average of the county population projections as follows

Local Counties	**50%**
Sacramento/Yuba City Area	**30%**
Rest of California	20%

Table 3-15 shows estimated future recreation use for each Recreation Opportunity Spectrum (ROS) Class According to these projections, developed recreation demand will exceed supply by the middle of the third decade Total developed recreation (public and pnvate) capacity is 1,055,000 RVD's while projected fourth decade use is 1,155,900 RVD's Until then, existing developed recreation facilities are assumed to meet demand

On high use weekends, it will not be possible to meet peak demand at the more desirable developed facilities Recreation users can be encouraged to use facilities not traditionally full. Temporary overflow sites can also be provided, or additional capacity on high demand sites can be built

"Pnvate developed recreation under Forest Service permit is included with "public developed" for total recreation projections However, it will probably not grow substantially in relation to total developed recreation One reason is the lack of new capacity for recreation residences **(53** percent of private recreation) on Forest land Indicators are static growth in organized sites (27 percent of pnvate use) and declining use for resorts and lodges (three percent of private use) If private recreation does increase, the Forest will consider increasing capacity on a site by site basis

g. Trends

Developed Recreation Past reductions in capital financing for recreation have reduced the emphasis on construction of new facilities for developed recreation Reductions in operation and maintenance funds have provlded the impetus to explore concession operation of public campgrounds by the pnvate sector The operation of the Eagle Lake campgrounds by a concession is the first attempt at this

With the recent increase in snowmobiling, the Forest has improved snowmobile opportunities by building parking areas and warming huts financed by State Off-Highway Vehicle "Greensticker" funds Additional developments are planned with the implementation of the 1989 Winter OHV Management Plan.

Dispersed Recreation As population increases and emphasis on developed recreation facilities decreases, increased dispersed recreation is expected. It is difficult to predict the trends in specific dispersed reereation activities; however, maintaining a range of recreational opportunities through the Recreation Opportunity Spectrum (ROS) should help meet the varied recreation needs of the future

Recreation Residences Because of the anticipated demand for water-onented recreation in the future, continued occupancy of waterfront reereation residence lots will need to be monitored. For this planning cycle, use of the majority of the 400 recreation residences is expected to continue

16. SENSITIVE PLANTS

a. Introduction

Sensitive plant species are those native plants listed as Sensitive by the Regonal Forester This listing is based on the special management emphasis needed to insure their viability and to preclude the need for Federal or State listing as Threatened or Endangered

Public interest in Sensitive plants is based both on aesthetic appreciation and on the ecological pnnciple of "saving all the pieces" Since these species exist in small discrete populations, excessive disturbance to their specialized habitats could cause extinction

Because the Forest typically has large tracts of uniform habitat types, most plant species are widely distnbuted Only twelve species that have been designated as Sensitive by the Regional Forester are known to occur on the Forest (*Orcuttia tenuis* and *Gratiola heterosepala* are listed as Endangered by the State) Their habitats tend to be small and isolated and the plants are normally sparsely distnbuted Therefore, populations of these species are easily overlooked

b. Populations

The twelve Sensitive plant species that are known to occur on the Forest are:

Arabzs constancez (Constance's Rock Cress)
Asplenium sepentrionale (Northern Spleenwort)
Calochortus longebarbatus var longebarbatus (Long haired star tulip)
Eryngzum mathazszae (Mathias' Coyote Thistle)
Gratzola heterosepala (Boggs Lake hedge-hyssop) - State Endangered
Lupınus dalesıae (Quincy Lupine)
Mımulus pygmaeus (Egg Lake monkeyflower)
Penstemon personatus (Closed throated beard tongue)
Orcuttıa tenuzs (Slender Orcutt grass) - State Endangered
Scheuchzerza palustrıs uar amerzcana (Amencan scheuchzerıa)
Sedum albomargznatum (Feather River stonecrop)
Senecio eurycephalus var lewısrosei (Cut-leafed butterweed)

These species occupy specific and localized habitats mthin the Forest

Constance's rock cress (*Arabıs constancei*) grows in rocky serpentine areas near Yellow Creek

Northern spleenwort ***(Asplenium septentrıonale)*** grows on volcanic rock outcrops in and near Lassen Volcanic National Park

Long-haired star tulip (*Calochortus longebarbatus*) grows usually at the margins of grassy meadows that are wet in spring and early summer and dry out completely in middle to late summer

Mathias' coyote thistle (*Eryngium mathiasıae*) grows in vernal pools and seasonally wet drainages in the northern part of the Forest

Bogg's Lake hedge-hyssop (*Gratıola heterosepala*) grows in vernal pools and reservoirs on the Hat Creek Ranger District California State Endangered

Quincy lupine (*Lupınus dalesıae*) is a yellow flowered lupine found in open, rocky soil in the Feather River drainage It is found near Yellow Creek on the Almanor Ranger Distnct

Egg Lake monkeyflower (*Mımulus pygmaeus*) is a miniscule annual apparently restncted to moist soil areas in meadows, along streams, and in drying muddy pools on flats

Closed throated beard tongue ***(Penstemon personatus)*** is a perennial herb gromng on dry hillsides in **fir** and mixed conifer forests Populations are known on the southern boundary of the Forest.

Slender Orcutt grass (*Orcuttıa tenuıs*) is a member of the grass family that grows in the beds of vernal pools on the northern portion of the Forest

American scheuchzeria ***(Scheuchzerza palustrıs var amerıcana)*** is a perennial bog plant last seen in California in 1897 and presumed extinct It was recently re-discovered on the Forest at Willow Lake and Domingo Lake

Feather River stonecrop ***(Sedum albomorgınatum)*** grows on serpentine rock cliffs near Yellow Creek

Cut-leafed butterweed ***(Senecioeurycephalus uar lewısrosei)*** is a small perennial herb foundin the Yellow Creek area of the Almanor Ranger Distnct It is associated mth serpentine soils

In addition to the twelve species known to occur, 10 other plant species with low population numbers have a high probability **of** occumng on the Forest They are:

Stoloniferous pussy-toes (*Antennarıa flagellarıs*) grows in gravelly soil with low sagebrush just north of the Forest

Wilkin's harebell ***(Campanula wılkınsıana)*** has been sighted on private land surrounded by Lassen National Forest.

Talus collomia (*Collomıa debılis* spp *larsenii*) is an alpine species with very few locations in California, including Lassen Volcanic National Park

Butte County fritillary (*Fritillaria eastwoodiae*) is found in foothills from Butte to Shasta Counties

Cantelow's lewisia (*Lewisia cantelowii*) grows on wet granite cliffs or outcrops both north and south of the Forest

Bellinger's meadowfoam (*Limnanthes floccosa* spp *bellingeriana*) grows in vernal pools and drainages, it has been collected near Lake Britton Taxonomy of this subspecies is uncertain

Stebbins' monardella (*Monardella stebbinsii*) grows on serpentine soils; known from Yellow Creek and Feather River drainages

Modoc County knotweed (*Polygonum polygaloides* spp *esotericum*) grows in seasonally dry flats and pond basins in sagebrush and juniper woodlands

Short petalled campion (*Silene invisa*) is known from the Tahoe, Plumas, Eldorado, Shasta-Trinity, Stamslaus, and Toiyabe National Forests, and in Lassen Volcanic National Park.

Salmon Mountains wakerobin (*Trillium ovatum* spp *oettingeri*) grows near wet or moist drainages in mured comfer forests just northwest of the Forest.

These plants occur on lands surrounding the Lassen National Forest in similar habitats, so it is highly probable that they occur in the Forest as well The Forest can improve its Sensitive plant program by inventorying specific habitat for these species and providing protection to any newly located populations.

c. Population Status

The California Native Plant Society, California Natural Diversity Data Base, and Forest personnel have provided the Forest with up-to-date information on known locations and distributions of Sensitive plant populations However, knowledge of their total abundance and management needs is incomplete, since literature and field surveys have been done only in response to specific project proposals, and no comprehensive Sensitive plant surveys have been completed It is important that all existing populations of these plants be surveyed to fully assess their population status and distribution

In plannmg and implementing resource projects, known locations of Sensitive plants are avoided or effects are fully mitigated If a new Sensitive plant is encountered, it receives similar protection, as outlined in the Forest Semce Manual (2670) and the R-5 Threatened and Endangered Program Handbook

d. Opportunities

The Forest will conserve Sensitive plant populations by identifying their specific habitats and preventing their disturbance or destruction The first step is to complete a comprehensive survey of all suitable and potential habitats Once the populations of a plant are located, care can be taken to protect its habitat, and thereby insure that the species remains in a viable condition If viability of a species is threatened, steps can be taken to protect or restore habitat or to otherwise increase populations

The Forest can maintain Sensitive plant populations if all planned timber sales and other projects continue to be assessed for Sensitive plants It may also become necessary to modify existing grazing uses, proposed road locations, timber harvest units, relocate burning unit boundanes, or other habitat disturbances The need for such action, however, is likely only in occasional isolated situations

Individual Sensitive plant management guides will be developed to aid in species' conservation.

17. SOILS

a. Introduction

Soil is the basic resource that directly or indirectly supports all other resources Soil productivity is necessary for wood, forage, vegetation, habitat, and watershed protection The soil serves as a growth medium for plants, filters biologxal and chemical substances, and regulates water transmission Various soil characteristics determine whether the soil is suitable for such things as timber harvest, road construction, facility construction, or range and wildlife improvement projects

Soil productivity is defined as the capacity of the soil, in a specific environment, to produce bio-

mass The factors that influence the productivity of the soil are: soil depth, texture, amount of rock fragments, available water-holding capacity, nutrient status, duff layer, mineral toxicity, pH, and soil organisms. Soil productivity is one of five environmental factors in determining overall site productivity Other environmental factors are precipitation, aspect, slope, and elevation

b. Current Management

The goal of current management is to maintain soil productivity This requires avoiding management actions that would irreversibly impair soil productivity. Soil productivity is also monitored to detect significant changes caused by management actions In addition, current management requires restoring or rehabilitating areas where soils are degraded There is a backlog of such areas on the Forest

Areas of soil degradation are located on all Districts Some Forest soils have been degraded by three main causes erosion, soil compaction, and loss of soil nutnents. The first of these is most common. Site-specific locations of soil degradation will be determined when the Watershed Improvement Needs (WIN) inventory is updated in the first decade.

An estimated **1,500** acres are in need of restoration In recent years, annual restoration work has varied from 10 to **40** acres, the base year restoration target was **15** acres The **1980** RPA targets were a "first approximation" estimate of restoration needs which now appear to be inaccurate Present funding and staff limitations do not allow completion of the RPA projected work (for example, 170 acres per year in the first decade)

Water Quality Management for National Forest System Lands in California

Current management for soils involves two types of actions The first is to adhere to Best Management Practices (BMP's) for water quality protection In the process of protecting water quality, they also help to protect the soil resource. BMP's for the Pacific Southwest Region are described in the document entitled *Water Quality Management for National Forest System Lands in California* (See Appendix Q for a listing of BMPs)

For example, a BMP may require installing cross ditches on skid trails The ditches divert water off the trail, to undisturbed sites beside the trail where the water's energy is dissipated, thus preventing soil erosion

The other type of action in current management for soils is providing input into environmental analyses for ground-disturbing projects. Grazing systems and timber harvests are designed to avoid or minimize soil compaction, soil erosion, stream sedimentation, and other types of damage to the soil resource Clearcut blocks, roads, skid trails, and landings receive careful attention in timber sale design and administration

Specific practices the Forest applies to protect soils during timber sales include

- Designing and constructing roads to reduce erosion
- Locating skid trail to minimize compaction in other areas
- Prohibiting tractors and requiring log end-lining (yarding) in wet areas and creek beds to reduce erosion, compaction, and puddling
- Restricting tractors from cinder cones and from slopes steeper than **35** percent to reduce surface disturbance
- Logging steep slopes by cable or helicopter to reduce erosion

c. Soil Inventories

The Forest is covered by two soil resource inventories. That portion of the Forest in Tehama County is covered by the Tehama County Soil Survey (1967), an Order 2 survey. The balance of the Forest is covered by the Lassen National Forest Soil Survey **(1984)** This was a medium-intensity (Order **3)** survey which is suitable for displaying the general kinds and locations of soils for broad planning purposes It is not suitable for project level planning or design which will require that more detailed Order 2 inventories be conducted at the project level.

d. Types of Soils

Based on the Forest Soil Survey, several observations can be made regarding soil resources and development Most of the Forest soils have formed in weathered volcanic rock material

Minor portions of the Forest have soils denved from granitics, nonmarine sediments, metavolcanics, and metasediments Most of the Forest's soils have high percentages of rock fragments Depth to bedrock vanes widely from shallow (less than 20 inches) to very deep (more than **60** inches), but in most areas it is moderately deep to deep (20 to 60 inches) Over the eastern portion of the Forest the volcanic bedrock is highly fractured This has a marked influence on runoff and other hydrologic charactensticsofthe overlying soils. Water normally sinks directly to groundwater with little overland runoff

The soils on the Forest can be grouped into 12 generalized map units, each of which is a broad area with a distinctive patternof soils, relief, and drainage. Each map unit is therefore a unique natural landscape. Table **3-16** lists soil groups made accordingto the 12 generalized map units mentioned above. Although there are other soils found on the Forest, these soils are representative ofthe more dominant soiltypes. Also shown is the extent and productivlty of each soil group. The soils of the Forest differ widely in their productive capacity.

Most Productive The most productive soils usually have large available water holding capanties and usually lie in hgher precipitation zones. They are normally deeper and more finely textured with fewer rock fragments These soils are well drained and typically occur on ridge surfaces and canyon walls on slopes gentler than **35** percent. Loam or sandy loam textures are found in the surface, with finer-textured subsoils. Depth to bedrock is greaterthan 40 inches Timber regeneration usually succeeds on these soils, as they are relatively easy to plant and seedling survival rate is high.

Moderately Productive The next most productive soils are the moderately deep and stony soils. These are well drained soils that occur on all land surfaces and on slopes up to 70 percent They have loam or sandy loam textures in the surface and may have subsoils with finer textures Depth to bedrock is between 20 and 40 inches and very often rock fragments make up more than **35** percent of the soil Regeneration usually is successful, but more expensive because of difficult planting caused by the rock fragments Seedlingsurvival rates are alsolower compared to the deep soils because of lower available water holding capacities.

Least Productive The least productive soils are those shallow soils that occur generally below 5,000 feet and on those miscellaneous land types that occur at all elevations on the Forest. These soils range from somewhat poorly drained to excessively drained and occur on all slopes They generally have loam or sandy loam textures throughout Depth to bedrock is less than 20 inches; very often more than **35** percent of the soil is rock fragments Regeneration is often unsuccessful because of difficult planting conditions and low available water holding capacities.

Timber Regeneration Timber regeneration is one ofthe main concerns of soil management In each of the very general soil groups listed in Table **3-16,** there are soils that are easily regenerated and others that are very difficult or impossible to regenerate The ability of the soil to regenerate can be broken down into at least two parts plantability and survivabilty Plantability concerns whether it is physically possible to put a seedling into the soil Plantability depends mainly on the amount of rock fragments present, but also on soil depth and slope Survivabilty concerns the chances of the seedling surviving after it has been planted. Many factors affect seedling survival, but the major one is probably the amount of soil moisture available for the plant compared to the plant's water requirements **As** the "water balance" approaches zero or becomes negative, the chance of seedling survival decreases **A** more detailed soil survey (Order 2) will be conducted to determine the location and extent of the Forest's soils having potential regeneration problems

e. *Soil Productivity*

Soil productivlty can be affected by almost all management activities; from timber harvest, to livestock grazing, to recreational use of the land **In** order to determine changes in soil productivity, soil quality standards (SQS) have been established Soilquality standards provlde threshold values beyond which further changes in soil properties or conditions would result in significant change or impairment in the productive capacity, hydrologic function or enmronmental health of the soil

Significant change in the productivity of the land is indicated by changes in soil properties that are expected to result in about a **15** percent

Table 3-16
Forest Soils

Soil Group	Representative Soil Families	Acres	Percent of Forest	Cu. Ft/Ac/Yr Timber
Front-country soils occurring below 5,000 feet	Pass Canyon	22,740	2.0	20-40
	Los Gatos	17,055	1.5	NA
	Lithic Haploxeralfs	15,918	1.4	15-30
	Toomes	22,740	2.0	NA
	Guenoc	11,370	1.0	NA
	Keating	14,781	1.3	NA
	Aikman	9,096	8	NA
High elevation summer rangeland, above 5,000 feet	Aquolls	23,877	2 1	NA
	Durixerolls	20,466	1 8	NA
	Litluc Haploxerolls	13,644	1.2	NA
	Rouen	10,233	9	NA
Low elevation, generally highly productive timber soils, occurring below 5,200 feet	Holland	59,124	5.2	120-160
	Bobbitt	45,480	4.0	30-70
	Skalan	44,343	3 9	80-119
	Washougal	13,644	1.2	50-84
	Neer	12,507	1.1	85-119
	Brownlee	11,370	1.0	25-49
	Sadie	10,233	.9	85-119
	Alicel	7,959	.7	50-80
High elevation, moderate to highly productive timber soils above 5,200 feet	Sheld	81,864	7 2	70-119
	Yallani	68,220	6 0	100-150
	Inville	54,576	4 8	65-84
	Portola	28,425	2 5	85-119
	Wintoner	20,466	1 8	85-119
	De Masters	19,329	1 7	70-100
Eastside pine soils above 5,200 feet and of moderate productivity	Trojan	76,179	6.7	50-70
	Inville	88,686	7 8	60-80
	Klicker	57,987	5.1	50-85
	Patio	55,713	4 9	50-65
	Boomtown	28,425	2.5	NA
Generally lugh elevation soils occurring on glaciated areas and cinder cones	Xeric Durandepts	17,055	1 5	20-49
	Typic Xerorothents	10,233	9	85-119
	Zynbar	6,822	.6	65-84
Generally high elevation soils occurring on the Diamond Mtn. and High Lakes areas	Gerle	9,096	.8	65-84
	Klicker, sedimentary	9,096	.8	50-84
	Lithic Ultic Argixerolls	4,548	4	NA
Miscellaneous land types occurring at all locations	Lava Flow	68,220	6 0	NA
	Rock Outcrop	22,740	2 0	NA
	Rubble Land	11,370	1 0	NA
	Lithic Xerumbrepts	5,685	5	NA
	Lithic Xerochrepts	5,685	5	NA

NA = Not applicable because timber does not grow on these soils

or more reduction in productive capacity over the planning honzon

Significant impairment of the productivlty of the land includes changes in soil properties that result in significant changes in the inherent productive capacity of the soil that extend beyond the planning honzon

Management activities can alter a vanety of soil properties in varying degrees which may or may not have measurable effects on soil productivity Therefore, it is desirable to identify a few soil properties or conditions that can serve as indicators of change in the productive capacity of the soil

Changes in the quantity and quality of soil cover, soil porosity and organic matter have beenlinked with changes in the long-term soil productivity potential. Practical means are available to measure or observe these soil properties or conditions in the field. The condition of other soil properties can be inferred by the status of soil porosity and organic matter because of the interrelationships between soil properties.

Soil porosityis used to reflect changes caused by compaction or puddling Organic matter is evaluated in three ways. as a part of soil cover for erosion prevention, as source matenal for soil organism habitat for nutnent cycling; and as soil organic matter to reflect nutnent status, soil moisture supply, and other physical and chemical properties

Soil cover provldes surface soil protection to prevent accelerated sheet and rill erosion rates from exceeding the rate of soil formation Soil cover can include litter, duff, loggmg slash, rock fragments, living vegetation, or applied mulches such as straw and wood chips

Soil porosity refers to the amount of air space in the soil Soil compaction and puddling occur when larger pore spaces are reduced in size and the soil becomes more dense. The availability of water, air and nutnents to plant roots decreases as soil density increases. This is due to reduced area that roots are able to penetrate and reduced air movement in the soil. This is especially important in dry summer areas such as the east side of the Lassen Forest, where plants rely on stored moisture for growth Generally, puddling occurs when a load is applied to wet soils Ruts with raised berms are common evidence of puddling Compaction generally occurs when a load is applied to moist or dry soils The visual evidence of compaction is less obvlous than with puddling, except in extreme cases Evidence of compaction includes hard dense layers, platy structure and equipment-caused depressions without berms

Organic matter is the reservoir for short- and long-term nutrient supply. It serves as habitat for soil organisms which convert nutnents into usable forms for plants Organic matter can also lessen adverse physical effects such as compaction. Litter, duff and small woody material is the pnmary sourceofnutnentreplenishment Large woody material provides hot summer survival habitat for microorganisms, small animals and insects that convert nutnents into usable forms or spread nitrifying bactena

Soil organic matter is mixed in the upper layers of the soil It is associated with short-term nutrient supply, soil water availability, soil aggregate stability, infiltration and resilience from compression Management activities that result in piling or displacing soil have the greatest effect on soil organic matter.

Soil quality standards apply to areas where management prescriptions are applied, such as forest and range production areas The standards do not apply to lands dedicated to other uses, such as administrative sites and roads The following threshold values have been set to determine the degree of detnmental soil disturbance At least 85 percent of the area dedicated to growing vegetation shall meet or exceed these values

Soil couer is sufficient to prevent the rate of accelerated soil erosion from exceeding the rate of soil formation The kind, amount and distnbution of soil cover necessary to avoid detrimental accelerated soil erosion is guided by the Regon 5 Erosion Hazard Rating (EHR) system and locally adapted standard erosion models and measurements

Soil porosity is at least 90 percent of the total porosity found under undisturbed or natural conditions. Porosity is evaluated between four and eight inches below the surface for soils with tree and shrub potential natural

communities; and between zero and four inches for soil with herbaceous potential natural plant communities

Organic matter is present in amounts sufficient to prevent significant short- or long-term nutrient cycle deficits, and to help avoid adverse physical soil charactenstics

The kinds and amounts of organic matter are guided by the following and by local analyses

- Soil organic matter in the upper twelve inches of soil is at least 85 percent of the total soil organic matter found under undisturbed or natural conditions

- Surface organic matter is present in the following forms and amounts

  Litter and duff occurs over at least **50** percent of the area The minimum organic layer thickness is determined locally and it is based on an amount sufficient to persist through mnter season storms and summer season oxidation.

  Large woody matenal, when occurring in the forested area, is at least five logs per acre in contact with the soil surface Desired logs are about **20** inches (or larger) in diameter, about ten feet (or more) in length, and represent the total range of decomposition Logs in the latter stages of decomposition must be protected from mechanical disturbance Large woody matenal requirements may be waived in strategic fuel break areas

- Soil moisture regime is unchanged where productivlty or potential natural plant communities are dependent upon specific soil drainage classes

- Soil hydrologic function Infiltration and permeability are not reduced to ratings of six or eight as defined in Regon **5** Erosion Hazard Rating system

- Soil environmental health Soil reaction class, buffering or exchange capacities, or biological populations are not altered to the degree that significantly effects soil productivity, soil hydrologic function, or the health of humans and animals

Erosion Natural erosion occurs on most areas of the Forest This erosion would occur even if man's activlties were absent. Natural erosion is caused by water and wind While some sedimentation occurs from this erosion, the streams are usually able to transmit the sedimentation with no detrimental effects. Human-caused erosion is usually associated m th a management activity, principally timber harvesting and livestock grazing Erosion can generally be classified either as sheet and rill erosion or as gully erosion Both types are commonly associated with water movement and loss of the protective canopy cover and soil litter Excessive erosion can reduce the site productivlty because the surface soil that contains most of the necessary plant nutrients is eroded away first Excessive erosion can affect off-site areas by increasing sediment in streams, which harms fish life and water-dependent activities downstream Preventing soil erosion is especially important because soil losses are irreversible on the scale of the human lifetime Human-caused erosion on the Forest can be prevented or controlled by the use of Best Management Practices The Forest has about **252,000** acres of soils with a high erosion hazard rating (EHR) The majonty of this area is highly erodible due to steep slopes (over **35** percent), but some of it has erosive rhyolite soils or Eocene non-marine sediments Metasediments, metavolcanics, granitics, and cinder cones can be erosive if water is concentrated.

Compaction It is commonly accepted that soil compaction is occurnng on the Forest and that it affects plant growth In order to harvest timber, a certam amount of compaction is inevitable Research is needed to further define the scope and degree of the existing problem. New sources of compaction also need to be analyzed, such as biomass removal and loggmg on wet soils Based on the research results, the Forest then needs to determine standards that define how much compaction is acceptable

The effects of soil erosion and compaction can be reduced by maintaining adequate vegetative cover and by limiting loggmg on moist soils This helps maintain soil productivlty not only directly

by softenmg the impacts of precipitation, runoff, temperature, and wind, but also indirectly by returning organic matenal to the soil

f. Trends and Opportunities

Demands are growing **for** forest products and amenities such as wood, water, forage, fish, wildlife, and recreation To meet these demands, continued production of goods and services from the limited land base is necessary This requires maintaining the existing soil productivity and also improving the soil in degraded areas. It not only increases the capability of the land to produce, but also makes the Forest more aesthetically pleasing

A complete survey is needed to identify and pnontize all areas on the Forest requinng restoration A Watershed Improvement Needs (WIN) inventory is scheduled for completion during the Plan decade Several areas have already been identified, and there is an opportunity to continue to add new projects to the inventory **as** they are located

In addition to restonng detenorated soils, there are opportunities to improve soils that are not damaged They include both artificial fertilization, and natural fertilization (e.g., leavlng biomass matenal on the ground to decay and return nutnents to the soil) Currently, artificial fertilization is not widely done on the Forest White fir stands usually respond to artificial fertilization **As** opportunities arise, these stands should be sampled to determine if there is a nutnent deficiency. At this time, the full extent of the possibilities to increase production through fertilization are not known.

g. Data Reliability

The soils data were obtained pnmanly from the Forest Soil Resource Inventory. Its reliability is limited for project planning because it had 40-100 acre mapping units, **low** sampling rate, and areas where ground-checkmg was not feasible. Reliability of the Tehama County survey within the Forest is limited for project planning by a low sampling rate and large areas not ground-checked The Tehama County portion of the Forest is being rechecked for accuracy and reliability as projects occur in that area

18. SPECIAL AREAS

The Forest has four types of exlsting or potential special areas a) Expenmental Forests, b) Research Natural Areas, c) National Natural Landmarks, and d) Special Interest Areas

The "Special Area" category is a general and informal one for some areas that the Forest Service has given special attention and management direction.

a. Experimental Forests

Introduction

An expenmental forest is an outdoor laboratory set aside for purposes of research and development of forest management techniques The Pacific Southwest Forest and Range Experiment Station is responsible for the management of experimental forests in the Region. The National Forest in which the experimental forest lies is responsible for implementing the Station's management direction for the expenmental forest Because the Chief of the Forest Semce establishes experimental forests, decisions to establish or abolish them do not lie with the Forest Supervisor **or** Regional Forester Therefore, this Forest planning process does not consider any change in the status of expenmental forests

Blacks *Mountain* and Swain Mountain Of the nine expenmental forests in the Region, two are located on the Forest The Blacks Mountain Expenmental Forest covers 10,252 acres of the eastside pine type on the Eagle Lake Ranger District. The timber gromng site is relatively good for the type The Swain Mountain Experimental Forest covers about 6,000 acres of the true fir type on the Almanor Ranger Distnct The timber growing site is above average for the type.

Within the Blacks Mountain Experimental Forest are **521** acres in five small parcels which constitute a Research Natural Area (RNA) The RNA is to remain in a natural condition for baseline and research purposes. Outside the RNA, much of the Experimental Forest is undergoing timber harvesting under vanous silvlcultural systems.

Essentially, expenmental forests are established and managed entirely for research purposes, whch means they are withdrawn from sustained timber production Each expenmental forest is managed under a long range plan for operation (approved in 1980 for Blacks Mountain and 1979 for Swain Mountain)

b. Research Natural Areas (RNA's)

Introduction

Research Natural Areas (RNA's) are areas set aside in perpetuity as baselines of natural ecologxal conditions. They are established by the Chief of the Forest Semce for several reasons: (1) to contnbute to the preservation of examples of all significant natural ecosystems for purposes of research and ecologxal study; (2) to provlde gene pools; and (3) where appropriate, to protect habitats of rare and endangered species of plants and animals (FSM 4063 R-5 Supplement 3) Nationally, the Forest Semce has a partial network of research natural areas with typical and/or unique charactenstics of scientific interest and importance The National Forest Management **Act** (NFMA) regulations direct that the Forest planning process recommend new RNA's **for** establishment to meet the needs of research, ecologxal study, and education Forest personnel will identify examples of important forest, shrubland, grassland, alpine, aquatic, and geologic types that have special or unique characteristics of scientific interest and importance, and that are needed to complete the national network of RNA's (36 CFR 219 25) Through the planning process each Forest will recommend establishment of new RNA's to the Chief of the Forest Semce for the physiographic province(s) in which it lies Most of the Lassen National Forest lies mthin the Cascade Range province The Regional and Forest planning issues also reflect public interest in recommending establishment of additional RNA's by the Chief.

Existing **RNA'S** Table 3-17 shows the research natural areas on the Forest that have been established by the Chief, in addition to those areas that are being recommended by the Forest Plan

Table 3-17

Existing and Candidate Research Natural Areas

Area	Biotic Type/ Unique Features	Size (acres)	Ranger Distnet
Existing RNA's			
Blacks Mountain	**Intenor Ponderosa Pine**	**471 (4 areas)**	**Eagle Lake**
	Open Sagebrush	**50 (1 area)**	Eagle Lake
Cub Creek	Mixed Conifer	3,922	**Almanor**
	Total	**4,443**	
Candidate RNA's			
Graham Pinery	**Pacific Pondersa Pine**	**660**	**Almanor**
Green Island Lake	Bog	**1,210**	**Almanor**
Indian Creek	**Blue Oak/ Digger Pine**	**3,890**	**Almanor**
Mayfield	Knobcone Pine/Geology	**980**	**HatCreek**
Soda Ridge	**White Fir**	**1,295**	**Almanor**
Timbered Crater	**Modoc Cypress**	1,777	**HatCreek**
	Total	**9,812**	

Candidate RNA's The Forest has six candidate RNA's, see Table 3-17.

Evaluation studies have not been completed for all candidate RNA's Candidates are still eligible for RNA status and, therefore, are also constant in all alternatives except CUR One area, Devil's Parade Ground, was analyzed hy the Region and subsequently dropped from consideration because it inadequately represented the target element Appendix F summanzes the RNA evaluation. The areas are

Graham Pinery This terrace drops off into Deer Creek and nearby canyons The pinery is an isolated park-like stand of ponderosa pines and oaks surrounded by a dense fnnge of small black oaks It lies at 2,320 to 2,810 feet in the Southern Cascade province, is remote and difficult to access. Graham Pinery was burned by the Finley Fire in 1990, and a replacement RNA for this target element will be sought

Green Island Lake This basin includes three small lakes in different stages of lake/bog/meadow succession, and a seasonal meadow/pond The slopes surrounding the meadows are red fir forest blending into montane chaparral and nparian deciduous vegetation Opportunities are abundant for research into lake-meadow succession, lodgepole-red fir succession, aquatic insects, etc The area lies at about 6,000 feet elevation of the Southern Cascades provmce, and has poor access, and therefore remains in natural condition

Indian Creek This drainage in the foothills has diverse vegetation communities including good blue oak/digger pine stands and annual grasslands It is remote and easily protected from outside influences. It lies between 2,000 and 3,000 feet elevation in the Southern Cascades province

Mayfield Located in rough, flat lava flows at the remote northern border of the Forest, the area is forested with knobcone pine and ponderosa pine The lava flows offer distinctive geologx features, including a wide spectrum of volcanic structures The area lies at 3,800 feet elevation on the Modoc Plateau A low-standard road allows access and occasional hunter use, but there are no resource conflicts.

Soda Ridge The north-facing slope offers an excellent example of mature white fir forest Its mosaic of stands represents different successional stages and fire histories, and provides excellent study opportunities into the relationships between fire history and stand development It lies between 4,500 and 6,000 feet elevation in the Southern Cascades province It is relatively remote, natural, and free of resource conflicts

Timbered Crater The rugged lava flow terrain is vegetated with a ponderosa pine forest that includes Modoc cypress and knobcone pine Northern basalt flow vernal pools with unusual plant species are also present Timbered Crater is accessible by road and lies at 3,600 feet elevation on the Modoc Plateau Applications have been filed in the area for geothermal exploration

Devil's Parade Ground This area has been analyzed by the Region and recommended as unsuitable for further RNA consideration because it poorly represents the black oak type This rugged canyon-cut area consists of north-facing black oak stands along lower Deer Creek The black oak type is not continuous, but is intermixed with blue oak, digger pine, and fnnged by mixed conifer Anglers use a trail in the area to reach Deer Creek, but off-trail use is very minor It lies at about 2,400 feet elevation in the Southern Cascade province

Until final selection and approval of RNA's by the Regional Forester and Chief, the Forest will manage all candidate areas to maintain their inherent qualities An aquatic communities RNA target system is being developed by the Region The Region has deferred development of a geologic RNA target system. Further inventory and investigation is needed into the significance of paleontological and geologx sites on the Forest

c. National Natural Landmarks

Introduction The National Natural Landmarks (NNL) program was established to (1) encourage the preservation of sites illustrating the geological and ecologxal character of the United States, (2) enhance the educational and scientific value of the site thus preserved, and (3) foster a greater concern in the conservation of the Nation's heritage

NNL Process The National Park Service conducts theme studies to identify potential sites that appear to meet the cnteria for natural landmarks Four general natural history themes are used to select areas: (1) Landforms of the Present, (2) Geological History of the Earth, (3) Land Ecosystems, and (4) Aquatic Ecosystems Forest planning direction is to recommend to the National Park Servlce areas to be nominated to the National Registry of Natural Landmarks In the Forest Plan or outside it, the Forest Supervisor can recommend sites to the USDI National Park Service that represent a diversity of the nation's environment according to the four themes. After evaluation by the National Park Semce, the Secretary of the Intenor can then approve the Forest Semce recommendations

Once an area is designated as a National Natural Landmark, the Regional Forester and Forest Supervisor take the appropnate steps to protect the important features Provided the integrity of the landmark is protected, no restrictions are placed on managmg the site under the multiple use concept

Potential NNL's Appendix G summarizes the evaluation of the potential National Natural Landmarks. The seven that appear eligible for NNL recommendation are listed in Table 3-18. A summary of each follows

Bogard Buttes The area is an unusual, distinctive alignment of at least 18 cinder cones It covers 5,120 acres northeast of Lassen Volcanic National Park Few other places in North America have so many cones aligned over such a long distance Some road building, cinder mining, and loggmg has altered the natural ground surface

*Deep **Hole*** The area is a symmetrical pit crater formed by the collapse of andesite lava It covers about 100 acres just west of Lassen Volcanic National Park It represents one of the few good pit craters outside Hawaii, with the possible exception of Lava Beds National Monument

Devil's Parade Ground The black oak vegetation type is intermixed with stands of blue oak, digger pine, and fringe mixed conifer The area covers 710 acres just east of the Ishi Wilderness Natural integrity is high as there is little visitation of the rugged area

Eagle Lake Area The second-largest natural lake entirely mthin California, Eagle Lake is a

Table 3-18

Potential National Natural Landmarks

Area	Feature	Size (acres)	Ranger District
Bogard Buttes	Aligned cinder cones	5,120	Eagle Lake
Deep Hole	Pit crater	100	Hat Creek
Devil's Parade Ground	Black oak vegetation type	710	Almanor
Eagle Lake	Multiple features	40,280	Eagle Lake
Hat Creek Valley	Volcanism and faulting	7,700	Hat Creek
Murken Bench	Volcanism and faulting	43,737	Hat Creek
Red Lake Mountain	Rare quartz-basalt	4,942	Hat Creek
	Total	102,589	

unique and environmentally sensitive place. The area offers numerous and varied physical and biological features: the junction of four physiographic provmces, the junction of several ecological types, key habitat for bald eagles and ospreys, key waterfowl habitat, and the Eagle Lake trout The area lies on the northeastern edge of the Forest and covers 40,280 acres of National Forest land within the Eagle Lake Planning Area, which also includes pnvate land and Bureau of Land Management land Roads, campgrounds, mannas, buildings, and other developments are located on Forest lands, and timber harvesting has occurred. The lake and tnbutary streams are highly important and sensitive resources

Hat Creek Valley The southern part of the valley offers an abundance and vanety of structural and volcanic features that illustrate the interrelationships between the two The 7,700 acre unit lies just north **of** Lassen Volcanic National Park and includes fault scarps, lava flows, lava tubes, ice caves, cinder cones, etc Two State highways cross the area, and several National Forest campgrounds lie along Hat Creek

Murken Bench Portions of the Hat Creek valley provide excellent examples of faulting, volcanism, and their interrelationships in uneroded volcanic terrain Features include lava flows, cinder cones, lava tubes, and tectonic features such as faults, fault blocks, and fault scarps. The area covers **43,737** acres in Hat Creek Valley, north of Lassen Volcanic National Park. Some developments such as dirt roads, powerlines, and recreation facilities have been built within the area.

Red Lake Mountain The unusual features of two relatively incompatible minerals (quartz and olivine) occurnng in the same basaltic rock make the area highly unusual The area covers 4,942 acres just west of Lassen Volcanic National Park The forested portions are commercial timber land that has been logged, but the geological aspects are unaffected by continuing timber management

Any area recommended to the National Park Semce in the Forest Plan for NNL designation will be managed as such until action by the Secretary of Intenor

d. Special Interest Areas

Introduction Special interest areas (SIA's) are broadly defined to include areas of unusual or outstanding botanical, aquatic, scenic, geologx, zoological, paleontological, cultural, or other unique charactenstics that may ment special attention and management

SIA Process Forest planning direction is to identify potential SIA's and establish qualified ones in the Forest Plan for approval by the Regional Forester There are many areas on the Forest that may be appropriate for **SIA** status. Many potential areas have been initially identified Screening to the final candidate list is based on (1) uniqueness and relative significance, and (2) special management need. Potential SIA's can be considered for RNA designation, requiring nomination by the Regional Forester and approval by the Chief of the Forest Semce.

Once they are classified (established) by the Regional Forester, SIA's are managed to protect their unique resources and, where appropnate, to foster their public use and enjoyment The Forest manages each formally designated area through a specific special interest area plan. These plans will be developed to protect the special features for which the area has been designated They will not include development and use of other resources such as timber harvesting, livestock grazing, or mining The SIA plan would be prepared after Forest Plan approval

Potential SIA's The supply of potential **SIA's** is gradually decreasing as man's activities alter scenic and undisturbed scientific qualities of many areas Of the many potential sites **sug** gested by Forest personnel and the public, and subsequently analyzed, approximately 60 areas were identified as having significant values They fall into five categories zoological, botanical/aquatic, geologic, cultural, and scenic Appendix H summarizes the evaluation of the potential SIA's on the Forest The great majority were found to not meet the minimum criteria for SIA's

(FSM 2360) The 14 that appear eligible for SIA classification are in Table 3-19.

A summary of each area follows

Black Rock Black Rock is an intrusive basaltic plug exposed by erosion It serves as a distinctive symmetrical landmark several hundred feet tall Its location at the bottom of the deep Mill Creek Canyon is unusual, forcing the creek to flow around it in a picturesque waterfall Black Rock occupies about 15 acres Roads and a campground are nearby

Crater Lake A small 40-acre lake located inside the caldera near the top of a shield volcano, Crater Lake is an uncommon geologic feature. The basin covers 200 acres in the east-central part of the Forest. A dirt road leads to the lake, with a small campground at the end of the road which is moderately popular to campers and anglers

Deep Hole Crater See National Natural Landmarks, above.

Deer Creek Surrounding the proposed Wild and Scenic River corridor, the Deer Creek area has attractive canyon scenery and interesting eroded mudflow geology The cliffs, bluffs, spires, and caves in the Tuscan formation are of scenic and geologx interest The area covers 14,108 acres of land in the southwest-central part of the Forest

Diamond Mountain This distinctive fault-scarp mountain range marks the northeastern most extent of the Sierra Nevada range It forms a scenic backdrop for the city of Susanville, a population center of about 10,000 The 5,399 acre mountainside lies on the eastern edge of the Forest, and has been only lightly marked by timber harvesting and road building

Eagle Lake Area See National Natural Landmarks, above

Hat Creek Valley See National Natural Landmarks. above

High Lakes This mountainous region offers scenic views of high Sierra meadows Old growth forests cover the bottom of a deep canyon and blend into rocky granitic slopes. It marks the intersection of the basaltic southern Cascades and the granitic Northern Sierra Glacial lakes, stnations, cirques and other features are common. A total of 17,054 acres are included near the southern boundary of the Forest Some dirt roads, jeep roads, mines, and campsites mark the area The area is used for OHV recreation

Homer/Deerheart Lakes The area is a row of three scenic glacial cirque lakes, each of a different color and each in its own separate basin They are perched on a steep escarpment marking the northernedge of the Sierra Nevada which is visible for long distances to the north Cultural values include Homer Lake and Keddie Ridge in

Table 3-19

Potential Special Interest Areas

Area	Feature	Size (acres)	Ranger District
Black Rock	Geolopc	15	Almanor
Crater Lake	Geologic	200	Eagle Lake
Deep Hole	Geologic	100	HatCreek
Deer Creek	Geologic	14,108	Almanor
Diamond Mountain	Scenic	5,399	Eagle Lake
Eagle Lake	Scenic/Geologic	40,280	Eagle Lake
Hat Creek Valley	Zoologic/Botanic Geologic/Scenic	7,700	Hat Creek
High Lakes	Scenic/Geologic	17,054	Almanor
Homer/Deerheart	Scenic/Cultural	1,480	Eagle Lake
Lake Britton	Cultural	600	HatCreek
Montgomery Creek	Botanic	20	HatCreek
Murken	Botanic	380	HatCreek
Rock Creek Falls	Scenic	10	HatCreek
Willow Lake Bog	Aquatic/Botanic	110	Almanor
Total		87,456	

local Native Amencan legend The 1,480 acre unit is unroaded and has one scenic hiking trail linking the lakes

Lake *Britton* Lying within a National Register of Histonc Places Distnct, the 600 acre unit contains important information on Native American cultures not available elsewhere Lake erosion and vandalism are damagmg some cultural properties Damage from diatomite mining can be mitigated in the plan of operations process Lake Britton is one of the most important cultural resource areas on the Forest.

Montgomery Creek ***Grove*** A small, high-site stand of mixed-conifer old growth that includes very large Douglas-fir trees, this area is a remnant of a forest type that is becoming increasingly rare as loggmg continues to liquidate old stands Pristine conditions prevail in this 20-acre natural area lying along the western boundary of the Forest

Murken ***Area*** An isolated area of westside foothill vegetation combines with Great Basin vegetation to create a 380 acre site of great botanical diversity. It encompasses part of Murken Bench, the Hat Creek Rim, part of the flat above the Rim, and a small vernal pool sagebrush flat Westside Digger pine, Oregon oak, buckbrush, and redbud grow intermingled with eastside mountain mahogany, sagebrush, bitterbrush, and Idaho fescue. Western juniper and ponderosa/ Jeffrey pine are the main conifers

Rock Creek *Falls* This two-tiered waterfall in a deep, rocky canyon is small, but scenic Lying along the Pacific Crest National Scenic Trail in the dry northwest corner of the Forest, it covers 10 acres and has a cool swimming hole at its base It is popular with campers, but its rocky surroundings preserve its natural condition and scenic appearance.

Willow Lake Bog The scenic lake contains an unusual floating bog that serves as a platform for at least two rare plant species, English sundew (*Drosera anglica)* and Amencan scheuchzeria (*Scheuchzeria* palustris *americana)* The Scheuchzeria is a plant last seen in 1897, and was believed to be extinct in California until its rediscovery in the bog in August 1988 This perennial plant has been added to the Region's Sensitive Plant List Such lakes as Willow Lake are relatively rare, and this one receives livestock grazing on the shoreline and angler tramphngon the bog itself It covers 110 acres of lake and nearby land just south of Lassen Volcanic National Park

19. TIMBER

a. Introduction

The Lassen is known as a timbered Forest About 73 percent of it is forested with commercial conifers, while 770,110 acres (68 percent) is available and tentatively suitable for timber production "Available" denotes land that is not set aside as wilderness, expenmental forests, or research natural areas "Tentatively smtable" indicates that regeneration of the timber is possible on the land

Forest Land Description The forested land is divided into four major timber types mured conifer, eastside pine, red fir, and lodgepole pine.

