for several decades. The challenge of yarding these large logs over steep, mountainous terrain while protecting the other resources like soil and water, has resulted in technological advances

such as long span skyline, balloon and helicopter logging systems. The high value of the old-growth wood makes it feasible to use these expensive systems.

Recreation users of the Forest enjoy old-growth stands of trees for many different reasons. The old trees are aesthetically pleasing and provide a living connection with the past and a visual reference to the natural successional processes of the forest environment. Many people feel that the massive, towering trees in some old-growth stands have a cathedral quality and are spiritually uplifting and inspirational. These stands provide a feeling of solitude and escape from the evidence of human presence. Old-growth stands are also important as a gene pool, conserving the diversity of characteristics which insures the survival of the species against attacks by insects and disease. These stands are also valuable for conducting research on the undisturbed organisms and processes of the forest ecosystem.

Threatened, Endangered, And Sensitive Plants

The 1989 Federal Register Notice of Review does not list any Federally listed Threatened or Endangered plants on the Forest. The Regional Forester has identified 13 documented and 10 suspected plant species on the Forest which are considered sensitive. This list was developed from Oregon Rare and Endangered Plant Program Task Force (OREPPT). An organization ofprofessional (University teachers, Federal and State agency) and lay people (taxonomists and botanists) knowledgeable of the status of the various plant species in Oregon and adjacent areas. The task force has the support of the Native Plant Society of Oregon (NPSO) members (200+). Plant inventory data from public and private land managers is shared with NPSO and Oregon Natural Heritage Data Base (ONHDB) recommendations. The information system that contains plant inventory data from OREPPT.

The Endangered Species Act of 1973 as amended (1978, 1979, 1982) declares that "...all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act."

Prior to 1973 there was an awareness of the need to protect endangered plants when management activities were proposed or implemented. Since 1973 the U.S. Department of Agriculture--Forest Service has established policies to carry out broad responsibilities under the Act through directing the development of management strategies to prevent species from becoming endangered. Such "sensitive species," although not subject to the Act, received special management emphasis to ensure their continued viability and preclude trends toward endangerment which would result in the need for Federal listing. This emphasis eventually resulted in the current USDA Forest Service - Region 6 Sensitive Plant List.

"Sensitive" species are those plant species identified for which viability is a concern. This is evidenced by a significant current or predicted downward trend in population numbers or density. Viability concerns are also indicated by significant current or predicted downward trends in habitat capability that could reduce a species' existing distribution.

The 1989 USDA Forest Service - Region 6 Sensitive Plant List identifies 23 species that are or could be found on the Forest. Typically, those plants are associated with certain types of habitat. The four main habitats usually account for most of the listed plants. These are 1.) bogs and wet/moist areas, 2.) moist, rocky sites, 3.) dry rocky sites, usually ridge tops, and open slopes, fields, meadows. Field inventories are required on proposed activity areas to determine if the plants are actually there. If found, then a determination needs to be made as to the extent of the population and the area occupied, so as to determine the impacts on the plant if the activity should occur and the mitigation necessary to avoid conflict.

Both natural events and human activities can affect a species' viability. Natural causes include catestrophic events and normal succession. Human activities that commonly occur on the Forest include timber harvest, commercial and scientific plant collection, recreation and livestock grazing. Road building and off road vehicle use can impact TE&S plants directly, through habitat loss, or indirectly, by potentially introducing competitive species or noxious weeds to sites that would otherwise have been isolated. Many of these activities are concentrated in specialized habitats such as riparian zones, rock faces or natural meadows. In many cases the TE&S species are uncommon because they are adapted to these unique environments and are habitat limited. This concentrates them in the same sites that concentrate human activities, greatly increasing the potential for conflict.

It should be noted that the effect of both natural and human activity on the species can be positive as well as negative. A few species are disturbance dependant, requiring fire, soil disturbance, increased light or some other alteration in the environment to reproduce or survive. The disturbance may revert the site to an earlier successional stage that is more suitable to the plant's survival. Species that are affected in this manner are responsive to habitat enhancement to improve their survival.

A current list of sensitive species is available in the planning records at the Supervisor's Office, Eugene, Oregon. This list is updated annually. Those plant species listed in the 1989 USDA Forest Service - Region 6 Sensitive Plant List, documented on the Forest, are shown in Figure III-G-8.

No evaluation has been made of impacts to Threatened, Endangered, and Sensitive (TE&S) plants caused by Forest Service programs and activities prior to the 1973 Act.

Table T___. Threatened, Endangered or Sensitive Plants (III-G-8)

Species	Designation	Forest Occurrence
Aster gormanii	Threatened Oregon R-6 sensitive	14 sites identified in the last 10 years
Calamagrostis breweri	Threatened Oregon R-6 sensitive	1 known site
Draba aureola	Oregon and R-6 sensitive	2 sites identified in the last 10 years
Frasera umpquaensis	Federal candidate Category 2 Oregon and R-6 sensitive	3 known sites
Gentiana newberryi	Threatened Oregon R-6 sensitive	1 known site
Hieracium bolanderi	Threatened Oregon R-6 sensitive	1 known site
Lycopodium annotinum	Threatened Oregon R-6 sensitive	1 site in last 10 years
Lycopodium inundatum	Threatened Oregon R-6 sensitive	1 known site
Montia diffusa	Oregon and R-6 sensitive	Numerous sites in Shady Beach fire area
Ophioglossum vulgatum L.	Endangered Oregon R-6 sensitive	3 known sites
Polystichum californicum	Threatened Oregon R-6 sensitive	1 known site
Romanzoffia thompsonii	Oregon and R-6 sensitive	21 sites in last 10 years

FIRE

Fire has played a key role in the development of forest ecosystems in the Western Cascades. Fires influence many segments of the physical and biological forest environment including plant species and communities; insects, parasites, and fungi; and even wildlife habitat patterns and populations. Fires also affect major ecosystems processes and characteristics such as nutrient recycling, energy flow, succession, diversity, productivity, and stability. Factors such as fire frequency, duration, intensity and size all have a bearing on these fire effects.

Historical Trends

At low elevations, most of the Forest was burned by large, lightning-caused fires between 120 and 450 years ago. Catastrophic fire intervals in the upper elevations, including the Pacific silver fir zone, may have been over 500 years apart. Over time, these fires have maintained the Douglas-fir vegetation characteristic of the west side of the Cascades.

Little is known about fires caused by native Indians, but as trappers and settlers moved through the Cascades in the mid-1800's, some fires were intentionally set, and some resulted from campfires left burning, causing an increase in fire frequency. Since the early 1900s fire suppression efforts have affected fire occurrence patterns and, in particular, potential large stand-replacement fires have generally been suppressed at a smaller size. Since 1950, out of more than 2,500 fires, there have been only 12 fires larger than 300 acres; of these, 7 were started by lightning and 5 were human caused.

Fire occurrence on the Forest is characterized by "peaks and valleys", with frequent periods of low fire occurrence and occasional periods of extremely high occurrence. Lightning fire occurrence is far more cyclic here than it is in eastern Oregon. The majority of fires on the Forest are fires of low to moderate intensity and are suppressed at a small size. During the last 30 years, the most lightning fires (316 fires) occurred in 1967 and the fewest number (0 fires) occurred in 1954 and 1988. In the same time period, human-caused fires accounted for 48% of the fires and 45% of the acreage burned. A majority of the human-caused fires have resulted from recreation related fires, e.g., campfires and smoking. The most costly and damaging human-caused fires have occurred from debris burning, industrial operations, and railroad related activities.

Some fire related ecosystem processes have been duplicated and others changed by timber management activities on the Forest. As mature and old-growth stands have been harvested, the timber has been removed from the site, and the remaining slash has been burned. These activities have created a divided mosaic of clearings and older stands. Prescribed fires of low to moderate intensity have changed soil, watershed, and vegetation characteristics less drastically than catastrophic wildfire. Generally, there have been smaller areas burned and, except for short-term slash accumulation during harvest, there has been a reduction of overall forest flammability.

Historically, prescribed burning has been the most common tool used for the reduction of logging residues and natural dead and down debris, and the preparation of sites for reforestation. In the past when prescribed burning was done primarily in the autumn, it was difficult to control fire intensity and duration. Spring and summer burning have increased flexibility to use low to moderate intensity fires to control fire effects and meet resource objectives.

Costs of prescribed burning have risen sharply. Logging is now occurring on steeper ground that cannot be machine piled and burned in winter months when mopup and patrol are not critical. Mop-up and patrol costs in the dryer summer season are much higher than those experienced during the early

spring and late fall when heavy rain aids with mopup efforts. Small, irregular shaped harvest units and the increasing need to meet air quality constraints have also contributed to increased prescribed burning costs.

Current Situation

On the Forest, all fires are suppressed, with an emphasis on the most cost effective suppression response. All fires that escape initial attack are evaluated to determine the strategies that would provide for the least cost for suppression plus the least damage to forest resources.

A wide variety of techniques and practices are currently used to minimize resource loss and suppression costs from debris burning, industrial operation and railroad fires. The Forest maintains three primary and three emergency lookouts, in addition, fire patrol planes are used during the fire season. Due to the extensive road system and sophisticated communication systems now in use, Forest visitors, contractors and permittees are also a significant part of the total detection system. While an increase in use of the Forest setting increases the risk of human caused fires, increased use also contributes to early detection and, in some cases, suppression of small fires.

Prescribed burning is scheduled to avoid smoke intrusions into smoke sensitive areas and to minimize air quality impacts during summer holidays and high use periods, and the State Forester's Office, Oregon Department of Forestry coordinates all forest and agricultural burning in western Oregon. As a result, efforts to maintain air quality have also increased the complexity of prescribed burning on the Forest. For additional information see Chapter III, Air.

On a limited basis, prescribed fire is being reintroduced to both natural and historic meadows on the Forest. Although early settlers managed historic meadows such as Mutton Meadow and Rigdon Meadow with fire, aggressive fire suppression has generally excluded fires from these meadows in recent years. The elimination of fire has caused an encroachment of trees, the loss of natural meadow ecology, and the loss of forage palatability. Prescribed fire can also be used to improve the forage for deer and elk. Fire eliminates old unpalatable forage and in turn adds nutrients to the soil. As a consequence, the new succulent growth is more nutritious.

Future Trends

Both natural and activity fuels need to be managed over time to meet long-term resource management objectives. Regeneration harvest of old-growth timber provides unique opportunities and challenges to establish essential fuel profiles that balance resource objectives such as utilization, hazard reduction, site preparation, and the maintenance of site productivity. In addition, fuel treatments for the improvement of wildlife habitat, the reduction of natural residues on Wilderness and nonwilderness lands, and the reintroduction of fire to Forest ecosystems may increase if treatments are found to be cost effective and funds are available.

Expected increases in public use of the Forest will provide additional opportunities for public contact. To maintain the low levels of human-caused fire incidents fire prevention, cooperative fire prevention efforts with local fire departments and the Oregon State Department of Forestry (OSDF) will continue.

FISH

The fish of the Forest are a diverse number of species adapted to a variety of habitats. Of the 30 species found on the Forest, most are native to the natural streams and lakes of the western slope of the Cascades. A native species is one which has always occurred here, reproducing on its own. Additionally, several species have become naturalized, primarily in lakes and reservoirs. A naturalized species is one that was introduced from other parts of the country or world and has been able to reproduce on its own.

Several native and naturalized species are artificially propagated to meet a variety of fish management objectives. By far the most abundant group is in the Salmonidae family. Fish in this family include anadromous, as well as resident species, and native, as well as naturalized species.

The spring chinook, winter steelhead, and summer steelhead are the most important anadromous species. Anadromous fish spawn and grow to smolt size in forest streams before migrating to the Pacific Ocean where they grow to adulthood. Smolts are juvenile salmon or trout who have undergone physiological changes allowing them to adjust to increased salinity of ocean water. These fish then return to their natal river to rest prior to spawning and completion of their life cycle.

Rainbow, cutthroat, and bull trout (formerly known as the dolly varden) are the most abundant native species of resident trout. Brook trout have been widely distributed in the new Cascade lakes and have naturalized in many areas.

Several salmonid species have limited distribution on the Forest. Native bull trout populations exist only in the upper McKenzie River drainage above Leaburg and in the South Fork McKenzie above Cougar Dam. Although brown trout have not been stocked for many years, naturalized populations persist in Leone and Linton lakes. The population of cutthroat trout found in the Hackleman Creek drainage currently receives special protection while fish systematists compare it to other stocks of cutthroat. Its long period of isolation, caused by lava flows 8,500 years ago, provides an excellent opportunity to study genetic differences caused by isolation.

Several species of resident fish, such as white and black crappie, largemouth bass, and brown bullhead are naturalized warm water game fish that support significant recreational fisheries in reservoirs. Many of the native species such as northern squawfish, largescale sucker, chiselmouth, and a variety of sculpins are either predators on or competition for salmonids. Others, such as redside shiner, brook lamprey, and several species of dace are prey species utilized by various game fish species. The Pacific lamprey is the lone anadromous nongame fish.

The Oregon chub (*Oregonicthys crameri*) is an unusual fish with small, isolated water populations. This 2- to 3-inch long minnow inhabits slough-like tributaries with extensive cover of aquatic plants and woody debris. In the past, the species has been recorded at many locations in the Willamette River Drainages, but its range has dwindled. It is presently found on the Forest at three locations. Because the entire population exists in a 1.5 mile long zone of the Willamette River, it is being proposed for listing as a threatened or endanger species.

The Bull trout is on the Regional Forester's sensitive species list as a consequence of it being on the U.S. Fish and Wildlife Service category-two list for species to be considered for threatened status. It's only known locations on the Forest presently are in the McKenzie River system above the Leaburg dam and in the South Fork of the McKenzie River above Cougar dam. Its presence is suspected in the

Middle Fork of the Willamette River above Hills Creek Reservoir where it was known to exist prior to 1968.

Another species of concern is a unique race of native cutthroat trout (*Oncorhnychus Clarki*). This race of cutthroat trout populates Hackleman Creek year around and when Fish Lake is full of water in the winter and spring the trout occupy the lake as well. To protect this race of trout, the ODFW has ruled that fishing in the creek is not allowed.

The fish habitat available on the Forest includes about 3,400 acres (1,292 miles) of lotic (flowing water) and 22,480 acres of lentic (lake and reservoir) environment (Figure III-I-1). Most of the fish producing streams and reservoirs are located at lower elevations while the natural lake habitat is located in the High Cascades.

This Forest offers diverse settings, species and opportunities for fishing. Opportunities range from fishing by boat or from the shore in reservoirs to hike-in fishing with bait in Wilderness lakes to fly fishing in large rivers such as the McKenzie or Willamette. When converted to dollar value of the commercial catch and sportfishing days, the Forest fish resources are worth an estimated 4.9 million dollars annually.

Fish produced on the Forest contribute to the commercial and sportfisheries both on and off Forest. Spring chinook and both summer and winter steelhead support sport fisheries in the major tributaries draining the Forest and in the lower Willamette River. Spring chinook contribute to the off-shore fisheries of the Pacific Ocean from southeast Alaska to northern California and are a major part of the the lower Columbia River gillnet fishery.

Management of the Forest's fishery resources is a shared responsibility between the Forest and Oregon Department of Fish and Wildlife. The State is responsible for setting seasons and manipulating the populations either through stocking or restrictive gear regulations. The Forest is responsible for maintenance of existing habitat, improving or expanding habitat, and for investigating fish/habitat relationships. The intricate relationships between the animals and the habitat requires continual interagency contact and coordination. Beyond the National Forest boundaries the Oregon Department of Fish and Wildlife assumes the additional responsibility for habitat, and also deals with downstream migrant passage at hydropower facilities.

Table III-I-1. Amount of Fish Habitat

River Drainage	Anadromous Fish Streams		Resident Fish Streams		Natural Lakes	Reservoirs
	Acres	Acres	Miles	Acres	Acres	Acres
Little North Santiam River	6.2	22.8	27.6	75.1	--	--
North Santiam River	0	0	104.0	267.1	--	3,580
Wilderness Streams	0	0	17.5	45.9	--	--
Breitenbush River	0	0	58.4	184.5	--	--
DETROIT RANGER DISTRICT TOTAL	6.2	22.8	207.5	572.6	964	3,580
Quartzville Creek	10.0	37.8	30.0	79.9	--	--
Middle Santiam River	8.2	33.6	30.4	107.9	--	--
South Santiam, Wiley, Calapooia	20.5	73.6	56.1	155.2	--	--
Lava, McKenzie, North Santiam	0	0	19.9	41.8	--	--
SWEET HOME RANGER DISTRICT TOTAL	38.7	145.0	136.4	384.8	80	0
Blue River, Gate Creek	1.5	3.0	45.1	196.8	--	1,420
South Fork McKenzie, Quartz Creek	6.2	22.3	67.5	184.4	--	1,280
Wilderness Streams	0	0	23.4	62.8	--	--
BLUE RIVER RANGER DISTRICT TOTAL	7.7	25.	136.0	444.0	40	2,700
McKenzie River, Horse Creek	46.8	114.0	87.1	207.6	--	320
Wilderness Streams	2.2	4.4	18.7	41.6	--	--
McKENZIE RANGER DISTRICT TOTAL	29.0	118.4	105.8	249.1	1,945	320
Fall Creek	29.0	103.4	96.8	249.1	--	--
Winberry Creek	6.6	24.9	26.9	63.3	--	--
Middle Fork Willamette River	0	0	54.5	133.7	--	1,940
LOWELL RANGER DISTRICT TOTAL	35.6	128.3	178.2	446.1	0	1,940
Salt Creek	0	0	53.3	115.9	--	--
Salmon Creek	0	0	71.7	126.1	--	--
North Fork Middle Fork Willamette	0	0	120.3	221.7	--	--
OAKRIDGE RANGER DISTRICT TOTAL	0	0	245.3	463.7	7,912	--
Hills Creek	0	0	29.1	74.8	--	300
Middle Fork Willamette	0	0	122.7	322.3	--	2,410
RIGDON RANGER DISTRICT TOTAL	0	0	151.8	397.1	292	2,710
FOREST TOTAL	137.2	439.8	1,161.0	2,957.5	11,233	11,250

Historic Trends

Fish habitat on the Forest has undergone significant modifications in the last 4 decades. In the 1950s and 1960s, construction of flood control and hydropower reservoirs isolated approximately 257 miles (925 surface acres) (see Figure III-I-2) of anadromous fish habitat and impaired the productivity of an additional 75 miles (273 surface acres). A total of 11,250 additional surface acres of reservoir water also became available for management of warm and cold water resident species as a consequence of dam construction. There are approximately 119 miles of streams on the Forest which currently produce one or more species of anadromous salmonids. An additional 18.2 miles of anadromous fish habitat exists above Foster and Green Peter Dams on the South Santiam River. This habitat is currently not

being utilized due to fish passage problems over the dams and the possibility of introducing diseased hatchery stock. Current anadromous habitat is about one-third of the historic level.

Fish hatcheries have been established on every major river system draining the Forest, either to mitigate for fish populations damaged by the flood control reservoirs, or to augment the natural productivity of the existing fish habitat. There are seven hatcheries that use water from rivers draining Forest lands. Hatcheries at Marion Forks (North Santiam), Foster (South Santiam), Leaburg (McKenzie) and Oakridge (Willamette) were established specifically to mitigate impacts on downstream migrations of smolt salmon and steelhead. Marion Forks Hatchery near Idanha and Willamette Hatchery at Oakridge are located on the Forest under a special use permit to the United States Army Corps of Engineers who, in turn, contract with Oregon Department of Fish and Wildlife (ODFW) for operation of the facilities.

A significant storm in late 1964 caused heavy degradation of fish habitat in several major resident trout streams, such as Salmon Creek and Middle Fork Willamette River. After undergoing a prolonged period of restabilization, these habitats are now in a recovery mode and should continue to improve. See Chapter III, Water for a detailed discussion of flood events.

The 1950s and 1960s were also decades in which considerable stream habitat for anadromous and resident fish was degraded by road construction and logging practices that increased erosion and removed streambank vegetation. This activity continued into the 1970s, although at a lesser rate. By the end of that decade, approximately 1,075 miles of streams (24%) were adjacent to clearcut units and an additional 238 miles were within 100 feet of a road (Stewart and Skeesick 1981). Culvert installations occasionally isolated spawning habitat for resident trout and prevented juveniles from reaching protected winter habitat.

The late 1970s and early 1980s were periods of increasing awareness of fishery values and need for improved protection of fish habitat. Streamside management unit prescriptions, improved logging methods, better road locations, and improved erosion control techniques significantly reduced the impact of land management activities. By the mid-1980s actual fish habitat improvement projects were being implemented to mitigate previous impacts and to capitalize on the inherent productive capabilities of the various aquatic habitats.

Populations of anadromous fish and resident fish have followed distinctly different trends during the last several decades. Since 1950, the native anadromous fish populations have decreased significantly and have largely been replaced by fish released from the hatcheries. Smolt mortalities associated with Fall Creek Dam, Eugene Water and Electric Board diversions on the McKenzie River, and Foster Dam on the South Santiam River have decreased those stocks considerably. The summer steelhead stocks introduced by the ODFW have become naturalized in the McKenzie River system. The wild smolts in conjunction with continued hatchery liberations have generated an excellent population of summer steelhead using the McKenzie River and its major tributaries.

The overall supply of native resident cold water fish is not known to have changed significantly over time even though populations inhabiting several major streams may have been depressed as a result of the 1964 flood or other habitat distresses. There is some indication that bull trout may now inhabit fewer areas than they did previously.

Fish stocking by the State (Fish Commission) began as early as 1912 in Linton Lake and others. During 1913, the Oregon Fish Commission stocked several lakes with eastern brook trout. To help sustain the relatively intense fisheries on moderate to large rivers, the ODFW has developed a large-scale program of stocking fishing streams with legal-sized fish. Concurrently, they stocked the reservoirs and selected road accessed lakes with both legal-sized and fingerling trout and salmon. Less accessible lakes were

stocked with fingerling trout, first by pack horse, then by fixed-wing aircraft, and more recently by helicopter.

Warm-water fish were introduced into Detroit, Hills Creek, and Lookout Point reservoirs by unauthorized parties; and, brown bullhead, largemouth bass, white crappie, and black crappie naturalized. The white crappie population in Hills Creek Reservoir expanded rapidly and by the late 1970s was supporting a very active spring fishery.

Table III-I-2. Anadromous Fish Habitat

River System	Current Anadromous Habitat (miles)	Lost Anadromous Habitat (miles)
Little North Santiam	6.2	0
North Santiam	0	35.7
South Santiam	20.5	18.2
McKenzie	56.7	70.1
Fall Creek	35.6	0
Middle Fork Willamette	0	133.3
TOTAL	119.0	257.3

Current Situation

Important fish species on the Forest include those belonging to the family Salmonidae. These include the native species of spring chinook, winter steelhead, rainbow trout, cutthroat trout, bull trout, and mountain whitefish as well as the introduced species of summer steelhead, brook trout, brown trout, and sockeye salmon that have become naturalized. These species support major recreational fisheries on the Forest and contribute significantly to sport and commercial fisheries in the Pacific Ocean, lower Columbia River, and lower Willamette rivers. The current smolt population on the Forest is estimated at 169,000 fish. Anadromous fish spawning population levels are reasonably well documented (Figure III-I-3).

No estimates of abundance of resident cold-water fish have been attempted because of the variability of the productivity of the various habitats and the dependence of many of the water bodies upon regular stocking to maintain population abundance.

The premier fisheries supported by fish produced on the Forest are for spring chinook and summer steelhead. The primary spring chinook harvest occurs in the lower Willamette River between St. Helens and Oregon City. Fish reared in the Santiam, McKenzie, and Middle Fork Willamette subbasins account for 80% of the average 15,000 fish catch. In addition, the lower Columbia River gillnet fishery harvests an additional 8,000 of these, the highest quality of all the salmon stocks.

The summer steelhead stocks are a recent phenomenon based upon proper stock selection and hatchery technology implemented in the 1970s. Adults returning from hatchery releases and natural production support major fisheries in the Santiam, McKenzie, and Middle Fork Willamette rivers just below the Forest boundaries. These fisheries are gaining in popularity as more people learn the proper angling methods and preferred locations to fish.

The stream fishery for resident trout is supported primarily by wild native cutthroat and rainbow trout. The cutthroat are the main contributors in the small tributaries and head water streams while the rainbow are the major target in moderate to larger sized streams. Hatchery augmentation of trout populations in streams has gradually been reduced and is now limited to a few intensively fished areas where the catch rate justifies the high cost. Special fly-fishing only regulations on North Fork of the Middle Fork Willamette River provides a unique opportunity to fish for native rainbow and cutthroat trout at high population levels.

Table III-I-3. Approximate Current Anadromous Fish Spawning Populations [1]

Drainages	Spring Chinook	Summer Steelhead	Winter Steelhead	Coho Salmon
Little North Santiam River[2]	50	30	50	10
South Santiam River[2]	0	0	300	0
McKenzie River	2,350 [3]	1,000 [3]	0	2
Fall Creek	0	0	250 [4]	0
FOREST TOTAL	2,400	1,030	600	12

[1] Excluding Hatchery Stock.
[2] In USFS Ownership.
[3] Leeburg Dam Counts.
[4] Fall Creek Dam Counts.

Presently, nearly half of the watersheds in the Forest exhibit high sediment yields, as compared to natural levels, and are considered indicators of lower water quality. Sediment that is significantly elevated above natural levels can reduce fish habitat quantity and quality.

In the recent past, acknowledgment of the importance of providing and retaining large woody debris in streams has resulted in a diversified as well as a reasonably stable condition for fishery habitat Forest-wide. Specifically, attempts to return Fall Creek tributaries to a more natural condition by the addition of in-stream rock and log structures has been accomplished. Initial evaluation suggest efforts have had significant beneficial effects for fish populations.

There are approximately 390 natural lakes with trout populations on the Willamette National Forest. These range from Waldo Lake at 6,410 surface acres down to 2 acres in size. Most of the total acreage (10,924) of lakes on the Forest is located in the High Cascades where stream drainages are poorly developed. Consequently, few of the lakes have natural spawning areas available. Approximately 90% of the lakes are regularly stocked with fingerlings by the Oregon Department of Fish and Wildlife (ODFW) to capitalize upon the productive capacity and to support the recreational opportunities associated with the lakes. ODFW stocks lakes one acre or larger in size. Recently helicopters have been used to improve the reliability of stocking fingerlings in small lakes. However, financial limitations have caused significant interruptions to the program in recent years. Helicopter stocking of remote lakes is normally conducted every other year. The majority of the lakes are stocked with fingerling brook trout with rainbow planted in most of the rest. Cutthroat trout receive limited distribution because of a lack of stocks adapted to lentic environments. West slope cuttroat trout are being stocked experimentally with some success.

Flood control and hydropower reservoirs on the Forest have created 11,250 acres of fish habitat when at full pool (Figure III-I-4). During the flood control season (November through February) that area is

reduced to approximately 4,470 acres. Although the annual fluctuations reduce the value of flood control reservoirs as fish habitat, these reservoirs produce valuable cold and warm water fish.

Lookout Point and Hills Creek reservoirs provide nearly all the significant warm water fish habitat in all of Region 6 (Oregon and Washington). The white crappie fishery in Hills Creek reservoir is a significant spring event that adds measurably to the fishing opportunities on the Forest. Efforts are occurring to identify the proper fish species for use in Lookout Point Reservoir to establish a self-sustaining fishery. Each of the reservoirs, except Lookout Point Reservoir, is stocked with fingerling and/or legal-sized rainbow by ODFW to support the major fisheries that occur there. Lookout Point Reservoir receives annual stocking with juvenile spring chinook.

Several volunteer organizations have been instrumental in helping the Forest develop technology for establishing terrestrial vegetation in reservoir drawdown zones. This vegetation is expected to: provide structural diversity and protective cover for juvenile fish; add organic matter to the reservoir food web; provide big-game winter forage; and improve the visual characteristics of the reservoir slopes.

The demand for fish and fishing opportunities in western Oregon continues at a strong steady level (Lowry 1977, Griggs 1984).

Table III-I-4. Reservoirs on the Willamette National Forest

Reservoir	Agency	Full Pool Acres	Low Pool Acres	Fish Species Present [4]
Detroit	COE [1]	3,580	1,450	Rb, K, BrB, SCh
Carmen	EWEB0 [2]	30	15	Rb, BT
Smith	EWEB	170	170	Rb, BT, CT
Trailbridge	EWEB	120	120	Rb, BuT, CT, BT
Blue River	COE	1,420	130	Rb, CT, SCh, CSu
Cougar	COE	1,280	635	Rb, Wf, BuT
Lookout Point	COE	1,940 [3]	400	Sq, K, SCh, CSu, BrB, WC, BC, RsS, LB, Rb
Hills Creek	COE	2,710	1,550	Rb, WC, BC, BrB, CT, RsS, LB
TOTAL		11,250	4,470	

[1] United States Army Corps of Engineers (COE).
[2] Eugene Water and Electric Board (EWEB).
[3] Inside Forest Boundary
[4] Rainbow (RB), Kokanee (K), Brook Trout (BT), Bull Trout (BuT), Spring Chinook Salmon (SCh), Whitefish (Wf), Squawfish (Sq), Coarsescaled Sucker (CSu), Brown Bullhead (BrB), White Crappie (WC), Black Crappie (BC), Redside Shiner (RsS), Chiselmouth (CH), Largemouth Bass (LB).

Future Trends

The spring chinook of the lower Willamette and Columbia Rivers will continue to be dependent upon the quality water and habitat conditions of the Forest. Increased supplies of spring chinook and winter and summer steelhead will occur from four sources: hatcheries, habitat improvement, passage improvement, and cooperation with other agencies.

The Oregon Department of Fish and Wildlife is planning to increase the Willamette River spring chinook populations by 25%. Fish passage improvements at Foster Dam, Leaburg Dam, and Willamette Falls (Oregon City) are improving survival rates of naturally produced smolts, leading to greater returns of

adults. Protection of the undammed tributaries of the McKenzie River system will contribute to habitat productivity. These tributaries include streams on the Forest such as Horse Creek, Deer Creek, Lost Creek, and the South Fork of the McKenzie below Cougar Reservoir. Fisheries management of the McKenzie River above Leaburg Dam will focus on Spring Chinook and wild trout. The Northwest Power Planning Council is preparing a critical review of the full production potential for all anadromous fish in the Willamette Basin. The Northwest Power Planning Council program mitigating the effects of hydropower production will, in the longer term, finance projects designed to improve the inherent productivity of stream habitat and may also fund development of fish production facilities. Any production facilities added will rely heavily upon the high quality water produced on the Forest.

When fish passage improvements are provided by the Army Corps of Engineers at the Fall Creek, Foster, and Green Peter Dams; these drainages will support increased anadromous fish production. Recent activity by local organizations is seeking to intensify fisheries management of major salmonid habitat on- and off-Forest to improve economic benefits to local communities (i.e., McKenzie-Willamette Fisheries Enhancement Group sponsored by Lane County Intergovernmental Relations Committee). Maintenance of high quality water and improvement in riparian habitat will continue to strongly influence resident fisheries on the Forest. Although there has been habitat recovery in some drainages such as Fall Creek and Salmon Creek, the ability of the streams on the Forest to produce resident trout in the future is contingent on the continuation of fishery habitat improvements. Historically, the ODFW has supported a put-and-take fishery at selected sites on the streams, reservoirs, and lakes within the Forest boundary. Legal sized trout are intermittently stocked near recreation areas from May to September, to augment fish populations. The high cost of augmenting naturally produced stream trout with legal sized hatchery fish dictates that only a few of the more heavily fished streams will continue to be stocked by ODFW. This practice is being heavily scrutinized and will probably be reduced over time. The high mountain lakes fish populations and fisheries are expected to continue at current levels with the exception of a few non-Wilderness lakes where habitat improvements will be made to improve productivity.

The full development of resident warm-water fisheries at Hills Creek and Lookout Point Reservoirs will be important to future management of the Forest. Currently, Lookout Point has the biggest untapped resident fishery potential of the eight reservoirs on the Forest. Resolution of predation and competition problems will increase both fish production and fishing opportunities. As well, the manipulation of vegetation on drawdown zones of flood control reservoirs will provide bank stability and increase fish productivity. This vegetation will provide forage for animals, a food base for aquatic invertebrates, and serves as a nursery area for young warm water fish.

The Forest expects to invest substantial habitat improvement funds to augment the work of volunteer organizations to capitalize on this opportunity. Fishing organizations and volunteers are expected to play an important role in continuing to improve fish habitat and our knowledge base. The Challenge Grant Program for funding habitat improvements will stimulate investment in those areas where local interest is highest, and organizations other than USDA Forest Service can provide part of the funding. In addition, volunteers will be accomplishing surveys, collecting data, and doing projects to improve the management of the Forest fish resource.

The improvements in anadromous fish habitat and numbers, improvements in the productivity of the reservoirs, and the establishment of a fishery in Lookout Point Reservoir can be expected to have a significant impact of the local economies of the areas where the fisheries occur. For example, a 25% increase in population and catch of spring chinook will add 2,000 fish (31,200 pounds) worth $32,760 (RPA values) annually to the Columbia River commercial fishery and 3,750 fish worth $370,000 to the lower Willamette River sport fishery. This expansion in the population is dependent upon habitat maintenance and continued production of high quality water for the hatcheries, and in-stream production.

WILDLIFE

The Forest provides diverse habitats which support over 260 wildlife species. This includes 170 avian breeding species, 64 mammalian species, and 30 amphibian and reptilian species.

Several important roles are played by wildlife in the Forest. As predators, animals act as natural controls of insect populations, helping reduce the frequency and severity of epidemics. Predators also remove sick and weak individuals, influencing the populations of prey species. Burrowing or tunneling animals aerate the soil and carry the remains of plants and prey to lower levels. All of these smaller animals in turn support a host of larger predators. Animals that feed on plants and their seeds are agents in helping to disseminate seed. Some are pollinators; others browse or clip vegetation for food. As certain animals dig and grub for food in logs they are helping with the breakdown of this larger material that enables quicker decomposition of organic matter. Aquatic animals like the beaver alter water flow patterns, create marshes, and meadows. Beaver ponds also provide excellent habitat for resident trout and young anadromous fish.

Wildlife also contributes to local economies. Communities near the Forest benefit from the tourist income generated from hunting and sightseeing recreationists.

Historical Trends

Habitat conditions are the prime determinants of wildlife abundance both in the number of species and the number of individuals over time. The abundance of most wildlife species is directly dependent upon the condition of available habitat, whether used for breeding, feeding, or resting.

The mosaic of wildlife habitat on the Forest has been continuously changing. Prior to the early 1900s, wildfire was the primary source of disturbance to the Forest environment of the Western Cascades, although floods, landslides, drought, and wind also influenced habitat conditions. Forest management activities tend to alter the stages of plant succession in a similar fashion to wildfire. However, management activities may change the habitat composition and rate of successional development. Another major difference between natural succession following wildfire and Forest management activities is that during activities such as road building and timber harvest nutrients are being actively removed from the system in the form of logs, rock, fill material, and other products.

The relationship between wildfire and succession has been used to predict the effects of Forest management activities on wildlife populations. Habitat management systems affecting Forest management activities and wildlife populations have historically focused on contolling damage to tree seedlings, and maintenance of habitat for game species. More recent research focuses on the retention of snags, down logs, and remnant live trees within managed stands, and landscape patterns created as a result of Forest management activities. These factors are now believed to be an integral part of maintaining biological diversity. (For more information regarding vegetation diversity, refer to the Vegetation Section.)

Species populations adapted to a wide variety of plant communities and stand conditions have been less likely to decline because of the number of habitat options available to them. Examples of these species are deer, elk, and bear. However, as the landscape is converted from natural conditions dominated by old-growth Forest stands into young, managed stands wide fluctuations in deer and elk numbers may occur due to lack of high quality cover resulting in poor winter survival. Other species, such as the northern spotted owl, are more dependent on specific stand conditions. Their populations have been more likely to decline as the amount of Forest lands in late stages of stand development decreases. Some species are affected less by direct changes in vegetation conditions. Peregrine falcons, for example,

are cliff-nesting birds whose productivity has been more strongly influenced by pesticide use, prey abundance, and predation than by the changes to Forest vegetation. Prey populations of peregrine falcons are directly influenced by vegetation diversity which provides for high populations of song birds.

The Endangered Species Act of 1973, as amended, declared that federal agencies shall seek to conserve endangered and threatened species of plants and animals. Two species of birds, the northern bald eagle and peregrine falcon, occur on the Forest and are listed as threatened or endangered in the 1989 Federal Register. Several other species are either proposed or being considered for listing. All federal, state, and regional proposed, threatened, endangered, and sensitive species are listed on the Regional Foresters Sensitive Species List. (See Figures III-G-8, Threatened, Endangered and Sensitive Plant Species, and Figure III-J-1).

All species in a given area must be maintained to assure the continued existence of the populations throughout their natural range. Managing for viable populations of wildlife species reduces the potential for species becoming listed as Threatened, Endangered, or Sensitive (TE&S) or for local elimination of the species.

Table III-J-1. Threatened, Endangered or Sensitive Fish and Wildlife Species

Species	Designation	Forest Occurrence
BIRDS		
Harlequin duck	R-6 sensitive	Habitat exists on forest. Pairs sighted regularly along major rivers and streams.
Ferrugenous hawk	R-6 sensitive	Occasional visitor. Inadequate foraging habitat to support breeding.
Peregrine falcon	Federal/endangered	No known nest sites on Forest. Potential nesting habitat exists. Several sightings have occurred on Forest.
Bald eagle	Federal/threatened	Seven known active nest sites. Utilizes habitat on Forest for winter forage sites.
Greater sandhill crane	R-6 sensitive	Habitat limited to high lake country. Birds breed in marshes of lakes just outside the Forest boundaries.
Northern spotted owl	Proposed federal listing Oregon/threatened R-6 sensitive	Habitat exists on Forest. Known nesting, roosting, foraging sites are identified on Forest.

Table III-J-1Cont. Threatened, Endangered or Sensitive Fish and Wildlife Species

Species	Designation	Forest Occurrence
MAMMALS		
Pacific western big-eared bat	Federal candidate Category 2 R-6 sensitive	Habitat exists on Forest and two known roost sites identified. Other sites on private land within forest and on neighboring lands
White footed vole	Federal candidate Category 2 R-6 sensitive	Habitat exists on forest and 3 known sites identified.
California Wolverine	Federal candidate Category 2 Oregon/threatened R-6 sensitive	Intermittent sightings over the past 20 years on Forest. Majority of sightings in the Wilderness where abundant habitat exists.
AMPHIBIANS		
Red-legged frog	R-6 Sensitive	Habitat exists on Forest and scattered sightings have been reported in past 10 years.
FISH		
Oregon chub	Federal candidate Category 2 R-6 sensitive	Habitat exists on Forest and species occurs at two known sites.
Klamath large-scale sucker	Federal candidate Category 2 R-6 sensitive	Species documented as having occurred on Forest
Bull trout	Federal candidate Category 2 R-6 sensitive	Habitat exists on Forest with distribution limited to the upper reaches of a single drainage.
INVERTEBRATES		
Beer's false penny beetle	Federal candidate Category 2	Species documented as having occurred on Forest
Mt. Hood primitive caddisfly	Federal candidate Category 2	Detroit R.D.
Tombstone prairie caddisfly (*Farula reaperi*)	Federal candidate Category 2	One record from 1965; Sweet Home R.D.
Tombstone prairie caddisfly (*Oligophlebodes mosthento*)	Federal candidate Category 2	Blue River R.D.
Ft. Dick Limnephilus caddisfly	Federal candidate Category 2	One record from 1969; Oakridge R.D.
One-spot caddisfly	Federal candidate Category 2	Rigdon Ranger District

Current Situation

The implementing regulations for the National Forest Management Act of 1976 (NFMA) require the Forest Service to plan the management of wildlife habitats to "maintain viable populations of existing native and desired non-native vertebrate species in the planning area." To facilitate management of all these species, NFMA further requires each Forest to identify management indicator species (MIS) through the planning process and to establish objectives to maintain and improve the habitats of these indicator species. Implementing regulations for NFMA further define viable population management. "In order to insure that viable populations will be maintained, habitat must be provided to support at least a minimum number of reproductive individuals and that habitat must be well distributed so that individuals can interact with others in the planning area" (36CFR 219.19).

Seven species of wildlife, one group of bird species, resident fish, and anadromous fish have been selected as management indicator species to represent the habitat needs for fish and wildlife species present on the Forest. Management indicator species are considered representative of other species with similar habitat requirements for life and reproduction. By managing for viable populations of indicator species and their associated habitat, viability risks for other species found in the same habitats are reduced.

Management indicator species represent either featured species or ecological indicators. Featured species are threatened and endangered plant and animal species on federal lists, species that are hunted, fished, or trapped, species of special concern or interest, and species with special habitat needs that may be at risk due to planned management activities. Ecological indicator species were selected because their population and habitat changes indicate potential effects of management activities on other species dependent on selected habitat types or water quality. Population and habitat recovery objectives for federally Listed Threatened and Endangered species are determined by the U.S. Fish and Wildlife Service and encorporated into Land and Resource Management Plans through development of interagency Management Plans designed to meet site specific needs for habitat protection and enhancement. Usually each nest site or territory has a site specific plan to ensure recovery objectives are met.

Figure III-J-2 lists the species with special management requirements for the Forest, and is followed by a discussion of each species. The selection of these species was based on the following criteria:

1. Endangered or threatened species identified on federal lists for the planning area;

2. Economically important species that are commonly hunted, fished, or trapped; or

3. Species having limited or specific habitat requirements that may be significantly influenced by management practices. Limiting habitats are those habitats which may be subject to reduction by unconstrained management activities below levels necessary to maintain viable populations.

Table III-J-2. Management Indicator Species

Indicator Species	Habitat Feature	Selection Criteria
Spotted Owl	Threatened species; Old-growth and mature conifers	Ecological Indicator, represents limited habitat
Pileated Woodpecker	Old-growth and mature conifers	Ecological Indicator, represents limited habitat
Pine Marten	Old-growth and mature conifers	Ecological Indicator, represents limited habitat
Elk	Winter range	Commonly hunted
Deer	Winter range	Commonly hunted
Cavity Excavators	Dead and decaying trees	Ecological Indicator, represents limited habitat
Bald Eagle	Threatened species (T&E habitat)	Federal Register List of T&E species
Peregrine Falcon	Endangered species; nesting habitat near prey	Federal Register List of T&E species
Anadromous Fish [1]	Water quality	Commonly fished
Resident Fish [1]	Water quality	Commonly fished

[1]Anadromous and resident fish are discussed in Section I, Fish.

Through Region-wide coordination, each Forest identified the minimum numbers, distribution, and habitat characteristics needed to satisfy life history needs for each species or group of species identified as having a Management Requirement(MR). Report on Minimum Management Requirements for Forest Planning on the National Forests of the Pacific Northwest Region, USDA Forest Service, June 1986. Maintenance of the MRs ensures the viability of management indicator species and the species they represent. MRs are therefore incorporated into all of the Alternatives, except for the No Change Alternative.

Old growth and Mature Conifer Habitat

Old growth and mature conifer habitat provides the feeding, resting, and breeding areas that are required by the northern spotted owl, pileated woodpecker, and pine marten. These management indicator species represent wildlife associated with late seral stages of Forest development. As ecological indicators, these wildlife species represent all species which may be affected by limited amounts, distribution, and quality of mature and old-growth coniferous forests.

Bald Eagle: Threatened and Endangered Species - The bald eagle is listed in the Federal Register as a threatened species. Examination of Forest conditions near nest sites has shown that bald eagles require Forests with old-growth characteristics for nesting (Anthony et al. 1989). The diameter and height of individual nest trees are usually the dominant and largest diameter trees in the stand. Bald eagles require large trees with stout thick limbs to support their large nests which may be up to 10 feet in diameter and can weigh in excess of several hundred pounds (U.S. Department of Interior,

Fish and Wildlife 1982). Perch trees associated with the nest tree need to be tall enough to provide a clear line of sight to the forage area and surrounding terrain. Bald eagles need to feed without interference from human activity (Stalmaster and Newman 1978). All Forested lands within 1.1 miles of the shoreline of major water bodies can be considered potential nesting habitat (U.S. Department of Interior, Fish and Wildlife 1981).

Tenacity to a nest site is weakest in late winter and early spring when a pair first establishes a territory. Disturbance of even limited duration at that time may cause desertion of the site (Fyfe and Olendorff 1976). Nest abandonment, however, can occur at any time as the result of frequent and persistent disturbance.

Bald eagle roosting and feeding areas are usually associated with rivers, lakes, and reservoirs. No communal roost sites have been identified on the Forest. Resident and wintering populations tend to be dispersed within territories around foraging areas. Human activity can adversely affect feeding bald eagles (Stalmaster and Newman 1978). The availability of and access to fish, water-fowl, invertebrates, and carrion becomes critical in nesting season. Young bald eagles are less tolerant of food deprivation than the adults.

Systematic surveys are conducted annually by the Forest Service and the Oregon Department of Fish and Wildlife. There are five known bald eagle nest sites on the Forest. Pairs of bald eagles occupy primary and alternate nest sites along Lookout Point Reservoir and Hills Creek Reservoir (2). Surveys conducted in 1989 confirmed additional nesting pairs at Detroit Resevoir, Clear Lake, and Erma Bell Lakes. Seventeen potential nest sites containing at least 125 acres of nesting habitat have been identified around 11 major water bodies.

When bald eagle nests are found, site specific management plans are prepared in compliance with the USDI Fish and Wildlife Service recommendations and in accordance with the Pacific States Bald Eagle Recovery Plan (1986). Roost sites that are identified in the future will be managed in accordance with the Pacific States Bald Eagle Recovery Plan.

Northern Spotted Owl:Ecological Indicator - The Northern Spotted Owl is listed as a Sensitive Species on the Regional Forester's Sensitive Species List. The spotted owl has been the center of controversy throughout its range. Debate centers on the threat to species viability due to harvesting mature and old-growth forests and silvicultural practices which are designed for harvest rotations of less than 100 years. The northern spotted owl has been proposed and is being considered for listing on the Federal Register for Threatened and Endangered Species.

Old-growth Forests provide high quality habitat for nesting, roosting, and foraging spotted owls. Recent studies have suggested that the northern spotted owl uses habitat areas ranging in size from about 1,000 acres to 3,000 acres. The *Final Supplemental Environmental Impact Statement* (FSEIS 1988) and *Amendment to the Regional Guide* (1989) requires at least 1,500 acres of mature and old-growth habitat for a pair of spotted owls in the Oregon Cascades. All allocated habitat should occur within 1.5 miles of the nest or roost site. Information from the FSEIS for the spotted owl indicates that a larger home range of approximately 6,600 acres, with 2600 acres of mature or old-growth habitat, may be utiliized by a pair of spotted owls.

The principal prey species of the spotted owl are primarily found in mature and old-growth Forests. The northern flying squirrel is the most abundant prey species in spotted owl diets in northwestern Oregon. Prey species may be more abundant and available in old-growth stands than second growth stands. The size of the old-growth limbs are larger and able to support arboreal nests of flying squirrels and red tree voles. Snags and down logs are generally abundant. Foraging perches found in old-growth

stands enhance detection and capture of prey. In addition, many old-growth stands lack the dense understory brush associated with second growth Forests. An open understory may make detection and capture of prey more energy efficient.

Northern spotted owls do not build nests, but rely on pre-existing cavities, broken tops or platform structures as potential nest sites. Large, decadent trees with missing limbs and tops provide these cavities and platforms for spotted owl nests. Selection of old-growth nesting habitat by spotted owls is also influenced by prey abundance. Production of prey biomass is greater in old-growth than that produced in second growth stands. This abundance of prey provides an optimal environment to support food requirements of young as well as adults.

Multi-layered canopies associated with old-growth stands provide favorable roosting habitat that moderates temperature extremes, producing shade during warm weather, and buffering the effects of cold, wet weather and snow. Juvenile spotted owls are dependent on leaning trees and understory trees for climbing off the ground once they have fledged from the nest, but are not yet mobile enough to escape predators. Once off the ground, multi-layered canopies provide hiding cover from predators such as the great-horned owl and goshawk.

The Forest has verified the presence of 219 spotted owl pairs since 1985. During 1989, 156 pairs were reverified. Of these, 15 pairs were located within Wilderness or lands Congressionally reserved from timber harvest.

In compliance with the implementing regulations for the National Forest Management Act of 1976, spotted owl habitat will be provided to ensure existence of a viable population of the species. The Region 6 Planning Guide requires all National Forests within the Cascades Province to maintain 1,500 acre spotted owl habitat areas (SOHAs) with specific guidelines on spacing to ensure distribution across the range of the species.

The process used to establish viable population levels is fully discussed in the Spotted Owl FSEIS and Amendment to the Regional Guide. The Amendment to the Regional Guide estimated current habitat capability of the Forest to be 254 pairs of spotted owls. The 15 year capability to be maintained is 225 pairs of spotted owls. The SOHA network developed under the Regional Guide resulted in establishment of 59 SOHAs protecting 60 pairs of spotted owls. In addition to the 59 SOHAs, 83,680 acres of suitable habitat capable of supporting 35 additional pairs of owls exists within Wilderness and other Reserved areas. The Forest's SOHAs and reserved sites contribute to the Regional MR network for managing spotted owls throughout its range in Oregon and Washington. It should be noted that not all the habitat acres within the SOHAs are on lands suitable for timber harvest. Approximately 10800 acres within the SOHA network (12%) coincides with lands unsuited for timber production.

Pileated Woodpecker:Ecological Indicator - The pileated woodpecker represents those wildlife species which use large, standing dead trees (snags) and mature/old-growth trees when nesting, roosting, or foraging. Downed logs also serve as an important habitat function by providing foraging areas for insect and fungi eating species, as well as habitat for many repitles and amphibians. The diet of the pileated woodpecker consists predominantly of carpenter ants, termites, and other insects found in decaying wood. Foraging surfaces tend to be decayed tree trunks, dead limbs, snags and downed logs associated with mature and old-growth Forests (Mannen 1980). Nesting habitat is most often found in mature and old-growth Forests. The average diameter of a pileated woodpecker nest tree is 25 inches (Brown 1985). The pileated woodpecker is the largest of the woodpeckers, averaging 16 to 20 inches in height. Due to this large size, a pileated woodpecker requires at least a 21-inch d.b.h. nest tree to accommodate itself and its young. Research conducted in Western Oregon suggests that pileated woodpeckers have relatively large home ranges often exceeding 1000 acres in size (Mellen 1987). When

foraging, pileated woodpeckers tend to avoid openings, although they have been observed using shelterwoods on a regular basis (Evelyn Bull, personal communication). Minimum requirements for pileated woodpecker habitat estabished for Region 6 provide 600 acres of habitat per pair. At least 300 acres must be mature or and old-growth Forest.

No systematically collected survey data exists on the Forest for pileated woodpeckers or other wildlife species associated with the habitat features represented by this MR. Existing Forest habitat capability for this species is estimated at 514 individuals based on habitat availability and distribution.

Marten: Ecological Indicator - The marten represents wildlife species dependent on mature and old-growth forests for at least a portion of their life history needs. Marten home ranges often include several seral Forest conditions, ranging from poles to old-growth. Dead, down, and defective trees characteristic of old-growth Forests and seral fire regenerated Forests are critical to marten survival. Downed logs and snags provide potential den sites and access to small mammal prey that are active during winter months (Clark and Campbell 1976). An overhead Forest canopy provides protection from aerial predators (Herman and Fuller 1974).

The recommended habitat area (MR) for marten includes at least 160 acres of contiguous mature or old-growth forest. Home range size of individual marten may be significantly larger (Irwin 1987). Little information is available on home range size or habitat use on the west slope of the Cascade Mountains. The habitat characteristics of primary reproductive or core area habitat for marten are similar to those of the pileated woodpecker and spotted owl. Thus, habitat areas designated for spotted owls and pileated woodpecker MRs will also provide marten habitat.

No systematically collected survey data exists on the Forest for this species. Sighting and trapping records are available to establish general distribution patterns. Current habitat capability for marten is estimated to be 1,138 marten. An estimated 250,018 acres of suitable marten habitat exists on lands Congressionally removed from timber harvest. Lands unsuited for timber production may provide additional habitat, but may be in parcels to small or fragmented to provide suitable habitat to support individual home ranges.

Dead And Defective Tree Habitat

Dead and decaying trees (snags) are a vital component of the Forest ecosystem. Many wildlife species are dependent on these deteriorating trees for nesting, roosting, foraging, and other life functions. Wildlife species dependent on snags are associated with all successional stages of Forest development. Snags are an important source of food production. As the tree's wood fiber decays through time, the bark, cambium layer, and heartwood will serve as forage substrates for a rich supply of insects and bacteria. Some species such as western bluebirds, tree swallows, and violet-green swallows are secondary cavity nesters and use snags located in early seral Forests. Other species are associated with closed canopy stands. On the Forest, wildlife species dependent on dead and defective trees are represented by a group of birds referred to as primary cavity excavators.

Snags and defective trees with heartrot, fungal conks, dead branches, and old wounds are often selected by primary excavators as nest trees. Natural cavities as well as those constructed by primary excavators provide thermally regulated nest sites and over-wintering enclosures for many wildlife species.

Snags are also food storage sites where a variety of birds and mammals cache prey and other food items. Reproductive behavior and territorial defense for specific species may be critically tied to snag numbers and distribution.

Primary Cavity Excavators: Ecological Indicator - Snags, live defective trees, and down logs provide the critical habitat for primary cavity excavators and secondary cavity users.

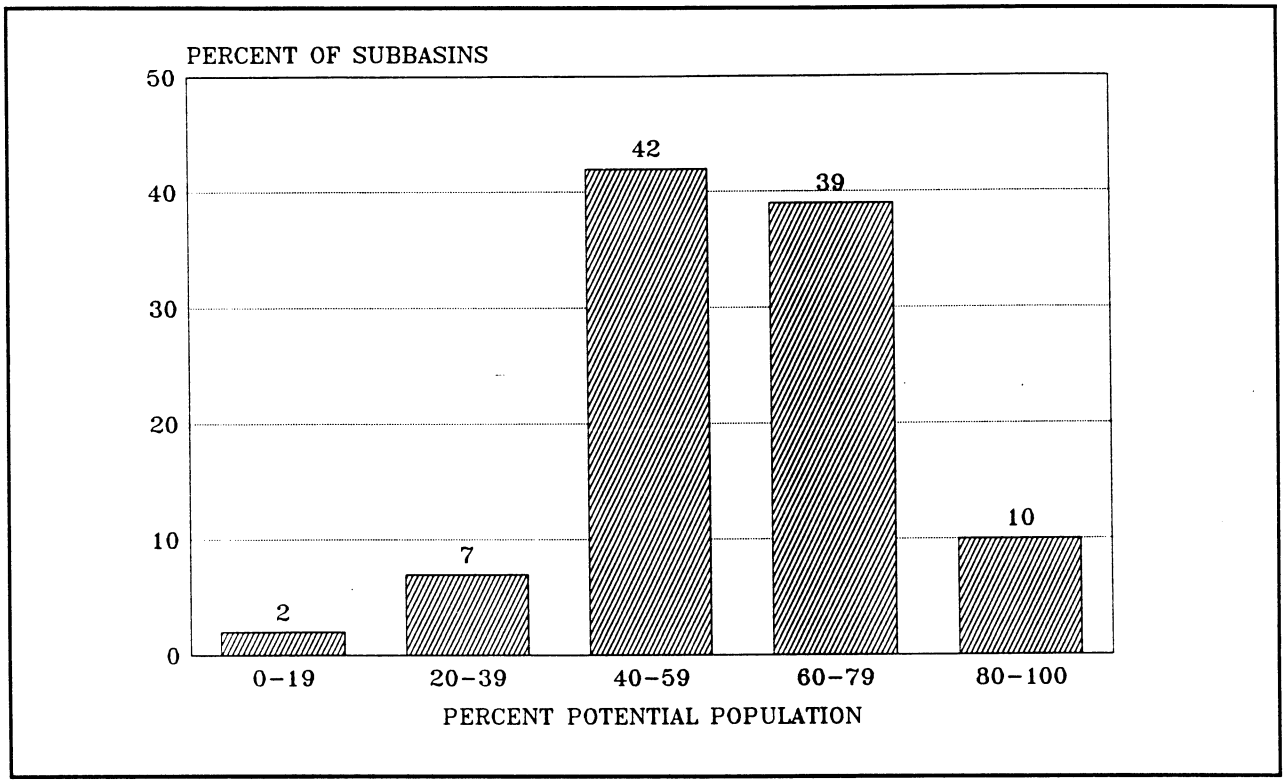
Primary cavity excavators used as ecological indicators on the Forest are those birds, other than pileated woodpeckers, which require dead and defective trees for nesting, roosting, and foraging. Primary cavity excavators create new cavities each year for roosting and nesting. Cavities constructed and abandoned by primary excavators are used by other species (secondary cavity users) for nest and roost sites.