The mured conifer type occupies 57 percent of the productive land It consists of a mixture of white fir, ponderosa/Jeffrey pine, Douglas-fir, sugar pine, incense cedar, hardwoods, and other species. This type is found on the west slope of the Cascade and Sierra Nevada ranges between 3,000 and 5,500 feet elevation, and also on the Forest's east side on north-facing slopes

The eastside pine type occupies 29 percent of the forested land and **is** located in the northeastern portion of the Forest Ponderosa and Jeffrey pine are the predominant species with some white fir, incense cedar, and lodgepole pine Two other timber types are limited in acreage, but are important components of the timber resource. One, the red fir type, occupies 10 percent of the productive land and is found at the higher elevations, usually above 6,500 feet. The other type, lodgepole pine, occupies four percent of the productive land and is found on wetter sites at middle and higher elevations

Size Class Distribution The size distribution of suitable Forest timber is not in an even, or regulated, condition The current distnbution shows a preponderance in the pole and small sawtimber size classes, and relatively less in the smallest and the larger size classes, as shown in Table 3-20

Table **3-20**

Timber Size Class Distribution

Size Category	**Approx** Diameter Range	**Approx** Age Range (years)	Percent of Conifer Land
Seedlings, Sapling	0-5"	0-30	**4**
Poles	**5-11"**	30-60	**19**
Small Sawtimber	**11-24**	**60-120**	**55**
Medium-Large Sawtimber	>24"	**120+**	**19**
Two-Stoned Stands	Mixed	Mixed	**3**

Suitability Classes Under the current timber plan, forested land is divlded into three intensities of management full, modified, and limited The lands suitable for full or modified timber management (about 80 percent of the suitable land) can be regenerated artificially or naturally to achieve or exceed minimum stocking standards Because of this ability to regenerate and the desirability of reproducing shade-intolerant species such as ponderosa pine and Douglas-fir, even-aged regeneration cutting methods have been found appropnate They include clearcutting, seed tree, and shelterwood cutting Further discussion on silvlcultural systems may be found in Appendix **O** Intermediate cutting methods are also used, such as commercial thinning in immature stands, and sanitation harvests in mature stands

The land available for hmited timber management (about 20 percent of the tentatively suitable forested land) is **(1)** too rocky to be regenerated artificially following an even-aged regeneration cut, (2) poorly-stocked eastside pine, or (3) areas devoted primarily to other resources These lands are sometimes referred to as marginal lands On rocky land, sites generally regenerate naturally over a long period of time **(30** years or more) as plant succession proceeds in small openmgs created by tree mortality or harvest Planned harvests consist mostly of salvage ofmortality and removal of trees that have a very high nsk of dymg mthin a few years

Timber stands on poorly-stocked land, about five percent of the forested land, have low density and slow growth These stands are on the east side of the Forest Artificial regeneration on these sites can be expected to be successful in aclnevmg the Region's minimum stocking standards, but may require one or more replantmgs Planned harvests consist mainly of salvage and sanitation intermediate cuts

Past Management Timber harvesting on the Forest began in the eastside pine type in the early 1900's Railroad access was relatively easy, and pine was preferred by the loggmg companies The early sales were large The first significant one was a multi-year sale sold in 1917 that contained a volume of about 220 million board feet — greater than the Forest's entire annual harvest today Harvesting on the west side of the Forest in the mixed conifer type did not begin until the early **1940's** The Lake Almanor area had its first commercial timber sale in 1957

Various methods of partial cutting were used on early timber sales to remove mature and overmature high-nsk trees that othermse would have died The conversion to even-aged management began with approval of the Forest's first Timber Management Plan by the Chief of the Forest Service in 1960 Harvest methods in this plan included small clearcuts, overstory removal, intermediate harvest to improve stand condition, and modified harvesting where full timber production would conflict with other resource objectives The allowable annual cut was 166 **6** million board feet (MMBF)

The original average annual sell volume under the current Timber Management Plan (1976-1985) is 179 MMBF This figure was amended to 175 5 MMBF in 1978, and was based on expectations of high yleld regeneration cutting. Potential yleld in the standard component was the fifth highest in the Regon Sale size has ranged from under 100,000 board feet to over **35** million board feet. Both the prevlous and the current Timber Management Plans recognized that extensive regeneration in the future was necessary

tosustainahighlevelofharvest. Smce 1985,the Forest has moved toward regenerating acres called for in the second decade of the 1975 Timber Management Plan.

Logging Systems Tractor loggmg is by far the most common technique because most of the Forest is relatively flat Tractor loggmg is suitable for slopes up to about 35 percent, or 20 percent on cinder cones. Cable loggmg is being used more often as harvests extend into the steeper, more remote parts of the Forest Helicopter logging is used in therelativelyinfrequent cases where both tractor and cable loggmg would be prohibited by physical or environmental obstacles, or by economic considerations

Regeneration Regeneration of trees is achieved by both natural and artificial methods Artificial regeneration is used mainly on lands that are sultable for full and modified timber management and where the pnmary objective is timber production. The planting stock conforms, as a minimum, to the Base Level Program of the 1976 Tree Improvement Master Plan for the California Region. This is a program to maintain the genetic base and quality of all forest land while striving for gains in volume growth of up to 10 percent.

Harvesting prior to this Forest Plan has caused stands in some areas to be understocked, but it has not damaged the productive potential of the land itself. The 1975 Timber Management Plan made these stands high prionties for regeneration. Other stands which are poorly stocked due to fires or pests are also high pnonty for regeneration

Site Preparation After a regeneration harvest or in brush conversion projects, the land must be cleared and prepared for seedling planting or natural seeding. Site preparation is done by prescnbed burning, mechanical means, chemical means, or a combination of those techniques Mechanical site preparation, the most common, usually consists of tractor piling or windrowing Brush crushing is sometimes done as a preliminary to broadcast bunnng.

Timber Stand Improvement Timber stand improvement (TSI) consists of both the suppressing of competing vegetation and the thinning of young stands. The benefits are increased vlgor and reduced susceptibility to insects and disease Presently most TSI on the Forest is thinning by mechanical shearing Release treatments to suppress competing vegetation in young plantations is expected to increase in the near future

Even-Aged Management Long range harvest schedules of the 1960 and 1975 Timber Management Plans were based on even-aged management Regeneration techniques utilizing clearcut, shelterwood, and overstory removal are even-aged management Until recently, most of the regeneration on the Forest consisted of overstory removal Many stands which have had repeated intermediate sanitation harvests in the past are now in need of regeneration

Commercial Thinning In recent years, commercial thinnings of overstocked stands has become more commonplace Commercial thinnings have been conducted to promote the growth and vigor of the wild stands

Sustained Yield; Non-Declining Flow Long-term sustained yleld capacity is defined as the highest wood yleld from lands being managed for timber production that may be sustained under a specified management intensity consistent with multiple use objectives The pnnciple of non-declimng flow is that the harvest level planned for a future decade is equal to or greater than the harvest level planned for a preceding decade and that the harvest level of any decade is not greater than the long-term sustained yleld capacity

Harvest levels are calculated based on a Forest-wide sustained yeld unit rather than on smaller sustained yleld sub-units of the Forest This is because the Forest, as a whole, has a wider variation in age classes and stocking levels than any subunit. This allows faster conversion of existing timber stands to a regulated forest condition.

Herbicides Aerial application of herbicides on the Forest for plantation site preparation or release began in 1965 Sprayng was done each year from 1965 through 1971, with a total of 10,000 acres sprayed. No sprayng has been done since 1978 In March 1989, the Pacific Southwest Region of the USDA Forest Service issued a Final EIS for *Vegetation **Management** for **Reforestation*** The EIS assumes a full range

of vegetation management methods for reforestation and timber stand improvement. On the Forest, as throughout California and the western states, appeals and court cases have delayed proposed herbicide projects If this continues, timber yields of regenerated stands will decrease and costs of vegetative management (site preparation and release) will increase On the Forest, mechanical and hand cutting of brush and scalping started in 1980 and has continued since

Christmas Trees Christmas trees are a usable product that comes from surplus trees These surplus trees are found in sapling and pole stands that need thinning or in the form of unsaveable small trees under a sawtimber overstory The number of trees sold by commercial Christmas tree sales has been relatively steady over the last several years Personal use permits have been sold for 13 years on the Hat Creek District and six years on the Almanor and Eagle Lake Districts Demand is unpredictable, but has risen sharply in recent years and seems to be influenced mostly by accessibility due to weather conditions Christmas tree sales in recent years are shown in Table 3-21

Table 3-21

Christmas Tree Sales

Year	No of Permits	Sold Value 1/	No of Permits	Sold Value 2/
1987	15,185	75,925	2,451	6,582
1988	20,649	103,245	4,647	18,910
1989	21,123	105,615	3,837	17,546
1990	21,209	106,045	4,400	33,826
1991	13,180	105,442	2,047	10,551

highest bidder

b. Supply

According to the latest timber inventory (1980), the Forest has approximately 114 billion board feet of standing timber on tentatively suitable acres This is roughly unchanged from the 1970 timber inventory Table 3-22 shows the inventory volumes as well as area and growth for each timber strata

The Forest supplies timber to about 15 local mills, helping satisfy regional and national demand for lumber and associated wood products Each year nearly all of the Forest's timber is processed in the impact counties. From 1961 to 1970, 1477 million board feet of timber (MMBF) were harvested from Forest land, for an average of 148 MMBF per year Volumes harvested generally increased each year, ranging from a low of 66 MMBF in 1961 to a high of 240 MMBF in 1969 In 1970, the harvested volume dropped to 164 MMBF

From 1970 through 1990, an average of 174 MMBF per year has been harvested from the Forest Harvested volumes have fluctuated considerably, reflecting demand Volumes range from a low of 88 MMBF for 1982 to a high of 244 MMBF for 1986 As a result of the depressed timber market during the early 1980's, harvest volumes declined In 1982 harvested volume dropped to 88 MMBF, representing 9 4 percent of the harvest in the state There has been a general decline in harvested volumes since 1986 In 1990, the harvest volume was 147 MMBF Harvested and sold volumes from 1961 to 1989 are displayed in Figure 3-14

As shown, each year's sale volume does not equal the cut volume This happens mainly because National Forest timber does not have to be harvested in the same year it is sold Consequently, when demand for lumber and wood products is down, purchasers refrain from harvesting the timber until demand increases or a sale nears its termination date

The supply of timber from National Forests is not considered responsive to price since the amount of timber offered is set by agency policies that generally do not consider current or expected future price The amount of timber offered for sale by a National Forest, however, will have an impact on the local and regional price (Haynes 1981) This relationship cannot be directly observed because National Forests contribute only a portion of the total quantity supplied in each region, and it is total quantity that establishes regional prices How much of an impact any particular Forest's offerings have on

Table 3-22

Timber Area and Volume

Major Timber Type	Area Timber Stratum a/	Acres Suitable Full Timber Management b/	Acres Suitable Limited Timber Management b/	Total Volume (Estimated) Total Acres	MMBF	MMCF
M Mixed Conifer	M3G	162,610	30,034	212,644	3,277	500
	M3P	73,367	40,944	114,311	775	121
	M4G	45,786	9,598	55,384	2,037	317
	M4P	16,645	6,753	23,398	464	73
	M6	14,095	3,429	17,524	387	58
	M1X	12,343	961	13,304	Unestimated	Unestimated
Total		344,846	91,719	436,565	6,940	1,069
P Eastside Pine	P2G	103,966	10,158	114,144	872	135
	P4G	22,897	4,737	27,634	336	51
	P4P	18,196	4,163	22,359	185	28
	P6	4,851	756	5,607	48	7
	P1X	13,538	1,651	15,189	Unestimated	Unestimated
	P2P	22,931	8,015	30,946	184	28
	P4S	0	8,187		41	6
Total		186,399	37,667	224,066	1,666	256
R Red Fir	R3G	33,554	4,521	38,075	1,319	206
	R3P	14,059	14,479	28,538	360	56
	R4G	8,301	720	9,021	470	74
	R4P	1,864	400	2,264	85	13
		57,778	20,120	77,898	2,234	349
L Lodgepole Pine	LPX	29,461	2,120	31,581	514	84
Total		618,484	151,626	770,110	11,354	1,758

a/ A Timber Stratum is a two or three-character code representing Timber Type, Size Class, and Density Class Characters are defined as follows

Timber Type	Size Classes (Crown Diameter]	Density Classes (Crown Cover)
M-Mixed Conifer	1-Seedlings and saplings (0-5 feet)	G-Good Stocking (40%-100%)
P-Eastside Pine	2-Pole timber (6-12 feet)	P-Poor Stocking (20%-40%)
R-Red Fir	3-Small sawtimber (13-24 feet)	S-Sparse Stocking (0%-20%)
LP-Lodgepole Pine	4-Large sawtimber (over 25 feet)	X-All Density Classes
	6-Two-storied stand (sawtimber over poles)	

b/ Acres listed are potential values Altemative constraints cause full timber management and limited timber management acres to fluctuate

regonal pnce depends on its relative contribution to the total supply in the region

c. Demand

As discussed, most of the timber harvested from the Forest is processed in mills withm Lassen, Plumas, Shasta, and Tehama counties. The resulting finished products are used to satisfy regional and, to a lesser extent, national demands.

The demand **for** timber is denved from the demand for wood products. The major wood product markets include housing, nonresidential construction, manufactunng, and shipping (pallets, containers, etc) Over the next 50 years these markets are expected to place greater demands on timber markets (USDA Forest Semce 1981)

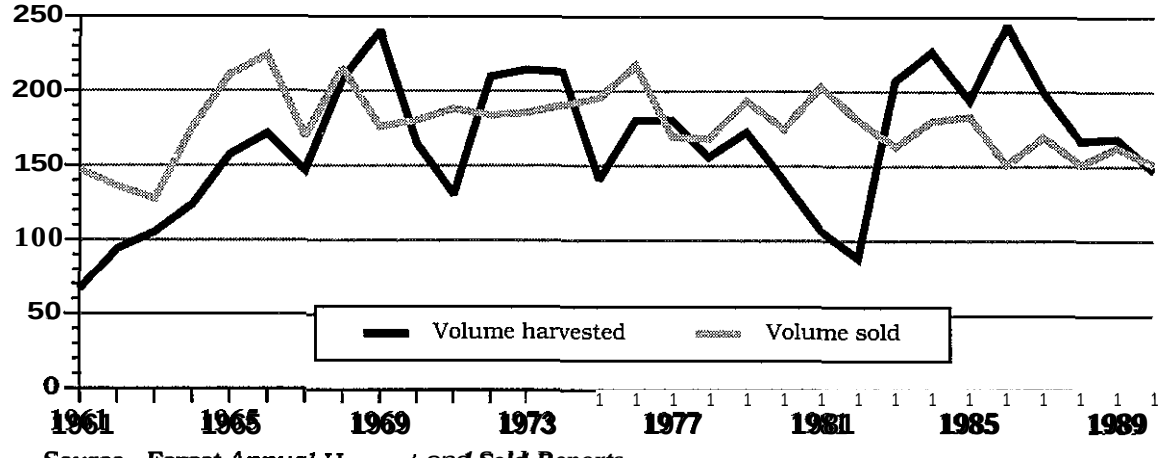
In 1982, there were 15 mills in the impact area, with a combined eight-hour milling capacity of 2.94 million board feet of finished lumber The annual milling capacity vanes by the number of eight hour shifts per week that each mill runs In 1976, the 15 mills produced a total of about 905 2 million board feet (Hiserote and Howard 1976) There are currently 18 mills in the impact area with an annual production of 871 MMBF

The bid value of timber on the Forest has been among the highest in the Region for several years. The main reasons are high industry demand, high-value tree species, and low logging costs Demand is high because nnll capacity in the local area is about three times the Forest's annual sell volume, leading to highly competitive bidding on most sales. Private timber lands cannot significantly meet demand because most have young growth stands that are not ready for harvest The high value tree species are ponderosa/Jeffrey pine and sugar pine, which make up about 25 percent of the Forest inventory and command higher pnces than the firs This is especially true *of* old growth pine. Pine lumber goes to many uses other than new home construction and thus is less affected by the current slump in that industry Logging costs are low because most of the Forest has easy to moderate terrain, few stream crossings, and extensive road networks.

The combination of high value timber, high demand, and low loggmg costs all contnbute to very high bids for Forest timber sales Sales typically sell for several times more than the advertised rates Annual timber sale receipts have typically totaled two to three hundred percent of the entire Forest budget.

Even in this healthy timber market, the possibility exists for individual timber sales to be sold below cost Such sales would be very infrequent and would be sold only if it was determined that the multiple use benefits exceeded the potential dollar losses.

Figure 3-14
Timber Volume Sold and Harvested, 1961-1990
(Millions of Board Feet)



Source Forest Annual Harvest and Sold Reports

How much each mill operates in the future unll depend on the health of the economy in general, the strength of the major timber product markets in particular, and the availability of timber supplies.

Based on past experience and future projections, it is reasonable to assume that all timber offered for sale by the Forest will be bought and processed As discussed, however, mcreasmg the Forest's timber offenngs would have only a slight downward effect on timber prices, and decreasing the offenngs would have only a slight upward effect This relationship can be approximated by a timber price that stays constant for each quantity offered, and is expressed by a honzontal demandcurve.

20. VEGETATION AND DIVERSITY

a. Vegetation

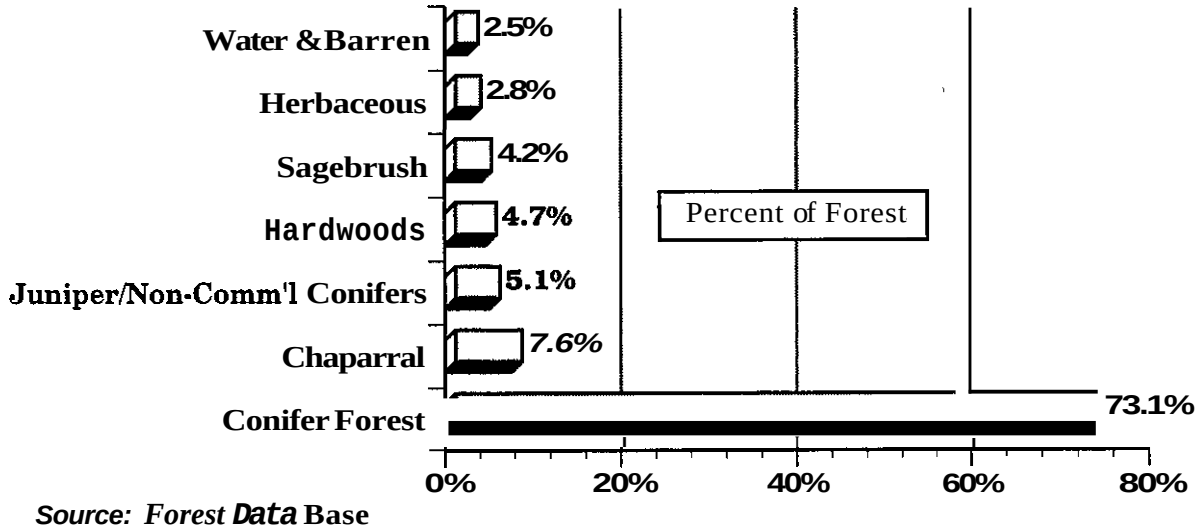
In addition to the commercial conifer forest discussed under the Timber section, the Forest contains substantial amounts of other vegetation types These types may be classified into broad classes on the Forest, including western juniper and noncommercial conifers, hardwoods, chaparral, sagebrush, and herbaceous vegetation. Intermingled among these vegetation types are 12,000 acres of npanan habitat Figure 3-15 shows the proportion of each formation. They are based on, although not identical to, CALVEG Formation Classes (USDA Forest Semce 1981b).

The following sections descnbe the vegetation formations and their constituent habitat types It also descnbes resource uses and values, and available improvement opportunities and techniques

Conifer Forest Most of the Lassen consists of conifer forest, which includes four major habitat types: red fir, mixed conifer, eastside pine, and lodgepole pine. Specific information on these types is found in the Timber section of this chapter The red fir type is dominated by red fir, but also includes minor amounts of western white pine and mountain hemlock Relatively little logging or other disturbance has occurred in this type The main species in the mixed conifer type are white fir; ponderosa, Jeffrey, and sugar pines, Douglas-fir; and incense cedar. Vegetation in the mixed conifer type has been altered by logging and by fire suppression, which have increased the proportion of white fir Eastside pine, consisting mainly of ponderosa and Jeffrey pine, at one time had open park-like stands but today is much more dense. Fire suppression and loggmg have resulted in growth of pine and white fir thickets and a decrease in bitterbrush and Idaho

Figure 3-15

Vegetation Types: CALVEG Formation Classes



Source: Forest Data Base

fescue understories The lodgepole pine type behaves as a seral (successional) type when established by fire, but as a climax type when adjacent to meadows and other wetter sites.

Western **Juniper and Non-Commercial Conifers** The western juniper habitat type usually occurs between the eastside pine and sagebrush types in the northern half of the Forest It often forms a sparse overstory above sagebrush. The non-commercial digger pine occupies dry, rocky areas on the west side of the Forest, usually below the elevation of commercial conifers A few scattered stands grow in the Fall River Mills-Hat Creek area. Knobcone pine is found on similar sites, but only on the northernmost edge of the Forest. Juniper is cut for firewood, but neither digger nor knobcone pine has any commercial value at this time.

Hardwoods The Forest contains 13,000 acres of black oak habitat type, 36,000 acres of blue oak savannah, and 4,000 acres of Oregon white oak Small acreages of maple-dogwood, cottonwood-alder, quaking aspen, and cottonwood communities also occur.

Black oak is found interspersed with the wedgeleaf ceanothus, blue oak, and annual grass types in the front country foothills (Deer, Mill, and Antelope Creek areas) and in the Pit River drainage. It also intermixes with the mixed comfer type at lower elevations, and occasionally reaches elevations over 5,000 feet. Blue oak savannah mixes with the foothill chaparral, black oak, and annual grassland habitat types on the western slope of the Forest between 500 and 3,000 feet Oregon white oak grows on low elevation slopes of the front country and along the Pit River It is commonly associated with digger pine and annual grasslands, and occurs in both tree and shrub forms. The remaining hardwood types are associated with riparian systems.

Hardwood types have been changed by a number of influences. Fire suppression has caused invasion of some black oak stands by conifers, especially white fir. This invasion increases the stands' susceptibility to wildfire, and over time it may lead to loss of oaks due to shading by conifers As in many areas in California, neither blue oaks nor white oaks are reproducing successfully, some white oak stands are also stunted, old, and dense Ripanan hardwoods, especially aspen, also lack adequate regeneration. Existing stands are being eliminated by old age, and to a lesser extent by beavers, woodcutters, and livestock grazing These types can be perpetuated by applymg silvicultural treatments, prescribed burnmg, and fencing where needed.

Demand for hardwood and woodland types is based on their values as livestock forage, wildlife habitat, watershed protection, fuelwood, and visual quality. The State Board of Forestry recognized the potential effects of statewide demand for hardwoods and appointed a Task Force in 1983 specifically to assess this problem. Many demands are not intensive on the Forest at this time, although the demand for hardwoods as firewood is very high in certain localized areas, particularly around Fall River Mills. Presently, the Forest does not allow cutting of living oaks for firewood, except in a few instances to improve mldlife habitat. For further information on hardwoods refer to the Wildlife section of this chapter

Chaparral Of the 86,000 total acres of chaparral, 33,000 are montane chaparral. This habitat type consists of mixed shrubs dominated by greenleaf manzanita Stands average approximately 70 acres, and range from small isolated openings to **units** of over 1,000 acres. They *are* generally found above 3,000 feet scattered throughout the conifer zone

Montane chaparral stands do not have potential to produce commercial timber Stands with chaparral species that have such potential are classified as either non-stocked or plantations, and are included within the timber type that is most common to the same kind of site. Montane chaparral often grows in small isolated patches and on very rocky and poor sites.

Montane chaparral stands are important mainly in provlding erosion control, cover for wildlife, and limited forage for wildlife and livestock Opportunities exist to burn or mechamcally treat these areas to provide additional forage for livestock and wildlife, break up fuel continuity, and enhance habitat diversity

The foothill chaparral habitat type consists primarily of wedgeleaf ceanothus, and covers 53,000 acres of Forest land. It grows most commonly below 3,000 feet in the front country foothills and

in the Pit River drainage. Wedgeleaf ceanothus stands are interspersed with blue oak savannah and black oak types

Wedgeleaf ceanothus is adapted to fires every **15** to 20 years Effective fire suppression has left many of the stands of foothill chaparral older than 40 years and decadent This condition reduces the value of the stands for wldlife and livestock, and greatly mcreases the potential for an unnaturally intense wildfire and its undesirable impacts on soil and other resources

The Foresthas recentlybegun burning wedgeleaf ceanothus with prescnhed fire Burns have been multi-agency efforts covering several hundred to several thousand acres, including pnvate land and lands administered by other agencies Prescnbed burning of foothill chaparral offers opportunities to increase livestock forage, reduce fire hazard, increase stream flow, and improve winter range for deer herds Burning improves the quality and availability of new browse and develops better stands of grasses Prescnbed burning restores a more natural vegetation **mo**saic that provides a better arrangement of both forage and cover for wildlife, and improves habitat diversity.

Demand for chaparral management comes from both the pnvate and public sectors Ranchers want foothill chaparral burned to increase the amount and quality of livestock forage. They benefit from coordmating burning programs on public lands with burnmg on their ranches The California Department of Fish and Game also cooperates on burns on their Tehama Wildlife Area and adjacent Forest lands They support a burning program to help meet long-term winter range objectives for the East Tehama and McCloud Flats deer herds. Benefits currently being denved from coordination are from site specificprojects, however, this coordination could be formalized in coordinated resource management plans. These plans would mcrease the benefits to a larger area, integrate all resources, be implemented in systematic manner, establish goals and commitments, and could include private, State and Federal lands. Presently, no such coordinated resource management plans exist on the Forest

Sagebrush The sagebrush type consists of 26,000 acres of basin sage, 1,500 acres of low sage, and 20,000 acres of bitterbrush. Basin sagebrush is also the dominant understory plant in western juniper stands Most of this vegetation occurs on relatively flat topography in the northern and northeastern portions of the Forest

Much of the sagebrush type is less productive than it was histoncally. As a result of heavy livestock grazing in the late 1800's -early 1900's, the extent and density of sagebrush and the introduced cheatgrass has increased, while density of perennial grasses and forbs has declined sharply Although sagebrush range management is much improved, forage production still remains below potential

Sagebrush is used mostly for livestock grazing and wildlife habitat. Herbage production on certain sagebrush and juniper sites can be increased by prescribed burning, spraying with herbicides, chainng and plowing. Normally, these techniques do not detnmentally affect watershed, fish, and wldlife values if treatments are confined to flatter ground and small areas. Seeding, planting, and deferment of grazmgfor one or two years after treatment is usually necessary to attain best results

Demand for such treatment is high because it increases livestock forage and habitat diversity Currently, the Forest seeds about 200 acres per year. This rate could be increased substantially Major drawbacks to such vegetative improvements are project costs, fencing costs, and the need to eliminate grazing for one or two grazing seasons.

Herbaceous Vegetation The annual grassland, perennial grassland, and sedge-rush habitat types cover 6,000, 10,000, and 16,000 Forest acres, respectively. Annual grasslands occur in the front country foothills and near the Pit River Perennial grasslands are interspersed throughout the forested portions of the Forest, and the sedge rush types grow in seasonal wetlands on the northern and eastern portions of the Forest

Most of these areas are producing at full potential and there is little opportunity to increase herbage production Resource coordination is needed, however, to insure that the vegetation condition improves or does not decline Additional acres of herbaceous vegetation could be

temporarily created by type conversion using prescribed burning, herbicide spraying, and mechanical treatment

Local demand is high for these areas because they are some of the highest producers of livestock forage as well as one of the most productive unldlife habitats For more information refer to the Range section of this chapter.

b. Diversity of Plants and Animals

Diversity of plants and diversity of animals are closely related Species composition, age, size, and density of vegetation form major components of animal habitat. Generally, a greater diversity of vegetation results in a greater diversity of animals This relationship between plants and animals is the basis for the California Wildlife Habitat Relationships Program (Laudenslayer 1982).

Diversity may be evaluated according to three components richness, evenness, and pattern, as defined below.

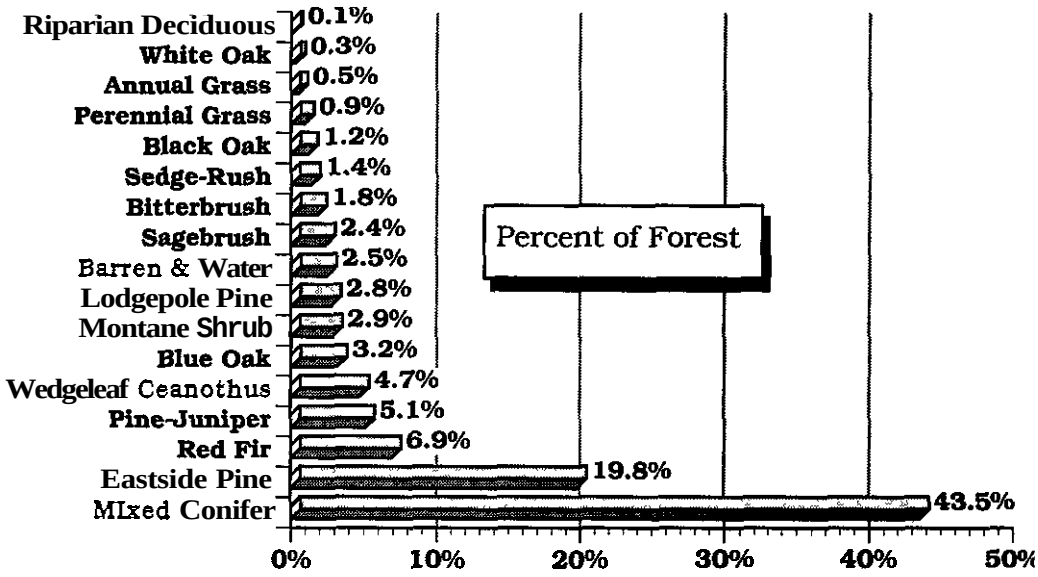
1. *Richness* The number of different kinds of species, communities, or special habitat elements found in the planmng area.

2 *Evenness* The relative abundance of animals, habitat types, successional stages, and cover classes within the planning area Evenness descnbes the relative extent to which the proportional abundance of these elements is uniform.

3. ***Pattern*** The sizes and structural complexity of stands of vegetation and the spatial distribution of plants and animals withm the planning area.

Richness Plant community nchness can be represented by the number of different Wildlife Habitat Relationship (WHR) habitat types on the Forest (Figure 3-16). This may be referred to as habitat type diversity The presence of 17 major habitat types on the Forest indicates that the Lassen is a diverse Forest which spans a large range of environmental conditions. This diversity is also reflected in the richness of animal species The Forest regularly supports 361 vertebrate species (listed in Appendix R). These include 24 species of amphibians and reptiles,

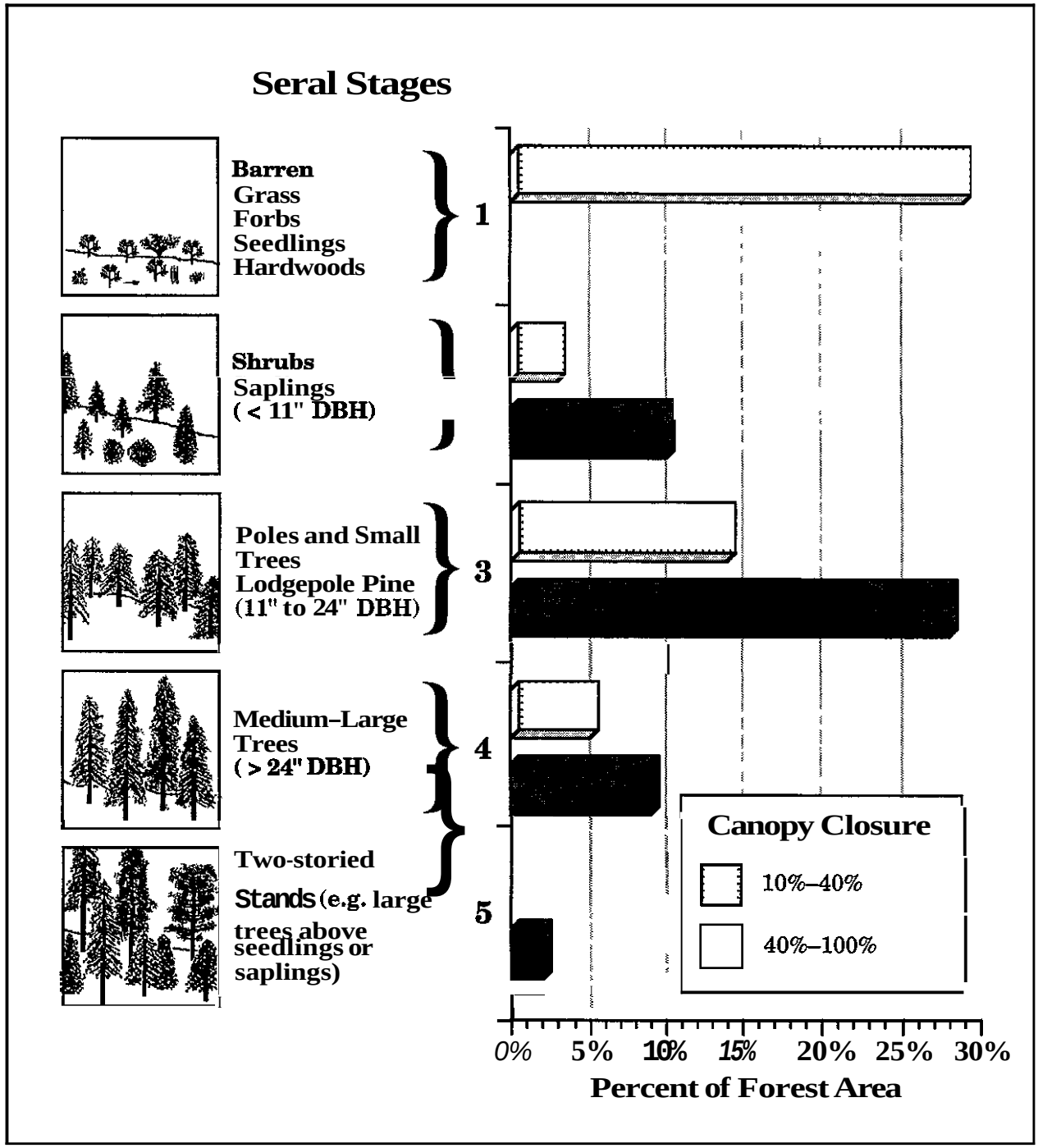
Figure 3-16
Vegetation Types: Wildlife Habitat Relationships (WHR)



Source. Forest Data Base

Figure 3-17

Conifer Forest Successional Stages and Canopy Closure



224 species of birds, *84* species of mammals, and *29* species of fish. Species richness has remained fairly stable over the last **100** years, as only a few species have become locally extirpated (i.e., extinct in a local area) and several others have been successfully introduced

Evenness Evenness of both plant and animal communities can be approximated by the proportions of the Forest within each habitat type Figure **3-16** shows the proportions of the Forest in each vegetation type and provides a good estimate of evenness from a broad perspective. This graph shows that a large majority of the Forest (about **70** percent) is in the mixed conifer, eastside pine, and red fir vegetation types Smaller, but important amounts of non-timber vegetation occur.

The individual vegetation types may be further categorized based on plant size, density, and age to evaluate the evenness component of plant diversity at a finer scale. This is referred to as habitat stage diversity. In the conifer forest, there is a disproportionately greater share of the Forest in very small trees (seral stage *2)* and medium sized trees (seral stage **3),** and relatively few acres in stands with old large diameter trees (seral stage *4).* See Figure **3-17** Animal species that favor young timber stands, therefore, are more abundant overall than species that are most abundant in old stands. As the relative abundance of old growth forest continues to decline, animal species that favor old growth communities will also decline. **Figure 3-17** shows that the proportions of each canopy closure class (a measurement of density) are similar within various tree size classes. The relative amounts of non-timber vegetation in various age classes are also an important aspect of habitat type diversity. Considering the major shrub types (sagebrush and chaparral) as a group, the majority is in older decadent age classes (**83** percent) while little is in young (**8** percent) and intermediate *(9* percent) ages.

Pattern The pattern aspect of diversity is difficult to quantify at the Forest level. Grasslands, chaparral, and oakwoodlands dominate the lower elevations. Eastside pine and sagebrush dominate the northeastern portion of the Forest, and mixed conifer and true fir forests dominate at the middle to high elevations. However, the distribution of size and age classes within these types is not easily described. In general, as a result of past logging and fire management, younger stands are more common in the pine type and in areas of slight to moderate relief; older aged stands are mainly on steep terrain within the mixed conifer and red fir types. Sizes of stands created by fire vary widely; stands regenerated by logging are small, usually **5-30** acres.

In general, the plant and animal diversity on the Forest is high. If present trends continue, habitat for species that favor younger vegetation in both forest and shrub types will increase while habitat for species most common in intermediate-aged and older vegetation until decline The Forest will continue to monitor all Threatened, Endangered and Sensitive species to insure viable populations continue and Forest actions do not extirpate any species.

21. VISUAL RESOURCES

a. Introduction

The visual resource is the physical appearance of the Forest. A number of natural factors affect the appearance of a particular area including slope, elevation, geology, soils, vegetation and the abundance of water. The interrelationships of these factors is the basis for dividing land into landscape provinces. The Lassen Forest is divided into three distinct landscape provinces - The Sierra Nevada landscape province, the Sierra Foothill landscape province, and the Northeast Volcanic landscape province. The southernmost ten percent of the Forest is in the Sierra Nevada landscape province with its rugged granitic mountains. This is typified by the High Lakes area. The westernmost ten percent of the Forest lies in the Sierra Foothill and Low Coastal Mountain landscape province, characterized by low-elevation, steep-walled canyons, and chaparral and grassland vegetation. The Ishi Wilderness preserves a prime example of this front country landscape. In sharp contrast, the remainder of the Forest is within the Northeast Volcanic landscape province, a forested upland plateau. Dotted with shield and cone volcanoes, faulted ridges, and lava flows, it supports eastside pine and mixed conifer forests interspersed with extensive rangelands. This landscape province includes portions of the Modoc Plateau and the Southern Cascade Mountains geomorphic provinces

These general landscape types provide the settings for a variety of recreational actinties enjoyed by Forest vlsitors and permanent residents. For example, the oak-dotted foothills and grasslands along Mill Creek are the setting for spnng hiking and camping The shady canyon dnve up Highway **32** along Deer Creek, a Wild and Scenic River candidate, draws travelers to its changmg natural vanety The Hat Creek Valley, confined on one side by the stnking escarpment of the Hat Creek Rim and on the other by volcanic peaks, frames a stnkmg new of snow-clad Lassen Peak Hat Creek flows through black lava beds, green meadows, and clear fishing holes to empty into the Pit River and Lake Bntton. Along Highway **44,** broad forested uplands dotted with volcanoes and flat rangelands reveal sweeping vistas and a sense of openness not common to forest lands in California Eagle Lake and Lake Almanor provide cool relief from summer heat for recreatiomsts from all over the State The snow-capped faces of Diamond Mountain and Keddie Ridge are bold backdrops for Susanville and Westwood The natural appearance of these landscapes contnbutes greatly to their populanty and appeal

b. Demand

Demand for vlsual quality is difficult to measure objectively, but it can be inferred from vanous sources The number of laws and policies that consider aesthetics **of** the vlsual resource has increased significantly in the past decade and reflects public concern The California State Scenic Highways Master Plan recognizes Highways **89** and **299** as potential State Scenic Highways The Tehama County General Plan recognizes that Highway **32** along Deer Creek has county-level scenic significance Highway **44** with its old growth pines has been identified as a potential Scenic Byway

Another indicator of concern for scenic quality is the number of people whose recreation activities it enhances In **1990,** there were about **1,242,600** RVD's (Recreation Visitor Days) of recreation use on the Forest Actinties that are enhanced by scenic quality, such as sightseeing, driving for pleasure, and hiking, represent over 70 percent of that total recreation, Recreation use in the Pacific Southwest Region exceeds that of other Regions, and the recreationists' concern for scenery is known to be high

The development of concerns and social values regarding the visual resources, as evidenced by the number and scope of laws enacted, coupled with the participation rate in associated recreational activities indicates a high demand for visual resources in the future

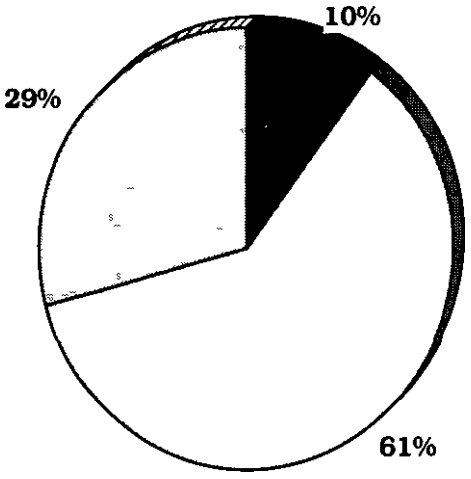
c. Visual Resource Management

Because of public concern about the quality of the vlsual resource, a visual management system has been established to help manage it The vlsual resources management program is based on principles descnbed in the Forest Service Visual Management Handbook This system prondes for the identification and classification of scenic quahty, as well as aesthetic concern for that quahty. The system assists in determining quality objectives for the alteration of the vlsual resource. Visual quahty objectives (VQO's) are established for every acre of National Forest land They are based on a combination of three inventones inherent vlsual diversity of the landscape (vanety class), the level of public concern for visual quality (sensitivlty level), and the area and distance at which the landscape is mewed (distance zone) The following descnbes these basic components of the system

Variety Class A major pnnciple of vlsual resource management is that the greater the natural vanety in landforms, water forms, and vegetation, the greater the landscape's appeal will be The three vanety classes — distinctive, common, and nunimal — are evaluated according to different cnteria for each landscape province The Forest's landscape is predominantly common and minimal with only **10** percent distinctive (See Figure **3-18)** The large amount of minimal variety landscape is found in the northeastern portion of the Forest with its flat terrain and few water bodies The distinctive landscapes are found mostly in the southwestern portion and surrounding Lassen Volcanic National Park.

Distance Zones For Seen Areas Distance zones, the distance from newer to the landscape, are foreground (up to **1/2** mile), middleground (1/2 to **4** miles), and background (over **4** miles) The area potentially seen from each road and use area has been mapped by distance zone and sensitivity levels

Figure 3-18
Visual Variety Class (Percent of Forest) - 1980



A [Distinctive]	115,700 acres
B [Common]	684.700 acres
C [Minimall	329,200 acres

Source. Forest Data Base on *Inventoned Visual Quality Objectives*

Sensitivity Level Sensitivity levels provlde a way to measure scenic quality in relation to its importance to the public Inventoned sensitivity levels range from 1 (highest) to 3 (lowest) They are determined **for** landscapes viewed by those who travel through the area and those who use recreation facilities or Forest water bodies. An inventory of current use patterns on the Forest indicates that **56** percent of the Forest has high, 17 percent average, and 27 percent low sensitivity levels

d. Visual Quality Objectives

Information from these three inventories were combined to produce Visual Quality Objectives for the Forest These describe acceptable levels **of** change and how the Forest will look in the future The five visual quality objectives (VQO's), ranging in order from ecological changes only, to greatest acceptable change in the natural landscape character, are Preservation, Retention, Partial Retention, Modification, and Maximum Modification Figure 3-19 shows the area of the Forest assigned to each VQO, Appendix Q gwes definitions of the VQO's. These acres of inventoned objectives were adopted in 1979 as intenm direction until the Forest Plan is approved, at which time they will be modified according to the Plan and established as the Adopted Visual Quality Objectives (AVQO's)

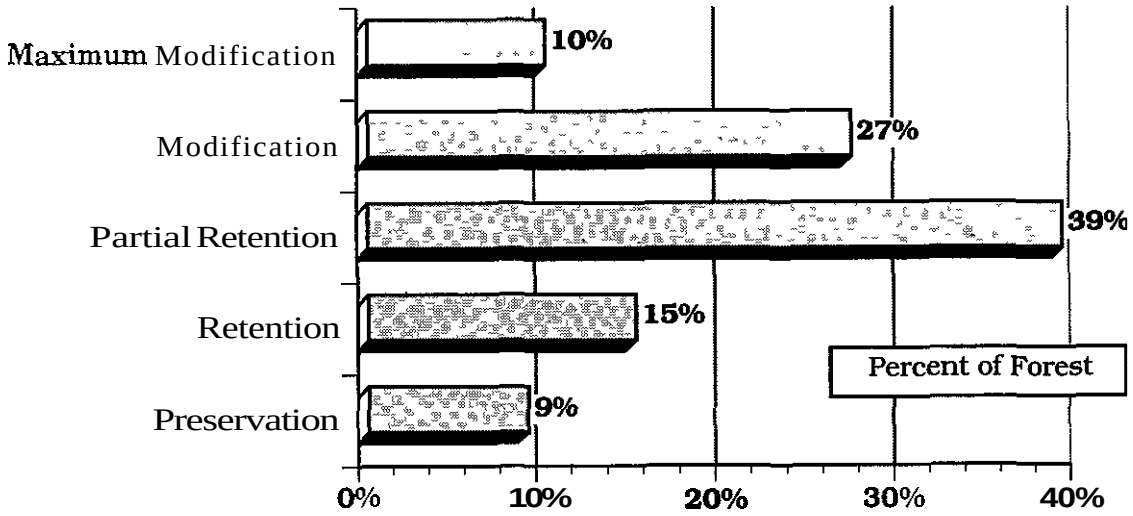
e. Existing Visual Condition

Histoncally the Forest has presented a largely undisturbed, natural landscape to public view The vlsual resource trend, however, has been declining somewhat for the last 40 years This is a direct result of the natural landscape being altered by road construction, timber harvestmg, structures, brush field clearing, and utility corridors

The Existing Visual Condition (EVC) inventory maps of the visible degrees of disturbance to the natural landscape Unlike the VQO's, EVC defines how the Forest looked in 1980 rather than how it will look in the future, and serves as a benchmark Figure 3-20 illustrates this range of vlsual conditions on the Forest Note that the 83 percent **of** the Forest's landscape had not yet been noticeably altered. The EVC conditions 1 through **5** (Untouched, Unnoticed, Minor Disturbance, Disturbance, Major Disturbance) correspond directly with the five VQO's (Preservation, Retention, Partial Retention, Modification, and Maximum Modification, respectively) See Figure 3-21 to compare EVC conditions with VQO's and how they look on a forest landscape

Figure 3-19

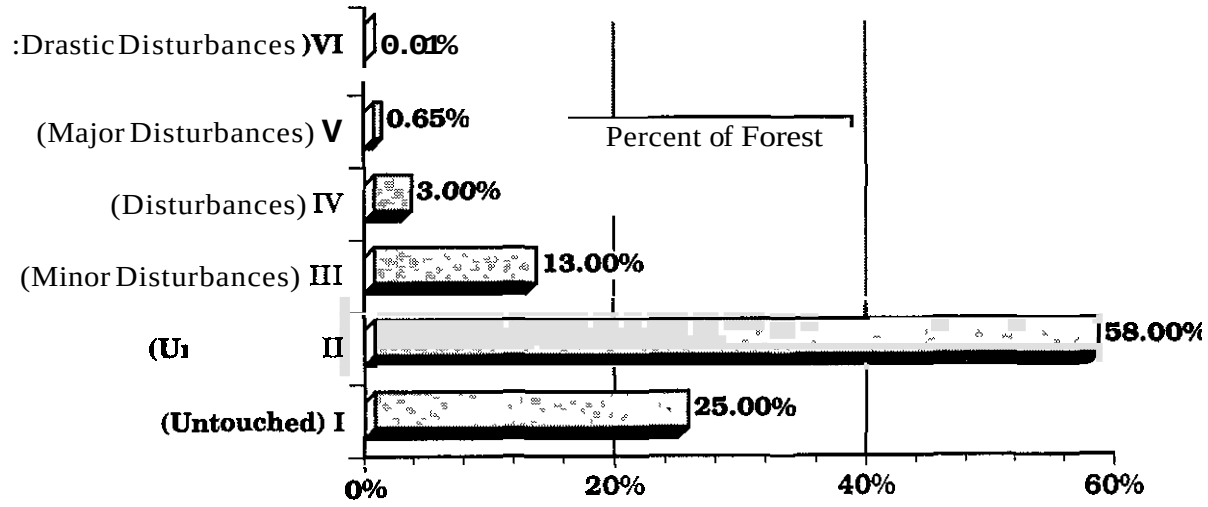
Inventoried Visual Quality Objectives (VQO) - 1979



Source Forest Data Base

Figure 3-20

Existing Visual Condition (EVC) - 1980



Source. Forest *Data* Base

f. Visual Management Concerns and Trends

Future problems in managing the visual resource will most likely Involve conflicts between commodity production and vlsual quahty The demand for summer and winter recreation is expected to increase, and with it, a demand for scenic natural environments.

Timber Management In the past, the Forest has produced timber using mostly partial cut harvest. Future timber management will reqmre more evenaged management, including clearcutting. If silvicultural options produce more evenaged timber stands, conflicts with vlsual quality in sensitive areas will Increase. In addition, much of the Forest's timber harvests have been on the flatter terrain. *As* the steeper slopes

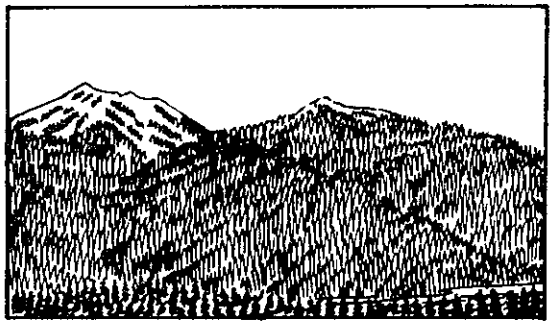
Figure 3-21

Visual Quality Objective (VQO) and Visual Condition (VC)

VQO Preservation

VC I Untouched

Predominately ecological changes



VQO Modification

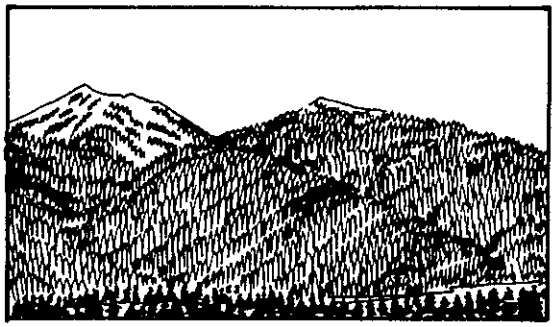
VC IV Disturbance

Changes are easily noticed and attract attention

VQO Retention

VC II Unnoticed

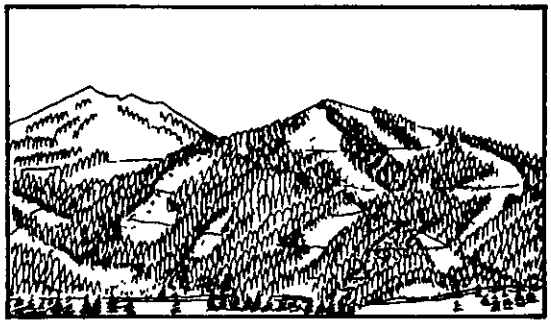
Changes are not evident



VQO Maximum Modification

VC V Major Disturbance

Changes are very strong and attract attention



VQO Partial Retention

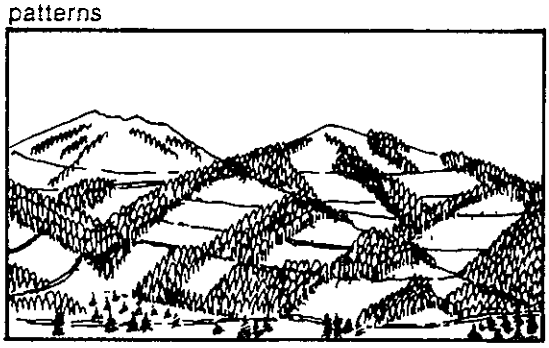
VC III Minor Disturbance

Changes are noticed. but do not attract attention

VQO Unacceptable Modification

VC VI Drastic Disturbance

Changes are in glaring contrast and disharmony with natural patterns



NATURAL CHARACTER DOMINATES — ALTERED CHARACTER DOMINATES

are harvested, maintaining visual quality will become a more difficult task

Energy and Minerals Proposed small hydroelectric projects, geothermal, oil and gas wells and facilities, mining, and accelerated biomass utilization will also impose new impacts on visual quality.

Old Growth Conflicts with commodity production may result from increasing demand to maintain old growth stands. Some of the late successional-stage timber remaining on the Forest is found along highway corndors. Much of it lies within spotted owl territones. Old growth yellow pines (ponderosa and Jeffrey) represent centuries of growth. Their great size and yellow plated bark distinguish them from the rest of the Forest. They create a lasting public image along roads such as Highways 44 and 36 Viewshed corridor plans need to be prepared to guide vegetation management along the most heavily used roads, trails, and at the Forest's key recreation use areas

Ski Area A future issue that would affect the visual quahty of a large part of the Forest is the potential Carter Bowl Ski Area development on Butt Mountain The north side of Butt Mountam has good physical potential for an alpine ski area Butt Mountain lies within an unroaded area and appears to be pristine. Evaluation of the visual impact of a ski development depends largely on the spenfic design of the ski runs, towers, lift line clearings, and structures.

Eagle Lake The Eagle Lake Basin is an area of high environmental sensitivity and great public interest. For private land there, Lassen County has adopted restrictive measures to protect the visual and other resources within the Eagle Lake Planning Area (shown on the map of Management Area 14 in the Forest Plan). These measures include restnctions on subdivisions, construction design, signs and timber harvesting. The Planning Area contains the western Eagle Lake backdrop on National Forest land. A level of vlsual quality commensurate to the above county restrictions would be the VQO's of Partial Retention with Retention along County Road A-1, as defined in the 1979 Inventoned Visual Quality Objectives.

g. Management Opportunities

Opportunities for improving the vlsual qualities of the Forest include.

1. Create special scenic areas with specific objectives and operating requirements to promote high scenic quality

2. Maintain a high level of employee training in vlsual resource management. Maintam a workforce with an appropnate level of knowledge to apply visual resource management.

3. Rehabilitate lands and facilities that meet a visual quality objective lower than the adopted VQO's.

4. Use prescnbed fire to restore the natural appearance to landscapes where fires have long been suppressed.

5. Acquire pnvate lands in key public view areas.

6. Prepare and implement corridor plans for high sensitivlty travel routes or use areas.

7. Use visual enhancement measures to improve scenic quality in areas of Partial Retention and Retention where consistent with other resource objectives.

22. WATER AND RIPARIAN AREAS

a. Introduction

Water and riparian areas are closely related, although they are discussed separately in this section. The water resource includes both water quality and water quantity. The riparian resource includes the thin strips of land bordering springs, streams and lakes. Actions affecting riparian areas can affect water quality; conversely, actions affecting water flows, lake levels, or water quality can affect the npanan resource.

For discussion of the Forest's groundwater situation, see the Geology section of this chapter.

b. Water

(1) Introduction

Although often overlooked, water is one of the more vital resources produced on the Forest In fact, "securing favorable condition of water flows" was one of two reasons for establishing National Forests in the Organic Administration Act of 1897 (the other was to "furnish a continuous supply of timber").

Forest lands include hundreds of streams, including several major rivers and creeks. Forest lands are also watersheds for many lakes, including natural lakes such as Eagle Lake and reservoirs such as Lake Almanor, Mountain Meadows Reservoir, Butt Valley Reservoir, North Battle Creek Reservoir, McCoy Flat Reservoir, and Hog Flat Reservoir. In the Forest's highest elevations, glaciers scoured out many basins now occupied by small lakes. Many of *these* are pothole lakes lying in the **Canbou** and Thousand Lakes Wildernesses, but others are scattered elsewhere on the Forest. Pothole lakes are unusual because they are usually shallow and supplied only by snowmelt from their immediate surroundings Except in wet years, they have no surface outflow.

Water flowing from the Forest in creeks and streams is vital for its fishenes and downstream uses. The Forest includes significant reaches of the last unobstructed anadromous fishenes in the Sacramento River system — Deer Creek, Mill Creek, and Antelope Creek (see Fishenes section).

The source of all the Forest's water is precipitation which falls mainly during the winter; summers are very dry. Some Precipitation occurs as summer thunderstorms on the northern and northeastern portions of the Forest, but such storms contribute little to long-term water supply. Precipitation is generally greater at the higher elevations (above 4,000 feet), where it falls mainly as snow Below that, it is mostly ram. Annual precipitation ranges from 90 inches near Lassen Park and on Snow Mountain, to 16 inches in the northeast corner of the Forest. Although streams abound on the southern and western sectors of the Forest, the northern and eastern portions have scant surface runoff and few streams. Precipitation disappears quickly into the thin volcanic soils and feeds the regional aquifer that supphes the Pit River, Hat Creek, the Susan River, and other perennial streams. Water quality in Forest streams and lakes is good, it now meets State standards in all major streams

(2) Supply

(a) *Quantity* The Forest has a total of 1,650 mles of streams. These can be sorted into stream orders, as illustrated in Figure 3-22 Forest lands produce a total average stream flow of 1,308,000 acre feet per year, not including flows from adjoining or intermingled pnvate lands. Annual runoff for each of the Forest's watersheds is summanzed in Appendix V. Runoff from a watershed depends mainly on the amount of precipitation it receives, and slightly on the amount of vegetation on the ground. On the Forest, stream flow can be deliberately increased in only two ways (1) by clearcut harvesting of timber, and (2) by prescribed burning of chapparal. Such activities can increase water yield, but only by a marginal two percent Forest-wide above current levels. It is possible, however, that even that increase would be masked by variable rainfall from year to year and by groundwater flows reflecting the previous year's rainfall. While increased timber harvesting can increase total annual runoff, any such increase would occur in spring.

The Forest can, however, develop water sources to: (1) better utilize the water that does run off; or (2) tap groundwater sources. The Forest maintains livestock and wildlife water holes on the dry east side, as well as stock ponds and wells in other dry, upland areas. Water supply is short for road-dust abatement and fire protection uses on the drier eastern and northern parts of the Forest. To meet these needs, the Forest is developing proven well sources such as the old railroad well at Hall's Flat For further discussion see the Geology and Groundwater section above.

(b) *Quality* At present, water quality is acceptable in all Forest streams and lakes. There are, however, a number of existing and potential water quality problems Road construction and clearcutting tend to cause sedimentation in streams, which lowers their water quality. Other potential problems are

(1) microorganism (*Giardia*) contamination of surface waters,

(2) nutnentloading,bankerosion, and shade reduction from livestock grazing,

(3) hazardous spills from highways into streams and septic tank drainage from recreation residences,

(4) waste water and vault leakage from campgrounds, and

(5) temperature or sedimentation effects from geothermal and small hydroelectnc development

Forest personnel inspect most of the known problem sites regularly and correct deficiencies when detected

The Lassen National Forest is required to meet State water quality standards by the Clean Water Act (PL 92-500, Section **313)** In some cases, e g public swimming beaches, the Forest must meet standards set by the Envlronmental Protection Agency (EPA) or the Forest Service Manual State standards are issued from two sources The State Department of Health Services (for dnnlung water systems) and the Regional Water Quality Control Boards (for surface water and in some cases groundwater) Standards are set by the Regional Boards, approved by the State Water Resources Control Board, and certified by the Envlronmental Protection Agency

Water quality is currently maintained and improved throughthe application of state-approved and EPA-certified Best Management Practices (BMP's) for controlling non-point sources of pollution to surface water Methods and techniques for applymg the appropnate BMP's are identified dunngon-site investigation of Forest projects that have the potential to degrade surface water quality More detailed discussions of BMP's and the implementation process are presented in Appendur Q of the Forest Plan

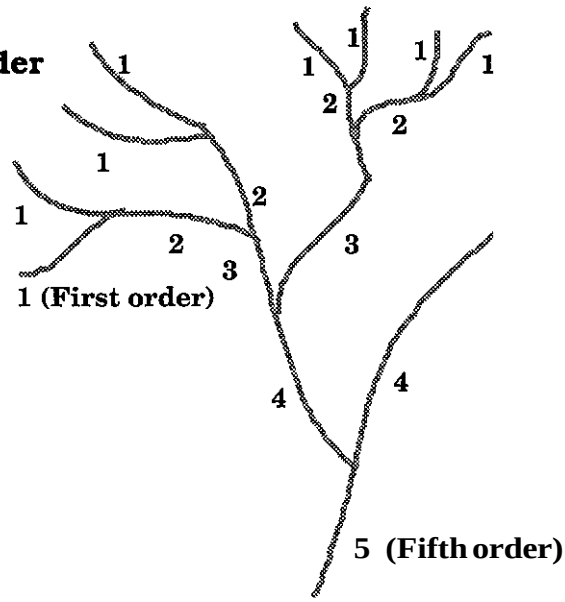
In the case of an individual resource project such as a timber sale, the Forest applies Best Management Practices (BMP's) to mininnze that project's adverse effects on water quality. Forest personnel also analyze cumulative watershed impacts to consider the additive effect of many land disturbances over time and space Such analysis enables decision makers to keep the overall disturbance in any watershed below a problem-triggering "threshold" level so the activlties do not degrade water quality or impair water uses or conditions, either locally or downstream Fac-

Figure 3-22

Miles of Streams by Stream Order

Stream order	Miles
1, 2	1,270
3	236
4	112
5	32

Source: Forest Data **Base**



tors that can temporarily cause cumulative effects above the threshold include accelerated erosion, channel scouring, bank cave-ins, debris flows, landshdes, and heightened flood flow peaks

Presently all but two of the Forest's fourth order (see Glossary, "stream order") watersheds are well below the 15 percent equivalent roaded acres (ERA) threshold for accelerating damage The exceptions are two small, heady-impacted watersheds tnbutary to Lake Bntton on the Pit River.

The Forest's watersheds contain a number of Class I streams (see Glossary, "stream classes") Some of these are important fishenes for native game species, and a few are spawning streams for anadromous fish After some past timber harvests, some of the sub-watersheds for Deer Creek, the Susan River, Mill Creek, Antelope Creek, and other streams have exceeded the 15 percent ERA This situation has been mostly corrected However, some of these prevlously disturbed sub-watersheds still flush sediment into their receiving streams during spring snowmelt, althoughtheir equivalent roaded acre values are now below 15 percent

Proposed increases in regeneration harvest area would increase disturbance in most watersheds. Because planningresources are limited, cumulative impact analysis will focus on protecting Class I fishenes (see Glossary, "stream class") By emphasizing protection of fishenes, other downstream uses will also benefit.

Cumulative impact analysis can be used in several ways

(1) To adjust project scheduling, so that impacts are spread out through time,

(2) To determne the most effective places and objectives for project mitigation; and

(3) To locate and prioritize watershed improvement projects so that impacts are qmckly reduced

Private lands comprise up to 66 percent of some major watersheds The cumulative effects BMP is most effective when more than two thirds of a watershed is National Forest When more than 50 percent of a watershed is pnvate land, the beneficial effects of reducing cumulative effects on National Forest land could be totally masked by pnvate land users Watersheds supporting important fishenes that contain large areas of pnvate ownership include Burney Creek, Warner Creek, Lake Almanor, Antelope Creek, and Upper and Middle Deer Creek. Consultation with private landowners is important to avoid adverse, cumulative effects.

A land disturbance index (LDI) was used to compare different alternatives' long term effects on the land. The index adds the eqmvalent roaded acres created by new roadbmlding, brush burning for mldlife habitat improvement and timber harvesting onto the disturbance base already created by the emsting Forest road system The LDI also considers whether actinties originate in sensitive or non-sensitive watershed areas (see Glossary, "sensitive watershed lands")

(c) Quantity and Quality As a rule, when vegetation is removed from part of a watershed, both stream flow and sedimentation increase immediately and then qmckly decline while the area revegetates. As stated above, both timber harvesting and chaparral burning increase water flow However, they differ in their effects on water quality because of timing Timber harvesting, occurring mostly above the snow line, causes earlier snowmelt and therefore higher spring runoff. This can reduce water quality. Chaparral burning, on the other hand, occurs mostly below the snow line and primanly increases spnng and summer flows; therefore, it has little effect on water quality, except that slightly more sediment may wash from burned watersheds into streams.

(3) Demand

(a) Quantity Demand for water in California is heavy In normal precipitation years, water users are insistent about exercising their water nghts, in drought years the competition becomes intense The two main Forest streams that flow east are the Susan River and Pine Creek (see Appendix V) Pine Creek flows unencumbered into Eagle Lake The Susan River is nearly 100 percent utilized by the Lassen Irrigation Distnet

and other agricultural users in dry years. Approximately 60 percent of the Forest's streamflow that goes west flows into the Feather River or the Pit River, each of which has a series of PG&E hydroelectric facilities. Some of the water from the northwestern part of the Forest also reaches hydroelectric stations at Shasta and Keswick dams. Overall, summer flows are particularly valuable for both agricultural and hydroelectric purposes in addition to their value for sustaining fisheries and riparian vegetation.

The Forest's water values are assumed to be constant for any extra amounts it can produce. RPA water values for 1982 are used for Forest water. These are based on average demand downstream from the Forest. Water flowing west into the Central Valley had a basic value of $59 per acre foot, reflecting the Valley's intensive agricultural use for orchards, rice, and other crops. Water flowing east had a value of only $12 per acre foot, reflecting less-intensive agricultural uses downstream such as growing hay and irrigating pasture. The reservoirs and hydroelectric facilities located on many west-side streams add different values to water in those streams. The most valuable water on the Forest is that which flows into Mountain Meadows Reservoir. Because it passes through a sequence of six hydroelectric plants before reaching the Central Valley irrigation channels, it had a total value of $131 per acre foot.

The Forest Service holds about 350 water rights for uses varying from stock ponds and wetlands to highway rest stops and campgrounds. The Forest has adequate water to meet most of its on-Forest needs. As discussed, demand exceeds the supply for convenient water sources for road-dust abatement and fire protection. Although the Forest has several high-quality fisheries, no water rights have been adjudicated or otherwise established to protect instream resources.

The Lassen National Forest contains no municipal watersheds that are managed under any type of agreement. Some streams have diversions that supply individual, domestic uses. The most nearly "municipal" of these diversions is to the water system shared by the community of Mineral and the nearby administrative site for Lassen Volcanic National Park. The water comes from Martin Creek and nearby springs.

(b) Quality. Demand for water quality is not quantified in this planning process. This type of demand derives from the value of clean water for Forest recreationists, Forest fisheries, and downstream users. Water quality standards are set by the Regional Water Quality Control Boards. They are then approved by the State Board and Certified by EPA. The Forest adheres to these standards by implementing the Best Management Practices (BMP's). In the last decade on the Forest, timber harvesting and road building have generally been moved further away from riparian areas to reduce the potential for damage to streams and riparian zones. The Forest has also worked in several watersheds to rehabilitate damaged channels and riparian vegetation. Typical work has been stabilizing stream banks, riprapping channels, and installing gully plugs and check dams. In some riparian areas, Forest crews have also reseeded bare areas with grass and planted willow seedlings.

Watershed improvements are needed on an estimated 1,500 acres. (This area will be better assessed by an updated Watershed Improvement Needs inventory, to be completed within the Plan decade.) After this initial backlog of restoration work on known problem areas is completed, there will remain a long-term need to do some work indefinitely, both to maintain existing improvements and to solve minor new naturally-occurring problems. This long-term work is estimated at five acres per year.

c. Riparian

(1) Introduction

Riparian areas occur in stream corridors, along lakeshores, and around springs, wetlands, and wet meadows. Table 3-23 shows the acres of these types of riparian areas on the Forest. Vegetation in riparian areas can include characteristic hardwood types such as aspen, alder, or willow, or it can include larger and more vigorous trees of the same species as found on adjacent uplands.

Table 3-23

Riparian and Related Areas

Type of Area	Acres
Ripanan Areas	
Along Intermittent/ Ephemeral Streams	4,367
Along Perennial Streams	2,641
Springs & Wet Meadows	1,496
Lakeshores & Wetlands (not included in above)	3,713
Total	12,217
Related Stream Corridor and Small Lake Areas	
Intermittent/ Ephemeral Streambeds (Aquatic)	1,931
Intermittent/ Ephemeral Terrestrial Zones	9,636
Perennial Streambeds (Aquatic)	1,121
Perennial Terrestnal Zones	9,030
Lake Areas (inside National Forest)	5,485
Floodplain Areas (not included in above)	5,481
Total Related Areas	32,684
Total of Ripanan and Related Areas	44,901

Riparian areas are protected by establishing streamside management zones in timber sale areas and by regulating livestock grazing. Riparian areas have been locally damaged by livestock grazing, road building, skidding logs, timber harvest, fire, or temporary crossings. Some problems can be corrected by range and timber sale area improvement activities, but other problems persist. The actual acreage of damaged riparian areas is unknown. Restoration includes such measures as seeding with grass, planting ripanan hardwoods (willows, aspen, alders, and/or cottonwoods); building streambank protective measures; and management of livestock Under the Forest Plan, no timber harvesting will occur within streamside management zones except when ripananvalues can be maintained or when human safety is a concern. (Refer to the Riparian/Fish Prescription in Chapter 4 of the Forest Plan.)

Currently, some watershed and fisheries improvement projects aim at curing persistent ripanan problems. Recent expenences mdicate that 20 acres is a realistic annual goal for restoring riparian habitat.

Ripanan vegetation is cntical for maintaining water quality and fisheries. It is also important for many wldlife populations because it provides food, nesting sites, shade, overhead cover, and hiding cover. In addition, it prondes nutnents necessary for stream life. Human actinties in ripanan areas include camping, fishing, hiking, mining, timber harvesting, road budding, boating, and aesthetic enjoyments.

(2) Streamside Riparian

Currently, livestock grazing is damaging some riparian areas. Cool, lush streamside areas are as attractive to livestock as they are to wildlife and recreationists, especially in mid-summer The effects of grazing vary by area, from almost none along many creeks outside grazing allotments (such as some tributaries to Mountain Meadows Reservoir), to notable damage from trampling of streambanks and foraging on hardwood regeneration within some allotments (such as along Colby Creek, Benner Creek, and Pine Creek).

(3) Lakeshore Riparian

The Forest's lakeshore riparian areas are generally in good condition Recreation is the major cause of disturbance around larger lakes, especially where the lakeshores are near roads. All small lakes with sport fisheries are circled by angler trails. Trails, campsites, trampling, and littering are the main types of damage, notably at Silver Lake and Lake Almanor. Around many smaller, more remote lakes, such as Echo Lake and Homer Lake, undeveloped campsites are

common in the npanan and other lakeshore areas The npanan areas around pothole lakes and other small lakes are important buffers against pollution Because they have httle or no flushing action by surface outflow, the water in these lakes is particularly sensitive to degradation

(4) Trends

The Forest cannotmcreasethequantityofstream or lakeshore npanan areas except by building new wetlands Vegetative condition and diversity can be improved in exlsting npanan areas, however, thus maintaining or enhancing riparian-dependent resources. Vegetation can be managed to improve bank stability, shade patterns, canopy heights, crown density, and cover Beneficianes include fish, wildlife, and recreationists Opportunities exist to better coordinate fire, grazmg, and loggmg practices to avoid reducing the extent and quality of available nparian area Water nghts applications for small hydroelectric projects threatened mstream water supplies in many cases during the 1980's, but only a few projects were completed A number of other proposals are presently inactive.

Mitigationmeasuresareneeded to prevent small hydroelectnc projects from reducing the amount of water in stream reaches Such flow reductions can diminish fishenes and dry up nparian areas There have been about **30** pending small hydroelectric applications on Forest streams; for further discussion of small hydroelectnc projects, see the Energy section of this chapter (see page **3-15)**

Streams, spnngs, and lakes define the natural limits of the Forest's available npanan areas, which will become increasingly valuable for many resources ***AS*** mature timber is harvested from upland areas, unlogged timber in ripanan areas mll become more important to a wide vanety of mldlife species. Riparian areas will also take on added populanty for hunting, fishing, hiking, and camping Forest management must also intensify in order to resolve resource conflicts and better protect these sensitive areas

Localized npanan areas have been damaged by livestock, road building, skid trails, landings, and felling of harvested trees across creeks The actual extent of such damage is unknown. While some areas have been restored by timber sale area improvement activities, others will remain disturbed until corrected by management activities or natural processes The goals set for improvement of ripanan habitat are to encourage the solution of such past problems, using appropnated funds such as fisheries improvement, range betterment, KV, or watershed improvement projects

23. WILD AND SCENIC RIVERS

a. Background

A Wild and Scenic River is one designated by Congress to preserve certain natural and recreational nver values The 1968 Wild and Scenic Rivers Act established the means by which nvers with "outstandingly remarkable" values could be protected and preserved in their natural or existing condition for use and enjoyment by the public **A** free-flowing condition and "outstandingly remarkable values" are required for a nver segment to be eligible for wild and scenic consideration The Act allows for three different levels of classification wild, scenic, and recreational. The degree of naturalness determines the appropnate designation for each nver or river segment

In establishing the Act, Congress encouraged State and local governments to participate in the program. The State of California established a State System in 1972. Four years later, the State Department of Fish and Game and the Forest Semce entered into a Memorandum of Understanding establishmg a cooperative relationship for handling wild and scenic nver matters in both the National and State Systems

In response to Presidential direction in 1979, the former U.S. Department of Interior (USDI) Heritage Conservation and Recreation Semce conducted a Nationwide inventory to identify by physiographic region those rivers (or segments of rivers) that were in a relatively natural and undeveloped condition. Not all of the streams on the list are totally natural and free flowing, but they represent the best remaining stream segments in each physiographic region. In March 1980, USDI published the Nationwide Rivers Inventory (NRI) Phase I In 1981 the USDI,

National Park Service, published a further refined list of streams believed to be the best qualified candidates

b. Direction

The Wild and Scenic Rivers Act directs Federal agencies to consider potential wild and scenic nvers In accordance mth this, the Forest planning process requres an assessment of the eligibility and suitability of nvers listed on the Nationwide Rivers Inventory **or** identified in the land management planning process Eligibility is determined by applymg the Wild and Scemc Rivers Act cntena and supplemental cntena provlded in USDI guidelines Suitability is analyzed using Forest planning alternatives that contain a range of mld and scenic river recommendations The analysis includes such factors as resources protected and foregone, public and agency interest, pnvate lands and their acquisition costs, etc.

Any recommendation in the Forest Plan for a wild and scemc nver designation is a preliminary administrative recommendation only, whch will receive further renew and possible modification by the Chief of the Forest Semce, the Secretary of Agriculture, and the President of the United States. The Congress has reserved any final decisions to designate rivers to the National Wild and Scemc Rivers System

c. Candidate Rivers

The three rivers that appear in the NRI and cross Forest land are Deer Creek, Mill Creek, and Big Chico Creek Additionally, other rivers were suggested by the public for consideration as potential Wild and Scenic Rivers, mcluding Antelope Creek, Cub Creek, Butte Creek, Hat Creek, Feather River, and Pit River After consideration of the values of the nvers and associated land areas, three nvers were determined to be candidate Wild and Scenic Rivers Antelope, Deer, and Mill Creeks Portions of the latter two nvers cross the Ishi Wilderness and lands being considered for mlderness Refer to Appendix E for a summary of the eligibility and suitability renew process and its rationale

Antelope Creek The headwaters of Antelope Creek form several tributaries on the slopes of Turner Mountain The creek flows southwest paralleling Mill Creek into the Sacramento River, cutting a narrow canyon through mixed conifer forest, oak woodlands, chaparral, and grassland, supporting a narrow belt of npanan vegetation. The area has cultural resource significance because of past use and occupancy by the Yahi Yana people Antelope Creek offers outstanding, challengmg trout fishing, and important habitat for the remnant runs of spring-run salmon and steelhead The segments studied include seven mles of the north fork and seven of the south fork, both upstream from the Forest boundary at Paynes Place. Approximately two of the **14** miles flow through pnvate land, and all of the segments are mthin the Antelope Creek unit of the Ishi B further planning area.

Big Chico Creek Big Chico Creek begins at about 5,200 feet elevation in sloping conifer forest terrain and flows through a deep, scemc, volcanic canyon The lower section has oak-woodland vegetation with patches of shrub and grasslands Its cliff-lined canyon is particularly narrow and rugged mth a boulder-stream bed and nparian vegetation. A total of only one mile of the stream crosses a small portion of the Lassen National Forest, comprised of three scattered parcels of land along Highway **32** Since less than one mile of the creek crosses National Forest land, formal assessment was not considered appropnate and this creek is no longer a candidate for Wild and Scenic River status

Deer Creek Deer Creek has its headwaters on the north slopes of Butt Mountain and flows in a generally southwest direction through the Forest into the Sacramento Valley and the Sacramento River It cuts through rugged, forested mountains and deep canyons mth spectacular geologx formations. The canyon has nationmde cultural significance as part of the area inhabited by Isln, the last survivor of the Yahi Yana Indian tnbe In addition to trout fishing, Deer Creek offers valuable spawning grounds for spnng-run chinook salmon and steelhead The total length of the inventoned nver mthm the Forest boundary is 38 miles, 31 miles flow through National Forest lands Almost 10 mles pass through the Ishi Wilderness

Mill Creek Mill Creek originates in Lassen Volcanic National Park and flows in a southwest direction through meadows and dense forests It then descends rapidly through a spectacular

canyon lined with steep lava and basalt cliffs, to the Sacramento Valley and into the Sacramento River In addition to its rainbow trout fishery, Mill Creek has an anadromous fishery with the highest elevation spawning habitat and longest tributaries ascended by spring-run chinook salmon in California As part of the former home of Ishi, it also has high cultural significance. The total length of the inventoried river is 32 miles, 26 5 miles are on Forest administered lands Almost 10 miles flow through the Ishi Wilderness, and about 12 miles through the Mill Creek Further Planning Area

The creek ends at about 300 feet elevation, it enters the Forest at 5,200 feet elevation and leaves at about 2,800 Recreation activities here are limited, although trout fishing is rated as good along most of the creek The lower reaches contain small populations of steelhead trout, and spring and fall run chinook salmon Other animal life is typical of the southern Cascades and northern Sierra Nevada Stream flow is very low in the summer but increases 15 fold in the winter; water quality is good.

Dual Designation Mill Creek flows through the Ishi Wilderness as well as through the Mill Creek further planning area. Deer Creek also flows through the Ishi Wilderness, near the southern mlderness boundary If designated, where these rivers cross a wilderness, the Wild and Scenic River Act directs that the area in common be subject to the provisions of both that Act and the Wilderness Act, and that in cases of conflict the more restrictive provisions apply

The assessment of these candidate Wild and Scenic Rivers is described in Appendix E, Wild and Scenic Rivers Evaluation

24. WILDERNESS *AND* FURTHER PLANNING AREAS

a. Introduction

As provided by the Wilderness Act of 1964, a Wilderness is a unit of undeveloped Federal land designated by Congress It retains its primeval character without permanent improvements or human habitation, and is protected and managed to preserve its natural condition On this Forest, the Wilderness Act designated the Caribou and the Thousand Lakes Wildernesses

Twenty-one roadless areas on the Forest have since been identified as potential new wildernesses They have been studied since 1977 in the RARE II process and since 1980 in the Forest Planning process The California Wilderness Act of 1984 added 1,800 acres to the Caribou Wilderness and designated the Ishi Wilderness, bringing the Forest wilderness total to 78,060 acres Of the remaining 18 roadless areas, the Act made 12 available for non-wilderness management. The Forest Plan recommends either wilderness or non-wilderness for the six remaining further planning areas Wilderness recommendations are preliminary administrative recommendations only, which will receive further review and possible modification by the Chief of the Forest Service, the Secretary of Agriculture, and the President Congress has reserved the authority to make final decisions on wilderness designation.

b. Existing Wilderness

Caribou Wilderness The 20,625 acre Caribou Wilderness is located on the Almanor Ranger Distnct It lies along the eastern boundary of Lassen Volcanic National Park and shares many of the same features The Caribou is characterized by a gentle, rolling, forested upland with many forest-fringed lakes, and eighteen miles of trail access for fishing and camping In 1991, this wilderness received 14,600 recreation visitor days (RVD's) It is used both as a destination wilderness and as cross-country access into the wilderness backcountry of Lassen Volcanic National Park The 1984 California Wilderness Act added 1,800 acres (the Black Cinder and Trail Lake A roadless areas) to the Caribou Wilderness, extending the original boundary to conform with more recognizable features on the ground

Ishi Wilderness The 41,100 acre Ishi Wilderness lies on the Almanor District in the southwest portion of the Forest Located in the transitional zone between the warm Sacramento Valley and the Sierra Nevada, it is the only wilderness that preserves a major area of the Sierra/Cascade foothill ecosystem Elevation of the landscape ranges from 1,400 feet along Deer Creek to 4,000 feet near Barkley Mountain, in a network of flat ridges, sheer canyon walls, and

deep ravines Lava formations throughout the area create cliffs, caves, pillars, and rushing rapids in the creek bottoms. Mill and Deer Creeks flow through rugged canyons, both are listed in the Nationmde Rivers Inventory for addition to the National Wild and Scenic Rivers System. These creeks support resident trout and an important anadromous fishery of spnng run chinook salmon and steelhead trout The area has been used for a vanety of activities including hiking, camping, hunting, fishing, grazing, and off-highway use. Motonzed use is now prohibited In 1991, the Ishi Wilderness received 7,800 RVD's of use

Thousand Lakes Wilderness The Thousand Lakes Wilderness is located northwest of Lassen VolcanicNational Park on the Hat Creek Ranger District In addition to many clear lakes, it has 16,335 acres of contrasting topography and vegetation types Twenty-two miles of trail reveal volcanic and glacial formations, rocky ravines and mountain slopes, open meadows, and stands of lodgepole pine and red fir The wilderness is dominated by Crater Peak (elevation 8,677 feet), the highest point on the Forest Thousand Lakes Valley, in the heart of the wilderness, is a reminder of the glacial action that eroded an old volcano and created the many small lakes and ponds scattered throughout. Dunng 1991, the wilderness received 5,500 RVD's of use

The followmg discussions on wilderness activities do not include statistics on the 1984 wilderness additions because reliable use data are not yet available for these areas

c. Wilderness Activities

Recreation use in the Canbou, Thousand Lakes and Ishi Wildernesses represented 185 percent (27,900 RVD's) of the total recreation use on the Forest in 1991 The use data are based on a combination of self registration at trailheads, vehicle counts and one-on-one contacts with users A permit system was used at one time and may he reinstated in this planning period Permits provide specific information on numbers of users, group size, purpose of visit and mode of transportation (foot or horse)

Over three-quarters of the wilderness recreation activlty is camping (35 8 percent), hiking (26 5 percent), and fishing **(23.5** percent) See Figure 3-23. Future recreation in the Canbou and Thousand Lakes Wildernesses is expected to follow the same activlty pattern, while that in the Ishi Wilderness will most likely vary due to the terrain. The rugged Ishi country and lowland attractions of Deer and Mi11 Creeks contrast sharply with lake, forest, and alpine terrain The Ishi Wilderness is also snow-free and available for use year-round Use data, recorded for Ishi Wilderness since 1985, shows thirty percent as Wildlife or Fish User Days (WFUD's) For modeling and reporting purposes, these WFUD's are subtracted from the total wilderness RVD's and accounted for separately.

Although recreation is the most common use of mlderness, other types of uses are part **of** the total wilderness demand. Many people enjoy wilderness vicariously (Fisher et al 1972), they may never set foot in it, but still value its emstence Other types of wilderness uses include scientific, educational, therapeutic, and cultural actinties

d. Wilderness Demand

Wilderness demand, or use, is affected by a vanety **of** economic and cultural factors In the mid-1970's, the increased populanty of backpacking caused wilderness use to intensify, in the early 1980's, the economicrecessioncausedit to drop Despite these short-term fluctuations, there has been an overall stable and growing demand for wilderness in the long run

Population, income, education, and demographics all affect mlderness use. Of these, population is by far the best predictor over the long-term

About 90 percent of wilderness users on the Forest are California residents and are distnbuted fairly evenly throughout the State Therefore, the projected rate of increase in wilderness use on the Forest is expected to closely approximate the rate of increase in the population **of** California

When the Ishi Wilderness was designated in 1984, it more thandoubled the area ofwilderness on the Forest Ishi represents a unique mlderness expenence which is accessible year-round, and is located near the population centers ofthe Sacramento Valley, these factors augment its potential popularity Although some use of the

Ishi area is expected to displace use of the Caribou and Thousand Lakes Wildernesses, some will be newly-generated

e. Existing Management

The Caribou Wilderness Management Plan and the Thousand Lakes Wilderness Management Plan (USDA 1976, 1977) are being rewritten to guide the administration of the two pre-1984 wildernesses Both plans contain specific direction, in 32 categones, to implement three management objectives common to both areas

1 Perpetuate natural conditions

2 Provide for recreation consistent with natural processes, primitive conditions, and solitude opportunities

3 Provide freedom from rules and restrictions while preserving the wilderness resource

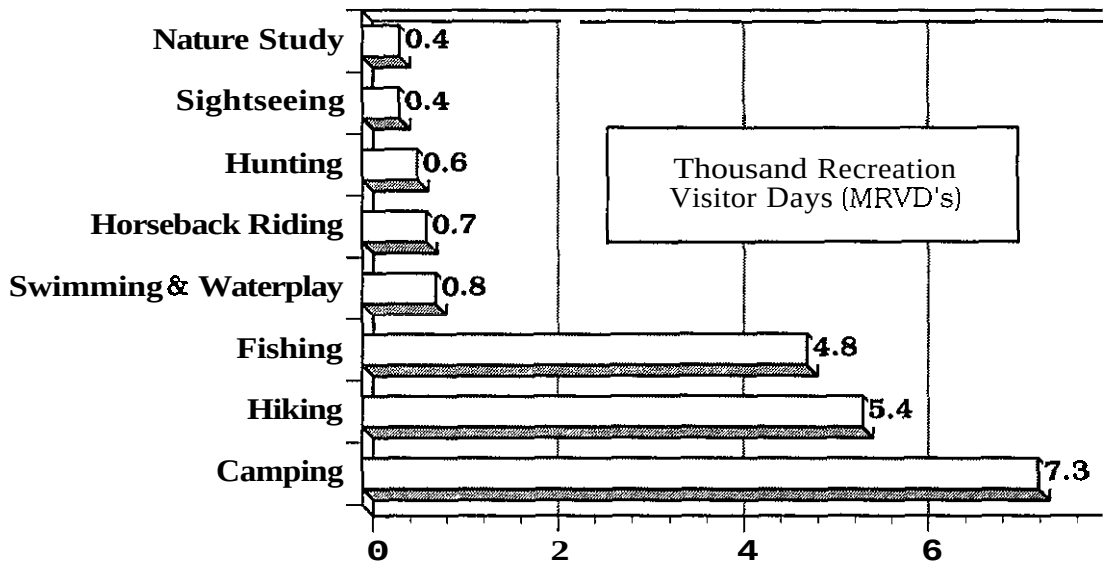
In both areas, wilderness visitors tend to use the areas adjacent to lakes and meadows most heavily As use increases, the potential exists for conflicts between users (e g , backpackers vs horse groups) and resource impacts (e g , damage to fragile meadows, contamination of water sources by *Giardia*) The Forest will need to assess the extent of such impacts, as the basis for amending existing management plans to maintain wilderness values

The Forest, in conjunction with Lassen Volcanic National Park, had an approved fire plan for both Caribou Wilderness and the Park This plan was originally approved in October 1982 It called for natural fires in these areas to be monitored as they burned, and to allow fire to resume its ecological role in Lassen Volcanic National Park and Caribou Wilderness ecosystems

In 1988, all prescnbed natural fire plans were put on hold until a committee reviewed policy, direction, and processes used in managmg prescribed fire This was a result of the problems experienced during the 1988 fire season and the fires around Yellowstone National Park In 1989, final direction on a fire management policy was released.