Species of primary cavity excavators used as ecological indicators on the Forest are the red-breasted nuthatch, northern flicker, hairy woodpecker, downy woodpecker, red-breasted sapsucker, Lewis' woodpecker, black-backed woodpecker, and northern three-toed woodpecker. The amount, size, and distribution of dead and defective trees is a limiting factor in existing managed Forest stands.

No systematically collected survey data exists for primary excavator species or secondary cavity users on the Forest. Figure III-J-3 illustrates habitat capability for primary cavity excavators at the sub-watershed level.

Habitat capable of supporting high populations of insectivorous birds may be needed to maintain biological control of endemic insect population levels. The primary ecological role of these birds in controlling insect levels is moderating epidemic outbreaks.

Figure III-J-3. Subbasin Snag Levels



Deer And Elk Habitat

Deer and elk have been selected as Featured Species because they are important game species on the Forest. Economically, they are important to local communities which benefit from the revenue generated by hunters and other recreationists that like to view and photograph game species.

The historic range of Roosevelt elk, black-tailed deer, and mule deer includes all of the Forest. Long-term viability of these species is not presently a concern, but populations capable of supporting hunting and viewing demands are dependent on biological and habitat conditions.

The Oregon Department of Fish and Wildlife (ODFW) estimated the wintering populations of deer and elk to be 17,762 and 3,720, respectively as of 1987. Planning benchmarks for deer and elk populations have also been established by ODFW. Planning benchmarks provide population estimates needed to maintain current and predicted demand for hunting opportunities. To meet demand for hunting opportunity, ODFW estimates a wintering population of 24,500 deer and 6,200 elk should be provided for on the Forest.

The Roosevelt elk population on the Forest has been supplemented through a transplanting program conducted in cooperation with the ODFW beginning in 1972. Since then, about 280 Roosevelt elk have been released into areas of underutilized habitat.

During the winter months, much of the Forest is covered by deep snow. As a consequence, the herds of deer and elk that range over thousands of acres during the summer months are restricted to significantly smaller range areas for much of the time between November through April. These low elevation areas are referred to as winter range. Winter range habitat must supply deer and elk with optimal cover, an available food supply, and security. Without these habitat features wintering populations suffer high mortality during winter periods and surviving cows and does have a low potential for producing viable young the following year.
Winter range is characteristically at lower elevations and along riparian areas where snow accumulation is not as deep. High quality winter range provides protection from wind, snow, rain, and low temperatures, constant availability of quality forage, and security that limits harrassment and allows for efficient use of energy reserves. This habitat is typically found where large patches of old-growth timber provide optimal cover interspersed with meadows, major riparian areas, and harvest units. Security may be provided by all cover types, but in a managed Forest landscape harrassment and poaching may become a limiting factor associated with open roads and recreation sites.

Over the years, the total acres of winter range has been reduced. In the past few decades, flood control projects, road building, timber harvest, and recreation use have all been intensely focused on winter range on the Forest. The development of eight reservoirs in the late 50's and 60's eliminated over 11,000 acres of prime winter range for deer and elk on the Forest. The development of the reservoirs removed thousands of old-growth trees that served as optimum thermal cover and forage sources. Hundreds of deer and elk were displaced from traditional wintering areas and migration routes changed or were eliminated. As a consequence, current deer and elk populations have access to less winter range habitat than was historically available.

Habitat availability on summer range is not considered as critical or limiting as winter range. Most of the Forest provides summer range. Quality of habitat remains a concern. Summer range habitat conditions ultimately determine the amount of stored fat reserves that animals take into the winter period. Lactating does and cows and breeding bulls require high nutrional levels and efficient energy use while utilizing summer range. Little information exists on the relative quality of forage areas on the Forest.

The past few decades have brought changes in the landscape characteristics of deer and elk ranges on the Forest. The gentler slopes at lower elevation allowed greater accessibility for road building. Harvest of the mature and old-growth Forests was concentrated in these areas through 1960. Steeper terrain has been extensively roaded since 1960, and timber harvest has become distributed throughout the available Forest lands.

Roosevelt Elk: Featured Species - Roosevelt elk, blacktailed deer, and mule deer utilize similar habitats on the Forest. All species migrate using summer and winter ranges. Elk appear to be more sensitive to the effects of Forest management activities and are used to represent the habitat requirements of all three species.

Four habitat variables are recognized as being directly influenced by Forest management activities and as having significant impacts on deer and elk habitat. Forage quality, cover quality, open road density and the distribution and size of forage and cover areas contribute to habitat effectiveness. Each of these habitat variables play an important biological function, and interact at the landscape level to determine habitat effectiveness.

Forage Quality - The quality of forage ultimately determines the amount of energy, protein, minerals, and fiber an animal has available throughout the year. Most techniques used to measure forage quality have been adapted from research on domestic ungulates. Quality rather than quantity of forage is usually more limiting in western Oregon. Quantity may be of concern during specific time periods, winter and early spring, or where competition with domestic livestock occurs for the same forage resource.

Forage requirements for deer and elk can double during the winter months because of increased energy requirements imposed by the weather conditions. Since does and cow elk are normally pregnant during the winter, forage availability and accessibility are also critical. Research has indicated that cow elk having more than 3% weight loss after January and prior to calving produced calves with less than 50% chance of survival (Thorne et al. 1976).

No research has been completed on the Forest assessing the availability and quality of forage species. Research from other areas west of the Cascades has been used to describe the relationships between Forest management activities, successional Forest development, and forage quality (Wisdom et al 1986). Forages capable of providing greater than 6% digestable protein are required for maintenance of body condition. Significantly higher protein levels are required for lactating cow elk and growing young (Sharrow 1985).

Forage areas are described as vegetated lands with less than 60% canopy closure of trees and tall shrubs. The sucessional stages comprising primary forage areas in Forest types are grass-forb, shrub, and open sapling pole. Availability of forage may become limiting in the open sampling pole stands as tree and shrub heights exceed normal browse heights of deer and elk. Meadows, marshes, and bogs are also preferred forage areas.

Cover Quality - The quality of cover increases as Forest development progresses. Hiding cover develops first, and has been described as vegetation capable of hiding 90% of an individual animal at a distance of 100 feet. On the Forest most forested stands more than 15 years old begin providing cover from predators and harrassment. Viewing angle may increase the density and height of vegetation required to achieve effective hiding cover on steep terrain (Lyons 1985).

Thermal cover develops during the mid seral stages of forest development. Stands with canopy closure greater than 70%, stem diameters greater than 8 inches, and canopies at least 40 feet tall provide

thermal cover. Thermal cover offers protection against adverse weather conditions and hiding cover. The closed canopy buffers wind, moderates cold and hot ambient air temperatures, and provides some shelter from rain and snow.

Optimal cover develops late in Forest succession. Stands of optimal cover supply forage and the most effective thermal cover. Quality of cover increases with structural development of several vegetation layers and accumulation of large woody material. Low elevation stands containing old growth Douglas fir have a capacity to hold large amounts of snow in the canopy. This reduces the energy elk must expend to access forage. During periods when Forest openings become inaccessible due to snow, understory vegetation and litterfall are critical to deer and elk survival.

Figure III-J-4 displays the relationship between succession development in Forested ecosystems and deer and elk habitat.

Distribution and Size of Forage and Cover Areas - The distance deer and elk travel into cover or forage areas determines how effective individual stands or landscapes are in meeting habitat requirements. Maximum use of forage with the least expenditure of energy occurs when forage and cover are interspersed. Size of individual openings become less effective as the distance from cover increases. The relationship of stand size and effective habitat distribution can be expressed in terms of distance from edge (Figure III-J-5 displays this relationship).

The current amount and type of cover and forage areas on summer and winter range is displayed in Figure III-J-6. These percentages represent a Forest-wide average. Depending upon the amount of past timber harvest activity, frequency of harvest entry, and size of harvest units within a given subdrainage, amounts and distribution of forage and cover areas varies throughout the Forest.

Rate of timber harvest determines the long-term availability and distribution of forage and cover areas. Natural forage openings comprise only 1% of the Forest. Openings created during timber harvest make up 13% of the Forest. Continued long-term availability of forage openings depends on timber harvest or fire in many areas of the Forest.

Figure III-J-4. Deer and Elk Forage and Cover Areas

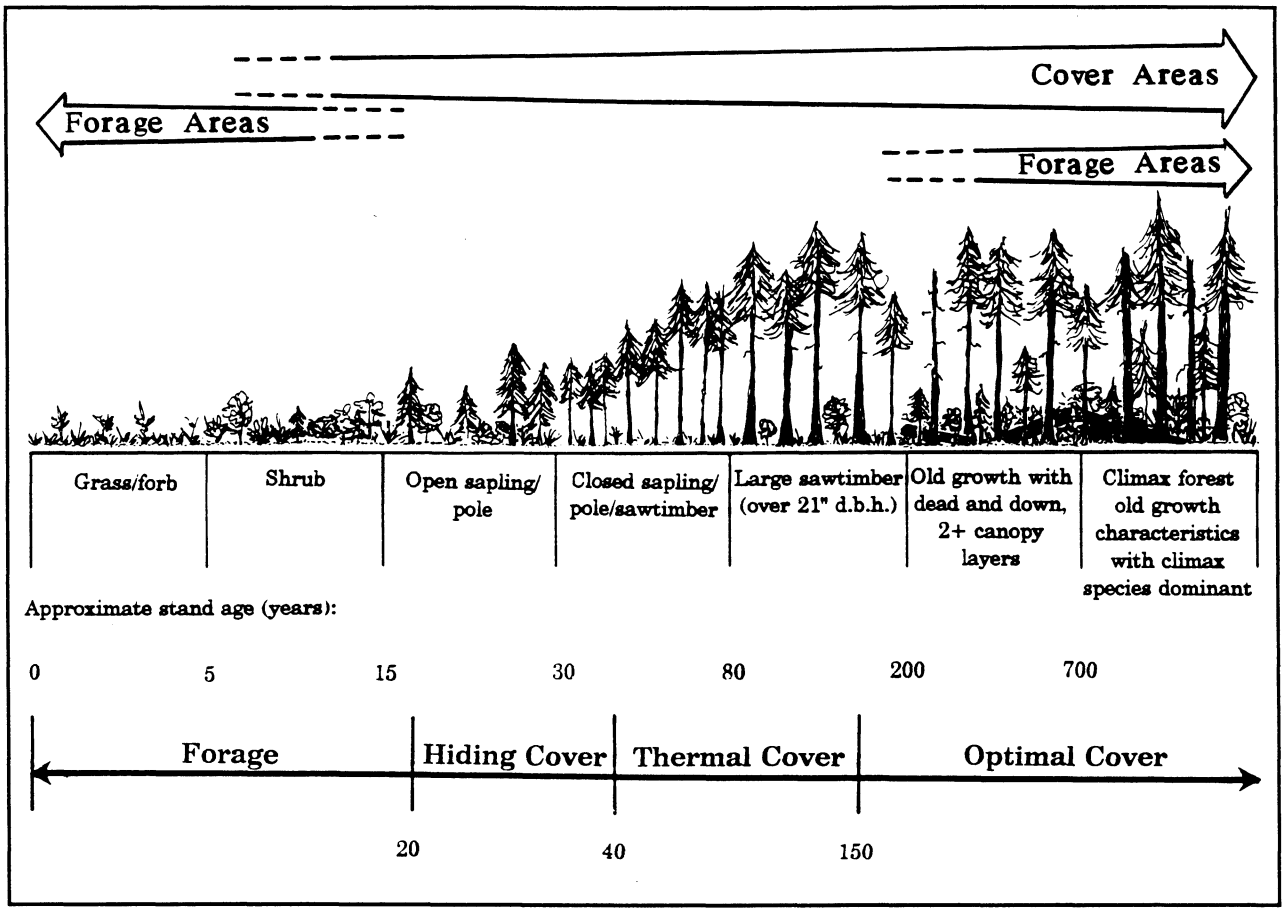
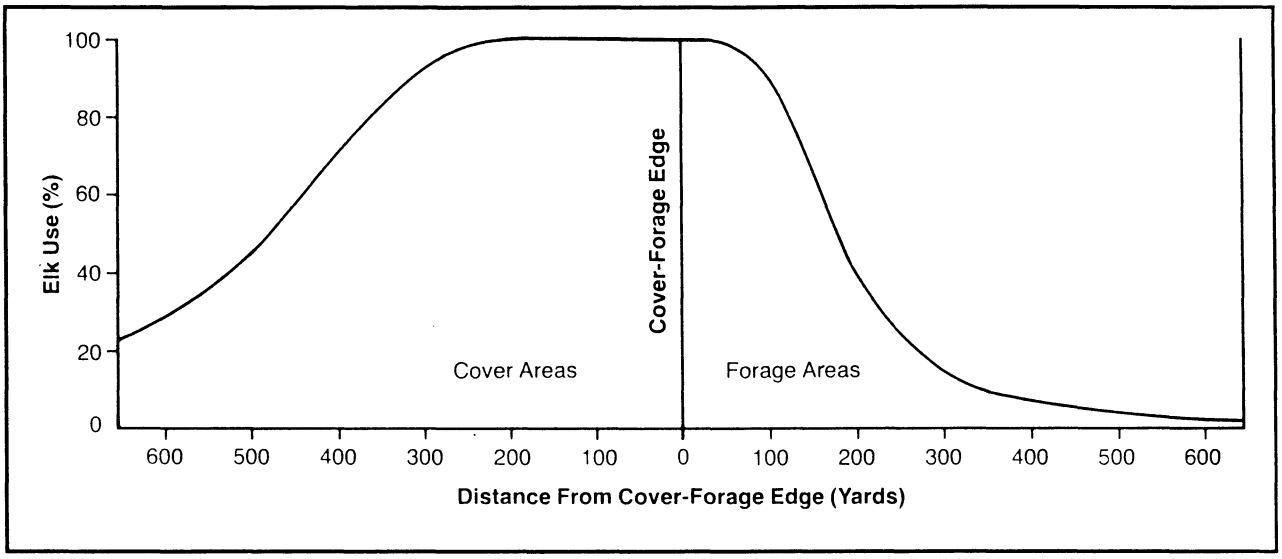
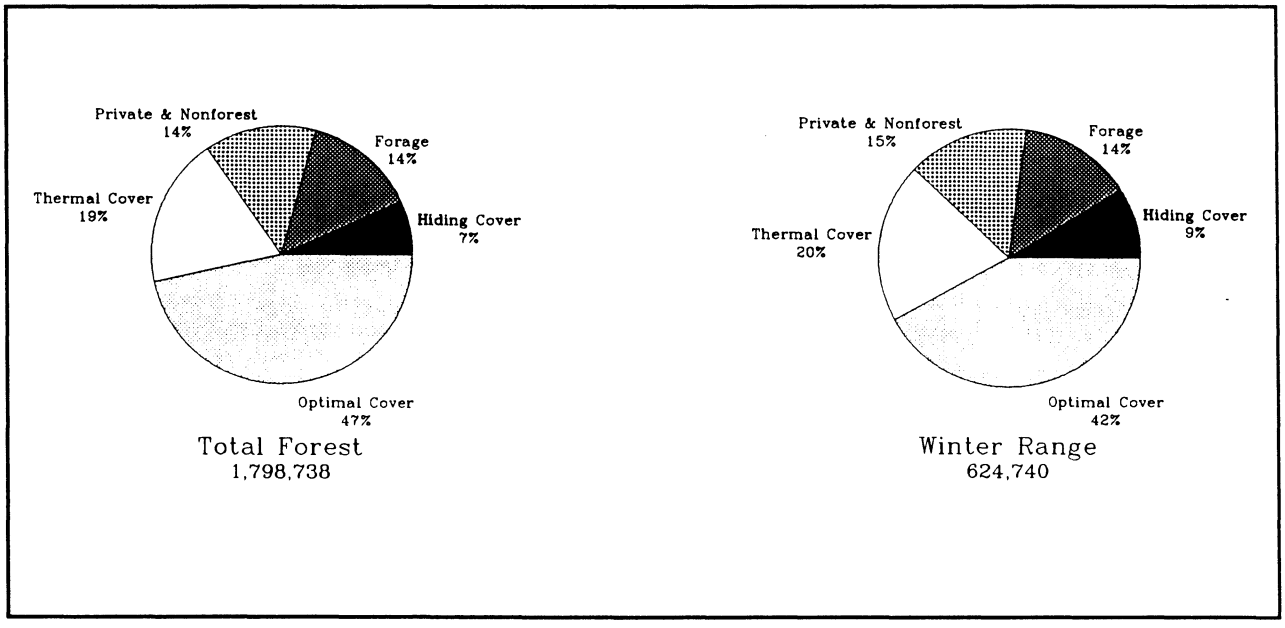


Figure III-J-5. Relationship of Elk Use to Distance from Cover-Forage



Source: Wisdom et al. 1986

Figure III-J-6. Existing Distribution of Forage and Cover Types



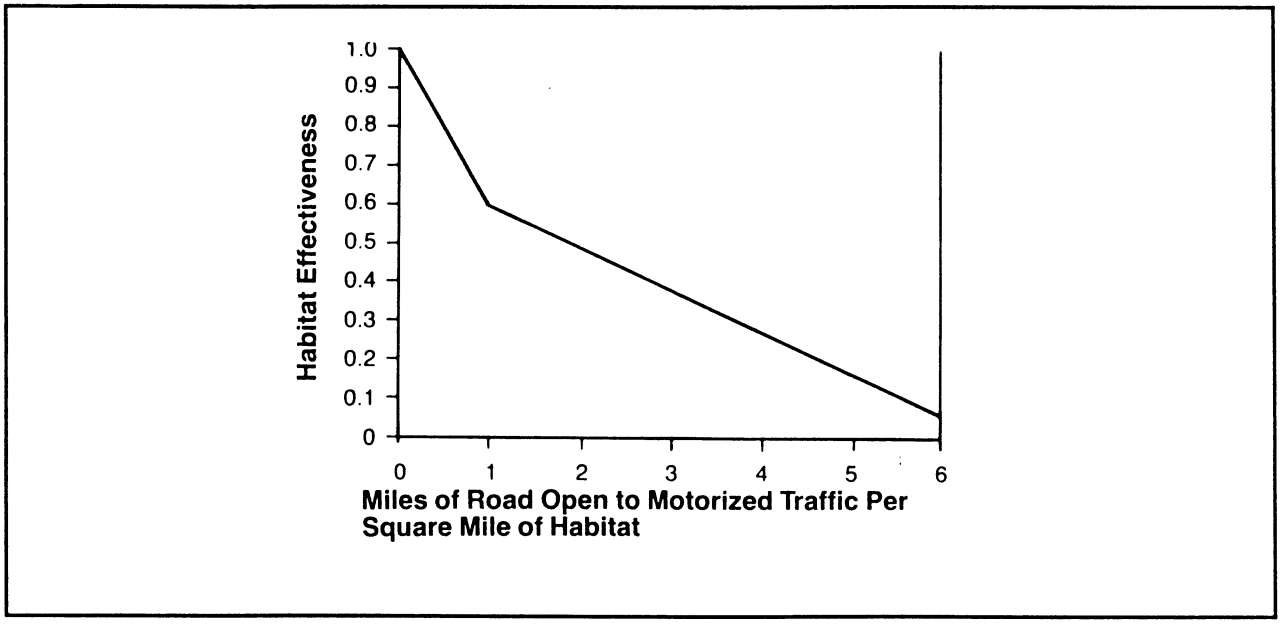
Density of Roads Open to Moterized Vehicles - Elk avoid roads to a greater degree than deer. Roads open to vehicular traffic significantly affect use of adjacent habitat by elk (Lyon 1983, Witmer and DeCalesta 1985). Hunted population show greater avoidance than populations that are protected. The frequency of road use that results in habitat avoidance has not been determined.

Open roads have been identified as a limiting factor in bull escapement during hunting seasons. In addition, ODFW estimates that significant numbers of deer and elk are illegally harvested (TWS 1989). Open roads reduce effective law enforcement capability because of the number of escape routes available to poachers. Because summering populations are dispersed over a larger geographic are, they are less suceptable to poaching. Exceptions occur near key use areas and along migratory routes. Figure III-J-7 displays the relationship between habitat effectiveness and miles of road open to motorized vehicles.

Current estimates are that 6500 miles of road are present on the Willamette. Higher elevation summer ranges contain more wilderness and roadless areas thus have an overall lower road density. Road closures have been implemented and timber sale contracts have been modified in an effort to reduce harassment to elk during winter and calving periods.

Surveys of hunters indicate that the greatest concern associated with current habitat conditions and recreational opportunities is the density of open roads (ODFW 1983). Hunters expressed concern at the lack of "walk-in" hunting opportunities, and the impacts of illegal harvest on opportunities to be successful during designated hunting seasons.

Figure III-J-7 Relationship of density of roads to habitat effectiveness



(Lyon 1983)

Special and Unique Habitats

Special and unique wildlife habitats are found throughout the Forest. These habitats are often associated with natural Forest openings, riparian areas, meadows, hardwood Forests, geologic features such as cliffs, talus, and caves and open water. Meadows provide foraging areas for numerous species including elk, bear, deer, and song birds. Predators including hawks, owls, falcons, coyotes, foxes use meadows and riparian habitats extensively while hunting. Caves are an important habitat element for bobcats, cougars, and bats providing shelter, roost, and den sites and protection from predators. Cliffs provide secure places for a variety of raptors to nest and rear their young. Talus concentrates animals such as pikas, frogs, toads, lizards, snakes, and other small mammals, and provides protection for some species during reproduction and hibernation. Open water provides needed habitat for wintering waterfowl, as well as foraging for eagles, ospray, and other fish eating species. Although these areas are a relatively small part (146,153 acres) of the Forest, they contribute significantly to the diversity of wildlife species.

In the past, some of these special and unique habitats have been altered by timber management and road building activities. The removal of Forest stands adjacent to special wildlife habitats alters food sources, eliminates visual barriers, opens areas to increased human harassment, and changes wind current patterns. Although natural openings such as caves, cliffs, and talus have not been changed to any great extent, the surrounding vegetation which contributes to their microclimatic conditions or usefulness as habitat for certain wildlife species has often changed dramatically.

Peregrine Falcon: Endangered Species

The peregrine falcon is listed in the Federal Register as an endangered species. A systematic inventory and survey for peregrine falcon has not been completed on the Forest. No nesting pairs of peregrine falcons have been found on the Forest, although several sightings have occurred. In 1981, the Forest in cooperation with ODFW identified cliffs meeting nest site characteristics for peregrine falcons. Subsequently, the ODFW conducted an aerial reconnaisance and identified 12 of these sites as having high potential as nest sites, but found no peregrines present. Table III-J-8 displays the locations of potential peregrine falcon nest sites.

Table T013. Potential Nest Sites for the Peregrine Falcon (III-J-8)

Ranger District	Location	Legal
Detroit	Mt. Beachie	T9S R5E Sec. 11/12
	Blowout Cliff	T10S R5E Sec. 23 (mostly private)
	Puzzle Creek	T11S R8E Sec 26/27
Sweet Home	Scar Mt.	T12S R6E Sec. 31/32
	Jumpoff Joe	T14S R5E Sec. 11
McKenzie	Lookout Mt.	T15S R6E Sec. 31/32
	Horse Creek	T16S R6E Sec. 28-34
Blue River	None	
Lowell	None	
Oakridge	Monteith Rock	T21S R4E Sec. 20/28
	Mt. David Douglas	T22S R5E Sec. 24
Rigdon	Balm Mt.	T25S R3E Sec. 23 (with Umpqua N.F.)
	Dome Rock	T24S R3E Sec. 36

In the Pacific states, American peregrine falcons nest almost exclusively on cliffs, usually near water and abundant populations of song birds. Preliminary studies show peregrines prefer nest sites that are sheer cliffs 150 feet or more in height. The cliff usually has a small cave or overhang ledge large enough to contain three or four full grown nestlings (USDI Fish and Wildlife 1982).

The direct use of cliff habitats for nesting and dependence on diverse vegetation conditions for high populations of prey species makes the peregrine falcon a featured species form these habitat types. Many other species of raptors are also commonly found in association with special and unique habitats. The diversity of wildlife species and habitats associated with special and unique features contributes significantly to the long-term recovery potential for peregrine falcons and to maintaining viability of many wildlife species.

Future Trends

Habitat of native and desired non-native species will be maintained at levels capable of supporting viable populations. The use of Management Requirements (MRs) for featured species will provide habitat conditions distributed throughout the Forest to ensure that all represented species exist in viable numbers. This will be accomplished by managing habitats and populations so that limiting factors are reduced and habitat characteristics are provided in the vegetation mosaic throughout the Forest.

Habitat conditions for those species associated with old-growth Forests will continue to decline. Forests managed on rotations less than 150 years will not provide suitable habitat. Only those areas allocated

to no harvest prescriptions will provide suitable habitat for species dependent on mature or older forests conditions.

Although the overall number of species present on the National Forests will remain stable, large fluctuations in the number of individuals within a species will likely occur. Populations are expected to remain viable, but whether the populations are high enough to ensure that the biological function of the species in the ecosystem remains uncertain.

Nesting peregrine falcons are likely to be found on the Forest in the near future. The species has been reported nesting on the adjacent National Forests and suitable habitat exists on this Forest. The Forest will be maintaining the 12 potential nest sites in suitable cliff habitat identified in the 1981 assessment of potential nest sites. When presence of nesting peregrine falcons, is verified, site specific management plans will be developed. All nest sites will managed in compliance with the USDI Fish and Wildlife Service recommendations and the "Pacific Coast Recovery Plan for the American Peregrine Falcon" (1982).

INSECTS AND DISEASE

Insects and diseases play a very important role in the ecosystem. Insects provide food for other insects, animals, and fish and act as plant pollinators. Many insects and disease relationships in the Forest ecosystem contribute directly to the carbon and nutrient recycling process in dead plant residue and to the development of Forest soil organic layers. Insects and disease may have negative impacts on stands of trees. Younger, vigorous trees are more resistant to damage from insects and disease. Mature or old-growth trees tend to have the greatest incidence of disease. Trees inhabitated by insects or disease have reduced sound fiber for utilization as wood products. Other insect-disease relationships are responsible for mortality and retarding growth in Forest stands.

Historic Trends

Historically, the Forest's overall tree mortality from insects and disease has been moderate. However, scattered outbreaks with tree damage have occurred, usually following fire or blowdown. In 1953, 80,000 acres on the Forest were sprayed to control an outbreak of the Spruce Budworm. Insects, diseases, and their hosts have evolved together for centuries, each responding to changes in the other. Though antagonistic to individual plants, many insects and diseases are beneficial to the Forest ecosystem, acting as a natural and necessary component of the system as long as the system is in balance.

Insects, including bark beetles and wood borers, utilize fungi as their primary food base and contribute directly to the dispersal and effectiveness of these decay organisms. In the process of eating the fungi, the insects ingest spores which sometimes survive passage through their digestive tracts (Witcamp 1975). Tree pathogens such as root rotting fungi are dispersed through the Forest ecosystem in this way.

Physical stress, such as lack of moisture, light, or nutrients, predisposes plants to invasion by insects and certain diseases or pathogens. Moisture stress reduces the tree's ability to combat insect attacks. Insects and disease, that attack stressed trees can release the healthier and more resistant trees. The result is similar to a precommercial or commercial thinning.

There are primarily three insects which have caused significant timber losses in the Forest. These are: The Douglas-fir bark beetle (*Dendroctonus pseudotsugae)*; Mountain-pine beetle (*Dendroctonus ponderosae*); and the Balsam wooley aphid (*Adelges piceae*). Douglas-fir bark beetles are occasionally found in down Douglas-fir timber. Mountain pine beetles occasionally kill pines that are weakened by white pine blister rust, poor or changing site conditions. Balsam wooley aphid damage may occasionally be found in the true firs, particularly Pacific silver fir. An aggressive salvage program has kept insect damage at a minimum.

In many instances birds regulate insect populations locally (Buke 1974). Pileated woodpeckers forage for carpenter ants and termites that invade the heartwood of trees, while sapsuckers and hairy woodpeckers prey on larvae and pupae in the cambium layer. Adult bark beetles, spiders and ants are pursued by other insectiverous birds such as the brown creeper, and the white-breasted nuthatch (Evans and Conner 1979). These birds, bats, other small mammals, and microbes help hold insect populations at nondamaging levels or exert some control during early stages of outbreak. The Forest standards and guidelines for wildlife trees will help maintain viable populations of these valuable species throughout the Forest.

In 1984, an isolated and well-established gypsy moth infestation was discovered on about 5,000 acres of white oak, alder, and Douglas-fir on a ridge south of Oregon Highway 58 between Rattlesnake and

Williams Buttes in Lane County. The area is about 15 miles west of the Forest boundary. Some moths were also found on the southwest portion of the Lowell Ranger District. The gypsy moth has not been proven to be a major defoliator of Douglas-fir; its greatest impact will be on south aspects where oaks and other hardwood brush is abundant. On these habitats it has shown the ability to build up to high population levels and is suspected of defoliating minor amounts of needles of Douglas-fir along with the hardwood species (Miller 1986).

Immediately after this infestation was detected, the Oregon Department of Agriculture and U.S. Department of Agriculture Animal and Plant Health Inspection Service (APHIS) established a quarantine area to regulate and restrict the spread of the gypsy moth. Approximately 200,000 acres of the Forest were included in this quarantine area. All Forest products, including nursery stock, Christmas trees, lumber, firewood, and wood chips had to be certified as being free of gypsy moth life stages before being shipped from the regulated area.

Current Situation

All of the diseases that attack timber species in the Douglas-fir region are present on the Forest. Much of the old-growth timber has heavy defect from butt and trunk rots. Root rots often weaken trees making them subject to windthrow. Dwarf mistletoe causes considerable damage, loss of growth, and occasional death in hemlock and true fir stands. White pine blister rust is prevalent in western white pine and sugar pine.

As existing older stands are harvested from lands suited for timber management, the total Forest losses due to defect will be reduced. The biggest disease losses in the regenerated stands are and will continue to be caused by pockets of root rots, such as *Armillaria mellea* root disease, *Phellinus weirii* root rot, and *Ceratocystis wageneri* black stain root disease. Consideration is now being given to planting tree species more resistant to root disease where the root disease pockets have been identified prior to reForestation actions.

Black stain root disease can be spread by bark beetles and weevils which pick up the fungus while feeding on infested trees and transfer it to other trees. This is minimized by scheduling thinning treatments in June and July when the insects are inactive. The stumps then dry out and are not attractive to the beetles or weevils.

Current tree management and silviculture systems provide methods of control of insects and disease. Prescribed management practices include but are not limited to:

- Removal of disease-susceptible or infected trees.
- Introduction of rust-resistant western white pine and sugar pine.
- Salvage of beetle-infested or susceptible trees.
- The use of more resistant species in reForestation programs.
- Cutting and disposal of mistletoe-infected trees to prevent spread of this disease.
- Aerial reconnaissance for and detection of insect and disease problems to assure prompt and timely treatment.

- Timing cultural operations to minimize insect population increases.
- Enhancing habitat for predators that control insect populations.

The potential threat of the gypsy moth outbreak to Oregon's economy was significant. In 1980, the total Oregon timber product value was $4.4 billion. Receipts from National Forest lands in Oregon during 1984 totaled about $350 million. The Oregon nursery industry ranks third in producing woody nursery stock for shipment throughout the Nation and overseas. Nursery sales and Christmas tree sales in Oregon are valued at $215 million annually.

Through the aggressive effort of federal and state agencies, the outbreak was controlled by aerial applications of *Bacillus thuringiensis* (Bt), a bacterium that produces a toxin against the moth.

The quarantine was lifted in 1989 after 3 years of trapping with zero moths captured. Industry was able to adjust to the compliance procedures of the quarantine and the impacts were less than predicted.

Currently there is a small outbreak of Spruce Budworm in the Santiam Pass area, that has apparently spread from the Deschutes National Forest. The population is being monitored closely to see if pesticide use will be necessary.

Future Trends

Major outbreaks of insects or diseases are unpredictable. As timber is harvested, new pockets of disease will be discovered. Prescriptions will be implemented that will reduce the product loss in plantations. Perpetuation of some of these diseases is inevitable. Insects will cause damage in isolated areas and will probably be recurrent on cone crops. Current tree management and silviculture systems will continue as long as there practices effectively reduce loss of wood fiber and protect other resources.

The benefits of salvaging scattered mortality must be weighed against the reduction of wildlife tree habitat and large woody debris. Loss of this habitat along road corridors will require more green trees to be left in harvest units to maintain the overall watershed in an acceptable condition. Trees causing a safety hazard must be felled but their removal is not necessary.

ARTIFACTS AND SITES

Evidence of past human use of the land and resources within what is now the Forest remains in prehistoric (American Indian) and historical sites throughout the Forest. These sites, and scattered artifacts, make up the cultural resources from which information can be learned about former ways of life in the forest setting, of the Western Cascades.

Historic Trends

Human use of lands and resources in and around the Forest extends over an estimated 8,000 years. Previous American Indian inhabitants within or adjacent to the Forest at the time of historic contact include the Molala, Kalapuya, Tenino, and Northern Paiute. The Molala and the Kalapuya peoples wintered at sites along streams in the lower elevations of the Western Cascades and traveled to the higher elevations to hunt game, gather wild plant foods, and to collect toolstone (obsidian) and other necessities of primitive life. American Indian sites are documented throughout the Forest including toolstone quarrie, habitation sites and seasonal camps, trails, food gathering areas, peeled bark trees, rock shelters, and religious sites (Minor et al. 1987).

Euro-American settlers, miners, trappers, and loggers have used Forest lands and resources since the 1800s. Remnants of the historic (1805-1910) Euro-American use include trails, wagon roads, railroad grades, homesteads, cabins, sheep camps, and mines. The physical remains of early Forest administrative sites (1910-1940) include cabins, guard and Ranger Stations, trails, lookouts, and Civilian Conservation Corps (CCC) recreation and administrative structures.

Many prehistoric and historic sites have been lost or degraded due to environmental processes including weathering, erosion, tree fall, and fire. Historic buildings and structures are affected by weathering, insect infestation, moisture, and fire. Archaeological sites are affected by erosion and natural weathering.

Past experience has shown that cultural resources can also be lost directly through development of campgrounds and trail construction, logging and road construction, and indirectly through improving access which increases potential for vandalism and artifact theft. Occasionally, public use may result in the deliberate destruction of cultural properties through vandalism, relic collecting, theft, and carelessness. Losses of this type may increase in the future with increasing use of the Forest for a wide range of activities. The main protective measures used in the Forest have been to maintain the confidentiality of specific prehistoric site locations, to direct public use away from archaeological properties, and periodic monitoring of sensitive areas. Public education has been used to promote awareness and protection of prehistoric and historic sites.

A number of laws have been enacted to ensure the preservation of the Nation's cultural resources. Principal laws affecting the Forest are:

Preservation of American Antiquities Act of 1906
Historic Sites Act of 1935
National Historic Preservation Act of 1966
National Forest Management Act of 1976
National Environmental Policy Act of 1969
Archeological Resources Protection Act of 1979
American Indian Religious Freedoms Act of 1978
Federal Land Policy and Management Act of 1976
Executive Order 11593 (1971)

Guidelines in 36 CFR 800; 36 CFR 60, 63, 66; and 7 CFR 3100.
United States Forest Manual, Part 2360.
Historic Preservation Handbook

The National Historic Preservation Act, as amended, directs that cultural resources on federal lands be inventoried and evaluated. Project inventory, cultural site evaluations to determine *National Register of Historic Places* and various kinds of investigations including archeological data recovery evaluations are completed annually on the Forest. Enhancement and interpretation of cultural resources has not been accomplished as a regularly scheduled activity. Limited interpretation or enhancement has been accomplished for prehistoric properties to date. Future study will be done of both prehistoric and historic sites as regular program of activities.

Current Conditions

Over 1100 cultural resource sites have been identified in the Forest as of January 1990. Figure III-L-1 summarizes this data by Ranger District. One historic site, Independence Prairie Guard Station, is on the *National Register of Historic Places*. Some 200 evaluated historic and archaeological sites eligible for addition to the National Register. In addition, prehistoric and historic land use patterns suggest a high probability for the occurrence of other significant cultural resources within the Forest.

The Forests CCC era administrative and recreational structures are currently in the process of being nominated to the National Register of Historic Places. Included in this process are: Longbow, Trout Creek, and Clark Creek Organization sites; Breitenbush and Marion Forks Guard Stations; Fish Lake Remount Station and Santiam Lodge; Olallie Mt. and Carpenter Mt. Lookouts; and White Branch Lodge. In addition, the two historic wagon roads (Santiam Wagon Road and The Oregon Central Military Wagon Road) in the Forest are eligible for nomination to the National Register of Historic Places.

There are no known Native American burial sites located in the Willamette National Forest. The Confederated Tribes of The Warm Springs, Grande Ronde and Siletz, and The Cow Creek Band of The Umpqua are regularly consulted regarding Forest activities that are known or likely to affect prehistoric and historic sites. To date, no groups have expressed strong interests about specific prehistoric or historic sites or traditional use areas on the Forest.

The Forest has undertaken a program to identify, evaluate, protect, enhance, and mitigate adverse effects on prehistoric and historic resources within the Forest. The program has expanded from preliminary inventory of known significant prehistoric and historic resource sites to include field surveys of any areas in which proposed management will result in ground disturbance or an exchange of property. Cultural resource inventories consist of project area reconnaissance surveys to identify the presence or absence of cultural sites. The Forest currently inventories approximately 23,000 acres per year. The scientific or historical value or "significance" of all identified cultural resources is determined by evaluating the properties against the National Register criteria for evaluation (36 CFR 60.4). When there is insufficient information present to evaluate a prehistoric site, the Forest archaeologist coordinates a testing program usually consisting of subsurface excavation and scientific collection of artifacts.

Cultural resource compliance procedures, mandated by federal laws and regulations require on-going consultation with the State Historic Preservation Office (SHPO), and the Advisory Council on Historic Preservation and the Keeper of the National Register of Historic Places (National Park Service). When appropriate situations arise, the Forest also coordinates its cultural resource activities with those of adjacent federal land-managing agencies such as the National Park Service, the Bureau of Land Management, and the Army Corps of Engineers.

Table T015. Cultural Resource Information (III-L-1)

Ranger District	Number of Sites		Sites Tested[1]	Sites Eligible to NR [2]	Site Impacts Mitigated[3]
	Prehis-toric	Historic			
Rigdon	134	16	30	16	5
Oakridge	120	58	8	3	0
Lowell	98	37	13	10	1
Blue River	95	14	5	7	2
McKenzie	234	9	24	15	4
Sweet Home	237	20	20	18	6
Detroit	251	35	12	6	5
TOTAL	1,169	189	112	75	21

[1]Denotes sites where either full acheological testing or historic archival research occurs to determine the importance or "National Register" significance of site(s).
[2]National Register of Historic Places
[3]Adeverse affects to cultural sites by project activities are usually mitigated through project redesign and "avoidance". This figure denotes only those cultural sites subject to scentific "data recovery" excavations or historical recording as mitigation measures prior to partial or total site destruction by ground disturbing projects.

Future Trends

As the dimension of land development increases on private and public lands, a correspondingly greater proportion of the physical remnants of our American heritage and a large source of scientific and historical data will be irrevocably lost. As a result, the value of cultural sites on National Forest lands will increase with time. This intensifies the need to protect and manage this irreplaceable resource.

The anticipated demand for identification and use of cultural resources will likely be a function of four factors: 1. intensified timber management activities; 2. recreational use; 3. Native American religious or cultural use; 4. and the development and expansion of archaeological and historical research. The probability for loss of cultural resources increases as lands are allocated to uses involving land modifying activities. The degree of loss will depend upon the location and extent of land alteration.

Timber harvest can result in significant ground disturbance caused by roads, skid trails, and landing construction, yarding of logs, slash piling, and tree planting. At the same time, timber harvesting provides opportunities for identification and evaluation of previously unknown cultural properties. Field reconnaissance for cultural resources accelerates proportionally to the number of acres scheduled for harvesting. In heavily vegetated environments, the removal of understory and forest duff may provide the only means of locating archaeological sites.

Cultural resources will continue to be identified as more of the Forest is inventoried according to the Forest's inventory plan. This plan will enable archaeologists and cultural resource technicians to concentrate their inventory efforts in areas of high probability for the occurrence of artifacts and sites. Current efforts to identify where cultural resources are likely to be found in the Forest are documented

in a forest-wide inventory of occurrence probability. Figure III-L-2 displays the relative occurrence probability of artifacts and sites by landscape feature.

Table T016. Occurrence Probability of Artifacts and Sites (III-L-2)

Landscape Feature	Occurrence Probability			
	High	Moderate	Low	Total Acres
Water Related	218,675	--	--	218,675
Saddles/Knolls/Ridges/ Benches	78,110	--	--	78,110
Meadows/Ecotones	12,627	--	--	12,627
Valley Floors	12,307	--	--	13,307
Aspects - S, SE, SW	--	145,471	--	145,471
Other	--	--	1,208,217	1,208,217
TOTAL ACRES	321,719	145,471	1,208,217	1,675,407

Evaluation of cultural properties will likely remain constant in the near future, while mitigation, including site avoidance, will increase as more ground disturbing projects will be planned for areas with identified cultural properties. Enhancement and interpretation of prehistoric and historic resources has become a high priority in recent years (since 1987) as Forest inventories come near completion and as site evaluation and mitigation accelerate. A large body of information about the prehistoric and historical human use of the Western Cascades has been amassed as a result of these efforts. Consequently, in concert with broader Forest efforts, the Forest has embarked upon a program to enhance and interpret important and represenative cultural sites for public education and enjoyment (See activity schedule for enhancement and interpretation projects, Appendix D of the Forest Plan). This program will likely increase in importance in future years along with the Forest's recreational opportunities.

There are currently few data sources available to determine recreational use of cultural resources on the Forest. Enhancement and interpretation of historical properties would likely increase the demand for recreational use. An effort by th

RECREATION

The Forest offers a diversity of recreation settings ranging from developed sites to Wilderness. People participate in a wide range of recreation activities throughout the year. The most popular recreation activities in the Forest are camping, driving for pleasure, fishing, and boating-related activities. In 1982 participation in these four activities represented approximately two-thirds of the total recreational use in the Forest. Next in popularity were swimming, picnicking, hiking, and resort use.

The dispersed and developed recreation resources of the Forest serve to meet the varied recreational needs of its residents and are an important aspect of the area's economy.

Dispersed Recreation: Forest recreation that takes place outside of developed recreation sites is referred to as dispersed recreation. Areas of dispersed recreation opportunities are available throughout the Forest from a spectrum of landscape settings that range from the densely forested West Cascades to the meadow and lake dotted Cascade Crest. This spectrum of recreation opportunity settings provides the basis for users to engage in a variety of activities, including fishing, hiking, horseback riding, hunting, off-road vehicle (ORV) use, cross-country skiing, driving for pleasure, gathering Forest products, and nature study.

Developed Recreation: Opportunities are considered developed when a particular activity utilizes a structure, facility, or site that has been developed for recreation purposes. These opportunities are provided from an array of developed sites that vary widely in their degree of environmental modification and development. Sites range from downhill ski areas, to campgrounds where facilities are provided for the convenience and comfort of users, to primitive campsites where environmental modification is minimal and facilities are provided only for the protection of basic resources.

Recreation use is measured in Recreation Visitor Days (RVDs) which are used to quantify the amount of participation in various recreation activities. An RVD is equivalent to 12 person hours spent recreating on National Forest land; e.g., 12 hours spent by one person, 6 hours spent by two people, etc.

The primary purpose of managing recreation resources is to provide a range of opportunities from which National Forest users can obtain satisfying recreation experiences. To fulfill this purpose the USDA Forest Service uses a land classification system to inventory and describe a range of recreation opportunities called the Recreation Opportunity Spectrum (ROS). This system seeks to identify recreation settings of varying characteristics that range from large, remote, undeveloped areas to small, easily accessed highly developed sites. These settings are described in terms of five ROS Classes. (See Figure III-M-1 for a description of Classes.) Within this management framework, the traditional concepts of developed and dispersed, motorized and nonmotorized, and trail and nontrail recreation opportunities are interwoven.

Table III-M-1. Recreation Opportunities Spectrum Descriptions [1]

ROS Class	Descriptions
Primitive	Area is characterized by essentially un-modified natural environment of fairly large size. Interactions between users is very low and evidence of other users is minimal. The area is managed to be essentially free from evidence of human induced restrictions and controls. Motorized use within the area is not permitted. Extremely high probability of experiencing isolation from the sights and sounds of humans. Independence, closeness to nature, tranquility, and self-reliance through the application of of outdoor skills in and environment that offers a high degree of challenge and risk.
Semiprimitive Nonmotorized	Area is characterized by a predominately natural or natural-appearing environment of moderate-to-large size. Interaction between users is low, but there is some evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but are subtle. High probability of experiencing solitude, closeness to nature, tranquility, self reliance, challenge and risk. Access and travel is nonmotorized on trails, primitive roads, or cross country. Vegetative alterations; sanitation salvage units to be very small in size and few in number, widely dispersed and not obvious. No on site facilities except limited signing, sanitary and safety needs in native or rustic materials. Minimal to no site modifications. Interpretation through self discovery. Some use of maps, brochures, and guide books.
Semiprimitive Motorized	Area is characterized by a predominately natural or natural-appearing environment of moderate-to-large size. Concentration of users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but are subtle. Motorized use is permitted. Moderate opportunity for solitude, tranquility, and closeness to nature. High degree of self reliance, challenge and risk in using motorized equipment. Vegetation alterations very small in size and few in number, widely dispersed and not obvious. Limited facilities for signing sanitary and safety needs in native or rustic materials. Minimal site modification for facilities. Interpretation through very limited on-site facilites. Use of maps, brochures and guide books.
Roaded Natural	Area is characterized by a predominately natural-appearing environment. Interaction between users may be low to moderate, but with evidence of other users prevalent. resource modification and utilization practices are evident, but harmonize with the natural environment. Conventional motorized use is provided for in construction standards and design of facilities. Opportunity to affiliate with other users in developed sites but with some chance for privacy. Self reliance on outdoor skills of only moderate importance. Little challenge and risk. Some obvious on-site control of users. Access and travel is conventional motorized including sedan and trailers, RVs and some motor homes. Moderate site modification and amount and complexity of facilities for comfort and convenience of user. Interpretation through wayside exhibits. Use of primarilly native-like or rustic material with some refinement in design. Some casual interpretation from Forest staff.
Roaded Modified	Area is characterized by substantially modified natural environment. Resource modification and utilization practices are to enhance specific recreation activities and to maintain vegetative cover and soil. Sights and sounds of humans are readily evident, and the interaction between users is low. Facilities may be provided for special activities. Moderate densities of use are provided for away from developed sites. Opportunity to get away from others but with easy access. Feeling of independence and freedom but with little challenge and risk. Substantially modified natural environment where roads, landings, slash, and debris may be strongly dominant from within, yet remain subordinate from distant sensitive roads and highways. Conventional motorized access including sedan and trailers, RVs & motor bikes. Little on-site controls of users except for some gated roads. No on-site facilities except signing at major road junctions and occasional sanitary facilities for user health protection. Interpretation by simple wayside signs of native or rustic materials may be provided.

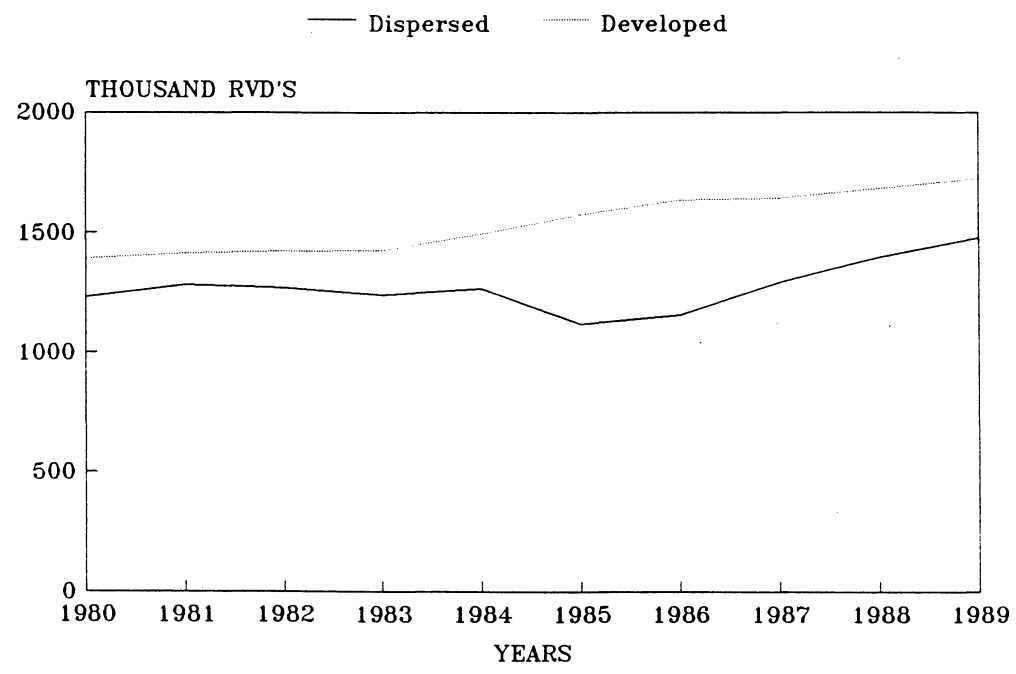
[1]Source: Pacific Northwest Region ROS Photo Poster.

Historic Trends

To determine the most likely rate of change in future recreation use it is necessary to examine trends in historical data. The primary source for visitor use data for the Forest is the Recreation Information Management (RIM) System. RIM files contain use data for specific activities and sites in the Forest. Similar RIM activities were combined into appropriate categories for analysis and display.

Analysis of RIM data from these activity groupings for the period 1980-89 revealed an average annual growth rate in recreation use for all activities of about 2.7%. See Figure III-M-2 for dispersed/developed use trends and Figure III-M-3 for trends of all activities. Although some fluctuations in use were noted between 1980-1989, clear trends of continued growth are evident in the data.

Figure III-M-2. Recreation Use in Thousands of RVDs[1]



Type of Use	1980	1981	1982	1983	1984	1985	1986	1987	1988[2]	1989[2]
Dispersed[3]	1,232.5	1,283.3	1,270.9	1,241.2	1,267.5	1,118.8	1,155.9	1,293.7	1,399.5	1,480.9
Developed	1,393.4	1,414.0	1,424.2	1,426.3	1,497.2	1,575.9	1,636.4	1,644.8	1,684.3	1,724.7

[1]Thousands of Recreation Visitor Days (RVD): 1 RVD = 12 hours of use.
[2]Estimates of Forest use based on historical use patterns.
[3]Does not include Wilderness use.
Source: USDA Forest Service, Recreation Information Management System (RIM).

Table III-M-3. Recreation Use for Selected Activities[1] [2](Thousands RVDs)

Activity	1980	1981	1982	1983	1984	1985	1986	1987	1988[3]	1989[3]	Average Annual % Change 1980-89
Camping	982.0	1,027.7	1,027.7	1,053.3	1,059.1	1,101.1	1,123.9	1,207.2	1,259.6	1314.3	+ 3.4
Driving/ Sightseeing	399.1	416.2	413.1	403.1	418.4	434.4	469.8	481.0	491.7	502.7	+ 2.6
Hiking	128.7	170.2	140.9	145.8	144.2	154.2	140.9	164.8	176.8	189.7	+ 4.7
Picnicing	166.8	168.0	145.0	152.6	162.6	163.2	173.2	174.4	179.8	185.4	+ 1.1
Boating/ Waterskiing	222.9	225.4	226.3	232.2	218.8	217.5	226.3	244.1	250.1	256.2	+ 1.5
Swimming	135.2	164.9	147.7	109.2	125.6	147.9	166.2	171.0	180.9	191.3	+ 4.2
Horseback Riding	23.3	24.3	24.1	26.1	24.3	28.8	28.6	28.4	29.8	31.2	+ 3.4
Downhill Skiing	21.0	4.2	22.5	26.8	36.6	49.0	40.8	50.9	51.9	52.5	+15.0
Cross Country Skiing	12.7	9.6	16.6	25.5	26.2	29.9	23.2	31.0	32.2	34.4	+16.3
Other Winter Sports	36.9	30.5	37.2	37.5	45.7	46.3	44.3	48.2	51.4	54.8	+ 4.9
Organization Camping	79.1	69.0	69.2	70.4	71.8	62.2	64.6	60.2	61.1	62.2	- 2.1
Resort Use	116.6	117.8	119.0	90.5	93.7	96.8	94.5	98.2	99.2	100.2	- 1.4
VIS	56.1	54.5	57.7	66.1	61.1	62.4	64.3	61.2	62.8	64.5	+ 1.5
Hunting	84.6	86.7	85.8	84.0	84.4	89.1	85.8	99.5	102.8	106.2	+ 2.6
Fishing	261.5	233.4	260.7	256.4	253.4	266.9	274.4	297.2	307.6	318.3	+ 2.2
Other	65.8	85.3	93.8	94.1	99.9	101.8	93.8	80.7	83.5	86.4	+ 3.2
TOTAL	2,792.3	2,887.7	2,887.7	2,873.6	2,926.2	3,053.9	3,114.1	3,268.0	3,421.2	3,551.1	+ 2.7

[1]Source: USDA Forest Service, Recreation Information Management System (RIM).
[2]Includes use attributed to Wilderness.
[3]Source: Estimates of Forest use based on historical use patterns.

During the 1980-1989 period, participation in most recreation activities increased at varying rates with some noticeable peaks, valleys and plateaus in the trend lines. It seems evident from the figures that recreation use was affected by such variables as weather and travel costs. Although use in most activities showed some decline during the 1980-1989 period total use has increased steadily. Total use did not change from 1981-1982. This may be due in part to the econmic resession the region was experiencing, although there was dramatic increases in use for some activities.

Two activity groupings show a decrease in participation over the 10 year period: organized camping and resort use. Hiking and picnicing use dropped dramatically in 1982 and have only recently regained their 1982 participation levels. Swimming use follows a similar pattern. Between 1982 and 1985, swimming use decreased significantly. Since that time, it has risen to approximately the 1981 level and has shown increases over the last four years.

Current Situation

Access to the Forest is provided by four highways, U.S. Highway 20 and State highways 22, 126, and 58. From these highways, Forest roads branch out to the many points of interest and recreation opportunities. From the Forest roads many trails provide access to remote, undeveloped recreation opportunities.

People from many western Oregon counties, other states, and even other nations visit the Forest. Lane, Linn, and Marion County residents are the most frequent users of the Forest, although Benton, Polk, and Yamhill counties, the Portland metropolitan counties of Clackamas, Multnomah, and Washington, as well as Deschutes County to the east, all contribute many recreationists.

Total recreation use in the Forest is split almost evenly between developed sites and dispersed areas (including Wilderness). The wide variety of sites and settings available provides opportunities for everyone to participate in many different activities and have meaningful recreational experiences.

Recreation Activities: Approximately 80% of the Forest's camping use occurs at developed sites. Nearly one quarter of all developed recreation site use occurs at Detroit Lake State Park, a site managed by the State of Oregon under special use permit. Other high use campgrounds include Paradise, Coldwater Cove, Ice Cap Creek and Big Lake.

About half of the driving and sightseeing activities occur on the major Forest roads in the High Cascades of the McKenzie and Oakridge Ranger Districts. The mountain pass roads are extremely popular for this type of activity.

Some of the reservoirs in the Forest receive heavy boating and swimming use during the summer months. Over 40% of reservoir boating use occurs on Detroit Lake with another 30% on Hills Creek Reservoir. Lakes receiving heavy boating use include Big Lake, Clear Lake, and Lost Lake in the McKenzie Ranger District. These reservoirs and lakes also receive a large portion of the swimming use, both at developed sites and nondeveloped areas along the shore. The remainder (over 40%) of the swimming activities takes place along the rivers and streams flowing through the Forest. The Fall Creek area in the Lowell Ranger District accounts for over half of this type of use. Fishing use in the Forest is divided almost equally between lakes/reservoirs and rivers and streams. Heaviest river and stream use occurs in the Detroit (North Fork of the Santiam and Little North Fork of the Santiam River), Rigdon (Middle Fork of the Willamette), and McKenzie (McKenzie River) Ranger Districts. Lake and reservoir fishing use is heaviest on Detroit Lake and the high elevation lakes on the McKenzie District.