The Forest and Lassen National Park met to revise the 1982 plan with the new direction The revised plan should be approved and in place by

Figure 3-23
Wilderness Use by Activity, 1982



Source Forest Recreation Management *(RIM)* system

summer 1992. The Forest will prepare similar Fire Management Action Plans for the Thousand Lakes and Ishi Wildernesses

The Forest planning process reassesses the existing management direction, and current wilderness plans will be made compatible with the approved Forest Plan A wilderness implementation plan was completed for the Ishi Wilderness in 1989 A supplement will be prepared to further address the issues of grazing and inholder access The Caribou Wilderness Plan will be amended to include the new additions

f. Roadless and Further Planning Areas

A roadless area is defined as an area of 5,000 acres or larger that is substantially undeveloped and natural

The Department of Agriculture, Forest Service, issued a national environmental impact statement in January 1979, documenting the results of a review of 62 million acres of roadless and undeveloped areas within the 190 million acre National Forest System. The purpose of this roadless area review and evaluation (RARE II) was to determine which roadless areas were suitable for wilderness and which should be used for other purposes

In the Pacific Southwest Regon, RARE II analyzed over six million acres located in California About 983,000 acres were recommended for wilderness, 2,643,000 acres were recommended for further planning, and 2,395,000 acres were recommended for non-wilderness

On the Lassen National Forest, 21 roadless areas were identified by RARE 11, totaling approximately 208,600 acres or 20 percent of the Forest For the Forest, RARE II recommended three areas for non-wilderness (about 31,300 acres), nine areas for further planning (about 101,700 acres), and nine areas for wilderness (about 75,600 acres)

In late 1984, the California Wilderness Act was passed by Congress and signed by the President On this Forest, the Act designated three areas as mlderness, established six further planning ar-

Table 3-24

Further Planning Areas

Area Name	RARE II#	RARE II Allocation	1984 CA Wild Bill	Acres Gross	Acres Net
Butt Mountain	5100	FP	FP	8,300	8,300
Heart Lake	5096	FP	FP	9,289	9,289
Ishi (B) (split unit)	B5098	FP	FP	25,312	20,027
Antelope Unit				*28,855*	*27,624*
Brushy Mtn Unit				*6,457*	*2,405*
Mill Creek	5284	FP	FP	9,815	7,990
Trail Lake (B)	B5095	FP	FP	1,115	1,115
Wild Cattle Mountain	5093	FP	FP	5,265	4,965
Total				59,096	51,686

eas, and released 12 areas from wilderness consideration in this planning period. Table 3-24 summarizes the result of the legslation

The non-wilderness areas are not being managed for other multiple use purposes due to public concerns Public interest in maintaining non-roaded areas has made it difficult to resume multiple use management, but such management is tentatively planned for the future The decision to enter roadless areas for timber management or other resource actinties will be made when projects are proposed and after site specific environmental analysis

Appendix C discusses the six further planning areas and their future management by alternative, Appendlx M displays the 12 other roadless areas and their future management by alternative. Table 3-25 summarizes the Forest's six further planning areas

g. Available Wilderness

Several other wilderness areas lie adjacent to or within a relatively short distance of the Forest's three wildernesses. Most of Lassen Volcanic National Park is designated wilderness (78,982 acres) The Bucks Lake Wilderness is on Plumas National Forest to the south, and the South Warner Wilderness is on Modoc National Forest to the north The latter two are about a two-hour dnve and a three-hour drive, respectively, from the Forest

The 1984 California Wilderness Act added an additional 1,792,830 acres of National Forest wilderness in the State Nearby Forests surrounding the north end of the Sacramento Valley all now have wildernesses from which users can choose

Table 3-25

Effect of California Wilderness Act on Roadless Areas

Area	Area Number	Wilderness	Further Planning	Released
Black Cinder	5091	X		
Butt Mtn.	5100		X	
Chips Creek	5099			X
Cinder Butte	5090			X
Cub Creek	5094			X
Cypress	5088			X
Devil's Garden	5067			X
Heart Lake	5096		X	
Ishi (A)	A5096	X		
Ishi (B)	B5098		X	
Lava	5084			X
Lost Creek	5089			X
Mayfield	5085			X
Mill Creek	5284		X	
Mt. Harkness	5092			X
Polk Springs	5097			X
Prospect	5086			X
Timbered Crater	5083			X
Trail Lake (A)	A5095	X		
Trail Lake (B)	B5095		X	
Wild Cattle Mtn.	5093		X	

25. WILDLIFE

a. Introduction

The Forest provldes habitat for over **361** species of animals — amphibians, reptiles, fish, birds, and mammals The bald eagle, peregnne falcon, and Shasta crayfish are Federally classified as Endangered, and the northern spotted owl has been listed as Threatened by the **U.** S Fish and Wildlife Service. Seven of the species are considered Sensitive in the Pacific Southwest Region Forty-five species provlde hunting and trapping opportunities Appendix R lists the species that occur on Forest and their classified status

Many wildlife species can be assigned into two categones of habitat preference 1) early successional species — those most dependent on young vegetation, and 2) late successional species — those most dependent on mature or over-mature vegetation Other species depend on special habitats (e g riparian areas, wetlands, or boulder fields), special habitat elements (e g snags, dead and down wood, and cliffs), or combinations of several habitat types, successional stages, and special habitat elements

b. Management Zndicator Species

The objective of the mldlife and fish management program is to manage habitats in order to maintain or enhance vlable populations of existing mldhfe and fish species To insure that viable populations of all species occurnng on the Forest are maintained, certain species–called Management Indicator Species (MIS)--were selected to act as barometers for mldlife communities These species were selected because of their status as a listed species or because they represent the vegetation types, successional stages, and special habitat elements necessary to provide for viable populations of all species on the Forest In addition, their population changes are believed to indicate the effects of management activities on other wildlife and fish populations If a selected species and its habitat are mfluenced significantly by management activities, similar effects can be expected on other fish and wildlife species with like habitat requirements The process used in selecting Management Indicator Species and Habitat Capability Models (Shimamoto and Airola 1981)is available in the Planning Records and at the Ranger Districts

Eighteen mldlife and fish species were selected as MIS on the Forest Species and a summary of their habitat and habitat elements are listed in Table **3-26** Appendix S descnbes their distribution, habitat, and population sizes No Sensitive plants were selected for Management Indicator Species because most of their habitats are too specialized to make the species useful indicators of conditions in other than a very small area Designating Sensitive plants as MIS would also not provlde them any more protection from special management than they already receive

Management of fish and wildlife on National Forest lands is a multi-agency effort The California Department of Fish and Game is responsible for managmg wildlife populations, pnmarily through the regulation of harvest The Forest Semce is responsible for managmg wildlife habitat on National Forest lands Because of the interdependence of populations and habitat, the State and Forest Service work closely together to attain common goals. The U S Fish and Wildlife Semce enters this multi-agency effort where Threatened and Endangered species, migratory waterfowl, or animal damage control are involved Other agencies such as the Bureau of Land Management and National Park Servlce are involved where lands that they administer share common boundaries with the Forest.

Management of habitat to insure the recovery of the Endangered bald eagle, peregrine falcon, and Shasta crayfish, and of the Threatened northern spotted owl, is required under the Endangered Species Act Certain other species have been designated by the Regional Forester of the Pacific Southwest Region as "Sensitive" These species must be gwen management attention to insure that their populations do not decline to the point where vlability of the species is jeopardized Thus, management must assure that an adequate number of breeding individuals remain distributed throughout the current or potential range of the species California spotted owl, marten, fisher, northern goshawk, Sierra Nevada red fox, great gray owl, and willow flycatcher are all Region **5** Sensitive species that occur on the Forest

Table **3-26**

Wildlife Management Indicator Species and Their Successional Stage and Special Habitat Preferences

Species	Reason for Selection	Successional Stage	Special Habitat Indicated
Bald Eagle	Recovery species (Endangered)	Late	Large bodies of water, some isolation from human disturbance, mature conifers with canopy closure less than 40% in a multilayered stand, snags
Black Bear	Special interest and harvest species	Early and Late	Mature conifer forest interspersed with brush patches and meadows, abundant dead and down logs
Bufflehead	Special interest and harvest species, cavity nester	N/A	Wetland, large and small ponds and lakes; large snags with suitable cavities, abundant macroinvertebrates
Fisher	Sensitive species	Late	Dense (60-100% canopy closure), multi-stoned, multi-species climax coniferous forests, large snags and down logs
Goshawk	Sensitive species	Late	Late successional stage (mature) conifers with canopy closure of at least 40%, meadows, openings, or npanan areas, snags, dead and down logs
Hairy Woodpecker	Special interest species	Late	Late successional stage (mature) conifers with canopy closure of at least 40%, large snags with suitable cavities
Mallard	Harvest species	N/A	Wetlands, large and small ponds and lakes, emergent vegetation, open water, invertebrates, submerged aquatics, and grasses
Marten	Sensitive species	Late	Dense mature and over mature conifers with canopy closure greater than 50%, large snags and down logs

Table 3-26 (continued)

Wildlife Management Indicator Species and Their Successional Stage and Special Habitat Preferences

Species	Reason for Selection	Successional Stage	Special Habitat Indicated
Mule Deer	Harvest species	Early	Interspersion of many seral stages (edges), riparian vegetation; meadows, early to midsuccessional stage of most vegetation types
Osprey	Special interest species	Late	Large ponds, lakes, large snags, well stocked populations of cold and warm water fish
Peregrine Falcon	Recovery Species (Endangered)	N/A	Diverse range of vegetation types and seral stages, riparian areas, cliffs.
Pileated Woodpecker	Special interest species	Late	Large (>24") snags, mature conifers with at least 40% canopy closure
Pronghorn Antelope	Special interest and harvest species	Early	Meadows, riparian vegetation, sagebrush, bitterbrush
Rainbow Trout	Special interest and harvest species	N/A	Stable stream channels, pools; 70-95% water surface shade, 25% or greater gravel in riffles, abundant orgamsms
Spotted Owl			
California	Sensitive species	Late	Late successional stage (mature) conifers mth at least 40% layered stand; snags, dead and down logs.
Northern	Recovery species (Threatened)	Late	
Steelhead Trout and Chinook Salmon	Special interest and harvest species	N/A	Moderately deep streams with riffle velocity between 5 and 3 5 feet/second, 40% or greater of the stream composed of coarse gravel and rubble, greater than 60% stream cover, abundant macroinvertebrates
Western Gray Squirrel	Special interest species	Late	Well-distributed age classes in oak woodland, digger-pine mth oak, mature mured conifer, greater than 40% closure in the canopy, den trees greater than 15 inches, fungi and acorns

The relative abundance and distribution of wildlife are affected by most land management actions Wildlife is of high interest to the public, and wildlife habitat is of particular interest to the hunting and wildlife viewing public, Forest managers, and other government agencies. Forest managers need to decide how much of what types of wildlife habitat should be provided through time

c. *Supply*

(1) Threatened and Endangered Species

Bald Eagles The National Forest currently supports *14* breeding pairs of bald eagles Five suitable unoccupied territones also exist Lands immediately adjacent to the Forest support at least three other pairs This density ranks the Forest as one of the most productive areas for breeding bald eagles in California Approximately 6,900 acres on the Forest are included mthm bald eagle nest territones, and approximately 7-15 young eagles are fledged on the Forest annually As many as 80 bald eagles unnter on the Forest Potential habitat exists for an estimated maximum of 19 nesting pairs on the Forest itself, adjacent lands have additional habitat The Forest has been assigned a goal of **16** breeding pairs in order to meet its contribution to population recovery

Current management includes monitoring nesting success and coordinating bald eagle needs with other resource activlties, and with the California Department of Fish and Game and the U S . Fish and Wildlife Semce Needs for existing and future eagle nesting habitat are coordinated with the Forest's timber sale program

Nesting success depends on the presence of suitable nest trees, an adequate forage base, and freedom from disturbance during the nesting season. Species recovery depends on eliminating the problem of pesticide contamination, eliminating the killing of individual birds, and maintaining adequate undisturbed habitat to permit normal annual population recruitment Although the Forest has control over some of the factors that affect eagles, a number of factors are outside Forest Service management responsibilities or occur away from National Forest Lands

Peregrine *Falcon* The peregrine falcon is another Federally listed Endangered species on the Forest Although only one occupied territory is known, potentially suitable habitat is abundant. At least five areas are judged suitable as nesting temtones. Declines in peregnne falcon populations have resulted mainly from excessive accumulation of organochlorine pesticides within the birds. Nesting success requires suitable nesting ledges near suitable hunting areas and freedom from disturbance dunng the nesting season The Forest monitors nesting success annually and conducts surveys to locate possible new nest sites

The Forest can meet species recovery goals by recruiting wild hatched birds, but can accelerate this process by supplementing natural populations with birds from captive breeding programs. Because of the remote locations of active and potential sites, human disturbance is not a major problem

Shasta Crayfish The Shasta crayfish is the only invertebrate species found on or near the Forest that is Federally listed as Endangered. It was placed on the Endangered list in September 1988

Habitat for the Shasta crayfish is found in the Hat Creek and Pit River drainages The species requires a clear, temperature-constant aquatic environment, provided by spring-fed streams and lakes Current population levels are reduced due to competition from introduced exotic species of crayfish that compete with the Shasta crayfish **An** inventory of potential Shasta crayfish habitat was conducted in 1990 on the Forest, but no populations were found In all management actions the Forest will protect and/or enhance all known and potential habitat for the Shasta crayfish

(2) Sensitive Species

Fisher The fisher classified as Sensitive by the Regional Forester, requires dense Douglas-fir and mixed conifer forest types where pines comprise 20 to 80 percent of the timber cover Hardwoods may be an important component of fisher habitat in some areas

In the northern Sierra Nevada of California, the mean elevation of the majority of fisher sightings

is 5,500 feet (1,676 meters) Preferred habitat is charactenzed by dense (60 to 100 percent canopy), multi-storied, multi-species, mature coniferous forests with a high number of large snags (greater than **30** inches DBH), and down logs which provide adequate cover and an abundance of potential den sites. These areas must be in close proximity to dense riparian corndors and saddles between major drainages, for use as travelways **An** interspersion of small openings (less than 2 acres) with good ground cover is also required for foragmg use Habitat in unroaded areas is preferred

The Forest does not have current information on population numbers or trends for fisher Because fisher habitat requirements are greater than the Forest can provlde, the Lassen National Forest, alone, cannot support a viable fisher population The Forest will, however, contribute to maintaining population vlability for the fisher by establishing management direction that provides for a series of suitable habitat areas, all connected by travel corndors to other areas of suitable habitat on adjacent lands within the Klamath and Sierra Nevada provinces

In March 1990, five habitat management areas (HMA's), with dispersal/travel corridors connecting them, were tentatively identified for the Lassen National Forest These 9,800 acre HMA's were delineated in areas of known fisher observations and suitable habitat Each habitat area is connected by a 600 foot wide travel corridor which generally follows riparian areas and has 50 to 60 percent canopy closure.

Adequate acreage of suitable habitat is fundamental to maintaining viable fisher populations, however, a key issue in management of the species involves habitat reduction through timber harvest Fisher dependence upon old and mature successional stages of forest makes management of their large terntories difficult The Forest's goal, as described above, is to provlde fisher habitat by maintaining areas suitable for denning, resting, and foragmg Scheduled timber harvesting is deferred in fisher HMA's until additional information is gathered on their population trends and habitat requirements See Appendix T in the Plan for an analysis of the current situation and management constraints

Great Gray ***Owls*** Great gray owls are designated as Sensitive by the Forest Service in California. They are probably the rarest owls in the Sierra Nevadas. They require stands of overmature timber contaming large snags adjacent to large meadows There has been only one great gray owl located on the Forest in recent years

The forest can provlde for great gray owls by managmg meadow ecotones to preserve large, overmature trees and high snag densities

Marten The marten is classified as Sensitive in the Pacific Southwest Region Marten are opportunistic feeders, with much seasonal variation in their diet, and meadows adjacent to timber are important foragmg habitat Large blocks of mature and overmature forest for denning and foragmg are needed Optimal habitat is conifer and mixed conifer-hardwood forests with multistoned stand structure, large diameter trees, dense canopy and stand decadence

The Forest does not have information on population numbers or trend Although there are histoncal sightings of marten, their elusive nature makes them difficult to locate and study The major issue is a reduction of old growth stands through timber harvesting and the resulting decline of suitable marten habitat

In March 1990, 19 marten habitat management areas were modeled on the west side of the Forest, linked with 600 foot wide travel corndors to provide dispersion routes for young Habitat areas and corndors were also located to provlde linkages to other areas of suitable habitat on adjacent lands and through Lassen Volcanic National Park The locations of the HMA's meet the habitat requirements for marten as summarized in a comprehensive literature review for the Pacific Southwest Region The network was designated based on (1) historical information for marten or suitable habitat, (2) proper distribution of habitat as defined by the regional literature renew, (3) presence of areas of marten habitat that most closely meet the 2,100 acre guideline, and (4) minimizing impacts on other Forest goals Scheduled timber harvesting is deferred in marten HMA's until additional information is available on their population trends and habitat requirements See Appendix T in

the Plan for additional information on management constraints

Northern Goshawks Goshawks are designated as Sensitive by the Forest Semce in California They appear to be limited by the amount and quality of nesting habitat, which generally consists of closed-canopy conifer stands of large diameter trees Twenty active goshawk nesting terntones have been identified on the Forest, but frequent sightings of adult birds in other areas strongly indicate the presence of many additional breeding pairs

In order to insure that a vlable population of goshawks occurs over time on the Forest, a network of terntones was identified throughout potential goshawk habitat on the Forest The network met the Regional Planning Direction of at least one territory per 18 square miles, and 50 acres of mature habitat per pair These criteria resulted in a habitat network for 113 pairs of goshawks for the Forest

The Forest can provlde for goshawks by protecting mature forest habitat for nesting Future nesting habitat may also be provlded by silvlcultural treatments Foragmg habitat can be improved by increasing habitat age diversity through timber harvest

Szerra Nevada Red Fox The Sierra Nevada red fox is classified as Sensitive in California. Little is known about the life cycle of this fox, but it seems to be rather general in its habitat requirements and not particularly abundant in any habitat type There have been widely scattered sightings over many years on the Forest

Forest management will probably not affect the range or distnbution of the Sierra Nevada red fox, and no special management practices will be required

Spotted *Owls* Two subspecies of the spotted owl are found on lands managed by the Lassen National Forest The northern spotted owl (*Strix occzdentalzs caurina*) is found north of Highway 299 The California spotted owl (*Strix occidentalis occidentalis*) is found south of Highway 299 Both subspecies tend to occupy similar habitat large blocks of mature and over-mature forest for foragmg, roosting, and nesting, or younger forests that possess the appropnate structural and vegetational attnbutes with abundant prey species. Optimal habitat is true **fir** and mixed conifer forests with multi-stoned stand structure, large diameter trees, dense canopy closure and stand decadence

Inventories have located at least 87 pairs of California spotted owls on the Forest There are no known pairs of northern spotted owls on the Forest The total known spotted owl population on the Lassen as of 1991 is 191 ndividuals, one of which is in the range of the northern spotted owl

In January 1987, the U S Fish and Wildlife Semce (USFWS) received a petition to list the northern spotted owl as an endangered species under the Endangered Species Act In June 1989, the USFWS proposed to list the northern spotted owl as Threatened Following this proposal, an interagency committee of scientists and researchers (ISC) was formed to develop a conservation strategy for this subspecies. Their report, issued in Apnl 1990, recommended the creation of Habitat Conservation Areas (HCA) to replace the SOHA management concept in Washington, Oregon, and the Klamath Province of Northern California One HCA is located on Shasta National Forest lands administered by the Lassen In June 1990, the USFWS listed the northern spotted owl as Threatened throughout its range

Pending enactment of new legislation, any applicable action by the Endangered Species Committee, adoption of a recovery plan by the Fish and Wildlife Semce, or the results of further biological consultation between the Forest Service and the Fish and Wildlife Semce, the Forest Semce will conduct timber management activlties in a manner not inconsistent with the Interagency Scientific Committee recommendations.

The California spotted owl is considered Sensitive by the Pacific Southwest Regon of the Forest Service Without active efforts to protect sufficient habitat, the California subspecies could also reach Threatened or Endangered status.

The Pacific Southwest Regional Guide directs that a network of California spotted owl territories be established to insure species vlability

The number of SOHA's necessary to provlde a vlable population on the Lassen National Forest ıs 39

In December 1982, the Forest identified the locations of the 39 Spotted Owl Habitat Areas (SOHA's) that best met the Regional requirements for an owl network to maintain species vlabihty while mınımızıng the impact on other Forest goals The SOHA network was based on several factors (1) the presence of owls or suitable habitat; (2) proper dıstrıbutıon as defined in Regıonal direction, (3) the presence **of** amounts of owl habitat that most closely met the 1,000 acre guıdelıne for suitable base habitat and 650 acres of replacement habitat; and (4) the lack of conflict wıth active timber sales

In addition to the 39 SOHA's that met requirements, four new SOHA's were established to further enhance spotted owl viability on the Forest Three of these were located in the Pit River "corridor" to enhance dıspersal and interchange opportunities between the northern and California owl subspecies in the Klamath and Sierra Nevada provınces. The fourth was added because it contained a successfully reproducing pair of California spotted owls in habitat not previously considered mthin its range In 1990, the three SOHA's north of Highway 299 were replaced by a Habitat Conservation Area, as discussed in Appendur S of the Plan This area constitutes the southeastern limt of the northern spotted owl's range The HCA established by the ISC report is located on Shasta National Forest lands which are administered by the Lassen. The three SOHA's mthin the focus **of** the study by the ISC report are no longer being managed as SOHA's Instead, they wıll be managed in a manner not inconsistent wıth the recommendations found ın the ISC report

Within the SOHA's and HCA, only 27,000 acres of suitable habitat remain, creating a shortfall of 48,000 acres Shortfalls in acreages of suitable habitat are expected to be eliminated mthin 30-50 years as younger stands mature and become suitable Dunng the interim, non-network owls wıll be protected until there are 39 nesting pairs mthin the SOHA's Forest direction calls for the protection of 125 acres for each non-network pair found If a single owl is found, 125 acres mll be protected from timber harvesting for two field seasons until the status of the bird can be determined This 125 acre size delineation was developed from the standards and guides in the ISC report. The report recommended that a 1/4 mile radius or 125 acres of habitat be protected for nesting pairs of owls outside of HCA's No scheduled timber harvesting mll occur mthm the SOHA network or HCA

Willow Flycatcher Willow flycatchers have been designated as Sensitive by the Regıonal Forester. This flycatcher is dependent upon riparian deciduous habitat or wet meadows wıth willow thickets. Willow flycatchers were confirmed to inhabit the Forest in 1990

All npanan habitat and meadows wıll be protected using Best Management Practices (Forest Plan, Appendlx Q). These measures should assure continuing populations of the wıllow flycatcher.

(3) Other Species

Mule Deer and Black-Tailed Deer The California Department of Fish and Game has completed management plans for the sıx deer herds on the Forest The follomng information is drawn from these plans

Although deer populations increased follomng the early days of loggmg and grazing, they have declined sigmficantly in the recent past Declines have been due to a vanety of factors including maturation of brush vegetation, conversion of brush habitat to timber, and housing and recreational development It is estimated that 49,000 deer used the Forest for summer range ın 1982. The target for the population on Forest land is 54,760, based on values listed ın the indivldual Californa Department of Fısh and Game Deer Herd Plans (Appendur T) Coordinating resource management actinties (especially timber management) and other habitat improvement wıll help achieve this goal

About 200,000 acres of the Forest lie mthin deer mnter range, but only about 53,000 are suitable for treatment to increase carrymgcapacity. Most of this is in the wedgeleafceanothus type around Day Bench, Murken Bench, Lake Britton, and the front country foothills

For the past several years the Forest has carried out prescribed burning of several thousand acres

of winter range per year, in a program cooperatively financed with the Califorma Department of Fish and Game. Such work should be coupled wlth improvement **of** fawning habitat and summer range to be most effective Ideally, timber harvests should be coordinated so that location, size, and timmg of treatments provide desirable forage-to-cover ratios and fawning habitat

Osprey The osprey population on Forest lands is about **32** pairs. It is currently stable and production has increased markedly since the late 1960's and early 1970's. Nesting habitat is adequately protected. The Forest modifies timber management activities mthm active and potential nesting areas to prevent disturbance, and to provlde current and future nest trees.

Populations on National Forest lands could potentially be increased by 20 percent at Eagle Lake and by a small amount at McCoy Flat Reservoir, the remainder of the Forest is probably approaching capacity. Opportunities to enhance habitat include provlding suitable snags, constructing artificial nesting platforms, and maintaining a permanent pool at McCoy Flat and other reservoirs.

Pileated Woodpecker Pileated woodpeckers are found throughout the Forest within comfer and conifer-hardwood stands, where large diameter softwood snags are present. Conflicts in managing this species occur pnmarily from timber and fuels management actinties which reduce the older age class of timber, remove standing snags and down logs, and salvage recent timber mortality. Fuelwood gathering also limits the number of standing snags on the Forest where vehicle access is easy.

Opportunities exist to create and/or recruit large-diameter softwood snags into areas now deficient, and to provide an adequate distribution of older mature mixed conifer stands throughout the Forest.

Pronghorn The Forest provides approxlmately seven percent of the total habitat used by the Lassen subherd of pronghorn antelope This is primarily summer range mthin Grays, Harvey, Pine Creek, and Antelope valleys

Cattle and pronghorn graze together on summer ranges and, in areas of concentrated livestock **use,** some competition between cattle and pronghorn probably occurs.

According to Pyshora (1981), water availability **or** predation of antelope kids by coyotes could be limiting this subpopulation Although these pronghorn show the lowest survival of young for any subherd in the State, they mcreased from approxlmately **432** animals in 1958 to **1,428** in 1981

Pronghorn numbers can probably be increased if the Forest Semce continues to develop water sources, allocates additional forage to antelope, and modifies fences to permit free antelope movement Some reduction in forage use by domestic livestock may also be necessary. Conflicts between antelope, hvestock, and wild horses on winter ranges off the Forest would also need to be resolved.

Western Gray Squirrel Gray squirrels are present throughout the Forest wherever oaks, pines, and snags are present Abundant populations of gray squirrels currently exist on the Forest Opportunities exist to improve habitat for this species by manipulating young stands of hardwoods to produce older age classes, by protecting oak stands during timber harvesting activities, and by regenerating older oak stands through timber management and burning.

Snags, and Dead and Down Wood Snags and dead and down wood are important to many wildlife species Snags provlde needed habitat for at least **47** bird species, **26** mammals, and many reptiles and amphibians on the Forest Dead and down wood has similar value as habitat for wildlife Management Indicator Species dependent on snags and/or dead and down wood are the bufflehead, hairy woodpecker, pileated woodpecker, marten, black bear, bald eagle, osprey, and spotted owl.

The Pacific Southwest Regional Guide specifies that, to the extent possible, **1** 5 snags per acre be maintained with each timber compartment Surveys conducted in 1980 showed that mured-conifer and red fir habitat types had adequate snag densities. Much of the eastside pine type has snag densities too low to insure long-term vlability of cavlty dependent species; additional snags will be maintained by limiting firewood cutting and salvage harvestmg. Live culls may

also be substituted for dead snags, provlded at least one dead snag remains per acre.

Dead and down wood on the Forest is abundant as a result of accumulations of natural fuels, and loggmg and thinmng slash. However, adequate dataonthe amounts, sizes, andconditionarenot always available It is assumed that vlable populations of species dependent on such material can be maintained if effective coordmation continues between fuels and wldlife management

Waterfowl and Riparian Dependent Species-Ripanan vegetation on the Forest vanes widely Sedges and rushes dominate ephemeral wetlands. Willows, cottonwoods, alders, and aspen grow along intermittent and perennial streams; and oaks, maples, and dogwoods line the banks of larger streams in the western part of the Forest

Management Indicator Species that depend on npanan habitat are the bufflehead, mallard, goshawk, spotted owl, deer, marten, fisher, black bear, chinook salmon, steelhead trout and rainbow trout.

Grazing by domestic livestock has reduced the productinty of somenparian areas, particularly alongthe streams inthe more and portions ofthe Forest. Although the extent and degree of damage has not been surveyed, vlsual inspection indicates the impacts are primarily physical damage to the plants, structural damage to streams and streambanks, and in some cases, lowenng of the water table The Forest has recently begun a program of npanan enhancement. Signuficant opportunities emst to improve ripanan areas by fencing selected reaches of streams and by using improved grazing systems (Ruyle et. al. 1980).

Timber harvesting, skiddıng of logs, and leavlng thinning slash in and around streams have histoncally been common practices that resulted in riparian degradation Tımber operations no longer cause significant damage to ripanan habitat, as a result of coordination with other resource needs Use of Best Management Practices (BMP's) for streamside management zones has helped dramatically. Restonng past damage however, is an important prionty for npanan habitat wthin forested areas

Hydroelectric development may damage nparian systems dunng construction and through reduction of flows. Proposals for small power-generating facilities on Rock Creek, Grizzly Creek, Hat Creek, and Lost Creek appear the most feasible. Analysis of their potential effects on the npanan habitat will be necessary before construction is approved

Lakes with timbered borders are important to cavlty nesting waterfowl such as the bufflehead Loss of nesting sites has occurred at older impoundments due to rotting of flooded snags, and wood cutters have removed snags from some lakeshores. Improvement opportunities include protection and recruitment of snags and erection of nest boxes.

The supply **of** npanan habitat cannot be increased over present levels except where new impoundments are constructed The quality of nparian habitat, however, can be improved through better coordination with other resource activlties.

There are currently about 60,000 acres of perennial and ephemeral wetland habitat on or adjacent to the Forest Lake Almanor and Eagle Lake account for about 51,000 of these acres These wetland areas provlde sigmficant habitat for breeding and wintering waterfowl

Excellent opportunities exist to increase wetland habitat quality and waterfowl production on at least 5,000 wetland acres. The pnmary limıtıng factors for waterfowl on these areas are inadequate amounts of water and nesting habitat If water nghts could be obtained, a number of impoundments could be constructed Construction ofwells to use groundwater may also he feasible Nesting habitat can be improved mth construction of nesting islands or other structures, and by better coordination with livestock grazing

Oaks and Aspen Oaks are an important habitat type for wildlife because they contribute food, cover and structural diversity to an ecosystem Management indicator species that depend on oaks include gray squirrel, deer, and black bear Retaining oaks in mixed conifer/oak stands and allowing their replacement over time is neces-

sary to maintain habitat for these and other species A number of different oak species grow on the Forest, each producing somewhat different habitat values For a more detailed discussion of these habitats refer to the Vegetation and Diversity section

Many stands of Oregon oak are dense and have grown too tall to be available as deer forage. Although habitat conditions in the blue oak savannah and black oak woodland are generally high at present, lack of establishment of young trees is a problem in the blue oak type, and decline in vlgor of old stands is a problem in the black oak type

Invasion of oak stands by conifers may provlde higher quality habitat for some non-game species However, continued growth of conifers may reduce habitat quality as oaks become shaded out High conifer density in the understory may limit accessibility of stands to deer Relatively little conversion of mixed conifer-oak stands to pure conifers has occurred on the Forest

Several management actinties have the potential to improve oak habitats Shrub oak types could benefit from burning Dense Oregon oak shrub stands can be thinned to increase tree size Successful regeneration ofblue oaks is an important need on the Forest, as well as statewide The black oak type may benefit from burning to regenerate shrub stands and remove encroaching conifers, and from thinning to enhance mast production and longevity Some older stands may eventually require regeneration to improve productivity The mixed-conifer/oak type could benefit from removal of competing conifers by timber harvest or prescribed burning

Aspen is another important hardwood community Although it grows in limited amounts, either in very small stands or intermixed with conifers, it improves the nchness of associated habitats Currently, most aspen stands are old and decadent with little sign of natural reproduction Disturbance such as fire or cutting is necessary to perpetuate them Pilot projects using cutting and fencing to exclude livestock have been implemented and may be expanded

d. Demand

The Forest generates an estimated 62,400 Wildlife and Fish User Days (WFUD's) annually from wildlife-associated recreation (a WFUD is a 12-hour activity day) Approximately **43** percent of this recreation is spent hunting while the remainder consists of wildlife oriented nature study, viewing, hiking, and camping Deer and waterfowl hunting are the major hunting activlties Bird watching and associated activities are the major non-consumptive demand for wildlife

Public interest in bald eagles and peregrine falcons is extremely high Bald eagles and osprey generate much interest from bird watchers at Eagle Lake, Lake Almanor, and Lake Britton The Forest's share of bald eagles needed to reach recovery from Endangered status is 16 breeding pairs, two more than presently exist Likewise, two additional breeding pairs of peregrine falcons are needed to meet species recovery goals on the Forest Public concern for spotted owl and goshawks centers around perpetuating species viability, associated suitable habitat, and the viability of other old growth dependent species Because of the implications on timber production of providing habitat for these species, the demand is of local, regional, and national significance

Hunter demand for pronghorn antelope far exceeds supply In 1982, over 14,000 permit applications were received but only 600 hunting permits were issued for all of northeastern California Of these, only about 85 were issued for the subpopulation that uses the Forest The Cahfornia Department of Fish and Game's long-term goal is to increase this subherd from 1,400 to 2,500 animals

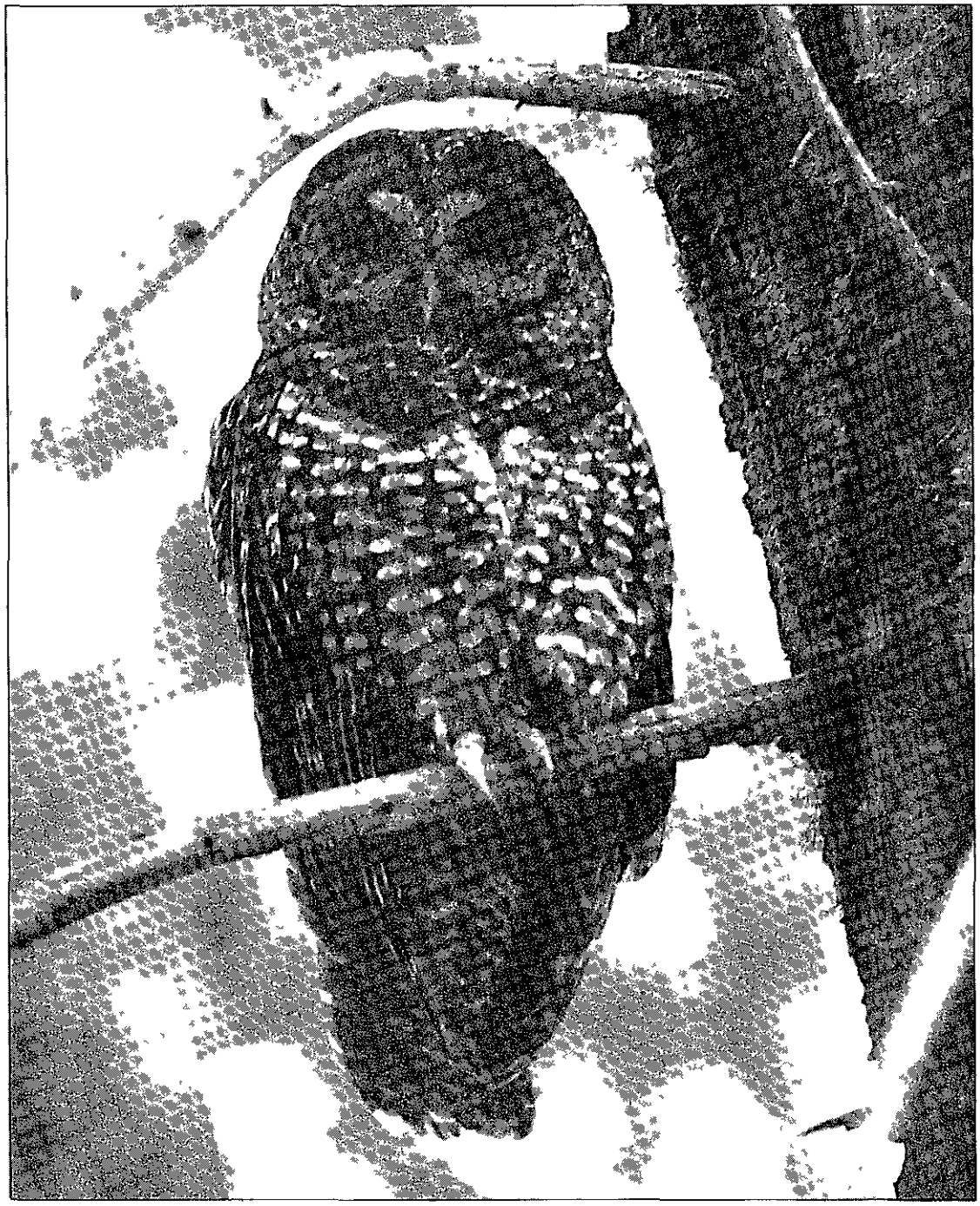
Demand for deer hunting also far exceeds supply In order to meet demand, the California Department of Fish and Game deer herd plans request higher deer populations in deer herds Although State-wide demand for deer is stable or slightly declining, demand for deer will continue to increase on the Forest due to the larger size of deer and higher bunting success rates Waterfowl hunting will continue to be in high demand

as private landowners continue to limit hunting on their lands. The California Department of Fish and Game recognizes this demand and has recently financed many waterfowl habitat improvement projects on National Forest lands The wetlands program on the Forest is of high regional and national significance because relatively few other National Forests have potential for significant waterfowl production

Satisfying the demand for riparian habitat, oak habitats, wetlands, snags, dead and down wood, and plant and animal diversity are major goals for the Forest Maintaining viable populations of all animals directly depends on providing these highly specific habitats and habitat elements Perpetuating productive and healthy ecosystems may also depend on achieving goals for habitat elements and special habitats

Environmental Consequences

4



California **spotted** owl

CHAPTER4- ENVIRONMENTAL CONSEQUENCES

A. INTRODUCTION

The purpose of this chapter is to disclose the environmental consequences of implementing the alternatives descnbed in Chapter **2** Relative to the existing conditions and affected envlronment described in Chapter **3,** each alternative potentially impacts various resource elements within the envlronment Those effects are presented in this chapter, and form the scientific and analytic basis for the environmental comparison of alternatives summanzed in Chapter **2**

The description of environmental consequences is groupedbythesameresource elementsusedin the previous two chapters Impacts on each of the 26 socio-economic and resource elements are discussed in terms of their significant direct, indirect, and cumulative effect(s) Direct environmental effects are defined as those occurring at the same time and place as the initial cause or action. Indirect effects are those that occur later in time or are spatially removed from the activity, but would be significant in the foreseeable future Cumulative effects result from the incremental effects of actions when added to other past, present, or reasonably foreseeable future action, regardless of what agency (Federal or non-Federal) or person undertakes such other actions Cumulative effects can result from individually minor, but collectively significant actions taking place over a period of time

Potential adverse environmental effects which cannot be avoided are discussed at the end of this chapter Unavoidable adverse effects result from managmg the land for one resource at the expense of the use or condition of other resources Many adverse effects can be reduced or mitigated by limiting the extent or duration of effects

Short-term uses (effects) are those that occur annually or within the first ten years of project implementation Long-term productivity refers to the capability of the land and resources to continue producing goods and services for 50 years and beyond Short-term uses and long-term productivity are also discussed at the end of Chapter **4**

Irreversible and irretrievable resource commitments are not normally made at the programmatic level of a Forest Plan Irreversible commitments are decisions affecting non-renewable resources such as soils, minerals, cultural resources, and plant and animal species Such commitments of resources are considered irreversible when the resource has detenorated to the point that renewal can occur only over a long penod of time or at a great expense, or the resource has been destroyed or removed For instance, the gradual decline in old-growth habitat would be considered an irreversible commitment While the application of management prescnptions allowing land altenng activities can indicate the potential for such commitments, the actual commitment to develop, use or affect non-renewable resources is made at the project level

Irretrievable commitments represent opportunities foregone for the period during which resources use or production cannot be realized These decisions are reversible, hut the production opportunities foregone are irretrievable An example of such commitments is the allocation of management prescriptions that do not allow timber harvest in areas containing suitable timber lands For the time over which such allocations are made, the opportunity to produce timber from those areas is foregone, thus irretrievable Irreversible and irretrievable commitments are discussed in more detail at the end of Chapter **4**

All effects disclosed in this chapter assume complete compliance with the Standards and Guidelines summarized in Chapter **2** Environmental consequences would be far more severe, or unacceptable in the absence of Standards and Guidelines, and accompanying Best Management Practices (BMP's) These Standards and Guidelines contain many of the mitigation measures that avoid, minimize, reduce, or eliminate probable or potential environmental impacts Standards and Guidelines, in coordination with Monitoring and Evaluation requirements, serve as the

mechanism for reaching desired future conditions The Monitoring and Evaluation Plan comprises Chapter 5 of the Forest Plan and applies to all alternatives

For estimating the effects of alternatives at the programmatic Forest Plan level, the assumption has been made that the kinds of resource management activities allowed under the management prescriptions will in fact occur to the extent necessary to achieve the goals and objectives of each alternative However, the actual location, design and extent of such actinties is not known at this time That is a project level decision Thus, in many cases the discussions refer to the potential for effects to occur, realizing that these are only estimates. The effects analysis is useful in comparing and evaluating alternatives, but should not be applied per se to any specific location within the Forest

Maps for each of the alternatives, including the proposed action, are included in the Map Packet These maps show the geographic distnbution, by alternative, of management prescnptions and show the differences in emphases between alternatives

The issue of herbicide use was addressed in a final environmental impact statement for vegetative management and reforestation issued by the Pacific Southwest Region in March 1989 (see Chapter 2, section E **2** d), which is hereby incorporated by reference Therefore, no additional discussion of the consequences of herbicide use is presented in this chapter

The following abbreviations for the alternatives are used throughout this chapter

PRF	Preferred Alternative
CUR	Current Alternative
EGP	Environmental Group Alternative
TGP	Timber Industry Group Alternative

B. DIRECT, INDIRECT, *AND* CUMULATIVE ENVIRONMENTAL CONSEQUENCES

ECONOMIC CONSEQUENCES

Zntroduction

The major effects of the alternatives on the human environment would be changes in economic opportunities associated with Forest resources, and changes in the quality of resources such as scenery, wildlife, and recreation use Economic Opportunities are examined by considering the amount of money which would be paid from Forest receipts to counties, and shifts in employment and income levels resulting from changes in Forest outputs, receipts, and expenditures These factors, along with less quantifiable changes in amenity values, are considered in examining the effect of the alternatives on lifestyles and community structure

Changes in management on the Lassen National Forest could have profound effects on the people who live, work, and recreate on or near the Forest However, these social and economc impacts are often the most difficult impacts to predict with certainty because of the many other vanables which must be considered These variables include economic indicators such as growth or slowdown both in the regional and national economies, and factors related to personal preferences for types of recreation actinties

In general, the effects of the alternatives are determined by comparing projected conditions in the next decade to average conditions from the past 10 years The baseline from which social and economic changes are measured is an estimate of the present contribution of Forest activities and outputs to local communities This baseline is intended to represent the average level of activities and outputs from the Forest.

The social analysis largely focuses on the effects of economic changes dunng the first decade within communities in the counties surrounding the

Forest These changes would result mostly from decreases in the amount of timber harvested, and increases in recreational use of the Forest

Chapter 3, under "Economic and Social Environments", discusses the existing conditions on and around the Forest For a more detailed discussion of assumptions and analysis procedures and regional timber supplies, refer to Appendices D and W

a. Direct and Indirect Effects

Each alternative would create *direct, indirect and cumulative* effects Direct effects are the estimated government expenditures for each alternative As a result of these expenditures, the public consumes forest products (both goods and services) This in turn produces indirect effects including benefits, revenue, jobs, and incomes Cumulative effects on the social and economic environment reflect the net effect of Forest service programs on the entire array of Forest users Examples of these effects include the economic viability of Forest programs, the total predicted changes in jobs and income, opportunity costs, and resulting impacts on lifestyles, attitudes, and community cohesion

The economic consequences of implementing the alternatives can be measured in various ways Some of the more important direct effects include

- Present Net Value (PNV),
- Benefit-Cost Ratio,
- Area Employment and Income,
- Forest Reserve Fund Payments,
- Forest Budget, and,
- Net Cash Flow

These direct effects are summarized in Table 4-1, and are described below in more detail

Present Net Value (PNV) Present Net Value is a measure of relative economic scale and efficiency All future costs and benefits of each alternative were discounted to the 1982 base year The difference, benefits less costs, is the PNV Discounting values to a common period makes possible a comparison of benefits and costs that occur at different times

Table 4-1

Comparison of Alternatives' Economic Effects

Indicator	Alternative PRF	CUR	EGP	TGP
PNV(MM$) a/	946	1,315	874	1,060
Benefit-Cost Ratio	300	358	276	292
Employment (Decade 1)	1,624	2,296	1,618	1,860
Annual Income (MM$ Decade 1)	487	688	485	558
Estimated FRF Payments (Decade 1) MM$	55	78	59	68
Forest Budget (MM$ Decade 1)	163	151	170	185
Net Cash Flow (MM$ Decade 1)	50	157	58	77

a/ The Minimum Level Benchmark (MLV) described in Chapter 2 reveals the background costs of simply maintaining the National Forest in Federal ownership In order to compare the effect of the management alternatives, these background costs have been subtracted from the PNV in each alternative

Due to the unique age structure of the forest, PNV was never maximized The age structure of the Lassen Forest has a high proportion of age class 2 stands, poles and young sawtimber The maximum PNV would result from deferring timber harvest in those stands for several decades, to allow the trees to mature into higher values However, the principle of sustained yield was allowed to override the best economic solution, in order to provide stable employment and economic returns to the local community

After constraining the model for sustained yield and applying each alternative's unique set of additional constraints, the Forest Planning model (FORPLAN) allocated land uses and scheduled

activities to maximize the PNV of each alternative

Benefit-Cost Ratio Benefits include revenues received by the Forest for timber, grazing, campingfees, and other special use fees Benefits also include the value of recreation and other amenities on the Forest Alternatives with higher allowable sale quantities would produce higher levels of cash benefits Alternatives with lower harvest levels would produce more non-cash benefits

Federal costs are tied to units of output produced under the various alternatives An alternative with a high level of timber harvest has higher total sale preparation and administration costs, for example Costs are based on projections of proposed budgets and may not reflect funding that would be received in future years

If the value of the ratio of the total discounted future benefits to costs is greater than one, then the Forest's expenditures would be more efficient than an investment of funds yielding a reasonable rate of return (assumed to be investment in long-term corporate bonds at four percent interest) Table 4-1 shows that this efficiency would easily be exceeded in all alternatives

Area Employment and Income Forest outputs support local industries and provide revenue to county school and road programs from the sale of commodities Costs to operate the Forest include expenditures for salaries, services and supplies Forest outputs and costs can create changes in employment and income within local communities These changes are projected for the first decade and are based on the expected level of timber harvest, recreational use, wildlife and fish habitat, payments to counties, and Forest Service expenditures The projections include both the direct effects that changes in Forest outputs would have on jobs and income in the lumber and wood products, tourist, and fishing industnes, and the indirect effects in all sectors of the local economy The projections are based on the Lassen National Forest IMPLAN model The estimates have not been adjusted to account for recent advances in sawmill technology which have eliminated many millworkers' jobs in the past decade Details of the IMPLAN model are provlded in Appendix B under "Implan"

The overall effect on the employment difference between any alternative is determined by the amount of timber that is actually harvested, and not by the amount offered for sale by the Forest Service Employment is dependent on the market conditions that the timber industry faces, on its supply of needed timber, and on the degree of plant modernization that is occurring It is estimated that each additional million board feet of timber harvested from the Forest results in approximately nine jobs in the local economy Additional employment opportunities beyond the local economy are also affected by local timber harvest No attempt has been made to account for these added jobs

The average industry harvest from the Forest from 1970 to 1990 was 178 MMBF from an average allowable sell of 178 MMBF dunng the same period of time In the last six years (1986 - 1991), the sell has ranged from a high of 169 MMBF to a low of 82 MMBF for an average of 145 MMBF This gwes a histoncal perspective with which to compare the estimated effects of employment changes Technological changes as well as expected reductions in the available timber supply from all ownerships in the impact area may require fewer workers in the wood products industry

Recreation and tourism presently account for about 20 percent of the job opportunities stimulated by Forest use Recreation and tourism employment opportumties are essentially the same for all alternatives, since recreation usage is primarily a function of population Forest management is assumed to affect the quality of the recreation expenence much more than the quantity of recreation utilization Livestock grazmg only accounts for about one percent of the employment Opportunities, but the ranches that depend on Forest grazing are an important part of the local social fabric The remaining job opportunities are accounted for by direct Forest employment and employment related to providing goods and services needed either directly for the management of the Forest or by employees of the Forest and their families

Forest Reserve Fund Payments Twenty-five percent of the gross receipts collected on the Forest are distributed to counties for school and road programs These payments are projected for each alternative based on the receipts from

future timber sales and fees from mineral leases, livestock grazing permits, campground users and special use permits Effects of changes in payments would be felt most in Lassen, Plumas, and Tehama Counties The remaining effects would be in Butte and Shasta Counties Changes in the receipts would affect the amount of money available for county road and school programs, and could also affect the taxes paid by local residents The differences in payments to counties among alternatives would be due mostly to differences in the level of timber harvested 1/

The annual payments to counties in the first decade are shown in Table 4-1 They are projected to range from **5 5** million (adjusted for inflation to 1982 dollars) with the PRF Alternative to 7 8 million for the CUR Alternative Payments can vary considerably from year to year These values are based on the assumption that stumpage prices will be at the levels shown in Appendix **B,** Table B-7

Forest Budget Total annual projected costs of managmg the Forest vary by alternative, and are displayed for decade 1 in Table 4-1 A substantial portion of the Forest's budget enters the local economy The timber program associated with each alternative may not be fully funded If this should occur, PNV, employment, income, and Forest Reserve Fund payments would all be reduced Partial funding could also result in lower levels of commodity outputs and lower levels of maintenance and resource protection These effects could range from insignificant to very serious depending on the magnitude of the funding shortfall

Net Cash Flow Net cash flow is total revenue minus total Federal cost Total revenue includes revenues from timber sales, user fees, special use permits, land uses, power permits, and mineral leasing The largest contributor to the total amount is timber sale revenues Timber sales account for 98 percent **of** the total revenue on the Forest The amount of variation among alternatives in the total revenue is almost directly related to the amount of timber harvest Alternatives with the highest allowable sale quantity also have the highest potential revenues

Total cost represents the cost of managmg the National Forest under each alternative The total cost includes the cost of recreation, wildlife, fisheries, transportation, and timber programs as well as the stewardship and protection costs for the Lassen National Forest

Net cash flow is an important indicator for two reasons First, net cash flow measures the ability of the Forest to "make money" for the American people After Forest Reserve Fund payments (computed as 25 percent of gross revenue) are deducted from net cash flow, the remainder, if any, can be applied against the Federal debt

A second application of net cash flow is as an indicator of the economic viability of the Forest's timber sale program Timber related expenditures currently account for an average of 70 percent of the Forest budget In every alternative, significant net cash flow is generated, indicating that the timber program produces revenue far in excess of expenses Below-cost timber sales, if they occur at all, would be infrequent (While the timber sale program as a whole generates significant net revenue, it is conceivable that an occasional below-cost timber sale could be part of the program This would occur only if the resource benefits exceeded the financial losses of the sale)

All **Alternatives**

As the data show, annual income, employment, Forest Reserve Fund (FRF) payments, and the Forest budget generally correlate with PNV throughout the alternatives PNV is largely dependent upon the level of timber production The EGP Alternative is an exception to this Although PNV is lowest under EGP, the FRF payments and net cash flow are higher under EGP than in the PRF Alternative The reason for this effect is that EGP harvests all of the older, highest value trees in the first decades, increasing its receipts initially Receipts from later decades, when the other alternatives maintain their value and increase their harvest levels, are not reflected in these figures

1/ Under certain circumstances, payments in lieu **of** taxes (PILT) by the federal government may offset a portion **of** the change in FRF payments **for** county school and road payments PILT payments are not restricted to just county school and road programs

Although developed recreation contributes significantly to PNV, it does not vary substantially between the alternatives

The following is a discussion of the economic consequences of each alternative

PRF Alternative

Net cash flow would be lowest under this alternative while PNV would be the third highest Economic efficiency, as indicated by the benefit-cost ratio, would be second highest, but lower than the Current Management (CUR) Alternative This is caused by a *44* percent reduction in the timber sale program Increased recreation opportunities would only be partially offsetting The emphasis on amenities, such as visual quality and semi-primitive recreation opportunities, is not reflected in PNV, except to the extent that it affects the timber program Employment opportunities would be nearly **29** percent lower than CUR, primarily because of the lower timber harvest

CUR Alternative

The CUR Alternative would have the highest net cash flow, the highest benefit-cost ratio, and the highest **PNV** The benefit-cost ratio is the highest due to the amount of high value intermediate harvesting proposed, which compensates for more costly even-aged management, particularly clearcutting Efficiency, especially PNV, would be limited by the budget Economic efficiency would be gamed at the expense of amenities Visual quality constraints on timber production would be relatively low, only a few unroaded areas would be retained, and no new wilderness would he recommended This alternative would provide the highest commodity outputs and employment opportunities

EGP Alternative

This alternative emphasizes amenities over commodities The PNV and benefit cost ratio are the lowest among the four alternatives due to extensive use of group selection timber harvesting which is more expensive than other methods This, in turn, would require in a higher Forest budget EGP produces the lowest commodity outputs and employment opportunities

TGP Alternative

PNV would be the second highest in this alternative Efficiency in terms of the benefit-cost ratio would be the third highest, resulting pnmanly from the increased use of clearcutting and even-aged timber management This alternative has the second highest commodity outputs and employment opportunities

SOCIAL CONSEQUENCES

a. Direct and Zndirect Effects

Ranchers, urban emigrants, government workers, timber industry workers, and Native Americans are the social groups most likely to be affected by Forest outputs, land allocations, and management practices Social groups are categories of people who share the same interests and concerns They are not mutually exclusive, and individuals may be included in more than one group Other groups—women, handicapped, elderly, minorities—are distributed within the five identified groups, and none of the alternatives discriminate among them There are no disproportionate effects on Native Americans, women, minorities or other groups

Social consequences resulting from economic effects of the vanous alternatives will be measured by three criteria

1) Lifestyle effects,

2) Population effects,

3) Community cohesion effects

Lifestyles Lifestyles are the characteristic way different groups of people live, including both work and leisure time Some people have lifestyles that are financially dependent on a particular Forest resource (e g people working in tourism, or the lumber and wood products industries) Others are less financially dependent on forest resource management

As discussed in Chapter **3** of the FEIS, people in communities around the Forest or those who may be further away, but still consider the Lassen National Forest to be important to them,

tend to fall into five social or minonty groups ranchers, timber industry workers, government workers, urban emigrants and Native Amencans The lifestyles these people currently have may be very affected, or not at all affected, by changes in Forest management The decrease in Forest commodity outputs would have minimal effect on government workers and urban emigrants. Somejobs could be lost, but the overall decline would be small Any loss would tend to be offset by the expected in-migration and population growth, and an expanding service industry The loss of jobs would be significant for timber industry workers The availability of traditional resources and lands for Native Amencans would not change significantly in any alternative

A reduction in Forest commodity outputs and increased management reqmrements would be felt most by ranchers and timber industry workers General economic activity would decline in those rural communities dependent upon the timber industry In those areas, timber employment levels would drop, and lifestyles, population levels, and community cohesion would change

Population Net population change in the impact area is most directly influenced by economic opportunities and quality of the environment Vanables such asjobs, recreation, tourism, and other amenity values affect the level of in-migration and economic growth Employment associated with the goods and semces provlded by the Lassen National Forest has a minor influence in the local economy, compared to other employment sectors

Many communities have a history of moderate boom-and-bust population cycles due to the contraction and expansion of the local economy Some of these cycles have been associated with the extraction of natural resources such as mining and timber harvesting Within the impact area, employment related to agriculture, forestry, and fishing has declined since 1982 In 1989,agriculture, forestry, and fishing accounted for **2** 5percent ofthe total employment in the five impact counties Employment related to manufacturing wood products has remained steady at approximately ten percent of the total employment within the impact area **A** loss of employment in these sectors would not affect the overall population level

None of the alternatives would change the economic and social conditions of the impact area populations in a predictable way No direct potential net population effect can be discerned, particularly in the light of current in-migration.

Community Cohesion The activities, resources outputs, and environmental conditions that would differ among the alternatives could affect the cohesion and infrastructure of local communities. Community infrastructures are public and commercial facilities and services It is assumed that polanzation within a community is harmful, and that this polanzation could be caused by the adoption of an alternative which is perceived as favoring one point of view over others In contrast, selecting an alternative that somewhat meets the desires of diverse participants would improve cohesion

Most communities are not static, hut are constantly experiencing change Effects on lifestyles are subject to many influences other than the management of the Lassen National Forest Population and employment growth within the impact area in the last decade (and expected growth through the year 2000) has often strained the level of services provided to county residents For instance, law enforcement programs in some local communities are not adequate to meet current needs Many schools have not been able to keep pace with the influx of new students. State mandated programs have also strained county budgets At least two counties within the impact area (Butte and Lassen) have recently faced the possibility of declaring bankruptcy All of these factors affect community stability and community cohesion Community stability is judged by two factors

> Continuity *of* the financial base – the extent to which tax supported community services will be supported in the future. As discussed previously, the impact of the alternatives will be generated by changes in the county revenues which are tied to the timber program
>
> Diverszfication *of* the *community* economy – the extent to which diversification makes it possible for the community to weather a downturn in one economic sector

Because continuity of the financial base is interpreted from Forest Reserve Fund payments and the total employment level, the CUR Alternative meets this goal best The reduction in the Allowable Sale Quantity with the EGP Alternative could result in an estimated loss of up to three million dollars to county road and school programs In Lassen County, which receives the majority of these receipts based on the amount of National Forest land within the county, this could result in a two percent decline in their current (1990) funding level for schools and a 20 percent decline in funding of the county road program Both programs provide essential community services, and any loss of funds would reduce community cohesion

Payments to counties are based on gross receipts and are mathematically denved The result is based on the assumption that the amount of timber offered and its selling price, and the amount sold and its selling price will be the same Both of these factors are highly unpredictable, and they depend more upon market conditions within the national economy than upon local Forest Service policies and practices A declining timber supply could lead to rising prices wlnch would counter potential funding decreases for county school and road programs

Loss of employment opportunities associated with a lower Allowable Sale Quantity (ASQ) would decrease community cohesion in towns dependent upon National Forest outputs Mills could close, and the sense of community identity as a "timber town" could be lost Other communities with more diversified economies have, histoncally, been able to ride out fluctuations in the timber market. Larger, more urbanized communities can better absorb the adverse effects of a lower ASQ without long-term impacts on program funding and unemployment levels

Community cohesion could also be affected by the amount of land dedicated to other resource uses besides timber harvest Old growth habitat, wilderness, and roadless area management are specific resource uses that can cause community polanzation or cohesion depending upon local preferences

b. Cumulative Effects

Cumulative economic and social effects related to Forest Semce management are difficult to predict and define There are many vanables which shape the economc and social envlronment Most of these are beyond the control of the Lassen National Forest The timber management policies of other National Forests, other government land management agencies, and private landowners can combine to have dramatic effects on regional timber supplies and rural employment (See Appendix W)

The Forest Semce has histoncally attempted to supply a relatively steady or increasing flow of timber over time All alternatives would have lower allowable sale quantities than histoncal levels Three alternatives would call **for** harvest levels significantly lower than those in the past two decades If all National Forest timber supplies were reduced, both the pnce and the harvest rate of local non-National Forest tmber could increase proportionally, depending on national and international market conditions and competition The reduction of supply, along with the increased cost to mlls and technological advances, could also cause mill closures, including some with regional economc significance Existing mills may need to re-tool and shift their operations to manufacture other, value-added timber products such as doors, windows, or pellets for wood burmng stoves Mills geared to handle large-diameter logs may have to re-tool to process smaller diameter second growth.

In summary, the impact area for the Lassen National Forest can expect to have lower forest products employment levels (and related social effects) due to significant changes in timber harvest volumes over the long term

c. Mitigation Measures

A number of mitigation measures are available to communities facing a decline in the supply **of** National Forest timber Some of them are beyond the control of the Forest One vanable within the Forest Service's control is to phase in a gradual reduction of the Allowable Sale Quantity over a three to five year penod This would lessen the shock to the economic structure of those communities that rely on National Forest timber It would give people time to plan for the expected employment and income changes The major drawback to this type of mitigation is that a gradual reduction in harvest levels over the first five years of the Plan (which requires ini-

tially maintaining it above the programmed ASQ) would necessitate an ASQ below the programmed level in the latter half of the decade to compensate

Unemployment compensation, dislocated worker programs, and retraining programs may somewhat mitigate the problems faced by people out of work due to lower harvest levels Some communities may pursue other employment opportunities related to tounsm and recreation, and the services sector Maintaining an attractive Forest environment has the benefit of enhancing recreational use Recreation and tourism are seasonal, however, and generally do not offer year round employment Also, salaries in the services sector are often considerably less than in the manufacturing sector Mill workers and loggers who transfer to other employment sectors may receive fewer benefits than they earned in the timber industry One goal of economic development is to raise personal income which services sector jobs do not generally provide Other communities may experience a gradual shift in employment from a timber based economy to a more diversified one by continued in-migration of people from urban centers

Depending upon Forest budgets, contract work to implement the Plan could also be accomplished early in the first decade This scheduling could increase the opportunity for local contractors to compete for such work on the Forest Budgets permitting, this would reduce some of the adverse employment impact from lower timber harvests

Several programs provide aid to rural communities Among them are two Federal programs which offer assistance to dislocated workers and to forest-dependent communities that are significantly affected by lower harvest levels They are the 1982 Job Training Partnership Act and the 1990 Farm Bill Some of the assistance they offer is summarized below

Title III of the ***1982 Job Training Partnership Act*** (JTPA) authorized a program to assist experienced workers who have permanently lost their jobs due to technological displacement, foreign competition or other structural changes in the economy Programs can also be organized in response to crisis situations such as a major plant closing, or tailored for specific industries statewide, or targeted to high unemployment communities Called the Dislocated Worker Program, it provides Federal funding (with some matching of state funds) for state-administered employment and training services aimed at re-employing the victims of displacement Discretionary grants are also available to states (with no requirement for matching state funds) to aid indinduals who are affected by mass layoffs, natural disasters, Federal government actions, or who reside in areas of high unemployment or designated enterpnse zones

Title III authonzed a broad range of services Specifically, funds may be used to help re-employ dislocated workers through training and related employment services which may include, but are not limited to

- job assistance,
- job development,
- training in job skills for which employer demand exceeds the supply of eligible workers,
- programs conducted in cooperation with employers or labor organizations to provide early intervention in the event of facility closures

In addition, financial relocation assistance may be pronded if the State of California determines that 1) the individual cannot obtain employment within his or her commuting area, and 2) the individual has obtained a joh or has a bona fide job offer in another area of the State

Eligible individuals must fall into one of the following general categories outlined in the Act

- Have been terminated or received notice of termination from employment, are eligible for or have exhausted their entitlement to unemployment compensation, and are unlikely to return to their previous industry or occupation, or
- Have been or will be terminated as a result of any permanent closure of a plant or facility, or

- Are long-term unemployed with little likelihood of employment in a similar occupation near where they live, or

- Are unemployed older individuals who may have substantial barriers to employment by reason of age

The California Timber Industry Revitalization Committee in Qumcy, CA is an example of a program funded through JTPA and the Department of Commerce Under this program, the Committee has focused on the potential market for a hardwood industry in California. Its goal is to look at other resource products, in this particular case tan oak and black oak paneling, that would provlde a vlable substitute for soft wood manufacturing and help stabilize the State's timber industry Because a skilled labor force related to softwood manufacturing already exists in rural areas such as the northern coastal counties, natural resource opportunities for economic diversification are emphasized Pellet milling is another product being studied The Committee is also explonng economic diversification through other areas of potential growth that are not natural resource based and possibly subject to the same fluctuating supplies as the softwood industry

Subtitle G of the ***1990 Farm Bill*** provides assistance to rural communities located in or near National Forests The purpose of this subsectionis to help diversifythe economies of forest dependent communities and improve the social, envlronmental, and economic well-being of rural America Congress recognized that the lack of economic diversity would be particularly serious ın communities whose economies are predominantly dependent on timber and recreation resources They were aware that land management decisions made on the national forests by Federal organizations may disrupt the supply of those resources In order to deal with changmg land management decisions, the 1990 Farm Bill provides technical assistance, training, education and other assistance to eligible communities in greatest need

Economically disadvantaged rural communities may request assistance from the Department of Agnculturein identifyingopportunitiesthat will promote economic improvement and diversification, and revitalization Through the Act, programs can be established to assist businesses, industries, and policymakers to create jobs, raise incomes, and increase public revenues ın a manner consistent with environmental concerns These programs will 1) identify opportunities for resource-based industnes to become more efficient, productive, and competitive; 2) assist businesses with marketing, 3) provide training and education services focusing on community economic analysis and diversification, and **4)** train local leaders ın strategic community economic development

Upon request and selection, eligible communities will work with the Forest Service, and other agencies and the private sector, to prepare an economicdiversification action plan This action plan will identify opportunities to expand the economic base ofthe community, and alleviate or reduce their dependence on national forest resources To implement action plans, grants, cooperative agreements, and contracts from the Department of Agnculture may be obtained to provide the necessary technical and related assistance. In addition, the Department of Agriculture may make loans to economically disadvantaged rural communities for the purpose of securing technical assistance and services to further implement action plans

The primary objective of the 1990 Farm Bill is to generate employment and revenue, expand existing infrastructure, facilities, and servicesthat capitalize on opportunities to diversify economies now dependent on National Forest resources The Forest Semce will work with affected communities ın the implementation of this Act and the Agency's Rural Development Strategic Plan Both the Act and Agency policy will help mitigate the social and economic effects of a lower ASQ

PRF Alternative

This alternative supports the lifestyles of those who value recreation opportunities, protection of the natural environment, and a balance of resource uses Recreation opportunities would be provided and facilities (campground, picnic areas, interpretive sites and trails) would be developed and maintamed to meet demand The natural character of much of the Forest would be maintained ın wilderness, Wild and Scenic Rivers, wildlife habitat, and semi-pnmitive recre-

ation areas The lifestyles of those dependent on commodity production from the Forest would be adversely affected because of reduced commodity outputs and employment However, commodity production would increase after the first decade, nearly reaching the level of the TGP Alternative in decade 5

Despite increasing services sector jobs due to increased recreation opportunities, population growth trends would initially decline In the first decade, unemployment would increase in timber dependent communities, slowing population growth The ensuing steady rise in economc opportunities after the first decade would cause population growth to accelerate

Forest receipts returned to the counties and yield tax revenues to the state would be reduced initially, then rise steadily in later decades These funds support state and local services (especially roads and schools), and contribute to community cohesion and stability The anticipated increase in the value of forest products would help to offset the shortfall in receipts, but communities dependent on the timber program would be adversely affected at first These communities would eventually acquire more diversified employment opportunities and regain some of the lost timber jobs and revenues, Contributing to community cohesion and stability Until that time, however, local political and economic entities would strongly oppose any reduction in commodity outputs because of significant adverse effects on local programs, funding levels, and people's lives

CUR Alternative

Although called the "Current Alternative", CUR represents current management only in achieving a similar **ASQ,** employment level, and Forest Reserve Fund payments Other management activities, such as proposed silvicultural treatments, are substantially different from what is practiced on the Forest today The increase in clearcut acres would have a significant effect on the other resource values far exceeding present management These include effects on visual quality, recreational use, wildlife habitat, and water quality

The lifestyles of timber industry workers, ranchers, and others relying on commodity production of natural resources would continue to be supported Those who value recreation opportunities and protection of the natural environment would be adversely affected Limited recreation development, along with regional population growth, would result in increasingly crowded facilities The lack of new wilderness, Wild and Scenic Rivers, and semi-pnmitive areas would allow the natural appearance of the Forest to gradually decline as a result of management actinties Commodity production would remain stable Other values, such as diversified wildlife populations, could also decline, and the Forest would look intensively managed

Employment opportunities would diminish somewhat as the timber industry continues to become automated Population trends would remain stable, as other opportunities replace timber-related jobs Forest receipts returned to the counties and state tax revenues would probably increase as commodity values increase, supporting local roads and schools, and contributing to community cohesion and stability Communities dependent on the timber program may gradually become more diversified in employment opportunities, but would continue to ride the cycle of boom and bust related to loggmg trends

EGP Alternative

This alternative supports the lifestyles of those who value recreation opportunities and protection of the natural environment Recreation opportunities would be provided and facilities (campgrounds, picnic areas, interpretive sites and trails) would be developed and maintained to partially meet demand Preservation and interpretation of our cultural heritage would be supported This alternative provides for the most wilderness and semi-pnmitive recreation areas Harvesting timber through the group selection method would avoid unsightly clearcuts The lifestyles of those dependent on commodity production from the Forest would be adversely affected because of reduced outputs Commodity production would remain at the same level throughout the planning horizon, causing a permanent reduction m timber related economic opportunities

Despite increasing services sector employment from increased recreation Opportunities, population trends would initially follow the decline of

timber outputs and employment opportunities In the first decade, unemployment would increase in timber dependent communities, slowing population growth This slowdown would probably continue, unless new economc opportunities are developed

Forest receipts returned to the counties and yleld tax revenues to the state would be reduced, with negative short term effects on community cohesion and stability The anticipated increase in the value of forest products would help to offset the shortfall in receipts, but communities dependent on the timber program would be adversely affected Harvest levels over time are not expected to increase, primanly as a result of not allomngherbicide use to regenerate stands These communities might eventually gam more diversified employment opportunities, especially increased recreation and services sector jobs, to provide greater long-term community cohesion and stability

TGP Alternative

This alternative generally supports the lifestyles of those who depend on commodity production from the Forest, especially timber industry workers and ranchers Groups which value pnmitive recreation opportunities and protection of the natural envlronment would be adversely affected Developed recreation opportunities would be provided and facilities (campgrounds, picnic areas, interpretive sites and trails) would be built and maintained to meet demand No additional wilderness would be proposed, no semi-primitive areas would be designated, and the least amount of Wild and Scenic Rivers would be recommended Natural undisturbed conditions on the Forest would occur only in existing wilderness, wildlife habitat, and special areas Although commodity production would initially be reduced below current levels, it would increase after the first decade

This alternative would not support current employment levels in loggmg and milling In the first decade, unemployment would increase in timber dependent communities, slowing population growth The ensuing steady rise in economic opportunities from in-migration and gradually increasing harvest levels would cause population growth to accelerate

Forest receipts returned to the counties and yeld tax revenues to the state would be reduced initially, nsing steadily in later decades These funds support local roads and schools, and contribute to community cohesion and stability The anticipated increase in the value of forest products would help to offset the shortfall in receipts, but communities dependent on the timber program would be adversely affected at first These communities would eventually gain more diversified employment opportunities and recover some of the lost timber jobs and revenues

RESOURCE CONSEQUENCES

1. AIRQUALITY

The planning issue for air quality focuses on how to protect the air resource from various on-Forest activities Two by-products of management activities prescribed in the alternatives have the potential of significantly affecting air quality They are smoke and dust The quantities of these pollutants have direct effects on vlsibility and in limited circumstances on human health

Another primary cause of air pollution on the Forest is the dnft of polluted air from the Sacramento Valley Smoke from woodburning stoves and vehicle/equipment emissions from communities within and adjacent to the Forest are also primary sources of air pollution. The Forest has no direct control over these sources

The charactenstics by which air quality is evaluated are visibility and the levels of pollutants, for which State and national ambient air quality standards are established Wildfire can cause temporary, but substantial, air quality degradation To some degree, the incidence and magnitude of wildfire can be affected by Forest activlties such as thinning and loggmg slash treatments Prescribed fire and dust can also cause temporary degradation The consequences to air quality of the alternatives can be compared by considenng probable effects of wildfire, prescnbed fire, timber management, road construction and engme-use emissions

All Alternatives

a. Direct Effects

Dust A potential for short-term air quality impairment from dust is created by a variety of management practices Machinery operations related to timber management often raise clouds of dust Traffic on roads is another source of dust Prescribed burn areas can also he a source of dust on windy days, depending on time of burn, subsequent rainfall and revegetation Road construction and maintenance machinery operations are also dust contributors both in actual road work and in rock crushing operations These impacts are usually of a local nature and short duration

Anticipated levels of fugitive dust from these management actimties are considered too low for detailed projections They will also tend not to vary greatly among alternatives They will be discussed further in the mitigation section

Engine Emissions Smoke, dust, and engine emissions generated by vehicles and other motorized uses cause some local air quality degradation However, under all alternatives this would be minor

Prescribed Fire The Total Suspended Particulates (TSP) production from prescribed burning will vary among the alternatives, depending on the mix of management activities such as range improvement, timber management practices, wildlife habitat improvement, road construction, and natural residue hazard reduction

Currently, prescribed fire is used on this Forest for three major purposes **1)** disposal of slash from timber harvest, **2)** reduction of fire hazard, primarily by underburning in eastside pine stands, and 3) improvement of wildlife/range habitat Acres of prescribed burns for each alternative are displayed in Table 4-2 Wildlife/range habitat improvement prescribed burns tend to be of a higher fire intensity than other types of burns These higher intensity burns result in more complete combustion and therefore tend to produce less particulate matter than the lower intensity burns The slash fuels tend to smolder longer and produce more particulate matter

Table 4-2

Prescribed Fire For All Uses (Acres/Year-Decade1)

Type of Prescribed Fire	Alternative PRF	CUR	EGP	TGP
Fire-Related (Hazard Reduction)	1,150	2,000	1,150	1,150
Timber-Related (Slash Disposal)	3,600	5,900	3,600	5,000
Wildlife/Range	1,300	1,760	1,300	1,300
Total	***6,050***	**9,660**	***6,050***	**7,450**

Smoke The principal smoke emissions affecting msibility are the fine particulates added to an airshed Particulates contributed to the air by activities are measured by tons of total suspended particulates

Smoke contnbutes most of the particulate material that originates from the Forest The two major sources of smoke for the area are from wildfires and prescribed burning

In general, air quality decreases as more acres are burned The Forest burning program is designed to meet State and national ambient air quality standards through prescriptions based on suitable atmospheric conditions (according to Forest Standards and Guidelines) However, variable weather will sometimes cause smoke to accumulate in local smoke-sensitive areas (canyons and valleys with communities), flow toward "Class I" areas (Thousand Lakes and Caribou Wildernesses or Lassen Volcanic National Park), or flow to the heavily-populated Sacramento Valley (National Parks and wilderness areas greater than 5000 acres which were designated wilderness before the **1973** Clean Air Act are Class I areas for Prevention of Significant [air quality] Deterioration as governed by the Clean Air Act All other areas are Class II) While significant health hazards are not anticipated, the smoke levels may be annoying

Smoke generated by wildfire will have short-term impacts on visibility no matter which alternative is selected The amount and duration of

visibility impairment will be dependent on the amount of wildfires burning, fire size, fire intensity, and meteorological conditions

Wildfire The TSP production from wildfires is highly variable and range from low in years of infrequent wildfires to high in years of numerous wildfires It is assumed that the estimated TSP's contributed by smoke from wildfires will not vary significantly among alternatives

Fire is also an important natural component of the Forest's ecosystems, especially on the east side Excluding fire from these ecosystems in the past has resulted in fuel loading increases Wildfires in these areas burn more acres at a higher intensity with resultant increases in damage than would have occurred had nature been left to run its normal course

Timber Management Fire is an important tool for vegetative management and site preparation on the Forest Restrictions on the use of fire to minimize the impairment of vlsibility would affect the Forest's ability to accomplish site preparation and reforest the land The effects would be the most significant with the CUR Alternative as it proposes the most regeneration

Firewood There is also an indirect effect on winter air quality in local urban communities through the use of fuelwood provided by the Forest This utilization of cull matenal from prevlous timber sales, and standing dead or down wood, helps reduce smoke emissions from the Forest, but tends to concentrate those emissions in the towns **A** discussion of this indirect effect is included in the Firewood section of this Chapter

The relationship between the amount of firewood sold on the Forest and air quality is not a direct qualifiable relationship

b. Zndirect Effects

The minor temporary decrease in air quality that would occur under all alternatives would have few effects on other resources

Human Health Documentation of adverse effects from long-term exposure to wildland fire smoke is virtually nonexistent Forest workers are at some risk of low-level exposure contributing to such health effects as emphysema or lung cancer Long-term effects from even lower levels of smoke experienced by the public-at-large are less well known. Individuals with chronic lung disease or other respiratory ailments may experience additional irritation from the infrequent episodes of stagnated smoky airmasses

There are a number of potentially toxic components known to exist in wildland smoke However, the levels experienced under normal conditions and exposures are well below any levels known to cause harmful effects on humans Some of the more common are carbon monoxide, carbon particles, and trace amounts of a number of chemicals that may enter the lungs on the surface of particulate matter Close to 90 percent of the particulate matter **is** small enough (less than **2 5** microns diameter) to penetrate deeply into the lungs

Some of the components (polycyclic aromatic hydrocarbons) are known carcinogens under exposures much higher than that documented from wildland smoke Other components, such as the aldehydes, are acute irritants These are most likely to affect forest workers who receive high exposures at burn sites

By incorporating mitigation measures, reductions in emissions are projected for all alternatives, which should continue to widen the gap between probable exposures and any possible health effects, chronic or acute

Recreation Some short-term temporary reductions in the quality of visitors' recreational experiences could occur during times of prescribed burning and episodes of wildfire

Visibility Smoke and dust reduce vlsibility There is a direct relationship between TSP amounts and visibility impairment For example, the amount of visibility impairment (measured in days of smoky conditions) will be twice as much if TSP production doubles Reductions in TSP levels represent a similar reduction in visibility impairment Percent change from present TSP levels can be interpreted as resulting in a similar percent change in visibility

The effect of dust on visibility is generally localized and short-term, and will not vary significantly among alternatives Smoke can have a

greater and more widespread (although still usually localized) effect on visibility, but is also relatively short-term Alternatives which use more prescnbed fires (such as CUR) would produce more smoke from those fires, but may have slightly fewer wildfires The net effect is little variation between alternatives in visibility due to smoke

c. Cumulative Effects

The existence of smoke from off-Forest prescnbed burning, regional haze from populated areas and smoke from agricultural burning in the Sacramento Valley can combine wlth on-Forest prescribed burning to amplify air quality degradation This most often occurs dunng spnng and fall penods when burning takes place under more stable atmospheric conditions or when the wind has a strong easterly direction The cumulative effect of multiple contributors of smoke and haze in the air is not expected to change significantly between alternatives. Any smoke produced by forest activities would comply wlth State and national ambient air quality standards

d. Mitigation Measures

New technology and techniques have greatly improved the efficiency of prescribed burning operations At the same time, research continues to confirm the vital role fire plays in forest ecosystems To continue using fire in managmg the Forest, it will be necessary to mitigate undesirable impacts as much as possible

Perhaps the most effective form of mitigation is the timing of burning operations Correct timing, such as burning in the spnng, can reduce the amount of fuel consumed due to higher fuel moisture Burning when smoke will ventilate into the upper atmosphere or away from population centers and Class I areas would also reduce impacts Burning in periods of low visitor use would reduce impacts on Forest visitors, especially in Class I areas The method of ignition itself can mitigate impacts Mass ignition would minimize the transfer of beat downward and reduce the longevity of the smoldering phase of combustion

In timber sale operations, directional felling will reduce breakage with corresponding reductions in fuel loading Increased utilization of currently substandard matenal would reduce the presence of smoldering fuels and the need to burn anything at all Alternatives to burning, like chipping and crushing, will be used wherever practicable

Volumes of suspended particulates would be reduced by restrictions on prescribed burning, particularly broadcast burning The main substitute for broadcast burning would be yarding of unmerchantable matenal (YUM) Under this technique, logs of a certain size would be dragged to a landing for disposal Assuming that disposal would be at least partly by non-burning means, this method would substantially cut production of suspended particulates Timber yarding techniques have the concurrent effect of encouragmg utilization of material previously considered cull Once hauled to a landing, much more of this material would be utilized than if left in the harvest unit Demand for this type of material is increasing and should contribute to future reductions in suspended particulate production

Predicted reductions in particulates are based on emission factors, acres treated, and treatment type Reductions from current levels are a direct result of the mitigation measures descnbed above Timing of burning operations has already proven very effective in mitigating air quality impacts Burning under favorable ventilation conditions has significantly reduced impacts, as has spring burning

Utilization standards have steadily increased over the past decade, with corresponding reductions in tonnage burned, and consequently, reductions in air quality impacts

Air quality will be monitored to assure compliance with State and national air quality standards

Dust abatement will be aided through

- Road watering, oiling or paving as warranted by conditions
- Controls on machinery operations and timing in relation to other use activities
- Dust abatement controls on stationary sources such as rock crushing operations

PRF, EGP, and TGP Alternatives

Prescribed burning for wildlife/range improvement and hazard reduction would be the same under all three alternatives Due to the higher number of acres in timber-related slash burning, expected air quality impacts would be greater with the TGP Alternative than PRF and EGP

CUR Alternative

Prescnbed fire for all uses is highest under the CUR Alternative The prescnbed burning program could result in smoke movement into smoke-sensitive areas

2. BIOMASS

The planning issue for biomass involves the use of wood material for energy production while still meeting ecological needs, as well as its prionty for consumption Biomass was defined in Chapter **3** as the above-ground portion of trees The main source of biomass on the Forest is commercial thinning yields

All Alternatives

Forest Service policy is to insure that firewood is available to meet the demand for personal use Therefore, material suitable for firewood is not considered available for biomass utilization Enough biomass material must also be left in the Forest to meet ecological needs for soils, plants, and animals Therefore, in all alternatives the only material considered available for biomass utilization is logging residue and thinning slash surplus to firewood and ecological site needs

The estimated net amount of biomass that could be obtained annually from loggmg residue and stand thinning in decade **1** is shown in Table 4-**3** for each alternative These levels were obtained by FORPLAN modeling of projected timber harvests adjusted for accessibility of the material Adjustments were also made for biomass yields associated with tree thinning operations Gross biomass tonnages were developed from tree weight tables, which give tonnages in three size classes 0-3 inches, 4-9 inches, and 10 inches+ The 10 inch+ size of matenal is presumed to be used for firewood and wildlife needs,

Table **4-3**

Potential Logging Residue Available **for** Biomass Annually - Decade 1

	Alternative			
	PRF	***CUR***	EGP	TGP
Estimated Accessible Loggmg Residue (Thousand Oven-Dry Tons/Year)	165	148	165	**187**

and thus only a portion is included here as available tree residue The smallest size matenal is designated to be left on site for nutrient recycling and erosion prevention Thus the primary source of residue is the 4-9 inch class

The increased pnce of energy could increase the amount of residue that would be utilized and could induce use of low-value commercial timber species Improved biomass collection technology could also enable use of matenal that is now unavailable or unusable These factors could collectively or individually increase the amount of biomass available

This analysis of consequences is based on the assumption that within the life of the Plan, sawlogs and "clean" chips will continue to be a more valuable commodity than energy fiber, and on continuation of the policy that firewood users will have first priority of available fiber

Sawmill residue, which is currently a major source of energy fuel, is not considered in this analysis, since the Forest has no control over the use of such matenal (see Chapter **3)**

The supply of biomass is affected pnmarily by the level of timber harvest and by the amount of land from which it may he obtained Under all alternatives, loggmg residue is available to meet about 12 percent of the total needs of existing power plants The total need, as shown in Table 3-2, is 1,240,000 oven dry tons per year At the present time, most of this need is being supplied by manufactunng residue or from private lands

The available loggmg residue from all alternatives would be sufficient to supply about 25 megawatts (MW) of power New roads would provide improved access to biomass cutting ar-

eas Based on its harvest level, the TGP Alternative would provlde the most residue for biomass cutting

a. Direct, Indirect and Cumulative Effects

Under all alternatives, biomass production will have similar effects on other resources Biomass thinning operations will have a beneficial effect on long-term timber growth Thinning results in less competition between indivldual trees for water and nutrients, which allows the remaining trees to attain larger sizes and more economic value before harvesting. The trees in less crowded timber stands also tend to be healthier, better able to withstand stress from climatic conditions and attacks from forest pathogens.

Biomass operations could have adverse effects on mldhfe species that prefer dense timber stands for thermal **or** hiding cover Deer tend to utilize stand edges near openings for cover, and other species such as marten may require dense stands for travel corndors. Biomass thinning could expose many acres to view from roads, and could increase disturbance to mldlife species The effects would spread to many acres over time, leaving few areas in a natural condition, except those lands allocated to other management objectives Over time, dense hiding and thermal cover would be much reduced

Biomass removal has the potential to affect soil productivlty in two major ways first is by the removal of nutnents and second is through physical compaction of the soil

Nutnents that are stored in the biomass are removed mth harvesting The majonty of these nutnents are stored in the needles and twigs with minor amounts in the bole of the trees Under natural conditions, the needles and twigs fall to the forest floor and become part of the litter layer. **As** they come in contact with the soil surface, they start to decay and the nutnents stored in them are released to the soil to be used again by the vegetation gromng on the site If the site is a productive one (deep soils and enough rainfall each year to recharge the soils), then an occasional removal of biomass will not affect soil productivity adversely However, if the site is of lower productivity to start mth, then it is more critical to keep all the nutrients on site Normally, harvest operations associated with thinning pose little threat to the nutnent balance Care must be taken when stands are regenerated to leave sufficient nutnents on the site.

Biomass harvesting is a highly mechanized two-stage operation which may result in serious soil compaction First, a feller-buncher sheers and "bunches" the trees. This usually does not cause significant compaction since it normally travels over each parcel of ground once Next, the bundles are sludded to the landings This may cause excessive compaction if the feller-buncher runs over skid trails several times. Soil productivlty has decreased due to soil compaction resulting from five or more passes Frequently, biomass harvesting occurs on prevlously harvested sites and may augment compaction caused by prior harvesting

b. Mitigation Measures

To mitigate the effects of biomass thinning, pockets of unthinned stands would be left for screening Streamside management zones would help provlde travel corndors for species such as bear, marten, and fisher Areas reserved for wilderness, semi-pnmitive recreation, vegetative diversity and Sensitive species habitat would provide addltional cover and a variety of natural stands

The most effective method of preventing soil compaction through biomass operations is **to** avoid harvesting when soil moisture content is high The Forest intends to establish cnteria to control biomass harvesting operations dunng periods of hgh soil moisture Another option to lower soil compaction is the use of designated skid trails The skid trail will be compacted, but the rest of the area will be protected If the trails and landings are located correctly, then they can be used again in the future. In that sense, they become part of the transportation system The regional standard at this time is for no more than 15 percent of an area to become disturbed in this manner If more than 15 percent is disturbed, then the compaction must be mitigated The usual form of mitigation is ripping the compacted areas with a forest cultivator or subsoiler

All sales should be properly designed to prevent soil compaction Under the best of conditions, ripping the soil after compaction has occurred

does not return the soil to its pre-compaction state However, npping will allow water and roots to penetrate the soil and lead to quicker recovery of the site

3. CULTURAL RESOURCES

The preservation and protection of the Forest's cultural resources are closely associated with their location, resource management activlties, and public use. Impacts to cultural resources may occur from natural forces, from Forest visitors or the management of other resources

Erosion and other envlronmental effects may deteriorate cultural resource sites through decomposition. stabilization, regular maintenance, rehabilitation or data recovery are means to prevent the loss of the sites and the information they contain

Public use may destroy cultural resource sites through inadvertent damage caused by compaction, or other ground disturbing activities. Lootmg and vandalism result in the loss of information and destruction of the resource. Protection of important cultural resource sites from public use includes maintaining confidentiality about specific site locations, monitonng, and directing public use away from the most vulnerable sites

Areas managed for recreation provlde opportunities for protection and interpretation for the public education and enjoyment Active educational and interpretive programs may create a greater awareness of the importance of cultural resources to our hentage and foster a sense of stewardship while adding to the recreational expenence However, protective measures to control or eliminate intentional destruction of these areas by looters and vandals must be implemented

Multiple-use activlties have benefited cultural resources by provlding opportunities for their inventory and evaluation Ground disturbing activlties have the most potential to adversely affect cultural resources and their environmental settings The degree of effect is determined largely by the location and nature of the activity and the characteristics of the cultural resource

Cultural resource management may increase the cost of implementing other resource projects Some areas may need to be avoided entirely in order to protect the cultural sites This may result in greater expense in accessing areas and a loss of commercial products such as timber or minerals Protection of important cultural resources often precludes timber harvesting or mining activities.

In all alternatives, the preferred management of cultural resources on, or eligble for, inclusion on the National Register of Historic Places shall be to maintam those values that result in their eligibility Potential effects from envlronmental modification will require consultation with the State Historic Preservation Officer and the Advisory Council on Histonc Preservation to determine means to avoid or mitigate the effects. These potential effects are dimmished when the physical settings in and around cultural resources are maintained in a natural state.