Over 80% of the hiking in the Forest takes place on the Forest trail system. Much of this occurs in the Detroit and McKenzie Districts which together contain 65% of the Wilderness and 30% of the nonwilderness trail mileage in the Forest. Over half of the general undeveloped area hiking occurs in the Rigdon and Blue River Districts. Cross-country hiking without trails makes up about 20% of the hiking experiences on the Forest.

An emerging dispersed recreation activity on the Forest is Mountian Bike use. Mountian Bike enthusists are becomming organized as an group with a desire to cooperate in identifying Mountian Bike use opportunities on the Forest. Currently several trails have been identified as being ideal for this use.

Nearly 65% of all hunting in the Forest is for big-game animals--primarily deer and elk. Another 20% is for small game with the remainder for upland birds and waterfowl. Two-thirds of the big-game hunting occurs in the Detroit, McKenzie, and Oakridge Districts while nearly 70% of the small game hunting occurs in the McKenzie District.

Many of the other recreational activities in the Forest take place at specialized developed sites. Picnicking, resort use, downhill skiing, visitor information services, and much of the cross country skiing fall into this category. Others activities such as horseback riding, nature study, mountain climbing, and gathering Forest products occur primarily in dispersed areas.

Dispersed Recreation: Opportunities for dispersed recreation are available from nearly all land and water areas within the Forest. The type and quantity of dispersed nonwilderness recreation opportunities have been identified through the Recreation Opportunity Spectrum (ROS) inventory process. The inventory, through the use of specific criteria, classifies the Forest landscape into categories that identify a spectrum of recreation opportunity settings. In Figure III-M-4 a summary of acreages, trail miles, and Recreation Visitor Day (RVD) capacity is displayed for each recreation opportunity settings located in the Forest. The spatial distribution of these opportunity settings is illustrated in map form by Figure III-M-5.

Of the four recreation opportunity types that occur in the Forest, the semiprimitive motor and nonmotor are in shortest supply, as they comprise 19% of the Forest's nonwilderness dispersed recreation opportunities. These opportunity types are coincident with Inventoried Roadless Areas and other unroaded lands. Inventoried Roadless Areas, discussed later in this chapter, together with other unroaded lands (less than 5,000 acres in size) comprise the land base from which the Forests semiprimitive dispersed recreation opportunities are derived as illustrated in Figure III-M-5.

Table III-M-4. Nonwilderness Dispersed Recreation Opportunities [1]

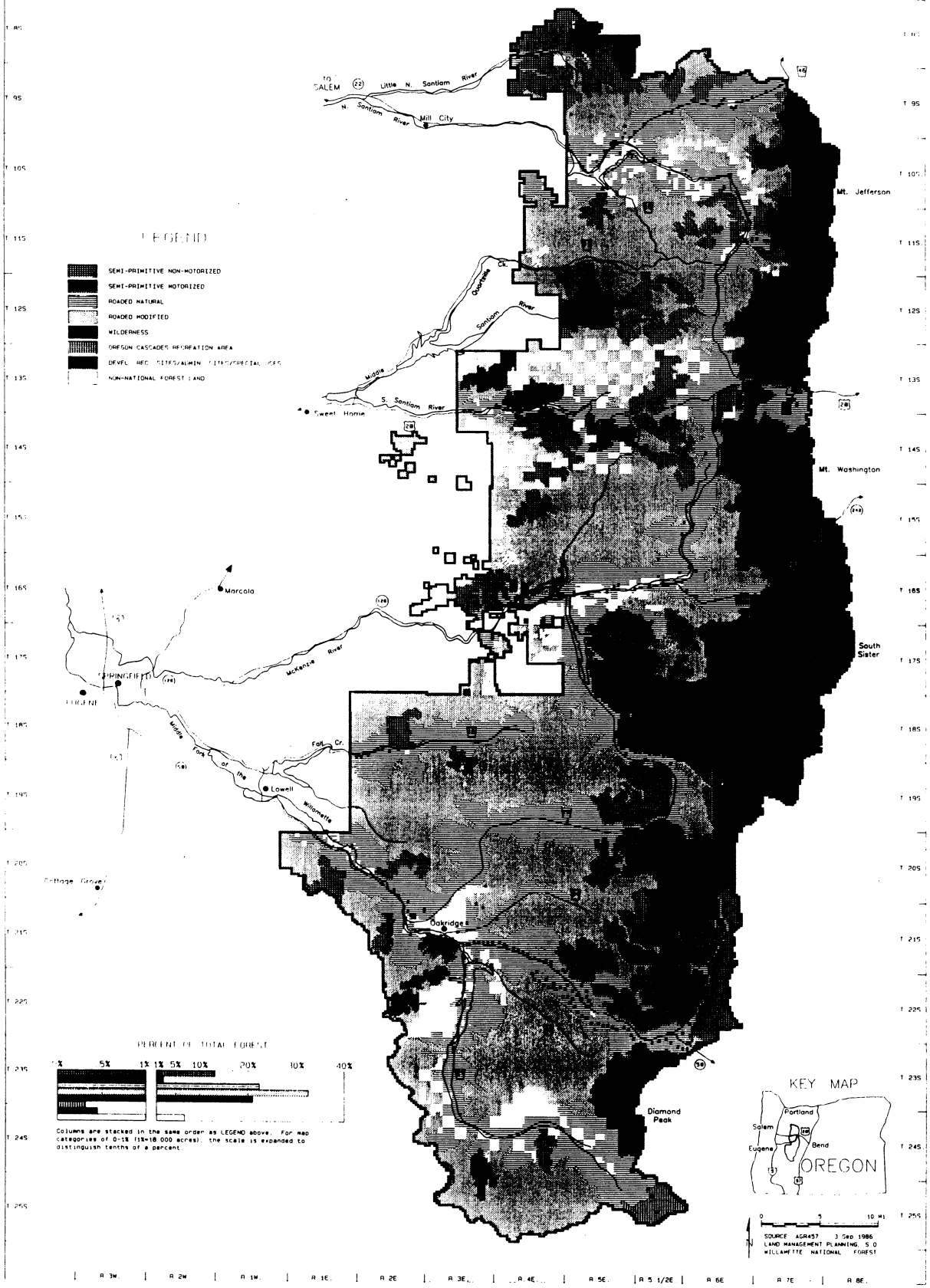
Data Categories	Primitive	Semiprimitive Nonmotor	Semiprimitive Motor	Roaded Natural	Roaded Modified	Totals
Acreage [2]	0	205,335	43,300	437,615	600,120	1,286,370
Trail Mileage	0	280.7	60.5	248.3	124.2	713.7
RVD Capacity	0	125,084	67,378	2,954,146	1,686,858	5,833,466

[1]See Planning Records for documentation of ROS Inventory criteria and process.
[2]Acreages include the Oregon Cascades Recreation Area but exclude developed recreation sites, special use and administrative sites and designated Wilderness.

Figure III-M-5.

WILLAMETTE NATIONAL FOREST

Dispersed Recreation Opportunities



Oregon Cascades Recreation Area: One unique nonwilderness area in the Forest which provides semiprimitive recreation opportunities has been reserved by Congress for recreation purposes by the Oregon Wilderness Act of 1984. This area spreads over adjacent lands of the Deschutes and Umpqua National Forests.

The Oregon Cascades Recreation Area (OCRA) was established by Congress ". . . to conserve, protect, and manage, in a substantially undeveloped condition, certain National Forest System lands in the State of Oregon having unique geographic, topographic, biological, ecological features and possessing significant scenic, wildlife, dispersed recreation, and watershed values . . . within the Umpqua, Willamette, Winema, and Deschutes National Forests . . . "(Oregon Wilderness Act of 1984).

The Forest portion (6,122 acres) of the OCRA (84,278 acres) is located in the Timpanogas Basin about 45 miles southeast of the city of Oakridge. This area includes the headwaters of the Middlefork of the Willamette River and ranges from 5,200 to 7,664 feet in elevation. Most of the area is a true fir/mountain hemlock forest type dotted with numerous small lakes.

Both dispersed and developed recreation opportunities exist in the basin, consisting of two nonfee campgrounds and 20.2 miles of developed hiking trails. Both developed campgrounds, Indigo Lake and Timpanogas Lake have a use season of June 15 to October 15 with peak use occurring in August and September. Timpanogas Lake (10-unit campground) is accessible by a high standard gravel surface road while Indigo lake (two units) requires a 1.5-mile hike.

Dispersed recreation in the OCRA is primarily confined to the trail system consisting of both hiker and off-road vehicle uses. Much of the use originates from either Timpanogas Lake Campground or the Pacific Crest Trail. Motorized use in the OCRA is limited to the existing trail system except for over the snow vehicles.

The OCRA is being managed under a seperate management plan prepared in accord with and subsequent to enactment of the Oregon Wilderness Act of 1984, which has been in effect since February 2, 1989.

Wild and Scenic Rivers: The Forest also provides for a wide range of dispersed recreation activities within two designated Wild and Scenic Rivers: the McKenzie River, from Clear Lake to Scott Creek and the North Fork of the Middle Fork of the Willamette River from Waldo Lake to near West Fir, Oregon. These designated rivers were established by congress in the Oregon Ominbus Wild and Scenic Rivers Act of 1988. Both river corridors provide for extensive hiking opportunities, dispersed and developed site camping, white water boating, fishing, hunting, and other natural resource appreciative activities. A complete description of these and other potential Wild and Scenic Rivers are included in the Wild and Scenic Rivers section in this Chapter and in Appendix E of the FEIS.

Trails: The Forest trail system is the basic off-road facility that dispersed recreationists, such as hikers, horseback riders, hunters, and motorized trail bikes and mountian bike enthusiasts utilize to access and traverse many areas of the Forest. The Forest's trail system includes a total of 714 miles of nonwilderness trails. Three National Recreation Trails, and portions of the Pacific Crest National Scenic Trail are included. Figure III-M-6 displays Forest trail mileages by trail type.

The capacity of the Forest to provide additional trail facilities and enhance trail related use in nonwilderness areas is represented by an 81% expansion potential of the existing trail system mileage. Refer to Figure III-M-6 for a display of potential trail mileage.

Table III-M-6. Nonwilderness Trail Mileage

Trail Type	TRAIL MILEAGE		
	Existing Trails	Potential Trails	Total Miles
Forest Trails	644.1	569.1	1,188.8
National Recreation Trails[1]	46.3	7.5[2]	53.8
Pacific Crest National Scenic Trail[1]	23.3	0.0	23.3
TOTAL	713.7	576.6	1,265.9

[1]Trail segments occurring outside of established Wilderness areas.
[2]Both the Breitenbush and Fall Creek NRTs are proposed to be extended.

Off-Road Vehicles: Off-road vehicle use opportunities are currently available from 71% of the Forest. The remaining 29% is closed to or restricted from ORV use due to topography and safety, potential disruption of wildlife habitats or damage to basic natural and cultural resources, or conflicts with other existing or potential uses. ORV use opportunities are generally available within Roaded Modified, Roaded Natural, and Semiprimitive Motor ROS Class categories. Much of the area identified in the ROS inventory of dispersed recreation opportunities may not be desirable for certain types of ORV use due to slope, dramatic terrain variations, vegetation density, or lack of trail access. ORV opportunities within these ROS Classes may be subject to further adjustment based on these consideration. ORV use is allowed on 63% of the nonwilderness trail system mileage in the Forest. This type of use is projected to increase, which will result in the need for more ORV dispersed recreation opportunities.

Developed Recreation: Existing opportunities for developed recreation are available from 174 Forest Service managed sites and 30 sites managed by the "private sector" under Special use permits. The 204 total sites have the combined capacity to accommodate 2,538,714 Recreation Visitor Days (RVDs) annually. These sites have a combined estimated capacity to accommodate 25,318 persons-at-one-time (PAOT). The distribution of sites by ROS Class is illustrated in Figure III-M-7.

Potential developed recreation opportunities can be made available from a wide variety of sites within the Forest. These potential sites have been identified by field specialists from each Ranger District utilizing such criteria as accessibility, slope, attractiveness, and proximity to water, as well as to other attractions or use areas. This inventory process identified 193 sites with an estimated capacity of over 3.5 million RVDs. Sites from this inventory provide the basis to increase use opportunities for site types that may reach capacity before the year 2040.

Table III-M-7. Developed Sites by ROS Class[1]

Kind of Site	Number of Sites by ROS Class					Total No. of Sites
	P	SPN	SPM	RN	RM	
Observation Sites	--	1	--	9	--	10
Boating Sites	--	--	1	21	2	24
Swimming Sites	--	1	--	6	--	7
Trailheads	--	--	--	14	4	18
Campground - Family	--	2	6	60	3	71
Campground - Group	--	--	--	3	--	3
Picnic Ground	--	--	1	14	3	18
Hotel, Resort, Lodge	--	--	--	3	--	3
Organization Camp - FS	--	--	--	2	--	2
Organization Camp - Private	--	--	--	7	--	7
Concessionaires	--	--	--	2	--	2
Recreation Residences	--	--	--	10	--	10
Ski Areas	--	--	--	--	2	2
Winter Sports Areas	--	--	--	11	--	11
Documentary Sites	--	--	--	1	--	1
Interpretive Sites	--	--	--	13	--	13
Information Sites	--	--	--	2	--	2
Total Number of Sites	0	4	8	178	14	204

[1]Includes both public and private sector sites.

Future Trends

Future recreation use in the Forest will likely be affected by changes in various socio-economic indicators (e.g., population growth, disposable income, leisure time), the availability of opportunities, technology, weather conditions, and other variables. Due to large uncertainties about the variables affecting future use, use projections become more tenuous as they are extended further into the future. Studies which have developed future growth projections for recreation cannot anticipate fluctuations in weather patterns nor predict events such as a world energy crisis or economic recession. Their projections generally assume that an underlying demand is present and will increase with a growing population that has an ever-increasing awareness and appreciation of recreation values. Based on these factors and the general trends in past use in the Willamette Forest, it seems appropriate to assume that future participation in all activities in the Forest will increase as long as opportunities are provided.

To determine future participation rates for all activities in the Forest, recreation activity projection rates of three separate studies were reviewed. During prreparation of the DEIS projection rates of the State Comprehensive Outdoor Recreation Program-Oregon; Projections of Future Forest Use, USDA Forest Service, 1979; and Pacific Northwest River Basins Commission, 1979 were compared. The annual growth rates for recreation use developed in the River Basins Commission study were selected for making use projections in the development of the DEIS and Draft Forest Plan because they most closely approximated trends in the Forests historical (1973-1982) use data. They were also the highest projection rates of the three studies and thus, indicated the upper level of use which could be expected in the year 2000.

However, since release of the DEIS and Draft Forest Plan, more recent studies of user preferences and use projections for a wide range of recational activities have been completed. In addition historical

use data for the Forest has been updated for more accurate comparisons with use projections of recent studies. In 1987 the Pacific Northwest Outdoor Recreation Study (NORS) was completed and in 1988 a draft of the State Comprehensive Outdoor Recreation Plan (SCORP) for Oregon was issued. The NORS study is a regional approach to integrated recreation planning and management among public agencies and is directly related to SCORP processes of participating states. The NORS study included the states of Washington, Oregon and Idaho.

The SCORP for Oregon utilized NORS results from the Oregon Survey portion of the study. Further Oregon's SCORP subdvides the state into geographic regions for purposes of recreation planning. The Willamette Natonal Forest is included in the State's Mid-Willamette Valley Region (Region 8). Oregon's SCORP provides recreation use projection rates for activity groups for each of it's regions. Average annual growth rates for activities within SCORP Region 8 for 1991 to 2010 are displayed in Figure III-M-8.

The annual growth rates for recreation activities presented in the draft SCORP and developed through the NORS study were selected for making use projections for the Forest's FEIS and Forest Plan. Use projections for the Mid-Willamette Valley, SCORP Region 8, closely approximate the Forest's historical use trends for the period 1980-1989. They were selected for use because they exceed SCORP projection rates on a state-wide basis, are specific to the Forests primary area of influence, are the most current projection rates available, and are also the highest projection rates of all studies reviewed and thus, may show the upper level of use expected in the year 2010.

Selecting an appropriate growth rate for recreation participation beyond the year 2010 is more difficult since there are few projections of the underlying factors affecting these activities. An annual average rate of 1.4% for the period 2011-2040 is assumed for the Forest. This rate represents an extension of Bonneville Power Administration (BPA) forecasts of electricity consumption in the Pacific Northwest (Appendix I, Economic/Demographic Projections, May 1982), projected population growth rates for the Pacific Northwest and the State of Oregon.

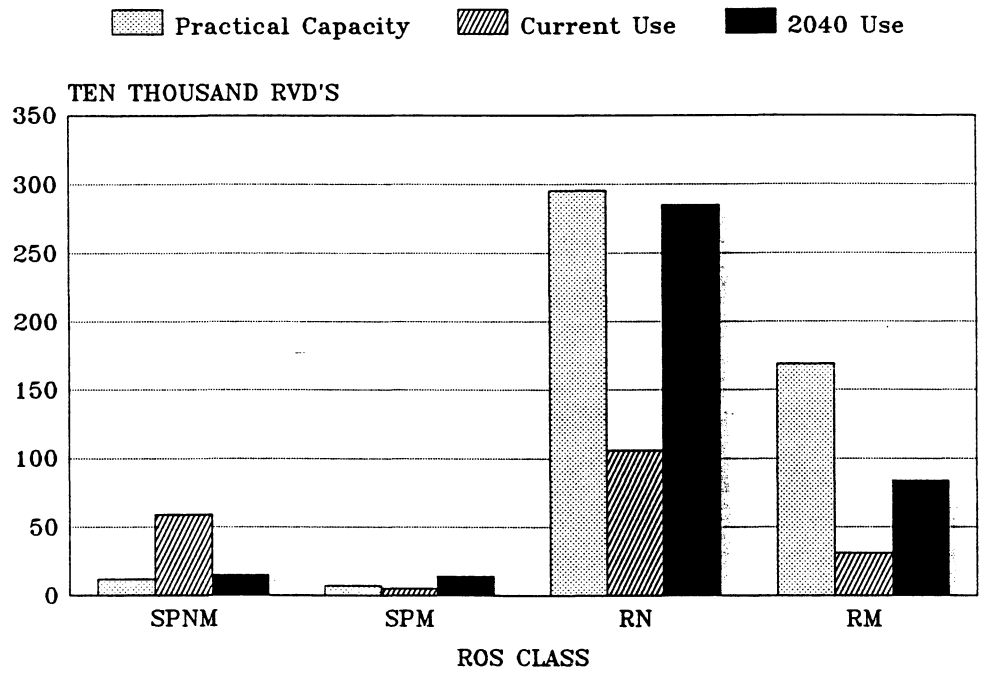
Table III-M-8. Recreation Projection Rates

Activity Group	1991-2010 Rate[1]	2011-2040 Rate[2]
Cammping	3.7	1.40
Driving/Sightseeing	4.9	1.40
Hiking/Walking	4.1	1.40
Picnicking	3.8	1.40
Boating/Waterskiing	5.5	1.40
Swimming	4.2	1.40
Horseback Riding	1.7	1.40
Downhill Skiing	2.6	1.40
Cross Country Skiing	2.8	1.40
Other Snow Activities	3.1	1.40
Organized Camping	1.0	1.40
Resort Use	1.0	1.40
Visitor Information	2.5	1.40
Hunting	2.5	1.40
Fishing	2.5	1.40
All Other Activities	2.5	1.40

[1]Source: Oregon State Comprehensive Outdoor Recreation Plan (SCORP)-Draft 1988. Activity groupings listed in SCORP were grouped according to the categories shown above. Projection rates for this time period represent a moderate scenario of future use for SCORP's Mid-Willamette Vlley Region 8.
[2]Source: Bonneville Power Administration 1982. Forecasts of electricity consumption for the Pacific Northwest.

Dispersed Recreation: Use of nonwilderness dispersed recreation areas has averaged 41% of the total recreation use in the Forest over the past decade. In the past there have generally been adequate use opportunities in terms of quantity of various ROS settings for most dispersed activities. Demand for dispersed recreation is estimated by applying growth projection rates to dispersed activities to obtain total use by time period. The subsequent disaggregation of total dispersed use to ROS Classes is based on observed patterns of activity participation in relation to Forest recreational settings. Although the science of estimating or proportioning demand by ROS Class is somewhat less than exact it affords comparison with existing and potential supply categories. Figure III-M-9 compares the practical RVD capacities by ROS Class for the existing inventory of dispersed recreation areas with 1989 and 2040 projected use.

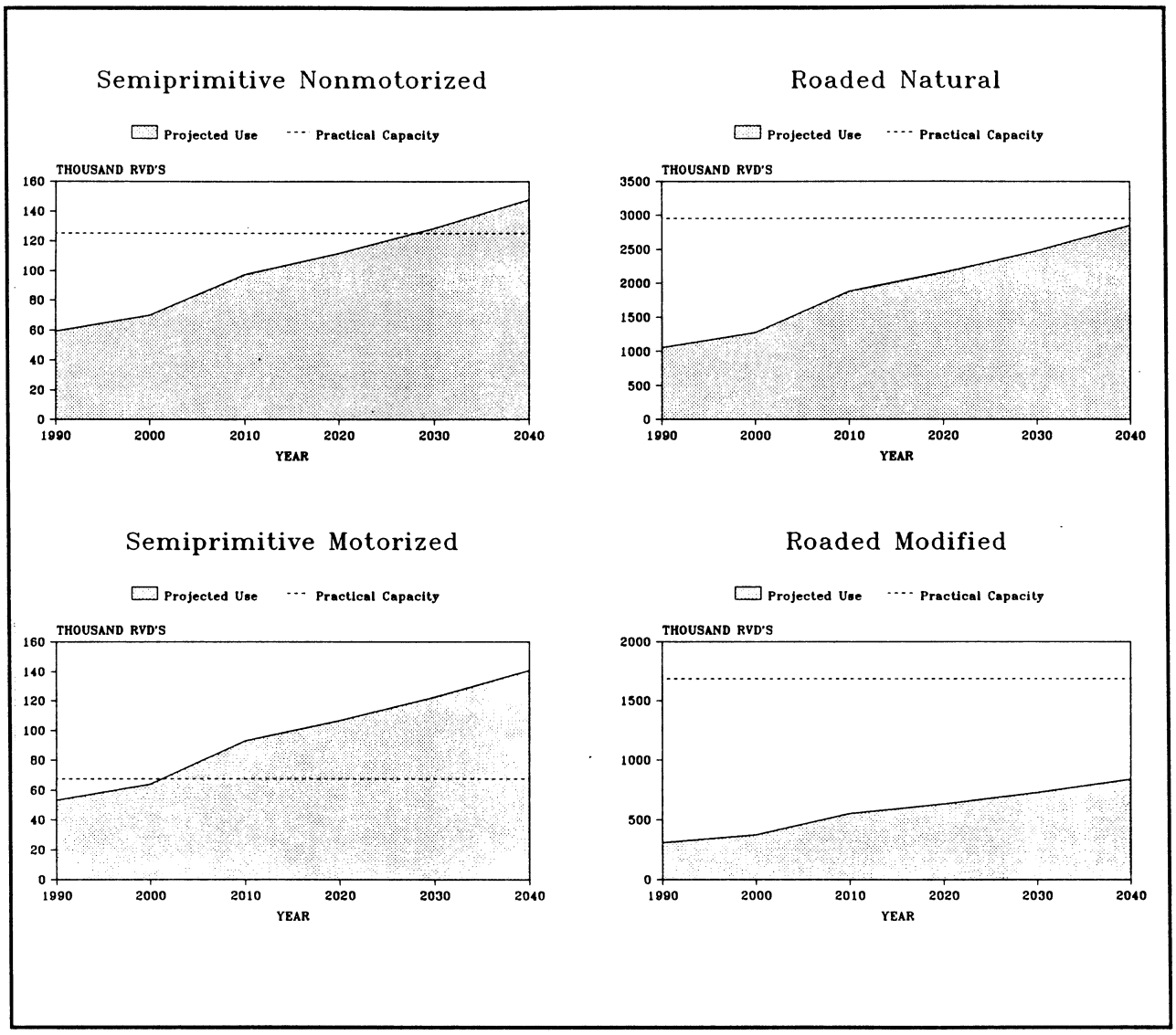
Table III-M-9. Comparison of Dispersed Recreation Capacity and Use



ROS Class Use	Acres	Practical RVD Capacity	Current RVD Use	2040 RVD USE
Semiprimitive Nonmotor	205,335	125,084	59,300	147,800
Semiprimitive Motor	43,300	67,378	53,100	140,900
Roaded Natural	437,615	2,954,146	1,056,300	2,852,700
Roaded Modified	600,120	1,686,858	311,600	839,200
TOTAL	1,286,370	4,833,466	1,480,300	3,980,600

Total dispersed practical capacity for the Forest far exceeds projected total use levels through 2040. This relationship, however, is not consistent among all ROS Classes. Uses which depend upon a semiprimitive setting face a decreasing supply of opportunities as lands are converted from an unroaded state. Unroaded areas which undergo intensive timber harvesting and accompanying road construction will lose those attributes that provide the solitude and undisturbed environment associated with semiprimitive recreation experiences. Even if existing inventories of semiprimitive opportunities were maintained, future demand is expected to exceed capacity by the year 2010. Figure III-M-10 displays projected recreation use by ROS Class and provides an indication of when future use may exceed practical capacity for the Forest.

Figure III-M-10. Projected Dispersed Recreation Use by ROS Class



Developed Recreation: Developed recreation opportunities are provided through a wide variety of site types in the Forest. The practical capacity for each site type in the Forest is compared with projected use in Figure III-M-11.

Developed recreation use for twelve types of sites, and for the Forest as a whole is expected to exceed existing practical capacity before the year 2020. Of these twelve site types, two are supplied primarily by the private sector: resort hotel/lodges, and private organization sites. The demand for organization sites can be met from the potential supply in the Forest regardless of whether they are managed by the public or private sector. There are also enough potential resort hotel/lodge sites in the Forest to meet future demand. However, these site types would be developed and operated almost exclusively by the private sector. At this point, it is difficult to predict if economic conditions will exist to make future investments in these sites attractive.

Table III-M-11. Developed Site Capacity and Use in RVDs

Site Type	Existing Practical Capacity	Projected Use in Year 2040	% of Use Supplied
Observation	39,052	52,201	75
Boating	263,036	463,298	57
Swimming	32,840	250,800	13
Trailheads	111,186	245,200	45
Campgrounds - Family	1,212,904	2,265,255	54
Campgrounds - Group	34,332	51,908	66
Picnic	133,510	333,509	40
Hotel, Resort, Lodge	54,340	176,500	31
Organization - Public	18,980	22,000	86
Organization - Private	81,160	87,600	93
Concessionaire	17,248	54,175	32
Recreation Residences	158,660	158,660	100
Ski Areas	238,096	117,100	203
Winter Sports Area	97,456	61,300	158
Visitor Information Services	45,914	141,800	32
TOTAL	2,538,714	4,481,300	57

Of particular importance is the demand for downhill skiing facilities as expansion plans for one area have received intense public scrutiny. As shown in Figure III-M-11, increases in downhill skiing use do not exceed the total practical capacity of the Forest's two ski areas -- Hoodoo Bowl and Willamette Pass. This relationship holds true for each area individually as well as on a combined basis.

The theoretical capacity for ski areas is determined by skiable acres times skier density by level of skiing ability. It is assumed that a ski area is operating at capacity for the entire use season. Ski area use, however, is not even throughout the week. On peak use days (i.e., weekends and holidays) overuse can occur, with the limiting factor usually being the uphill or lift capacity of the area. Thus, if lift capacity becomes limiting on too many days of a particular season, the theoretical capacity may be an overstatement of the actual use capacity.

Therefore, rigid use of theoretical capacity limits may not be entirely appropriate to determine when expansion should occur for some ski areas. The projected use shown in Figure III-M-11 is in visitor days. The privately operated facilities base their planning more on the number of people, or in the

case of a winter sports area the number of skiers, at one time rather than the number of visitor days that can be provided.

Typically a skier visit includes six or fewer hours of actual skiing during their normal visit to a ski area. Since in most cases the uphill lifts are only operated for about seven hours per day the actual capacity of a winter sports area is more likely to be about 30% of the theoretical capacity, rather than the 40% figure that is provided in Figure III-M-11. Therefore, in order to realize the projected 117,100 visitor days use shown for the year 2040 in Figure III-M-11, the two ski areas on the Forest would need a total number of visits that exceeds 235,000 skiers during a season.

Ski areas also expand to disperse skiers more evenly, as well as to capture periodic increases in use. Accessing new terrain may attract new skiers to the area, permit longer operating seasons, and provide some protection against years with limited snow. These and many other supply and demand related factors (e.g., costs, revenues, and effects on local communities) are carefully evaluated by both the private investor and the Forest Service before any development decision is made on public land.

The service level or types of amenities provided at a developed site can affect demand. While demands exist for all different types of services, there appears to be a growing desire from a more urban-oriented population for facilities which provide more than the basic amenities including the opportunity to participate in multiple and varied activities.

For developed recreation, future use levels can be accommodated to varying degrees by expanding existing capacity for specific types of sites which are likely to experience the projected increases. The availability of substitutes off forest is not taken into account in the projections. This, plus quality-related and other management variables such as the length of managed use season, types of service provided, public versus private sector management, and the charging of fees at public sites can all affect the amount of future use.

The point in time when future use will exceed capacity, if at all, will be different for each site type. This implies that the supply of some site types can and should be increased at various points during the 50 year planning horizon.

Dispersed and developed recreation areas and resources interact with, and are affected by, other resource management activities and natural events. Some management activities, such as wildlife habitat and riparian zone management generally have no adverse effect on recreation settings. In fact, these activities can provide long term beneficial effects to the recreation resource such as improved fishing and wildlife viewing opportunities. However, other activities such as timber harvest, road construction, and fire management may have an opposite affect on recreational settings.

Wildfire suppression activities, such as the construction of firelines, can introduce human modifications into dispersed recreation settings. On the other hand, fire can have a beneficial affect by reestablishing or perpetuating plant and animal diversity within recreation settings.

Trails are affected most by industrial operations and road construction. Logging operations can inhibit trail travel and make it an unpleasant experience. Another important interaction is between different types of trail users. Large groups are generally incompatible with individuals seeking isolation and quiet. Firearms and dogs can be offensive to many users. Off-road vehicle (ORV) users can affect other types of recreation use. Their use can produce noise impacts over large areas and their mobility increases potential to encounter groups and other users unexpectedly. Their use in high elevation Forest zones may also cause damage to vegetation and fragile soils.

Developed recreation is least compatible with Forest industrial operations such as logging and mining and most compatible with Forest management that emphasizes other resources such as wildlife, water, and scenery. Developed sites are vulnerable to vandalism and to the effects of increasing use. Budget reductions may inhibit maintaining facilities for the levels of use they may receive, resulting in increased site compaction, loss of vegetation including large trees, and a general worn-out appearance of facilities. Potential sites are affected most significantly by other Forest uses that may permanently alter the suitability or availability of an area for recreation development.

SCENERY

The landscape of the Forest is composed of dense coniferous vegetation, varied terrain, an abundance of geologic features, lakes and rivers, wildlife, and snow-capped mountain peaks which together form an outstanding scenic resource. This resource provides a broad range of natural and managed scenic experiences for both local and distant visitors.

The quality of the Forest's scenic resource is important to the local tourist industry as well as the Pacific Northwest. Many residents of the southern Willamette Valley, and beyond, through their recreational pursuits, seek an overall natural appearing landscape in contrast to their normal surroundings of urban streets and agricultural lands. The scenery of the Forest is an important asset to the local communities which are attempting to diversify their economic base in an effort to recover from recent declines in the wood products industry.

Historic Trends

The scenery of the Forest is characterized by two distinctive geologic provinces or landscape character types; the Western Cascades and the High Cascades. Each landscape character type is a broad geographical area that exhibits throughout its extent similar features of landform, rock form, vegetation, and water form. Although landform is usually the most significant feature, all features combine to create a certain visual image of the character type.

The Western Cascades landscape character type is oriented in a north-south direction and occupies the western two-thirds of the Forest. The High Cascades character type, also oriented in a north-south direction, occupies the eastern one-third of the Forest. A map of the geologic provinces of the Forest is located in Chapter III, Geology.

The Western Cascades type is characterized by a general conformity in ridge crests separated by deep valleys with moderately steep, highly dissected, side slopes. In the southern portion of this type, the major valleys are V-shaped. Glacial features are evident, but not pronounced throughout the area. Some rock cliffs and rock outcrops exist. Vegetation is characterized by dense stands of large trees including western hemlock, Douglas-fir, and true fir. Most areas have a continuous cover of overstory and understory vegetation. Deciduous species such as alder and maple are often intermixed along drainages. Some meadows are found in both lower and upper elevations.

A wide variety of rock formations exists in the area but most are hidden by the dense vegetative cover. Some extensive bare rock ridges and volcanic plugs stand out above the vegetation, and old volcanic lava flows are sparsely vegetated. Water bodies, particularly lakes, ponds, and marshes are scarce within this character type. Other waterforms consist of streams and major rivers, all of which drain into the Willamette Basin.

The visual experience of Forest visitors in this landscape type is characterized by views that are focused or directed at points or features in the landscape by road and trail side vegetation or landform structure. To a lesser extent, visitors will also experience landscape spaces enclosed by a continuous physical barrier of trees, hills, or mountains.

The High Cascades landscape character type consists of a volcanic plateau capped by shield volcanoes, cinder cones, and other volcanic forms such as lava flows of various ages. All these landforms are in various stages of disintegration. It is essentially an area of rolling terrain, but interrupted at intervals by glaciated channels in the major drainages. The area is dotted with a chain of volcanic peaks and

cones which rise above the surrounding landscape. Much of the landscape is mantled with pumice and volcanic ash. Vegetation is characterized by both dense and open stands of conifers. Usually with sparse understory, western portions are dominated by Douglas-fir, hemlock, and true fir while eastern portions have mostly mountain hemlock and lodgepole pine. In higher elevations there are meadows with lush stands of alpine and subalpine vegetation.

Rock forms are numerous and significant in the landscape. Most rock forms are volcanic in origin, either glaciated volcanic peaks, lava flows, or talus slopes. Some deep, glaciated canyons exhibit extensive rock cliffs on their steep side walls. A wide variety of water bodies dot the landscapes including marshes, lakes, streams, and rivers. Many of the lakes and small streams are the headwaters for rivers flowing west to the Willamette basin.

The visual experience of Forest visitors in this landscape type is characterized by broad panoramic views encompassing considerable distance, also dominated by a single landscape feature or group of features. Visitors will also experience, however to a lesser extent, areas of open space enclosed by a continuous physical barrier of trees, hills, or mountains.

Change in the Forest's landscapes in recent centuries was due primarily to wildfires, but since the early 1900s, noticeable change has been due to a variety of land and vegetation altering activities, such as road and railroad construction, timber harvesting, and dam building, as well as wildfires. Human-caused changes are most apparent in the Western Cascades character type, as evidenced by a mosaic of harvest areas in various stages of regeneration. In the face of this landscape change, Forest managers recognized and sought to manage portions of the landscape for its scenic value by establishing water and travel influence zones.

However, not until recent years have the quality and the characteristics of the scenic forest landscape actually been described and inventoried. Since 1973 the visual resources of the Forest have been described through the use of four inventories integral to the National Forest's Visual Management System (VMS) including: Viewshed Corridors (VSC); Visual Resource Inventory (VRI); Visual Absorption Capability (VAC); and Existing Visual Condition (EVC).

The Visual Management System (VMS) is the primary means for planning and management of the Forest's scenic resources. Through use of this system, project designers seek to maintain the visual quality of the Forest's scenic resources, based on their inherent value, prominence, and public interest. Now adopted throughout the U.S. Department of Agriculture--Forest Service, the VMS enables Forest managers to integrate the principles of landscape management into multiple-use resource planning. The system sets forth procedures that enable managers to identify and classify the visual characteristics of the Forest landscape establish scenic resource objectives and simulate and analyze the visual effects of proposed resource management actions.

To meet the public's long-term expectations for scenic quality, the rate at which change is introduced into the Forest landscape is regulated; management activities are carefully located through viewshed corridor planning; and activities are designed to assure that effects on form, line, color, texture, and scale in the Forest landscape are minimized.

The public's desire for scenic quality has increased over the years. As resource management activities have extended into previously undisturbed and undeveloped areas the public has become more vocal about protecting scenic values. Groups and individuals have actually become involved in the design, location, and scheduling of activities. The public's increasing desire for scenic quality in the Forest is partially reflected by increased demand for recreational opportunities in which scenic quality is an integral part, such as driving for pleasure, hiking, camping, and fishing.

Current Situation

The scenic resources of the Forest are described through the use of four inventories. These inventories display particular aspects of the scenic resource having significance to Forest managers, including the identification of management opportunities, visible areas, existing conditions, and resource limitations. Each of these inventories is described below.

The Forest's potential opportunity to provide scenic resource quality is determined by the Visual Resource Inventory (VRI). The VRI categorizes the Forest landscape into zones of relative scenic importance based upon attractiveness, proximity to travelways and use areas, and the concern Forest users have for scenic quality. Through this process all areas of the Forest are assigned one of five Visual Quality Objectives (VQOs), each representing relative degrees of acceptable alterations of the natural landscape. In addition, through project activities the site specific objectives of enhancement and rehabilitation may be employed to improve existing landscape conditions. A graphic illustration in Figure III-N-1 depicts VQOs on a forest landscape. Definitions and acreages of these VQOs are listed in Figure III-N-2. The spatial distribution of VQOs within the Forest is illustrated by Figure III-N-3.

The distribution of VQOs described in Figure III-N-3 are divided into viewshed and nonviewshed areas within the Forest. The Viewshed Corridor (VSC) includes the visible areas adjacent to important travelways that traverse the Forest. These areas are the most sensitive portions of the Forest in relation to the public's concern for scenic quality. The location and extent of each viewshed corridor is displayed in Figure III-N-4. Figure III-N-5 lists the Forest's most important viewsheds and displays the inventoried visual quality objective acreages fo the Forest.

Figure III-N-1. Visual Quality Objectives and Visual Condition

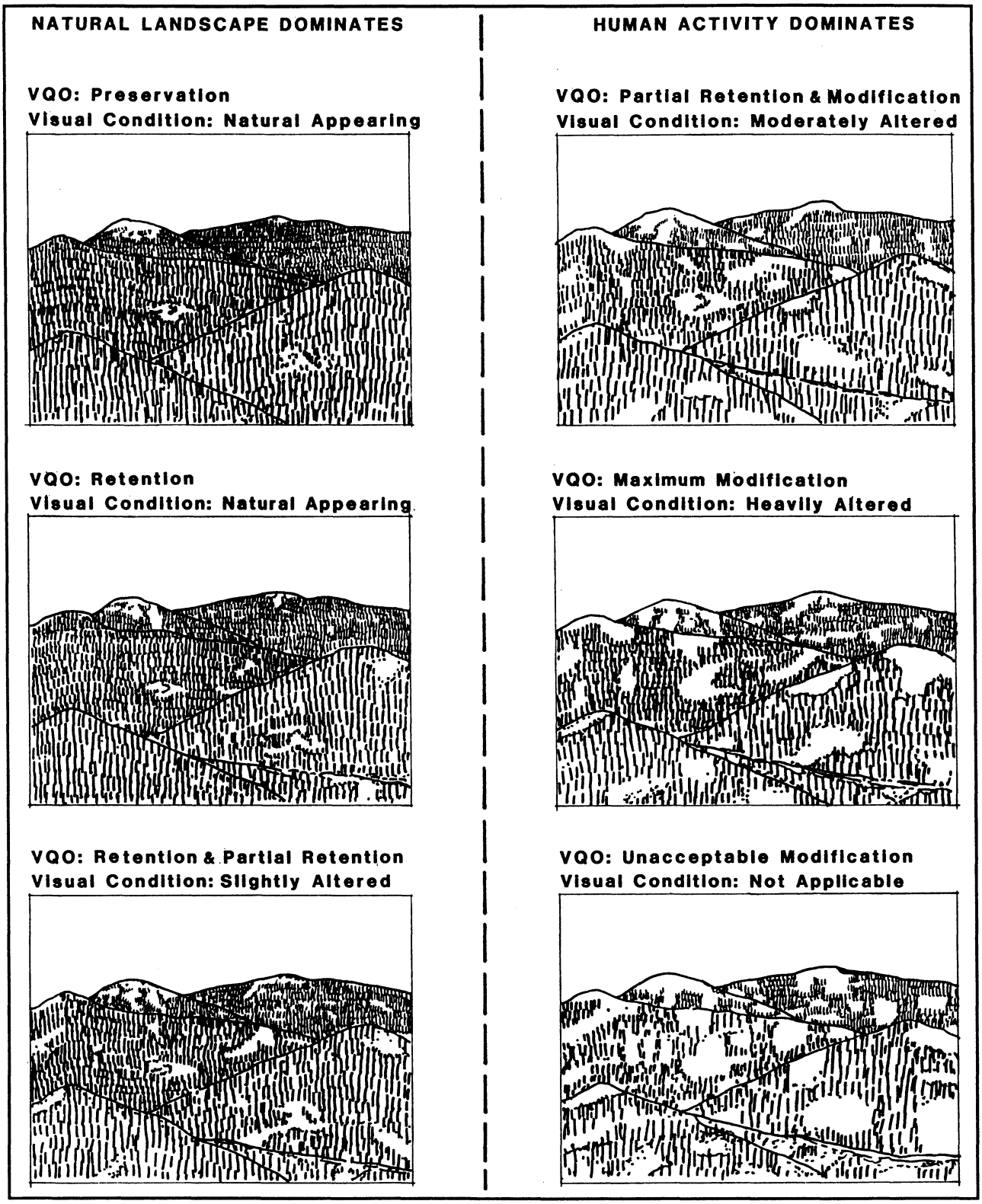
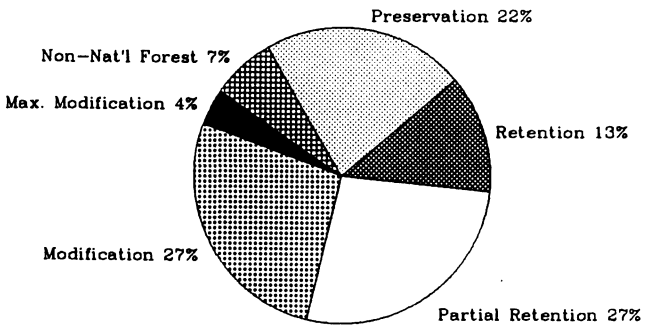


Figure III-N-2. Visual Quality Objectives Descriptions



Category	Description	Acres [1]
Preservation (P):	A VQO that provides for ecological change only.	389,486
Retention (R):	A VQO which, in general, means human activities are not evident to the casual Forest visitor.	232,262
Partial Retention (PR):	A VQO which, in general, means human activities may be evident but must remain subordinate to the characteristic landscape.	488,649
Modification (M):	A VQO meaning human activities may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture, and appear as a natural occurrence when viewed in foreground or middleground.	484,170
Maximum Modification (MM):	A VQO meaning human activity may dominate the characteristic landscape but should appear as a natural occurrence when viewed as background.	80,841
Enchancement (E):	Enhancement is a short-term management practice aimed at increasing positive visual variety where little variety now exists. Enchancement may be achieved through alteration of existing conditions which create additional variety of forms, edges, colors, textures, patterns, or spaces.	--
Rehabilitation (REH):	Landscape rehabilitation is a short-term management practice used to restore landscapes containing undesirable visual impacts to a desired visual quality. It may not be immediately possible to achieve the prescribed visual quality objective with rehabilitation, but it should provide a more visually desirable landscape in the interim.	--
Non-National Forest Land:		123,330
TOTAL ACRES		1,798,738

[1]Forest Visual Resource Inventory (1973 as adjusted).

Figure III-N-3.

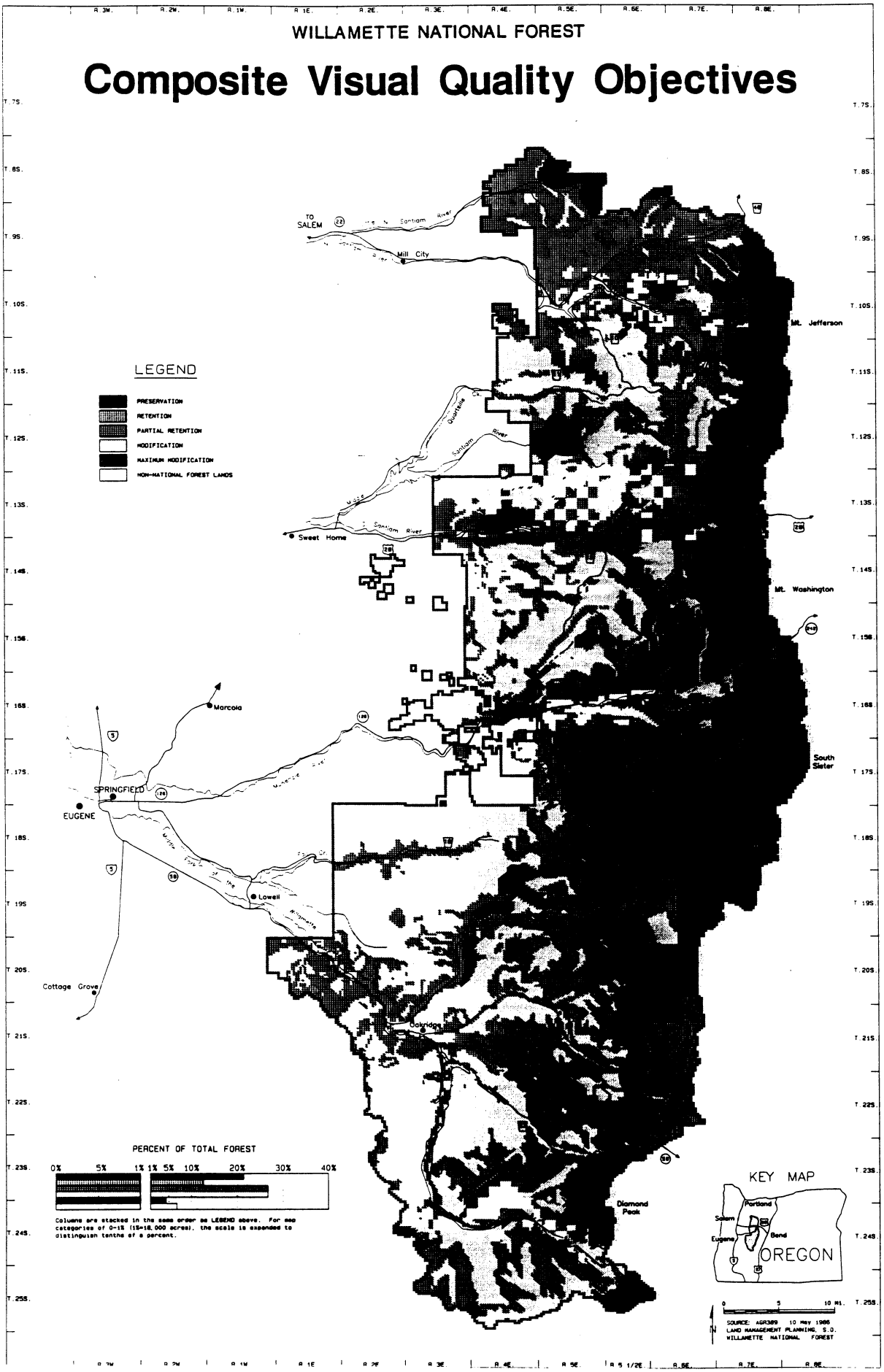


Figure III-N-4.

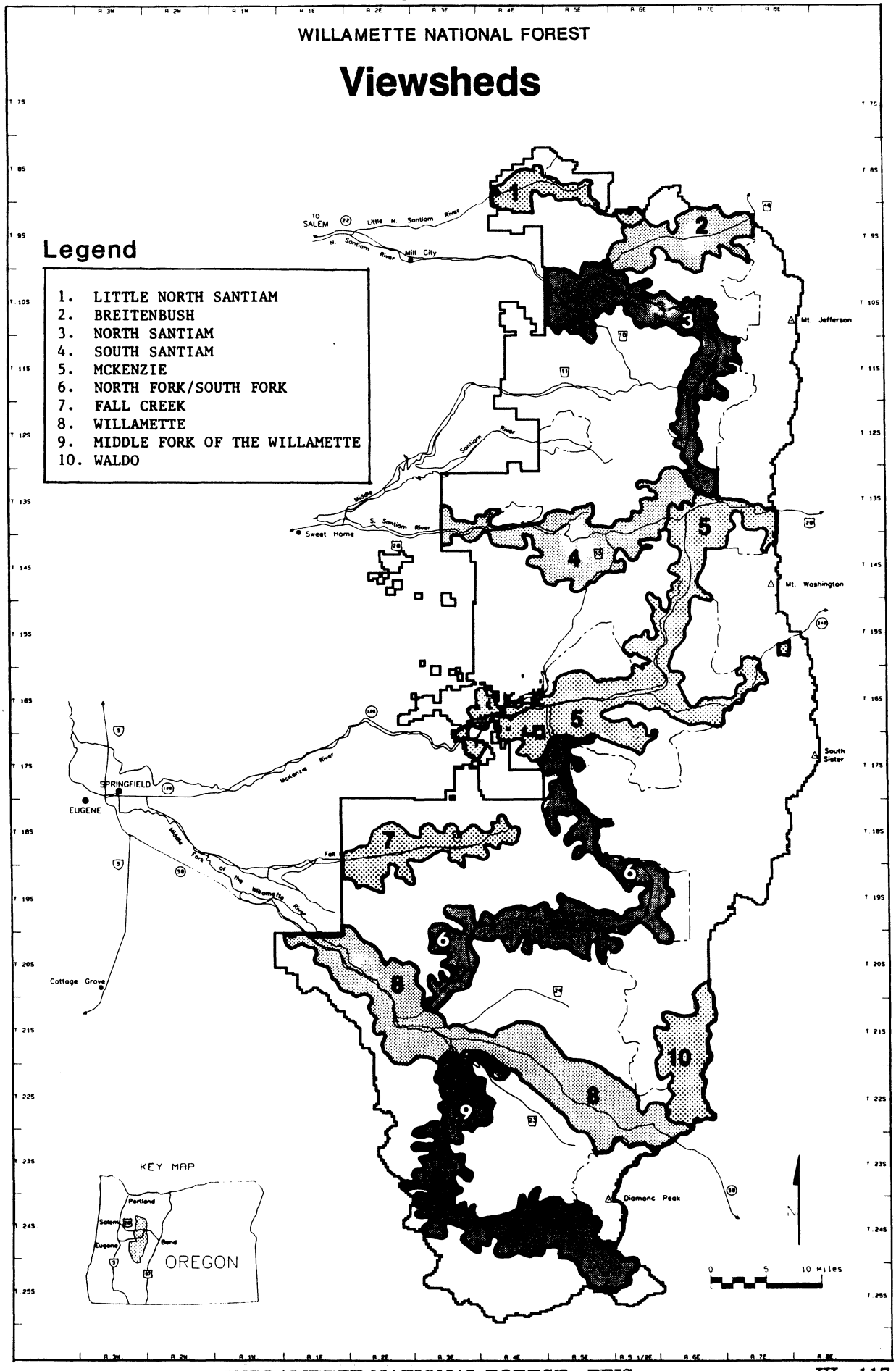


Table III-N-5. Viewshed Condition Ratings and Visual Quality Objectives

	Inventoried Visual Quality Objectives[1]							
Viewshed Corridors	**EVC[2]**	**P**	**R**	**PR**	**M**	**MM**	**NonNational Forest**	**Total Acres**
Little North Santiam	NA	--	5,674	6,058	341	--	149	12,222
Breitenbush	HA	--	15,400	15,080	1,642	--	235	32,357
North Santiam	MA	--	24,828	23,655	2,133	1,109	12,201	63,926
South Santiam	SA	43	14,078	21,031	9,343	64	8,447	53,006
McKenziey[3]	MA	384	38,159	37,413	9,087	6,570	11,518	103,131
No. Fork/So. Fork[3]	SA	--	34,149	29,094	13,971	3,200	619	81,033
Fall Creek	NA	--	2,538	6,890	21,373	--	128	30,929
Willamette	MA	--	27,452	53,261	15,486	--	6,548	102,747
Waldo	NA	469	17,747	8,447	43	--	--	26,706
Middle Fork	MA	--	128	26,428	35,557	7,145	13,992	83,250
Nonviewshed Areas	HA --	388,590	52,109	261,292	375,194	62,753	69,493	1,209,431
TOTAL ACRES	--	389,486	232,262	488,649	484,170	80,841	123,330	1,798,738

[1]See Figure III-N-2 for Visual Quality Objective descriptions and Figure III-N-1 for a graphic illustration of Existing Visual Condition (EVC) Classes.
[2]Existing Visual Condition (EVC) Classes: NA = Natural Appearing; SA = Slightly Altered; MA = Moderately Altered; and HA = Heavily Altered.
[3]Includes Designated National Scenic By Way route.

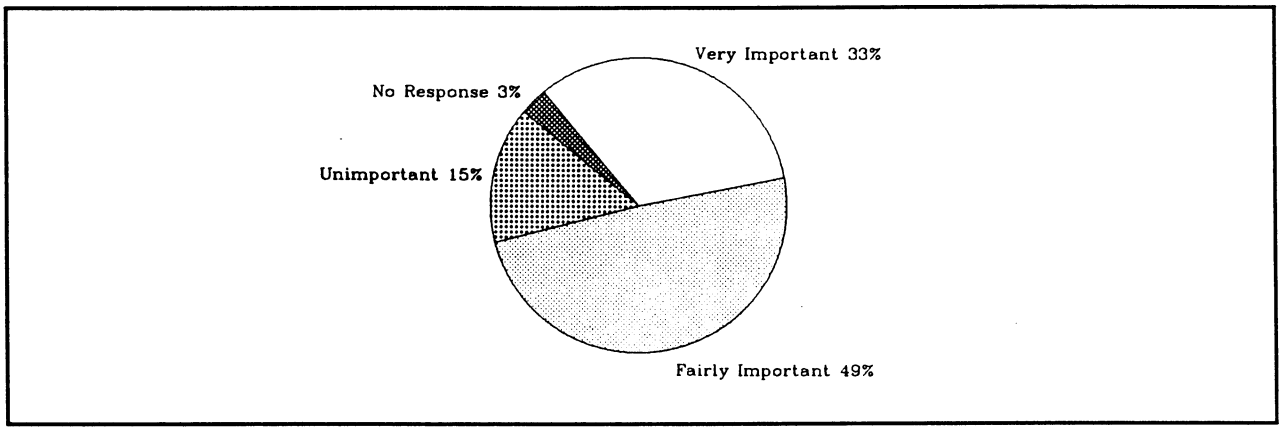
A recent evaluation of the Forest landscape was completed to determine to what extent management activities have altered the appearance of the Forest's scenic resources. This evaluation is referred to as the Existing Visual Condition (EVC) assessment and its purpose is to classify Forest lands in relation to the degree they have been altered as compared to the natural appearing landscape. The assessment stratifies the Forest landscape in to as many as four condition classes: Natural Appearing, Slightly Altered, Moderately Altered, and Heavily Altered. A graphic illustration of these EVC classes is provided in Figure III-N-1. The EVC assessment of the Forest reveals that 38% of the Forest landscape remains natural appearing and that 62% has undergone apparent management alteration. The Existing Visual Condition of the Forest's 10 Viewshed Corridors is included in Figure III-N-5. Those portions of the Forest in a natural appearing condition include Wilderness, unroaded areas, the Oregon Cascades Recreation Area, and several of the Forest's major travel corridors. The EVC assessment serves as a benchmark against which to estimate the effects of proposed management alternatives and to measure actual changes in visual conditions at some future time.

The visual resource is vulnerable to management activities and natural phenomena that alter land forms and vegetation patterns. The limitations of the visual resource to absorb these natural and management induced affects is determined through the Visual Absorption Capability (VAC) inventory. The VAC inventory provides an assessment of the relative ease or difficulty with which change may be introduced into the landscape without impairment of its value as a scenic resource. The VAC inventory reveals that 30% of the available Forest land base is rated as having a high visual absorption capacity while 15% is rated as moderate and 33% as low.

Demand for scenic quality is expressed on the basis of visual sensitivity level data and public issue response data. Tabulation of public comment data for the Forest, in 1981, as shown in Figure III-N-6,

documented that 33% of respondents feel that scenic quality is very important, 49% fairly important, and 15% unimportant. Summarization of visual sensitivity data from the VRI reveals that scenic quality is very important to Forest users particularly on lands adjacent to major federal and state highways, the most heavily used Forest roads and trails, and destination type recreation areas and sites. Approximately 48% of these areas is classified as highly sensitive; 25% is moderately sensitive, and 27% has low sensitivity. The publics concern for scenic quality was expressed through more than 4,000 specific comments on the DEIS and Draft Forest Plan. Of these comments, most (85%) favored protection and maintenance of scenic resource quality with a major emphasis on Viewshed Corridors of State Highways and major Forest roads. The remaining 15% of the public comment expressed concerns that too much area is allocated for scenic resource protection and that quality objectives and management standards are too restrictive.

Figure III-N-6. Public Input on Scenery



The Forest coordinates with other agencies (federal, state, and local) to ensure that visual resource quality is maintained along state and federal highways, around reservoirs, in and around utility line clearings and at electronics sites. In areas of the Forest where private land holdings are heaviest (i.e., along portions of State Highway 20, 22, 126, and 58 and along Forest Road 21) the Forest Service has no control over these lands nor the effects that their management may have on scenic quality. However, every opportunity to coordinate management activities with private land owners is persued to maintain or improve the scenic resource quality in these corridors.

The operation and maintenance plans of the Army Corps of Engineers, Eugene Water and Electric Board, Bonneville Power Administration, and the Oregon Department of Fish and Wildlife are reviewed to identify the potential conflict of activities and to ensure coordination with Forest Service Visual Resource Management objectives.

Additionally, the Forest will coordinate with state and county law enforcement agencies for the location, operation, and maintenance of electronic sites; state and county highway departments for the operation and maintenance of roads and roadside zones; Bureau of Land Management (BLM) for their role in managing subsurface minerals; and the Oregon Department of Aeronautics for management of two small air strips within the Forest.

Since release of the DEIS, the Forest Service has sought to draw attention to and encourage use of the nations scenic resources through establishment of the Scenic ByWays Program. National Forest

Scenic ByWays are being established to maintain, enhance, and interpret the extraordinary cultural, geologic, biological and historical features along selected Forest travel routes. Nation-wide Scenic ByWays are being designated for the natural beauty and scenic diversity through which they pass and for their potential to provide enjoyable, memorable experiences for those who drive for pleasure or use the open road for vacation activities.

Two Scenic Byways have been designated on the Forest and more may be nominated for Scenic ByWay status in the future. The Robert Aufderheide Memorial Drive parallels for 70 miles the South Fork of the McKenzie River and the North Fork of the Middle Fork of the Willamette River on Forest Road 19. The McKenzie Pass - Santiam Pass Scenic ByWay loop follows portions of State Highway 20, 242, and 126 for 82 miles through the volcanic landscape of the recent Cascades with spectacular views of mountian peaks and alpine lakes. Scenic ByWay designation of these two travel routes does not preclude other activities such as creating new views or vistas; interpretive programs, wildlife management programs, meadow habitat improvements; or timber harvesting.

Future Trends

The condition of the scenic resource is expected to change as management activities are implemented to fulfill Forest Plan objectives. Human-caused changes in the condition of the scenic resource during the next decade will primarily result from two factors: the rate at which timber harvest and road building occur; and the rate at which harvested and otherwise disturbed areas become revegetated.

Timber resource management activities may change the character of the scenic resource by altering the landscape's vegetative cover through silvicultural treatments. Intensive treatments such as clearcutting present new patterns of openings in the Forest canopy. Depending on how these openings are designed, they have the potential to contrast significantly with the adjacent area. This potential contrast is greatest in areas where the Forest canopy is homogeneous. Planned alterations, in areas with little natural variety, which incorporate those attributes of the characteristic landscape, however subtle, propose to assure the scenic quality of an area. It is anticipated that changes will become more apparent in areas that are at this time natural appearing.

Road construction can also change the scenic resource by creating unnatural appearing cut or fill slopes. This may be especially evident in steep topography where cut and fill slopes appear as strong horizontal lines. This type of change is generally long lasting and apparent even when viewed as background (3-5 miles viewing distance).

Interest in and concern for scenic quality is increasing with the demand for recreational opportunities. As population increases within the Forest's area of influence greater numbers of Forest users will expect attractive and pleasing environments for many of their recreational activities. The quality of view from recreation sites, scenic travelways, and prominent view points will become increasingly important.

Future demand for scenic quality is expected to parallel demand for both developed and dispersed recreational activities for which scenic quality is an integral part. Forest users engaged in recreation pursuits seem to prefer settings that are physically attractive. Many of these users have formed expectations about how the Forest should look and express concern when their observations are different from their expectations.

Recreationists generally are attracted to scenic features and, in turn, tend to generate interest in protection of these features to maintain the integrity of the physical settings for activities in which

they participate. The quality of the experience derived from these settings is becoming increasingly important to the tourism industry as it becomes more dependent on the scenic quality of the forest.

Management to achieve scenic resource objectives may increase the cost of operations due primarily to the techniques employed during project design and actual implementation. Such techniques may include use of unevenaged silvicultural systems, road location, road closures, use of vegetative screens, seeding cut and fill slopes, and use of color applications on rock walls or structures to reduce contrast between management activities or facilities and the surrounding landscape.

WILD AND SCENIC RIVERS

The Wild and Scenic Rivers Act of 1968 (Public Law 90-542 as amended) established a method for providing federal protection for certain of our remaining free-flowing rivers, and preserving them and their immediate environments for the use and enjoyment of present and future generations. Rivers are included in the system so that they may benefit from the protective management and control of development for which the Act provides. Section 4(a) of the Act mandates that all rivers designated as potential additions to the system be studied as to their suitability for inclusion in the system. Rivers can be identified for study for potential inclusion in the System by several means:

1. Federal statute that mandates federal agencies to study a river pursuant to section 5(a) of the Act.

2. Identification for study by the Secretary of Agriculture or the Secretary of the Interior pursuant to section 5(d) of the Act.

3. The Nationwide River Inventory (NRI) developed by the National Park Service.

4. The land management planning process.

In accord with section 4(a) of the Wild and Scenic Rivers Act, the Departments of Agriculture and Interior initiated studies of several rivers which the Act authorized for study as potential additions to the National Wild and Scenic Rivers System. In order to facilitate the study process, it became necessary for the two agencies to agree to a uniform evaluation and management approach. Therefore, the *Guidelines for Evaluating Wild, Scenic and Recreational River Areas Proposed for Inclusion in the National Wild and Scenic Rivers System Under Section 2, Public Law 90-542* was prepared and promulgated in February 1970. The guidelines not only provide guidance for the congressionally mandated studies, but are also useful for evaluations conducted by land management and water resource development agencies under section 5(d) and for States applying for inclusion of State-designated rivers in the national system. In addcord with these guidelines the river planning and assessment process follows a three-step procedure that includes: determination of eligibility; potential classification; and determination of suitability.

Eligibility of a river is determined by applying specific criteria ("free-flowing" conditions and "outstandingly remarkable values") from the Act and from the USDA-USDI Guidelines. For a river to be eligible for designation to the National System it must be "free-flowing" as defined by the Act and posses one or more "outstandingly remarkable values" with in the river area, such as scenic, recreational, geological, fish and wildlife, historical, cultural or other values, including ecological values. Application of these criteria is based on the professional judgement of an interdisciplinary study team and their collective knowledge of individual rivers or river segements.

When a river or river segment is found to be eligible, it is given a potential classification of Wild, Scenic, or Recreation. The classification of a river is based on the conditions of the river and that of adjacent lands. Figure III-O-1 provides a brief description of each river class used in this step of the process.

Table III-O-1. Wild and Scenic River Class Descriptions

Classification	Description
Wild	Free of impoundments Inaccessible except by trail or water surface Watershed or shorelines primitive Waters unpolluted
Scenic	Free of impoundments Shorelines largely primitive Accessible in places by roads Timber harvest may be practiced within the 1/4-mile corridor
Recreation	Readily accessible by road or railroad Some development along shorelines Some impoundment or diversion in the past Segments may be in or near urban areas Timber harvest may be practiced within 1/4-mile corridor

[1]See also Figure III-O-4 for location and extent of designated rivers.

Determination of suitability is the final step in the river assessment process. This step provides the basis for the decision to recommend designation or nondesignation of eligible rivers to the United States Congress . The determination of suitability considers: characteristics which do or do not make an area a worthy addition to the National System; current status of land ownership, including amount and type of private land uses; potential land and water uses that would be enhanced, curtailed or foreclosed; public, State, and local governmental interests; estimated costs of acquiring necessary lands and interests, and for administration if added to the System; and other issues and concerns identified during the river planning process.

In Oregon, rivers can be designated as part of the National Wild and Scenic Rivers System through an Act of Congress or an Act of the Oregon Legislature and subsequent applications by the Governor of Oregon to the Secretary of Interior. In addition, rivers within the Forest may be designated as State Scenic Waterways. The Oregon Scenic Waterways program, established in 1970, is administered under the authority of the Oregon Transportation Commission through the State Parks and Recreation Division (ORS 390.805-ORS 390.925).

Historic Trends

Cultural History

As long ago as 10,000 years, rivers now under jurisdiction of the Forest had been utilized as travel routes and sources of subsistence materials by aboriginal peoples. Prehistoric use of river corridors has been confirmed by archaeological survey along the Blue River, Breitenbush River, South Fork McKenzie River, South Breitenbush River, McKenzie River, Middle Santiam River, Quartzville Creek, North Fork of Middle Fork Willamette River, Middle Fork Willamette River, and the South Santiam River.

In the late 1700s-early 1800s, Euro-American uses of these rivers consisted of trapping, hunting, and fishing. The Middle Fork Willamette country was first explored by Hudson's Bay Company fur traders in the 1820s. Prospecting and mining were important especially along the Little North Santiam River, South Fork McKenzie River, and Quartzville Creek. Later, in the mid-1800s as the Willamette Valley began to be settled by migrants from the east the river corridors were sites of homesteads and livestock

grazing particularly on the South Santiam River, Middle Fork Willamette River, and South Fork McKenzie River. The first recorded passage down the McKenzie and the Middle Fork Willamette Rivers was in 1853. The South Santiam River corridor was explored by early entrepreneurs for location of the Cascade Mountains and Willamette Valley Wagon Road, an east-west passage across the western Cascades. Another historic route, the Oregon Central Military Wagon Road was located along the Middle Fork Willamette River in the 1860s.

By the turn of the century, Euro-American settlers had established lodges and hotels near the hot springs of the Breitenbush River and McKenzie Rivers, and way stations along riverside transportation corridors at Rigdon Meadows (Middle Fork
Willamette River) and Long Ranch (South Santiam River) providing food and shelter for pioneer travellers. Evidence of the 1930s Depression Era can be seen in Civilian Conservation Corps construction of organization camps and trail shelters particularly along the South Santiam, Breitenbush, McKenzie, and North Fork of Middle Fork Willamette Rivers.

Hydroelectric power has been developed within several of the river corridors ranging from small hydroelectric plants on the South Santiam River to Cougar Dam and its much larger power generation facilities along the South Fork McKenzie River. Extensive studies of flood control facility feasibilities were conducted by the Army Corps of Engineers in the 1950s with resultant construction of many of the dams in the 1960s. Dams or reservoirs extant within Forest boundaries are: Blue River, Hills Creek, Lookout Point, Detroit, Trailbridge, Carmen, and Smith.

Planning History

The 1977 Forest Environmental Impact Statement documents that Wild and Scenic River Act criteria were used to evaluate Forest streams in 1970. At that time no streams on the Forest were selected by either the Secretary of Agriculture or the Secretary of Interior for inclusion in the National Wild and Scenic Rivers System. The status of rivers on the Forest changed in the early 1980s when the Little North Fork of the Santiam and the North Fork of the Middle Fork Willamette River, including Waldo Lake were designated by the Oregon State Legislature as State Scenic Waterways in 1983 and 1985 respectively.

The Forest planning process addressed the Wild and Scenic River issue during development of the 1987 DEIS/FP. Planning direction for WSR evaluation at that time required National Forests to focus on rivers identified in the Nationwide Rivers Inventory (NRI). The NRI included segments of the McKenzie River and the Breitenbush River within the Forest. During the process of determining eligibility for both rivers the Breitenbush was determined ineligible for further consideration as a potential WSR. It was subsequently removed from the NRI by the National Park Service (USDI Memo: RES 20-1(PNR-RP) November 16, 1982). The McKenzie River was found to be eligible and met the criteria for classification as a Recreation River. As required by planning regulations, the McKenzie River was recommended for WSR designation in at least one DEIS alternative: Alternative C. Subsequently, the McKenzie River was determined not suitable for inclusion in the National Wild and Scenic River System, but was proposed for management as a Special Interest Area in the Draft Forest Plan.

Following release of the DEIS/FP significant feedback on rivers and river management issues was recieved from several public interest groups. The review comments of these groups focused attention on how rivers were addressed in the planning documents. Review comments included discussions regarding protection of specific rivers, WSR designation, management activities, resource effects, and the planning process itself. The issue of river management intensified during the document review period, and although the subsequent passage of both federal and State river legislation was significatly

influenced by these interest groups, river designation and management of river resources remains a significat issue.

In the Oregon Omnibus Wild and Scenic Rivers Act of 1988 two rivers were designated as included in the National Wild and Scenic Rivers System and two rivers were desinated as Wild and Scenic Study Rivers. Also two additional rivers were added to the State Scenic Waterways System through a State ballot measure on November 8, 1988. Those rivers designated as included within the National Wild and Scenic River System, federally designated as Study Rivers, or designated as State Scenic Waterways are discussed and their designation status summerized below.

In response to public comment and intensified concern regarding the management of Forest rivers, a process was initiated in December of 1988 to determine Wild and Scenic River eligibility of those rivers identified through public comment to the Draft Environmental Impact Statement and Draft Forest Plan. In accord with the laws and regulations described above and through application of the river assessment process described in the Land and Resource Management Planning Handbook (FSH 1909.12 Chapter 8 - Wild and Scenic Rivers Evaluation) and Forest Service Manual 1924, the Forest identified segments of several rivers within the Forest's boundaries as being eligible for inclusion in the National Wild and Scenic Rivers System. The Forest's eligibility assessment of these rivers was completed by an Interdisciplinary Team (IDT) supported by representatives from each Ranger District. The results of the eligibility assessment and determination of potential river classification as either a Wild, Scenic, or Recreation River segment are sumerized later in this section.

Current Situation

Designation Status of Forest Rivers

Through both federal and State legislation in 1988 the Forest gained two federally-designated Wild and Scenic Rivers, two federally-designated Wild and Scenic Study Rivers, and two designated additions to the State Scenic Waterways System.

The Oregon Omnibus Wild and Scenic Rivers Act of 1988 designated the McKenzie River, from Clear Lake to Scott Creek, and the North Fork of the Middle Fork Willamette River, from Waldo Lake to near West Fir, Oregon, as National Wild and Scenic Rivers. The same Act designated Blue River from its headwaters to Blue River Reservoir, and the South Fork McKenzie River from its headwaters to Cougar Reservoir and from Cougar Dam to the McKenzie River as Wild and Scenic Study Rivers.

Additions to Oregon's State Scenic Waterways System through passage of a state ballot measure on November 8, 1988 include: the McKenzie River, from Clear Lake to Paradise Campground; and the South Fork McKenzie River, from its headwaters to Cougar Reservoir and from Cougar Dam to the McKenzie River. In addition the Little North Fork of the Santiam River, from its confluence with Opal Creek and Battle Axe Creek to the Forest boundary, and the North Fork of the Middle Fork of the Willamette River, from its headwaters, including Waldo Lake, to the Middle Fork Willamette River are also included in the State Scenic Waterways System. The current designation status of Forest rivers is summerized in Figure III-O-2. A full description of these rivers is included in Appendix E of the FEIS.

Table III-O-2. Designation Status of Forest Rivers [1]

River Name	National WSR	State Scenic Waterway	National WSR Study River
Little North Santiam		X	
McKenzie	X	X	
Blue River			X
South Fork McKenzie		X	
NF MF Willamette	X	X	

[1]See also Figure III-O-4 for location and extent of designated rivers.

The free-flowing conditions and outstandinly remarkable values of designated Wild and Scenic Rivers are protected and managed in accord with: the USDI-USDA Interagency Guidelines (47 Fed. Reg. 39454); the standards and guidelines for each river class as noted in the Land and Resource Management Planning Handbook (FSH 1909.12 Chapter 8 - Wild and Scenic Rivers Evaluation); and the management direction outlined in the Forest-wide and Management Area Standards and Guidelines in Chapter IV of the Land Management Plan. These management standards and guidelines apply to a designated Wild and Scenic River until a River Management Plan is approved and to a designated Study River until it has been determined not suitable for inclusion into the National System or until action is taken by the U.S. Congress. Wild and Scenic River Management Plans for the McKenzie River and the North Fork of Middle Fork Willamette River are currently being developed and are expected to be completed during 1991.

In general interim management of designated or study river corridors should, to the extent the Forest Service is authorized under the law, provide for: control of stream impoundments and diversions, and maintenance of free-flowing characteristics in an unmodified condition; protection and to the extent practicable enhancement of outstandingly remarkable values of identified rivers; and the maintenance of a rivers eligibility for inclusion in the National System at the highest river classification for which it qualifies.

The Oregon Scenic Waterways Act generally requires notification of proposed changes of land use within 1/4 mile on each side of the designated waterway to be evaluated for their potential to impair the natural scene. The Act also requires the Commission to cooperate with local, state, and federal agencies to ensure their compliance with the requirements of the Act and to study additional rivers for possible inclusion in the State Scenic Waterways System.

Eligible and Ineligible Rivers

As described above, the Forest initiated an assessment process to determine eligibility and classification of those rivers identified through public comment to the DEIS for their potential inclusion in the National Wild and Scenic Rivers System. The results of this process, based on application of specific criteria for "free-flowing" conditions and "outstandingly remarkable values" from the Act and and from the USDA-USDI Guidelines are provided below.

Included in summary form in Figure III-O-3 are the findings of the eligibility and classification assessment process and related information. "Outstandingly remarkable values" that are listed for each river are those that were considered (on a scale of 1-10) to be 7 or higher in the following categories: scenic, recreation, geologic, fish, wildlife, historical/cultural, ecological/biological. In addition river miles and approximate corridor acreages are provided for each river segment. Complete descriptions of each

river evaluated for its elegibility for potential inclusion in the National Wild and Scenic Rivers System are located in Appendix E of the FEIS. The location and extent of each river segment evaluated is displayed in Figure III-O-4.

Current planning direction requires protection of free-flowing conditions and "outstandingly remarkable values" of eligible river segments at the highest river classification for wihich they qualify. Protection is extended until a river segment is found not suitable for inclusion in the National System or until action is taken by the U.S. Congress. Land and Resource Management Planning direction also requires that suitability determinations of all eligible rivers be completed with in five years. This process will determine whether a river should or should not be recommended to Congress for inclusion in the National Wild and Scenic River System. River segments determined ineligible for inclusion in the National System will continue to be managed for a wide range of multiple-uses consistent with Current Forest Plan direction.

Generally speaking, the designated and eligible rivers under Forest administration can be described as having outstanding scenery, rich native fisheries and wildlife habitats, unique historic and prehistoric remnants throughout the river corridors, and diverse recreation opportunities ranging from whitewater kayaking to hiking on tranquil riverside trails.

Since the mid-20th century, the river corridors in the Forest have been the focus of tremendous growth in the numbers of recreational users with the majority of visitors utilizing the outstanding recreation potential of those most accessable. Many Forest campgrounds within these river corridors offer developed water-oriented facilities to visitors, and dispersed camping spots are located adjacent to virtually every designated or potential Wild and Scenic River. Recreation outfitters specializing in guiding whitewater or fishing activities depend on seasonal tourism and the continued growth of that industry as do commercial enterprises and service sector businesses.

Figure III-O-3. Eligibility and Classification Status of Forest Rivers

River	Segment Description	River Class	Outstanding Values	Miles	Acres [1]
Little North Santiam River	Battle Axe Creek to Forest boundary	Scenic	Scenic	7.8	2,626
Battle Axe Creek	Headwaters to confluence with Opal Creek	Not eligible	--	5.0	1,727
Opal Creek	Opal Lake to confluence with Battle Axe Creek	Not eligible	--	4.0	1,493
North Fork Breitenbush River	Confluence with NF of NF and SF of NF to SF Breitenbush	Not eligible	--	7.0	1,941
	Headwaters of SF of NF to confluence with NF of NF Breitenbush	Not eligible	--	3.5	597
South Fork Breitenbush River	Russell Lake to Wilderness boundary	Wild	Scenic, Wildlife	4.0	1,749
	Wilderness boundary to Breitenbush River	Scenic	Scenic, Wildlife	6.5	1,834
Breitenbush River	North Fork Breitenbush River to Detroit Reservoir	Recreation	Recreation	9.5	3,040
North Santiam River	Headwaters to Wilderness boundary	Wild	Wildlife	3.8	1,450
	Wilderness boundary to Highway 22	Scenic	Scenic	4.2	1,088
	Highway 22 to Rainbow Creek	Recreation	Ecology	19.5	6,912
	Rainbow Creek to Detroit Reservoir	Not eligible	--	3.5	1,130
Quartzville Creek	Headwaters to unnamed creek west of Bruler Creek	Recreation	Scenic	2.30	875
	Unnamed creek west of Brule Creek to Forest boundary	Recreation	Scenic	10.0	2,944

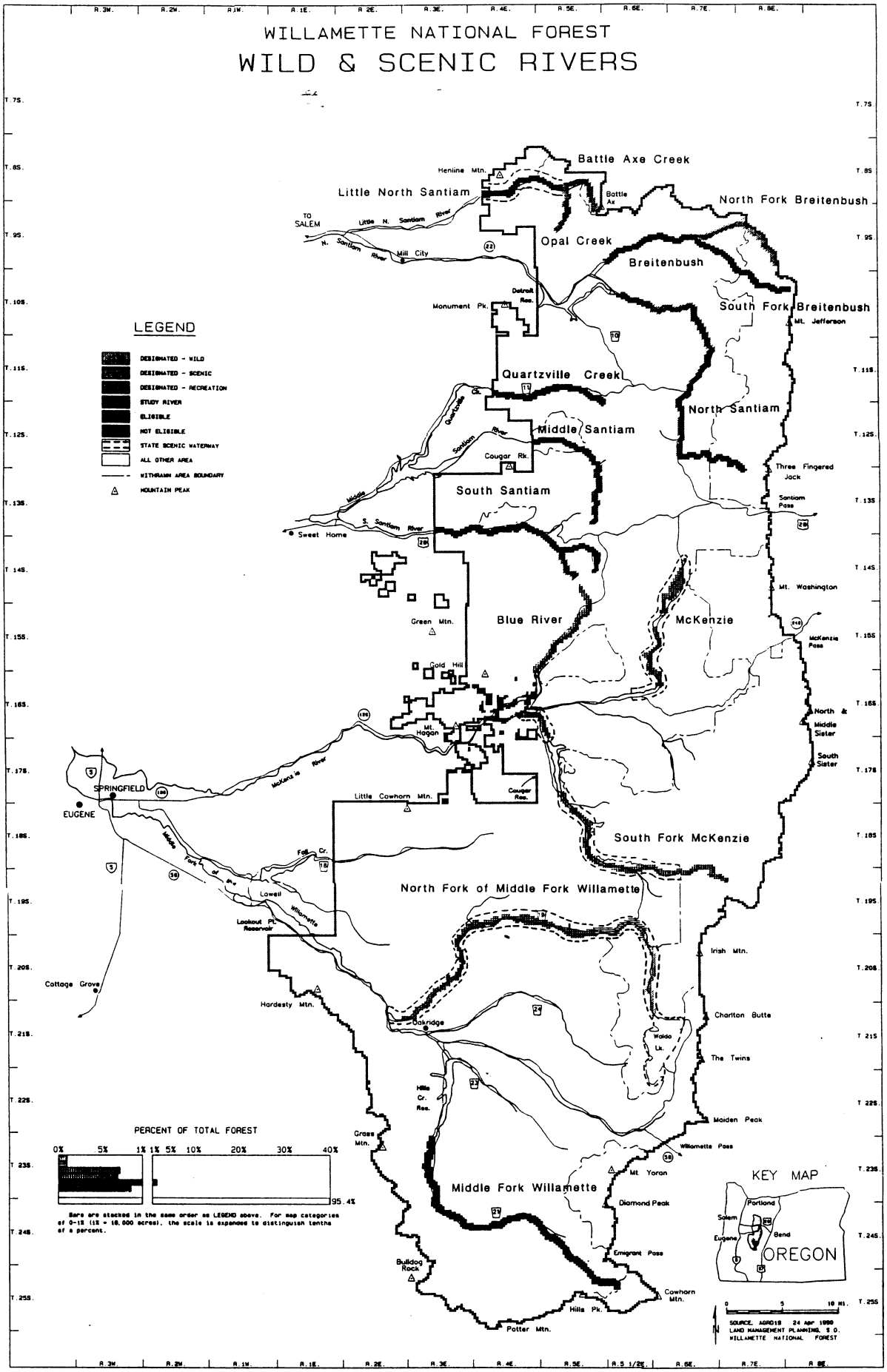
[1] Acreages are based on a 1/2-mile-wide corridor as represented in the Forest Grid Mapping System database.

Figure III-O-3 Cont. Eligibility and Classification Status of Forest Rivers

River	Segment Description	River Class	Outstanding Values	Miles	Acres [1]
Middle Santiam River	Headwaters to west boundary Section 31	Not eligible		6.0	2,090
	West boundary of Section 36 to Wilderness boundary	Scenic	Scenic	2.0	853
	Wilderness boundary to Forest boundary	Wild	Scenic, Ecological/ biological	6.0	1,493
South Santiam River	Headwaters of Sevenmile Creek to Squaw Creek	Wild	Scenic	4.0	1,706
	Headwaters of Squaw Creek to Sevenmile Creek	Not eligible	--	3.0	1,024
	Sevenmile Creek to Forest boundary	Recreation	Scenic, Wildlife, Historic	10.8	4,287
Middle Fork Willamette River	Lower Timpanogas Lake to Echo Creek	Scenic	Scenic, Historical/ Cultural, Ecological/Biological	16.0	5,674
	Echo Creek to Hills Creek Reservoir	Recreation	Recreation, Wildlife, Historical/ Cultural	14.0	5,247
TOTAL	Rivers Evaluated	--	--	152.0	51,780
	Rivers Eligible	--	--	120.4	41,760

[1] Acreages are based on a 1/2-mile-wide corridor as represented in the Forest Grid Mapping System database.

Figure III-O-4.



Future Trends

Demand for Wild and Scenic River designation is primarily expressed through public comment and response to agency proposals. The degree to which this comment and response favors designation is an indication of demand for a wide range of uses, activities, and resource qualities associated with management of river corridors. One of the primary attractions of designated and potential Wild and Scenic River corridors is the vast opportunities they provide for recreation activities.

Although recreation demand is closely related to present population numbers and projected growth of the local areas, the act of river designation would likely result in increased levels of recreation use in the designated and potential Wild and Scenic River corridors. Principal increases in use, in the event of designation, would probably be in dispersed recreation activities. National designation of the rivers as Wild, Scenic, or Recreation has the potential to increase future tourism development in local areas, enhancing the Forest and the region as a recreation destination as well as providing economic benefits to local communities.

In the event of designation, most Forest management principles will apply only to federal lands within the designated or eligible river area. In the case of both federal and private ownership of river corridor lands, Forest management standards will apply only to the extent required by other laws such as local zoning and air and water pollution regulations.

Management of some river corridors without Wild and Scenic River designation could pose a threat to the quality or conditions of those resource values that permit river segments to be eligible for designation status (i.e., water quality, fisheries, scenic quality, recreation opportunities, and cultural/historic preservation). However, threats to Wild and Scenic River resource values will be relative to the particular Management Areas applied to individual river corridors. Most river corridors identified in Figure III-O-4 are allocated to Management Area prescriptions that in many ways provide conditions equal to those expected within some Wild and Scenic River classes.

Specific activities that could alter river values and thus affect river eligibility or classification include timber harvest, road and bridge construction, geothermal development, expansion of hydroelectric generating facilities, and some forms of development and management of private lands within river corridors. The affects of these activities could result in environmental changes in the river corridors that limit any future consideration of the rivers for inclusion into the National Wild and Scenic River System.

Changes in the natural appearance of the landscape because of timber harvest and or road development could alter the types of recreation experiences people have in these river corridors. Road development can have an effect on the resources of the river corridors as well as the users' sense of loss of remoteness through increased accessibility.

The amount of visible management in the river corridors would vary by the type of Management Area applied. For example, the amount of harvest activity in special categories, such as Recreation River or Scenic Resource areas is moderated by extending the management rotation period from 40 to 120 years longer than that used in Geneeral Forest areas. In addition harvest unit design characteristics are modified and a wide range of silvilcultural systems are employed to minimize affects and protect river values.

Dams and impoundments within river corridors would alter their free-flowing conditions. Altering these conditions would change the eligibility of the river for inclusion in the Wild and Scenic Rivers

System. If a river were to be included in the National Wild and Scenic Rivers System, dam building and development of the river's hydroelectric potential would not be permitted.

WILDERNESS

The Forest Service began administering some of the National Forest System lands to preserve their primitive character as early as 1930. Congress formalized the designation of Wilderness in 1964 with the passage of the Wilderness Act. It contains the following definition:

> A wilderness, in contrast with those areas where man and his own works dominate the landscape, is . . . recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean . . . an area of undeveloped federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least 5,000 acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

The purpose of Wilderness is . . . to assure that an increasing population, accompanied by expanding settlement and growing mechanization, does not occupy and modify all areas . . . leaving no lands designated for preservation in their natural condition . . . (The Wilderness Act; Public Law 88-577 September 3, 1964).

To further this purpose and the intent of Congress, through the Wilderness Act, the National Wilderness Preservation System promotes, perpetuates, and preserves the wilderness character of the lands, protects watersheds and wildlife habitat, preserves scenic and historic resources, and promotes scientific research, primitive recreation, solitude, physical and mental challenge, and inspiration for the benefit of all Americans, to a greater extent than is possible in the absence of Wilderness designation.

The philosophical foundation on which National Forest Wilderness management rests is grounded in values that include aesthetics, water and air quality, wildlife and wildlife habitats, and vegetative diversity, as well as recreation. Wilderness lands within the National Forest have value precisely because they are not required to include a human component; rather, they will be sustained only if human impacts are minimal. This does not preclude public use, but actually enhances the Wilderness experience for those who venture into such an environment.

Wildernesses offer recreationists unique opportunities for physical challenge and solitude in natural settings where evidence of human activities is negligible. In addition to special recreation experiences, Wildernesses provide diverse plant and wildlife habitats as well as summer range for big game such as deer and elk. They often serve as important watersheds, collecting and channeling large quantities of water for downstream uses throughout the year.

Historic Trends

Several trends relating to Wilderness are evident, including establishment of areas, type and amount of use, and management influences.

The preservation of Wilderness has evolved in two ways since the early 1930s. A notable change is the methods of classifying areas to be preserved. Areas were first classified as primitive areas, wild areas,

and then Wilderness using agency administrative authorities and, then, after 1964 as Wilderness by Acts of Congress. This latter method is now the only way in which lands are established as Wilderness.

In addition to the change from administrative to congressional designation of areas, the amount of area preserved as Wilderness has increased. Figure III-P-1 illustrates the reclassification trend of areas, and the increases in the amount of land preserved as Wilderness on the Forest since 1930.

Table III-P-1. Wilderness Classification Trends

Classification Type	1930	1933	1937	1938	1956	1957	1964	1968	1978	1984
Primitive Area	32,420	57,520	184,820	240,820	240,820	57,520	57,520			
Wild Area					38,030	54,230				
Wilderness [1]						189,833				
Wilderness [2]							191,063	254,744	301,933	380,805
CUMULATIVE TOTAL	32,420	57,520	184,820	240,820	278,850	301,583	248,583	254,744	301,933	380,805

[1] Administratively designated.
[2] Congressionally designated.

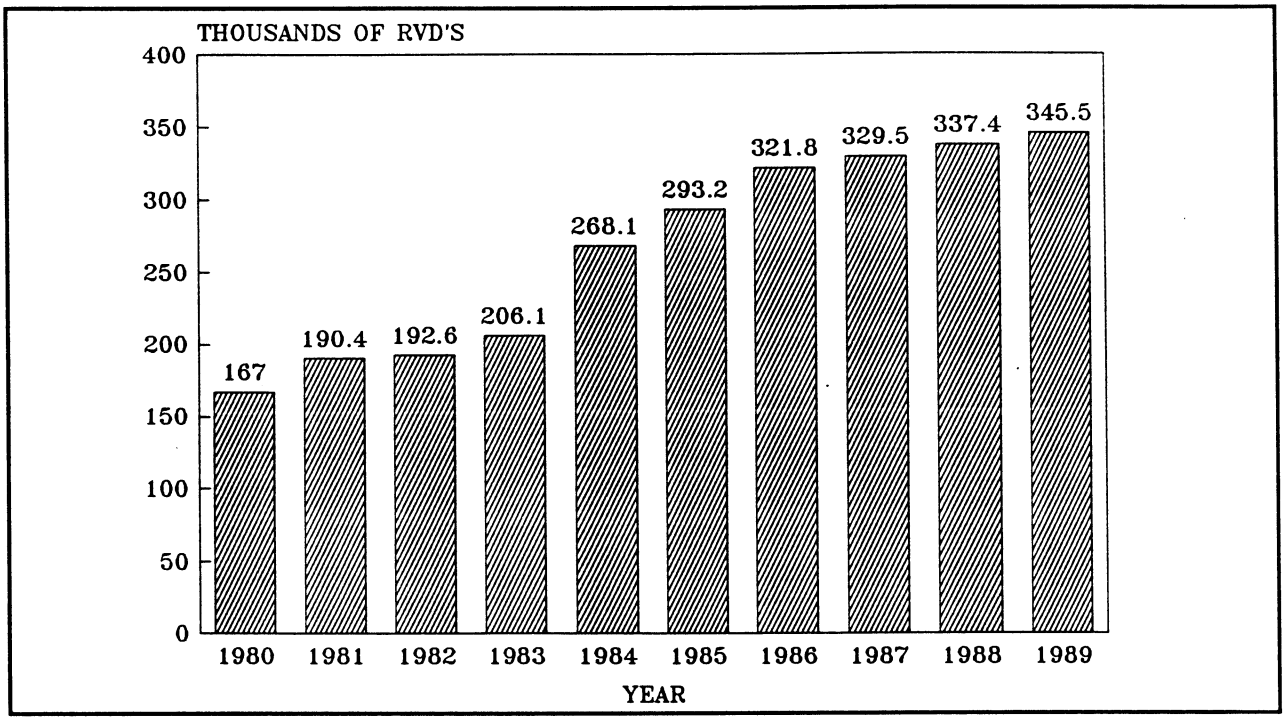
Most of the trails in the Forest Wilderness were originally built for purposes other than recreation. Excluding those trails most recently constructed, most trails were developed for administrative purposes requiring direct access to destinations such as guard stations and fire lookout locations. Little attempt was made, therefore, to design trails with scenic vistas or gentle grades. Since expediency was the rule in the early days of Forest trail construction, some trails may have excessive grades, poor drainage and hazardous stream crossings for packstock and hikers.

Wilderness use, since the mid 1940s, has increased dramatically, and the range of activities that Wilderness users engage in has broadened considerably. Due to significant increases in population, leisure time, and prosperity, National Forest Wilderness visitation since the mid 1940s has increased nearly three times over the use level of the mid 1930s. Recreation activity participation, following World War II, broadened from traditional forms of use such as hunting, fishing, hiking, and camping to include nature study, photography, mountain climbing, snow camping, skiing, and commercially guided pack and saddle trips.

The primary source of visitor use data in wilderness is the Forest's Recreation Information Management (RIM) system. All use and capacity data use here are expressed as Recreation Visitor Days (RVDs). One recreation visitor day equates to twelve hours of use. Figure III-P-2 illustrates Wilderness use in the Forest for the period 1980 to 1989.

Recent trends in total Wilderness use as reported in RIM have shown a steady increase between 1980 and 1989. Some of this increase, particularly since 1984, is a result of the transfer of reported use from dispersed recreation areas, as more Wilderness is designated. The addition of several new Wildernesses in 1984 means that even more use will be attributed to Wilderness than in the past.

Figure III-P-2. Wilderness Use



During the 1980-89 period, participation in most recreation activities increased at varying rates with some noticeable peaks, valleys, and plateaus in the trend lines. It is evident from the data that recreation use is affected by such variables as weather, travel costs, general economic conditions as well as emerging forms of recreation activities. Total Wilderness use dropped significantly after 1974, following the first "energy crisis" and has only recovered to pre-1974 levels in recent years.

Most recently, the perception of the value of Wilderness lands has expanded from an essentially recreation focus to one that includes consideration for the contributions that Wilderness areas can make to fisheries, water quality, wildlife habitat and healthy wildlife populations, ecosystem research, plant and animal diversity, and commercial use. For example, fisheries experts have recognized that high water quality within Forest Wilderness watersheds is a primary determinant of the viability of downstream fisheries. Most of the lakes within Forest boundaries are in the High Cascades Wildernesses, 74% of which are fish-bearing. Heavy snow pack collects on the permeable lava beds at high elevations supplying critical ground water re-charge. Wilderness lands are also refugia for many plant and animal species, such as arthropods, reptiles, amphibians, and soil organisms, certainly humble but necessary components of the forest ecosystem.

Although the evidence of past fires is not always apparent, especially in the western Cascades, most biological communities have evolved with the presence of fire. Fire suppression efforts during the past 40 to 50 years have generally suppressed fires in Wilderness at a smaller size than free-burning natural fires, modifying the role of fire in Wilderness ecosystems.

The public in its response to the 1987 Draft Environmental Impact Statement was concerned mainly with issues of management planning, development of standards and guidelines, and long term protection; size of Wilderness areas; regulation of user group size and length of stay, including commercial operations;

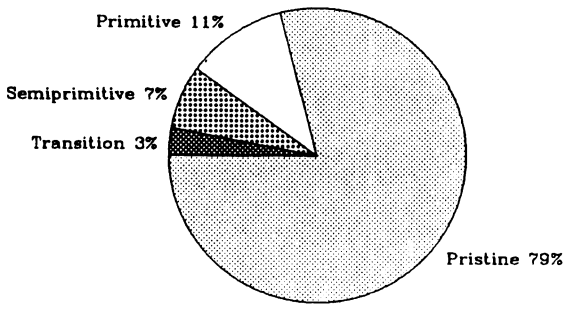
concern for animals in the Wilderness such as dogs, packstock, and llamas and their effects on the environment and wildlife; consideration for Wilderness values other than recreation; and suppression of natural fires.

Current Condition

The Forest's existing supply of Wilderness opportunities and experiences is derived from eight established areas. Management of five Wildernesses is shared with two other Forests--the Deschutes and Mt. Hood National Forests. The Forest presently contains 380,805 acres of designated Wilderness. This acreage is approximately 21% of the Forest and contains 642 miles of Wilderness trails. Wilderness trails comprise 47% of the Forest's total trail mileage.

The Forest has utilized the Wilderness Resource Spectrum (WRS) inventory process as a method to identify WRS classes within each Wilderness and continues to use this system as a framework for Wilderness management. Figure III-P-3 provides a description of each of the WRS classes.

Figure III-P-3. Wilderness Resource Spectrum Class Descriptions [1]



Classification Type	Descriptions
Pristine	This class is characterized by an extensive unmodified natural environment. Natural processes and conditions have not and will not be measurably affected by the actions of users. The area is managed to be as free as possible from the influences of human activity. People are only brief visitors. Essentially no facilities are required to protect the Wilderness resource. Terrain and vegetation allow extensive and challenging cross-country travel. This class provides the most outstanding opportunity for isolation and solitude, free from evidence of past human activities and with very infrequent encounters with other users. The user has outstanding opportunities to travel cross-country utilizing a maximum degree of primitive skills, often in an environment that offers a high degree of challenge and risk.
Primitive	This class is characterized by essentially an unmodified natural environment. Concentration of users is low and evidence of human use is minimal. This class is managed to be essentially free from evidence of human-induced restrictions and controls. Only essential facilities for resource protection and safety are used and constructed of native or natural materials. No facilities for comfort or convenience of the user are provided. Visitors are encouraged to disperse to desirable existing sites to minimize contacts with other groups. This class provides an high opportunity for exploring and experiencing considerable isolation, solitude, and self-reliance through application of primitive recreation skills in an environment that offers a high degree of challenge and risk.

[1]FSM 2320 R6 Supplement No. 81.

Table III-P-3.Cont. Wilderness Resource Spectrum Class Descriptions [1]

Classification Type	Descriptions
Semiprimitive	This class is characterized by a predominately unmodified natural environment of moderate size. Concentration of users is low, but there is often evidence of other users. This class is managed in such a way that minimum on-site controls and restrictions may be present but are subtle. Facilities are only provided for the protection of Wilderness resource values rather than visitor comfort or convenience. Materials should be natural or natural appearing. In this class moderate opportunities for exploring and experiencing isolation from the sights and sounds of other users; independence; closeness to nature; tranquility and self-reliance through the application of no trace and primitive skills in a natural environment that offers a moderate to high degree of challenge and risk.
Transition	This class includes areas that are characterized predominantly by conditions of relatively concentrated use where encounters with other groups are frequent, opportunities for solitude are limited, and user controls may be highly evident. This zone will provide opportunities for one to pursue satisfaction of one's outdoor recreational needs within a wilderness setting. However this zone will provide experiences in the low to moderate range for isolation, solitude, challenge, and primitive recreation.

[1]FSM 2320 R6 Supplement No. 81.

The WRS management framework establishes classes within the Wilderness based on such criteria as current conditions of use, density of camping sites, and presence of trails. Figure III-P-4 illustrates the current acreage of each WRS class and trail mileage within each Wilderness. Figure III-P-5 shows the capacity of each Wilderness, as currently inventoried, to accommodate human use in RVDs and maximum number of persons at a given time. Figure III-P-6 illustrates the location of each Wilderness in the Forest and the spatial distribution of inventoried WRS classes.

Table III-P-4. Inventoried Wilderness Opportunities by WRS Class[1]

	Pristine		Primitive		Semiprimitive		Transition		Totals	
Wilderness	Acres	Trial Miles	Acres	Trials Miles	Acres	Trail Miles	Acres	Trial Miles	Acres	Trail Miles
Bull of the W	6,314	0.0	1,152	9.5	0	0.0	0	0.0	7,466	9.5
Mt. Jefferson	55,778	0.0	6,015	49.5	8,084	77.0	2,688	12.4	72,565	138.9
Middle Santiam	7,167	0.0	299	2.5	725	6.0	362	3.0	8,553	11.5
Menagerie	4,011	0.0	341	2.0	597	4.9	0	0.0	4,949	6.9
Mt. Washington	37,349	0.0	1,813	15.2	1,834	14.2	0	0.0	40,996	29.4
Three Sisters	146,793	0.0	22,994	190.5	9,044	74.8	10,515	70.4	189,346	335.7
Waldo Lake	27,132	0.0	5,119	42.3	4,181	27.7	725	4.0	37,157	74.0
Diamond Peak	14,803	0.0	3,285	27.3	1,493	12.8	192	0.5	19,773	
TOTALS	299,347	0.0	41,018	338.8	25,958	217.0	14,482	90.3	380,805	646.1

[1]Information pertains only to the Willamette National Forest.

Table III-P-5. Inventoried Wilderness Capacity by WRS Class[1]

	Pristine		Primitive		Semiprimitive		Transition		Total Area Capacity[2]	
Wilderness Area	RVD	PAOT	RVD	PAOT	RVD	PAOT	RVD	PAOT	RVD	PAOT
Bull of the Woods	26	1-5	300	5-35	0	0	0	0	326	6-40
Mt. Jefferson	6,258	25-42	28,517	117-168	37,012	228-345	6,406	23-111	78,193	393-666
Middle Santiam	227	2-5	320	8-9	946	8-45	6,258	51-67	7,769	69-126
Menagerie	107	1-3	152	1-8	904	8-37	0	0	1,163	10-48
Mt. Washington	2,920	16-28	5,568	51-56	11,336	88-113	0	0	19,824	155-197
Three Sisters	23,305	60-110	104,408	372-570	63,118	287-392	83,326	490-782	274,157	1,209-1,854
Waldo Lake	1,020	12-20	7,947	98-159	18,374	151-207	8,390	69-81	35,731	330-467
Diamond Peak	996	7-11	8,419	64-102	6.642	51-83	3,213	10-32	19,270	154-227
TOTAL WRS CAPACITY	34,859	124-224	155,631	716-1,107	138,350	821-2,473	107,593	643-1,073	436,433	2,326-3,625

[1]Information pertains only to Willamette National Forest.
[2]RVD = Recreation Visitor Days and PAOT = Persons-at-one-time.

Forest Service researchers have been working on a process for establishing acceptable levels of Wilderness use called Limits of Acceptable Change (LAC) system. This concept does not propose to eliminate all changes to Wildernesses caused by human use, but recognizes that impacts can be the result of the specific kind of use, user behavior, and the season and distribution of use. The LAC System calls for inventories of existing conditions in each Wilderness and the comparison of existing conditions to the standards and guidelines for each WRS class. The Forest is currently in the process of conducting LAC inventories with an emphasis on areas sustaining heaviest use: Mt.Jefferson, Three Sisters, and Mt.Washington Wildernesses.

Initial findings of LAC inventories in these Wildernesses indicate that specific areas and trail corridors are receiveing use in excess of capacity as determined by WRS class management standards and LAC indicators. These findings further suggest that estimated capacity of some WRS classes in most Wildernesses, as currently inventoried, are overstated when compared with current use levels and physical resource conditions of Wilderness. A listing of specific areas and trails where use capacity is being exceeded and the effects of overuse are present can be found in discussions of each Wilderness later in this section.

Expansion of Wilderness opportunities in the Forest for this cycle of planning include one unroaded area near the community of Blue River. The area is known as the Mt. Hagan roadless area and is 6,292 acres in size. Mt. Hagan is the only area to be addressed as potential Wilderness in the Forest planning process. This area was included as recommended Wilderness in one alternative in the DEIS: Alternative C. The inclusion of the Mt. Hagan area as potential Wilderness is based upon the criteria set forth by Congress in the Oregon Wilderness Act of 1984.

The Oregon Wilderness Act of 1984 directs that for the initial National Forest Management Act (NFMA) land management plans the National Forest lands in Oregon which were reviewed in RARE II or in unit plans and roadless lands which are less than 5,000 acres in size have had adequate consideration of their suitability for inclusion in the National Wilderness Preservation System. The Department of Agriculture will not be required to review the Wilderness option prior to the revision of the plans, but will review the Wilderness options when the plans are revised, ordinarily on a 10-15 year cycle (Section 7(b)(2) Oregon Wilderness Act of 1984). The roadless lands will be managed for multiple use in accordance with the land management plans, and they need not be managed for the purpose of protecting their suitability for Wilderness designation prior to or during revision of the land management plans (Section 7(b)(3) Oregon Wilderness Act of 1984).

The Mt. Hagan area was neither reviewed in RARE II nor evaluated in a Forest Unit Plan and therefore must be considered for the Wilderness option in the current planning process. The WRS inventory indicates the Mt. Hagan area is suitable for providing primitive Wilderness opportunities. See Appendix C for a description of this area.

The unique ecosystemic contributions that Wilderness lands make to the ecology of the Western Cascades and Willamette Valley include significant influences on maintenance of high quality air and water; protection of habitats required by diverse animal species; and conservation of vegetative diversity through protection of representative plant communities. Establishment of several Research Natural Areas within Wilderness boundaries is reflective of the research value of the Forests Wildernesses. A Research Natural Area has been established within the Middle Santiam Wilderness boundaries, and RNAs are proposed for establishment in the Three Sisters Wilderness (McKenzie Pass RNA) and the Waldo Wilderness (Torrey-Charlton RNA).

Specifically, Wilderness lands are critical to continuance of high water quality which has direct bearing on terrestrial and aquatic species dependent on water and riparian habitats, and are primary factors in maintaining floral and faunal diversity. Without Wilderness lands, there would be a significant decline in species richness and abundance. These designated lands are a mixture of all forest types ranging from low to high elevations and encompassing forested and nonforested communities including meadows, sub-alpine, and alpine types. For example, the Menagerie Wilderness, Middle Santiam Wilderness, and the French Pete section of the Three Sisters Wilderness are prime low elevation lands with significant stands of old-growth Douglas-fir. Species preferring this kind of habitat are Northern Spotted Owls, wolverines, peregrine falcons, and bald eagles. Other animals favoring wild lands, especially along the crest of the High Cascades, are martens, fishers, and cougars.

Wilderness lands along the crest of the High Cascades (Three Sisters, Mt. Jefferson, Mt. Washington) are important as high use summer range for herds of deer and elk that winter on both sides of the summit. Because of this shared summer range, interbreeding between mule-deer and black-tailed deer occurs. These designated Wilderness lands serve also as an unbroken corridor for plant migrations and genetic exchange. They are an important transition zone between east and west sides; in addition, the mechanics of wind and water in the river corridors are dispersal agents for seeds and pollen from Wilderness plant communities out into managed lands.

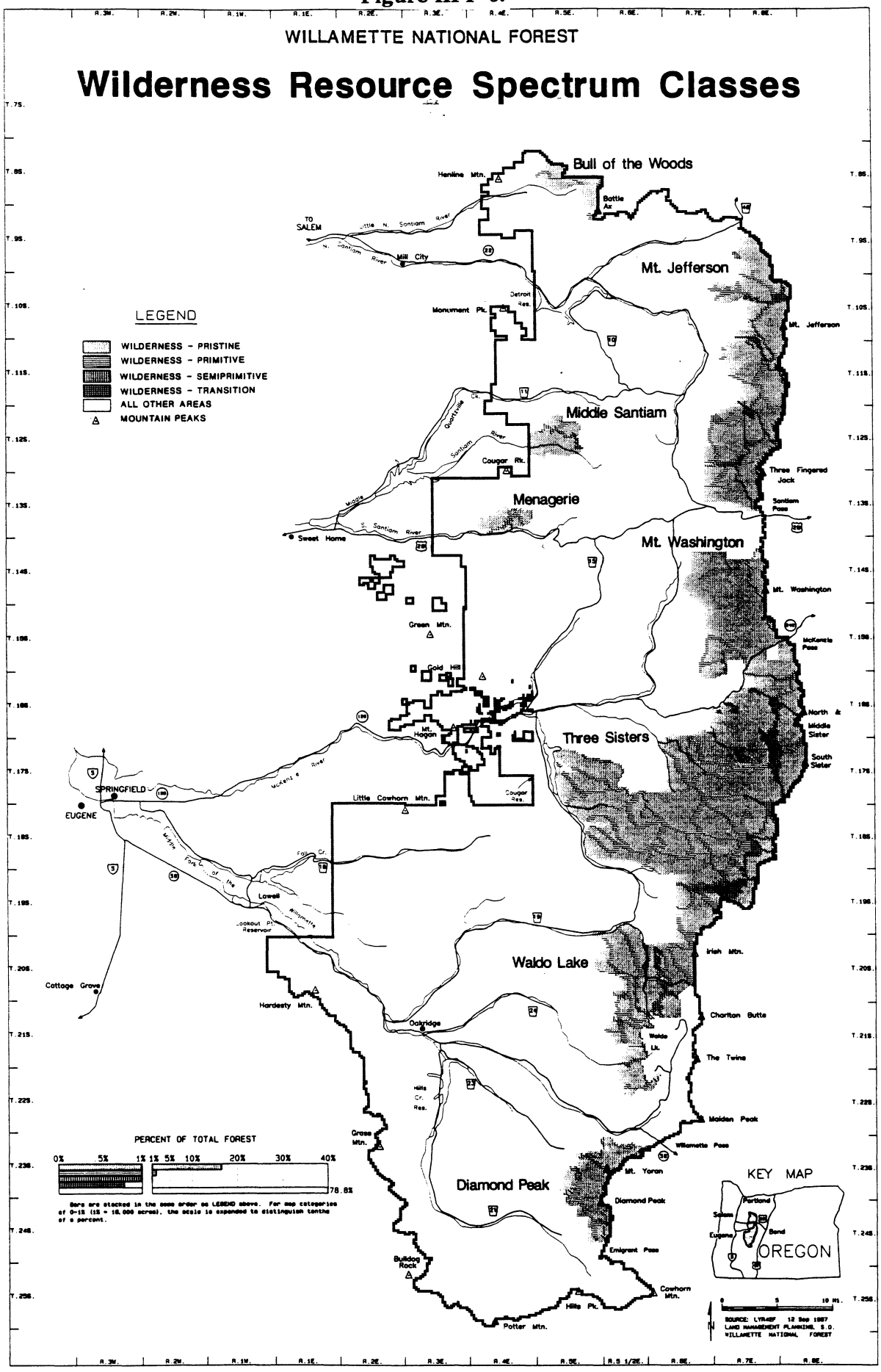
Wilderness lands are intact natural systems and, therefore, reservoirs of natural processes such as nutrient cycling, geologic events, etc. In addtion, they are repositories of natural genetic stock and variability providing the ecosystem with vigor and protection against disease. They are a baseline against which we can compare managed lands not only on a short-term basis, but in the face of such significant trends as global warming, on a larger scale.

Within Wilderness boundaries is scattered evidence of prehistoric and historic cultural behavior. Remnants of cabins, homesteads, old roads and livestock trails frequently can be found especially in Wildernesses, primarily due to the undeveloped status of the land. Evidence of aboriginal use of the land can often be seen in deposits of chipping waste and fragments of stone tools. Many of these cultural resources have been inventoried and are protected by the same legislation that directs cultural resource preservation and management on other parts of the Forest.

Primary issues that currently concern the public regarding Forest Wilderness lands do not diverge much from issues and concerns following publication of the DEIS in 1987. Briefly, the public is concerned with natural processes, social and resource impacts, trails and access, information sharing and public involvement, and regulation of use. Specifically, the Forest has been asked to address issues of recreational impacts from commercial and individual users to Wilderness ecosystems at popular areas and the effects of these impacts on other Wilderness values such as wildlife, plants, ecological processes; trail and sign maintenance and map updates; regulating Wilderness use through permit or registration procedures, thus, reducing impacts; enforcement needs.

The Forest will continue to involve the public in the Wilderness management process through consultation and communication during all levels of decision making.

Figure III-P-6.



Bull of the Woods Wilderness

The Bull of the Woods Wilderness was established by the Oregon Wilderness Act of 1984. This 33,851 acre Wilderness is located in the Willamette (7,466 acres) and Mt. Hood (26,385 acres) National Forests, approximately 68 miles southeast of Portland and 65 miles east of Salem. In the Forest this area is accessible from the west by the Little North Santiam Road, by French Creek Road on the south, and Elk Lake Road on the east.

The area is characterized by steep mountainous terrain dissected by numerous mountain streams. Within the Wilderness are the headwaters of the Collawash, Breitenbush, and Little North Fork of the Santiam Rivers. Elevations range from 1,600 to 5,560 feet. Lower slopes are typically covered by dense stands of Douglas-fir and western hemlock while upper slopes are forested with Douglas-fir, true fir and mountain hemlock. Rocky slopes and outcrops are common on upper slopes and are often associated with a shallow soil layer. There are several small lakes scattered throughout the Wilderness, many supporting an abundance of fish. These lakes are usually isolated from one another by steep, high ridges. Nongame wildlife species are varied and abundant; however, big-game populations are sparse.

Recreational opportunities within the area are hiking, horseback riding, backpacking, mountain climbing, fishing, hunting, rockhounding, and nature study. The Bull of the Woods Lookout is one of the most heavily used areas in the Wilderness as it commands a 360 degree view of the surrounding area. Mine shafts, old pieces of equipment, and other evidence of the area's mining history are found in this Wilderness.

Recreation use of the Bull of the Woods Wilderness consists primarily of hiking, camping, and fishing. The most popular trail in this Wilderness under the administrative jurisdiction of the Forest, meanders from Battle Axe Creek over to Whetstone Mountain to Gold Creek. At this time the trail receives only light recreational traffic.

There are many physically-challenging recreation opportunities in Bull of the Woods Wilderness, particularly during cross-country travel. In the upper elevations above the continuous stands of timber, the variety of terrain, the scenery and excitement of travel provide excellent mountaineering experiences. A sense of spaciousness and solitude can be experienced within most of this Wilderness.

Bull of the Woods Wilderness maintains the flow of high quality water in the Little North Santiam watershed which is the main water supply for the City of Salem in-take. In addition, the Little North Santiam which originates in the Wilderness is one of the few free-flowing streams in the Forest that supports an anadromous fish population.

Mt. Jefferson Wilderness

The Mt. Jefferson Wilderness is jointly administered by the Willamette (72,565 acres), Deschutes (32,734 acres) and the Mt. Hood)(3,793 acres) National Forests. The Wilderness extends approximately 25 miles in a north/south direction along the crest of the Cascades with portions of the area in Jefferson, Linn, and Marion Counties. The area is approximately 60 miles southeast of Salem and 40 miles northwest of Bend, Oregon. U.S Highway 20 parallels the southern boundary and Oregon State Highway 22 parallels the western boundary.