Land allocations having a high potential for major envlronmental modifications include the Timber (T) Prescription and Range (R) Prescnption. These allocations are most likely to affect important cultural resources through damage to them or alteration of their natural settings In many instances, retention of a natural envlronment is crucial to maintammg the values that result in a cultural resource's eligibility for inclusion on the National Register

Land allocations havlng a moderate potential for environmental modifications include the View/Timber (V) Prescnption, and the Rocky/Sparse (K) Prescription These allocations are most likely to have a moderate impact on important cultural resources through alteration of their natural setting.

Land allocations having a low potential for environmental modifications include the Wilderness (W) Prescription, both Semi-Primitive (M, N) Prescnptions, the Special Areas (S) Prescription, the Late Successional (L) Prescnption and others where land disturbing activities are not emphasized These allocations are most likely to have a low effect on important sites through alteration of the envlronmental settmg The inventory, evaluation and protection of cultural resources in these areas are subject to the same

cultural resource management requirements a5 other areas of the Forest

All Alternatives

All alternatives provide for the identification, evaluation, protection, and interpretation of cultural resources

Each alternative will have varying levels of timber harvest and recreation use Other activities also impact cultural resources, hut these two and grazing have the greatest effect and are a good measure of the potential to alter sites on the Forest Therefore, for the purpose of estimating effects on cultural resources, the alternatives have been grouped according to their Land Disturbance Index (LDI), recreational use, grazing levels and other activities See Table **4-4**

Cultural resources will he protected in all alternatives through the application of Forest Standards and Guidelines that apply to all management activities with the potential to disturb sites The Standards and Guidelines implement the National Historic Preservation Act and Executive Order 11593and insure that all ground-disturbing activities wll he preceded by an inventory for cultural resources, evaluationofsites located, and avoidance or mitigation of effects of management activities on any important cultural resource

a. Direct and Indirect Effects

Alternatives calling for greater timber harvest and road construction levels, and more recreation and grazing use will increase the potential for inadvertently disturbing sites

Range Significant interactions between cultural resources and range-related activities are most directly associated with livestock levels, water developments, and range improvement programs For example, breakage or displacement of artifacts through trampling can he severe, depending on the number of livestock and density of artifacts/sites The development of springs and reservoirs for livestock use can impact cultural resources occurring in and around the developed areas The relative stability of many seeps and springs, reflected in their recurring use by Native Americans as well as European groups, increases the possibility that significant sites may be adversely affected by such development activities

Nonstructural range improvements include the use of prescribed fire, broadcast seeding, and chemical applications to reduce competition from non-palatable species These practices are not necessarily threats to cultural resource sites Prescribed burning can increase the effectiveness of cultural resource surveys by enhancing ground visibility in heavily vegetated areas

Excavations or impoundments to create stock watering reservoirs can have obvious effects on cultural resource sites, either through the excavation activity itself or inundation of sites Mechanical treatment to enhance forage production, achieved through the use of heavy equipment, can generate substantial ground disturbance which threatens archaeological sites Plowing, disking, drilling, pushing, piling, and chaining represent potential mechanical treatment practices

Recreation Construction and management of developed recreation sites do not vary significantly by alternative However, increased recreational use, especially dispersed recreation, can affect cultural resources The PRF and EGP Alternatives increase opportunities for dispersed use, and may result in an increase in cultural resource impacts from dispersed site and access improvements, relic collecting, and repeated use of popular areas

Direct effects to cultural resources may he realized as recreational facilities are developed or expanded The construction of campground facilities, reservoirs, boat ramps, or trails can disturb significant cultural resources, as these facilities are often associated with site locations Associated increases in recreational use of the Forest would result in additional visitors, increasing the potential for unauthorized collection of artifacts and excavation (looting)of sites Incidents ofvandalism, intentional or otherwise, would likely increase

Positive effects associated with the expansion or development of recreational facilities would include a concomitant increase in opportunities to enhance and interpret important cultural resource sites for public education and enjoyment

Table 4-4

Cultural Resource Risk Analysis

Risk Factors	Base Year 1982	Decade	Alternatives			
			PRF	CUR	EGP	TGP
Land Disturbance Index (effects of timber harvesting, road building and fires)	44 3	1	36 5	44 3	36 6	40 2
		5	34 1	42.1	32 2	37 1
Dams and Reservoirs (numbers)	17	1	19	19	19	19
		5	25	20	19	25
Minerals (plans and permits)	58	1	54	60	44	63
		5	70	76	58	79
Grazing (M AUM's)	49 7	1	48 5	49.7	48 5	48.5
		5	48 5	49 7	48 5	48.5
Recreation (M RVD) of developed and dispersed public use)	903	1	1,031	1,031	1,031	1,031
		5	1,586	1,454	1,586	1,586
Semi-Pnmitive Non-Motonzed and Wilderness Area Acres (M acres)	221	1	147.6	78.1	176.1	78.1
		5	147.6	78.1	176.1	78.1
Wild and Scenic Rivers (miles under wild status only)	0	1	48 5	0	48 5	16 0
		5	48 5	0	48 5	16 0
Cultural Resource Program Level (reference Chapter 2, E-4)	Low	1	Mod	Low	Mod	Low
		5	Mod	Low	Mod	Low
Risk	High	1	Mod	High	Mod-Low	Mod-High
		5	Mod	High	Low	Mod-High

Roads The effects of road construction on cultural resource sites are obvious Because the major components of the Forest's transportation system are sometimes superimposed on histonc and, to a lesser degree, prehistoric routes of travel, the likelihood of direct impacts to cultural resources sites is high As previously unroaded areas are entered, cultural resources will become more vulnerable to looters

Again, the relative risk among the alternatives to the disturbance and destruction of cultural resources is shown in Table 4-4 (based on activlties planned in decade 1 and anticipated in de-

cades 2-5) Risk is decreased by efforts to manage cultural resources (cultural resource program level), restrictions on access and use of vanous lands (e.g wilderness and semi-primitive management) and reduced land disturbance (e g. timber harvest, roads, grazing, etc).

Under each alternative, the management of cultural resources will generally have little effect on other resources Requirements for the maintenance or recovery of cultural resource values are the same under each alternative. Modification of resource projects and additional implementation costs will occasionally be required to protect or recover cultural resource values

Timber Harvest Timber sale activities involve cultural resources more than any other Forest activity Haul road and landing construction, tree felling, skidding, slash disposal, and tractor yarding are among those actinties which have the potential to alter or destroy surface or shallow buried sites Silvicultural treatment of timber sale areas may result in direct effects caused by increased ground visibility, presence of tree planting crews and ground disturbing equipment

Slash and brush disposal through prescribed burning can result in direct impacts to the surface components of archaeologxal sites if the fire intensity is high

Based on the estimated harvest volumes in the first three decades, the CUR and TGP Alternatives have the greatest potential to affect cultural resources. Harvest actinties and road development increase the potential for disturbing cultural resources. Increased access resulting from road construction can result in damage to histonc and archeological sites by looters or curious visitors.

The PRF and EGP Alternatives display the lowest volumes Lower harvest levels would result in fewer roads into sensitive areas and less chance for disturbance or destruction of important sites

b. Cumulative Effects

Forest Service histonc preservation compliance procedures incorporate the consideration of cumulative effects to important cultural resources caused by any proposed action on National Forest land These effects are subsequently avoided or mitigated through a vanety of measures. However, there is no adequate compensation for the loss of some sites, each of which forms a piece in the "puzzle of the human past" Some sites are, in part, aesthetically or even emotionally significant, and they convey (by their preservation in-place) a special link with the past Even with the most careful and complete of mitigation efforts, the loss (or substantial alteration) of such resources would result in a cumulative loss of cultural values Because the CUR and TGP Alternatives have the greatest number of acres assigned to management prescnptions that may substantially alter the environment, they present the highest nsk for cumulative loss of cultural resource values The **nsk** is less under the PRF and EGP Alternatives

c. Mitigation Measures

All alternatives include requirements for inventory, protection, preservation, interpretation, and consultation with the State Histonc Preservation Office as descnbed in the Forest Standards and Guidelines This compliance review process considers cumulative effects to cultural resources of any proposed action on National Forest Lands Effects are avoided or mitigated through a variety of measures

Mitigation of potential effects to cultural resources other than avoidance may include protective enclosures, systematic monitoring of project activities, or mandatory restrictions on project design When effects cannot be avoided, systematic recovery of the information through excavation, collection of materials, and detailed documentation may be required as determined through consultation with the State Histonc Preservation Officer and Advisory Council of Historic Preservation Mitigation of adverse effects will result in the collection of information The cumulative effect of data collection will result in an increase in knowledge of previous human settlement patterns and cultural development

There are no absolute standards that establish what level and kind of project mitigation would be necessary Each cultural resource is unique, and therefore appropriate mitigation measures will usually be developed on a case-by-case basis as part of specific cultural resource compliance procedures that apply to the project

d. Mitigation Measures for Illegal Activities

Destruction of valuable cultural resource sites and theft of artifacts result **from** ignorance of the laws and actual criminal intent Recreationists, unfamiliar mth the laws, may casually collect artifacts from the surface, unaware of the information they are destroying. Commercial **or** hobby collectors are very familiar with the laws, yet engage in illegal excavation and collection as a lucrative commercial or personal endeavor. Just as the reasons for the threat to cultural resources range from ignorance to cnmmal intent, ***so*** must the nntigation measures range from education to law enforcement

To inform the general public and those who may not be aware of the sensitivity of the resource or laws protecting it, the Forest is increasing the number of interpretive opportunities. These opportunities include signed archeological sites and educational programs to various groups. Hopefully, education and increased awareness will result in a decrease in the casual collection of artifacts. It may also indirectly affect the activities of the commercial collector if more Forest vlsitors are encouraged to report suspicious actinties

When education fails, law enforcement becomes necessary The Archaeological Resources Protection Act (ARPA) and the Code of Federal Regulations (35 CFR 296), prohibit excavation **or** collection of artifacts from federal lands Illegal excavation resulting in damage to the archeological value of a site **in** excess of $500 is a felony. Criminal penalties under ARPA are **$20,000** and two years in pnson for the first offense, and $100,000 and five years in prison for a repeat offense Several collectors have been successfully prosecuted for illegal excavation and destruction of cultural resource sites on the Forest

None of the alternatives would deny Native Amencans access to areas of traditional significance. However, vanous alternatives would make access to specific resource areas either more difficult **or** easier The amount of land allocated to vanous management prescriptions would influence the potential availability and supply **of** traditional resources.

In the consequences of each alternative discussed, changes refer to changes from conditions present in 1982

PRF Alternative

Less land will be disturbed largely as a result of lower hmber harvest levels Therefore, potential disturbance of cultural resources would be reduced. However, looting and vandalism of cultural properties would be expected to increase as recreational use increases Effects to cultural resources would be mitigated as a result of a greater effort to identify, evaluate, interpret and protect sites. Although effects to cultural resources will probably increase over time, effects will continue to be less than under current conditions.

CUR *Alternative*

Land allocations involve little change in current timber harvest levels, road construction actinties **or** other commodity onented projects. However, there is a significant change in proposed silvicultural treatments with the emphasis on clearcutting. All of these land disturbing actinties have a moderate to high potential to impact cultural resources Conflicts between cultural resources and other resource management actinties are likely, with a corresponding need to mitigate adverse effects.

Only minimum requirements for the management of cultural resources would be met Efforts to identify cultural resources would be restncted to areas where Forest actions may affect them The continuing absence of information on the location, distribution and nature of cultural resources would substantially curtail efforts to manage them. Little would be contributed to the public's understanding of their cultural heritage.

EGP Alternative

Substantially less land would be disturbed largely as result of the decline in timber production Therefore, potential disturbance of cultural resources would be reduced. Looting and vandalism of cultural properties would be expected to increase as recreational use increases However,

the addition of Ishi B to the wilderness should significantly reduce access to a heavily looted area Effects to cultural resources would be mitigated as a result of a greater effort to identify, evaluate, interpret and protect them This alternative would best protect cultural resources, while providing for their interpretation to the public

TGP Alternative

Land allocations and lower timber harvest levels involve less alteration of the landscape and ground disturbance Corresponding impact to cultural resources is expected to be less than under the CUR Alternative

Only minimum requirements for the management of cultural resources would be met, as in the CUR Alternative Little would be contributed to the public's understanding of their cultural heritage

4. ENERGY

There are two parts to the planning issue associated with energy how much energy can be produced from Forest products to support local and regional needs, and how much energy is consumed managmg the Forest Environmental consequences on the energy resource are discussed below for each type of energy

Wind and Solar

In all alternatives, wind or solar projects are subject to indimdual project envlronmental analyses and resulting requirements to mitigate environmental impacts

Consumption and Conservation

Energy consumption by Forest management will be the same under all alternatives except that consumption would vary with the extent of activities and numbers of employees Existing buildings have been retrofitted with energy conservation materials and devices to minimize heat and air conditioning losses For further discussion of energy balances by resource, see Section G, Energy Requirements and Conservation Potential, of this Chapter

Hydroelectric

a. Direct and Indirect Effects

Existing hydroelectric power facilities will be allowed to continue under all alternatives New hydroelectric facilities are directly affected by the land allocations of each alternative and whether access or development is restricted Where allowed, new hydroelectric projects would be permitted, subject to environmental analysis and mitigation requirements on an individual project basis

Possible direct and indirect effects include

- Wildlife migration, watering, or forage patterns may be interrupted by impoundments that flood old streambank and npanan areas, along with game trails
- Riparian and nearby upland vegetation can be inundated or dried up

The Wilderness Act prohibits development of hydroelectnc facilities in existing wilderness (except in rare cases), and the Forest will ordinarily oppose such development in proposed wilderness Of the six further planning areas on the Forest, only the Mill Creek and Ishi B areas have significant potential for hydroelectnc projects Hydroelectric applications have been filed on Mill Creek and Antelope Creek in the past In addition, the Wild and Scenic Rivers Act precludes hydroelectnc development in designated or proposed Wild and Scenic Rivers, with the rare exception of projects in a "recreational" classified segment that do not affect the nver values Table 4-5 summarizes the wilderness, and Wild and Scenic River withdrawals by alternative It shows their relative effects on precluding hydroelectric development

b. Cumulative Effects

Hydroelectric dam developments, on both National Forest lands and on other public and private lands, can create cumulative effects on streamflow, channels, animals, plants, and riparian land conditions Possible cumulative effects include

- Changes in local streamflows and water depths Some reaches may carry greatly

Table 4-5

Effects of Wilderness and Wild and Scenic River Recommendations on Hydroelectric Development

		Alternative			
		PRF			TGP
Proposed Wilderness with Hydroelectnc Potential		Mill Ck	None	Mill Ck, Ishi B	None
Proposed Wild and Scenic Rivers with Hydroelectnc Potential (miles)					
Mill Creek	Recreation	9 5	0	9 5	0
	Scenic/Wild	22.5	0	225	8
Deer Creek	Recreation	8	0	8	0
	Scenic/Wild	22	0	22	8
Antelope Creek	Recreation	0	0	0	0
	Scenic/Wild	14	0	14	0
Total	Recreation	17 5	0	175	0
Total	Scenic/Wild	58 5	0	58 5	16
Total All Segments	All Segments	76 0	0	760	16

Nates In the PRF and EGP Alternatives, mlderness recommendations overlap with Wild and Scenic River recommendations within the Ishi Wilderness and the proposed Mill Creek Wilderness, in the TGP Alternative, overlap is within the Ishi Wilderness 'Scenic' classification and "Wild" classification bath prohibit hydroelectnc development Recreational' classification prohibits hydroelectnc development where outstandingly remarkable values would be affected

diminished flows, while others may shift from flowing waters to pooled water Some areas may dry up while others become flooded As more stream segments are affected, adverse effects on the original stream conditions become more pronounced

- Fish species and population characteristics can change with altered stream conditions, and animals and birds that prey on fish can also be affected

- Visual condition can be adversely affected, with increasing disturbance along a stream Not all vlsual changes are bad, but the native, visual character of the stream and the landscape it traverses would be altered, as hydroelectric impoundments become an increasingly dominant landscape feature.

- Recreation uses, user numbers, and activities can change For example, a lightly-fished stream may be flooded and turned into a lake that is accessed by roads and heady-used for water-sluing, boating, and shoreline camping

c. Mitigation Measures

Mitigation measures are developed by interdisciplinary teams during project planning and environmental analyses They are incorporated as 4(e) recommendations to FERC and into project special use permit clauses and easement conditions or reservations Mitigation measures for hydroelectric projects may include.

- Limiting times and/or amounts of flow diversions from streams, based on in-stream or ripanan zone needs

- Restricting the total length of stream segments that could be impacted without adverse effects on water quality, fisheries, or nparian areas

- Installing compensating stream improvements in other reaches, either upstream or downstream from stream reaches affected by the project For example, streambed gravels could be improved or imported at some critical downstream location

- Implementing off-site mitigation measures at other locations or in other streams, to offset loss or damage to stream resources in the project area or impacted stream system

PRF Alternative

Recommending the **7,580** acres in the Mill Creek further planning area for wilderness, and **76** miles of Mill, Deer, and Antelope Creeks for Wild and Scenic Rivers, would preclude hydroelectric projects on much of the remaining lengths of these streams currently outside wilderness These are some of the most promising reaches of streams for hydroelectric potential on the Forest Development would be remotely possible m the **17.5** miles proposed for "recreational" river, and theoretically possible on the private lands along these creeks

CUR and TGP Alternatives

These alternatives recommend no new wilderness, and no Wild and Scenic Rivers (except TGP, which recommends eight miles each on Deer and Mill Creeks for wild status within the existing Ishi Wilderness) There would be no negative effect on hydroelectric potential Future road building into creek-side areas for loggmg may facilitate hydroelectric studies and development

EGP Alternative

Recommending Ishi B and Mill Creek for wilderness, and recommending **76** miles for Wild and Scenic Rivers, will have the most impact on hydroelectric potential of all alternatives Road building and access to potential new projects would be restncted in the proposed wilderness and along most of the proposed Wild and Scenic Rivers Like the PRF Alternative, some segments would be classified "recreational" and open to possible development

5. FACILITIES

Introduction

The planning issue for facilities focuses on what roads, trails, utility corridors, buildings, water and sewer systems, dams and stream crossings would be needed for the management of other Forest resources Environmental consequences on the facilities resource are listed below for each type of facility

a. Roads

Most of the Forest development road system is a result of local road construction for timber harvest activities New road construction and reconstruction was modeled by FORPLAN on a per acre basis The model produces a reasonably accurate estimate of the total miles of local road construction needed over the next **50** years Approximately **66** percent of the new roads associated with each alternative will be constructed in the first two decades

Construction of local roads associated with recreation improvements was not included in the model However, some development will occur Additional road surfacing improvements to existing campgrounds can be expected for all alternatives Reconstruction of local roads associated with administrative developments would also occur in all alternatives Reconstruction for administrative purposes consists of road relocation to serve additional facilities, provide public parking, and improve drainage and road surfaces

Currently, about **172** miles of the existing road system is not managed for continuous car and truck use, but may allow non-motorized and foot traffic Culverts may be removed from these roads, and the roads themselves may revegetate

naturally or he seeded with native seed sources Another **2,767** miles are currently open to high clearance vehicles, hut are isolated from large road systems or communities and are infrequently used The remainder of the existing roads **(533** miles) are open to motorized vehicles and are maintained for continued multiple-use activities As projects are proposed, cumulative effects of the current road system and proposed new roads will he considered in a site-specific manner for the resources present These project level decisions may change the mix of open road density for any gwen watershed or transportation network depending on the specific resources that may need consideration

Each alternative will require reconstruction of a portion of the existing road system in each decade Reconstruction of a road protects the original investment, protects resources, and makes the road suitable and safe for its intended use Reconstruction involves the rehabilitation of the ongmal roadbed Common reconstruction activities include cleaning ditches and culverts, replacing damaged drainage structures, and grading and shaping of the road surface

All Alternatives

(1) Direct and Indirect Effects

A multitude of direct, indirect, and cumulative environmental effects on various resources are associated with roads, and these are discussed at length under the respective resource section in this Chapter Activities that directly affect the transportation system are road construction and road closure Estimated miles of road construction and reconstruction associated with each alternative are displayed in Table **4-6**

Road closures to meet resource management objectives on the Forest are either yearlong or seasonal Reasons for road closures include providing for water quality, erosion control, public safety, reduction of road-user conflicts, reduction of maintenance costs, legal mandates such as roads within wildernesses, managmg opportunities for semi-primitive recreation, and protection of wildlife or wildlife habitat for species that are intolerant of human disturbance

The indirect effect of the road system on cultural, scenic, fishery, range, timber, soil, water, and mineral resources are proportional to the amount of roads that are constructed, reconstructed and maintained

Table 4-6

New Construction and Reconstruction of Roads (Average Miles/Year)

	1982 Base Year	Alternative PRF	CUR	EGP	TGP
Decade *1*					
New Construction	**15**	16	*	16	21
Reconstruction	80	50	*	50	67
Total	**95**	**66**	**77**	**66**	88
Decade **5** (potential)					
New Construction		**4**	*	**3**	**4**
Reconstruction		**55**	*	**36**	**45**
Total		**59**	**111**	**39**	**49**

* Updated mileage figures separating new construction from reconstruction are not available

Arterial and Collector Roads An adequate arterial and collector road system for the Forest is in place The present Forest development road system is **3,472** miles long

Needed improvements to arterial roads have been identified (see Table **3-5)** and are included in the Forest Highway Inventory for future funding consideration Some reconstruction of collector roads may also he needed in the future

Among the alternatives, arterial and collector system management is essentially the same The major difference among alternatives regarding the Forest transportation system would he the mileage and management of local roads Those alternatives with higher commodity production will necessitate the need for increased access in both roaded and unroaded areas, and

the relocation of existing local roads presently causing resource damage In alternatives where commodity emphasis is less, new road construction will be less and road management strategies will be implemented to reduce road densities

Alternatives that promote both high recreation use or high commodity production will generate higher traffic volumes Conversely, lower levels of use or production will reduce traffic volumes The location of activities, whether dispersed evenly throughout the Forest or concentrated in localized areas, will have a direct effect on traffic volumes on specific roads When activities in an area are scheduled to occur at a high level for a short duration, followed by periods of non-activity, theintermittent trafficvolumes could exceed the acceptable road capacity and may require reconstruction to a higher standard, which has a direct effect on other resources Therefore, the quantity, the location and the timing of timber and recreation program activities on each alternative have an indirect effect on soil, water, wildlife, and geology

Recreation Recreation use on the Forest creates demand for roads to accommodate public travel The type of recreation use causes different kinds of effects on the road system Higher recreation volumes create a demand, generally, for higher standard roads. Higher standard roads can include features such as two lane or wide single lane, higher travel speeds, smoother roadway surfaces, and greater vlsibility

Driving for pleasure creates the highest demand of any recreation use for roads open to public travel. For those alternatives which focus on creating the highest amounts of dispersed recreation, a portion is associated with driving for pleasure. Demand for roads open for public use creates safety concerns and results in a need for higher standard roads that are well maintained

All alternatives are proposing the creation of scenic by-ways through the Forest to attract more recreational use Dnving for pleasure will be a pnmary activity along these scenic routes Facilities such as rest areas and interpretive sites will be established and maintained to accommodate more visitors

Alternatives with the highest number of scenic viewsheds protected have a direct effect on road construction Since roads often introduce a contrast in line form or color, they arc either restricted or designed to he screened, which affects the cost of road construction in viewsheds

Huntinghas seasonal effects on road use Hunting increases the amount of travel on the **road** system during a portion of the year

Roads in semi-primitive motorized recreation areas may be maintained ab a part of a high-clearance vehicle trail system rather than maintainedas apart oftheroad system Additionally, some roads in semi-primitive motorized recreationareasmaybeclosedorobliterated toachieve optimum road density levels for this off-highway vehicle use

Soils and Geology Soil properties, rock properties, and topography have direct effects on transportation facilities Availability, location, design, construction, maintenance, reconstruction, and costs of roads are affected by the geological Characteristics of the Forest

The existing Forest development road system is affected similarly in all alternatives Most of the road system is on stable soil and rock subgrades with few mass movement failures A few portions of the road system are on moderately stable or unstable soil and/or subgrades Less stable soils/rocks may result in an increased incidence of road failure and an increased need for road maintenance Mass soil movement could result in loss ofroadbeds Road reconstruction is required more frequently, and is more costly on unstable soils Road maintenance is also more costly on less stable soils

Timber Timber harvest and haul affect the road system Alternatives producing the highest timber harvests will have the greatest need during the planning horizon for an extensive and well-maintained road system

Timber harvest creates a demand for low standard roads to gain access to harvest sites and haul timber from the Forest Most road construction on the Forest is in response to timber access needs

Those alternatives which focus on high commodity production will result in the most miles of local (low standard)road being built Timber

haul has a physical direct effect on roads. Repeated truck trips create wear on road surfaces and can lead to their eventual failure or need for reconstruction

Scheduling of timber activities in conjunction with recreation actinties may have an indirect effect on traffic volumes When commercial (commodity) haul and recreational traffic use the same roads, the combination can generate enough traffic to warrant changes in road standards This results in wider roads, more construction/reconstruction expense, and increased maintenance costs

Alternatives which produce the greatest quantities of timber haul also create the largest amounts of cooperative road maintenance funds, which are collected from timber purchasers to be used on Forest roads Therefore, those alternatives which produce higher haul volumes have more funds available for road maintenance This results in a higher percentage of road miles being adequately maintained to the required standards Those alternatives which result in volumes lower than historic levels may increase the need for congressional budget funds for maintaining roads Lower haul volumes could reduce the need for maintenance or result in reduced road maintenance or limited access in some areas if no replacement funds are provided

Other indirect effects include increased access for firewood cutting, hunting or other forms of motorized vehicle recreation

Unroaded Areas The effect of entry into these areas on transportation is included in the discussion of Wilderness and Further Planning Areas in this Chapter

Expanding the road network into roadless areas could

- Change the ROS setting and associated recreational opportunities of these areas, resulting in a need to increase road standards
- Increase erosion and stream sedimentation rates, resulting in more costly road construction surfacing options
- Increase access for timber management, resulting in more miles of road construction and maintenance
- Increase the potential for disturbance of wildlife habitat, resulting in more complex road management strategies for permanent and seasonal road closures
- Increase access to the Forest for woodcutters, anglers, off-highway vehicle recreational opportunities, and hunters, which potentially create higher traffic volumes and result in a need for higher road standards

Water Quality/Fish Habitat New roads will be located to avoid riparian areas In addition, roads presently located in riparian areas may be relocated and reconstructed

Alternatives which focus on water quality enhancement will result in a proportionally larger amount of road closures or obliteration. This will have a direct effect on road maintenance with fewer miles to maintain

Structures placed in streams to increase fish habitat may have an indirect effect on bridges or other engineered structures during floods

Wildlife Alternatives that promote areas set aside for wildlife management will normally show a decrease in miles of open road, through a combination of road management strategies such as permanent or seasonal road closures These alternatives also will have fewer miles of road constructed than alternatives which focus on high commodity or recreation uses.

(2) Cumulative Effects

No significant adverse cumulative effects are expected to occur to the transportation system Forest Standards and Guidelines, as they apply to location design, operation and maintenance of the transportation system, assure that it will serve its intended use over time

Cumulative effects of the transportation system on other resources (indirect), such as water, wildlife and soil, are possible and are discussed in detail under those respective headings of this Chapter

(3) Mitigation Measures

The construction, reconstruction, maintenance, and management of Forest roads utilize many mitigation measures that are derived from engineering requirements Forest Standards and Guidelines also represent mitigation measures Cost of mitigation measures to improve open roads for public use, as well as measures necessary for resource protection, are incorporated in all alternatives The following actinties are examples of measures taken to mitigate impacts

- Outsloping road surfaces and adding culverts on ditched roads to keep water from concentrating
- Rocking waterbars and drain dips to reduce erosion where water leaves the road
- Diverting water onto undisturbed ground where sediment can be filtered out
- Adding riprap at culvert outlets to stop erosion
- Surfacing road travelways to reduce rutting and permit their use for log and firewood hauling when wet
- Seeding cut and fill slopes, waste areas, debris bunal sites, and unsurfaced roads to reduce erosion (Native seed is preferred)
- Draining spring areas adjacent to roads to protect the road investment and accommodate permitted uses
- Minimizing undercutting of cut slopes dunng ditch cleaning operations to reduce exposing bare soil
- Reducing overall width of roads by designing travelways, turnouts and curve widening for only the projected use
- Obliterating local roads no longer needed for management purposes and returning the land to productivity Obliteration will temporarily increase soil movement, but benefit soil and water resources by reducing erosion and sedimentation over the long term
- Removing culverts likely to be blocked during periods of long-term non-use (yearlong closures) to mitigate soil and water impacts and investment loss A short-term consequence on the water quality will occur when replacing the culverts dunng later entries

The cost of many of these measures increases as roading and timber harvest occur on steep slopes and sensitive soils

Prohibiting noncommercial traffic on weekdays and commercial traffic on weekends, gating and signing during commercial operations, and rescheduling some outputs to other areas to minimize traffic are examples of traffic management techniques They can be effectively used to mitigate safety conflicts between commercial and recreational uses, and eliminate the need for reconstruction

Restrictions on use of the Forest's road system can have a strong influence on the public's perception of the Forest's management Increasing public understanding of the road management strategy will increase acceptance and avert potential conflicts Information may be posted on signs in the Forest and/or on visitor maps

PRF Alternative

Roads currently utilized for commodity production would he maintained to allow passage by high clearance vehicles (fullsize pickups or larger vehicles) Roads providing primary access to developed recreation sites and other roads in high demand would be maintained to allow moderately-convenient travel with passenger cars Roads with little or no clearance would he closed to vehicle use, road maintenance would he the minimum needed to protect adjacent resources The mileage of roads maintained for use would be proportional to the level of commodity production, primarily timber harvest

CUR Alternative

This alternative has the highest timber harvest level and proportionally should have the greatest amount of new road construction and reconstruction over the next five decades Because of its emphasis on commodity production, the CUR

Alternative should also have the most roads open for use and the highest road maintenance standards Road mileages for the PRF, EGP, and TGP Alternatives were obtained from Version II FORPLAN analysis Mileages for the CUR Alternative were from Version I FORPLAN and are, therefore, not comparable with Version II results It was not possible to re-run the analysis for the CUR Alternative using Version II to get more updated mileage figures It is assumed that the correlation between harvest levels and roaded access would result in CUR havlng the highest number of miles constructed and maintained in the Forest development road system Under the CUR Alternative, no new mlderness, no Wild and Scenic Rivers, and no semi-primitive non-motorized areas are proposed, leaving more of the Forest available for roaded access

EGP Alternative

A minimum number of roads would be maintained for vehicular use, and in nearly all cases, high clearance vehicles would be needed to negotiate the accessible roads Roads providing primary access to recreation sites would be maintained to allow moderately convenient travel with passenger cars Where economically feasible, roads would be closed to vehicular use, maintenance would be the minimum needed to protect adjacent resources This alternative would have the most roads closed to use, and the lowest standards of maintenance and driving convenience

TGP Alternative

Commodity production is lower than CUR, but higher than the PRF and EGP Alternatives Road construction and reconstruction levels are correspondingly higher than PRF and EGP No new wilderness, Wild and Scenic Rivers outside of existing wilderness, or semi-pnmitive non-motorized areas are proposed **A** greater portion of the Forest is available for roaded access

b. Trails

All Alternatives

(1) Direct and Zndirect Effects

Recreational trail systems are most desirable when placed in a natural-appearing setting offering a variety of landscapes and levels of difficulty Depending on the intensity of timber harvest and road construction, the scenic character of the area and actual trail routes can be altered or use can be displaced, resulting in trail closures, trail relocation or reconstruction. Each alternative reflects a different level of trail system emphasis. These are, again, the result of differences in harvest levels, in miles of road constructed, and in how many unroaded and dispersed recreation areas are provided

The removal of trees along trails through various harvest methods, and associated post harvest treatments, will alter the basic character of trail settings and may displace trail use Dunng harvest and post harvest operations, affected trail segments may become impassable or destroyed The felling of trees, yarding, and residue treatment activlties can block access for users, and destroy or disturb trail surfaces These effects will typically result in temporary closures of the affected trail segments, trail relocations, and reconstruction of disturbed trail surfaces

(2) Cumulative Effects

Through expansion of the Forest trail system, users will be provided with improved, safer trails and with new trails which will provlde more recreation opportunities Existing trails which currently have resource or safety problems will be corrected through time

(3) Mitigation Measures

Trails that pass through timber sale areas will be protected during harvest operations by special sale layout, and contract preparation and administration Seasonal loggmg restrictions may apply Rehabilitation of sites disturbed by logging or road construction can mitigate long term effects on these sites In some areas, trail relocations or temporary trail closures may be considered

PRF and EGP Alternatives

These alternatives would maintain the current trail system as well as have an intensive program of new trail construction and reconstruction Approximately 35 miles of trails in the PRF Alternative, and 25 miles in the EGP Alternative, would be constructed or reconstructed in

the first decade Lower timber harvest levels would proportionally affect fewer trail corndors These alternatives would have the highest mileage of trails retained in a natural setting

CUR Alternative

The CUR Alternative would add no more trails to the present system except what is necessary for access into the Ishi Wilderness Due to the relatively large amount of land allocated to timber management prescnptions, this alternative would have the lowest number of trails that would be in a natural setting Trail users could expect to see significant amounts of timber harvest along trail corridors outside of wilderness. Some trails would be relocated due to harvest activities and road construction

TGP Alternative

The TGP Alternative has a moderate program of trail construction and reconstruction Approximately ten miles of trails would be constructed or reconstructed in the first decade The timber harvest level is higher than the PRF and EGP Alternatives Trail users should expect to see some timber management actimties along trail corridors Trails that must be relocated would be moved to more desirable locations or would be reestablished in-place after harvest activities are completed Trail users' experiences would not be significantly affected by this alternative

c. Utility Corridors

For environmental consequences to utility corridors, see section **11,** Lands, of this Chapter

d. Buildings, Water and Sewer Systems

Continuing efforts are underway to obtain funding or other authority to acquire, purchase, or build Forest offices where leased buildings are now used. This effort would not vary by alternative, and no other significant changes in administrative sites are anticipated

Most of the water and sewer systems are nearing the end of their design life, and will need major renovations within the next ten years, as well as continuing maintenance. If the systems fail to the point where they do not meet state standards, then the Forest will be forced to close the systems, unless regular cyclic maintenance and periodic replacement continue

e. Dams

In addition to the 19 existing dams, anticipated new Forest Semce dams would vary from none to six within the next ***50*** years depending upon the alternative (six potential dams in PRF and TGP, one in CUR, and none in EGP) Additional dams would provide more water for livestock and wildlife, as well as road watenng in certain areas. These may only entail a structure less than six feet high and impound less than 15 acre-feet of water

f. Major Stream Crossings

Any major crossing needs would be treated the same for all alternatives, through environmental analysis on a project-specific basis.

6. FIRE AND FUELS

a. Fire

Wildfires not only cost large sums to control, they also can affect fuels, soil productivity, air quality, mldlife, and the quality or quantity of water The degree of envlronmental impact depends on the size and intensity of a particular wildfire as well as how often fire occurs on any indimdual site **As** would be expected, fires that start where fuel loadings are high and moisture low will burn with the greatest intensities and cause the greatest impacts Wildfires frequently bum under such conditions On the other hand, fires burning where fuel loadings are low and moisture is high, such as prescribed fires, have low intensities, and environmental impacts are most often negligible

Soil is an indispensable resource of the forest ecosystem The intensity of fire, and the resulting degree to which soils are exposed to heat, control the degree of changes in soil properties due to fire Excessive heat affects land productivity and soil stability adversely If, on the other hand, aboveground fuels bum at such low intensity that soil temperature is not greatly increased,

land productivlty and soil stability may be unaffected or even enhanced. Fire of low intensity facilitates cycling of some soil nutnents Immediately after a fire, soil pH, phosphorous, exchangeable potassium, calcium, and magnesium increase, but some mtrogen is lost due to volatilization The loss of nitrogen is insignificant on low intensity fires, but nitrogen lost from the ecosystem due to high intensity fires burning when fuel moisture is low can be as high as 15 to 20 percent of the total nitrogen capital on the site Fortunately, mtrogen fixation, both symbiotic and nonsymbiotic, often becomes more active follomng fire, and this restores essential mtrogen to the soil system Nitrogen is requred in virtually all plant growth in the forest ecosystem.

Low intensity fires may also help to control plant pathogens and as a rule do not increase soil erosion Conversely, high intensity fires destroy organic mater and disrupt soil structure. This mcreases the threat of erosion and causes a loss in soil productivlty Factors to be considered in evaluating the effects of fire on a specific site include (a) the frequency of burning, (b) the size and intensity of the fire, and (c) mitigating effects

The effects of fire on air quality are presented in the Air Quality section of this Chapter Uncontrolled emissions of large volumes of smoke primanly affect visibility

Direct effects of fire on wildlife vary to extremes Vertebrates rarely succumb to fire because they can flee from it However, the immediate, post-fire-envlronment presents surviving wildhfe with a drastically changed habitat Effects may be positive or negative depending on the species For invertebrate animals, the main effects of fire are short term Populations may drop because animals themselves or their eggs are killed Their food supply and shelter may be destroyed or drastically reduced On the other hand, indirect effects may cause population increases for some species as a result of vegetative changes and increased forage after a fire.

Soil charactenstics are mtimately connected with both the quantity and quality of water The impact of water on soils involves such factors as rainfall interception rates, rainfall infiltration rates, the soil's ability to store moisture, snow accumulation and melt, and the potential for surface and mass erosion. The most powerful and important water quality responses associated mth fire are sediment and turbidity. Fires that consume the majonty of the duff layer and expose large areas of mineral soil close to streams have the greatest negative impacts Prescribed fire conducted when the duff moisture content exceeds 75 percent will create few adverse effects.

All **Alternatives**

(1) Direct and Indirect Effects

Wilderness Fire Management The effects of fire in managed forests are usually negative, but some positive effects can also materialize, depending on the situation Fires can have beneficial effects in wlderness under carefully prescribed conditions In all alternatives, fires will be allowed to play a more natural role in wilderness An analysis of the ecosystem changes in mlderness has shown some adverse impacts on natural succession caused by the Forest's past policies of total fire suppression In all wilderness, natural ignitions from lightning will be declared prescnbed fires as long as they burn mthm approved prescnption limits In short, this policy will allow fire to resume its natural role in wilderness ecosystems, but mthin safe limits If a mlderness prescnbed fire exceeds its prescnption limits, it will be declared a wildfire and put out Suppression of wilderness fires will be managed with minimum envlronmental impact and at minimum cost consistent with wilderness management direction

The Thousand Lakes and Canbou Wildernesses contain extensive stands of mature lodgepole pine and red fir with dense understories of shade tolerant conifers. This envlronment is contrary to natural conditions that would normally have existed had fire been allowed to play its natural role in these stands. If future site-specific analysis indicates that these stands have been significantly altered from natural successional processes, and if natural fire cannot be allowed its natural role, the use of planned, prescnbed ignitions will be considered

In 1990, the Campbell Fire burned 131,000 acres mthin the Ishi Wilderness, 80 percent of the

area Expected impacts from this fire on wildlife and vegetation are:

- improved forage for mldhfe, cattle, and the mld horse herd in this area.
- regeneration of decadent oak stands and chaparral

Prescnbed fire can be used in Special Interest Areas or Research Natural Areas, although the small size of most areas may make it infeasible SIA and RNA management plans will specify conditions under whch fires from natural ignitions (as well as planned ignitions) will be allowed to hurn in order to be consistent with management objectives for the area

Wildfire Occurrence Forest policy calls for the suppression of mldfires in a cost effective manner while also minimizing their effects on timber, plantations, water quality, and other resources Based on historical fire occurrence data, Table 4-7 displays the expected average annual acreage burned by wildfire for each alternative.

Table 4-7

Expected Average **Annual** Acreage Burned By Wildfire

Decade	Alternative PRF	CUR	EGP	TGP
1	760	818	757	761
2	862	857	807	828
3	873	916	871	897
4	899	947	909	944
5	878	984	913	937

Timber harvest operations can cause damagmg mldfires Sparks from trains and powerlines can also result in severe wildfires under the nght conditions Natural ignitions from lighting cause the most damagmg wildfires and account for most of the money spent on fire suppression.

Few fires are caused by recreationists and firewood cutters and the number of acres burned is usually small

Wildfire Suppression The fire management protection programs reqmred to efficiently implement each alternative were descnbed and compared in Chapter 2 (under each alternative and in the Companson of the Alternatives). Table 4-8 shows the fire protection resources of each alternative As discussed earlier, Table 4-7 shows the acreages expected to burn annually by decade. See Table 2-7 in Chapter 2 for the expected burn acreages by each mldfire intensity class.

Table 4-8

Fire Management Protection Resources

Protection Resource	Alternative PRF	CUR	EGP	TGP
Prevention Units	6	9	6	6
5-Person Engine Crews	9	11	9	9
Lookouts	6	8	6	6
Hotshot Crew	1	1	1	1
Helicopter w/Crew	1	1	1	1

Wildfire affects timber, range, water, soils, wildlife habitat, recreation, and wilderness. Most effects are directly related to acreage burned and intensity of combustion. High intensity mldfire can be very detnmental, whereas low intensity mldfire is, in many instances, beneficial. The total acreages burned in decade 1 and throughout the next 50 years are very similar for all alternatives.

Fire management for all the alternatives would rely on the traditional approach of suppression. Emphasizing fuel treatment involves slightly higher levels of nsk, but would result in less damagmg and more controllable, lower-intensity wildfires Spread rates and total acreage burned may not be reduced since the fine fuels left after fuel treatment often burn more rapidly, but less intensely, than the heavier fuels that would be present mthout fuel treatment Overall, fuel treatment would result in lower suppression costs and less wildfire damage. Continued reliance on fire suppression without fuel treatment allows fuel build-up, making fire suppres-

sion more difficult and expensive, and resource loss more unacceptable

Every alternative would allow a mix of suppression strategies: confinement, containment, or control. The appropnate strategy will depend upon the applicable management prescnption, fire lnstory in the area, and expected **fire** intensity Suppression strateges will, therefore, be consistent with management objectives for the area and the resource values at risk

Prescribed Fire Use Residues from timber harvest may need to be treated to reduce fire hazards and to prepare the land for planting These requirements affect the Forest's fire environment On-site treatments may mean piling slash with tractors and burning it, or broadcast burning Piling debns with tractors greatly reduces the nsk of fire, and burning piles is relatively safe from the risk of fire escape. However, piling slash with tractors compacts the soil, as discussed in the Soils section of this Chapter, and exposes the soil to erosion

Figure **4-1** shows the number of acres treated by prescnbed fire for decade 1 for each alternative Acres not treated by prescnbed fire are treated using such methods as yarding unutihzed material (YUM).

The effect of using prescribed fire on the air resource is discussed in the Air Quality section of this Chapter

Past expenence shows that a small percentage of the acreage treated by prescnbed fire will escape control and become a mldfire.

(2) Cumulative Effects

The average size and intensity of fires on the Lassen National Forest should not change in the future The fire management philosophy may change to allow for cost/benefit maximization Management will allow the use of prescnbed fire (both natural and planned prescnbed burns) to meet management objectives for timber and other resources (e g., wilderness, range and wildlife) The use of prescnbed fire will reduce the potential for large, catastrophic fires in the future.

(3) Mitigation Measures

Wildfire Suppressron The effects of wildfire would be mitigated through fuel treatment, fire prevention programs, and cost effective fire suppression. Fuel treatment would decrease the fuel available for wildfires, them intensity, and the difficulty of controlling such fires. Prevention programs which concentrate on education would decrease fires started by human activities Fire suppression would nntigate adverse impacts by keeping the size of the fire to a minimum while maxımızing cost efficiency Cooperative fire protection agreements with State and other local agencies will be encouraged

Prescnbed Frre Use Improvedutilization of wood residues and yardıng unutilized material would reduce the need to use prescribed fires. The chance of prescnbed fires escaping into mldfires would be correspondingly reduced.