This area was originally established as Mt. Jefferson Primitive Area in 1930; when Congress passed Public Law 90-548 in 1968, it was designated as Mt. Jefferson Wilderness and with passage of the 1984 Wilderness Act, the size of the Wilderness was expanded to 109,029 acres.

Scenic highlights in this region are two steep-sided volcanic cones: Mt. Jefferson (10,497) is located to the north and Three-Fingered Jack (7,841) is located in the south. As is common with rapidly decaying volcanic mountains, the lower slopes of these peaks are covered with talus and deposits of pumice and glacial debris on which dense conifer forest begin to occur. These slopes are dissected by stream valleys that are predominantly U-shaped as a result of previous glacial erosion. At the heads of these U-shaped valleys are the formations of bare glacier-formed piles of rocks known as moraines. Moraines often form natural dams creating small lakes from the glacial run off. Above the timberline where the moraines occur, only alpine plant species are present. These include: subalpine fir, mountain hemlock, and various shrub and ground cover species. The middle elevations between 3,000 and 5,000 feet support subalpine types, consisting primarily of silver and white fir, lodgepole and whitebark pine and mountain hemlock. The lower elevations below 3,000 feet support Douglas-fir, Ponderosa pine, western hemlock, white fir, and juniper.

Mt. Jefferson Wilderness provides favorable habitat for many species of wildlife and fish indigenous to the Oregon Cascades. The Pacific Crest National Scenic Trail provides major access to the area. Fishing quality and hunting attract numerous visitors as the early High Cascade deer hunting season allows visitors to combine hunting and fall fishing.

Due to the area's easy accessibility, it has become very popular for day use and overnight visitors. Ease of access along with the growing demands for high quality outdoor recreation activities have resulted in the Wilderness receiving use in excess of its capacity in some areas. Signs of resource damage such as soil compaction, destruction of vegetation, loss of ground cover, declining water quality, and use of snags for firewood are becoming apparent. These impacts are especially severe in the subalpine areas where the growing season is short and damaged areas recover slowly. Areas that have received the greatest impacts from recreational use are: Jefferson Park, Pamelia Lakes, Hunts Cove, Marion Lake, Mowich Lake, duffy Lake, Santiam Lake, Square Lake, Wasco Lake, Cabot Lake, Ann Lake, Carl Lake, Canyon Creek Meadows, Rockpile Lake, Shirley Lake, Long Lake, Lower Berley Lake, Jorn Lake, Blue Lake, Bowerman Lake, Red Butte, Dixie Lakes, Lake of the Woods, Jenny Lake, Prill Lake, Swallow Lake, Crown Lake, Turpentine Lake, Ruby Lake, the Eight Lakes Basin, and the Pacific Crest National Scenic Trail corridor.

Water quality and purity in the Mt. Jefferson Wilderness affect the heavily-used Breitenbush River recreation area. High water quality, cold temperatures, and excellent clarity enhance this publically-popular downstream zone.

In spite of heavy localized use and the visible effects which can result, the Mount Jefferson Wilderness is an area of outstanding beauty and scenery. It offers backpacking on miles of shady trails, mountaineering on Oregon's second highest peak, horseback riding, fishing, hunting, and many other wilderness-oriented recreational activities.

Middle Santiam Wilderness

The Middle Santiam Wilderness was established by the Oregon Wilderness Act of 1984. This 8,553 acre area is located in Linn County within the Sweet Home Ranger District and is bordered by National Forest lands on its north, south, and east boundaries and by private timber lands to the west. The west portion of this area is accessible by private roads and from other directions by National Forest roads.

Located within the Wilderness boundaries is the Middle Santiam Research Natural Area near Chimney Peak which includes representative old-growth stands of 450+ years Douglas-fir and western hemlock. Research issues being addressed at the RNA are productivity of old-growth forests and their significance

as wildlife habitat; composition and successful development of forest communities; and the role of coarse, woody debris in stream stabilization.

Elevations in this area rise from 1,600 to over 5,000 feet. Topographically, there is an abundance of gentle slopes and benches that rise to form dissected steep slopes, ridges, and high peaks. Vegetation varies from true fir associations at the higher elevations to the Douglas fir/western hemlock associations at the lower elevations. The Middle Santiam River transects the area and has several small tributary streams feeding into it.

Recreational opportunities include hiking, backpacking, berry picking, fishing, hunting, horseback riding, rock hounding, and nature study. Wildlife species are varied and plentiful in the area. Big game populations are moderate with the elk population especially showing an increase. Chimney Peak, Knob Rock, the Middle Santiam River and Donaca Lake are prominent features in the Middle Santiam Wilderness.

Timber harvesting activities on lands around the perimeter of the Wilderness could detract from a visitor's sense of remoteness and feeling of solitude within the Wilderness. Possible overuse is occurring along the Chimney Peak and Gordon Peak Trails which lead to Donaca Lake. Signs of this include soil compaction or increased erosion and loss of vegetation. Increased numbers of people using the trails have also affected opportunities for solitude, and may limit some forms of primitive recreation.

Intense management of private lands in the vicinity of the Wilderness have amplified the importance of the designated lands in maintaining the high water quality required by downstream users. Protection of the watershed and related fisheries through Wilderness designation is critical. In addition to its hydrologic value, the Middle Santiam Wilderness is important as a potential low elevation old-growth habitat for such wildlife species as: Northern Spotted Owls, wolverines, peregrine falcons, and bald eagles.

The Middle Santiam Wilderness area contains approximately 12 miles of trails that provide opportunities that range from nonstrenuous low elevation hiking to middle elevation backpacking, or off-trail mountaineering. Whatever the interests of the individual might be, the area's combination of rivers, streams, forests, peaks, and lakes offer a variety of Wilderness use opportunities.

Menagerie Wilderness

The Menagerie Wilderness was established by the Oregon Wilderness Act of 1984. This area is located in Linn County within the Sweet Home Ranger District. Access is primarily from trails originating at points along U.S. Highway 20, the area's southern boundary.

The Menagerie Wilderness is 4,949 acres in size and is characterized by steep dissected slopes. Smaller areas of more gentle slopes are present. The Rooster Rock area in the Menagerie Wilderness has a series of pinnacles that rise above the surrounding landscape; Rooster Rock is the largest. These basalt spires offer some of the most challenging rockclimbing opportunities in the Western Cascades. Elevations in the Wilderness range from about 1,600 to 3,560 feet.

Vegetation consists predominantly of the Douglas-fir/western hemlock association with few natural openings. Two streams supporting native cutthroat trout populations drain from the area. Black-tailed deer are the most usual big-game species with resident herds of elk depending on the area as winter range.

Included within the designated boundary are 85 acres of privately owned land. Except where private lands adjoin the Wilderness boundary to the north, much of the Menagerie Wilderness is bordered by National Forest lands.

Recreational opportunities include day use activities such as fishing, hunting, hunting, sightseeing, hiking, and nature study. The area has some opportunities for low elevation trail hiking and has approximately seven miles of developed trails. Current use patterns indicate that the trails from Trout Creek and Fernview Campgrounds into the Wilderness receive the heaviest use, primarily for day hiking. These trails show few effects from recreationists, although evidence is beginning to accumulate that the main ridges leading to the rock spires may receive use in excess of capacity.

Although the topography and dense vegetation make the area physically challenging, the experience of solitude and spaciousness is limited because of the area's size and its proximity to the highway and industrial activities.

Mt. Washington Wilderness

The Mt. Washington Wilderness is located in Deschutes County in the Deschutes (13,356 acres) National Forest and Lane and Linn Counties in the Willamette (40,996 acres) National Forest. The summit of the Cascade Range runs north and south through the Mt.Washington Wilderness, forming the east boundary of the Forest.

The Mt. Washington Wilderness was first established as a "Wild Area" in 1957, and as a Wilderness by the Wilderness Act of 1964. The area was recently enlarged to 54,559 acres by the Oregon Wilderness Act of 1984. This Wilderness is accessible on the south from the McKenzie Highway which forms a part of the south boundary. On the north it is easily reached by the Big Lake Rd. and the Old Santiam Wagon Road. On the west side, access is provided by several Forest Service roads and U.S. Highway 126. The main entrance point on the south is at the Pacific Crest National Scenic Trail (PCNST) crossing on McKenzie Pass Highway (State Highway 242). This point accesses immense lava flows originating from Belknap Crater and Little Belknap Crater.

The Mt. Washington Wilderness area offers varied recreational opportunities for the High Cascades traveler. Its diverse terrain ranges from forest, to lava beds, to scree slopes, to the steep vertical walls of Mt. Washington itself.

The principal attraction within the area is Mt. Washington, a spectacular peak, with an elevation of 7,802 feet. Wilderness trails provide hikers with excellent views of Mt. Washington's extensive lava beds and scenic views of other mountains and forested areas. Other popular activities include hunting on the east and west sides of Mt. Washington where deer are plentiful, and fishing at Patjens Lakes.

The gently sloping terrain would be ideal for camping were it not for the scarcity of water. Water supplies are practically nonexistent in the area because of the high permeability of the volcanic rock and soil. Over half of the Mt. Washington Wilderness area is lava flows covered occasionally by grass and low-growing shrubs, although vegetative cover varies with elevation. Lodgepole pine and true fir-mountain hemlock cover types are the most widespread, with Douglas-fir comprising less than 7% of the total area.

The Belknap lava field covers approximately 10,000 acres of the Mt. Washington Wilderness. Most of the lava flow is characterized by jumbled blocks of solidified magma with bristling, jagged surfaces. Visitors should be especially cautious on the lava flows where the unwary risk injury on sharp, rough rocks. Climbing of the mountain itself requires exacting safety precautions with the final ascent through

chimneys and vertical rock faces. Due to the technical difficulty of the climb and friable nature of the rock, the summit of Mt. Washington was not conquered until August of 1923.

Specific locations in the Mt.Washington Wilderness appear to be receiving use in excess of capacity. They are: Benson Lake, Tenas Lake, Hand Lake, George Lake, Patjens Lake, and the Pacific Crest National Scenic Trail corridor. Overuse is indicated by compaction and erosion of soil, destruction of vegetation, reduction of water quality, and the use of dead woody material and snags as fuel for campfires. These impacts are especially severe in subalpine zones where the environment is slow to recover. In these same areas, opportunities for solitude and primitive recreation are declining due to increasing numbers of users.

Three Sisters Wilderness

The Three Sisters Wilderness was first established as a 184,820 acre Primitive Area by the Chief of the Forest Service in 1937. In 1938, it was enlarged to include 56,000 acres of Forest land located between Horse Creek and the South Fork of the McKenzie River. In 1957, the area was reclassified as the Three Sisters Wilderness by the Secretary of Agriculture under Regulation U-1. At this time, 53,000 acres of the 56,000 acres added to the Primitive Area in 1938 were excluded from Wilderness classification. The Three Sisters Wilderness was given Congressional designation with passage of the National Wilderness Preservation Act of 1964. The American Endangered Wilderness Act of 1978 added to the Three Sisters Wilderness 47,200 acres of the 53,000 acres deleted from the Primitive Area upon its classification as Wilderness in 1957. The most recent addition to the Three Sisters Wilderness resulted from passage of the Oregon Wilderness Act of 1984. Through this Act, the total allocation was enlarged to its present size of 283,593 acres. Management of this Wilderness is shared by the Willamette (189,346 acres) and the Deschutes (92,706 acres) National Forests.

The western portion of the proposed McKenzie Pass Research Natural Area is located partially in the Three Sisters Wilderness. Refer to the FEIS, Chapter III for a description of the RNAs on the Forest.

Access to the Three Sisters Wilderness is by trails and Forest roads that originate from State Highway 242 on the north; Cascade Lakes Highway on the east; Waldo and Irish Taylor Roads on the south; East Fork Road and Aufderheide Drive (Forest Road 19) on the west.

Favorite recreational activities include fishing, hunting, nature study, mountain climbing, camping, hiking, and horseback riding. The Wilderness trail system traverses the Wilderness from north to south providing outstanding views of subalpine country, the Three Sisters, and other prominent peaks and cones along the Cascade Crest. Trails pass through fir, hemlock, and lodgepole pine stands on the north and south ends of the Wilderness and have evolved from earlier sheep driveways, firefighters' way trails, packers' routes, and fishing trails. One-day hiking and riding trips are possible in the peripheral areas such as Proxy Falls, Linton Lake, Sunshine Meadows, Sister's Mirror Lake, Horse Lake, and Green Lakes. Backpackers as well as riders with packstrings can spend many days exploring the more remote interior areas.

Fishing is a favorite recreational activity in the Mink Lakes Basin which contains a cluster of about 60 lakes surrounded by fir, mountain hemlock, and lodgepole pine forests of the southern portion of the area. Mink Lake at 360 acres is the largest in the Wilderness. These areas are showing signs indicating use in excess of capacity.

Originally constructed by the Civilian Conservation Corps for the convenience and safety of hikers and riders are five historic trail shelters, located at James Creek, Cliff Lake, Mink Lake, Buck Meadows,

and Muskrat Lake. All but Muskrat Lake are considered eligible for listing on tthe National Register of Historic Places.

A recreational activity that has become very popular over the past few years is mountaineering. The volume of climbing traffic particularly on the Three Sisters peaks has become heavy. On midsummer weekends it is often necessary to wait for preceding parties to pass through certain exposed areas on popular North Sister routes. Due to this overcrowding on the summits, climbing accidents as well as litter have become a problem. Climbing camps that receive considerable day use are located at the Sunshine Meadows-Obsidian area below North and Middle Sister, and the Green Lakes area between South Sister and Broken Top. North Sister at 10,094 feet is most difficult of the Three Sisters to climb while Middle Sister (10,053) and South Sister(10,354) are not technically difficult climbs.

The mosaic of forest, meadows, and openings within the Wilderness is a complex response to the interaction of climatic, soil, and geologic factors, insect and disease outbreaks, and fire. In the lower elevation canyon country on the west side of the summit there are extensive stands of Douglas-fir. On both sides of the crest in higher elevations true fir, mountain hemlock, and lodgepole pine stands prevail while timberline and subalpine areas are characterized by clusters of slow growing subalpine fir, mountain hemlock, and an occasional whitebark pine. Meadows and openings interspersed with the scattered trees in this zone form a scenic setting which is generally favored by recreation users.

The Three Sisters Wilderness is favorable habitat for black-tail deer, mule deer, Roosevelt elk, and black bear. Elk are generally from the herds that winter in the South Fork McKenzie River, and North Fork Willamette River areas, often ranging as far east as Tumalo Creek and Crane Prairie Reservoir.

Linton Meadows is the most popular area for early season deer hunting and winter elk hunting. Mule deer, black-tail deer, and elk inhabit the area in and around the meadows and on Lane Plateau. Hunters often hike or ride in by way of Obsidian Trail, Frog Camp, or from Lava Camp on the Pacific Crest National Scenic Trail. The patient observer can see many other indigenous mammals such as marten, coyote, fox, mink, weasel, bobcat, beaver, and badger. Birds typical of the Wilderness include Clark's nutcracker, gray jay, Stellar's jay, common raven, turkey vulture, hairy woodpecker, winter wren, Oregon junco, red breasted nuthatch, and chestnut-backed chickadee. Hawks, owls, osprey, bald and golden eagles, waterfowl, and shorebirds also prefer the high elevation habitat.

The effects of overuse in the Three Sisters Wilderness can be seen in environmental degradation and increasing resource damage. Locations exhibiting these effects include: Sunshine/Obsidian Falls, Arrowhead Lake, Eileen Lake, Husband Lake, Linton Meadows, Lower Linton Meadows, Linton Lake, Otter Lake, Erma Bell Basin, Proxy Falls, Sisters Mirror Lake, Horse Lake, Golden Lake, Moraine Lake, Chambers Lake, Park Meadow, Buck Meadows Shelter, James Creek Shelter, Cliff Lake Shelter, Rebel Rock Lookout, Muskrat Lake Cabin, Mesa Creek, Blow Lake, Doris Lake, Hinton Springs, Honey Lakes, Nash Lake, Porky Lake, South Sister Climbing Trail, Mink Lake and Mink Lake Shelter, North and South Matthieu Lakes, Soap Creek Crossing, Camp Lake, Green Lakes, Ollalie Guard Station, Olallie Lookout, the Pacific Crest National Scenic Trail corridor, and Lower French Pete Trail. Also past commercial grazing and the presence of nonconforming facilities within the Wilderness have affected the environment and Wilderness experiences

The effects of more than a half century of fire protection are apparent in the succession which is taking place in many of the fire-formed openings. Lodgepole pine and mountain hemlock are filling in these openings which resulted from fire, insect epidemics, or other natural processes. Some of this succession may be influenced by recent climatic events.

Mountain pine beetle and white pine blister rust are found in the western white pine which is a minor element in the Douglas-fir and true fir/mountain hemlock stands. Balsam woolly aphid infestations slightly near the epidemic stage have occurred in some stands of true firs at upper elevations. Other biological disturbances particular to this area include *Phellinus* (root rot) in mountain hemlock stands, and western spruce budworm.

A water power withdrawal covering Horse Creek and Separation Creek is in effect. The U.S. Army Corps of Engineers has made a preliminary proposal for a flood control dam outside the Wilderness. If constructed, the dam would back water into the Wilderness in Horse and Separation creeks.

Waldo Lake Wilderness

The Waldo Lake Wilderness was established by the Oregon Wilderness Act of 1984 and is located entirely within Lane County and the Forest. The area lies 20 miles to the east of Oakridge, directly north of Highway 58 and west of Waldo Lake Road. Primary access points include: Taylor Burn, North Waldo, and Shadow Bay campgrounds; Forest Service roads in Furnish Creek, Salmon Creek, and Black Creek drainages; and trailheads located along the upper end of Road 19 and the Waldo Lake Road. Prior to 1984, the area was managed as the Waldo Lake Recreation Area.

The Waldo Lake Wilderness includes 37,157 acres of Oregon's High Cascades between the volcanic remnants of the Three Sisters and Diamond Peak. Waldo Lake, adjacent to the Wilderness, is a most prominent feature and a popular recreation destination. The lake was named after Judge John B. Waldo, a Pioneer son who died in 1907.

Elevations range from 2,800 feet to over 7,100 with an average elevation of approximately 5,000 feet. Generally, topography can be described as gently rolling foothills, except in the northwest portion where the North Fork Willamette drainage breaks up the area to form steep dissected slopes.

Wilderness lands include more than 200 small lakes, ranging in size from small seasonal ponds to the 100 acre Lower Eddeeleo Lake. Almost all of the larger lakes in the area contain fish, and planting of fish in the more popular lakes by the Oregon Department of Fish and Wildlife commonly occurs. The majority of the lakes have rocky shorelines and are set in small basins surrounded by unbroken stands of timber, providing maximum seclusion for anglers and other visitors. Water clarity and purity in Waldo Lake, Oregon's second largest lake, is dependent on maintenance of high water quality within the Wilderness.

Stands of mountain hemlock, lodgepole pine, true fir, Douglas fir, western hemlock, and some true fir associations are typical of the Wilderness. Natural openings of shrub, grass/forb types are present. Many small streams originate in these openings and flow to the larger tributaries of the North Fork of the Middle Fork of the Willamette River. A variety of birds, animals, and amphibians inhabit the area, while deer and elk summer in the meadows and adjacent forested lands.

Hunting activity is light in the eastern part of the area, and heavier in the west. The upper end of the Black Creek drainage and North Fork of the Middle Fork of the Willamette River are the most popular deer and elk hunting areas with easy access and transport of game occurring by boating across Waldo Lake.

Many other recreation activities are available including: hiking, backpacking, horseback travel, boating, scenic viewing, hunting, fishing, wildlife observation, photography, and nature study. Unusual geologic features and indigenous plants add to the diversity of the area.

Nonconforming facilities in the Wilderness such as Waldo Mountain Lookout, Black Meadows Cabin, and Fuji Mountain Cabin may intrude on the natural landscape. There is some concern that certain locations are receiving recreation use beyond their capacity. Areas that show environmental degradation are: Eastern Brook Lake, Winchester Lake, Gander Lake, Wahanna Lake, Rigdon Lake, Kiwa Lake, Six Lakes, Torrey Lake, Whig Lake, Quinn Lakes, Long Lakes, Swan Lakes, Salmon Lakes, and Eddeeleo Lakes. Increasing numbers of visitors are affecting opportunities for solitude and primitive recreation. Some trails are also beginning to exhibit signs of overuse including: Winchester Trail, Rigdon Lakes Trail, Black Creek Trail, Six Lakes Trail, Wahanna Trail, Whig and Torrey Way Trails, and Salmon Lakes Trail. Evidence seems to suggest that commercial activities may be occurring in the Wilderness without permits. These activities may be adversely affecting the area through its use by excessive numbers of people in one location at the same time, groups too large for a wilderness setting, and increased probability of site damage from concentrated horse use.

Forest Service trails and trail structures, mountaintop land survey control points, and abandoned Forest Service lookout stations are evidence of human activities. In addition, old campsites are evident in meadows and near lakes. Industrial activities and the resulting change in visual quality of adjacent lands are visible from within the area along the northern and western boundaries.
The Torrey-Charlton proposed Research Natural Area, within the Waldo Lake Wilderness boundaries, was proposed in the 1977 Forest Multiple Use Land Management and Timber Management Plan. An establishment plan for the area is close to completion.

Diamond Peak Wilderness

The Diamond Peak Wilderness was first established as a "Wild Area" by the Chief of the Forest Service in 1957. The area was reclassified as Wilderness by the Wilderness Act of September 1964 and was recently enlarged to 52,773 acres by the Oregon Wilderness Act of 1984. Management is shared with the Deschutes (32,964 acres) and the Willamette (19,773 acres) National Forests.

The Cascade Crest runs generally north and south through the area. Diamond Peak (8,744 feet) is the most prominent point and dominates the Wilderness. This is a massive, barren mountain consisting of at least three major peaks with broad ridges extending east and west as well as along the Cascade Crest. Blocky lava, pumice, and red cinders cover the slopes above 7,200 feet in elevation. There are two other significant volcanic peaks within the area: Mt. Yoran, just to the north of Diamond Peak, and Lakeview Mountain near the east boundary.

The west slope of the Cascades is broken by many drainages and drops steeply to several lakes just within the Wilderness boundary. To the north of Mt. Yoran the ground tends to be characterized by benches and gentler ridges. Small meadows and potholes are typical. Near the north boundary the terrain breaks steeply to Salt Creek. The eastern portion, bounded on the north by Trapper Creek and on the east by Lakeview Mountain, is gently rolling terrain sloping gradually toward two ridges which form a basin at the foot of Diamond Peak.

Diamond Peak is an important watershed with drainages radiating in all directions. Trapper and Whitefish Creeks feed Odell and Crescent Lakes respectively. These streams and the ground water from nearly 20,000 acres are the major source for these lakes. Fall Creek and other drainages to the north feed Salt Creek and these with the many streams originating on the west slope, form a network of tributaries to the Willamette River. About 41 small lakes are scattered throughout the area, the largest of which is 27-acre Yoran Lake.

The area is generally snow covered from October to May. Summer days are usually warm and dry with temperatures near freezing at night.

The west slope of the Wilderness is heavily wooded with large stands of fir and hemlock. The remainder of the area is typically upper forest stands of true fir-mountain hemlock. A large band of lodgepole pine traverses the fir-hemlock stands in the eastern half of the area. The true fir-mountain hemlock understory is dense growths of dwarf manzanita or varieties of huckleberry. Little understory or ground cover is found beneath lodgepole pine stands.

Alpine flowers such mimulus, lupine, penstemon, and Indian paintbrush are common along the trails, streams, and lakeshores. Diamond Peak lakes are widely dispersed across the landscape, trails are usually in the timber, and opportunities for open meadow travel are scarce. Large areas of the Wilderness have no access trails; many sections of existing trail are unusually steep. One cannot circle Diamond Peak by trail within the Wilderness and much of the area is rugged so cross-country travel is challenging.

Rainbow and eastern brook trout have been planted in about 30 lakes. The area's streams offer only average fishing for various reasons including frequent water level and temperature fluctuations, lack of feed, and natural barriers. The lakes near the west boundary offer some of the best fishing and are just a short hike from access roads. On the east edge, there are no easily accessible lakes, but Odell and Crescent Lakes are near the Wilderness and many visitors to these areas enter the Wilderness for day hiking.

Black-tailed and mule deer, elk, and black bear inhabit the Wilderness. Deer and elk populations are limited by available forage. Wildlife populations are probably increasing on the western fringe of the Wilderness due to the number of timber harvest units on the Forest. Wildlife populations have remained stable on the eastern slopes. Both hunting and fishing pressure have been gradually increasing. Resident small mammals include marmot, snowshoe rabbit, pine squirrels, pine marten and pika. Birds found here are grouse, raven, Clark's nutcracker, Oregon jay, and water ouzel. In summer, numerous insectivorous birds and seed eaters frequent the area. Bufflehead and goldeneye ducks occasionally nest near the lakes.

Trails, bridges, and signs are the only improvements within the Wilderness. Many of the old trails were fishing or trapping trails which have been maintained by the Forest Service in essentially original locations. Consequently, trail grades are often steep with hazardous stream crossings, although Diamond Peak and Mt. Yoran provide fairly easy climbing routes which are popular with beginners. Wilderness trails often are in locations inappropriate to optimum user enjoyment, have poor drainage, and frequently duplicate routes to destinations.

There are two nonconforming cabin structures within the Wilderness boundaries and Vivian Lake seems to be receiving use in excess of its capacity.

The quality of Wilderness experience is good from the standpoint of solitude. However, noise from the Southern Pacific Railroad is heard in most of the eastern portion, particularly at night.

A light outbreak of balsam wooly aphid in the Wilderness at one time reached epidemic proportions around Odell Lake, but due primarily to change in timber type is not expected to cause major problems.

The Diamond Peak Wilderness is one of Oregon's most rugged and pristine wildernesses. The area's relative inaccessibility and diverse landscape truly can set the stage for a wilderness experience that offers the visitor solitude, challenge, and primitive recreation in many forms.

Future Trends

Future Wilderness use will likely be affected by changes in various socio-economic indicators (e.g., population growth, disposable income, leisure time, etc.), the availability of opportunities, technology, weather conditions and other variables. Due to large uncertainties about the variables affecting future use, projections become more tenuous as they are extended further into the future. However, to assess whether current Wilderness use capacity is adequate to satisfy future demand it is necessary to develop estimates for a 50 year planning horizon.

Participation in most activities has shown steady growth over the past decade and is projected to increase during the planning horizon. For all Wilderness Resource Spectrum classes, except for the Pristine class, the existing supply of opportunities is inadequate to meet current or future demand. Figure III-P-7 compares individual Wilderness and total Wilderness use for 1989 and projected 2040 use with current estimated capacity by WRS Class.

These comparisons on a Wilderness-wide basis indicate that Wilderness use, if permitted to increase, would exceed inventory capacity in the pristine class by 2030; primitive class by 2000; and transition class by 2010. Use in the semiprimitive class exceeds inventory capacity at this time. Supply and demand comparisons change considerably on an individual Wilderness basis. Current use in primitive areas exceeds capacity in three Wildernesses: Mt. Jefferson, Middle Santiam and Menagerie. In all other Wildernesses, except Bull of the Woods, current use also exceeds inventory capacity in the semiprimitive WRS class.

It may be necessary to regulate use and some types of activities in order to retain or restore Wilderness conditions where evidence of overuse is apparent or where such use is an impairment to Wilderness experiences. Mt.Jefferson, Mt.Washington, and Three Sisters Wildernesses have been identified as top priority areas with regard to establishing management strategies which will focus on achieving balance between capacity and use. The reconciliation of use and capacity will be critical in other Wildernesses as well.

Adjustments in the amounts or distribution of WRS classes, elimination of trail segments, or closure of specific areas would all directly affect use capacity of individual Wilderness. In addition the redistribution or changes in inventoried WRS classes would reduce current and future Wilderness use opportunities but would provide for enhanced user experiences and recovery of resource conditions.

Calculation of existing capacity assumes management of WRS classes as inventoried and current access to individual Wildernesses. In addition, as use increases above WRS class capacity levels the intended experience opportunities decrease. A reduced experience opportunity and the resource degradation associated with overuse can cause an area to effectively shift into a less primitive WRS Class. Rigorous application of the Wilderness non-degradation policy, adherence to WRS class management standards, and the "Limits of Acceptable Change" (LAC) principles are intended to prevent such an occurrence.

Overuse in many Wilderness areas is currently a serious problem. User education and regulating or modifying access (e.g., through permit systems, road and trail closures, etc.) are management options that may be employed to prevent further degradation and enhance user experiences.

Table III-P-7. Wilderness Capacity and Use Comparisons[1]

Wilderness Name	WRS[2] CLASS	RVD Capacity	1989 Use[3]	2040 Use[4]
Bull of the Woods	Pristine	26	9	36
	Primitive	300	267	564
	Semiprimitive	--	--	--
	Transition	--	--	--
Mt. Jefferson	Pristine	6,258	2,156	5,529
	Primitive	28,517	32,515	83,160
	Semiprimitive	37,012	39,390	104,114
	Transition	6,406	9,330	25,441
Middle Santiam	Pristine	227	60	144
	Primitive	320	476	1,409
	Semiprimitive	964	1,664	4,393
	Transition	6,258	1,220	3,249
Menagerie	Pristine	107	81	215
	Primitive	152	400	1,128
	Semiprimitive	904	1,701	4,832
	Transition	--	--	--
Mt. Washington	Pristine	2,920	1,574	3,948
	Primitive	5,568	3,301	8,457
	Semiprimitive	11,336	13,654	36,023
	Transition	--	--	--
Three Sisters	Pristine	23,305	9,481	24,412
	Primitive	104,408	66,840	170,268
	Semiprimitive	63,118	81,949	215,696
	Transition	83,326	34,459	93,199
Waldo Lake	Pristine	1,020	355	898
	Primitive	7,947	3,837	9,867
	Semiprimitive	18,374	20,933	55,352
	Transition	8,390	6,346	17,133
Diamond Peak	Pristine	996	284	718
	Primitive	8,419	2,728	7,047
	Semiprimitive	6,642	7,218	18.890
	Transition	3,213	3,245	8,714
TOTALS	Pristine	34,859	14,000	35,900
	Primitive	155,631	110,400	281,900
	Semiprimitive	138,350	166,500	439,300
	Transition	107,593	54,600	147,700

[1]Information pertains only to the Willamette National Forest.
[2]Wilderness Resource Spectrum (WRS) Class.
[3]1989 Use estimate.
[4]Proportional distrabution of projected use based on historical use patterns.

Wilderness managers will rely on a wide range of management strategies (such as registration, permits, use limitations) to restore any areas which are not within standards. Implementation and monitoring plans will be developed for each Wilderness on the Forest. Public input is invited throughout the process.

As Wilderness use increases the most desirable campsites and major attractions are affected. These areas are likely to incur impacts to vegetation, soil, and adjacent water features. Some forms of Wilderness use such as pack and saddle activities have a greater effect than average hiking groups. Pack and saddle users generally require larger campsites near water and meadow areas for stock maintenance purposes. In addition, commercial outfitters and guides tend to bring in larger groups with greater potential for impacting the isolation and solitude of smaller groups of users.

Land management activities, such as timber harvest, have the potential to cause localized effects along the boundary of the Forest's Wilderness. Timber harvest and road construction within view from Wilderness use areas may incur higher than normal costs due to attempts to minimize effects. Wilderness use in general can affect the location of new roads, may require road closures to maintain Wilderness character, and may require specific mitigation treatments in order to achieve management objectives of Wilderness.

Forest Wildernesses contain a wide variety of cultural resources, e.g. several shelters and cabins dating to the 1930s-1940s. The Wilderness Act directs that historic structures not be rehabilitated for long term preservation; these buildings will be evaluated, documented and allowed to deteriorate gradually, unless a definite safety or administrative problem develops. Evidence of prehistoric utilization of Wilderness lands can be found throughout the Forest and is of concern to Wilderness managers. As with historic resources, prehistoric resources are of regional importance to understanding land use patterns and human behaviors. Certain protective or data retrieval measures may be necessary in areas of heavy recreational use.

Efforts to suppress both lightning and human-caused wildfires have modified the role of fire in Wilderness ecosystems. Over time continued suppression of natural fires at small sizes will alter natural vegetative successional processes giving rise, in some cases, to a loss of meadows and open spaces through encroachment of surrounding tree species and in some areas a buildup of dead and down fuels. The Forest will continue to provide cost effective fire protection on Wilderness (and nonwilderness lands) by suppressing all fires with the least cost plus net value loss to resources. In the future, prescribed burning may be planned for areas in the Wilderness where natural ecosystem succession would be perpetuated or other resource objectives met without threatening adjacent nonwilderness lands.

Although the evidence of past fires is not always apparent, especially in the Western Cascades, most biological communities have evolved with the presence of fire. Within Wildernesses, the natural role of fire is most evident. Fire management plans for Wilderness lands will include consideration for re-establishing fire in its natural role as a major factor in retaining a variety of plant communities and overall ecosystem processes. During suppression of all naturally occurring fires in Wilderness, preference will be given, whenever possible, to methods that preserve Wilderness values and have the least physical impact on the land.

ROADLESS LANDS

Roadless areas are defined as areas or islands of "undeveloped Federal land within which there are no improved roads maintained for travel by means of motorized vehicles intended for highway use. A roadless island is further defined as an area that is surrounded by permanent waters or that is markedly distinguished from surrounding lands by topographical or ecological factors such as cliffs, canyons, thickets, or swamps" (RARE II inventory criteria, USDA Forest Service).

Areas in an unroaded condition have been inventoried (see roadless area in glossary) on the Forest. Roadless lands are inventoried for the purpose of identifying areas within the Forest that meet minimum requirements for consideration as Wilderness. To achieve this purpose, criteria have been established to guide resource specialists in the inventory process. Specific criteria for size, area manageability, and nonconforming uses are used to determine whether an area qualifies for inclusion in the roadless area inventory.
The identification of roadless areas serves to highlight the environmental condition of specific areas within the Forest landscape, and to emphasize their potential for a wide range of multiple resource uses, including Wilderness. In addition, roadless inventories serve to make known the extent of the roadless resource and to provide a data base managers and legislators can use to formulate land management proposals and planners may use as to assess resource effects and trade-offs. Further such inventories provide the opportunity for thoughtful consideration and evaluation of an areas full potential and highest use through planning analysis and management decision processes.

Historic Trends

The subject of roadless areas gained prominence in the Forest during the early 1950s when Forest management began to intensify and the Chief of the Forest Service deleted a 53,000 acre area, known as French Pete, from the Three Sisters Primitive Area. Public concern intensified about French Pete and other roadless areas within the Forest during the following 30 years. In addition, the issue of preserving roadless areas for their wilderness character and primitive recreation opportunities has expanded to include concerns for providing adequate habitat to sustain viable populations (see the Wildlife section) of wildlife and fish, protecting sensitive soils and unstable lands; and maintaining representative ecosystems of the region and nation. The intensity and depth of public concern about how roadless lands would be managed were factors in the development of the RARE and RARE II processes as well as Wilderness legislation.

Figure III-Q-1 illustrates, for the Forest, changes in the amount of designated Wilderness and land inventoried as roadless during the past 25 years. Figure III-Q-1 also illustrates that roadless land have decreased as more Wilderness has been designated by Congress. However, decreases in roadless land are also due to Forest development activities such as road construction and timber harvest.

Table T033. Trends in Wilderness and Roadless Land Acreages (III-Q-1)

Current Subject	1964	1968	1973	1978	1979	1984	1984	Current Total
Wilderness	191,063[1]	254,744[1]	254,744	301,933[1]	301,933	301,933	386,863[1] [2]	386,863 [2]
Roadless Land	Unknown	Unknown	357,127[3]	304,927	301,227[4]	295,137[5]	210,207[5]	172,007[5]
Total Area Undeveloped	Unknown	Unknown	611,871	606,860	603,160	597,070	597,070	558,870

[1]Wilderness legislation enacted.
[2]Includes Oregon Cascades Recreation Area.
[3]Roadless Area Review and Evaluation (RARE - 1973).
[4]Second-Roadless Area Review and Evaluation (RARE II - 1979).
[5]National Forest Management Act (NFMA) Roadless Area Inventory.

Current Situation

Areas in roadless inventories have typically been evaluated for their suitability, availability and need as wilderness during formalized planning efforts such as Unit Planning, RARE or RARE II. This process has been validated, with some alteration, by the Oregon Wilderness Act of 1984 (P.L. 98-328). The Act designated 78,872 acres of inventoried roadless area on the Forest as new Wilderness and 6,292 acres of roadless land as the Oregon Cascades Recreation Area.

The Oregon Wilderness Act of 1984 directs that, for the initial National Forest Management Act (NFMA) land management plans, the National Forest lands in Oregon which were reviewed in RARE II, or in unit plans, and roadless lands which are less than 5,000 acres in size, have had adequate consideration of their suitability for inclusion in the National Wilderness Preservation System. The Department of Agriculture will not be required to review the Wilderness option prior to the revision of the plans, but will review the Wilderness options when the plans are revised ordinarily on a 10-15 year cycle (Section 7(b)(2) Oregon Wilderness Act of 1984).

The roadless lands will be managed for multiple use in accordance with the land management plans, and they need not be managed for the purpose of protecting their suitability for Wilderness designation prior to or during revision of the land management plans (Section 7(b)(3) Oregon Wilderness Act of 1984).

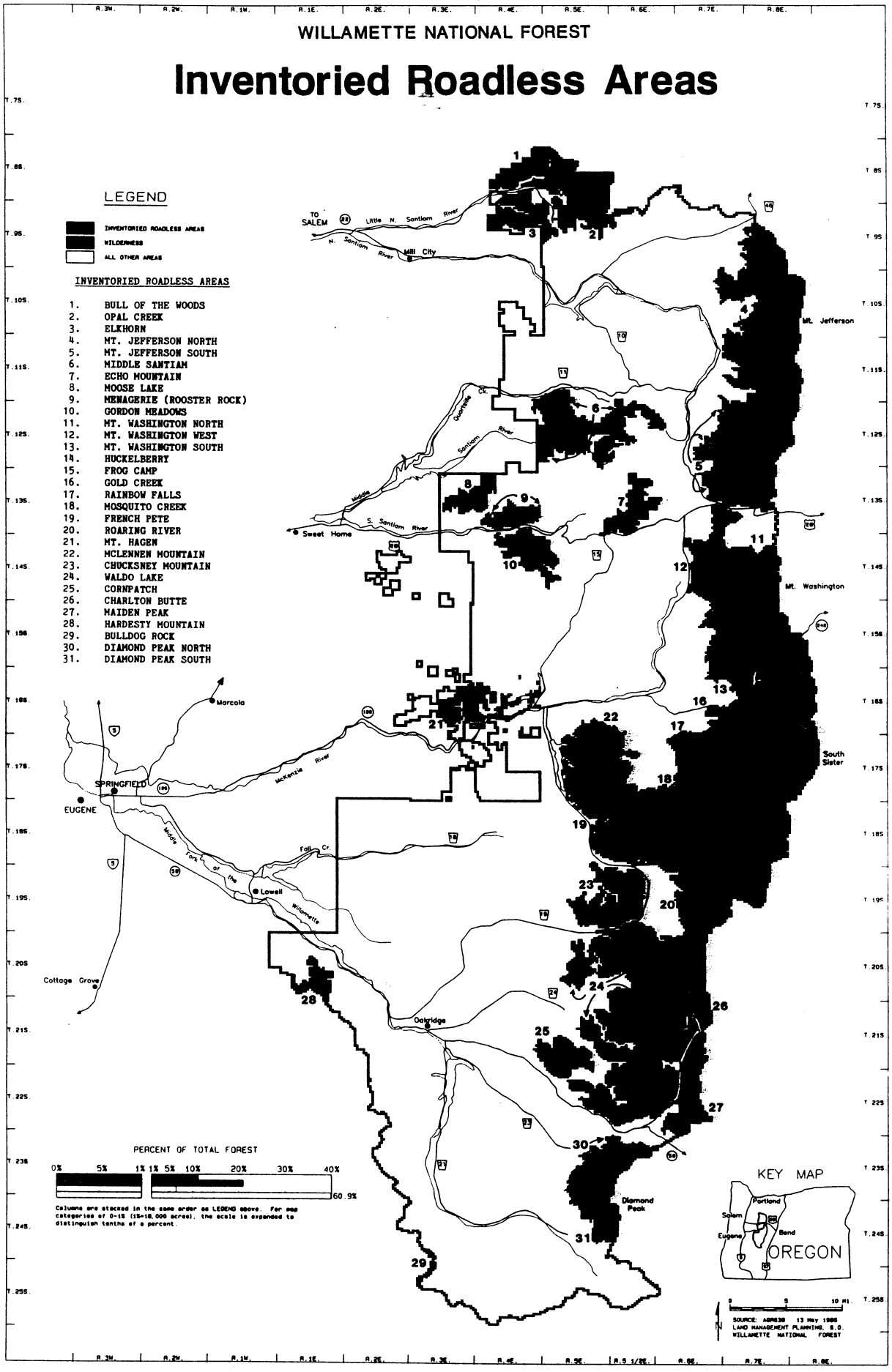
The Forest prior to release of the DEIS had 31 inventoried roadless areas which following passage of the Oregon Wilderness Act of 1984 totaled 210,207 acres. During the period 1984-1987 and the period following release of the DEIS (1987-1989), management activities were being implemented in many of these areas. A recent assessment of inventoried roadless area conditions indicates that 38,200 acres have been affected by management activities since the 1984 inventory was completed. The roadless area inventory currently includes 31 areas for a total of 172,007 acres. Figure III-Q-2 lists each roadless area by name; amount of area released for multiple-use management in 1984; amount of area affected since 1984; and remaining area in a roadless condition. A complete discussion of each area's attributes and resource potentials is provided in Appendix C. Areas identified in the roadless inventory are widely distributed throughout the Forest. Figure III-Q-3 illustrates the spatial distribution of areas.

Figure III-Q-2 Roadless Area Inventory

Roadless Inventory		Status of Inventoried Roadless Areas 1984-1989			
Areas listed below of less than 5,000 acres are either contiguous to designated Wilderness or roadless areas of adjacent National Forest.		Roadless area designated by Oregon Wilderness Act 1984[1]	Areas released for multiple use management by the Oregon Wilderness Act 1984	Acreages affected by Management Activities 1984-1989	Current size of inventoried roadless areas
Area Name	**Size**	**Acres**	**Acres**	**Acres**	**Acres**
Bull of the Woods	12,543	6,165	6,378	0	6,378
Opal Creek	12,585	1,301	11,284	597	10,687
Elkhorn	9,321	0	9,321	363	8,958
Mt. Jefferson North	16,871	7,187	9,684	3,648	6,036
Mt. Jefferson South	7,316	1,002	6,314	1,323	4,991
Middle Santiam	24,369	8,542	15,827	9,044	6,783
Echo Mountain	8,084	0	8,084	533	7,551
Moose Lake	5,674	0	5,674	896	4,778
Menagerie (Rooster Rock)	5,397	4,949	448	43	405
Gordon Meadows	9,556	0	9,556	1,195	8,361
Mt. Washington North	1,706	576	1,130	127	1,003
Mt. Washington West	9,726	0	9,726	3,050	6,676
Mt. Washington South	4,437	0	4,437	213	4,224
Huckleberry	853	0	853	0	853
Frog Camp	469	0	469	0	469
Gold Creek	1,301	0	1,301	256	1,045
Rainbow Falls	491	448	43	0	43
Mosquito Creek	491	0	491	85	406
French Pete [3]	2,730	0	2,730	149	2,581
Roaring River	2,410	0	2,410	362	2,048
Mt. Hagan [2]	6,292	0	6,292 [2]	0	6,292
McLennen Mountain	8,873	0	8,873	1,066	7,807
Chucksney Mountain	16,211	0	16,211	704	15,507
Waldo Lake [3]	89,591	44,734	44,857	12,968	31,889
Cornpatch	7,871	0	7,871	1,109	6,762
Charlton Butte	2,880	0	2,880	0	2,880
Maiden Peak	11,070	0	11,070	0	11,070
Hardesty Mountain	4,031	0	4,031	341	3,690
Bulldog Rock	555	0	555	0	555
Diamond Peak North	4,778	3,520	1,258	128	1,130
Diamond Peak South	597	448	149	0	149
Cowhorn [4]	6,058	6,058	0	0	0
Total Acreages	**295,137**	**84,930**	**210,207**	**38,200**	**172,007**

[1]Acreages are tentative until area boundaries are approved by Congressional Committee.
[2]This area was evaluated for the Wilderness option as well as other multiple uses; in the DEIS.
[3]This area is divided into several parts for purposes of description in Appendix C.
[4]Included in the Oregon Cascades Recreation Area as designated by the Oregon Wilderness Act of 1984.

Figure III-Q-3.



In addition to the Forest's Inventoried Roadless Areas, the Forest has also identified 24 unroaded land areas that range in size from 1,500 acres to 4,500 acres. These areas, too small for inclusion into the Forest's Roadless Area Inventory but large enough to provide semiprimitive dispersed recreation opportunities, are included in the Forest's Recreation Opportunity Spectrum (ROS) Inventory. The ROS Inventory is displayed in the Recreation section of this Chapter.

Under the provisions of the Oregon Wilderness Act of 1984, only one of the Forest's inventoried roadless areas has been evaluated for its suitability, availability, and need as potential Wilderness: Mt. Hagan. The Mt. Hagan roadless area, 6,292 acres, located near the community of Blue River, was neither reviewed in RARE or RARE II nor evaluated for the Wilderness option in a Forest Unit Planning process. In the DEIS the Mt. Hagan area was included in Alternative C as proposed Wilderness. The remaining roadless areas have been examined for their suitability to provide a full range of other multiple resource uses such as wildlife and fish habitat, scenery, recreation, research, wood products, and water in the DEIS Alternatives and the Alternatives included in this FEIS.

Public comment on the DEIS and Draft Forest Plan was highly polarized between the desire on one hand to maintain inventoried and other unroaded areas in an undeveloped state, and on the other hand a desire to enter and develop these areas in accord with "multiple use" objectives. Reasons stated for maintenance of roadless lands included: consideration for future Wilderness, ecological integrity, unroaded recreation, wildlife habitat, old growth preservation, and providing biological diversity. Respondents favoring development of roadless areas cite the Oregon Wilderness Act of 1984 as having settled the issue. This segment of the public feels that sufficient amounts of the Forest are currently dedicated to roadless area dependent uses.

Future Trends

It is anticipated that during implementation of the Forest Plan some roadless areas will become developed through road construction, mineral exploration, recreation facility construction and timber harvest; and others will remain in a roadless condition. The extent of development or preservation of roadless land is dependent upon the type of use to which areas are allocated in the Forest Plan and applicable management direction. However, if the Forest Plan favors development of roadless areas, the Forest's ability to satisfy future demand for uses dependent upon roadless conditions or evaluate areas for Wilderness in the next cycle of Forest Planning will be diminished. Conversely, if the preservation of roadless areas is favored then it is more likely that demand for uses dependent upon roadless conditions can be met and that more areas will qualify for Wilderness evaluation in the next cycle of Forest Planning (10-15 years).

The allocation of roadless areas to uses that do not permit development activities such as timber harvest, road construction, and mineral exploration have the potential to alter the economic base and social patterns of dependent communities. Allocation of roadless areas to uses that permit development activities on the other hand may result in changes to land form, vegetation, and size of individual areas. These changes typically alter an area's potential to provide isolation, solitude, and primitive recreation experiences, and hence their suitability for future Wilderness evaluation.

The extent of potential change to individual areas and the inventory as a whole is relative to the amount of roadless land either developed or maintained in an undeveloped state. The effect of allocation decisions of each alternative and their associated management activities on roadless areas is discussed in Chapter IV and in Appendix C.

SPECIAL INTEREST AREAS, OLD-GROWTH GROVES, AND NATIONAL NATURAL LANDMARKS

The Forest includes areas that exhibit unique ecological and biological communities, and geological characteristics. These lands are inventoried to identify their recreational and scientific values for the purpose of enjoyment and study. Special Interest Areas (SIAs) are designated to protect and where appropriate foster public use and enjoyment of areas with scenic, historical, geological, botanical, zoological, paleontological, or other special characteristics. Old-Growth Groves (OGGs) within the Forest have been identified for the purpose of protecting a unique component of the forest ecosystem. The principal values considered significant in managing OGGs are aesthetic, recreational, educational, biological diversity, wildlife habitat, and research. National Natural Landmarks (NNLs) are designed to preserve sites illustrating the geological and ecological character of the United States, enhance educational scientific value of preserved sites, and foster a greater concern for the conservation of the Nation's heritage.

Historic Trends

As resource management activities have extended into undeveloped areas, concern for the protection of unique and special Forest environments and features has been increasing. In general, public response to the issues of wildlife, plants and fish, dispersed recreation, developed recreation, visual resources, and cultural resources has focused on the concept of preserving areas of the Forest. Some responses have indicated the need to protect and preserve unique ecological and scenic values. Concern was expressed about the impact that developed recreation may have on sensitive habitats such as meadows, bogs, and lakes. Some responses stressed the need to preserve habitat which is suitable for Threatened and Endangered species and unique cultural resource areas.

This trend of concern for special areas is reflected by requests from the public to set aside specific landscape features as SIAs or OGGs. This trend has been supported by Forest proposals to establish more SIAs and OGGs. The value and importance of preserving unique and special aspects of our natural environment is emphasized by an expanded inventory of potential areas to be considered for designation by Forest managers. Five SIAs existed at the time of the 1977 Land Management Plan. The 1977 Plan proposed establishment of four new areas for a total of nine SIAs. Four of the five established SIAs in the 1977 Plan were reclassified as Wilderness when the French Pete area was added to the Three Sisters Wilderness by the Oregon Endangered Wilderness Act of 1978.

There has been a groundswell of public concern, both organizational and individual, for preserving for the benefit of present and future generations some of the most significant and representative stands of old growth. In 1976 the Forest Supervisor initiated an effort to identify and manage selected Forest OGGs, especially for their aesthetic and recreational values. Accessibility, stand and tree size, natural condition, and volume per acre were some of the criteria used in the selection. The 1977 Forest Land Management Plan listed 34 OGGs, 6 of which were later subsumed by the Wilderness Act of 1984.

Current Situation

The Forest currently contains one administratively established SIAs: the Lamb Butte Scenic Area located within the Blue River and McKenzie Ranger Districts. This area is mainly an open meadow with a variety of plant species; it provides summer range for Roosevelt Elk and black-tailed deer. Surrounding timber types are subalpine fir, true fir, and Douglas-fir. Taylor Castle, Lamb Butte, and English Mountain are three peaks of particular interest within this area of about 390 acres. Topography

is steep and elevation ranges from 4,800 to 5,600 feet. The area is managed to provide opportunities for high quality recreational experiences and to preserve its unique scenic resources.

The Forest also contains 49 potential SIAs. Of these, four areas were recommended for designation and are presently managed as SIAs under the current Forest Plan: Monument Peak Botanical Area, Tamolitch Valley Geological Area, Wolf Rock Geological Area, and Tumblebug Gorge Geological Area. Following release of the 1977 Forest Plan an establishment report was prepared for Monument Peak and the Moon Point area was identified as a potential SIA, however, Forest planning direction at the time reserved the establishment of any new SIAs until completion of new Forest Plans. These areas are included in Figure III-R-1; a complete listing of potential areas, their size, and classification type.

In addition to four proposed SIAs the current Forest Plan maintains 28 areas as designated OGGs. Ten additional OGGs have been identified and added to the inventory sine 1984, bringing the total number of OGGs to 38. Figure III-R-2 is a complete listing of inventoried potential OGGs.

The Forest contains no designated NNLs. There are currently, however, 21 potential NNLs within the Forest that have been identified by the National Park Service. These areas, in many instances, occur within the Forest's existing Wilderness or are coincidental with both established and potential SIAs, OGGs, Research Natural Areas, and the H.J. Andrews Experimental Forest. Figure III-R-3 is a complete listing of potential NNLs, their size and Forest location.

As shown by Figures III-R-1,2, and 3, numerous opportunities are available to establish SIAs and designate OGGs by the Forest Service and recommend establishment of NNLs by the Park Service. However, the choices among the potential SIAs is limited for potential zoological areas. This lack of representation of zoological areas for SIA designation could be compensated for through the establishment of Special Wildlife Habitat Areas. For a listing of potential Special Wildlife Habitat Areas refer to the Wildlife section in this Chapter.

Future Trends

Recreational use of designated SIAs and OGGs is likely to increase in the future. The fact of designating areas and identifying their locations serves to advertise availability and may inspire increased use. Actual use levels will, however, parallel those of general dispersed areas.

Unresolvable conflicts could occur between the various resource values protected within SIAs, OGGs, and NNLs. As an example, needed improvements to big game habitat may be incompatible within a Botanical Interest Area. In areas set aside for wildlife habitat purposes some management activities, such as burning, may conflict with recreational use or other values in specific locales for limited periods of time.

Certain types of developments within some potential NNLs or in SIAs or OGGs could result in disturbances to the specific values to be preserved, studied, or enjoyed.

Natural catastrophic events, such as fire, windthrow, and flooding could destroy the values protected within designated or potential SIAs, OGGs or NNLs . Management activities such as timber harvest and road construction could limit opportunities to maintain unique values if areas are recognized through protective designations. In addition, SIAs, OGGs, and NNLs could face the hazard of overuse by interested publics.

Table T035. Potential Special Interest Areas (SIAs) (III-R-1)

Potential SIAs[1]	Ranger District Location	Approximate Acres	Classification
Baby Rockshelter	Oakridge	107	Cultural
Bradley Lake	Rigdon	789	Botanical
Carpenter Mountain	Blue River	576	Geological
Chuckle Springs	Rigdon	107	Scenic
Clear Lake	McKenzie	512	Geological
Cloverpatch Butte	Lowell	576	Geological
Constitution Grove	Oakridge [2]	21	Scenic
Cougar Rock	Sweet Home	171	Cultural
Daly-Parrish Lakes	Sweet Home	405	Scenic
David Douglas	Oakridge	1,152	Geological
Deadhorse Rockshelter	Rigdon	42	Cultural
Doe Mountain	Sweet Home	149	Cultural
Eagle Creek	Oakridge	469	Scenic
Fish Lake	McKenzie	277	Cultural
Gold Hill	Sweet Home	1,536	Cultural
Hardesty Mt.	Lowell	3,178	Ecological
Hell Hole	Oakridge	85	Geological
Hidden/Lulu Lakes	Blue River	597	Botanical
Hills Creek	Detroit	256	Zoological
Horsepasture Cave	Rigdon	21	Cultural
Indigo Springs	Rigdon	21	Cultural
Iron Mt/Cone Peak	Sweet Home	2432	Botanical
Fall Creek	Lowell	2794	Recreational
Long Ranch	Sweet Home	43	Zoological
McKenzie River	McKenzie/Blue River	1,984	Recreational
Monument Peak[3] [4]	Detroit	384	Botanical
Moon Point [5]	Rigdon	2,005	Botanical
OCM Wagon Road	Rigdon	2,560	Cultural
Opal Creek	Detroit	277	Scenic
Pepper Rockshelter	Oakridge	21	Cultural
Phantom Natural Bridge	Detroit	128	Geology
Pinnacle Peak	Detroit	235	Geological
Rider Swamp	Blue River	21	Botanical
Rigdon Meadows	Rigdon	107	Cultural
Riggs-Don Lakes	Sweet Home	192	Scenic
Roaring River Spgs	Blue River	256	Geological
Salt/Diamond Cyn.	Oakridge	597	Scenic
Sand Mountain	McKenzie	363	Geological
Santiam Wagon Road	Sweet Home/McKenzie	3,263	Cultural
Shelter Falls	Sweet Home	64	Geological

Table T035 Cont. Potential Special Interest Areas (SIAs) (III-R-1)

Potential SIAs[1]	Ranger District Location	Approximate Acres	Classification
S.Fork McKenzie	Blue River	3,263	Recreational
Sweetwater Springs	McKenzie	128	Botanical
Tamolitch Valley[3]	McKenzie	1,813	Geological
Terwilliger Hot Springs	Blue River	149	Geological
Three Pyramids	Sweet Home	1,877	Botanical
Tumblebug Gorge[3]	Rigdon	427	Geological
Vine Rockshelter	Rigdon	21	Cultural
White Cliffs Cave	Oakridge	21	Cultural
Wolf Rock/Lake[3]	Blue River	597	Geological/Botanical
TOTALS 49 Areas		36,960	--

[1]Descriptions of individual areas are included in the planning record.
[2]Included within the NF MF Willamette River Wild and Scenic River corridor.
[3]Areas recommended for establishment in the 1977 Land Management Plan.
[4]Establishment Report--Monument Peak SIAs, March 24,1981.
[5]Moon Point Environmental Assessment--Interim Management Plan, March 16,1982.