Restrıctıng burns to times when soil and duff moisture is high would reduce impacts on the soil Rapid mop up of prescnbed burns would reduce air qualıty ımpacts and chances of escape

b. Fuels

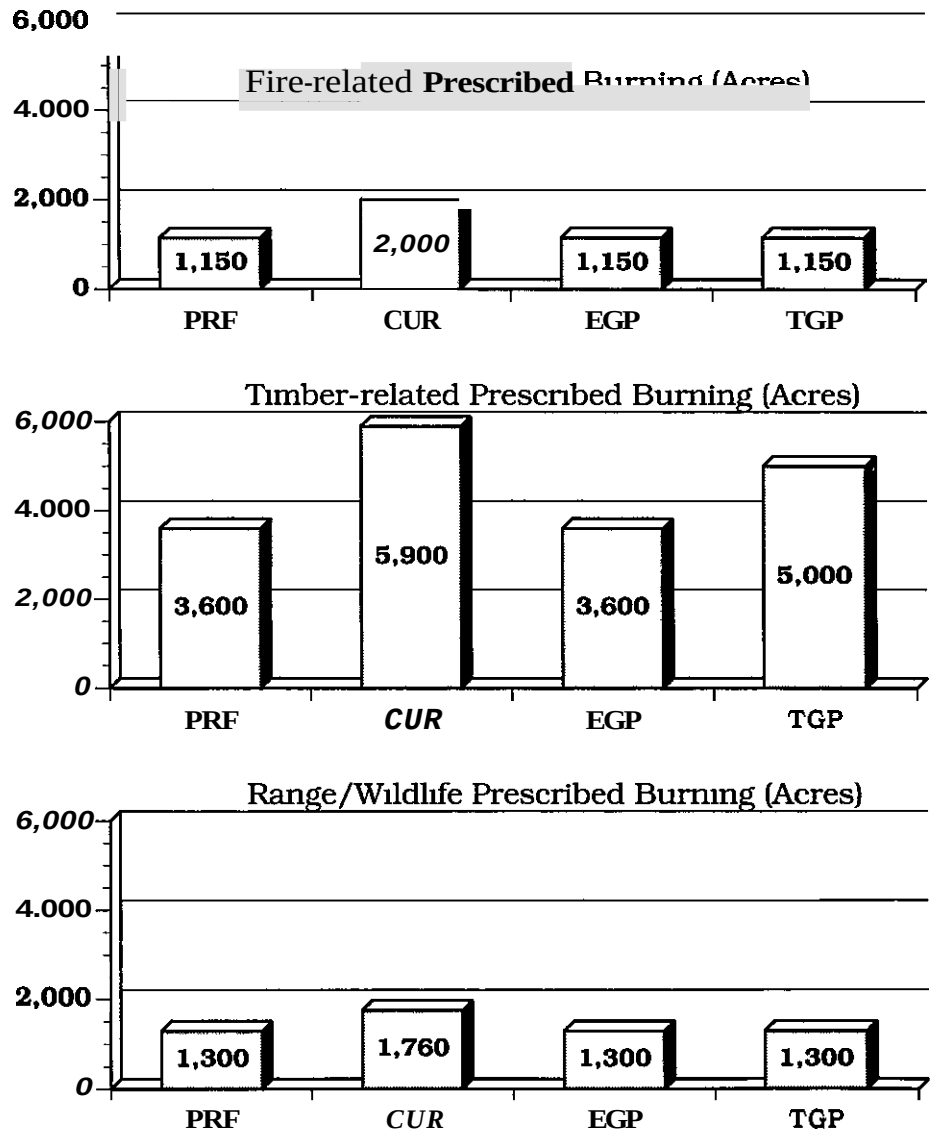
All Alternatives

(1) Direct and Indirect Effects

Fuel loading, an important factor contrıbutıng to destructive wildfires, will vary by alternative Timber harvest actinties create the bulk of the forest residue. The existence of heavy fuel loads (both natural and from timber harvesting) increases the hazard of damagmg mldfires The reduction of excessive fuel loads is pronded for as a part of timber harvesting actinties

The amount of timber harvest, by alternative, directly influences the amount of planned prescnbed burning Figure **4-1** displays this relationship The CUR Alternative would generate the greatest fuel treatment workload The EGP Alternative would produce the lightest workload through all decades Fuel profiles forest-wide will be directly affected by the quantity, location, and type of timber harvest actinty Those stands under intense even-aged timber management create a fuels profile over time of light surface

Figure 4-1
Prescribed Burning (Decade 1)



litter, light ground fuels, and a canopy **of** reproduction, saplings and/or second growth. The CUR and TGP Alternatives would result in the greatest quantity **of** this profile forest-mde. The EGP Alternative, with the least amount of planned timber production, would produce the least amount of residue requiring treatment This alternative would also produce the greatest vanety of fuel patterns and mosaics. Fuel profiles throughout the Forest would be broken up by the scattered placement of group selection harvest areas that compnse this alternative.

(2) Cumulative Effects

Fuel buildups affect forest resources in different ways and to varymg degrees, both because of their physical presence and because **of** the impact they have on **fire** behavior as compared **to** what would happen under natural fuel condi-

tions The impact may be favorable or unfavorable, depending upon the individual resource involved, as well as the amount of fuel buildup.

Highly flammable vegetative fuel (brush, timber reproduction, snags, and natural woody residues) is accumulating faster than it is being removed by natural decay, fire and other influences. Consequently, wildland fires tend to burn with greater mtensity, and are more difficult and costly to control

Unless actions are taken soon to mitigate those factors, the followmg conditions can be predicted with reasonable assurance

- The trend **of** increasing fire incidence will continue,
- **An** mcreasing number of fires will burn with greater mtensity,
- More large fires will spread from the wildland vegetation and involve more people and their homes;
- Damages to downstream areas from floodmg, windblown dust, and sedimentation followmg major fires will be magnified; and,
- Highly valuable wildlife habitat will be extremely vulnerable to long-term loss

(3) *Mitigation Measures*

Fuel buildups and mldfire can be both advantageous and harmful to all forest resources. The fuels management program holds the key to protecting and enhancing those resources Therefore, fuels managers must understand each individual resource and the ways in wluch the resources interrelate. They commumcate and work closely with all Forest specialists.

The following fuels management measures will be used to maintain fuel profiles that contnbute to the most cost-efficient fire protection and use program

- Assure fuel management participation in all Forest activlties,
- When planning and implementing fuels treatment, leave adequate snags, and dead and down matenal, for mldlife and ecosystem needs;
- Encourage industrial utilization of activity-created forest fuels;
- Make more fuels available for the public to utilize for firewood and other home products (e g. fence posts),
- Encourage the use of prescnbed fire from both planned or unplanned ignition sources

7. FIREWOOD

The plannmg issue for firewood reflects strong public interest in a sustained, reliable, and accessible supply of firewood. There is also a desire that this supply be allocated eqmtably The consequences of the alternatives on the firewood resource are therefore of great significance

All Alternatives

Under all alternatives, the Forest wlll continue to meet at least the current level of demand, estimated at 30,000 cords per year for decade 1 Forest Standards and Gmdelines reqmre the provision of a sustained supply of firewood Preference will be gwen to indivldual domestic heating uses over commercial uses.

The most sigmficant factors affecting firewood supplies *are* the level of timber harvest and the supply of cull logs, the amount of land available to harvest mortality, the level of new road construction, and whether or not certain stands are to be managed for firewood

Harvestmg mortality has the potential to degrade mldlife habitat for both snag dependent and cavity dwelling species. Typically, sensitive areas have been set aside or certain trees have been marked with signs to prevent their removal, although these measures are not always successful In the future, the woodcutting program will be more intensively managed to reduce adverse impacts upon mldlife habitat

The amount of firewood available annually is shown for each alternative in Table **4-9** The projected demand is also shown to allow comparison of supply and demand

Table 4-9

Potential Firewood Supply and Demand

	Decade	Demand	Alternative PRF	CUR	EGP	TGP
Estimated Firewood Supply (Thousand Cords per Year)	1	30	69	70	64	85
	5	58	83	65	68	92

a. Direct Effects

The availability of fuelwood is related to the timber harvest level In addition to providing cull material at the landing, the timber program also builds and opens roads which improves access to natural mortality in timber stands. As was discussed in Chapter **3** under Firewood, availability now meets current demand for all alternatives **AS** the population increases to expected levels within the impact area, demand may exceed availability in the future Biomass and thinning operations will also reduce stand mortality Over time, large diameter, standing or fallen dead firewood may become harder to find and the public may have to depend more on residues from the YUM yarding of cull material. State and federal air quality concerns may also reduce the desirability of firewood use in the future, or at least make it less desirable economically

b. Indirect Effects

If traditional fuelwood becomes harder to find, more people may switch to other sources of heat or obtain fuelwood from commercial sources.

The falling of snags for fuelwood may affect the populations of cavity nesting species, but Standards and Guidelines (Appendix O of the Forest Plan) are designed to protect habitat for these species, regardless of the alternative. Different snag levels are allocated through management prescriptions The G, K, and L Prescription areas call for higher snag levels than those prescriptions that provide for more intensive timber management such as the T and V Prescriptions Lands allocated to a G, **K,** or L Prescription will provide better habitat for snag dependent species than the T or V Prescriptions Snag levels for these prescriptions are described in Chapter **4** of the Forest Plan under Management Prescriptions

Although firewood collection reduces the total suspended particulates from slash disposal operations, particulates increase in towns where the fuelwood is consumed Currently, no State restrictions have been applied to consumers regarding wood stove use in the Forest's zone of influence. The regulation of particulate discharge from wood stoves may occur in the future

c. Cumulative Effects

The cumulative effects of the timber harvest program in all alternatives will result in a reduction of size and amount of cull material available Also, as stands are brought under management, the amount of natural mortality will decrease. Consequently, other lands (private or public) may serve as the supplier for the fuelwood consumer No significant cumulative effects are predicted, including those potential effects on cavity nesters. Forest Standards and Guidelines are designed to provide suitable habitat and minimum or higher snag levels on all forested acres.

d. Mitigation Measures

The Forest can make more material available by leaving roads open longer or by allowing firewood cutting instead of precommercial or commercial thinning This is an administrative process that could be done with any alternative, but may conflict with other objectives including road closures for wildlife, soil protection and maintenance.

Except for lodgepole and incense cedar, the Forest firewood program prohibits cutting of dead, standing trees greater than 21 inches **DBH** for the benefit of cavity nesters, therefore reducing the indirect effects on wildlife However, based on experience, there will still be some unauthorized falling of larger dead trees. If air quality becomes an issue in the future, the Lassen National Forest will cooperate with State or County

governments regarding firewood use as a means of mitigating indirect effects on air quality.

PRF, EGP, and TGP Alternatives

These alternatives provide firewood to meet expected demand, and include 8,200 acres of lodgepole pine that will be managed for firewood

CUR *Alternative*

No lodgepole pine cutting areas are allocated. Expected demand will be met

8. FISH

Introduction

The planmng issue for fish concerns the productivlty, quality, and diversity offish habitat on the Forest, and how it should be protected and enhanced The effects or impacts on fish resources can be separated mto two categones 1) the potential negative effects of management activities on fish habitat Capability; and 2) the positive effects of habitat enhancement on the fishenes resource Fish habitat is affected directly by management activlties in nparian areas as well as indirectly by activlties in upland areas In general, land disturbance activlties influence the aquatic ecosystem by affecting streambank stability, runoff and sedimentation rates, water temperatures, instream overhead cover, fish spawning and reanng habitat (distnbution and abundance), aquatic invertebrate production and nutnent availability

Effects of alternatives on fishenes were expressed in Chapter 2 as the capability of the habitat to produce harvested pounds of fish. Habitat capability models were developed for chinook salmon, rainbow trout, and steelhead trout which were selected as Management Indicator Species (MIS) for the Forest These models assume a relationship between fish habitat capability and the physical charactenstics of streams, such as water quality Estimates of habitat capability for each of the MIS occurs in two steps First, the potential habitat capability of Forest habitats is estimated Second, estimates of the effect of management activities, such as habitat enhancements and timber harvest, on the potential habitat capability are made

Currently, actual production of resident fish is near the potential production level, based on habitat capability However, actual production of anadromous fish is only about 2 percent of the Forest's habitat capability This deficit is due, in part, to downstream factors on non-Forest lands which prevent the return of an adequate number of adult spawning fish The California Department of Fish and Game and the Department of Water Resources are attempting to increase anadromous runs returning to the Forest, with the Forest's cooperation

Habitat productivlty is affected in two major ways. First, each alternative includes a specific amount of direct habitat improvement Second, watershed disturbance differs among alternatives according to the amount of road-budding, loggmg, and grazing Both factors were considered in determining potential production levels for resident and anadromous fish A comparison of nsk factors among of the alternatives is summarized in Table 4-10.

All Alternatives

Under all alternatives, Best Management Practices for water quality and ripanan areas would be implemented In addition, Forest Standards and Guidelines for the fishery resource require maintenance or improvement of habitat for desired species of fish

All nparian areas mll be managed under the F Prescription whch calls for limited timber management withm streamside management zones. Widths of these zones vary with the significance class of the stream as shown in Appendix R in the Plan No more than 2 5 percent of the inventory will be removed in any one decade, and only when it can be documented that timber management mll maintain or enhance riparian values Streamside management zones are effective buffers in mitigating the effects of other management activlties, in particular timber harvesting and roads

The objective of the F Prescription and the Forest Standards and Guidelines under Fish is to comply m th the National Forest Management Act of

Table 4-10

Fisheries Resource Risk Analysis (for 50 Year Period)

Risk Factors	Alternative PRF	CUR	EGP	TGP
Fisheries Program Level Through Decade 5 (see Chapter 2) 1/				
Resident	Mod (12%)	Low (-2%)	Mod (12%)	Mod (4%)
Anadromous	Mod (1%)	Low (-8%)	Mod (1%)	Mod (-4%)
Timber Sale Quantity (MMBF)	96	171	94	118
Road Construction/Reconstruction (miledyear thru Decade 1)	66	77	66	88
Range (M AUMs thru Decade 1)	48 5	49 I	48 5	48 5
Land Disturbance Index (Decade 1-5 average) 2/	35 0	44 4	35 3	39 8
Riparian and Adjacent Terr Zone Affected by Activities (percent acres/decade) 2/	69	72	69	69
Watershed Improvement (acres/years) through Decade 1	75	75	150	75
Proposed Wild & Scenic Rivers (miles)	76	0	76	16
Risk	Low	High	Low	Mod/ High

1/ Percent values represent an increase or decrease in production (pounds) from the 1982 base level

2/ Refer to section under Water and Riparian Areas

1976 and the implementing regulations found in 36 CFR 219 19 These regulations state that *"Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area"* In addition, 36 CFR 219 27(e) states *"No management practices causing detrimental changes in water temperature or chemical composition, blockages of water courses, or deposits of sediment shall be permitted within these areas* (referring to riparian areas) *which seriously and adversely affect water conditions or fish habitat"*

The F Prescription will be applied to all lands in and adjacent to lakes, streams (perennial, intermittent or seasonal), seasonal and perennial wetlands, bogs, seeps, and pothole lakes Under all alternatives, at least a minimum level of resident and anadromous fisheries production would be sustained by continuing to protect fish habitat Production for each alternative is summarized in Table 2-7 in Chapter 2

a. Direct and Indirect Effects

Resource management activities such as timber harvesting, related road construction and livestock grazing can increase peak flow and the amount of erosion entering a drainage This may result in an increase in turbidity and sediment levels, which directly affect water quality In-

creases in sediment levels influence fish in several ways In suspension, (1) it blocks transmission of light, thereby reducing the depth where photosynthesis can occur and potentially altering productivity in the aquatic system, (2) it damages the gill membranes, causing mortality where concentrations are high and exposure is prolonged, and (3) it can decrease foragmg efficiency for certain fish species, such as salmon and trout, which rely on sight for feeding Sediment settling in the gravel beds is harmful in the followingways (1) it increases siltationofstream substrates which can suffocate eggs and young fish occupymg this niche; (2) it reduces the available living space for the production of fish food organisms, and (3) it limits the available intergravel space important for fish refuge during winter and spring months when stream temperatures are low and water levels high

Effects from Timber Management Timber harvest in riparian areas can lead to removal of streamside shade, streambank failures, removal of future large wood material for stream structure, and can cause ecological changes in the ripanan zone Adverse effects from these activities include altenng nutrient cycles, altering stream flow and stream temperature, increasing sedimentation, and increasing fishing pressure through improved access

Under all alternatives, timber harvest in SMZ's would be proposed only to enhance nparian values and (except for CUR) no more than 2 5 percent of the inventory would be harvested per decade Under CUR, the maximum level would be 5 percent The risk to fishenes from timber harvest would be highest under the CUR Alternative with almost double the volume of that proposed under PRF and EGP The Land Disturbance Index is highest at **44 4** under the CUR Alternative (Table **4-10)**

Effects from Roads Road construction and use are often the greatest potential sediment source of all land disturbing activities, over both the short term and the long term Improperly designed, constructed, or maintained road crossings of streams can block fish passage and increase sediment deposited in fish spawning areas Roads constructed m ripanan areas can constrict the floodplain and channel, resulting in changes in channel morphology and associated habitat Roads also increase recreation access and fishing opportunities, but the increase in fishing pressure can result in potential overharvest of wild stocks of fish Roads located within the floodplain can also modify stream sinuosity

The TGP Alternative has more road construction and reconstruction than the other three alternatives at 88 miledyear in the first decade CUR had the second highest with 77 miledyear in decade 1, although this figure would be presumably higher if analyzed through FORPLAN Version II Because the CUR Alternative was analyzed through Version **I,** there is no direct companson with the other three Alternatives for roads In proportion to its harvest level, CUR would have the most road construction and reconstruction. PRF and EGP have 66 miles/year in the first decade The risk to fisheries from road construction and reconstruction is expected to be highest under the CUR Alternative

Effects from Range Management Livestock grazing along streambanks can adversely affect the fishery through changes in streamside vegetation, channel morphology and water quality Trampling of streambanks and loss of streamside vegetation caused by livestock use can accelerate soil erosion and alter the timing and volume of streamflows In general, fish production can decrease as a result of (1) reductions in streamside vegetation and overhanging banks which provide cover for fish, (2) changes in substrate composition and pool/riffle ratios which affect the quality and quantity of spawning and rearing areas, and (3) changes in water quality conditions Including increased water temperatures, nutnent loading and suspended sediment which directly affect egg and fish survival

All alternatives would maintain the current grazing level or have a slight reduction (2 percent) in AUMs The range condition would be maintained or enhanced under all alternatives This would result in little change in the present level of risk to fisheries Emphasis is placed on Forest Standards and Guidelines to maintain ripanan values and fish habitat

Effects from Fish Habitat Improvements Fish habitat improvement is planned under all alternatives The number of proposed improvement structures and affected acres for each alternative are shown in Table **2-7** in Chapter **2**

These proposals have not had project specific field review or been subject to site-specific environmental analysis. Some of the projects are designed to rehabilitate past management-related activities **or** problems caused by natural events **or** conditions Improvement projects include, but are not limited to. channel stabilization, sediment retention structures, planting of ripanan vegetation, and timber management to promote more vegetative diversity, especially increasing the hardwood component within streamside management zones

Effects **from** Other Resource Activities Mineral activities, recreation use and fire may have an effect on fish, but generally these effects are local problems from a Forest-wide perspective.

b. Effects on Other Resources

Fish habitat, and its maintenance and improvement, may complement or conflict with the production or capability of other resources. Some of these interactions are discussed here by the affected resource.

Cultural Resource Occasionally the location of fish habitat enhancement projects may coincide with the location of cultural resource sites Development of fish projects requires careful cultural reconnaissance to avoid any conflicts between the resources. Implementation of the Forest Standards and Guidelines for cultural resources should result in no negative effects to the cultural resources. The effect of fisheries on cultural resources is not expected to change by alternative

Minerals Development of nnneral resources may be restricted in order to maintain **or** enhance fish habitat.

Recreation Maintenance and improvement of fish resources generally has a complimentary benefit on recreation **The** effects of fisheries on recreation are not expected to change by alternative.

Timber The maintenance of fish habitat in npanan areas requires that some portions of nparian areas be set aside from timber harvest, **or** have reduced timber ylelds due to harvest techniques which call for uneven-aged management

Transportation **The** goal to maintain **or** enhance fish habitat capability results in increased costs of road construction and maintenance. Road crossings of anadromous fish streams and many resident fish streams require higher construction costs for culverts **or** bridges. In **the** vicinity **of fish streams, full bench cut of roads in hillsides** is often required to prevent sediment from entermg streams. These costs are expected to differ by alternative, and be proportional to the miles of road constructed See Table 2-7 for estimates of miles of roads to be built in decades **1** and **5.**

Visuals Maintenance and enhancement of fish resources generally complement visual quality management. The F Prescnption calls for limited timber management within nparian areas to mantain fish habitat capability These timbered areas usually enhance the vlsual condition Enhancement of fisheries in visually sensitive areas may lead to a reduction in vlsual quality where man-made structures are constructed However, most of the time, fish habitat enhancement projects can be constructed in a manner that will meet the adopted visual quality objective

Water Maintenance of water quality complements optimum fish habitat capability requirements. **No** appreciable difference is anticipated between the PRF, EGP, and TGP Alternatives.

Wilderness and Wild and Scenic Rivers **The** Wilderness Act states that unlderness is "managed **so** as *to preserve* its natural conditions", and precludes most fish enhancement activities Current Forest Service direction is that comparable projects identified outside of wilderness should be implemented first, pnor to implementmg projects within wilderness. Fish habitat structures within proposed Wild and Scenic Rivers could be allowed in "recreational" and "scenic" segments. "Wild segments will be considered only when comparable enhancement projects can not be located outside of these areas Improvement structures will be evaluated on a site specific basis to determine their compatibility with the management objectives for exlsting and proposed wilderness, and proposed Wild and Scenic Rivers.

Wildlife Maintenance and improvement of fish habitat complement the needs of wildlife Riparian areas in an unharvested condition provide high quality habitat for wildlife species requiring aquatic habitats and, often, old-growth forest conditions. Higher fish populations provide greater food supplies for many fish-eating wildlife species such as black bear and eagles. Since all alternatives maintain and enhance fish habitats to the same degree, there are no differences expected in the interaction among wildlife and fish between the alternatives

c. Cumulative Effects

Cumulative impacts are the additive effect of any land disturbance activities over time and space. As previously discussed, roads, timber harvest and livestock grazing are all land management activities that "cumulatively" influence the quality and quantity of aquatic/riparian resources; these are based on continuation of known land use practices on all lands including National Forest, private and other public lands. Implementation of Forest-wide Standards and Guidelines and various mitigation measures in conjunction with site-specific project assessments by Forest personnel should insure that potential effects on aquatic resources are maintained within acceptable levels.

Monitoring of cumulative effects of land management activities on aquatic and riparian resources will be done by conducting baseline stream and watershed surveys during the first decade. This will provide important information to compare against monitoring data obtained during and after project implementation Changes in stream substrate materials, fish population counts, water quality trends, and fish habitat conditions are some of the yardsticks which will be used to detect change This will be more fully defined upon completion of the Forest's Fisheries Monitoring Plan

The primary factors used in analyzing cumulative effects of the alternatives on the anadromous fishery are the quality and quantity of fish habitat on National Forest lands, on intermingled non-National Forest lands within the Forest boundary, and on lands downstream from the Forest's boundary One area of concern is the decline of spring-run chinook salmon returning to Mill and Deer Creeks Private and other public ownership predominates along Mill and Deer Creeks after these streams leave the National Forest Extensive agricultural operations, diversions for irrigation and municipal uses, and ocean harvest all influence the number of salmon returning to suitable habitat on the Forest Aggressive actions need to be pursued by the State of California in concert with federal and local governments in order to insure perpetuation of this stock. Downstream "transportation" flows is one key restoration action item outlined in the upper Sacramento River Fisheries and Riparian Habitat Management Plan (1989) that is currently being implemented to help restore the anadromous stocks in Deer and Mill Creeks. Restoration actions in conjunction with continued maintenance and protection of stream conditions both on and off Forest are critical to their future

d. Mitigation Measures

Four mitigation measures designed to maintain or enhance fish habitat are common to all alternatives: Forest Standards and Guidelines, the Riparian Prescription, Best Management Practices (BMPs) and habitat improvement projects

Forest **Standards and** Guidelines Forest Standards and Guidelines for fish apply across the Forest (see Chapter 2). These Standards and Guidelines will provide for: (1) short and long-term maintenance of fish habitat capability, (2) stream bank and stream channel stability, (3) natural and beneficial quantities of large woody debris, (4) protection of water quality and temperatures, and (5) fish passage through stream crossing structures

The Riparian/Fish Prescription The Riparian/Fish (F) Prescription is applied along all perennial streams and riparian areas except where a higher priority prescription applies such as the Wilderness Prescription (see Chapter 4, Management Prescriptions in the Forest Plan) The F Prescription was developed to recognize the unique values of riparian areas and give preferential treatment to riparian associated and dependent resources where management conflicts exist.

The F Prescription applies to variable width streamside management zones (SMZ's) based on stream class stability, and type of stream (see

Appendix R in the FEIS) SMZ's apply to all alternatives

Bank stability and large woody debns deposits would be maintained at natural levels. Shade producing vegetation would be maintamed in all streams, to meet management area objectives Livestock would be reduced, redistributed, or excluded from riparian areas as needed Some areas may be fenced to protect nparian resources. Timber harvesting would be hmited to individual tree selection Riparian hardwood communities would be maintained or improved.

Best Management Practices Best Management Practices (BMP's), included in the Soil and Watershed Conservation Handbook (Chapter 10, FSH 2509 22), are applied to all alternatives. Best Management Practices are designed to meet the requirements of the Clean Water Act, State Water Quality Standards, and to reduce the potential for non-point source pollution entering stream channels FSH 2509 22 prondes a guide for conducting land management actinties Actual BMPs to be incorporated into any activity are developed based on those in the Handbook and the indindual project and site conditions. For further discussion of the BMPs and watershed mitigation, refer to the sections on Soils, and Water and Riparian.

Fish Habitat Restoration Restoration is emphasized in all alternatives. It is the objective of all alternatives to maintain fish habitat at emsting levels, and to evaluate habitat improvement projects to rehabilitate conditions created by past land management activities and to improve on present conditions. In general, structural habitat improvement projects are considered as last resort mitigation measures.

PRF Alternative

Anadromous fishery production values discussed below for each alternative are the sum of the sport and commercial catch values reported in Table **2-7. AS** discussed earlier, a fishenes resource nsk analysis, displaymg the primary factors that affect water quality and habitat conditions for each alternative, is in Table 4-10.

Resident Fish A moderate amount of habitat enhancement would be accomplished All of the identified habitat improvement projects would be accomplished by the end of decade 2 Additional habitat improvement that is not currently identified would also be accomphshed. The nsk of sedimentation to streams from watershed disturbance would be low due to reduced road bmldmg and loggmg actinties. Overall (considenng both habitat improvement and watershed disturbance), total annual production of resident fish would reach an estimated 54,000 pounds by decade **3** and remain at that level, 12 percent greater than the 1982 base year

Anadromous Fish A moderate amount of habitat enhancement would be accomplished All identified habitat improvement projects would be completed by decade **1.** The nsk of sedimentation to streams from watershed disturbance would be low due to beneficial effects of semiprimitive area designations, existing and recommended unlderness, wild and scenic river management, and conservative streamside protection in other areas. Overall, potential annual fish production would remain stable at 140,000 pounds, an increase of one percent over the 1982 potential level

CUR *Alternative*

Resident Fish A low amount of habitat would be improved, requiring more than five decades to complete all identified projects. Some newly-identified projects would also be accomphshed. Watershed disturbances would continue at a high level due to loggmg, road building, and grazing. By decade 5, fisheries production would total a projected 47,000 pounds, which is two percent lower than in 1982

Anadromous Fish A low level of habitat enhancement would occur. Half of the identified habitat improvement projects would be accomplished by decade 2 Watershed disturbance levels would be high due to increased road bmldmg and loggmg actinties in currently undisturbed areas. Overall, production potential would reach approximately 127,000 pounds by decade 5, which is eight percent lower than in 1982.

EGP Alternative

Resident Fish A moderate amount of habitat enhancement would be accomplished. All of the identified habitat improvement projects would be accomplished by the end of decade 2 Addi-

tional habitat improvement that is not currently identified would also be accomplished. Sedimentation due to watershed disturbance would be low due to reduced road building and logging activities. Overall (considering both habitat improvement and watershed disturbance), total annual production of resident fish would reach an estimated 54,000 pounds by decade 3 and remain at that level, 12 percent greater than the 1982 base year.

Anadromous Fish A moderate amount of habitat enhancement would be accomplished. All identified habitat improvement projects would be completed during decade 1. Watershed disturbance would be low due to beneficial effects of semi-primitive areas designation, existing and recommended wilderness, wild and scenic river management, and conservative streamside protection in other areas. Overall, potential annual fish production would remain stable at 140,000 pounds, an increase of one percent over the 1982 potential level.

TGP Alternative

Resident Fish A moderate amount of habitat enhancement would be accomplished. All of the identified habitat improvement projects would be accomplished by the end of decade 2. Additional habitat improvement that is not currently identified would also be accomplished. Sedimentation due to watershed disturbance would be at a moderate level. Overall (considering both habitat improvement and watershed disturbance), total annual production of resident fish would reach an estimated 50,000 pounds by decade 3 and remain at that level, which is four percent greater than the 1982 base year.

Anadromous Fish A moderate amount of habitat enhancement would be accomplished. All identified habitat improvement projects would be completed by decade 1. Watershed disturbance levels would be high due to increased road building and logging in currently undisturbed areas. Overall, potential annual fish production would stabilize at 133,000 pounds by decade 5, four percent lower than the 1982 potential level.

9. FOREST HEALTH

All Alternatives

a. Direct Effects

"Forest Health" is a condition where living and nonliving influences on the Forest (e.g. insects, diseases, silvicultural treatments, harvesting practices, fire) do not threaten management objectives either now or in the future. The discussion of this issue revolves primarily around effects from insects and diseases.

Fire plays a major role in maintenance of forest health on the Lassen National Forest. Too much fire intensity can injure trees, predisposing them to insect and/or disease entry. Too little fire interrupts natural ecological cycles in many plant communities on the Forest, historically leading to tree stand stagnation or species conversions to undesirable species. Absence of fires may also lead to insect or disease infestation. Insect epidemics, in particular, are common in these conditions, causing severe mortality, fuel accumulation, and eventually, stand replacement fires.

There are many naturally occurring organisms that have the ability to alter the forest environment. Of particular concern are those organisms that may negatively affect establishment and growth of trees. Most common of these are defoliating insects, bark beetles, fungal pathogens, dwarf mistletoe, small mammals, and livestock. The risk of forest stand damage from these pests by implementing the alternatives is discussed below.

Defoliators Insects that consume tree foliage are referred to as defoliators. Of particular concern is the Douglas-fir tussock moth, which has produced Forest-wide epidemics in recent years. White fir sawflies can also be a problem. Host tree species (e.g. white fir and Douglas-fir) will increase as a result of natural regeneration in mixed conifer types, especially with a light harvest, which maintains shaded conditions favorable for those species. This can contribute to increased defoliator populations and subsequent

damage Tree planting that emphasizes non-host tree species (pines) may reduce defoliator habitat and damage to future stands Precommercial and commercial thinning may also limit damage from defoliators by reducing height diversity in a stand, reducing the proportion of host species and maintaining stand vigor Harvesting of mature timber by clearcutting or shelterwood eliminates habitat for defoliators and thus can reduce their populations Small isolated timber harvest areas have little impact, but scheduled harvests over large acreages may significantly decrease populations by reducing the proportion of host species and breaking up the continuity of desirable habitat (Carlson, 1983) Overstory removal can have similar effects if the host trees are removed Selective harvests maintain host species in stands and create an uneven-aged condition which encourages the increase of defoliator populations and damage

Numerous natural controls play a part in regulating defoliator populations Birds eat large numbers and are particularly effective in young stands (Garton, 1983, Wickman, 1981) However, as trees mature and conditions favoring defoliators improve, the effectiveness of birds in controlling defoliators decreases (Campbell, 1983, Carlson, 1983, Wickman, 1981)

Bark Beetles Bark beetles are that group of insects that lay their eggs below the bark of host trees The larvae tunnel and feed in the inner bark The past five years of drought in the Sierra Nevada has increased western pine beetle (*Dendroctonus*) populations to epidemic proportion on some Forests Pine and fir engraver beetles (*Ips spp*) can also cause significant damage by killing the tops of trees *Ips spp* beetles usually breed in fresh green slash Although not epidemic on the Lassen, bark beetle infestations are, nevertheless, extensive across the Forest The followmg management activities have proven effective in controlling bark beetles

- The most effective control of damage from bark beetles is to maintain trees in a vigorous condition (Sartwell, 1976, Amman, 1977, Dolph, 19831. This can be accomplished through precommercial or commercial thinning
- Problems can also be prevented by proper slash disposal and by timing timber harvest activities to reduce the amount of green slash available in the spring and early summer
- Harvesting of mature and overmature stands, prompt salvage of infested trees, and maintenance of non-susceptible species are other actinties that can reduce bark beetles

Bark beetle populations may continue to remain high, but not necessarily epidemic in areas where control measures are not applied, such as in classified wilderness

Root Rot and Stem Decays This includes a variety of fungi or bacteria which cause diseases that infect the roots (root rot) or stems (stem decay) of host trees and cause growth loss, mortality of trees, or decay of sound wood Loss in infested stands is estimated to be as high as 75 percent of normal growth (Filip, 1982) The following actinties can affect the occurrence of root rots

- Natural regeneration in mixed conifer stands may result in an increase in root rots and stem decays in subsequent stands This is based on the assumption that the new stand would be dominated by true fir (Seidel, 1979) Planting can reduce root rots and stem decays in future stands if species other than true fir are used (Seidel, 1981)
- Clearcutting infested stands followed by regeneration with resistant species can reduce future incidence of root rots and stem decays (Filip, 1983; Dolph, 1980, Seidel, 1981) Shelterwood harvest can have the same effects as clearcutting if resistant species are used for reforestation, but infected overstory trees may provide a source for the new stand's infestation Sanitation and salvage cutting can remove obvious infected trees, but these treatments can also increase the likelihood for future occurrence of rots Selection cutting may increase infestation from root rots and stem decays

- Commercial and precommercial thinning can reduce root rots and stem decays by removing infected or wounded trees, increasing the proportion of resistant species, and maintaining stand vigor in some cases (Dolph, 1980, Roth, 1977) However, care must be taken to prevent injury to residual trees, or the benefits of thinning may be lost

- Treating stumps with borax during harvesting activities has demonstrated success in reducing the occurrence of annosus root disease

Forest stands with little or no timber management activities would have endemic levels of fungal activity similar to what presently exists except when wildfires occur, reducing the number of more susceptible tree species, such as those that occur in true fir stands

Dwarf Mistletoe Dwarf mistletoe damages the host by reducing growth, lowering wood quality, and killing or predisposing its host to attack from other pests (Graham, 1967) Dwarf mistletoe on ponderosa pine is of primary concern on this Forest The following section discusses timber management activities that may occur in the alternatives considered, and their resulting effects on dwarf mistletoe

Reforestation by planting or natural regeneration can reduce dwarf mistletoe by removing infection sources (Dolph, 1980), selecting resistant species (Seidel, 1981), and creating an even-aged stand (Barrett, 1979) Planting is usually more successful than natural regeneration to reduce mistletoe because of more control over these factors

Clearcutting is an effective way to eliminate dwarf mistletoe in forest stands, as it removes the infection source (Dolph, 1980, Seidel, 1981) Shelterwood harvest with later overstory removal can reduce dwarf mistletoe infestation if the overstory is removed before the regenerated stand is three feet tall (Dolph, 1980) Sanitation and salvage harvests in mature stands to reduce mistletoe have not been effective In fact, repeated sanitation and salvage cutting creates a multiple-aged condition which can favor the spread of dwarf mistletoe (Barrett, 1979) Selection harvest also creates multiple or uneven-aged conditions which tend to promote spread of dwarf mistletoe (Seidel, 1981; Barrett, 1979)

Both precommercial and commercial thinning are effective methods of removing dwarf mistletoe-infected trees. Thinned ponderosa pine stands sometimes outgrow the vertical spread of dwarf mistletoe (Barrett, 1985)

Blister Rust The most important disease of sugar pine and western white pine is blister rust It is a major problem in the Sierra Nevada and on the Lassen Blister rust causes damage wherever the alternative host genus *Ribes* occurs (Hepting, 1971) There is increasing public concern that blister rust is eliminating sugar pine as a natural component in mixed conifer stands

Extensive research and effort is being done by the Forest Service to control the spread of blister rust On the Lassen National Forest, apparent disease-resistant trees are being located and protected Seedlings grown from seed collected from these trees are being screened for disease resistance If the selected trees demonstrate ability to transfer disease resistance to their progeny, they are protected and will serve as seed source for the reforestation program Seed orchards will also be initiated from cuttings collected from resistant trees By the year 2000, it is hoped that all sugar pine reforestation needs will be satisfied by rust resistant seed

Elytroderma Disease Elytroderma disease of ponderosa and Jeffrey pine is visible in many areas of the Forest Symptoms are premature needle death, and deformed twigs and branches When infection is heavy, it can cause reduced growth and vigor Death may result, usually as part of a pest complex including bark beetles. Direct control methods are not available In areas of high risk based on previous outbreaks, nonsusceptible species should be favored Thinning pine stands in high-risk sites may also improve tree vigor and lessen the probability of mortality because of bark beetle infestations.

Animal Pests Animals that damage trees include rodents such as rabbits, pocket gophers, ground squirrels, mice, voles, porcupines and cattle Deer can also cause damage These animals feed on tree seedlings and seeds, directly affecting reforestation of an area, Some interactions are

- Timber harvesting tends to increase small mammal populations as it increases the abundance of ground vegetation on which many feed (Stoszek, 1976) Even-aged management especially increases the amount of food available for small animals such as pocket gophers, which have caused serious damage in plantations

- Scarification or broadcast burning for site preparation will temporarily reduce all or part of their habitat (Stoszek, 1976, Crouch, 1976) As a result, populations may change locally, hut the overall effect on total small mammal populations over time is expected to he insignificant

- Cattle grazing in newly established plantations can trample seedlings, increase soil compaction, and consume new growth Occassional seedling damage has occurred Successional reproduction and stocking levels have not been significantly affected by cattle grazing

b. Indirect Effects

Healthy forests provide for the long-term production of many benefits, including timber, scenic resources, wildlife habitat and others

Mixed conifer and ponderosa pine stands that are stressed hy drought are predisposed to attack by bark beetles When this occurs, cover for wldlife is reduced, visual quality is lowered, and timber productivity is temporarily foregone. These effects will last until the stand is either naturally or artificially (planted) regenerated, and has grown for fifteen to twenty years, at least This is an irretrievable loss of that particular resource value for an extended penod of time

Loss of wildlife cover from tussock moth defoliation can last up to ten years or longer Similar effects from bark beetle damage occur except that it is usually more localized and wildlife cover is not eliminated Loss of wildlife cover, timber productivity, and reduction of visual quality are the primary indirect effects from defoliation

Root rots and stem decays tend to increase with poor timber management practices such as excessive tree damage during logging and slash piling Inoculum build-up in stands occurs over time and the effects arc not noticeable to the untrained observer until epidemic levels occur Cover for wildlife will be reduced over time even though during initial infection stages this effect is minimal Without management, monitoring, and treatment of root rots and stem decays, timber stands eventually "fall apart," eliminating timber, wildlife and scenic values

Dwarf mistletoe (a parasite) also builds up to damagmg levels at a relatively slow rate, and death of trees occurs after long periods of time, depending on the species which is infected Again, only severe damage is noticeable to the untrained observer, hut the effects are long lasting When senous, dwarf mistletoe is best controlled by stand regeneration The major indirect effect is on timber production, hut with long lasting infestations, visual quality, wildlife cover, and other resource values are also reduced

c. Cumulative Effects

During conditions where populations are above normal, all of the organisms discussed under "Direct" and "Indirect Effects" (with the exception of small mammals), are symptomatic of forest stand conditions that are not in line with natural processes Changes in major species composition (as the result of the exclusion of fire) have created conditions favorable for these organisms to flounsh, and cumulatively there is substantial long-term n s k to management objectives, including timber production, wildlife cover, vlsual quality and outdoor recreation In some mixed conifer stands, dwarf mistletoe and root rots have been found together, causing stand damage to the point where the only option is to replace the stand with species adapted to site conditions In some pine stands, dwarf mistletoe can predispose trees to attack by hark beetles, creating cumulative stand damage

The ability to predict the overall cumulative effect of these organisms on Forest resources is low Based on available information, the alternatives can be ranked in terms of their risk of maintaining conditions favorable for cumulative, negative effects on Forest health Assumptions are 1) wilderness and semi-pnmitive areas, where use of fire for forest stand maintenance is not an integral part of management, will

provide future "breeding areas" for defoliators, bark beetles and dwarf mistletoe Stem decays will also he prevalent, but root rots will probably stay at low, endemic levels, 2) the Forest will maintain sufficient quality control in treated stands to minimize infestations, which will hold true for all of the alternatives, 3) those alternatives which emphasize uneven-aged management will have a greater nsk of sustaining higher levels of defoliators, dwarf mistletoe, and root rots, and 4) alternatives with higher timber harvest schedules will treat more acres in the short term, thereby reducing habitat for major insects and diseases Using these assumptions, the PRF and EGP Alternatives would have a higher nsk of negatively affecting Forest health than CUR and TGP

d. Mitigation Measures

Integrated pest management is key to reducing the insect and disease impact on forest resource values Integrated pest management is an approach to reducing pest damage to tolerable levels through a variety of techniques, including predators and parasites, genetically resistant hosts, natural environmental modifications and, when necessary and appropriate, chemical pesticides State-of-the-art integrated pest management places emphasis on modifying the natural environment through silviculture

The ultimate goal of silviculture in integrated pest management is the creation of plant diversity both in species mix and in age distribution Plant diversity provides the greatest opportunity for ensuring a healthy forest Most insects and diseases are host-specific, or depend upon plants which are under stress Therefore, increasing species, age class, and structural diversity will decrease losses caused by insects and diseases, and in turn reduce their impacts Diversity can he influenced through processes outside the control of the land manager (windthrow, mldfire, landslide, etc) or purposefully directed by the land manager

Scheduling timher harvest of high-nsk stands before infestation occurs is another control measure planned by the Forest To the extent feasible, timber harvest in this as well as future decades will be scheduled in the most high nsk stands identified through silvlcultural prescnptions

PRF, CUR, EGP, and TGP Alternatives

Implementation of the alternatives would involve different levels of pest management and would likely result in varying severities of pest-related damage on the Forest Indicators of pest-related damage include tree mortality, reduced growth, top-killing, and reduced quality and quantity of seed production Damage can result in sawtimber defect, understocked stands, delay or failure of regeneration, reduced site productivity, hazardous trees, degraded or closed recreation sites, and other undesirable vegetation changes

Vegetative management provides the best opportunities to prevent or reduce the amount and impact of pest-related damage, although other direct preventive and control actions against pests may he necessary in specific situations In general, increases in stand management, including control of stocking levels and species composition, and the timely removal of stressed trees, should reduce insect and disease damage The appropriate use of regeneration timher harvest provides the means to remove stands particularly susceptible to, or currently experiencing, unacceptably high levels of pest damage Examples include stands heavlly infected with dwarf mistletoe and/or with high levels of mortality from bark heetle, root disease, or other pest complexes Although regeneration often creates the need to control competing vegetation and pocket gophers, it also creates the opportunity to maintain insect and disease damage at acceptable levels throughout the rotation of the stand. Intermediate and selection harvest, through the removal of stressed indinduals and groups of trees, and the reduction of stocking to biologically appropnate levels can also reduce and prevent insect and disease damage

In order to compare alternatives, the intensity of vegetative management is used as a proxy to indicate the opportunity to prevent and reduce damage Areas managed intensively for timher would present the greatest pest management opportunities Other areas where the condition of the vegetation is important, such as in developed recreation sites, would also present significant opportunities for pest management, even though timber production is not their primary objective Wildernesses, on the other hand, would

present limited possibilities that would occur only when pests were an immediate threat to resources outside the wilderness boundary or threatened an unnatural loss of wilderness character Areas managed non-intensively for timber production would have moderate pest management opportunities The intensity of vegetative management for each alternative is shown in Table 2-7 in Chapter 2 for Reforestation, Timber Stand Improvement, and Allowable Sale Quantity

Defoliators Research literature is compelling towards use of management prescnptions that utilize even-aged management (in mixed conifer) and the use of prescribed fire for control of defoliators The objective is to "reverse the successional trend created by nearly a century of fire suppression, selective harvesting (mthout proper follow-upcultural practices), and an overall lack of awareness of ecological principles Significant outbreaks of defoliators such as the Douglas-firtussockmoth have occurredrecently, and will in all likelihood continue in the future The long-term effects are unknown, but if predictions are accurate, recurring large scale defoliations mll be common until forest stands are brought under an "integrated pest management" strategy. Effects will probably be cumulative

All alternatives, except EGP, would be effective in reducing losses to defoliators because of the large number of acres treated with even-aged management

Bark Beetles All alternatives are probably effective at reducing the risk from bark beetle damage because of proposed pre-commercial and commercial thinning, and stand maintenance harvests

Root Rots and Stem Decays All alternatives would be effective in reducing the risk from root rots and stem decays in lands managed for varying levels of timber production

Dwarf Mistletoe All alternatives, except EGP, would be effective for prevention of dwarf mistletoe The EGP Alternative would not be as effective as the other alternatives because of its reliance on uneven-aged management

Animal Pests Animal damage will probably increase with those alternatives that emphasize even-aged management (especially clearcutting and shelterwood harvesting)

10. GEOLOGYAND GROUNDWATER

On the Forest, adverse geological impacts are primanly a result of slope instability that is reflected by the occurrence of landslides and slumps Slope failure of soil and rock can be caused by natural processes or as a result of management activities Geologically-sensitive lands constitute less than one percent of the Lassen National Forest

a. Direct and Indirect Effects

There are a vanety of direct and indirect effects on the environment that result from geologic interactions Acceleratedrates ofslumpingabove naturallevels areanunavoidable consequenceof building roads and harvesting timber in potentially unstable terrain The degree of effect can vary greatly depending on location and design

Someofthe indirect effectsassociatedwith slumping and landslides can include

- Loss of facilities and capital investments (pnmarily roads);
- Increased cost and personnel required for management of areas where accelerated slumping has taken place,
- Increased risk of injury,
- Increased sediment to streams and reservoirs,
- Loss of shading for streams used by anadromous fish,
- Temporarydecrease in water quality (primanly due to increases in turbidity),
- Visual impacts of landslide scars and deformed vegetation,
- Loss of productive capability of the land due to erosion from slumps and landslides

b. Cumulative Effects

The analysis of cumulative effects takes into consideration past, present and future activlties on National Forest and other lands. Impacts are reviewed with regard to the timing and intensity of activities, their location and land sensitivity

Analysis of cumulative effects requires that threshold values be established, above which the cumulative effects are significant and below which they are judged to be insignificant At this time, there are no widely accepted methods or models available to set threshold values for determining the significance of cumulative effects of slope failures Further, because it is impossible to forecast the occurrence of storms which tngger landslides, the prediction of when threshold values might be exceeded is not possible

The concentration of intensive management (road construction and timber harvest) in steep, potentially unstable terrain is more likely to cause greater cumulative impacts than the same activlties in stable terrain Areas on the Forest where sensitive lands are Iocated have been identified during the planmng process

Significant adverse cumulative effects on geology and groundwater are not expected to occur from implementing any of the alternatives

c. Mitigation Measures

A wide vanety of techniques are used to lessen the impacts or prevent accelerated mass movement resulting from timber harvest Foremost is the identification of unstable terrain The most reliable and cost-effective method in dealing with unstable terrain is simply avoidance of known problem areas Project environmental assessments utilize detailed mapping to verify and update the location of unstable acres All of the alternatives call for the use of Best Management Practices to minimize impacts on water quality by the avoidance of unstable soils

The Forest Semce operates under the pnnciple that management actions should be dispersed (by timing and location) rather than concentrated, in order to avoid adverse cumulative effects

Additional mitigation measures associated with timber harvesting include replacing clearcut silvicultural prescriptions with partial cut prescnptions.