Table T---. Potential Old-Growth Groves (OGGs) (III-R-2)

Old-Growth Grove	District	Dominant Species	Significant Attribute	Acres
Big Swamp	Rigdon	Douglas fir/w.redcedar	Tree diameter	192
Camp Creek [2]	Sweet Home	Noble fir	Tree diameter	363
Castle Rock	McKenzie	Douglas fir	Accessibility	43
Cayuse Creek	Oakridge	Douglas fir/true fir	Tree diameter	43
Cliff's Creek	Detroit	Douglas fir/w.hemlock	Accessibility	107
Delta	Blue River	Douglas fir/true fir	Accessibility	277
Echo Basin	Sweet Home	Alaska yellow cedar	Outstanding example	256
Elk Camp	Oakridge	Douglas fir, Pacific silver fir	Outstanding example	128
Fall Creek	Lowell	Douglas fir	Tree diameter	85
Fisher Creek	Oakridge	Douglas fir	Tree diameter	85
Fish Lake Creek	McKenzie	Douglas fir	Stand Density	43
Gold Lake	Oakridge	Douglas fir/Mtn.hemlock	Outstanding example	469
Goodman/Sawtooth	Lowell	Douglas fir	Tree diameter	43
Hackleman Creek	Sweet Home	Douglas fir/W.white pine	Accessibility	21
Highway 20	McKenzie	Douglas fir	Stand Density	85
Hugging Tree [2]	Lowell	Douglas fir	Tree diameter	21
Indian Creek	Sweet Home	Douglas fir/w.white pine	Outstanding example	43
Johnny Creek	Lowell	Douglas fir	Stand Density	43
Kelsey Creek [2]	Oakridge	Douglas fir	Tree diameter/age	192
Little Fall Creek I [2]	Lowell	Douglas fir	Tree diameter/ht.	107
Little Fall Creek II [2]	Lowell	Douglas fir	Tree diameter/ht.	93
Lost Creek	McKenzie	Douglas fir/w.redcedar	Accessibility	192
McKenzie	Blue River	Douglas fir	Accessibility	43
Outerson Mountain	Detroit	Alaska yellow cedar/w.hemlock	Outstanding example	384
Pyramid [2]	Sweet Home	Douglas fir	Accessibility	448
Sardine Butte	Oakridge	Douglas fir	Tree diameter/age	64
Scar Creek [2]	Sweet Home	Douglas fir/T.fir/w.red cedar	Outstanding example	85
Scar Mountain [2]	Sweet Home	True fir	Park-like stand	192
Seven Mile	Sweet Home	Douglas fir	Outstanding example	85

Table III-R-2. Potential Old-Growth Groves (OGGs)

Old-Growth Grove	District	Dominant Species	Significant Attribute	Acres
Slick Creek/Bedrock	Lowell	Douglas fir	Stand Density	43
South Fork Breitenbush	Detroit	Douglas fir/w.hemlock	Accessibility	384
Three Creeks [2]	Sweet	Douglas fir	Tree diameter/age	1792
Tumble Creek	Detroit	Alaska y.cedar/Douglas fir	Outstanding example	576
Upper Furnish Creek	Oakridge	Douglas fir/Pacific s.fir	Stand diversity	128
Upper Salmon Creek	Oakridge	Noble fir	Park-like stand	64
Wall Creek	Oakridge	Douglas fir/w.redcedar	Accessibility	107
Whitewater Bend	Detroit	Douglas fir/w.hemlock	Accessibility	85
TOTALS	38 Areas	--	--	7,496

[1]Descriptions of individual areas are included in the planning record.
[2]Inventory additions since 1984.

Table T036. Potential National Natural Landmarks (NNLs) [1] (III-R-3)

Potential NNLs/Vicinity	Ranger District	Approx. Acres WNF	National Forest[3]
Belknap Crater/Mt. Washington Wilderness	McKenzie	2,346	Willamette/DNF
Clear Lake/Clear Lake	McKenzie	107	Willamette
Exper.Watershed No.2/H.J. Andrews Exper.Forest	Blue River	171	Willamette
Gold Lake Bog RNA/Gold Lake	Oakridge	469	Willamette
Iron Mountain/Cone Peak/Highway 22	Sweet Home	6,719	Willamette
Jefferson Park/Mt. Jefferson Wilderness	Detroit	896	Willamette
Lamb Butte/Lamb Butte Scenic Area	McKenzie	405	Willamette
Lowder Mountain/Three Sisters Wilderness	Blue River	149	Willamette
Mack Creek/H.J. Andrews Exper.Forest	Blue River	1,557	Willamette
McKenzie Summit/Highway 242	McKenzie	192	Willamette/DNF
Middle Santiam/Middle Santiam Wilderness	Sweet Home	1,152	Willamette
Hagan Block RNA/Mt. Hagan	Blue River	853	Willamette
Mt. Washington/Mt. Washington Wilderness	McKenzie	256	Willamette/DNF
Ollalie RNA/Ollalie Ridge	McKenzie	724	Willamette
Quaking Aspen Swamp/Three Sisters Wilderness	Blue River	235	Willamette
Rock Mesa/Three Sisters Wilderness	McKenzie	811	Willamette/DNF
Three Fingered Jack/Mt. Jefferson Wilderness	Detroit	939	Willamette/DNF
Three Sisters/Three Sisters Wilderness	McKenzie	11,902	Willamette/DNF
Torrey-Charlton RNA/Charlton Butte	Oakridge	2,154	Willamette/DNF
Waldo Lake/Waldo Lake	Oakridge	6,612	Willamette
Wildcat Mountain RNA/Wildcat Mountain	Sweet Home/ McKenzie	1,003	Willamette
TOTAL	21 Areas	39,652	--

[1]Source: USDI Park Service.
[2]Willamette National Forest Acreage.
[3]DNF = Deschutes National Forest.

RESEARCH NATURAL AREAS AND H.J. ANDREWS EXPERIMENTAL FOREST

The National Forest Management Act (NFMA) of 1976 called for Forest planning to establish a nationwide system of Research Natural Areas (RNAs). Research Natural Areas are biotic preserves which serve as ecological reference points, or as experimental controls, against which it is possible to measure and assess the results of Forest management activities. They also serve as field laboratories to monitor natural processes and storehouses of genetic diversity.

The role of RNAs is limited to research, study, observations, monitoring, and educational activities that are nondestructive and nonmanipulative, and that maintain unmodified conditions. Research Natural Areas can be used to preserve a wide spectrum of numerous natural situations. These comparatively small sized areas provide the following functions:

- Preserve and maintain genetic diversity.
- Protect against serious environmental disruptions.
- Provide educational and research areas for ecological and environmental studies.
- Monitor environmental and hydrological conditions as baseline information for determining effects of land management practices on terrestrial and aquatic systems.
- Serve as baseline areas or controls for research measuring ecological and hydrological effects of land management manipulation techniques and practices.
- Preserve gene pools for typical and threatened and endangered plants and animals.

The H.J. Andrews Experimental Forest was dedicated for development of better methods for managing forested lands in the Western Cascades and to determine the effects of timber management activities on soils, fish, wildlife, and water quality and quantity. Timber is harvested to meet the specific needs of research on an irregular basis. Harvesting may include a full range of silvicultural practices and harvesting methods.

Historic Trends

Early research on the Forest began around 1910 by Thornton T. Munger. Mungar initiated a series of Region-wide sample plots in second growth Douglas-fir, the first in a 50-year-old stand near Oakridge. Between 1910 and 1914 a number of expiermental plantations were established to test the adaptability of eastern hardwoods in various areas of the Forest. Under the direction of Julius Kummel several areas; 3.25-acre tracts behind the McKenzie Bridge Ranger Station, a tract near West Boundary Ranger Station, and some strips near Dead Mountain were planted. According to research records these "apparently were all failures." A number of large plantations were also set up, mainly in old burns, including the Battle Ax tract on the border of the Mt. Hood and Santiam National Forests in 1913-1915; Breitenbush tract, near the springs in 1915; Dead Mountain, 1915-1917; and Seven Mile Hill in the same period. Trees planted in these tracts with the aid of forestry students from Oregon State University were Douglas-fir, western white pine, and with some tracts of noble fir.

These early research efforts were later followed by the formal designation of Forest lands for research purposes. The establishment of Research Natural Areas (RNAs) and Experimental Forests has been

increasing since the McSweeny-McNary Act of 1928. The H.J. Andrews was established 20 years subsequent to this Act, and between 1965 and 1979, four RNAs were created. The number of research projects undertaken each year in established areas has also increased.

The Experimental Forest is representative of mid- and upper-elevation forests on steep slopes with extensive areas of unstable land. It was established for the study of forest and watershed management problems associated with conversion of old growth Douglas-fir and upper-slope mountain hemlock and noble fir to young managed stands. In the beginning, most studies were about methods of cutting timber and building roads.

Over the years, use of the Experimental Forest has gradually shifted and expanded. In the 1960s, research attention focused on the effects of forest practices on water quality and quantity. Beginning in 1969, basic research on ecological and environmental phenomena was intensified, and use by university scientists increased. From 1969 through 1978, the Experimental Forest served as an intensive study site of the Coniferous Forest Biome Project of the International Biological Program. In 1974, it became part of an international system of Biosphere Reserves designated by the United Nations Education, Cultural, and Scientific Organization. The primary objectives of these reserves was conservation of genetic diversity, environmental research and monitoring, and education.

The H.J. Andrews Experimental Forest increases in value as a research site as data about various processes of ecosystem functioning accumulate from old and new long-term studies. One reason it is uniquely suited to ecosystem studies is that scientists of many disciplines are working side-by-side, sharing data, looking at the same processes and products from different viewpoints, and making use of the many years of record. Some records date almost to 1948 when the Experimental Forest was established. Indirect records (i.e., tree rings) provide information that goes back about 850 years in some areas. Precipitation has been measured since 1951 and temperature and humidity since 1957. Three experimental watersheds were established in 1952 and a plant collection was begun in 1958.

In 1977, the Experimental Forest was selected as the Nation's first Experimental Ecological Reserve supported by the National Science Foundation. In 1980, it became a charter member of the National Science Foundation's Long-Term Ecological Research network of research sites. The network now totals 15 sites and includes many of the major ecosystem research sites and groups in the nation. The list of publications stemming from work done at the *H.J. Andrews Experimental Forest since 1948* contains almost 600 reports, papers, and abstracts that address the the consequences of various management actions related to silviculture, soils, hydrology, wildlife, geology, ecology and fire.

Current Situation

The Forest currently administers one Experimental Forest and four established Research Natural Areas. There are no proposed additional nor anticipated Experimental Forests in the Forest. Five areas have been identified as potential RNAs. In addition the Wildcat Mt. RNA is proposed to be enlarged by 384 acres. Figure III-S-1 displays information about the established Research Natural Areas.

Table T037. Established Research Natural Areas (III-S-1)

Area	Acres	District	Established Date
Gold Lake Bog RNA	463	Oakridge	1965
Olallie Ridge RNA	720	McKenzie	1963
Middle Santiam RNA [1]	1,145	Sweet Home	1979
Wildcat Mountain RNA	1,000	Sweet Home	1968
TOTAL ACRES	3,328	--	--

[1]Within the Middle Santiam Wilderness.

The four Research Natural Areas (RNAs) established in the Forest as representative "cells" (i.e., a basic unit such as an ecosystem, vegetative community, or habitat) are listed by the Pacific Northwest Research Natural Area Committee as component parts of the overall coniferous forest ecosystem of the Northwest. Each of these established areas is briefly described below.

Olallie Ridge RNA: Established in 1963 to represent mountain meadow and true fir-mountain hemlock communities prevalent on high ridges in the Western Cascades of Oregon. The area provides unusual opportunities for studying subalpine meadow-forest mosaics. Many subalpine meadows are becoming increasingly impacted by recreation use. Research on an unimpacted area should help with planning management regarding use problems. The RNA is also an important refugium for disjunct populations of numerous plant species. Research in this area includes studies of distunct flora, distribution and role of fungi on conifer needles, and habitat classification.

Gold Lake Bog RNA: Established in 1965 to preserve some prime subalpine bogs. It provides for the protection of six uncommon species of bog plants. The surrounding forest land creates opportunities for studying the variation in composition, structure, and productivity of forest communities along an environmental gradient from wet, low-lying to dry, upland areas. Research in this area includes studies of the bog communities and their flora.

Wildcat Mountain RNA: Established in 1968 to preserve prime examples of the noble fir stands found on mountain ridges in the Western Cascades of Oregon. This area provides numerous opportunities for studying the various management concerns related to noble fir (i.e., cone production, amount and quality of annual seedfall, soils, growth and yield of stands, and causes of mortality). Other studies on the RNA include distribution of birds and mammals in relation to plant communities, relation of site index to habitat types in the Pacific silver fir zone and ecological monitoring of long-term effects of energy development.

Middle Santiam RNA: Established on May 23, 1979, is now within the boundaries of the Middle Santiam Wilderness Area which was designated by Congress in 1984. The area includes representative stands

of old-growth (450+ years), Douglas-fir/western hemlock forests of the Western Oregon Cascades, and three drainage tributaries to the Middle Santiam River. Studies taking place on the Middle Santiam have included: productivity of old-growth forests; composition and successional development of forest communities as related to environmental factors such as soil, aspect and topographic position; role of coarse woody debris in stream stabilization and sediment routing; and research on old growth as wildlife habitat.

Of the potential RNAs, Hagan Block and Torrey-Charlton were proposed in the Forest's 1977 Multiple Use Land Management and Timber Management Plan. Establishment reports for these areas are generally complete. There is a proposal to add about 425 acres to the Hagan Block area to complete some ecological systems, for a total of 1,280 acres. The Rigdon Point area is a specific cell listed for the knobcone pine species but does not represent the specific plant community (i.e., SAF timber Type 248). The Mckenzie Pass potential RNA is a subalpine lava flow with representative vegetation. This ecosystem is well protected by the surrounding Wilderness. The ecotone between the younger unvegetated lava flows and the older vegetated flows that surround the area should provide good opportunities for successional studies. The Three Creeks area is a stand of old-growth timber including trees exceeding 700 years in age. The proposed expansion of the Wildcat Mt. RNA includes two parcels totaling 384 acres along the northern edge of the area. Figure III-S-2 includes information relating to each of the potential RNAs.

Table T038. Potential Research Natural Areas (III-S-2)

Area Name	District	Acres
Mt. Hagan	Blue River	1,280
Torrey-Charlton [1]	Oakridge	2,154
Rigdon Point	Rigdon	300
McKenzie Pass [2]	McKenzie	1,195
Three Creeks	Sweet Home	661
Wildcat Mt. Addition	Sweet Home	384
TOTAL ACRES		5,987

[1]Partially within the Waldo Wilderness.
[2]Partially within the Three Sisters Wilderness.

The H.J. Andrews Experimental Forest (HJA) was established on the Blue River Ranger District in 1948 as a site for research and education on the ecology and management of coniferous forests and watersheds in the Douglas-fir region by the Pacific Northwest Forest and Range Experiment Station. Through a use agreement, Oregon State University in recent years has used the HJA extensively in teaching programs and for student research projects. Management of the Experimental Forest is a joint effort of the Pacific Northwest Forest and Range Experiment Station and the Forest.

The HJA is a 15,700 acre area that includes the entire Lookout Creek drainage north of the town of Blue River. It has steep, densely forested slopes ranging from 1,500 to 5,000 feet in elevation. Rich forest soils produce high quality/quantity Douglas-fir with minor amounts of Pacific silver fir, noble fir, western hemlock, western redcedar, and a few pine species.

Roads have been constructed to harvest timber and are maintained periodically to protect resources and provide safe travel routes. There are no developed recreational facilities within the HJA but many

forms of dispersed recreation may be enjoyed throughout the drainage, except where restrictions are posted.

Future Trends

With the increasing demand for the various uses of forest land (both public and private) including the utilization of renewable resources, more knowledge is necessary to protect and keep these lands productive. This has been specifically recognized by Congress (see McSweeny-McNary Act, May 22, 1928; and the McIntire-Stennis Act, October 10, 1962). It is evident that the importance of the existing and proposed research and experimental areas will continue to grow locally, nationally and worldwide.

The demand for Experimental Forests and Research Natural Areas is derived from the kinds of management problems that are experienced daily and the kind of habitats that are encountered. Areas of land have been selected and/or proposed which contribute to the maintenance of biodiversity, and are representative of cells (habitats, communities, organisms, etc.) deemed important elements in the Pacific Northwest coniferous biome.

The current demand is established through management needs for managing Forest lands and renewable resources. An additional demand is expressed through the need to protect the cells listed before they have been changed ecologically by Forest management activities.

Climatic, geologic, and biologic systems are dynamic. Thus research involving these systems will be expanding and becoming more intensive as land uses and resource utilization intensify.

Minor changes in conditions are expected, over and above those inherent in the management of RNAs or the HJA. All areas are subject to change resulting from natural events such as wind, fire, insect, and disease. Olallie Ridge and Gold Lake Bog RNAs are popular sites for the "recreation botanist" and other amateur biologists. University students also make use of the areas for study and research. As a group, these uses tend to alter existing conditions of the more unique plant habitats. Extensive timber harvesting on the perimeter of these areas has the potential to reduce the effective size of some of the included habitats (cells). In the case of RNAs, the establishment report sets forth an area objective of maintaining the ecosystems within the boundaries in a natural state of succession. Where necessary, the management of adjacent lands is expected to be modified to protect these values and the integrity of the RNA. The Torrey-Charlton proposed RNA surrounds several fishing lakes. Existing recreation use of this area will be recognized in the establishment report and research plans, however, recreation use is not an objective of Research Natural Areas.

The research and activity interactions within the H.J. Andrews Experimental Forest include those of RNAs, as well as vegetation, landform, wildlife habitat, soil, and water alterations. Conditions resulting from these alterations are due to timber harvest and road building activities and are induced for the purpose of study and research.

RANGE

The heavily forested Forest has limited capacity for grazing of domestic livestock. There has been some use of the suitable areas for grazing cattle and sheep under fee permits and some free-use grazing of recreational stock.

Historic Trends

Permitted livestock grazing presently occurs on several scattered areas in the Forest, although domestic livestock grazing on the Forest has declined significantly over the years. In 1934, there were about 848 Animal Unit Months (AUMs) of permitted grazing by cows and 19,260 AUMs by sheep. An Animal Unit Month is equal to one 1,000-pound animal feeding for 30.5 days. However, by the mid-40s permit use had already started to decline and by 1951 there were no sheep grazing permits and only about 797 AUMs of permitted cow and horse use. (Forest Service file 2230.)

There were 398 AUMs permitted on two cattle allotments under a term permit in 1984, and free-use grazing permits on 15 recreation grazing allotments which reported 190 AUMs. There is also potential for livestock use in the form of transitory range.

The decrease in range use on the Forest can be attributed to several factors. Grazing for some permittees became less economically efficient due to the increased cost in labor and the transportation of livestock without similar increases in livestock values, and the higher cost associated with maintaining permits due to increased needs to protect the soil and water resources. The amount of available range has declined over the years due in part to Wilderness establishment. In new Wilderness, allotments were not available to new permittees. The amount and location of grazing permitted on the Forest has also been limited by other factors including the protection of water quality, sensitive plants, and unique habitats.

Livestock have considerable dietary overlap with elk; they often consume or damage forage that elk would otherwise eat. This competition for forage is especially significant in winter range which big-game need to compensate for a condition of low energy reserves.

In addition to forage competition with big game, livestock host diseases that may be detrimental to native species. Studies conducted on the Forest in the late 1970s suggested that domestic sheep hosted diseases that infected black tail deer. As more sheep were placed on the allotment, there was an increased incidence of several parasites within the overlapping deer population. (Forest Service files 2600.) Where range use between sheep and black tail deer overlap, these diseases can be a greater problem for deer than forage competition.

Predation by bear, coyote, and cougar on permitted livestock was suspected during the 1940s and 1950s. The conflict between native wildlife species and domestic livestock meant, in some instances, that the predators were destroyed. This is an adverse effect on wildlife and makes fewer animals available for viewing by the recreational user.

Current Situation

Livestock grazing has contributed to localized decreases in water quality due to defecation and streambank instability caused by trampling. Livestock have also, in localized areas, contributed to soil compaction which can change the soil structure, affect water absorption and holding capacity resulting in reduced plant growth. Compaction is minimized by ensuring that grazing lands are relatively dry

before grazing occurs. However, naturally moist meadows receive some damage regardless of when they are grazed.

Taking into consideration potential forage produced on harvested acres throughout the Forest (transitory range), the plant forage potential on the Forest is underutilized.

The narrow profit margin for both range cattle and sheep operations have made the use of the grazing opportunities on the Forest less desirable to potential permittees.

Future Trends

Future use of cattle and sheep grazing opportunities is difficult to predict. However, given current market conditions, there will be no significant changes in livestock grazing use on the Forest in the foreseeable future. Expected increases in future recreation use will probably result in more recreation stock utilizing forage on the Forest.

FACILITIES

Facilities on the Forest include Forest Service administrative sites and structures, special use structures, and utility corridors. Administrative sites serve a variety of purposes related to the administration and management of the National Forest. Utility corridors provide the land area needed for transmission facilities for basic utilities, such as electricity, telephone, and water lines. Special use structures are facilities developed and operated under special use permit to serve the specific purpose of the operator. These uses are widely varied; their role is to provide permittees with the opportunity to use Forest land as a base for activities or operations which are compatible with the environment and management of the other resources.

The use of these permits may impact several components of the environment including vegetation, water, soil, scenery, and wildlife. The USDA Forest Service provides for the continued existence and use of the present long-term high capital investment special use permits. However, if a permit is found to be in violation of legal requirements or minimum standards of other resources values, compliance is sought to remedy the violation. The authorized officer may revoke, suspend, terminate, or renegotiate terms of the permit.

Historic Trends

In the past two decades, construction of buildings has not kept up with needs for space, particularly office space. While positions were added to deal with more intensified resource concerns, construction of offices and related service buildings was reduced. Even after recent staff reductions and some new construction, the Forest has some overcrowded working conditions in outdated offices and temporary facilities.

Current Situation

Administrative Sites

The headquarters of the Forest is the Supervisor's Office located in Eugene. The Forest is subdivided into seven Ranger Districts with offices in Oakridge, Westfir, Lowell, Blue River, McKenzie Bridge, Sweet Home, and Detroit. Administrative sites located on National Forest System land include one work center, two seed orchards, and a variety of offices, residence bunkhouses, workhouses, tree coolers, shops, and other project related buildings.

The Forest has 8 buildings that were constructed for office space; 5 were built in the 1950s and 3 were built in the 1960s. There are also 4 leased office buildings, several converted garages and houses, and approximately 16 modular units being used for office space.

Currently 45 residences are available for employee use on the Forest. They are of varying ages, having been constructed in the following decades: 2 in the 1920s, 9 in the 1930s, 28 in the 1950s, 4 in the 1960s, and 1 in the 1970s.

A total of 14 permanent buildings have been constructed to provide warehouse and equipment storage space. They were built as follows: 1 in the 1920s, 5 in the 1930s, 5 in the 1950s, 2 in the 1960s, and 1 in the 1980s. Other buildings of various purposes exist at each site. Generally, their age classification is similar to those described above.

The Forest has one heliport under its jurisdiction at the Detroit Work Center. The Oakridge and McKenzie airports are also used as heliports. These heliports are used for fire and administrative activities.

Others

Various other facilities are found on the Forest including:

- A powerplant for the city of Eugene.
- Access roads and assorted facilities for the Southern Pacific Railroad.
- Electronic sites at 15 locations throughout the Forest.
- Facilities for the Bonneville Power Administration, Portland General Electric, and Eugene Water and Electric Board.
- A camp and picnic area operated by the Oregon State Parks and Recreation Division.
- Winter sports sites at Willamette Pass and Hoodoo Ski Bowl.
- A total of 248 recreation residences situated on 85 acres of the Forest.
- 21 small-scale hydroelectric projects in various stages of development, (only one project, Falls Creek, is on line).

Permits that alter the vegetation include utility corridors, ski areas, transportation corridors, and recreation residences. It is necessary to limit height of vegetation with in the corridors and ski area so the vegetation does not interfere with the use. Forage habitat with long linear edges is available for wildlife. Transportation corridors may add edge effect, but the noise and congestion of traffic also affects travel routes.

Hoodoo Ski Bowl is located one mile south of U.S. Highway 20 on the Santiam Pass. Facilities located on the 644 acre area includes three chair lifts, two rope tows, two day-lodges, and utility buildings and other facilities. The ski runs are essentially located on the east and northeast slopes of Hoodoo Butte.

Willamette Pass Ski Area is located at the crest of the Cascade Mountains on State Highway 58. This 1,100 acre facility will be implementing an expansion plan during this planning period. After expansion is completed the area will include six chair lifts, two day lodges, ski patrol building, parking overpass, utility buildings and other facilities. Environmental documents can be found at the Forest headquarters in Eugene.

Water quality has been affected by recreation residence use. This has been attributed to old systems of sewage disposal and illegal installations. Soils near these residences are generally not conducive to adequately filtering or storing waste.

Potential transmission corridors have been identified throughout the Western United States by the utility industry. These are displayed in the Western Utility Group's "Western Regional Corridor Study" of 1986. The Study identifies potential (and existing) utility transmission corridors across the crest of the Cascade Mountains at Willamette Pass (State Highway 58), at McKenzie Pass (State Highway 242), and down the North Fork of the Breitenbush River.

Future Trends

Monitoring of special uses will continue to avoid or remedy violations of legal requirements or violation of minimum standards of other resource values.

ROADS

Access into and through the Forest is provided by more than 200 miles of county, state, and federal highways. To facilitate protection, management, and use of the Forest, approximately 6,500 miles of permanent Forest roads have been constructed and are being maintained at various use levels. Forest roads originally were built, primarily, to access timber harvest units and for other administration purposes. Today roads also provide the primary access to lakes, trails, picnic and campgrounds, and the trailheads for hiking into the beautiful backcountry of our Wildernesses. They continue to facilitate resource management and wildfire suppression.

Historic Trends

The first roads on the Willamette were pioneer wagon roads. Some of these historic routes are now major roads and highways. The Santiam Wagon Road is one example; it carried the first auto over the Santiam Pass in 1902, and continues to carry auto and truck traffic today. Since the 1940s the majority of road construction and reconstruction has been in support of timber management activities. Recreation use has an increasing effect on the operation, maintenance, and management of the Forest road system. Historically, motor vehicle access by the public was allowed and encouraged throughout the entire system. This level of access resulted in high road costs.

Road management practices became more cost-effective during the early 1980s. Multiple-use opportunities and resource outputs can be provided without constructing and maintaining every road for every use. Many of the minor local roads are now maintained only for high clearance vehicles or allowed to close naturally, maintaining only the drainage system to avoid washouts.

Current Situation

The transportation system objectives are to plan, develop, and operate a network of roads that provide user safety, convenience, and efficiency of operations to accomplish the land and resource management objectives of the Forest.

Roads are classified as either arterials, collectors, or local roads. Arterial roads are primary roads, quite often double lane and paved, that provide the main access into and out of the Forest. Local roads serve as terminal roads or "work" roads that access the smaller work areas. Collectors are the roads that connect local and arterial roads. Collectors may be double lane roads but normally are single lane. Some collector roads are paved but most are rock aggregate surfaced. Figure III-V-1 lists the existing road system by functional classification, including roads under contract to be constructed by the end of fiscal year 1986.

The Forest has defined the traffic service level for each road. The traffic service levels describe the traffic and operational characteristics for which the road is managed. Figure III-V-2 shows traffic service levels for existing arterial and collector roads.

The current trend is to reduce costs of development, operation, and maintenance. Roads are now being developed, operated and maintained to serve only objectives identified during project planning. This results in reduced road clearing, road width, surfacing requirements and varied management techniques than required to accommodate the low clearance passenger car. In addition, roads serving small geographic areas, single project activities, or limited in use by weather and design features are being closed to prevent resource damage and reduce costs. Approximately 24% of the existing road system is suitable for use by low clearance vehicles. (See Figure III-V-3.)

Figure III-V-1. Existing Road System

Classification	Miles
Arterial	232
Collector	1,815
Local	4,480
Total Miles	6,527

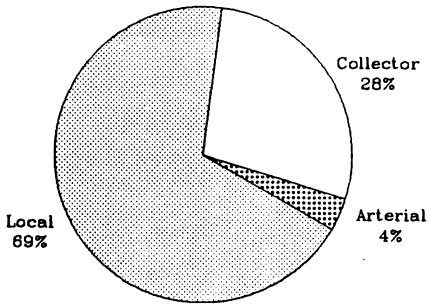
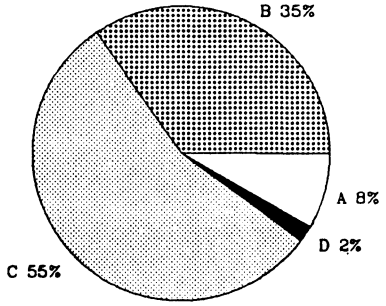


Figure III-V-2. Existing Arterial and Collector System [1]

Level	Miles
A	168
B	710
C	1,132
D	37
Total	6,527



[1] Traffic service levels are defined as:

- A - Free flowing traffic with adequate passing facilities and smooth surface.
- B - Congested during heavy traffic such as peak logging or activities. Surface is stable for the normal use season and smoothness is commensurate with the design speed.
- C - Traffic interrupted by limited passing facilities or slowed by the road condition. Surface may not be stable under all traffic or weather conditions during the normal use season.
- D - Flow is slow or may be blocked by an activity. Two-way is difficult and may require backing to pass. Rough, irregular surface is stable during dry conditions.

Table III-V-3. Existing Road System by Maintenance Level

	Operational Maintenance Level [1]					
Forest	1	2	3	4	5	Total
TOTAL	804	4,188	1,101	149	285	6,527

[1]Those roads in Level 1 (16%) maintenance are managed in a storage category and are closed for resource or safety reasons or are allowed to close naturally--being open for use until that happens. Those in Level 2 (60%) are kept open for high clearance vehicles, (pickups) but they are allowed to "brush in" and become much more natural until the next commercial use. The roads maintained in Level 3 and above (24%) are maintained suitable for use by low clearance vehicles (cars), those in the higher levels providing more comfort.

On the Forest the demand for roads is a function of the demand for recreation and timber. The amount of new construction depends mainly upon the need for access to timber sale areas. Some new road construction will occur for recreation purposes, (i.e., access to new campgrounds), depending upon the need for additional recreation facilities. The mileages of road construction and reconstruction are shown in Figure III-V-4.

The Forest manages traffic and roads for long-term, seasonal, and project purposes to support resource management objectives. Closed roads may exclude a variety of user groups or may provide access to a single user when imposed for one or more of the reasons listed below:

1. Wildlife--Closures may be used to protect and enhance high potential elk management areas, spotted owl habitat, and nest sites of Osprey and Bald Eagles. Road closures are also used to provide quality hunting areas. Some wildlife closures are open to vehicles during seasons of the year when disturbance of the wildlife has a lesser impact. The Forest cooperates with the Oregon Department of Fish and Wildlife in this effort.

2. Water quality and erosion control--Roads can be closed to prevent rutting and surface disturbance, and to reduce erosion and sediment entry into streams.

3. Public safety--Damaged roads or structures, wildfires, or activities dangerous to visitors require closure to certain users. Closure may also be required during certain activities including search and rescue operations.

4. Conflict of use--In a few cases, usually for user safety, it is necessary to give preference to one user over another. Examples are log hauling on a narrow road with few turnouts, or compliance with share cost agreements.

5. Maintenance cost reduction--The cost of maintaining the road system can be reduced by closure.

6. Legal mandates--Some areas, such as Wilderness, are afforded protection by Federal law from the use of motorized vehicles (36 CFR 261.16, 261.19, and 293.17 USC 551) without proper authority. Closures of this type are signed and enforced.

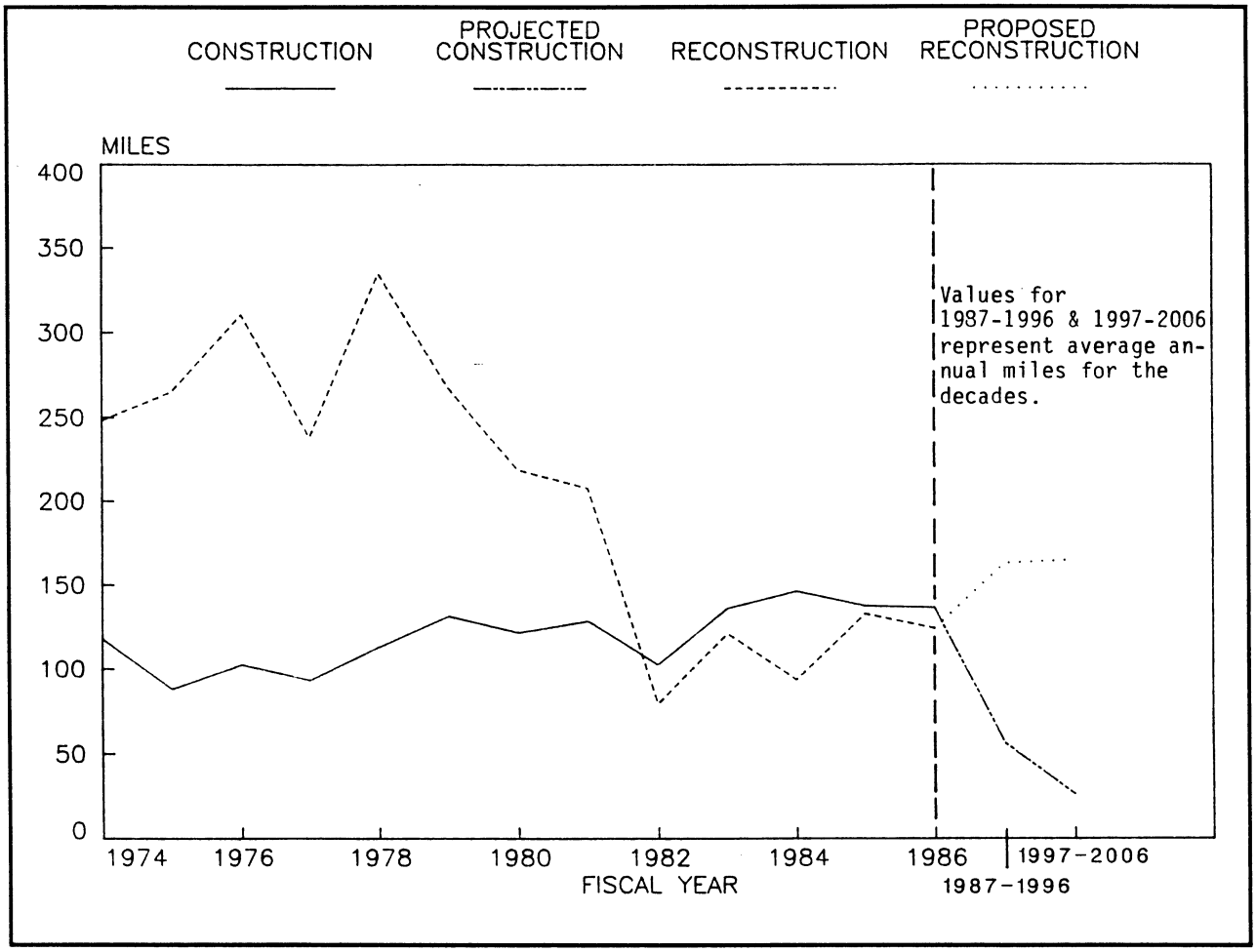
Future Trends

The development, maintenance, and management of the Forest development road system will continue as needed to respond to resource management objectives.

The rate of new road construction will continue to decrease as the road system nears completion. New roads constructed will be low standard (traffic service Level D) and usually will be maintained to Level 2 maintenance. Maintenance and reconstruction will increase in response to water quality needs on some existing roads. Some other existing roads may be closed to motor vehicle traffic and be minimally maintained (maintenance Level 1) for extended periods of time.

Some existing permanent roads will no longer be needed for resource management objectives. These roads will be permanently closed to motor vehicles; and have vegetative cover and natural-like drainage patterns reestablished.

Figure III-V-4. Road Construction and Reconstruction Mileage



TIMBER

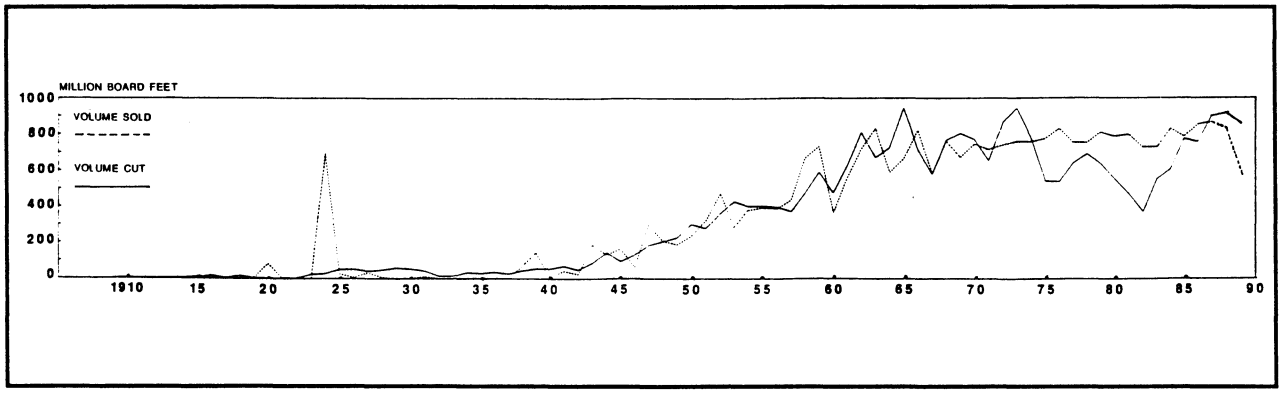
Trees utilized for commercial harvest are one component of vegetation. Timber is discussed with separately in Chapter III because of its importance as an economic resource and the effects that harvest has on other components of the environment.

Historic Trends

The earliest record of timber sale activity on the Forest was in 1909, when 100 MBF (gross) was sold for $106.00 ($1.06/MBF). The sale and harvest of timber was a minor activity for the first 3 decades, with the cut averaging about 23 MMBF per year. Management on the Forests during this time emphasized protection of the resources. In 1924, the Forest sold 696.3 MMBF, a large amount even by current standards. Of this amount in one huge sale of 685 MMBF to the Westfir Lumber Company of Oakridge was used to help establish a sawmill. The contract stipulated that not more than 50 MMBF could be harvested per year.

During and after World War II, the demand for wood products rose steadily and the sell and harvest of timber on the Forest kept pace. Management on the Forests began to favor development of the resources and sustained yield of timber. Since about 1962, the annual volume sold has remained about the same, averaging about 750 MMBF. During this time the volume cut has fluctuated from a low of 370 MMBF in 1982, to a high of 945 MMBF in 1973. Two other years have exceeded 900 MMBF, 1965 and 1988, with 943 and 908 MMBF respectively. The annual cut has averaged 708 MMBF per year. Figure III-W-1 shows the pattern of sell and harvest on the Forest from 1909 through 1989.

Figure III-W-1. Historical Perspective of Commercial Timber Sales: 1909-1989



The Forest has completed 3 timber inventories since 1962 which have assisted in the development of Forest Plans. The inventory information displayed in Figure III-W-2 shows the land base as it was inventoried, not as it was described and analyzed in the subsequent Forest plans. Changes in the total landbase are a result of land purchases and exchanges. Inventoried land base changes and trends can be summarized as follows:

- Nonforest lands have steadily increased as each inventory typed the land to tighter specifications.
- Unavailable lands have increased with additions to existing Wilderness and the addition of new Wilderness.

- Unsuited lands have shown a steady increase as definitions have changed and more information has been gathered concerning reforestation problems and unstable soils.

- As a result of increases in the above categories, the suited available land base has decreased by 25% since 1962.

- The amount of land occupied by timber stands that are less than 5.0" d.b.h. has increased since 1962 but should be close to leveling out. It takes the average stand about 30 years to reach 5.0" d.b.h., so the acres in this category are the harvested acres for the last 3 decades.

- The inventoried stands are those suited, available lands stocked by trees greater than 5.0" d.b.h. These have decreased with each successive inventory as a result of continued harvesting on a shrinking land base. These acres will level off under a given set of land allocations.

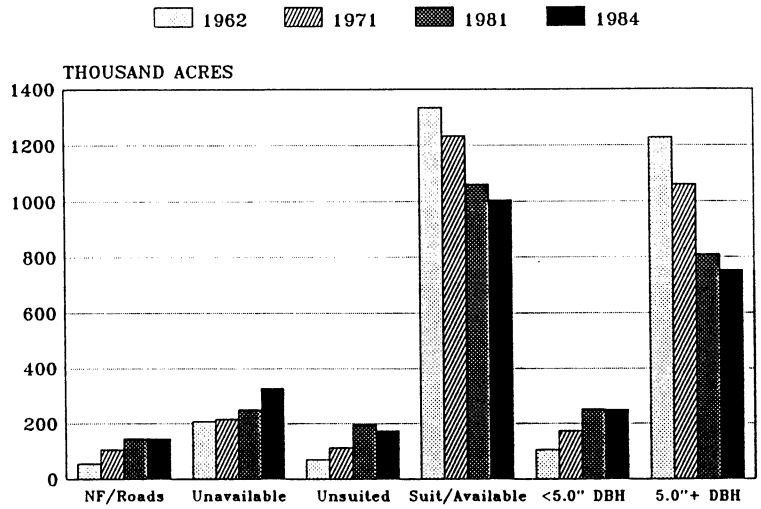
- The inventoried volume is the net volume from the stands greater than 5.0" d.b.h. and shows a decrease for the same reasons. This volume will eventually remain constant under a given set of management intensities.

- The average volume per acre has increased as a result of deleting the nonforest and unsuited lands from the inventoried land base.

Since the beginning of the current plan in Fiscal Year 1977, the potential yield has declined with the addition of new wilderness, while the annual volume sold has remained fairly constant, averaging 779 MMBF (gross). The volume harvested has averaged only 86% of the volume sold, or 672 MMBF. (See Figure III-W-3.) This resulted in an increase in the amount of volume under contract, from about 2.6 years in 1977 to 4.8 years worth of volume by the end of 1985. (See Figure III-W-4.) The increase in volume under contract was particularly noticeable in 1981 and 1982, during the worst of the recession, when only 59 and 51% of the volume sold was harvested.

Passage of the Federal Timber Contract Payment Modification Act in 1984, resulted in almost 2 years worth of volume being returned to the Forest (1,219 MMBF). An additional 279 MMBF of volume under contract was defaulted. For the last 3 years the volume cut has exceeded the volume sold, further reducing the volume under contract.

Figure III-W-2. Timber Inventory Comparison



* Reflects changes due to Oregon Wilderness Act of 1984

	Unit of Measure	1962	1971	1981	1984 [1]
Total NF Land Base	Acres	1,666,476	1,667,821	1,675,407	1,675,407
Nonforest Roads Change from Previous Inventory	Acres Acres %	55,202	104,510 + 89%	145,429 22,753 + 16%	145,429 22,753
Unavailable Change from Previous Inventory	Acres %	208,167	216,640 + 4%	251,246 + 16%	327,565 + 30%
Unsuited Change from Previous Inventory	Acres %	69,001	112,696 + 63%	195,318 + 73%	174,266 - 11%
Suited, Available Land Change from Previous Inventory	Acres %	1,334,106	1,233,975 - 8%	1,060,661 - 14%	1,005,394 - 5%
Stands Less Than 5.0" DBH Change from Previous Inventory	Acres %	104,793	174,050 + 66%	251,659 + 45%	250,494 --
Inventoried Stands (5.0"+) Change from Previous Inventory	Acres %	1,229,313	1,059,925 - 14%	809,002 - 24%	754,900 - 7%
Inventoried Volume Change from Previous Inventory	MMBF %	48,243	43,486 - 10%	34,033 - 22%	31,990 - 6%
Average Volume/Acre Change from Previous Inventory	MBF %	39.2	41.0 + 5%	42.1 + 3%	42.4 + 1%

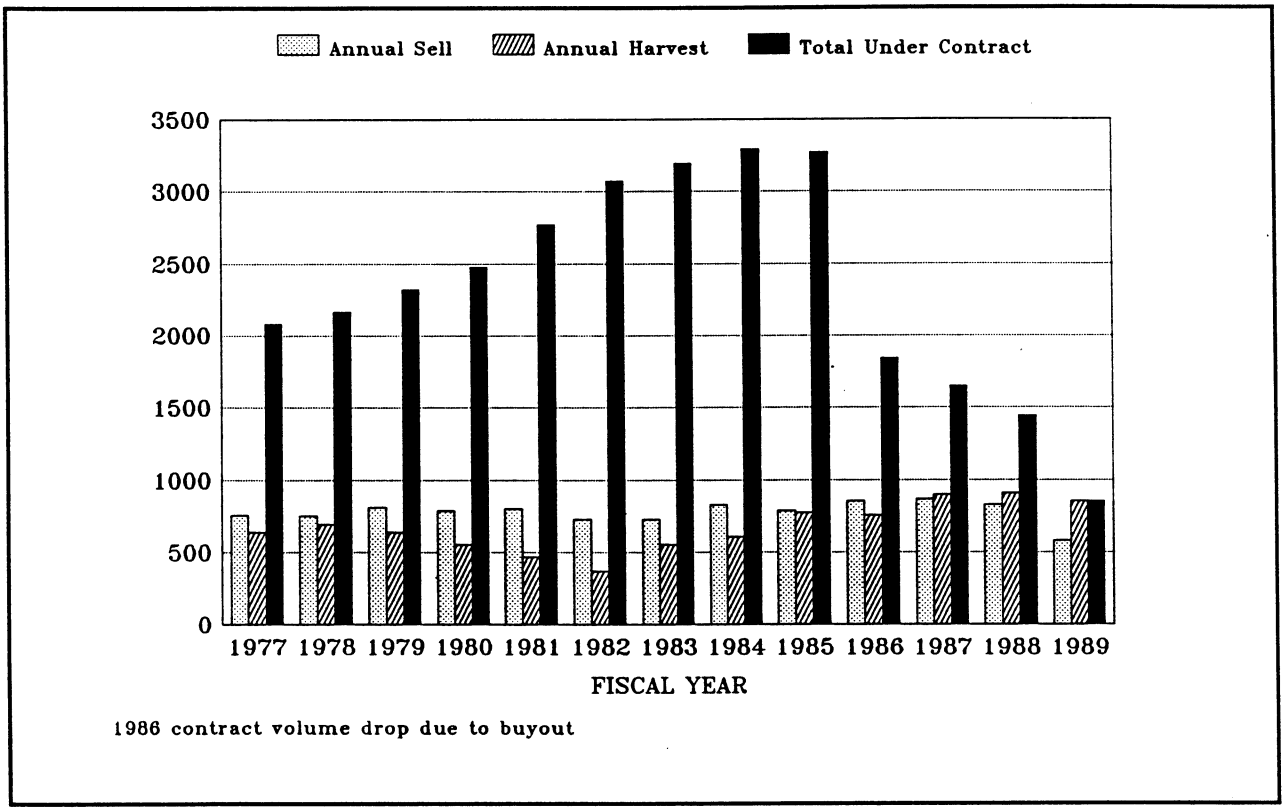
[1] Reflects changes due to Oregon Wilderness Act of 1984.

Table III-W-3. Potential Yield and Actual Volumes Sold and Cut

Fiscal Year	Potential Yield (MMBF) [1]	Sold (MMBF) [2]	Cut (MMBF) [2]	% Cut of Sold	Remarks
77	1,055	756.7	641.7	85	Implementation of Plan
78	1,055	755.3	693.1	92	
79	1,055	811.2	638.7	79	
80	1,042	788.8	554.0	70	French Pete Wilderness
81	1,042	799.8	470.7	59	
82	1,042	730.6	370.3	51	
83	1,042	731.1	555.0	76	
84	996	830.5	612.2	74	Oregon Wilderness Act
85	996	787.0	775.3	98	
86	996	853.7	758.4	89	
87	996	867.5	899.5	104	
88	996	826.9	907.7	110	
89	996	583.8[3]	854.9	146	
1977/89 Average	1,023.8	778.9	671.7	86	
1985/89 Average	996	784.3	839.2	107	

[1] This represents the maximum volume that could be produced, assuming no restrictions of funding or workforce, and solving all technical problems involved in managing marginal lands. Gross volume was estimated (for comparison to cut and sold volumes) by multiplying net volume from TM Plan by 1.25.
[2] Taken from the Forest cut and sold reports.
[3] Based on 234 MMBF (net) sold, plus 233 MMBF sold but not awarded until FY90. Net volume of 467 was multiplied by 1.25 to estimate gross volume.

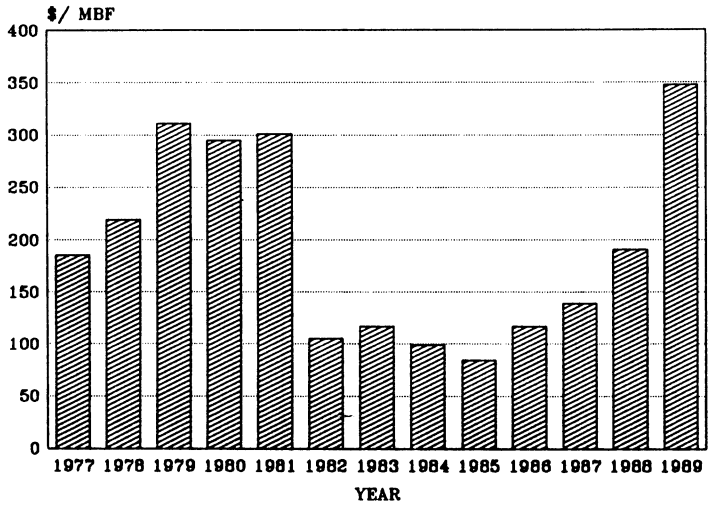
Figure III-W-4. Contract Volume



The average selling price of timber has varied widely since the earliest records beginning in 1909. The lowest average price was $0.16/MBF in 1938 and the highest average was $348.42/MBF in 1989. Figure III-W-5 shows the average selling price since the current plan went into effect.

Twenty-five percent of the total timber sale receipts from Forest lands and 50% of the receipts from converted Oregon and California Railroad grant lands are returned to the counties. The remaining funds go into the U.S. Treasury.

Table III-W-5. Average Selling Price of Timber [1]



Year	Volume Sold (MMBF)	$/MBF	Total Value Million $
1977	756.7	184.67	139.7
1978	755.3	218.82	165.3
1979	811.2	310.85	252.2
1980	788.8	295.38	233.0
1981	799.8	300.99	240.7
1982	730.6	104.95	76.7
1983	731.1	116.87	85.4
1984	830.5	99.49	82.6
1985	787.0	83.60	65.8
1986	853.7	116.68	99.6
1987	867.5	138.60	120.2
1988	826.9	190.93	157.9
1989[2]	583.8	348.42	203.4

[1]From Forest Cut and Sold Reports (does not include Purchaser Road Credits).
[2]Includes sales that were sold in FY89, but not awarded until FY90.

Current Situation

The 1981 timber inventory shows approximately 62% of the Forest is tentatively suited for timber management. (See Figure III-W-6.) This amounts to 1,032,138 acres, which is about 8% of the suited Forest land in Region 6. (See Regional Guide.) This is a falldown of 32,478 acres (3%) from the 1,064,616 regulated commercial Forest acres under the current plan after adjusting for the Oregon Wilderness Act of 1984. The change is due to better identification of unsuited soils and changes in land categories, particularly the dropping of the marginal category. Figure III-W-7 shows the Forest Land Classification under the current plan and can be compared with Figure III-W-6 to see the changes.

The total standing volume on the Forest, available for harvest (5.0" d.b.h. +), is about 33.0 billion board feet on 705,127 acres (from 1981 Timber Inventory Statistics updated through FY 1989). Douglas-fir is by far the predominant species accounting for 70% of the standing volume. Other important species include: western hemlock (14%), Pacific silver fir (4%), noble fir (4%), mountain hemlock (3%), and western redcedar (2.5%). The following species are also found on the Forest in small amounts (less than 1%) and are listed in order by volume: western white pine, grand fir, Engelmann spruce, sugar pine, incense cedar, lodgepole pine, alaska cedar, subalpine fir, and ponderosa pine. Hardwood species make up less than 0.2% of the standing volume with the most common being bigleaf maple, followed by black cottonwood, golden chinkapin, red alder and Pacific madrone. None of the hardwoods are commercially important as yet but they are very popular for firewood use.

In addition to the 33 billion board feet (BBF) of timber on tentatively suited lands, there is approximately 12 BBF on 325,000 withdrawn acres (poles and larger), and about 6 BBF on 130,200 unsuited acres. At the beginning of FY 1990, the total standing volume on the Forest was about 51 BBF on 1,160,000 acres of timber at least 5.0 inches in diameter.

Table III-W-6. Land Suitability for Timber Production

	Acres not Suitable for Timber Production	Total Forest Land Acres
Total National Forest Area		**1,798,737**
Other Ownerships	123,330	
Net National Forest Area		**1,675,407**
Water	23,101	(I-I.A)
Nonforest (not stocked with 10 % tree cover, or lands developed for other than timber production purposes)	123,052	
Roads	24,764	
Forested Lands (stocked with 10 % or more treee cover)		**1,504,490** (II - (II.A + II.B + II.C)D)
Withdrawn from scheduled timber production (219.14(a)(4))		
Wilderness	305,915	
Research Natural Areas	1,450	
Oregon Cascades Recreation Area	5,631	
H. J. Andrews Experimental Forest	14,505	
Irreversible resource damage (219.14(a)(2))	9,662	
Regeneration difficulty	135,189	
Lands tentatively suitable for timber production		**1,032,138** (III-(III A + B + C))
Forested lands not suitable for timber production	**472,352** (III - IV)	
Land status under existing timber management plan [1]	**547,024** Noncommercial Forested Land	**1,064,616** Commercial Forested Land [2]
Net reduction in lands tentatively suitable for timber production **1,064,616** (1971 Inventory) - **1,032,138** (1981 Inventory) = **32,478 Acres**		

[1]Amendment No. 2, July 5, 1984, after Oregon Wilderness Act.
[2]Includes standard, special, and marginal acres.

Table III-W-7. Current Land Management Plan Classification [1]

Land Classification		Acres			
Net National Forest Land Non-Forest + Unproductive		1,667,821 [2] - 247,088			
Productive Forest Land Productive Reserved Productive Deferred			1,420,733 - 297,129 - 2,807		
Commercial Forest Land				1,120,797	
Unregulated Commercial Forest Land				56,181	
Regulated Commercial Forest Land					1,064,616
Standard Special Marginal	793,553 145,959 + 125,104				
TOTAL	1,064,616				

[1] Amendment 2 (7-27-84)

[2] This differs from Figure III-W-5 (1981) due to land exchanges.

The biological potential yield of the Forest, including all forested lands, with no falldowns for other resource considerations, technical problems, or workforce requirements is estimated as shown in Figure III-W-8

Table III-W-8. Potential Yield

Land Classifications	Acres	Annual Yield MMBF (Net)
Tentatively Suited	1,032,138	763.2
Withdrawn	327,501	192.9
Unsuited	144,851	105.7
TOTAL	1,504,490	1,061.8

Four working groups represent the site class and vegetative associations of the Forest. These working groups are the basis for development of empirical and managed yield tables. (Appendix B of the FEIS contains more detail on how the working groups are modeled in FORPLAN.) The four working groups stratify the major species as follows:

1. Douglas-fir/Hemlock - This is the major working group on the Forest comprising about 82% of the available and suitable acres. It covers the whole broad spectrum of site and vegetation associations within the Douglas-fir, western hemlock, and grand fir series of forest communities.

2. Douglas-fir/True Fir - This group is made up of the Pacific silver fir and grand fir series, and accounts for about 10% of the suitable acres. Douglas-fir is the dominant species and is featured in management. Noble fir is also an important associate. Western white pine may also be found but is more commonly featured in the true fir or mountain hemlock types. The strata is cooler and generally wetter than the Douglas-fir/hemlock type with snow cover common in the winter. It starts at about 3,000 feet on certain slopes and aspects and reaches maximum area between 3,500 and 4,000 feet.

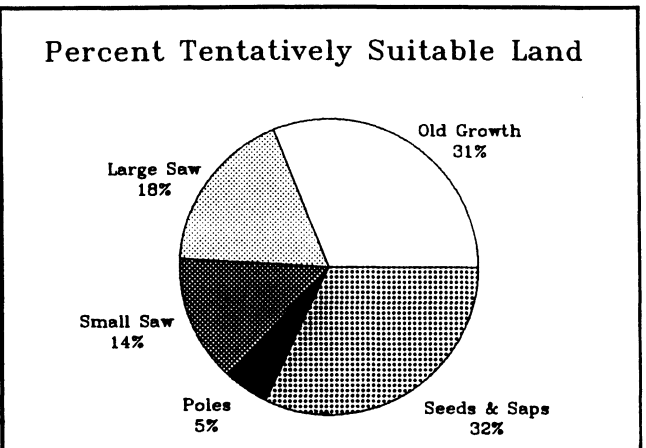
3. True Fir - This working group occurs in the Pacific silver fir series and occupies the least area on the Forest with about 3% of the suitable acres. It occurs in the same elevation range as the Douglas-fir/true fir strata but on cooler and wetter sites. Most of it lies on the rolling uplands of the New Cascades. Noble fir is the preferred management species with Douglas-fir, silver fir, white pine, and Englemann spruce as minor associates.

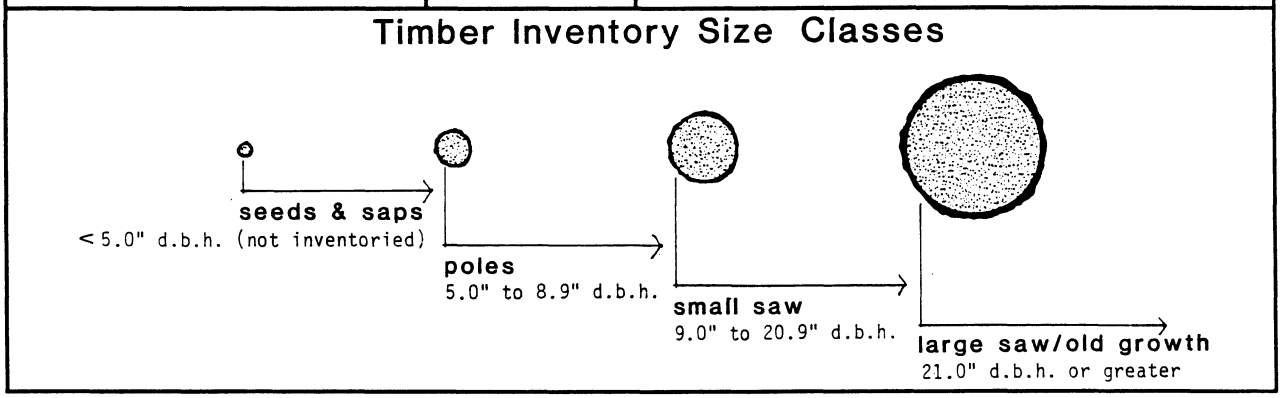
4. Mountain Hemlock/Lodgepole Pine - This working group occupies the highest and coldest areas of our commercial Forest land and occurs in the Pacific silver fir and mountain hemlock series. This group totals about 5% of the suitable acres and is located on the rolling land of the High Cascades. Seral species include lodgepole pine, silver fir, white pine, Englemann spruce, and noble fir. Alaska yellow cedar and Douglas-fir are minor associates. The cedar tends to occur in well defined pockets. The lodgepole pine is often a pioneer species on cold, frosty sites; then silver fir and mountain hemlock come in underneath the lodgepole pine, replacing it in 60 to 80 years.

As part of the inventory process, stands are grouped into the four size classes illustrated below. Figure III-W-9 shows the tentatively suited acres by size class (1981 inventory).

Figure III-W-9. Tentatively Suited Acres by Size Class

Size Class	Acres
Seedlings and Saplings	326,985
Poles	57,485
Small Sawtimber	140,930
Large Sawtimber	189,113
Old Growth [1]	317,625
TOTAL	1,032,138





[1] See Chapter III, Section G, Vegetation for information on old-growth.

Under the current plan, the total annual sell program of timber on the Willamette National Forest has averaged about 779 million board feet (gross). This represents about 15% of the timber production from Forests in Region 6 (Oregon and Washington) and about 7% of the production from the entire National Forest System (Regional Guide).

Timber management has been guided by a Timber Management Plan approved in 1977, which programmed an annual net sell volume of 615.6 MMBF. The plan has been amended twice to account for reductions in the land base due to new Wilderness and to take into account the effect of Timber Stand Improvement (TSI) accomplishments. The latest projections indicated the reduction in acreage was offset by increased TSI work and the net sell volume actually increased to about 641 MMBF.

Future Trends

National and Regional Timber Supply

The principal projections used in guiding the development and evaluation of long-range plans and programs for management of the Forests are contained in the latest Forest and Rangeland Renewable Resources Planning Act (RPA) Assessment (i.e., the 1984 Update and the President's Statement of Policy, September 19, 1986). These projections focus on the long-term (50 years) in 10-year increments

and do not recognize short-term local and regional fluctuations. A summary of projected RPA trends for timber supplies follows:

Hardwoods - The current balance between growth of wood and its removal shows that the hardwood forests and eastern softwood forests can support additional timber harvests. This balance will change, however, and future harvests, particularly in the decades beyond the year 2000, could vary over a wide range. Nonetheless, if commercial timberland owners continue to respond to price and inventory changes, timber harvests can be increased substantially in most geographic regions during the next few decades. Hardwood increases are expected to rise from about 3.4 billion cubic feet from 1980 to 9.4 billion in the year 2030 (RPA 1984). The largest increases will be in the South.

Softwoods - Total projected softwood roundwood harvests are expected to increase from 9.6 billion cubic feet in 1980 to 11.9 billion cubic feet in the year 2030. Though the outlook is for increased softwood harvests nationally, there are important differences among the major softwood timber producing regions.

In the Douglas-fir subregion, projected annual harvest from 1980 to 1990 is about 2.3 billion cubic feet. It then declines slightly to about 2 billion cubic feet per year. This level is roughly maintained through the rest of 50-year projection period.

In contrast softwood timber harvests in the South are projected to rise from about 4.1 billion cubic feet in 1980 to 7.3 billion in the year 2030. Much of the expansion in the South is due to greater diversification in its wood products production as compared to other regions of the country.

Local Timber Supply

Potential timber supply levels from the Forest have been calculated for each of the Alternatives presented in Chapter II of this document. To fully assess the potential impacts of these supply levels on the local timber industry, it is necessary to understand the relationship between the demand for and the supply of timber in the local market area of the Forest's affected environment. The significance of the impacts of changes in timber supply from the Willamette will depend upon assumptions about both future demand and the future supply available from other ownerships in the market area.

The major portion of the market area for timber from the Forest consists of Lane, Linn, and Marion counties in West-Central Oregon. Approximately 97% of the total land base of the Forest is located in these three counties. Over 98% of the total harvest from the Forest is processed into wood products in this three-county area. Small amounts are processed in some of the other adjacent counties with the most generally going to Douglas County. Of the amount processed in the three-county area about 66% is processed in Lane County, 27% in Linn County, and 7% in Marion County. The percent harvested by county is similar to the percent processed.

Both the demand for wood products and the supply of timber are important to the health of the timber industry. In the past, demand-related factors have been primarily responsible for the fluctuations which have occurred in the market for timber. The supply of timber has generally been abundant. There is some evidence, however, that this may be changing for some regions of the country including Western Oregon. A number of studies done within the last 10 to 15 years have pointed to the real possibility that harvest levels from private industrial lands will decline during the next 2 or 3 decades. This could occur because of reduced inventories brought on by harvesting in recent decades at levels higher than can be sustained over time. The harvest projections in one of these studies, *Timber for Oregon's Tomorrow: The 1989 Update* will be used here and in Chapter IV to assist in the assessment of the impacts of Forest harvest levels on the total available supply in the market area.

There are three major influences on the potential supply level: the amount of land available for harvest, the intensity of management on those acres, and the harvest flow schedule (nondeclining flow or departure). The available acreage is the most significant influence, since large changes in standing timber volume are directly related to land allocation. Departure from nondeclining flow can increase harvest level temporarily, but entails a decrease sometime in the future. Intensive management practices influence the supply level by affecting the growth rate of trees. The most effective practices for increasing and improving growth are planting of improved stock (genetics), stocking level control (precommercial thinning) and fertilization.

The most recent timber resource inventory of all ownerships in the study area was done by the Forest Service's Pacific Northwest Forest and Range Experiment Station in 1973-1976. The most recent inventory of the Forest was completed in 1981. Figure III-W-10 presents the entire study area by land class. Figure III-W-11 shows the amount of commercial forest land by ownership and the volume of growing stock. Of particular interest is that while the Forests contain less than half of the total acres of commercial forest land in the three-county area, they have (or had) over two-thirds of the existing growing stock. In contrast, forest industry owns over 24% of the commercial timberland, but has only about 13% of the existing growing stock. This indicates that industry has historically been harvesting its own lands at a faster rate than the harvest on the Forests.

A comparison of the Forest and industry inventories further supports this point. About half of the Willamette's suited timberland contains old-growth and large sawtimber while only about 17% of industry's land is in this timber size class. The % of industry's land that is in the smallest size class (i.e., seedlings, saplings, and nonstocked) is also about twice that of the Forests.

Table III-W-10. Study Area [1] by Land Class

Land Class	Thousand Acres	% of Total
Commercial Timberland	3,474	67.9
Reserved Timberland	201	3.9
Other Forest Land	184	3.6
Non-Forest Land	1,259	24.6
TOTALS	5,118	100.0

[1] Lane, Linn, and Marion counties.

Table III-W-11. Commercial Timberland and Volume of Growing Stock [1]

	Commercial Timberland		Volume of Growing Stock			
Ownership Class	Thousand Acres	% of Total	MMCF	% of Total	MMBF	% of Total
National Forests	1,608	46.3	11,330	67.7	67,343	69.2
BLM	382	11.0	1,690	10.1	9,925	10.2
State & Other Public	77	2.2	376	2.3	2,062	2.1
Forest Industry	841	24.2	2,112	12.6	12,015	12.3
Other Private	565	16.3	1,226	7.3	6,006	6.2
TOTAL	3,473	100.0	16,734	100.0	97,401	100.0

[1] Study Area = Lane, Linn, and Marion counties.

An examination of actual harvest levels shows that between 1970 and 1988 the harvest from industry lands nearly equaled that from Forest lands. Figure III-W-12 shows the average annual harvest levels by county and ownership class for the market area.

Harvest on industry and Forest lands accounted for an average of 83% of the total harvest in the market area. Thus, significant changes in the harvest levels from either ownership will impact the total harvest of the area.

As the result of present stand conditions, the supply of timber from forest industry lands is expected to drop significantly for a period of time during the next 10-20 years. Figure III-W-13 displays actual and projected harvest levels from the various ownerships within the study area.

Table III-W-12. Summary of Timber Harvest [1]

	Lane County	Linn County	Marion County	Total
Forest Industry				
Average Annual Harvest	436	324	22	782
% of County Total	35	52	23	40
Other Private				
Average Annual Harvest	48	43	7	98
% of County Total	4	7	7	5
State				
Average Annual Harvest	8	8	7	23
% of County Total	1	1	7	1
BLM				
Average Annual Harvest	163	49	8	220
% of County Total	13	8	8	11
Forest Service				
Average Annual Harvest	594	197	53	844
% of County Total	47	32	55	43
TOTAL	1,249	621	97	1,967

[1] 1976 to 1988 summary in millions of board feet (MBF).

Table III-W-13. Average Annual Actual and Projected Harvest Levels [1]

Timbershed	Time Period	Forest Industry	Other Private	BLM	National Forests	Total
Eugene	1970-79	459	47	165	636	1,307
(Lane County)	1980-85	379	50	128	478	1,035
	1986-95	313	54	182		
	1996-05	74	54	182		
	2006-15	199	127	182		
	2016-25	222	118	182		
	2026-35	267	118	182		
Mid-Willamette	1970-79	339	76	66	256	737
(Linn & Marion counties)	1980-85	383	27	38	205	653
	1986-95	403	59	47		
	1996-05	302	64	47		
	2006-15	102	118	76		
	2016-25	142	108	76		
	2026-35	165	108	70		
TOTAL	1970-79	798	123	231	893	2,045
	1980-85	762	78	167	683	1,690
	1986-95	716	113	229		
	1996-05	376	118	229		
	2006-15	301	245	258		
	2016-25	364	226	258		
	2026-35	432	226	252		

[1] Millions of Board Feet.

Future harvest levels are based on projections developed in the study *Timber for Oregon's Tomorrow* by Beuter, Johnson, and Scheurman (also known as the Beuter Report). This information has been updated to 1989, but was not available to change the data in Figure III-W-13. These projections reflect a specific set of assumptions about the rate of harvest and management intensity for all ownerships. In this study, all ownerships are assumed to maintain their current level of intensified management. The rate of harvest for public ownerships is held constant for the first 3 decades with private ownerships trying to maintain the total harvest level of the area. Figure III-W-13 shows the actual harvest level for Forest lands, not the level which was projected in the study. Harvest for all ownerships is maximized subject to a long-run sustained yield constraint after the 3rd decade.

These projections indicate that if the harvest from public lands remains at current levels or declines, the total supply available to processors in the three-county area would be reduced beginning in the 2nd decade. Opportunities for alleviating this potential falldown by augmenting the supply with timber from adjacent areas are not realistic. The only western Oregon timbershed which could provide additional volume is the North Coast timbershed. Haul distances associated with obtaining timber from this or any other region, however, would create a significant competitive disadvantage for mills in the Willamette's market area.

The supply of timber available for harvest in the market area will not, by itself, dictate the future condition of the local timber industry. Demand for wood products will also affect the amount of timber that is harvested. In general, demand for timber from the Pacific Northwest was quite low during the recession of the early 1980s. High interest rates, the influx of inexpensive timber from Canada, and the expansion of the South's market area contributed to the reduced demand during this period.

In 1985, however, demand for timber rebounded dramatically as the total timber harvest in Oregon was at a record high level. Lower interest rates and a record level of raw log exports contributed to the increased harvest. There was little change in the amount of wood processed, however, and the value of the wood products produced actually declined.

Despite the record harvest in 1985, employment in the woods products industry declined. Increased productivity, automation, and a desire to reduce costs continued the trend that began a couple of decades ago and accelerated during the recession. Substantial reductions in employment occurred during the recession as many of the older mills closed or cut back on production. Some of this employment is returning as smaller companies are reopening mills with smaller but more efficient operations.

One measure of the potential for the timber industry to meet future demand within a market area is the installed capacity of local mills. Area mills will operate at the capacity needed to provide the wood products demanded by society. Figure III-W-14 shows how the number and capacity of mills in the three-county area have changed between 1968 and 1982.

Table III-W-14. Trends in the Forest Products Industry [1]

	1968		1972		1976		1982		1985	
	No.	Capacity [2]	No.	Capacity [2]	No.	Capacity [2]	No.	Capacity [2]	No.	Capacity [2]
Sawmills										
Lane	41	3,913	41	4,724	38	5,176	22	3,767	22	3,326
Linn	17	1,235	14	1,276	13	1,067	10	1,070	11	985
Marion	9	405	7	602	6	395	5	390	4	620
Totals	67	5,153	62	6,602	57	6,638	37	5,227	37	4,931
Veneer & Plywood										
Lane	34	4,386	33	4,491	32	5,760	23	3,692	22	4,066
Linn	13	1,047	13	1,050	15	1,934	11	1,660	12	1,374
Marion	2	350	3	376	2	380	3	540	1	400
Totals	49	5,783	49	5,917	49	8,074	37	5,892	35	5,840
Pulp, Paper, & Board Plants										
Lane	5	1,729	5	3,300	4	2,763	3	1,400	3	1,300
Linn	6	3,494	8	3,100	7	1,451	6	1,225	7	1,415
Marion	1	240	1	275	1	248	0	0	0	0
Totals	12	5,463	14	6,675	12	4,462	9	2,625	10	2,715

[1]Source: Oregon's Forest Products Industry (1968, 1972, 1976, 1982, and 1985), Resource Bulletins, Pacific Northwest Forest and Range Experiment Station, USDA Forest Service.

[2]Capacity Measured in the Following Units:

- Sawmills; Thousand Board Feet (MBF) per 8-hour shift;
- Veneer and Plywood; Thousand Square Feet (MF) per 8-hour shift, veneer production only;
- Pulp Mills; Tons per 24 hours.

While estimates of future demand for Forest timber involve a number of assumptions and contain a great deal of uncertainty, they are necessary to assess the overall supply implications of land management planning alternatives. Figure III-W-15 contains estimates of demand for Forest timber.

Table III-W-15. Projected Demand for Willamette National Forest Timber [1]

Peiod	Estimated Total Demand	Non-Willamette NF Harvest	Demand for Willamette
1986-1995	1,533-2,045	1,264	269-781
1996-2005	1,533-2,045	930	603-1,115
2006-2015	1,533-2,045	1,009	524-1,036
2016-2025	1,533-2,045	1,049	484-996
2026-2035	1,533-2045	1,096	437-949

[1]Million Board Feet per Year

These projections were developed using the process and assumptions discussed as follows.

The actual amount of wood harvested and processed in any given time period provides a measure of demand for wood from a particular area. A range of potential future demand can be estimated from high and low periods of harvest. In the Willamette's market area, a high level of sustained production (an average of 2,045 million board feet per year) was maintained during the 1970 to 1979 period. A very low level of production (1,533 million board feet occurred during the recession of 1980 through 1982. These two extremes provide a realistic range of potential future demand assuming the many variables affecting supply and demand do not exceed the limits of variation experienced during these time periods.

Demand for Forest timber can be estimated by subtracting nonnational forest and other Forest harvest from the range of total estimated demand. "Demand" is defined as the volume of Forest timber that would be purchased (if available) by area mills in response to the combination of demand for final products and supply from other sources. The potential supply provided in the land management planning alternatives will be evaluated relative to this range of potential demand in Chapter IV of this document (see "Cumulative Effects of Alternatives on Timber").

Demand

Over the next 10 years, timber demand from the Pacific Northwest geographic region will grow slowly. Although there is a backlog of unfulfilled housing demand, the future will depend primarily on the continuing strength in personal income and the availability of affordable housing and financing. In addition, projections of exports to the Pacific Rim countries show a continuing slow economic growth. The analysis acknowledges there will be a declining trend in the construction sector. Structure replacement, rather than new construction, will characterize the market. The projections for increases in demand may be described as considerably restrained and cautious (Nomura 1981).

The long-term outlook for the solid wood products industries contains a number of challenges. Evaluation of recent data and information indicates that the demand for timber is changing to a moderate rate of increase as compared to the slowdown that occurred in the early 1980s.

The ability to sustain this increase on a long-run basis is linked to the critical issue of costs. The short-term future of timber and wood products demand is clouded by factors, such as the severity and length of the housing and wood products recession that began in 1980. The long-term trends in housing demand, the growing popularity of construction methods that use less wood, availability of wood substitutes, and a shift in business management strategies and methods, all contribute to a potential shift in future demand (Adams and Haynes 1985).

Wood supply will continue to be an issue in the sense that it will be highly dependent on the ability of producers to lower costs to be competitive with wood substitutes (Schallau 1986).

Although overall current timber supply levels in the Pacific Northwest region may be capable of meeting future demand, there are some problems within the subregional market areas. This needs to be recognized in terms of a shifting of industry within the region and also in the shifting emphasis on the types of wood products produced, as well as the ability of the subregion to supply the various kinds of wood needed.

A broader vision of the future that includes developing a flexible regional basis for stabilizing wood supplies and applies to forward-looking perspective on wood fiber management, will also better allow the Pacific Northwest timber industry to utilize the opportunity to increase exports to international markets. To achieve this, the Forest products industry will need to learn the workings of a different market system and provide more products in the form demanded. (Campbell et al. 1983.) In addition, actions by industry, such as modernizing facilities, adopting state of the art technology, reducing costs, and diversifying into other sectors of production (similar to what the southern region has done) could help to rebuild and stabilize the wood based sectors of the region (Schallau 1985).

Private and Public Land Interrelationships

Currently, part of the timber formerly supplied by the Pacific Northwest Region is now being supplied by the South and Canada. However, the supply situation from these other sources can be expected to change as soon as about 6 years, or at least by the year 2000. The projected change indicates a drop in supply capability of 30 to 50% from the current relatively high levels. By the 2nd decade (2000-2009), shortly after the drop in supply begins in other regions, the growth of wood fiber on private lands in the Pacific Northwest will start increasing. The private lands in the Pacific Northwest could then become a major source of supply for softwoods to meet national and international demand. Further, during the period before the private lands in the region regain their full supply potential, the public forests would be looked upon as a major source for a relatively stable supply of wood fiber (Schaullau 1985).

The land use planning process determines the range of harvest levels that the Forest can meet under a variety of conditions. This information is fed into the Resources Planning Act process which establishes Forest targets over a 5-year period plus long-term targets for a 5-decade period beyond that. These targets are adjusted on an annual basis depending on funding levels and political decisions. There are also targets for acres of reforestation and timber stand improvement.

The RPA target for timber production programs increases from a low of 792 MMBF in 1982 to a high, sustained yield of 870 MMBF in 2001. (See Figure III-W-16) The RPA program has not yet been updated to account for recent changes, like the Spotted Owl Management guidelines.

Table III-W-16. 1980 RPA Targets [1]

	1982	1983	1984	1985	1986-1990	1991-2000	2011-2010	2011-2020	2021-2030
MMBF	792	802	812	823	834	869	870	870	870
MMCF	145	147	149	151	153	159	160	160	160
Refor. (M Ac.)	17.154	16.990	16.800	16.675	15.729	15.200	15.500	16.920	16.920
TSI (M Ac.)	1.070	10.800	10.710	10.620	9.360	9.360	9.720	9.900	10.080

[1] Includes cull volume.

Figure III-W-17 shows the Forest targets contained in the Forestry Program For Oregon (FPFO). The FPFO data also needs to be updated to reflect recent changes affecting the acres available for timber management.

Table III-W-17. Forestry Program for Oregon [1]

Decade	MMCF/YEAR
1980	146.2
1990	149.2
2000	146.4
2010	145.5
2020	143.7
2030	141.0
2040	137.9
2050	136.0
2060	135.8
2070	135.1

[1] Based on 1,005,394 suited acres. Includes cull volume.

The Forest timber production levels play an important role in the Forestry Program for Oregon (FPFO) developed by the Oregon Department of Forestry. The Forestry Department documented the goals and objectives for the FPFO in the *1980 Oregon Timber Supply Assessment* using the computer program TREES (Timber Resource Economic Estimation System) to model harvest levels from all ownerships. The results indicate the longer the industry maintains harvest at the present rate, the greater the eventual decline in timber harvest from these lands. If industry immediately drops its current harvest from about 730 MMCF/year to a sustainable level of about 500 MMCF/year, Oregon's total harvest would decrease by 14% unless the other ownerships picked up the slack. The FPFO contribution from the Forest is estimated to be 149.2 MMCF (gross) per year for the decade beginning in 1990. This is close to the RPA target of 153 MMCF per year. To provide these levels of harvest, the Forest would have to depart from nondeclining yield as authorized by 36 CFR 219.12(d).

The 1990 draft update of the FPFO does not list volume targets for the Forests or other ownerships. Instead, the Board of Forestry has adopted six objectives to "ensure jobs and a quality environment

for all Oregonians, today and for future generations." Regarding timber growth and harvest levels, the objective is to "Promote the maximum level of sustainable timber growth and harvest on all forest lands available for timber production, consistent with applicable laws and regulations and taking into consideration landowner objectives."

Below-Cost Sales

The issue of below-cost timber sales has recently surfaced as a concern of the Forest Service and many members of the public. A below-cost sale is one in which total Forest Service costs exceed revenues. There is currently much discussion on how to analyze available timber sale information so that an assessment of below-cost sales can be made. Areas of particular concern include the type of analysis (i.e., cash flow or cost efficiency), the scope of analysis (i.e., Forest-wide, area-wide, individual projects, per acre, or some combination), the time frame of the analysis (i.e., annual or multi-year), and which benefits (or revenues) and costs should be included.

Many of these questions are interrelated and the cost-efficiency analysis used in the land management planning process represents one approach to the analysis of the issue. In this section, the issue is being addressed using an annual Forest-wide cash flow approach. (See Figure III-W-17.) This is designed to give an overall perspective of the magnitude of the below cost sales problem on this Forest.

Because the values and costs for any given year are for different groups of timber sales, the net receipts are not a direct reflection of the below-cost sale issue. The fact that net receipts averaged 24.8 million dollars over the seven year period is an indication that the Forest does not have a problem with below-cost sales. Only 1 year (1982) had a negative result where total cost exceeded gross receipts. The reason this happened is because 1982 had the lowest volume harvested since 1952, and had the least dollar value per MBF since 1976. This combination provided the lowest gross receipts since 1971. By contrast, the costs for 1982 were due to road construction, brush disposal, and reforestation associated with timber sales over the previous 2-5 years, and represents one of the highest total costs ever at 54.4 million dollars, due to the high level of harvest.

The negative value for 1982 is due to the difference between when the receipts are received and when the costs are incurred for a given sale, and not the result of below cost sales. To this point in time there have been few, if any, timber sales in the Forest that were below-cost.

Some potential exists for certain types of sales to have costs which exceed revenues. As the Forest begins to prescribe harvest of more smaller diameter material either through commercial thinnings or as a result of final harvests under shorter managed rotations, the total value of the timber will tend to decrease given a continuation of current market conditions and price-diameter relationships. Since costs will generally not follow this same trend, some sales may not be economical to harvest.

Another type of sale where total costs could exceed revenues is one that occurs in areas which require special protection for other resource values such as scenery, dispersed recreation, wildlife, and water quality. Numerous constraints on harvesting, including limits on unit sizes, are contained in prescriptions which emphasize multiple-use objectives. These result in higher timber management costs without an increase (and possibly a decrease) in total revenues. The total multiple-use benefits of these types of sales are not reflected in the Forest's cash flow analysis of a timber sale.

To deal with this concern about below-cost timber sales, Congress directed the Forest Service in 1984, to design a new accounting system that would report all costs and benefits of the timber sale program. The Timber Sale Program Information and Reporting System (TSPIRS) was developed and tested, and is now being implemented service-wide. The first official reporting year will be 1989.

The economic effects of the trend towards harvesting smaller diameter material and incurring increased costs for other resource objectives become more important for sales in areas dominated by low value species. On the Willamette, lower values are associated with stands of high elevation species including mountain hemlock, lodgepole pine and the true firs.

Efforts have been made by Forest managers to provide some direction and assurance that future timber sales will be economical from both an efficiency and cash-flow perspective. An example of this is the limitation placed on the minimum average stand diameter available for commercial thinning. A 12-inch diameter provides enough volume to cover the costs of the average sale. Other restrictions based on economic considerations include limiting the number of commercial thinnings for an individual stand and limiting the area that can be commercially thinned based on accessibility.

In addition some areas which are uneconomical to manage for timber production on a cash-flow basis are either dedicated to other uses before the Forest-wide FORPLAN analysis or fall out of solution as uneconomical from a cost-efficiency standpoint. The FORPLAN model will provide the most cost-efficient solution for the specific multiple-use objectives of each Alternative.

Despite efforts to make individual sales return at least as much as they cost, an examination of the total sales program may indicate that receipts did not exceed revenues due to fluctuations which can occur in the demand for timber. While the costs of selling timber may remain relatively constant, revenues for a particular year fluctuate with the amount harvested. This is due to the multi-year nature of timber sales. Figure III-W-18 contains the cost and receipt information for the Willamette.

Table III-W-18. Comparison of Timber Sale Values and Costs

			Values (MM$)			Costs (MM$)				
FY	Volume (MMBF) [1]	$/MBF	Timber Value [2]	Road Value [3]	Gross Receipts [4]	Appro-priated [5]	Allocated [6]	Roads	Total Costs	Net Receipts
1980	554	165	62.0	29.7	91.7	9.2	11.7	29.7	50.6	41.1
1981	471	153	47.7	24.4	72.1	12.1	13.5	24.4	50.0	22.1
1982	370	104	7.7	30.7	38.4	11.7	12.0	30.7	54.4	-16.0
1983	555	108	44.3	15.8	60.1	8.5	8.6	15.8	32.9	27.2
1984	612	107	53.1	12.2	65.3	14.0	11.1	12.2	37.3	28.0
1985	775	100	62.8	15.1	77.9	12.9	13.3	15.1	41.3	36.6
1986	758	95	60.3	12.1	72.4	9.9	15.8	12.1	37.8	34.6
1987	899	123	95.4	15.5	110.9	7.6	12.7	15.5	35.8	75.1
1988	908	155	125.4	14.9	140.3	8.8	14.3	14.9	38.0	102.3
1989	855	196	153.2	14.0	167.2	9.8	23.2	14.0	47.0	120.2
Ave.	676		71.2	18.4	89.7	10.5	13.6	18.4	42.5	47.1

[1]Volume figures include all convertible products harvested.
[2]Value includes all products, Christmas trees, etc. Also includes K-V and BD collections.
[3]Road costs are part of total value and include appropriated road construction, purchaser road construction, engineering, design, and administration.
[4]Gross receipts include timber and road values.
[5]All timber sale costs including program management, sale preparation, administration, stand exams, etc. Does not include road costs.
[6]Includes K-V, brush disposal (BD), salvage sale fund (SSF), and cooperative work (CWFS).

Implementation of the Forest Plan will include monitoring and analysis of the economics of individual timber sales or groups of sales. This will be done to assess the accuracy of planing assumptions and evaluate sale-specific concerns using site-specific economic information. Decisions to harvest and how best to do it will then be made on a sale-by-sale basis considering the differences in important economic and noneconomic factors.

Silvicultural Systems

Silvicultural systems are used to manage forest stands as identified in Agriculture Handbook No. 445. A silvicultural system is a planned sequence of treatments for controlling the species composition and structure of the vegetation during the life of a stand. A stand is a community of trees sufficiently uniform to be distinguishable as a silvicultural or management unit. A stand can be defined as a reasonably homogeneous unit that can be clearly differentiated from surrounding stands by its age, composition, structure, site quality, or geography.

A silvicultural system typically includes cutting trees, growing new trees, and controlling competing plants. Cuttings are classified as regeneration cuttings (those that help to replace stands), and intermediate cuttings (those that maintain or improve the character of existing stands, i.e., thinning harvests). Silvicultural systems are adaptations of natural occurrences. Nature makes "regeneration cuttings" by means of fire, insects, disease, wind, and other phenomena, by removing a single tree, a small group of trees, a stand, or sometimes a whole forest.

Selection of the appropriate silvicultural systems occurs at both the National Forest Land Management Planning level and Ranger District project level by considering the overall planning objectives and ecological characteristics of the Forest. At the Ranger District, project level selection of silvicultural systems is typically made by a certified silviculturist. Choices are based on matching the attributes of the silvicultural systems with specific management objectives and ecological characteristics for specific stands.

The clearcutting, seed-tree, and shelterwood systems are even-aged systems, which means that all of the trees in the stand are approximately the same age. The single-tree and group selection systems are uneven-aged systems because the trees in the stand differ markedly in age, with at least three major age classes present. Uneven-aged stands have no beginning or end points in time.

Even-aged management, with clearcut or shelterwood as the principal regeneration systems, is predominantly implemented on the Forest for the following reasons:

- Even-aged and group selection systems favor plants that can be readily established and which grow well in full sunlight (shade-intolerant plants). Many of our major tree species including Douglas-fir are shade intolerant to various degrees.

- To obtain high timber yields and growth rates, there must be strict control of stocking in regenerated stands. The other option, uneven-aged management, assumes continual replacement of old trees with new. This assumption of prompt regeneration poses a serious difficulty because of sporadic natural regeneration, brush invasion and competition, climatic and economic considerations, and silvicultural characteristics of many common tree species. However, uneven-aged management can be applied where greatly reduced timber yields are acceptable for meeting other important resource objectives (e.g., streamside or visually sensitive areas where maintenance of a forested aspect is important).

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- Stand structure is typically poorly balanced in terms of age and size class distribution in our existing stands. The oldest (or largest) trees in any managed forest depend primarily on the management objectives, not on the silvicultural systems. In particular the amounts of large-growth or old-growth to be produced or maintained depend more on cooperatived reductions in yield than on the kinds of silvicultural systems implemented to manage stands.

- The steep topography and rugged terrain found over much of the forest would cause excessive damage to reserve trees during frequent harvest entries. Repeated harvests of the largest trees have often caused undesirable results: understocked residual stands with lower quality, lower value trees.

A full discussion of silvicultural systems and management practices is found in Appendix F.

Tree Improvement

Increasing demand for timber and concern over management costs, indicate a need to produce more volume per acre per year. One method of doing this is to use sound genetic principles to increase growth, improve tree form and wood quality, and increase resistance to disease, insect, and animal pests. The forest is currently planting seedlings from seed collected from superior trees. Seed orchards are being established to further improve the quality of planting stock. Genetic improvement can also be realized through careful selection of trees to be left after precommercial and commercial thinnings as well as overstory trees in areas not clearcut.

Timber Stand Improvement

This refers to cultural treatments that improve the composition, condition or growth of a stand of trees. These treatments include release from brush competition, precommercial thinning and fertilization. Approximately 20% of new plantations require release from brush, 87% require pre-commercial thinning, and fertilizer can be applied to all stands with at least 60% Douglas-fir stocking.

Another form of TSI that has not seen much use in the recent past is pruning limbs to produce high-quality clear wood. However, in the future the Forest Service will be one of the few producers of large trees due to the NFMA requirement that rotation age is at least 95% CMAI (60-120 years). Most other forest landowners are managing on economic rotations of 40-60 years. As the old-growth available for harvest decreases, the demand for clear wood will increase. At the present time, pruning appears to be a neutral investment, but the potential is there for a significant gain in PNV (Mayo 1986). Opportunities will depend on funding and employment considerations.

MINERALS AND ENERGY

The National Forest System by coincidence of geology is a principal storehouse of mineral and energy resources. The search for and production of mineral and energy resources are statutorily authorized uses of the National Forest System, except for those lands formally withdrawn from mineral activities by Act of Congress or by executive authority. The Wilderness Act of 1964 has withdrawn designated Wilderness from all appropriation under the mining laws and minerals leasing acts, subject to valid existing rights.

The Forest encourages, facilitates, and administers the orderly exploration, development, and production of mineral resources to meet present and future needs of the nation integrated with the use, conservation, and protection of other resources.

Mineral activities on the Forest are encouraged in accordance with the national Mining and Mineral Policy Act, and the various applicable Federal and State statutes governing protection of the environment, including air and water quality. The Statutory and regulatory direction separate mineral resources in publicly owned lands of the United States into three categories: locatable, leasable, and salable.

Locatable Minerals

Locatable minerals are those valuable deposits subject to exploration and development under the U.S. General Mining Law of 1872 and its amendments. Commonly, locatables are referred to as "hardrock" minerals, which are naturally-occurring, solid, and usually inorganic compounds. Examples include gold, silver, copper, and zinc.

Citizens, and those who have declared their intent to become citizens, have the statutory right to explore for, claim, and mine mineral deposits on Federal lands including those of the National Forest System subject to 36 CFR 228 and other laws of the United States. Through a Memorandum of Understanding with the Bureau of Land Management (BLM), U.S. Department of the Interior, the Forest Service administers most aspects of U.S. Mining Laws on National Forest System lands. In addition, under the regulations in 36 CFR 228, the Forest Service approves exploration and mining operating plans and administers those operations to ensure protection and reclamation of affected surface resources.

The Forest contains four mining districts: Blue River, Fall Creek, North Santiam, and Quartzville. (See Figure III-X-1 on Mining Districts.) Most of the past and present mining activity is concentrated in the one million to 70 million year old volcanic rocks associated with dioritic and related intrusion. The mineralization occurs in veins which trend northwest and dip steeply. The four districts include the mineralized areas on the Forest which have the highest potential for locatable minerals. Even these areas are small isolated pockets with questionable potential.

Most of the mining activity on the Forest took place from the late 1800s to the early 1900s. During that time, the districts produced over $400,000 in gold, silver, and copper. Recent increases in the price of gold and silver, plus improved mining and metallurgical, techniques have stimulated recreational and commercial interest in the old deposits. An increase in recreational activity has been evident during the summer months and on holiday weekends particularly in the Little North Santiam and Quartzville areas. This may result in more trespasses on areas that have been withdrawn from mineral entry.

Probable future mineral activities include continued prospecting and exploration, and possible development of locatable mineral deposits in the vicinity of the mining districts (drilling, road building, and underground development), and new discoveries outside areas of previous activities. In the more

distant future, the potential exists for development of high grade copper breccia pipes in the North Santiam. The past and estimated future potential for minerals production is shown in Figure III-X-2.

Leasable Minerals And Energy

Leasable minerals include fossil fuels (coal, oil, gas, oil shale, etc.), geothermal resources, potassium, sodium, phosphates, and sulphur. These minerals are subject to exploration and development under leases, permits or licenses granted by the Secretary of the Interior. The controlling statutes currently are the Mineral Lands Leasing Act of 1920 and amendments, the Mineral Leasing Act for Acquired Lands of 1947, and the Geothermal Steam Act of 1970.

The Secretary of the Interior's authority is administered by the Bureau of Land Management (BLM). When National Forest System lands are involved, the BLM requests the Forest Service's recommendation for minerals, other than coal, subject to the 1920 Act, or the Forest Service's consent decisions for minerals subject to the 1947 and 1970 Acts and for all coal deposits. Forest Service recommendations for and consent to the BLM for leasing, permitting or licensing (except for coal) include appropriate stipulations to be included in the issued document for the management of surface resources. The Secretary of the Interior, through the Office of Surface Mining (OSM) for coal, and through the BLM for other minerals, has the authority to administer operations on leased National Forest System lands.

Prior to approval of operating plans, the Forest Service participates with BLM or OSM in the formulation of the site-specific terms and conditions of operating plans, so that the plans provide appropriate mitigation measures to ensure that adverse impact on surface resources will not exceed applicable environmental protection standards. Plans must be designed to minimize the impacts of operations on other uses and surface resources and to provide for prompt reclamation or restoration of affected lands upon abandonment of operations. All such plans and activities shall be an outgrowth of environmental analysis that complies with the National Environmental Policy Act of 1969 (NEPA 1969) procedures.

The Forest is not considered favorable for oil and gas exploration because the Western Cascades are generally composed of nonmarine material of volcanic origin. The High Cascades are characterized by recent volcanic cones, lava flows, and shield volcanoes which would indicate a low potential for oil and gas. In the 1970s there was a surge in lease applications after natural gas was discovered near Mist in the Coast Range. The Forest had about 200,000 acres in lease applications of which most have been terminated due to lack of payment or withdrawn due to cost of exploration and stipulations imposed to protect the resources. These measures reduced chances of recovering investments for the companies.

The Forest contains numerous hot springs and other indicators (such as areas with high heat flow) of geothermal systems at depth. Three hot spring areas, Breitenbush, Belknap-Foley, and McCredie-Kitson are classified as Known Geothermal Resource Areas (KGRAs) by the U.S. Geological Survey.

The Oregon Department of Geology and Mineral Industries identifies additional areas that merit further geothermal exploration the Forest; they include the upper McKenzie River, Horse Creek, and Willamette Pass (Priest and Vogt 1982). The target areas are characterized by high heat flow and are located adjacent to faults where the potential for fracture permeability is high.

There has been considerable interest in geothermal leasing on the Forest. During 1980 and 1981 private companies drilled over 55 exploratory temperature gradient holes and one 9,000-foot test well. Although no discoveries have been made to date, geothermal exploration in the area continues. The location of an energy source may lead to some potential for development on the Forest.

Figure III-X-1.

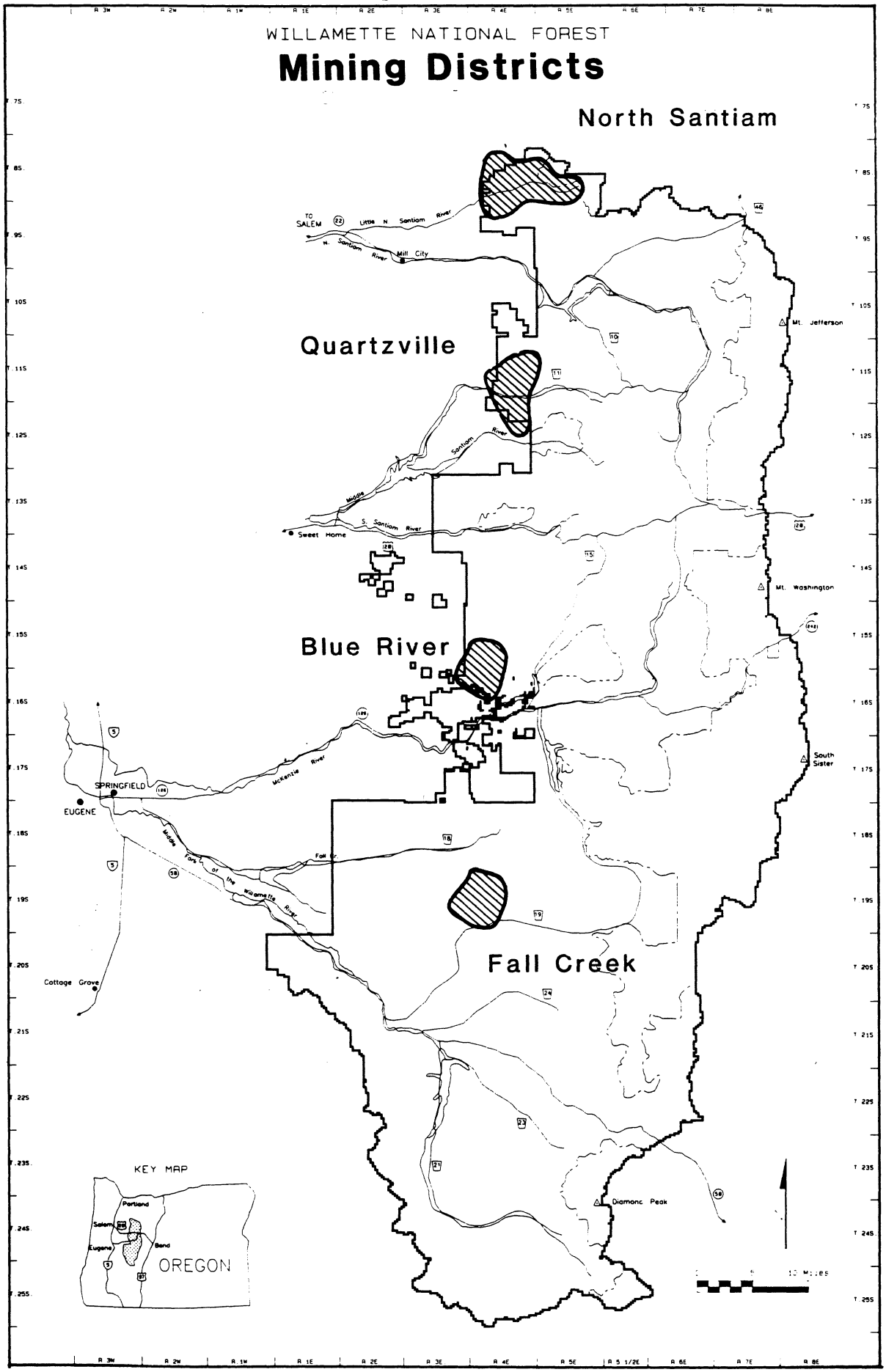


Table III-X-2. Minerals Production

District	Ore Extracted [1]	Minerals	Future Potential
North Santiam	$25,000	Gold, silver, copper, zinc, lead	Active exploration by major company. Medium potentia for gold, copper, gold, and silver.
Quartzville	$181,255	Gold, silver	Minor prospecting, Low potential for copper, gold, and silver.
Fall Creek	Unrecorded	Gold	Limited present activity. Low to medium potential for gold & silver.
Blue River	$200,000	Gold, silver	Limited present activity. Low potential for gold, silver, & copper.

[1] Dollar values at time of production, 1890-1940, from Gold and Silver in Oregon by DOGAMI.

Demand for leasable energy resources has dropped significantly in the years since the initial "energy crisis" of 1973 to 1974. The Northwest Power Planning Council projects an energy surplus for the Pacific Northwest until the 1990s. Thus, in the near term, it seems unlikely that any large-scale energy production or development will occur on the Forest. However, as industry looks to the long term and the development of alternate energy sources, activities associated with identifying potential supplies on the Forest are expected to increase.

Salable Minerals (Common Varieties)

A Federal Mining Statute known as the Act of July 23, 1955, removed common varieties of sand, stone, gravel, pumice, pumicite, cinders, and clay from the category of locatable minerals. The Act placed the common varieties under the Materials Act of 1947. This 1947 Act authorizes disposal of materials, including, but not limited to the above common varieties, on public lands through a sales system.

The use of common variety minerals is mostly for Forest road construction and maintenance in the form of gravel. The High Cascades provide a suitable inventory of good rock sources due to the fairly young nature of the rock. The Western Cascades provide some rock sources but not as many.

Rock sources are located within centralized areas of road development so cost of hauling rock is lowered. There are about 170 active rock sources. Traveling on a road where rock is being hauled can be hazardous where recreation and timber operations may conflict with gravel trucks.

The existing and potential supply of gravel is expected to be adequate to meet anticipated needs until the year 2000. As the inventory is completed, a better estimate will be possible. Demand for small mineral sales (common variety) will continue at about the same or slightly increased rate.

Gemstone sources are quite limited and those known are used by the recreation visitor or "rock hound." Jasper and agate are the principal stones to be found. One source of petrified wood, which is not classed as a gem stone has been located. Several sources of emery stone have been located and prospected to some extent, but have proven uneconomical to work.

Mineral Withdrawals

The Forest's early efforts in withdrawing lands from mineral location involved administrative sites at various locations across the Forest. More recent requests have involved special areas such as roadside zones, the H.J. Andrews Experimental Forest, and some recreation areas. Other withdrawals involved hydroelectric power development and flood control sites. These were quite extensive, covering most of the major streams on the Forest. In the early 1970s these withdrawals represented about 75% of the total area of the Forest where mineral entry on the land was prohibited. Now this has declined to about 40%. Much of this change is the result of reopening Federal Power Commission licensed sites. In accordance with the Wilderness Act, as of December 31, 1983, designated Wilderness became withdrawn from appropriation under the mining and mineral leasing laws, subject to valid existing rights.

As of 1985 there are 447,958 acres where mineral entry is prohibited by specific withdrawal authority. In addition, there are about 90,916 acres covered under special uses, power applications, and power sites where mineral entry is restricted. The USDA Forest Service has authority over 26 withdrawals, which are included in the above acreage figure.

The Forest must review all 26 withdrawals over which it has authority. The review will determine if the withdrawal is to be continued, revoked, or modified. This must be completed by 1990 as required by the Federal Land Policy and Management Act of 1976. The Forest is not responsible for withdrawals that were initiated by other agencies such as the Federal Power Commission or the Army Corps of Engineers.

There will continue to be lands withdrawn in the future. The Forest will make additional requests for withdrawal of lands where natural ecosystems are to be protected or where mining activities are not compatible with land management objectives. However, revocation of withdrawals may be requested where protection is no longer needed.

SOCIAL AND ECONOMIC ENVIRONMENT

Introduction

Forest planning focuses on resource-related issues and assesses the environmental, social, and economic impacts of alternative management choices. To make this assessment, the various components of the environment which are affected must be identified. This section of Chapter III describes the social and economic environment which is affected by management of the Forest. Some of the information presented here is a summary of a more comprehensive document on the subject which was prepared for the Forest by Linda Peterson in 1983. That document, *Socio-Economic Overview of the Forest's Area of Influence*, is on file as part of the Forest's planning records.

The Forest is located on the western slopes of Oregon's Cascade Range, within a two-hour drive of Oregon's major population centers in the Willamette Valley. It lies primarily in Lane, Linn, and Marion counties, but also extends south into Douglas County, east into Jefferson County, and north into Clackamas County. (See Figure III-Y-1.)

The Forest's resources play an important social and economic role in these and other Oregon counties as well as in the Pacific Northwest and the Nation. The goods, services, and uses available from or on the Forest represent major components in the lives of many people who live adjacent to or near the Forest.

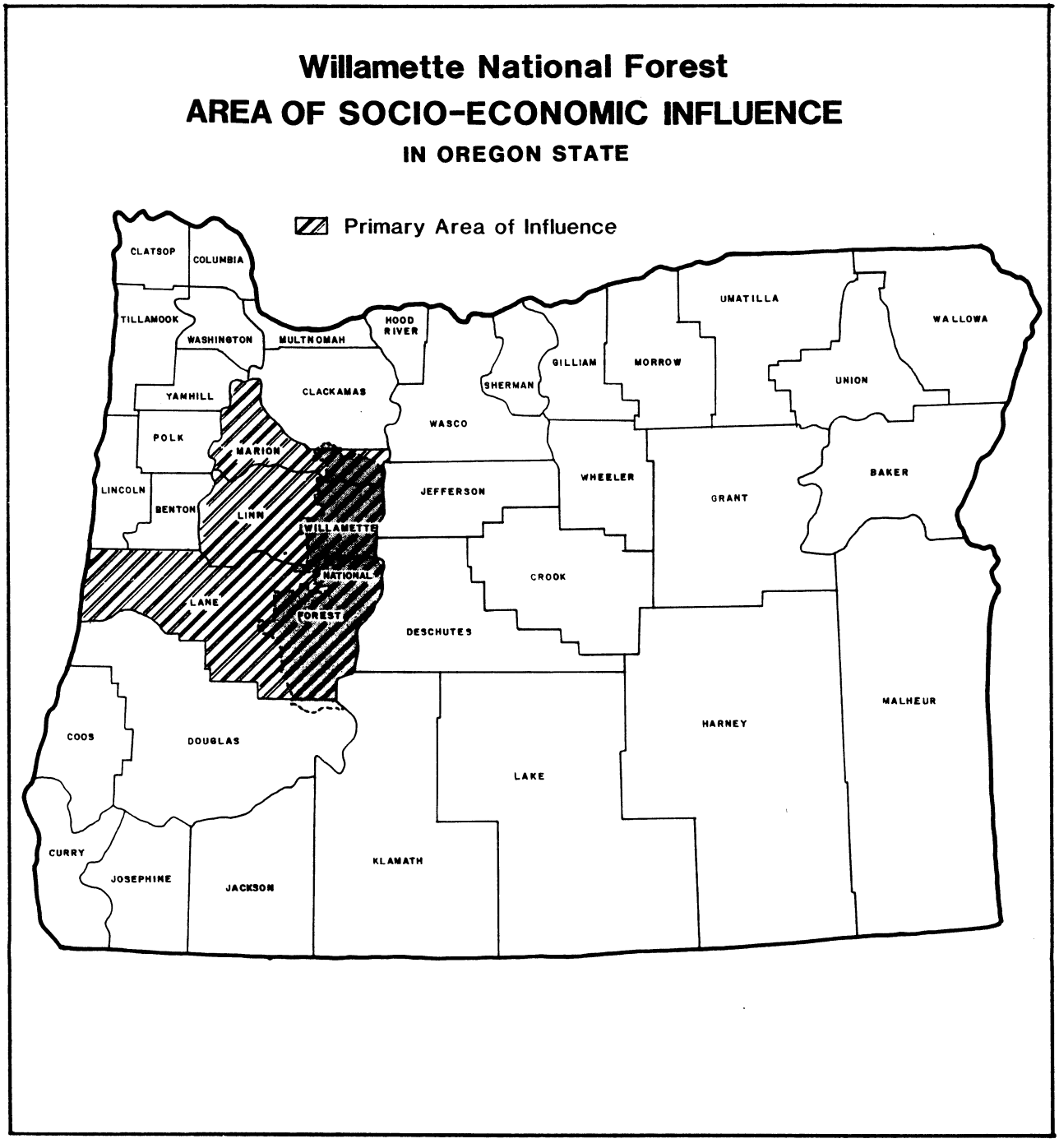
Many local communities rely on the employment and income generated from the use of Forest resources. A measure of stability is derived from a continuous supply of timber being available for harvest from the Forest, even though supply is not the only determinant of stable markets. Income and employment are also derived from people traveling through communities on their way to use the Forest for recreation and other purposes. An awareness of tourism's importance as a source of future economic and social activity for communities in and adjacent to the Willamette Valley is growing.

In addition to economic activity, the quality of people's lives is greatly enhanced by the physical environment associated with the Forest. A diversity of topography, vegetation, wildlife, and other resources opportunities provide for a variety of quality recreation experiences; and the many scenic and other attractions provide an attractive place to live and work.

All of these goods, services, and uses have value to the people who live in the area. Changes in the quantity or quality of these attributes affect their lives. With a limited resource base and increasing demands from a growing population, conflicts or issues related to the relative values of different goods, services, or uses are bound to arise.

A look at current and expected future conditions in areas influenced by the Forest will be useful to project possible changes in the socio-economic sectors as a result of implementation of any of the Forest Plan alternatives.

Figure III-Y-1. Area of Socioeconomic Influence



Area Of Influence

The area or zone of Forest influence was established by identifying the users of the Forest's resources. The major resources of the Forest include recreation opportunities, fish and wildlife, timber, and water. Each resource is used, processed, or consumed by different, though overlapping, segments of the population located in varying proximity to the Forest. The influence area for this analysis is defined by county boundaries and has been separated into a primary influence area and a secondary influence area.

The primary area of influence includes the counties of Lane, Linn, and Marion in Western Oregon. Each of the three counties contains portions of the Forest. Industries in the primary counties tend to process the bulk of the Willamette National Forest's timber and mineral resources, while also supplying the majority of the recreation users to the Forest. In addition, the counties receive millions of dollars of Federal timber receipts on a yearly basis, depending on the timber harvest volume and bid price for the timber (see the later section on payments to the counties).

A secondary area of influence includes four Western Oregon counties--Benton, Polk, Yamhill, and Douglas and one county in Central Oregon, Deschutes. Douglas and Deschutes counties border the Forest, while the other secondary counties are nearby and border the three primary counties. Although the five secondary counties tend not to share the same resource or recreation uses on or from the Forest, they receive or process some timber and mineral resources and provide some recreation users.

There are other counties and states that are marginally influenced by the management of the Forest. This is apparent in terms of recreation visitors and indirectly through the use of lumber products. The many lakes on the Forest, the migrating Chinook salmon and steelhead that spawn on the Forest streams, as well as the pristine Wildernesses, draw thousands of persons from the western states and other counties. However, the measurable influence that the Forest management alternatives have on these distant persons, counties, states, or nations is almost impossible to calculate.

Social Environment

Historic Trends

Western Oregon has a rich and varied history that was shaped by the people who moved to the area and the natural resources that were readily available. Predominant in the economic development of the Western Oregon region have been agriculture, mining, forestry, and later recreation. Initially, in the 1830s and 1840s agriculture was subsistence oriented. As the settlement base increased, the diversity of agricultural products also increased as cattle, sheep, wheat, corn, and garden vegetables were introduced in the 1850s. Through time, agriculture expanded its base with new varieties of herd animals, wheat and grains, fruits, nuts, and more recently, horticultural specialty crops.

Mining has periodically contributed to the economy of the area. It is one of the least documented activities and probably occurred on a larger scale than has actually been reported. The Blue River, North Santiam, Fall Creek, and Quartzville Mining Districts are located within the Forest boundaries. Today, they remain as some of the most important mining areas in the Western Cascades, although present activities are of a very small scale.

The timber industry has been of paramount importance in the economy of the Willamette's area of influence. On a noncommercial basis, the native trees were utilized by the early trappers, miners, and settlers for shelter and heating. In addition, the settlers removed many of the trees from their homesteads

so that agricultural products could be grown in the fertile soils. By the early 1850s small sawmills were scattered throughout the area and the commercial effort became somewhat profitable. Many townsites were established near the mills and transportation systems. New technology evolved from simple whipsaw operations to more sophisticated steam powered mills. By the early 1900s the lumber industry began to develop a substantial market outside the area, relying on the Southern Pacific railroad system for transportation of lumber products. Today, the timber base is very strong, with centralization, computer technology, and an integrated trucking system assisting the industry.

Transportation systems proved to be important to the development and continued survival of the local communities. The mid-1870s brought the Oregon and California (O&C) Railroad, which boosted the economic potential of the area. The railroad linked the region to new market areas. The Southern Pacific Railroad, which purchased the Oregon and California Railroad, provided some stimulus to help draw emigrants, through the selling of their Federal railroad grant lands. Yet many of the unsold lands were returned to Federal ownership in 1916 as the railroad company did not comply with the terms of the land grant. Administration of these lands became the responsibility of the General Land Office (later called the USDI Bureau of Land Management) and the USDA Forest Service. The O&C land payments which comprise 50% of the gross receipts (constrasted to 25% of standard natural Forest lands), in lieu of taxes, contribute to the economic base for the counties in the Willamette's area of influence.

The highway system in the region developed slowly. Prior to 1920 it relied on numerous local farm roads and a few county funded roads. By the mid-1920s, the State of Oregon began to fund a modern highway system, enabling the construction and paving of the Pacific Highway (U.S. 99), which connects the major population centers of Western Oregon together. In addition, several old wagon roads and toll roads over the Cascade Range were reconstructed in the 1920s and 1930s to an improved standard, with modern widening and paving occurring in the 1950s and 1960s. The latest highway improvement has been the construction of Interstate 5 during the 1960s. The all weather I-5 north-south corridor is the major transportation route, commercial zone, and recreational access for Western Oregon. It also links Oregon to markets and people in California and Washington.

Recreation is another component to the area's economy which has gradually expanded. Initially hot springs, hunting, fishing, and camping were the principle Forest attractions to residents and tourists. By the 1920s remote hot springs and resorts, as well as the high mountain lakes, attracted venturesome tourist expeditions. During the 1930s federal and state actions, often assisted by the Civilian Conservation Corps enrollees, enhanced the recreation potential by establishing numerous campground facilities through Western Oregon, especially along the state roads that cross the Forest. After World War II came the surge of recreation users for hunting, fishing, camping, boating, and many other recreational pursuits. In the last two decades, new recreational interests have expanded into such areas as backpacking, rock climbing, downhill and cross-country skiing, photography, river boating, rafting, and many other outdoor pursuits. As populations grow, so will the need for more recreational opportunities.

The vast timber resources of the Forest were barely tapped until World War II ended, when full scale development of a Forest road system allowed a vastly increased use of the Forest. The highest point of Western Oregon's timber industry was in the 1950s for both production and total employment. Since that time, the production levels have lowered, and the employment has been reduced.

Over 150 years of population growth and natural resource development in Western Oregon have helped to shape the people of the area. The zone of influence is still substantially dependent on natural resource related industries and employment. The three counties (Lane, Linn, and Marion) rely on timber receipts, agriculture, and recreation for a good portion of their income. Much of the recent change in employment

in Western Oregon has been towards secondary or service related jobs and in the future fewer jobs will be directly tied to natural resource production. The ease of transportation and increased leisure time, especially to the metropolitan cities of Western Oregon, has increased the recreation use on the Forest. It is expected that in the future even more persons will take advantage of the living conditions and recreational and job opportunities in the area. The physical attributes which enhance the quality of life for the people living and working near the Forest are also expected to help attract other industries to the area as local economies continue to diversify.

Population

The population in the Forest area of influence is comprised of rapidly growing county seats, smaller communities adjacent to main transportation routes, and rural families and farms. The inhabitants of this zone (see Figure III-Y-2) comprise almost 34% of the state total (1980 census), with most of the concentration around the metropolitan areas of Eugene-Springfield and Salem. There are several small cities within the external National Forest boundary including Oakridge, Westfir, McKenzie Bridge, Detroit, and Idanha.

The prospects for employment and an outstanding natural setting have led to a population growth of over 65% in the Willamette Valley in the last 20 years. This tremendous growth has occurred whether national and state economies have been strong or weak. The population in the State of Oregon has been increasing every decade, with the largest percent increase between 1900 and 1910, when there was a 62.7% rise. The years from 1940 to 1950 showed a rise of 39.6%. The next fastest growth period was from 1970 to 1980 when a spurt of 25.9% was recorded. Urban areas within the state grew at a faster rate during 1970 and 1980 than the rural areas, yet much of the urban growth was in cities with less than 25,000 population. There are no indications that this continued upward trend in the state will reverse despite the small declines in population growth during the early 1980s.

Within the Forest's primary zone of influence, the growth of county populations has taken a similar upward trend. All three counties grew at a rate higher than the state. The lowest change of population from 1970 to 1980 was in Linn County with 24.5% growth, while Lane County grew 27.8%, and Marion County gained 35.3%. The average change for the primary zone was more than 3% above the Oregon average for the same period. During the 1980s population in Lane County dropped in the 1980-1988 period only reaching above the 1980 census during 1988-1989. Linn County dropped below the 1980-census only in 1981 and 1982 and rose above in 1983, a trend which continues. Marion County, on the other hand, never dropped below their 1980 population, gaining almost 20,000 persons in the 9-year period.

In the secondary zone of influence all five counties are above the state growth rate with Deschutes County considerably above. Benton and Polk counties were just above the state average, Yamhill and Douglas counties were higher, with Deschutes County more than four times the state average for growth. The secondary area has about 60% of the population of the three primary counties.

Table III-Y-2. County Populations - Trends and Projections

	PRIMARY ZONE							
	Actual Population [1]			Projected Population [2]				
County	1960	1970	1980	1990	2000	2010	2020	2030
Lane	162,890	215,226	275,226	292,000	334,200	376,500	424,300	478,000
Linn	58,867	71,914	89,495	96,900	109,500	123,400	139,000	156,600
Marion	120,888	151,309	204,692	228,300	267,700	310,600	339,800	382,900
TOTALS	342,645	438,449	569,413	617,200	711,400	801,500	903,100	1,017,500
	SECONDARY ZONE							
Benton	39,165	53,776	68,211	73,900	84,300	95,000	107,000	120,600
Deschutes	23,100	30,442	62,142	75,800	102,100	115,000	129,600	146,000
Douglas	68,458	71,743	93,748	99,000	114,700	129,200	145,600	164,000
Polk	26,523	35,349	45,203	48,300	55,700	62,800	70,700	79,700
Yamhill	32,478	40,213	55,332	63,400	75,300	84,800	95,600	107,700
TOTALS	189,724	231,523	324,636	360,400	432,100	486,800	548,500	618,000

[1] Census data from the decade Federal Census for each decade.
[2] The 1990 and 2000 projections are based on the Center for Population and Census estimated population increase for the years 1980-2000 (Center for Population Research and Census, 1984). Projections for beyond the year 2000 were calculated with an average percentage increase of 1.2 percent per year, using the average Bonneville Power Administration population projections for the primary counties (Bonneville Power Administration, 1979).

Current Population

Population in the Forest's primary zone of influence was last estimated in 1989, by the Center for Population Research & Census at Portland State University, to be 594,000 persons or 21% of the State of Oregon total of 2,791,000 persons. Lane County, which has the largest population of the primary counties, has an adjusted estimate of 280,000 persons or 10% of the total in the state. Marion County has about 224,000 persons or 8% of the state. Linn County contributes the smallest proportion with 90,000 persons or 3% of the state population. These official estimates compare favorably with the 1980 census where the three counties comprised 21% of the total state population.

The Forest's secondary zone of influence has about one-half of the population of the primary zone. The five counties of Benton, Deschutes, Douglas, Polk, and Yamhill contribute 345,100 persons or 12.4% of Oregon's population.

Overall, the total Forest zone of influence contains an estimated 939,100 persons or almost 34% of the Oregon population. Two-thirds of these people reside in the primary zone, while the remainder live in the secondary zone. The state of Oregon has about 2.8 million persons, most of whom are concentrated in the large urban areas of the Willamette Valley. Eugene-Springfield and Salem, the

largest cities in the zone of influence, are termed Metropolitan Statistical Areas (MSA), which means that they are eligible for higher funding and special economic programs as defined by the Office of Management and Budget. Salem, in Benton County, is also the state capital.

Population Projections

Based on studies completed in the mid- to late 1970s, (the most recent population projection estimates), the population of Oregon is expected to increase by 250,000 by 1990, 420,000 more by 2000, 418,000 increase by 2010, and 531,000 additional people by 2030. Approximately two-thirds of these new people will find homes and employment in the Willamette Valley. The Forest's primary zone of influence is projected to grow at a slower annual rate than at present (see Figure III-Y-2). Despite the slower rate, Lane County should expect a large increase in population. The secondary zone will experience similar growth patterns, but the total increase will be much smaller. Deschutes County will be the exception, where the population could dramatically increase if the current trends continue.

Overall, the relative population increases in the zone of influence will have a real impact on the Forest. More people means a greater demand for outdoor recreation, forest products, and a higher density of automobiles on the forest road system. As the year 2030 is less than 50 years away, the Forest needs to effectively plan for a steady increase in demand by Forest users. In addition, these people will need employment opportunities, which the Forest will indirectly impact. The larger quantity and greater concentration of people will express more concerns and place more demands on the Forest to provide clean water, air, and recreation, as well as protection of soils and enhancement of visual resource conditions.

Minorities

The last federal census in 1980 (the 1990 census not available until 1991 or 1992) indicated that minority composition within the Forest's primary zone of influence was over 24,000 persons (see Figures III-Y-3 and III-Y-4). This was smaller (4% of total population) than the state percentage (7.9%). Marion County had more minority persons than the other primary counties, with 11,342 members (5.5%), while Lane County had 10,636 persons (3.8%), and Linn County had the least with 2,199 minority persons (2.4%). Lane County had more Black Americans (1,618) followed by Marion County (1,258), and Linn County (135). All three counties had different proportions of Native Americans, averaging about 1%. Both Lane and Marion counties had relatively the same proportions (1%) of people claiming Asian descent, while Linn only had one-half as many as either county. Marion County had a higher percentage (4.7%) of persons of Hispanic origin, who can be of any minority group, with Lane about 2.0% and Linn with about 1.8%.

The secondary zone of influence also had relatively low numbers of minority persons (3.6%) which was almost 2% lower than the state averate. Benton County had the largest proportion of minority people with 5.1%, followed by Polk County with 4.5%, Yamhill at 4.1%, Douglas with 2.5%, and Deschutes County at 1.8%. The minority category with the greatest number of persons was Other, which does not include Hispanic origin or white (4,433), followed by Asian (3,054), American Indian (2,854), and Black (909). The percentage of people claiming Hispanic origin in the secondary counties averages 2.4%, just under the state average of 2.5%. Polk and Yamhill counties contained the highest percentage of Hispanic origin people (around 3.4%), while the other three counties averaged 1.8%.

Table III-Y-3. People of Hispanic Origin by County, 1980

	County			
	Lane	Linn	Marion	Total Area of Influence
Not of Hispanic Origin	269,654	87,870	194,990	552,514
Hispanic Origin				
Mexican	3,495	1,090	7,940	12,525
Puerto Rican	238	52	147	437
Cuban	68	15	56	139
Other	1,780	468	1,559	3,807
TOTAL PERSONS	275,235	89,495	204,692	569,422

Source: U.S. Census, Summary Tape File 1.

Table III-Y-4. Persons by Race, 1980

	County			
	Lane	Linn	Marion	Total Area of Influence
White	264,599	87,296	193,250	545,145
Black	1,618	135	1,258	3,011
American Indian, Eskimo, and Aleut				
American Indian	2,382	723	1,923	5,028
Eskimo	43	11	37	91
Aleut	46	8	17	71
Asian and Pacific Islander				
Japanese	796	78	328	1,202
Chinese	798	107	307	1,212
Filipino	278	58	298	634
Korean	383	112	159	654
Asian Indian	203	22	12	337
Vietnamese	204	49	612	865
Hawaiian	177	35	122	334
Guamanian	60	12	16	88
Samoan	29	1	21	51
Other	3,619	848	6,232	10,699
TOTAL PERSONS	275,235	89,495	204,629	569,422

Source: U.S. Census, Summary Tape File 1A.

Native Americans

Lane County had the largest number of Native Americans (2,382), with Marion County following closely with 1,923 persons claiming American Indian descent (see Figure III-Y-4). Linn County had about one-half that amount, while the other secondary counties, except Douglas, had even less. Douglas

County, with 1,093 American Indians, has two Native American tribes; the Cow Creek Band of Umpqua Indians, recognized in 1982; and the newly recognized Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians, recognized in 1984. Deschutes County contains portions of the Confederated Tribes of the Warm Springs Indian Reservation.

Over 55% of American Indians in Lane County resided in the urbanized areas of Eugene-Springfield, with another 7% reported living the cities of Cottage Grove, Junction City, and Oakridge. The remaining live in smaller communities and in rural areas. In Marion County, only about 3% live in the Silverton, Stayton, and Woodburn areas, but many more live in the suburban areas around Salem. For the American Indians in Linn County, about 60% live in the Albany, Lebanon, and Sweet Home areas.

The Warm Springs Confederated Tribe is the only federally recognized Native American group that have traditional ties in the Forest. The Confederated Tribe resides on the Warm Springs Indian Reservation in Central Oregon. The western boundary of the reservation is, in part, the eastern boundary of the Forest along the crest of the Cascade Range. The tribe has traditionally used the high alpine areas on the Forest for centuries.

ECONOMIC ENVIRONMENT

Oregon Economy

Gross Product Value - Oregon has historically been dependent on its manufacturing sector as an economic base. Although the State's economy is gradually becoming more diversified industries based on production still dominate with a gross product value of 10.92 billion. Despite the 1981-1982 recession, the lumber and wood products industry is still the largest component of the manufacturing sector with a 1986 gross product value of 2.49 billion. Gross product value (or gross state product) is the value of the final output of all goods and services produced. Other major groupings and their 1986 gross product values are: producer services - 9.54 billion; distributive - 9.17 billion; government - 5.04 billion; social services - 2.85 billion; personal services - 2.08 billion; and extractive - 1.69 billion.

Oregon has traditionally depended on its natural resources as a major source of employment, income, and wealth; however, this industry has declined and is likely to continue to decline over the next decade. The gross product value of the lumber and wood products industry peaked at 2.98 billion in 1979. The national recession caused three years of decline to a low of 1.77 billion in 1982. The gross product value began rising again when the recovery started in 1983 but has not continued a steady growth.

Producer and social service sectors are the fastest growing in the state. Social services has more than doubled from 1.16 billion in 1977 to 2.85 billion in 1986. Producer services replaced at a similar rate of increase from 3.92 billion in 1977 to 9.54 billion in 1986. The transformative category including manufacturing, construction and utilities had the slowest growth of only 49% in the last decade. These figures point towards an economy shifting from a manufacturing base to a service-oriented economy.

The gross product value of the distributive category steadily increased during the last decade experiencing only a small decline during the recession. Overall this category experienced a 90% growth and is now the third largest industry in the state.

The extractive classification which is predominately agriculture is the smallest industry in terms of gross cash receipts. The total value of agricultural production has increased steadily during the 1980s. Values for 1982 through 1983 were lower than the $1.47 billion of 1980 because of lower commodity prices for many crops.

Much of the income associated with agriculture goes to purchases in other industrial sectors (e.g., farm machinery) rather than to labor. Employment in agriculture has been declining due to mechanization and the switch to less labor-intensive crops.

While agriculture is very important to the economy of the sparsely populated east side of the State, the most economically significant area in the State is the agriculturally diversified Willamette Valley. It produced about 40% of Oregon's agricultural product cash income in 1982. In 1984, Marion, Linn, and Lane counties ranked first, seventh, and tenth, respectively, in gross farm sales for Oregon counties. These three counties had $350 million in sales or about 20% of the state total.

The recession of the early 1980s either slowed or reversed established growth trends for many of the state's major industries. The sustained recovery that the nation has been experiencing since 1983 is reversing this decline. Figure III-Y-5 displays recent trends in gross product value for major industries of the state.

Table III-Y-5. Oregon Gross Product Value [1]

Year	Lumber and Wood Products [2]	Tourism and Travel [3]	Farming and Food Processing	Transportation	Construction	High Technology [4]
1983	2.88	1.56	1.97	1.33	1.08	1.39
1982	2.30	1.41	1.87	1.22	1.07	1.42
1981	2.54	1.27	1.89	1.24	1.31	1.39
1980	2.90	0.84	1.93	1.21	1.59	1.27
1979	3.22	0.79	1.61	1.12	1.65	1.07
1978	2.97	0.73	1.38	1.01	1.41	0.88
1977	2.57	0.51	1.09	0.89	1.15	0.70
1976	2.20	0.44	1.15	0.78	0.93	0.55
1975	1.71	0.50	1.14	0.67	0.80	0.48
1970	1.15	0.27	0.64	0.45	0.46	0.28
1965	0.86	0.18	0.48	0.36	0.40	0.16
1960	0.63	0.15	0.45	0.26	0.26	0.09

Oregon: A Statistical Profile, Oregon Economic Development Department, April, 1985.

[1]Billions of Current Dollars
[2]Includes paper and allied products.
[3]Includes out-of-state vacationers only. Other travelers not included.
[4]Includes Machinery, Electrical equipment and instruments. Not all machinery is in the high technology industries but is included here.

Employment - The gradual diversification of Oregon's economy is the result of two major shifts which are best seen through trends in the state's employment. The first is a change within the manufacturing sector. The lumber and wood products industry no longer dominates manufacturing employment to the extent it once did.

Despite high harvest levels in 1985, employment in the wood products industry declined. Increased productivity, automation, and a desire to reduce costs is in part an explanation to a trend that began two decades ago and accelerated during the recession.

Technological advances towards automation have significantly reduced the amount of labor required to process given amounts of timber. In sawmills and planing mills, it took about eight employees to

process a million board feet of timber in 1950. By 1979, only 4.5 employees were needed to process the same amount and in 1984 this was down to 3.4 employees.

In addition to technological advances substantial reductions in employment occurred during the recession as many older and less cost efficient mills closed. From 1980 to 1985 approximately 60 mills have closed in Oregon and have not reopened.

Over 16,000 timber industry jobs have been lost as a result of these changes. Despite having fewer mills with fewer workers, almost as much wood was processed in Oregon in 1985 as in the peak year of 1979. This indicates that most, if not all, of these jobs will never be recovered.

Other manufacturing industries have increased in importance as the timber industry has declined. Employment in high technology and metals increased dramatically in the 1960s and 1970s. The combined employment of these industries exceeded that of the lumber and wood products industry in 1989.

The growth and diversification in the manufacturing sector has not been uniform across the state. Much of it has been occurring in the Portland metropolitan counties. The rest of the state remains heavily dependent on wood products for its manufacturing employment. Figure III-Y-6 shows the percent distribution of state employment for major manufacturing sectors.

The second major change occurring in the Oregon economy is the shift from a manufacturing based economy to a nonmanufacturing or service-oriented economy. The nonmanufacturing component of nonagricultural employment has risen rapidly and been affected less by recessions than manufacturing employment. Between 1970 and 1980 manufacturing employment increased by about 25% compared to 60% for nonmanufacturing. This trend continued from 1980 to 1989 with manufacturing employment increasing by only 1% as compared to a 24% increase in nonmanufacturing. Figure III-Y-7 shows employment and percent of total for major sectors of the state's economy since 1960.

Figure III-Y-6. Oregon Manufacturing Employment

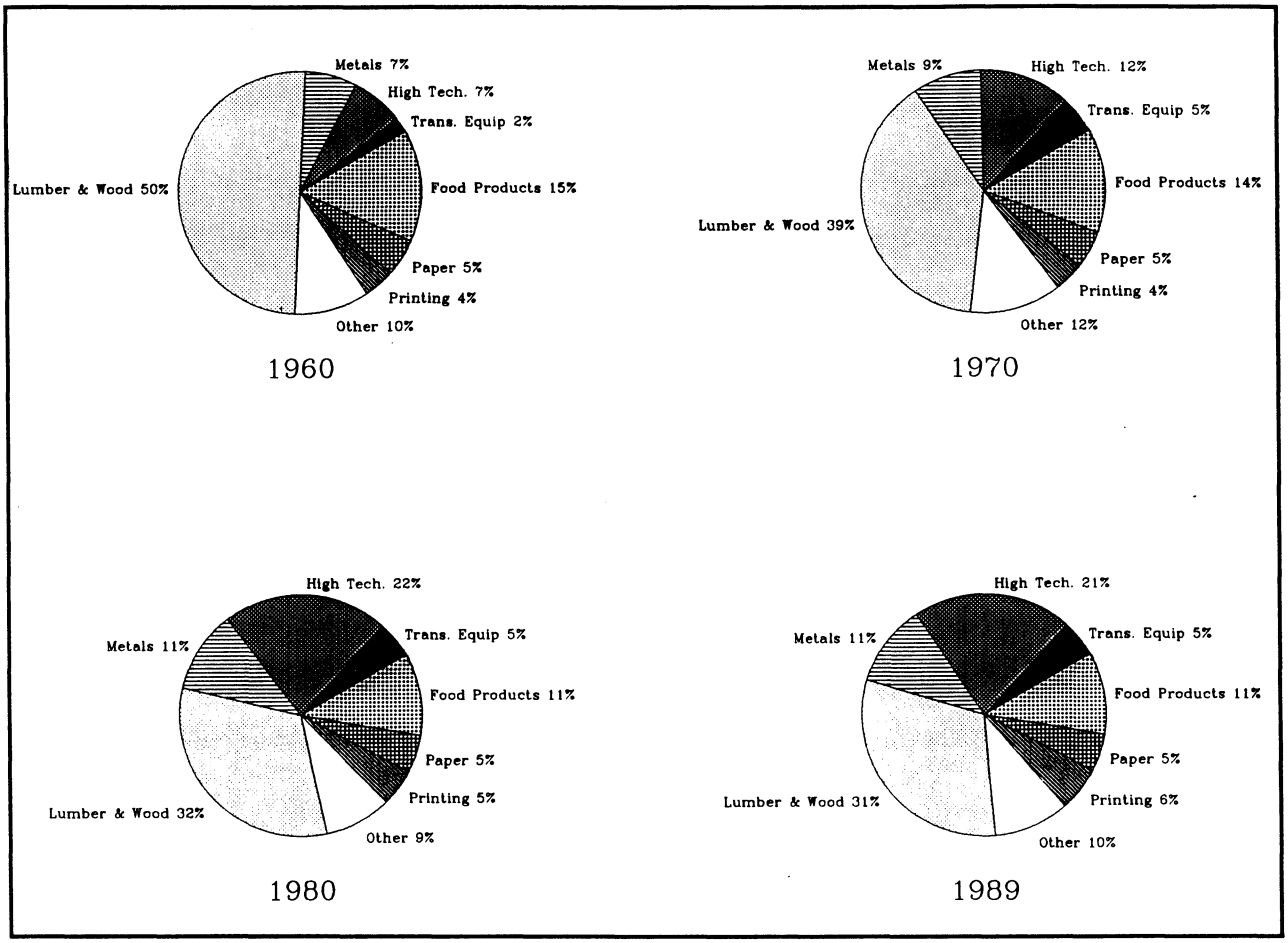
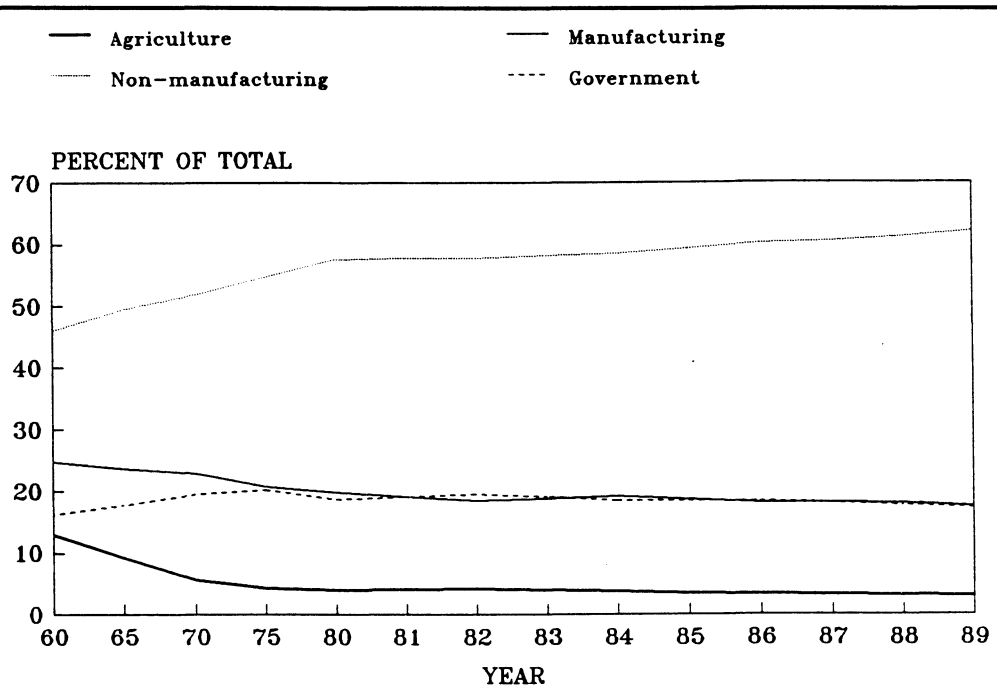


Table III-Y-7. Oregon Employment by Major Sector [1]



		Agriculture		Manufacturing		Non-Manufacturing		Government	
Year	Total	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent
1989[1]	1,244.0	37.3	3.0	217.2	17.5	774.3	62.2	215.2	17.3
1988	1,193.1	37.1	3.1	214.2	18.0	730.6	61.2	211.2	17.7
1987	1,137.3	37.2	3.3	206.2	18.1	688.3	60.5	205.6	18.1
1986	1,096.2	37.7	3.4	198.4	18.1	659.9	60.2	200.2	18.3
1985	1,067.6	37.6	3.5	199.3	18.7	633.0	59.3	197.7	18.5
1984	1,046.4	39.5	3.8	201.1	19.2	611.7	58.5	194.1	18.5
1983	1,006.9	40.2	4.0	188.8	18.8	585.6	58.2	192.3	19.1
1982	1,002.9	42.1	4.2	185.7	18.5	579.6	57.8	195.5	19.5
1981	1,061.5	43.1	4.1	202.7	19.1	613.1	57.8	202.6	19.1
1980	1,087.6	43.0	4.0	215.1	19.8	626.3	57.6	203.2	18.7
1975	874.7	37.3	4.3	182.1	20.8	478.2	54.7	177.1	20.2
1970	751.7	42.5	5.7	172.3	22.9	390.2	51.9	146.7	19.5
1965	669.0	61.6	9.2	158.2	23.6	331.0	49.5	118.2	17.7
1960	585.4	76.2	13.0	144.4	24.7	269.5	46.0	95.3	16.3

[1]Amount (in Thousands) and Percent of Total.
[2]1989 data are preliminary estimates

Sources: *Oregon: A Statistical Profile,* Oregon Economic Development Department, April 1985.
"Oregon Labor Trends," Employment Division, Oregon Department of Human Resources, February, 1986.
Employment Division, Oregon Department of Human Resources, February, 1989.

Economy of the Primary Area of Influence

Overview - The industries which are important to the State of Oregon are also important to the three counties which represent the Forest's primary area of influence. The impact the Forest has on the health and stability of these industries, however, varies considerably.

All three counties have a significant part of their manufacturing-based labor force in the lumber and wood products industry. Lane, Linn, and Marion county mills processed about 826 million board feet of timber from the national forest land or about 27% of the state's total in 1985. Over 75% of this was harvested from the Forest; consequently, changes in the amount of timber offered for sale by the Forest can affect a large number of people.

The direct effects are felt primarily in communities with lumber and wood products companies. Indirect effects are felt in other sectors over a much wider area. Employment and income in the service, trade, transportation, and other sectors throughout Western Oregon are linked to the lumber and wood products industry. Moderate-to-large changes in timber sale levels by the Willamette will affect these industries.

Other major industries are indirectly affected by changes in Forest management. The agriculture and food processing industries are very important to Lane, Linn, and Marion counties. Management of the Forest, however, has little effect on these industries. Demand for domestic livestock forage from the Forest is expected to remain virtually nonexistent, even though the Forest has some good grazing potential. Commercial fisheries are affected somewhat by changes to fish habitat on the Forest, but these effects occur in the counties along the Lower Columbia River and not in the primary area of influence. Thus, despite being very important to the overall economy in the three-county area, employment and income in the agriculture and food processing industries is not directly affected by changes in Forest management.

Tourism is another major industry in the primary area of influence. Recreation-related trade and services are important to the smaller towns within or adjacent to Forest boundaries as well as to the larger cities in the southern and central Willamette Valley. The Forest provides many of the recreation opportunities that support the industry in this area.

Tourism is an "industry" in the sense that it is a reason for economic activity to occur. The employment and income associated with or dependent on tourism and recreation is rather difficult to estimate. Unlike individual economic sectors such as lumber and wood products, tourism is composed of a broad spectrum of other industries. These include durable (e.g., recreation equipment) and nondurable (e.g., food products) manufacturing, wholesale and retail trade, transportation, and services. Historical information related to the many pieces of sectoral economic activity associated with tourism is generally not available. Thus, the discussion and data on employment and income in the three-county area will not deal directly with tourism as a separate or unique industry.

Employment - *Lane County* - Lane County is the largest county in the primary area of influence in terms of population and employment. It is the leading producer of lumber and wood products in Oregon. In 1985, its mills processed over 527 million board feet from the national forest land or 16% of the State's total. About 421 million board feet or 81% of this was harvested on the Willamette.

The structural changes occurring in the State's economy are also occurring in the economy of Lane County. A changing manufacturing base and a shift towards a more service-oriented economy are resulting in a gradual diversification in a county long dependent on the lumber and wood products industry.

Lumber and wood products employment in Lane County represented about 10% of the total nonagricultural wage and salary employment and about 53% of manufacturing employment in 1989. In 1972 these figures were about 20 and 74%, respectively.

This decline began before the 1981-1982 recession and reflects increased productivity per worker due to improvements in technology. Between 1972 and 1979 about 900 timber industry jobs were lost. The recession accelerated this job loss with about 3,800 jobs being lost between 1979 and 1982. As the economy improved over the next two years about 1,200 jobs were regained; however, pre-recession employment levels in this industry are not expected to return.

The most significant employment increases between 1980 and 1989 were in the service and trade sectors. Employment in services increased by 7,600 from 19,700 in 1980 to 27,300 in 1989. Trade employment experienced an increase of 3,400 jobs from 25,700 to 29,100 during this same period.

In the manufacturing sector employment in the nonlumber component increased by about 56% or about 1,900 jobs from 1980 to 1989. This reflects the slow diversification of the manufacturing sector. Figure III-Y-8 displays actual employment data by sector for a number of years between 1970 and 1989.

The Eugene/Springfield area is somewhat more diversified than the county as a whole. The area serves as a trade and service center for much of Western Oregon. The University of Oregon and Lane Community College in Eugene are also major employers which help put government employment in Lane County above the state average. In 1989 Lane County's government employment sector comprised 20% of the total nonagricultural wage and salary employment compared to 18% for the state.

Many of the outlying smaller communities are more dependent on wood products than the Eugene/Springfield urban area. While mills in some communities rely on wood from other suppliers, others get a substantial amount of their timber from the Forest.

Other communities, like those up Highway 126 along the McKenzie River, are dependent on recreation-related trade and services. The Forest supplies many of the opportunities which attract recreationists who spend money and support the businesses in these communities.

Table III-Y-8. Lane County - Nonagricultural Wage and Salary Employment

	Annual Average							
	1970	**1980**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**
Manufacturing, Total	18,400	19,800	19,300	18,600	18,000	19,900	20,900	21,100
Durable Goods	15,400	16,300	15,300	14,600	13,900	15,500	16,500	16,500
Lumber & Wood	13,600	12,900	11,700	10,800	10,100	11,100	11,500	11,200
Other Durable	1,800	3,400	3,700	3,700	3,800	4,400	5,000	5,300
Nondurable Goods	3,000	3,500	4,000	4,100	4,100	4,300	4,400	4,600
Food Products	1,550	1,500	1,600	1,700	1,700	1,600	1,600	1,600
Other Nondurable	1,450	2,000	2,400	2,400	2,500	2,700	2,800	2,900
Nonmanufacturing, Total	51,250	83,100	76,900	78,300	81,200	85,200	88,900	93,700
Mining & Quarrying	0	0	200	200	200	200	200	200
Construction	2,950	4,600	2,800	2,900	2,900	3,300	3,400	3,900
Trans., Comm., & Utilities	4,150	5,100	4,300	4,300	4,100	4,200	4,300	4,400
Trade	14,650	25,700	24,600	24,700	25,500	26,600	27,800	29,100
Finance, Ins., & Real Estate	2,950	5,500	4,600	4,500	4,600	4,900	5,300	5,500
Services & Misc.	10,050	19,700	19,700	20,500	22,100	23,800	25,100	27,300
Government	16,500	22,500	20,900	21,200	21,800	22,300	23,000	23,200
Total Wage & Salary	69,650	102,900	96,300	96,900	99,200	105,100	109,800	114,800

Source: Employment Division, Department of Human Resources, State of Oregon.

Linn County - Linn County has the smallest population and is the most rural of the three counties in the primary area of influence. Its manufacturing sector has historically accounted for a higher proportion of its total employment than Lane County, but also has been less dominated by the lumber and wood products industry. In 1989 manufacturing employment accounted for almost 33% of total nonagricultural wage and salary employment. Employment in lumber and wood products industries accounted for about 41% of total manufacturing compared to 53% for Lane County in that same year.

Jobs provided in lumber and wood products declined overall by 19% from 5,200 in 1980 to 4,370 in 1989. The services and trade sectors again showed the largest employment increase. Employment and trade services increase 24% from 5,670 in 1980 to 7,010 in 1989. Employment in services increased 56% from 3,800 to 5,550 during the same period. Though, a shifting from manufacturing to a service oriented economy is taking place, lumber and wood sectors are still important to many of the communities in Linn county. Figure III-Y-9 displays actual employment data by sector for a number of years between 1970 and 1985.

Linn County mills processed over 113 million board feet of timber from national forest land in 1985 which was less than one quarter the amount processed in Lane County. About 80% of this came from the Forest. Some of the smaller communities closer to the Forest boundary are somewhat more dependent on the timber industry than the county overall. Both Lebanon and Sweet Home have a number of mills which employ a high percentage of the people in those communities.

Table III-Y-9. Linn County - Nonagricultural Wage and Salary Employment

	Annual Average							
	1970	**1980**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**
Manufacturing, Total	9,340	11,070	10,140	9,730	9,630	10,410	10,410	10,790
Durable Goods	7,330	8,590	7,730	7,390	7,450	7,900	8,050	8,000
Lumber & Wood	4,730	5,200	4,940	4,370	4,430	4,780	4,650	4,370
Other Durable	2,600	3,390	2,790	3,020	3,020	3,110	3,390	3,630
Nondurable Goods	2,010	2,480	2,410	2,340	2,180	2,240	2,370	2,790
Food Products	970	1,120	1,020	880	740	750	800	990
Other Nondurable	1,040	1,360	1,390	1,470	1,440	1,500	1,570	1,790
Nonmanufacturing, Total	11,630	19,500	17,910	18,170	18,930	19,430	20,760	22,070
Construction	990	1,390	840	910	880	910	980	1,110
Trans., Comm., & Utilities	1,010	1,360	1,260	1,320	1,340	1,370	1,380	1,430
Trade	3,480	5,670	5,390	5,730	6,070	6,020	6,470	7,010
Finance, Ins., & Real Estate	720	1,290	1,230	1,140	1,200	1,040	1,020	1,060
Services & Misc.	2,290	3,800	3,940	3,990	4,220	4,760	5,490	5,910
Government	3,140	5,990	5,250	5,070	5,230	5,310	5,420	5,550
Total Wage & Salary	20,970	30,570	28,050	27,900	28,560	29,570	31,180	32,860

Source: Employment Division, Department of Human Resources, State of Oregon.

Marion County - Marion and Polk counties make up the Salem Metropolitan Statistical Area (MSA). Marion County residents account for approximately 82% of the MSA population. Employment in the MSA is dominated by the government sector which employed over 27,800 people in 1989. More than half of these government workers are employed by the State and work in Salem, the State capital.

Manufacturing employment in the MSA is very small. It accounts for about 15% of total nonagricultural wage and salary employment. Employment in the lumber and wood products industry increased steadily from 1984 to 1988 providing an additional 800 jobs. Slightly less than 192 million board feet of timber was processed in Marion and Polk County mills in 1985. About 56% of this came from the Forest.

Along Highway 22 in the North Santiam Canyon lie the small incorporated cities of Stayton, Mill City, Gates, Detroit, and Idanha. These communities are much more dependent on the lumber and wood products industry than the Salem metropolitan area. Several mills are located in these communities.

Recreation-related trade and services are also important to the North Santiam communities. Many retirees are moving to the area and Highway 22 is a major travel route between Salem and central Oregon.

Figure III-Y-10 displays actual employment data by sector for Salem MSA for a number of years between 1970 and 1989.

Table III-Y-10. Salem MSA - Nonagricultural Wage and Salary Employment

	Annual Average							
	1970	**1980**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**
Manufacturing, Total	10,600	14,300	13,100	13,400	13,500	14,500	15,300	15,600
Durable Goods	4,600	6,800	6,500	6,700	6,900	7,400	8,100	8,200
Lumber & Wood	2,400	3,500	3,100	3,200	3,500	3,800	3,900	3,800
Other Durable	2,200	3,300	3,400	3,500	3,500	3,600	4,200	4,400
Nondurable Goods	6,000	7,500	6,600	6,700	6,600	7,100	7,300	7,400
Food Products	4,000	5,000	4,700	4,800	4,500	4,900	4,800	4,900
Other Nondurable	2,000	2,500	1,900	2,000	2,100	2,300	2,500	2,500
Nonmanufacturing, Total	44,600	74,000	72,100	75,300	77,500	82,000	86,100	88,900
Mining & Quarrying	0	0	100	100	100	100	100	100
Construction	2,600	4,200	2,600	2,900	3,000	3,200	3,500	4,100
Trans., Comm., & Utilities	1,900	2,800	2,500	2,500	2,700	2,900	2,900	2,800
Trade	11,300	19,200	19,300	20,200	20,600	21,600	22,800	23,500
Finance, Ins., & Real Estate	3,100	5,600	5,200	5,000	5,300	5,500	5,600	5,400
Services & Misc.	7,900	14,800	15,700	16,600	17,800	19,100	20,800	22,000
Government	17,800	27,400	26,700	28,000	28,100	29,700	30,500	31,100
Total Wage & Salary	55,200	88,300	85,200	88,700	91,000	96,500	101,500	104,500

Source: Employment Division, Department of Human Resources, State of Oregon.

Personal Income - Income and wage data are other indicators of the relative health of an economy. Several types of income-related data can be used to compare areas or changes over time. These include total personal income, median family income, per capita income, covered payroll, average hourly earnings, poverty rates, and common wage rates. This discussion will focus on total personal and per capita income. Total personal income is a measure which will be used to compare land management planning alternatives. Most of the other indicators are discussed in the Forest's Socio-Economic Overview.

Total personal income is the income of local residents from all sources before taxes and Social Security are withheld. Per capita income is total personal income divided by the total population of the area.

Total and per capita personal income in Oregon and the three-county area have risen steadily since the recession of 1981-1982. Total personal income in both Oregon and in the primary area of influence increased 35% between 1980 and 1989. All components of total personal income, however, have not increased at the same rate.

Personal income for the three-county area lags behind that of the state and the nation when measured on a per capita basis. Per capita income exceeded the national average in the late 1970's but was hit so hard during the recession that it still lanquishes 8% below the national average. Explanation of the lag in per capita income when compared to the state and the nation can be explained in part by the effects on unemployment of the 1981-1982 recession on the local economies which are structured somewhat differently than the state and national economies. Many of the jobs lost in Lane and Linn counties were in the construction and lumber and wood products industries which are generally

higher-paying jobs. Marion County was not affected as much because it has a lower proportion of its workforce in the industries hardest hit by the recession. It also has a large number of moderate to high-paying jobs in the government sector.

The rate of increase between the counties and the U.S. have remained fairly consistent. Between 1982 and 1989, per capita income increased by 37, 30, and 31% in Lane, Linn, and Marion counties, respectively, 32% in Oregon, and approximately 33% in the nation.

A review of earned personal income (i.e., total income less dividends, interest, rent, and transfer payments) by sector gives an indication of the industries which contribute the most to the personal income of an economy. In Lane County durable goods manufacturing, services, and government each accounted for about 18, 24, 18% of total earned personal income in 1987, respectively. Most of the durable goods manufacturing comes from the lumber and wood products industry. Retail trade was the only other sector accounting for more than 12%.

The pattern is somewhat different in Linn and Marion counties, however. Durable goods manufacturing accounted for 31% of Linn County's earned personal income in 1987. This came primarily from the lumber and wood products industry and primary metals manufacturing. The service and government sector were the only other sectors accounting for more than 12% of the total.

The two sectors which provided over half of Marion County's earned income in 1983 are government with 30% and services with 21%. Marion County has a relatively small durable goods manufacturing base accounting for only 7% of the total personal income.

The distribution of earned personal income for Lane County most closely approximates that of the state. Over 54% of Oregon's personal income is derived from the durable goods manufacturing (16.1%), services (22.3%), and government (16.3%) sectors. Figure III-Y-11 compares the 1983 earnings by industry for Lane, Linn, and Marion counties and the State of Oregon.

An examination of earned personal income by industry over time also gives an indication of how county economies are changing. The 1981-1982 recession had somewhat similar effects on Lane and Linn counties. In both cases the percentage of total income in durable goods manufacturing declined between 1982 and 1987 while the proportion in services increased. Some of this change could be due to the gradual trend towards economic diversification occurring in these counties.

The proportion of income derived from major sectors did not change significantly in Marion County during this time period. A minor shift away from nondurable goods manufacturing and government towards services did occur. Shifts within major sectors such as durable goods manufacturing may also have occurred.

Table III-Y-11. Total Earnings by Sector, 1987 [1]

	Lane County		Linn County		Marion County		Oregon	
Economic Sector	MM$	% of Total	MM$	% of Total	MM$	% of Total	MM$	% of Total
Farming	37.6	1.5	50.0	6.4	90.0	4.7	920.0	3.4
Mining	6.6	0.3	0.7	0.0	4.0	0.2	63.1	0.2
Construction	131.6	5.4	33.4	4.3	105.9	5.5	1,399.0	5.1
Manufacturing	546.7	22.4	318.4	40.5	253.2	13.1	5,833.0	21.4
Transportation and Utilities	142.6	5.8	52.2	6.6	82.5	4.3	2,038.5	7.5
Wholesale Trade	143.2	5.9	26.7	3.4	86.0	4.5	1,861.0	6.8
Retail Trade	301.0	12.3	66.4	8.5	207.4	10.7	2,908.0	10.7
F.I.R.E. [2]	81.1	3.3	15.0	1.9	95.8	5.0	1,412.2	5.2
Services	583.4	23.9	115.7	14.7	410.2	21.2	6,088.0	22.3
Government	441.3	18.1	99.8	12.7	576.2	29.8	4,443.1	16.3
Other [3]	27.0	1.1	7.0	0.9	19.6	1.0	284.0	1.0
TOTAL	2,442.1	100.0	785.3	100.0	1,930.8	100.0	27,249.9	100.0

[1]Total personal income less dividends, interest, rent, and transfer payments in millions of dollars.
[2]Finance, Insurance, and Real Estate.
[3]Agriculture Services, Forestry, Fisheries, and International Organizations.

Source: Employment Division, Department of Human Resources, State of Oregon.

Finally, a comparison of the percentage of income derived from an industry and the percentage of employment associated with it gives an indication of wage levels and the relative employment and income impacts which might be expected from the analysis of Forest plan alternatives. An examination of Lane, Linn, and Marion county data shows that the percentage of total employment in manufacturing, construction, and transportation, communications, and utilities is lower than the percentage of total income. This indicates that these industries tend to have higher paying jobs.

The opposite is for the trade sector. The percent of employment in this sector tends to be higher than the percentage of total income generated. This is a reflection of the generally lower average pay associated with jobs in this sector.

Payments to Counties - Counties having National Forest land within their boundaries receive a portion of the revenues taken in by the Forest from the use of the land or sale of its resources. The distribution of payments to counties occurs in one of two ways. National Forest System lands money that is returned to the federal treasury 25% is distributed to counties based on the amount of National Forest land within their boundaries. These funds are earmarked for schools (25%) and roads (75%).

On Oregon and California (O&C) Railroad grant lands, 50% of the money paid to the Federal Treasury is returned to the Bureau of Land Management for distribution to the counties having these lands.

Revenues from the Forest are derived primarily from the harvest of timber. Over 99% of the Forest's revenues came from this source. Other revenues came from recreation user fees and permits for special uses, grazing, minerals, power, and other land uses.

The "25% funds" from National Forest system lands on the Willamette are divided among six counties: Clackamas, Douglas, Jefferson, Lane, Linn, and Marion. Almost 97% of the money returned goes to the three counties which make up the Forest's primary area of influence: Lane, 60%; Linn 29%; and, Marion 8%. About 3% goes to Douglas County and less than 1% to the other two counties combined.

Revenue from O&C Lands administered by the Forest averaged less than 5% of total timber revenues between 1979 and 1985. The Forest contains over 51,000 acres of O&C Lands or about 3% of its total landbase. Most (99%) of these are in Lane County.

Revenues returned to counties from National Forest land play an important part in county and school district budgets. A 1979 study found that revenues from all the National Forests accounted for an average of 17.4% of all the Oregon counties revenues in fiscal year 1977-1978. This represented a 50% increase over 1968-1969.

Dependency on revenues from any one source can be a problem if that source is subject to unpredictable short-term changes. This has been the case with Forest revenues that are predominantly dependent on the market for timber.

Forest revenues peaked in 1979 when both the volume harvested and the price of timber were high. Prices and volume harvested fell significantly during the 1981-1982 recession, but have recently regained strength with prices approaching the 1980 highs and the third harvest level in 1988 bringing 1/3 higher receipts than the highest previous harvest in 1979.

Receipts rose slowly in 1983 and 1984 and took a relatively large jump in 1985 and again in 1987 as the economic recovery finally reached the wood products industry in Oregon. Most of these increases were due to increases in the amount harvested, not increases in prices. Only recently have prices begun to increase above recessionary levels. From 1987 to 1988 there was a 23% increase in revenues with a corresponding increase in prices and a in volume harvested.

Figure III-Y-12 displays Forest revenues for 1979 through 1989 and their distribution to counties.

As long as payments to counties are linked to volume harvested they will be subject to periodic fluctuations. The relationship between timber prices and harvest levels is an important one affecting both total revenues and payments to counties. While it would appear to be in the interest of local counties to have high prices for National Forest timber, high prices can discourage harvest activity and result in less revenue. Low timber prices encourage harvest activity and may increase payments to counties more than rising prices would.

Timber prices are affected by a variety of factors at the local, regional, and national levels. The Forest's sale quantity, the supply from other producers, and national demand will all affect total revenues and payments to counties.

Table III-Y-12. Forest Revenues [1]

	Fiscal Year						
National Forest Fund (NFF)	**1979**	**1981**	**1983**	**1985**	**1987**	**1988**	**1989**
Timber (Net Stumpage)	93,971.6	65,368.7	39,567.1	63,903.9	94,917.5	117,493.2	122,542.0
Grazing	0.0	0.5	0.4	0.4	0.5	0.5	0.7
Recreation Special Uses	65.1	59.7	93.3	73.0	185.8	214.5	223.3
Recreation User Fees	59.9	78.4	98.9	141.3	109.1	134.5	182.5
Land Uses	7.2	7.2	9.2	17.9	21.0	18.0	22.0
Power	0.1	0.1	0.2	0.8	0.4	2.1	0.9
Minerals	5.6	3.2	8.0	36.4	3.8	6.5	10.2
SUBTOTAL	94,109.5	65,517.8	39,777.0	64,173.7	95,238.1	117,869.3	122,981.6
K-V [2] Collections	5,562.6	6,559.7	10,145.2	13,450.3	6,172.0	11,015.8	12,461.8
Purchaser Road Credits	10,859.4	15,267.3	14,207.4	9,392.0	11,047.3	10,171.6	9,563.3
TOTAL NFF RECEIPTS [3]	110,531.5	87,344.8	63,936.5	87,016.0	112,457.4	139,056.7	145,006.7
O&C Receipts [4]	8,441.0	3,523.4	3,130.9	2,821.6	6,410.3	7,579.9	6,636.0
	Distribution of NFF Receipts by County [5]						
Clackamas	13.8	10.9	8.0	10.9	15.7	18.1	21.1
Douglas	856.6	676.9	495.5	674.4	921.6	1,065.4	1,240.6
Jefferson	11.1	8.7	6.4	8.7	11.6	13.4	15.6
Lane	16,521.7	13,055.9	9,556.9	13,006.7	17,784.0	20,581.9	23,965.2
Linn	7,930.6	6,267.0	4,587.4	6,243.4	8,522.5	9,868.0	11,490.7
Marion	2,299.1	1,816.8	1,329.9	1,809.9	2,476.0	2,867.5	3,339.1
TOTAL	27,632.9	21,836.2	15,984.1	21,754.0	29,731.4	34,414.3	40,072.3

[1]Revenues in thousands of dollars.
[2]Knutson-Vandenberg.
[3]25 percent of these funds are returned to counties.
[4]50 percent of these funds are returned to counties by the Bureau of Land Management.
[5]Distribution of National Forest Fund (NFF) funds is based on the percent of total Forest acreage in each county.
[6]Fiscal year 1987 timber receipts incluse $965,211.35 in timber buyout receipts.

Other Influenced Areas

Some counties outside the Forest's primary area of influence are affected, though to an lesser extent, by management of the resources on the Forest. A brief discussion of the relationship of the Forest to some of these counties follows.

Clatsop and Columbia counties, located at the mouth of the Columbia River in northwest Oregon, are affected by the management of fish habitat on the Forest. Their economies are impacted by production levels of spring chinook salmon on the Forest. Up to 75% of the fish taken during the short spring chinook gillnetting season may have originated in the rivers and streams of the Forest.

These counties are lightly populated, although Columbia County is becoming more attractive to Portland commuters. The economies of both counties depend on agriculture, wood products, and paper. Fishing, seafood processing, and tourism are also important to Clatsop County. Although tourism continues to do well, wood products, seafood processing, and fishing have been declining.

Benton County is lightly populated, but growing. It has one of the more stable economies in Western Oregon. While wood products are important, the biggest employers are not wood products firms, but rather Oregon State University and Hewlett-Packard. Agriculture is also important.

People of Benton County have been strongly represented among the Forest's recreation users, especially in Wilderness use. Unlike Portland area people who can easily visit the Mt. Hood National Forest, Benton County backpackers find that the closest high altitude country is on the Willamette.

Douglas County mills have bought a small portion of Forest timber. The county has been rapidly growing, but still remains lightly populated. Over one-third of its people live in and around the Roseburg urban area. Douglas County is one of the most (if not *the* most) timber-dependent counties in Oregon; over four-fifths of its manufacturing sector employment is in lumber and wood products. In addition, its nonmanufacturing sector is relatively small. During the recession of the past few years, it has had one of the highest unemployment rates in Oregon.

NONNATIONAL FOREST LAND

This section discusses the relationships between National Forest land and lands of other ownerships. This includes parcels of nonnational forest land surrounded by National Forest, and parcels of National Forest lands surrounded by land of other ownerships.

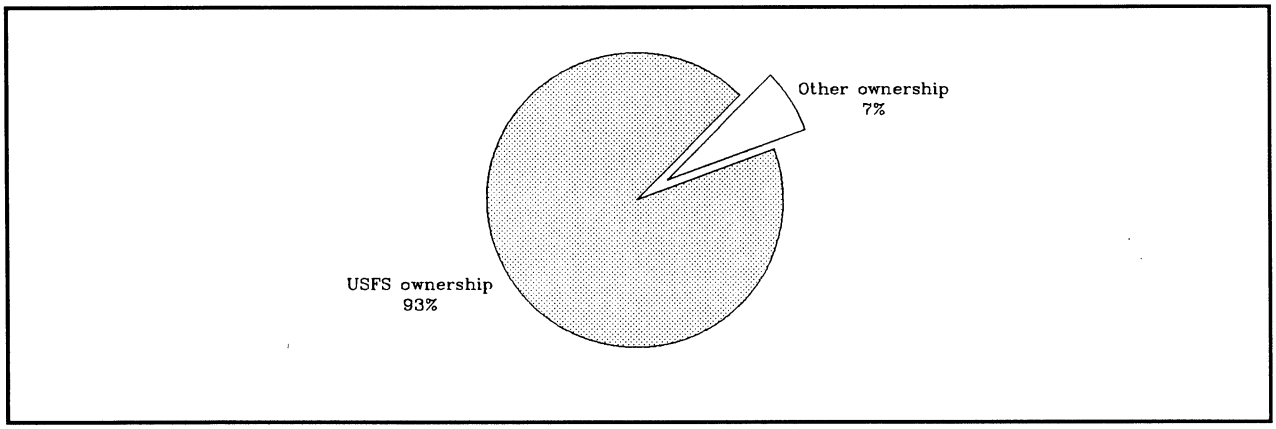
Current And Historic Conditions

Land Ownership Status

There is a variety of land ownership patterns within the proclamation boundary of the Forest. These patterns include unbroken federal ownership, attributable to early Forest Reserve set-asides; checker-board patterns, resulting from land grants made for the construction of railroads and wagon roads; and a mixed mosaic of ownerships, resulting from homestead and mining claim patents; other public land laws which made public domain lands available to the public for acquisition; and blocks of private land resulting from land exchanges.

Most of the Forest is in unbroken federal ownership. Although there are areas where management complexity is increased due to the ownership pattern, the overall impact of the ownership pattern on Forest management is low when compared to other units in the National Forest System. Figure III-Z-1 displays land ownership distribution within the Forest.

Figure III-Z-1. Land Ownership on the Forest



The Corps of Engineers, Bureau of Land Management, and the State of Oregon administer or own land within or adjacent to the Forest. The incorporated communities of Idanha, Detroit, Oakridge, and Westfir are within the exterior boundaries of the Forest. In addition, there are several smaller settlements which are unincorporated.

There are eight major owners of private lands within the Forest boundary: Willamette Industries Incorporated, Weyerhauser Company, Champion International Corporation, Pope and Talbot, Giustina Brothers Lumber and Plywood Company; Young and Morgan, Timber Services Incorporated,and Hill Family Interest.

The management of included or adjacent private land is occasionally encumbered by the need for access across National Forest land. Other landowners may be affected by management activities on the Forest, such as timber harvest and road construction.

Adjacent private ownerships may impact the National Forest through various types of trespass and increased risk of wildfires. Management activities require a coordinated approach to maintain resource values.

Ownership Adjustments

Past adjustments have been made by donations, purchases, interchanges and exchanges. The Oregon and California (O&C) Lands Exchange Act (53 Stat. 1144), July 31, 1939, and Public Law 426 (68 Stat. 170), June 24, 1954 blocked up some Forest ownership by adding over 51,000 acres. Through Fiscal Year 1982, the Forest obtained approximately 60,000 more acres through the other various acquisition methods.

The primary objective of land ownership adjustments on the Forest is to simplify management problems and help improve multiple use management of all lands within the Forest (USDA 1969). High priority is placed on improving efficiency in administering the Forest; protecting and enhancing environmental quality, and maintaining and improving land and resource productivity.

The current land adjustment action plan provides for the consolidation of ownerships, through the acquisition of small parcels of interior private lands and disposal of small isolated parcel of National Forest System lands. In addition, it provides for acquiring lands and rights-of-way needed for administrative improvements and lands with high recreation potential.

Rights-of-way Acquisition and Grants

Existing ownership patterns often require reciprocal granting of rights-of-way for access roads, tail holds, landings, and flyways for timber harvest activities. Special use permits and leases for numerous public utilities, businesses, and community uses of National Forest lands are complicated by these intermingled ownerships. Maintaining visual, fish, wildlife, and water quality management objectives is complicated by mixed ownership of habitats, watersheds, and viewsheds.

There are seven areas on the Forest where the major landowners have agreed to share the cost of construction, maintenance, and operation of a single road system across both private and National Forest lands for the mutual benefit of the landowners. In 1984, there were 136 supplements covering approximately 507 constructed road miles and 77 road miles to be constructed with cooperators in share-cost agreements.

Landowners not participating in share-cost agreement areas generally cooperate with the Forest Service in granting access to federal timber. There are approximately 388 existing rights-of-way acquired from nonshare-cost agreement landowners.

Access across National Forest lands is granted to cooperators and roading authorities by permanent and temporary easements, or special use permits, and is granted to others only through the special use permit process. There are approximately 120 easements existing on the Forest.

Future Trends

The future workload in land adjustments on the Forest could become increased somewhat over that at present. As the commercial timber is harvested from private lands within the Forest boundary, some of these lands could become proposed for exchange by the owners. The extent to which this situation might occur would be affected, in part, by the economic situation related to the lumber industry in the Northwest.

There are other considerations that could affect the rate of activity in land adjustments on the Forest. These include the interchange proposal between the Forest Service and the Bureau of Land Management and the recent Congressionally designated Columbia River Gorge National Scenic Area. The extent of the effects on land adjustment, if any, from these proposals is not clear at this time.

As the Forest development road system becomes completed, it is expected that the number of rights-of-way acquired will be less.