There are a number of mitigation measures which can be used to decrease the frequency and lessen the impacts of landslides which may be associated with road construction. Mitigation measures related to road construction can be separated into two categories. prevention efforts and remedial efforts Prevention measures which are very effective include avoidance of unstable terrain during road location, as well as engineenng and geotechnical site investigations to assess nsks and to provlde adequate project design for encountered conditions Monitonng will be required to evaluate the effectiveness of these measures in preventing slope failures related to road construction

When road related failures occur, some of the efforts to reduce the impacts (remedial efforts) include removal of slide matenal, regrading and revegetating the slope, placement of filtration and drainage structures at the slide, use of retaining structures, redirection of surface water away from the site, and interception and drainage of groundwater away from the failure These methods are generally quite effective in reconstructing the roadway and minimizing the potential for future failure at that site, but environmental damages may have already occurred For large failures, these efforts can be very expensive, and may not be totally effective

Contamination of groundwater by toxic materials during drilling operations or due to hazardous materials spills would be managed through plans of operation, special use permits, contract specifications, and contingency plans under all alternatives The total mitigated effect on groundwater for any of the alternatives will be negligible

PRF, CUR, EGP, and TGP Alternatives

The risk associated with geologic hazards is not expected to vary by alternative, nor is the threat to groundwater quality or quantity

Stability hazards on Eocene non-marine and granitic soils are the same for all alternatives, exposure to stability hazards is proportional to each alternative's Land Disturbance Index, shown in Table 4-10 of this Chapter

The CUR Alternative has a higher risk of impacting potentially unstable areas because of the greater area proposed for intensive timber management and road construction TGP, PRF, and EGP have correspondingly less risk

11. LANDS

The planning issue for the lands resource involves both landowner coordination and landownership adjustments how the Forest should coordinate its activities with adjacent public and private landowners, and how it should reduce conflicts by exchanging or acquiring lands The lands resource also includes utility corridors, special uses, land withdrawals, rights of way, and land line location The consequences are summarized below by these categories

All Alternatives

a. Direct, Indirect and Cumulative Effects

Land Adjustments Under all alternatives, the land adjustment program will result in a more consolidated land ownership pattern, reduced administrative costs, fewer trespasses, better resource protection, improved public service and enhanced recreation opportunities Land adjustment is defined as land purchase, exchange, donation, or other authorized real estate action This program will not vary notably among the alternatives

Proposed land adjustments are subject to environmental analysis to determine social, economic and environmental effects. Two major adjustments that have high public interest are the exchange for relocation of the Eagle Lake District office at the intersection of County A-1 and Highway **36,** and the proposed purchase unit at the south end of Eagle Lake Both of these adjustments have the potential of greatly expanding public service for visitors traveling to or recreating at Eagle Lake

Coordination With Adjacent Landowners Coordination efforts described in Chapter **3** will continue under **all** alternatives The average of land adjustments is not expected to vary significantly by alternative, but specific areas to be acquired and their relative priority for acquisition will vary in accordance with the theme of each alternative

Utility Corridors Issuance of special use permits for utility corridors (powerlines and energy transmission) can have significant indirect effects on other resources Land is often taken out of production from other uses, or at least reduced in terms of availability

Specified areas must be avoided in locating new utility corridors under any alternative designated and proposed wilderness, proposed wild and scenic river corridors, Research Natural Areas, semi-primitive recreation areas, experimental forests, Special Interest Areas, the Eagle Lake planning area, and areas used in the practice of Native American religions Since each alternative involves a different mix of these areas, future corridor locations could be affected differently The corndor study cited in Chapter **3** focused on an area north of the Forest for the location of a proposed east/west intertie A possible north-south intertie is also being studied which, at the most, would affect less than a hundred acres in the northwest corner of the Forest Thus, no new demand for a major corridor on the Forest is expected in the near future Under all alternatives, new facilities will he located alongside existing facilities whenever possible

Special Uses While the alternatives differ in the amount of land managed for particular purposes, these differences will have only a negligible effect on the special uses (used by other parties) program

Withdrawals Withdrawals vary by alternative and are discussed under the minerals section of this Chapter

Rights-of-way Acquisition and Land Line Location Rights-of-way acquisition and land line identification, posting, and marking priorities will vary in direct proportion to the allowable

timber sale quantity Joint funding with adjacent landowners will be used whenever possible, frequently allowing survey marking and boundary line posting beyond the minimum reqmred for a specific timber sale In addition, the Forest will maintain those boundary and survey lines that are up to standards on a IO-year cycle

b. Mitigation Measures

Standard and Guidelines in Chapter 2 stipulate measures to take in order to mitigate the effects of actions on other resource values (indirect effects) Central to these measures is that any proposed action must be consistent with emphases associated with individual management areas, this applies to issuance of special use permits as well (including utility corndors) All applications for permits must be renewed in accordance with NEPA regulations

Mitigation measures for pipelines, power lines and phone lines may include.

- Erosion and drainage control (e g., minimum clearing widths),
- Revegetation (primarily with native grasses and other noninterfering vegetation);
- Special measures at stream crossings (e g , nprap, concrete armonng, or deep trenchmg);
- Construction of diversions or settling ponds near water crossings, or limiting construction to specific seasons;
- Location or camouflage to mtigate visual effects on the landscape, or
- Restriction of off-road vehicles to limit soil erosion

12. LAW ENFORCEMENT

All Alternatives

a. Direct, Indirect and Cumulative Effects

Although law enforcement effects are difficult to predict, it is certain that the need for law enforcement will increase The incidence of actinties on the Lassen National Forest that have reqmred a law enforcement response has been on a steady increase over the past decade This trend is expected to continue, regardless of the selected alternative

Many factors affect the law enforcement equation Area economics and employment opportunities, recreational vlsitor use days, facility conditions and security, promulgation of new laws and regulations, population changes and social attitudes are but a few It is difficult to measure these influences accurately or scientifically, but some histoncal examples can be relied upon

It is also difficult to define effects as "direct, Indirect or cumulative", since one violation of law can contain all three For example, the illegal woodcutter who removes a mldlife snag has a direct effect on that individual snag The indirect effect is that future mldlife habitat has been removed from the area A cumulative effect may be shown if regulations are not enforced and repeat violations occur over a large scale

Certain effects, predicted by alternative, are descnbed below Issues where there is no projected difference from the CUR Alternative are not discussed specifically

All alternatives would produce an economic effect, through an increased Forest budget with the additional funds required to augment law enforcement staffing

Reduced timber harvesting will have a significant effect on law enforcement related actinties Local economics and the employment situation will change Some unemployed persons may resort to illegal actinties in lieu of legitimate employment Examples of this could be an increase in narcotics production on National Forest lands, and resource and property theft. Arson as a means of employment could also increase Historical examples indicate that reduction in the timber supply would lead to increased pnces, making unauthorized removal that much more lucrative This effect would be slightly less significant in the TGP than in the PRF or EGP Alternatives

Additional trail construction and wilderness designation under the PRF and EGP Alternatives

would result in an increase in visitor use days, with a resultant increase in law enforcement activities Vandalism of cultural resource sites will continue to be a problem New Wild and Scenic Rivers and Special Area designations under the two alternatives could result in increased regulation and protection of these areas While a decrease in road maintenance could offset some increased visitor use, the rate of related accidents due to poor road conditions could rise, as well as the potential for tort claims. Withdrawal of acres from mineral leasing and entry could cause a minor increase in trespasses needing resolution by law enforcement actions.

The CUR and TGP Alternatives show the most road and trail construction This would make more of the Forest accessible and probably draw more visitors, slightly increasing related problems Higher amounts of firewood made available would bring about an increase in regulatory law enforcement actinties Increased biomass activity would reqmre additional law enforcement support in timber sale actinties related to the layout, preparation and accountability of biomass sales

Under all alternatives, decreased acreage burned may lessen impacts of fire investigation, although the decrease is insignificant overall Added recreation opportunities could increase the actual number of human caused starts.

No change in wildlife-related law enforcement activities is currently predicted for the alternatives, although requirements for the protection of spotted owl habitat may change in the future

b. Mitigation Measures

Mitigation measures for law enforcement center on the tnangle of education, information, and enforcement The emphasis on education includes school visits, summer campground programs such as the Junior Ranger Program, and presentations to organized groups These programs provide an opportunity for law enforcement officials to meet with the public, explain the regulations for protecting forest resources, and respond to local concerns

Media contact, primarily newspapers and radio, is another method of announcing changes in forestregulationsanddetemngvlolations When an alleged violation has occurred and the suspects are apprehended, reports in the media also act as a deterrent for others A series of articles on the vandalism of cultural properties helped expand the public's awareness of the importance of these unique sites, and why they need to be protected

Personal contacts and interpretative information at major developed recreation sites or Forest Servlce administrative offices are one of the best ways to disseminate information on resource management activities and protection. Signs at campgrounds, informational brochures or explanations by Forest Service Hosts and law enforcement officials all give visitors a better understanding of the Forest's resource management programs Education and information have a positive impact on deternngviolations, and mitigating the law enforcement workload

13. MINERALS

a. Direct and Indirect Effects

Exploration and development of mineral resources on the Forest have varymg effects on the envlronment The potential envlronmental effects depend on methods, duration, and extent of operations Ground disturbance associated with mineral and energy activities can have important direct and indirect interactions with many of the environmental components described in this Chapter Conversely, land allocations designed to protect various resources from the adverse effects of ground disturbing activities can constrain mineral exploration and restrict development to varymg degrees

Forest Service policy is to encourage and facilitate mineral exploration and development on all lands not withdrawn from mineral entry This policy would not change in any of the alternatives

Under the different alternatives, certain lands are recommended for withdrawal from mining activity while other lands are recommended for management by various prescriptions The way lands are managed under each alternative will have a effect on the availability of those lands for mineral entry It will also have an indirect effect

on the cost of conducting exploration, develop ment and reclamation activities. Management prescnptions and the management of other resources may affect the actual cost of operation; management prescnptions could also influence interest in exploring some areas for their mineral resources.

The value of mineral resources is not well quantified. Therefore it is difficult to assess the effects on minerals that each alternative would have in terms of dollars, tons at a certain grade or billions of BTU's Likewise, since specific actinties have not been proposed, the indirect effects of protecting other resources from mining impacts cannot be specifically quantified in terms of delays, cost of operating, cost of reclaiming or in terms of production. These impacts will be analyzed and quantified when specific activities have been proposed and the location, scope and timing of an operation is known. As a consequence, the effects are best shown by analyzing the relative degree to which management prescriptions may increase the cost of operating, limit the availability of land for mineral exploration and development, or otherwise constrain proposed mineral activities.

The differences in access affect the availability of Forest lands for mineral exploration, development and reclamation In some areas such as wilderness, potential mineral resources may never be identified or developed. When management goals for other resources cannot be fully met in conjunction with certain types of mneral activities, the result is a conflict of interests. Alternatives with highly restrictive access and stricter guidelines for smaller area disturbance would, in general, have lower environmental risks and less impact from mineral entry.

Minerals and mineral related resources are grouped into three basic categories. Locatable, Leasable, and Mineral Materials

Locatable Minerals The locatable mineral potential (gold, copper, silver and other precious or semi-precious minerals) of the Forest is moderate.

Known locations of locatable minerals do not change with alternatives, but the availability for mineral exploration does (see Table 4-11). Conflicts could occur in areas where claims were made pnor to mineral mthdrawal, or where exlsting claims have been located in areas subject to recommendations for mneral withdrawal. Highly restricted access due to management prescriptions and management area direction can discourage exploration and development.

Because the mineral potential for locatable minerals is low, the likelihood of development is minimal for all of the alternatives. The acreage that would potentially be withdrawn from mineral entry varies considerably from one alternative to the next. Environmental consequences of the alternatives on mineral development would be directly related to the size and kind of area that would be withdrawn from entry. The closing of roads for various resource actinties could have an adverse impact on access for mneral exploration; however the construction of roads for other resources could also expose geologically promising strata to prospectors and increase access which would benefit mineral exploration and development actinties

Leasable Minerals With a valid pernut, people can explore for leasable minerals on all public lands not withdrawn from nnneral leasing laws Leasable minerals are primanly coal, oil, gas and geothermal resources In an area where valid exlsting mineral nghts do not already exist, leases and permits maybe granted under the provisions of all alternatives only if they incorporate the management direction of the lease/permit area If an area has been leased, the leasee has the right to explore, produce, and develop leasable minerals with reasonable access. Where other management goals cannot be completely achieved while leasing activities contmue, conflicts may arise. Conversely, management prescnptions could impair access to leasable minerals. Impacts of management prescriptions could affect the type of mineral leasing activity permitted, the quality of information acquired about the potential and occurrence of the mineral resource, and the ability of the leasee to supply nunerals to meet national demands (see Table 4-12)

Expenence indicates that only a small percentage of the leases are drilled and an even smaller percentage make a discovery and are developed Activity on the bulk of the leases usually will not proceed beyond preliminary exploration.

Table 4-11
Withdrawal of Locatable Mineral Resources By Mineral Potential and By Alternative

Withdrawal Areas	Locatable Mineral Potential		Existing Withdrawal (1984)a/	PRF	CUR	EGP	TGP
1 Wilderness	VH	Very High	0	0	0	0	0
	H	High	0	0	0	0	0
	M	Medium	0	90	0	90	0
	L	Low	32,983	54,477	32,983	75,979	32,983
	L/U	Probably Low	45,077	45,077	45,077	45,077	45,077
	U	Unknown	0	0	0	0	0
2 Wild Segment, Wild and Scenic River	VH	VeryHigh	0	0	0	0	0
	H	High	0	0	0	0	0
	M	Medium	0	500	0	500	0
	L	Low	0	8,790	0	8,790	0
	L/U	Probably Low	0	7,105	0	7,105	5,400
	U	unknown	0	0	0	0	0
3 Research Natural Areas	VH	Very High	0	0	0	0	0
	H	High	0	0	0	0	0
	M	Medium	0	800	0	800	800
	L	Low	0	5,995	0	5,995	5,995
	L/U	Probably Low	521	3,518	521	3,518	3,518
	U	Unknown b/	3,922	3,922	3,922	3,922	3,922
4. National Natural Landmarks	VH	Very High	0	0	0	0	0
	H	High	0	0	0	0	0
	M	Medium	0	0	0	0	0
	L	Low	0	0	0	0	0
	L/U	Probably Low	0	0	0	100	0
	U	unknown	0	0	0	0	0
5 Special Interest Areas	VH	Very High	0	0	0	0	0
	H	High	0	0	0	0	0
	M	Medium	0	0	0	0	0
	L	Low	0	395	0	395	0
	L/U	Probably Low	0	1,910	0	1,910	0
	U	Unknown	0	0	0	0	0
6. Eagle Lake Planmng Area c/	VH	Very High	0	0	0	0	0
	H	High	0	0	0	0	0
	M	Medium	0	0	0	0	0
	L	LOW	0	0	0	0	0
	L/U	Probably Low	0	40,280	0	40,280	0
	U	Unknown	0	0	0	0	0
Total Acres Recommended for Mineral Withdrawal d/	VH	Very High	0	0	0	0	0
	H	High	0	0	0	0	0
	M	Medium	0	1,265	0	1,390	800
	L	Low	32,983	65,258	32,983	80,425	38,978
	L/U	Probably Low	45,598	88,333	45,598	80,313	45,598
	U	Unknown	3,922	3,922	3,922	3,922	3,922
		Total	82,503	158,778	82,503	166,050	89,298

Table 4-11 (continued)
Withdrawal of Locatable Mineral Resources By **Mineral Potential and** By **Alternative**

Withdrawal Areas	Locatable Mineral Potential		Existing Withdrawal (1984) a/	PRF	CUR	EGP	TGP
Percent of Lands Withdrawn From Each Mineral Potential Level e/, f/	VH	Very High	0%	0%	0%	0%	0%
	H	High	0%	0%	0%	0%	0%
	M	Medium	0%	3%	0%	3%	2%
	L	Low	26%	52%	26%	64%	31%
	L/U	Probably Low	5%	9%	5%	9%	5%
	U	Unknown	19%	19%	19%	19%	19%

a/ Existing withdrawal acres are included in the alternatives

b/ Cub Creek is an existing RNA encompassing 3,922 acres It is planned for withdrawal

c/ Under the PRF and EGP Alternatives, the Eagle Lake Planning Area is not recommended for National Natural Landmark or Special Interest Area classification, but is proposed for withdrawal from mineral entry

d/ For all alternatives, the 'Total Acres Recommended for Mineral Withdrawal" do not equal the anthmetical sum of "Withdrawal Areas" rows 1-6 above This is because of several overlaps Wild and Scenic Rivers within wilderness, RNA's within wilderness, SIA's within wilderness, areas recommended for both NNL and SIA, etc

e/ The totals of mineral potential categories VH through U should not total 100%

f/ Total Lassen National Forest area is 1,129,585 acres The Forest-wide locatable mineral potential is approximately

VH	VeryHigh	6,475 acres	6 percent of Forest
H	High	600 acres	1percent of Forest
M	Medium	39,915 acres	3 5 percent of Forest
L	Law	126,670 acres	11 2 percent of Forest
L/U	Probably Low	935,140 acres	82 8 percent of Forest
U	Unknown	20,785 acres	1 8 percent of Forest

Table 4-12
Withdrawal of Leasable Mineral Resources By **Mineral Potential and** By **Alternative**

Withdrawal Areas	Locatable Mineral Potential		Existing Withdrawal (1984) a/	PRF	CUR	EGP	TGP
1 Wilderness	VH	Very High	14,892	6,767	0	7,832	0
	H	High	62,668	6,422	0	6,422	0
	M	Medium	500	1,985	0	20,932	0
	U	Unknown	0	6,410	0	7,900	0
2 Wild Segment, Wild and Scenic River	VH	Very High	0	0	0	0	0
	H	High	0	0	0	0	0
	M	Medium	0	10,773	0	10,773	0
	U	Unknown	0	5,622	0	5,622	0

Table 4-12 (continued)
Withdrawal of Leasable Mineral Resources By Mineral Potential and By Alternative

Withdrawal Areas	Locatable Mineral Potential		Existing Withdrawal (1984) a/	PRF	CUR	EGP	TGP
3 National Natural Landmarks	VH	VeryHigh	0	0	0	0	0
	H	High	0	0	0	100	0
	M	Medium	0	0	0	0	0
	U	Unknown	0	0	0	0	0
4 Special Interest Areas	VH	VeryHigh	0	110	0	110	0
	H	High	0	480	0	480	0
	M	Medium	0	715	0	715	0
	U	Unknown	0	0	0	0	0
5 Eagle Lake Planning Area b/	VH	Very High	0	0	0	0	0
	H	High	0	9,600	0	9,600	0
	M	Medium	0	30,680	0	30,680	0
	U	Unknown	0	3	0	3	0
Total Acres Recommended for Mineral Withdrawal c/	VH	Very High	14,892	21,659	14,892	22,724	14,892
	H	High	62,668	78,690	62,668	78,690	62,668
	M	Medium	500	35,098	500	46,245	500
	U	unknown	0	10,132	0	11,332	0
Total			78,060	145,579	78,060	158,991	78,060
Percent of Lands Withdrawn From Each Mineral Potential Level d/, e/	VH	VeryHigh	23%	33%	23%	34%	23%
	H	High	39%	50%	39%	50%	39%
	M	Medium	0 1%	5%	0 1%	6%	0 1%
	U	Unknown	0%	7%	0%	8%	0%

a/ Existing withdrawal acres are included in the alternatives

b/ Under the PRF and EGP Alternatives, the Eagle Lake Planning Area is not recommended for National Natural Landmark or Special Interest Area Classification, but is proposed for withdrawal from mineral entry

c/ For all alternatives, the "Total Acres Recommended for Mineral withdrawal" do not equal the anthmetical sum of "Withdrawal Areas" rows 1-5 above This is because of several overlaps Wild and Scenic Rivers within wilderness, RNA's within wilderness, SIA's within wilderness, areas recommended for both NNL and SIA, etc

d/ Totals of mineral potential categories VH through U should not total 100%

e/ Total Lassen National Forest area is 1,129,585 acres The Forest-wide leasable mineral potential is approximately

VH	VeryHigh	66,100 acres	5 8 percent of Forest
H	High	159,020 acres	14 0 percent of Forest
M	Medium	765,036 acres	68 0 percent of Forest
U	Unknown	139,429 acres	12 2 percent of Forest

Note Research Natural Areas were wthdrawn from locatable mineral entry, but withdrawal from mineral leasing is not necessary (directional drilling is possible)

Mineral Materials Mineral materials are common varieties of sand, gravel and cinders, etc. As the need for additional mineral materials develops, acreage will need to be set aside for them. Environmental consequences from development of new and existing sources would result pnmanly from the particular location in relation to other resources as well as the number of acres available The demand for additional pits and quarries will be high in alternatives where timber harvest levels are higher The consequences are illustrated by analyzing how acre assignments to management areas may limit the availability of lands for minerals exploration and development or constrain proposed mineral activlties.

b. Cumulative Effects

Because mining activlties are controlled by laws, regulations and site specific operating plans, and are also subject to economic factors, widespread, new mining operations on the Forest are unlikely. As a result, no significant cumulative effects on mining activities are anticipated under any alternative.

c. Mitigation Measures

Under all alternatives, Threatened and Endangered plant and wildlife species would be protected to the extent required by law, as would floodplains and wetlands Potential damage to archaeological and /or historic sites would require avoidance by the prospector or miner. Protection of surface and subsurface waters from contamination would be required, as would maintenance of am quality For each mining development, a Plan of Operation would be prepared and submitted to the Forest Service for approval, per 36 CFR 228 The plan of operation would incorporate these requirements, and others as needed, and identify how each requirement would be met All mitigation costs would be borne by the proponent Mining operations would also be subject to regulation by state agencies, such as the Regional Water Quality Control Boards and the Department of Fish and Game

Proposals for mineral exploration and development are considered on a case-by-case basis When a proposal is received, the Forest Service works with a proponent and other agencies to minimize or mitigate adverse impacts on those resources requiring some degree of protection. Only reasonable restrictions to mining can be legally imposed on areas not withdrawn.

All Alternatives

Because the same mining laws govern all alternatives, the only variable for minerals management is the potential to locate and develop minerals Alternatives calling for greater harvest and road construction levels will increase the potential for locating minerals.

In general, the relationship between the Forest's road system and mineral resources is a positive effect Common vanety mneral resources provide the materials from which roads are constructed and maintained, whereas the road system provldes access for mineral exploration, development and production activities On the Forest, the dominant market for mineral materials is in support of the timber management program

The manner in which lands are to be managed under each alternative will have an effect on the availability and level of restrictions on these lands for mineral entry The establishment of Research Natural areas and Special Interest Areas have a direct effect, because of the potential conflict between mining activlties with sensitive plants and unique plant communities Existing and proposed RNAs are recommended for withdrawal from mineral entry Special Interest Areas are also recommended for withdrawal

Designation of wild, scenic or recreation river reaches could have a significant direct effect on mineral activities due to access restrictions Designation of wild nver segments would result in the withdrawal of land from mineral activlties mthm one quarter mile either side of the nver In some cases, vvlthdrawal may be recommended in scenic nver segments Protection of visual resources on lands adjacent to the one quarter mile corridor may impact mneral activities on much larger areas due to public demand for protection of those areas Removal of sand and gravel would be prohibited Direct and indirect environmental effects on these areas would be minimal because of the access restnctions

Table 4-13

Mineral Potential of Further Planning Areas (acres)

Area	Mineral Type	Total Area	Mineral Potential VH	H	M	L	L/U	U
Butt Mtn	Locatable	8,300					8,300	
	Leaseable			1,600				6,700
Heart Lake	Locatable	9,289				9,289		
	Leaseable		2,867	6,422				
Ishi (B)	Locatable	20,027				20,027		
	Leasable			18,827			1,200	
Mill Creek	Locatable	7,990				7,990		
	Leasable			1,280			6,710	
Trail Lake	Locatable	1,115				1,115		
	Leasable			1,115				
Wild Cattle Mtn	Locatable	4,965				4,965		
	Leasable		4,965					

VH - Very high, H - High, M - Moderate, L -Low, L/U - Probably low, U - Unknown (See Chapter 3 for definitions)

In all alternatives, the acres of existing and proposed wlderness have already been withdrawn. The only mineral operations allowed within these areas are those authorized by valid existing rights at the time of the area's designation as wilderness There is a low potential for identifying new mineral resources in wildernesses.

Table 4-11 and 4-12 illustrate how the alternatives vary in the availability of the minerals resource. Table 4-13 shows the mineral potential of the further planning areas considered for wlderness designation in this planning process

PRF Alternative

Locatable In addition to lands already withdrawn, 76,275 acres would be withdrawn from mineral entry. None have a "high"or "veryhigh" potential for the occurrence of locatable minerals

Leasable In addition to lands already withdrawn, 67,519 acres would be withdrawn from mineral leasing Sixty-nine percent of the withdrawn acres have a "high"or "very high" potential for the occurrence of leasable minerals Two areas lying near Lassen Volcanic National Park's thermal areas (Heart Lake and Wild Cattle Mountain) would be recommended for mlderness and thereby reduce access to a potential geothermal resource The alternative, including existing withdrawals, removes 45 percent of the Forest's "high" and "very high" acreage from mineral leasing.

CUR Alternative

No increase in withdrawn acreage would occur This alternative would have the least adverse impact on minerals development

EGP Alternative

Locatable In addition to lands already withdrawn, 83,547 acres would be withdrawn from

mineral entry. None have a "high" or "very high" potential for the occurrence of locatable minerals This is the largest locatable withdrawal of any alternative

Leasable In addition to lands already withdrawn, 80,931 acres would be withdrawn from mineral leasing Sixty-four percent of the withdrawn acres have a "high" or "very high" potential for the occurrence of leasable minerals This is the largest leasable mthdrawal of any alternative It removes 45 percent of the Forest's "high" and "very high" acreage from mineral leasing, including existing mthdrawals

TGP Alternative

Locatable In addition to lands already withdrawn, 6,795 acres would be withdrawn from mineral entry None have a "high" or "very high" potential for the occurrence of locatable minerals.

Leasable No additional acres would be withdrawn from mineral leasing.

14. RANGE

Introduction

Range forage is the vegetation used by mldhfe and livestock. In most cases, both kinds of animals will use the same area, but often at different times of the year. The Forest, as a whole, provides forage in excess of current needs Wildlife species use different vegetative areas depending upon season of year and seventy of the winter. In mild mnters mth low snow depths, deer and antelope will use higher elevations, which greatly increases the area they can use as winter range It is only during the more severe winters, when deep snow forces the animals into lower-elevation areas, that competition for forage becomes more intense Livestock can be managed to reduce or eliminate the competition between domestic animals and game animals

There are three types of range transitory, primary, and secondary Transitory range refers to land that can be grazed by wildlife and cattle only until the trees become dominant such as after a mldfire or timber harvesting Permanent rangelands are designated as primary or secondary range, depending on their accessibility, available water, and livestock preference (see Glossary, Chapter 8, under Range)

Transitory range created by timber harvest will account for much of the Forest's increased forage production under all alternatives Forage utilization within the transitory range may vary. Utilization is limted by the difficulty in distnbuting livestock to small and scattered units, inability to control livestock dnft, natural barners, lack of water, and the short-term nature of the forage Where livestock can be contained on transitory range (by fencing), the expected utilization under all alternatives is approximately 80 percent of available forage, this level of utilization will be quite apparent(i e the area will have a mowed appearance). Some transitory range will be unavailable due to seedling protection needs Fencing or other management control will be needed to protect some plantations for the first three to five years of conifer regeneration

Excessive forage utilization by livestock on primary and secondary ranges can negatively affect many resources npanan zone vegetation, range condition and trend, soil structure and stability, level of undesirable vegetative species, recreation expenences, water quality, fishenes, and wildlife The effects depend on several factors livestock distnbution, grazing intensity, range improvements, stocking rates, timing and duration of the grazing penod, utilization of transitory range, climatic conditions, cooperation of permittees, and coordination with other resource use activities

There are three levels of grazing light, moderate, and heavy For pnmary, secondary, and most transitory range, the range conditions (and ultimately, the consequences) associated mth these three levels of grazing are

1 Light The forage appearance is uniform, lightly cropped and patchy Greater than 60 percent of the herbaceous forage remains Many plants have ungrazed seed heads Current annual growth of preferred browse species is less than 40 percent utilized Litter accumulation is increasing and the apparent soil condition trend is improving The apparent range condition is improvlng

2. Moderate The forage appearance is mottled, patchy, and uneven, 40 to 60 percent of the herbaceous forage remains Preferred browse species retain **30** to **50** percent of current annual growth Litter accumulations are replacing last years' litter and maintaining or enhancing the apparent soil condition trend. The apparent range condition is being maintained or enhanced

3 Heavy The forage appearance is uniformly smoothand closelymowed Less than40 percent of herbaceous forage remains. Browse twigs (currentyear's growth) may be grazed from 80 to 100 percent of total twigs, creating a hedge appearance Litter does not replace last year's accumulations; bare soil spots are visible throughout the vegetated areas. The apparent soil condition trend is not being maintained and the potential for erosion is increasmg The apparent range condition is in a downward trend.

All Alternatives

a. Direct Effects

The management activlties descnbed in the various alternatives would have direct effects on range vegetation. The alternatives will effect the availability, condition, and amount of permanent and transitory range. Timber harvest, the use of prescnbed fire, and livestock use are the pnmary tools for management of range vegetation

The quantity of transitory range will increase in alternatives which call for higher levels of timber harvest Timber harvest opens up tree canopies, allowing sunlight to reach the ground, which increases forage production In recent years, timber harvest has become more intensive with greater use of overstory removal, shelterwood, and clearcutting This has the potential to boost forage production more than selective harvesting. The degree of increase varies by alternative as displayed in Table 4-14. Using total acres of harvest by even-aged methods, the CUR and TGP Alternatives would increase forage production on transitory range the most, followed by PRF To better utilize transitory range, livestock distnbution may need to be modified The EGP Alternative would show the least increase because of its reliance on group selection harvesting, which would have minimal effect on transitory range. Group selection harvests are two acres or less in size; the edge effect from these small units does not allow as much sunlight to penetrate to the ground and promote the growth of early seral vegetation As a result, forage production would not be as high
Prescnbed burning of natural fuels and range improvements (pnmanly juniper and chaparral removal) can increase forage production. Table 4-14 shows acres of prescnbed range/wildlife burning. However, it is assumed here that the most important influence on forage production is timber harvest The ranking in order of increasing forage production is unchanged even with the effects of prescribed burning

Table 4-14

Expected Acres in Early Seral Stages and Range Use

		Alternative			
	Decade	PRF	CUR	EGP	TGP
Reforestation	**1**	**3,600**	**5,900**	**3,600**	**5,000**
	5	**3,200**	**5,600**	**3,000**	**3,400**
Range/Wildlife Fuel Treatment (acres)	**1**	**1,300**	1,760	**1,300**	**1,300**
	5	**1,300**	**2,100**	**1,300**	**1,300**
Range Use (M AUM's)	**1**	**485**	**497**	**485**	**485**
	5	48 5	49 7	48 5	48 5

Grazing by domestic livestock removes surplus forage and converts it to a commodity Properly done, livestock grazing has minimal environmental effects Likewise, use of forage or vegetation by mldhfe or recreational livestock, or leaving it ungrazed for recreational purposes, contributes to important uses and enjoyment of the National Forests. Grazing affects diversity in plant communities in terms of their species composition and condition. Properly timed, grazing will maintain and encourage a number of highly palatable and nutntious plant species in the community, and plant vlgor will be high Grasses will include a large proportion of perennial species that tend to decrease with improper grazing use For many plant communities these would include blue bunch wheatgrass and Idaho fescue Shrubs and forbs will vary dependingon the plant community

Improperly applied, livestock grazing can have adverse envlronmental effects. Repeated heavy grazing that is not properly timed can reduce species diversity, and shift species composition toward undesirable species and noxious weeds. Plant species diversity will be low, as will plant vigor. Annual grasses such as cheatgrass and perennial grasses that tend to increase with heavy grazing will replace the more desirable and palatable forage species Forbs and shrubs will vary depending on the plant community. In some commumties, grasses can be almost completely replaced by weedy forbs. Less desirable species result in lower productivlty and can impact other uses on the Forest. If the impacted areas are along streamsides and wet meadows, water quality, fishenes, and recreation can be affected.

Cattle favor nparian areas and some stream channels which are sensitive to physical damage such as trampling and compaction. The vegetation in these areas is an important component of streambank stability, and fish and wldlife habitat (see the fish, and the Water and Riparian sections of this Chapter). Livestock grazmg in riparian areas will be conducted under the Riparian/Fish (F) prescription. In some cases, modification of livestock grazing practices or fencing would be required

Changes in commercial livestock grazing may occur in response to increased recreational use. Public dissatisfaction with the presence of livestock in popular recreation areas could reqmre changes in allotment boundanes, fencing and livestock management.

NOXIOUS weeds can adversely affect food production, wldlife habitat, visual quality, forage production, reforestation, recreational opportunities, and land values Virtually every acre of land is susceptible to noxious weed infestation. Those alternatives creating more acres of ground disturbance will have the highest likelihood of mcreasing noxious weed infestations

b. Indirect Effects

Deer, antelope and cattle use the same forage component If the numbers of cattle increase, this competition can reduce the habitat and forage needed by game species In all alternatives, the use by cattle is predicted to be less than the Forest capacity and consequently will not compete significantly with game species Deer and antelope forage needs are accounted for when determining carrying capacity and allowable use by hvestock If conflicts do occur, allotment plans will be modified to insure satisfactory range conditions.

Grazing can lower the quality of recreation in developed and undeveloped areas Implementation of the Standards and Guidelines are designed to prevent this conflict In all alternatives, the level of grazing is not predicted to conflict with recreation.

Sensitive plant habitat can be damaged by grazing. Implementation of the Standards and Guidelines would prevent this damage by excluding cattle on certain management areas Momtonng of cattle use on the exlsting allotments would insure adequate data to change Standards and Guidelines if necessary.

Concentrations of cattle can damage tree seedlings in regeneration units The timing and amount of use are predicted to limit this damage to acceptable levels in all alternatives. Small areas of insignificant tree mortality due to temporary concentrations of cattle would still occur in all alternatives.

Concentrations of cattle in npanan and wet areas can degrade water quality. Fecal contamination can be a problem to downstream users The Riparian/Fish Prescnption and Standards and Gmdelines are designed to protect water quality in all alternatives. Local areas would still have concentrations of cattle use, but these areas would not degrade the fishenes resource. Fencing, and other livestock management strategies, will be used as needed to protect ripanan resources

Cattle can be a hazard to car and truck traffic on roads within the Forest, county roads and state highways This effect would occur in all alternatives

The wild horse herd and its territory will continue to be monitored to determme effects of management actinties and other external factors The herd population will be managed to exceed neither the current carrying capacity of the territory nor the established population size, based on a revised herd management plan.

c. Cumulative Effects

Heavy, continuous use of forage by livestock and wldlife can interrupt the succession of natural vegetation toward tree cover In these areas, overgrazing can also create bare ground. If vegetation cover is reduced over a large area, there can be cumulative effects on other resources. Some of these effects are: (1) reduction of vegetative competition to improve growth response of trees (which can subsequently shade out available grazing vegetation, thereby affecting livestock and wldlife), and **(2)** overgrazing to the point where bare ground is exposed (creating conditions conducive to erosion, lowered water quality, and reduced soil productivlty).

Because 15 percent of the npanan areas within current grazing allotments are in less than satisfactory condition, measures necessary for their recovery may result in temporary reductions in permitted stocking. Any reductions in permitted stock may impact the economics of the grazing operations on effected allotments. Jobs associated with grazing in general are not expected to go either up or down significantly with any of the alternatives The long-term benefits of temporary stock reduction are improvements in water quahty, wldlife habitat, and forage production.

d. Mitigation Measures

Several mitigation measures could be implemented to reduce the effects of grazing on other resources, while maintaining range conditions. These measures are summanzed here.

The most important part of mitigating the effects of livestock use on other resources is knowing what end results are expected, setting site-specific objectives, and developing a comprehensive allotment management plan to meet these objectives A good management plan, implemented in cooperation with the permittee, must provide mitigation measures to maintam or enhance forage, water quality, timber, wildlife/fisheries habitat, recreation use, and soil productivlty.

Determination of the current capacity and amount of grazing use to be allowed must consider the requirements of all other resources in an area. Controlling livestock is equally important. Water should be provlded where it is needed. Once water sources are properly located, well-maintained fences will provide flexibihty for managmg livestock. Development of livestock trails and dnftways provides access over difficult terrain or through heavy cover to areas receiving light or no use Riding and proper salt placement can be helpful to improve livestock distnbution. Livestock can be used as a tool to release tree seedlings from grass competition. Certain areas can also be intensively grazed to reduce fire hazards

Standards and Guidelines identify what level of use can be made of forage while either maintaining satisfactory Conditions or improving unsatisfactory conditions to satisfactory Management prescriptions provlde for the protection of other resource values while allowing grazing use.

Application of intensive grazing systems such as rest rotation, deferred rotation, double rest, npanan pasture, etc., if properly done, provlde for distribution and use of forage, while not exceeding utilization standards and other resource management objectives.

Other mtigation measures for grazing include:

- Production of forage for wildhfe in key wldlife areas to reduce competition with domestic livestock.
- Seeding to key (preferably native) forage species to improve forage production where it does not restnct tree establishment or growth.
- Grazing on transitory range when significant damage to young trees will not be incurred
- Timing of use by domestic livestock to achieve vegetative management objectives.
- Exclusion of livestock from ripanan and other preferred areas when needed; control of use patterns through structural improvement for cover and watershed protection

Monitonng of use and range conditions will provide the basis for adjustment of management and permitted stock where necessary to assure

that grazing objectives and satisfactory conditions are achieved.

PRF Alternative

Grazing use would have a slight drop (2 percent) from the base year to **48,500 AUM's** per year in each decade. There will be an increase in transitory range in regenerated timber harvest areas. Where necessary, livestock will be moved from riparian areas onto transitory range to allow the riparian areas to recover. Existing permittees could utilize the transitory range unthout significant change in their livestock operations New allotments or recruitment of new permittees would not be expected Grazmglevels would be "moderate" on primary range, ''light"on secondary range, and "moderate" on transitory range Current range conditions would be maintained or enhanced.

CUR *Alternative*

During decade 1, forage availability would remain at the base year level of about **49,700 AUM's** per year Thereafter use would be expected to fluctuate up to **56,400 AUM's,** but level off at 49,700 AUM's in decade 5 This fluctuation is due to the change in regeneration acres each decade and the amount of transitory range available Production of **AUM's** would be achieved through implementation of the Range/Wildlife Prescnption on **98,000** acres and the Range Prescnption on 12,000 acres. Some current management intensities would change to provlde protection of other resources and to maintain or enhance apparent range condition.

Existing permittees' livestock operations would adjust with the forage fluctuation, but new allotments or addrtional permittees would not be expected Grazing levels would be "light" to "moderate" on primary and secondary ranges, and "moderate" on transitory range Current range condrtions would be maintained or enhanced.

EGP Alternative

Grazing use would decrease 2 percent from the base year to **48,500** AUM's and remain constant at that level for all 5 decades There would be a minimal increase in transitory range. Where necessary, livestock would be moved from riparian areas onto transitory range to allow quicker recovery

Existing permittees could utilize the transitory range with only minor changes in their livestock operahons; new allotments or recruitment of new permittees would not be expected Grazing levels would be "light to moderate" on pnmary range, "hght" on secondary range, and Yight to moderate" on transitory range Current range conditions would be mamtained and enhanced

TGP Alternative

Dunng decade 1, grazing use would decrease 2 percent from the base year to **48,500** AUM's per year. This use would remain constant through all five decades There would be an increase in transitory range Where necessary, livestock would be moved from ripanan areas onto transitory range to allow the ripanan areas to recover.

Existing permittees could utilize the transitory range without significant change in their livestock operations, new allotments or recruitment of new permittees would not be expected. Grazinglevels would be "moderate"onprimaryrange, "light"on secondary range and "light" on transitory range. Current range conditions would be maintained or enhanced.

15. RECREATION

Recreation, tounsm, and their related semces are becoming increasingly important to the economy of northeastern California

Use of the Lassen National Forest for recreation can be generally classified as either developed recreation or dispersed recreation In order to descnbe potential recreation opportunities as accurately as possible, dispersed recreation has been further divlded into roaded or unroaded (non-wilderness) dispersed recreation.

Discussion of the effects of the alternatives on recreation focuses on recreation settings. Recreation settings are locations on the Forest exhibiting certam envlronments that people choose for different recreation expenences The recreation Opportunity Spectrum (ROS) describes

these settings in terms of the types of recreation opportunities they offer. ROS classes are bnefly described in Chapter 3. They are: Pnmitive, Semi-Pnmitive Non-motonzed, Semi-Primitive Motorized, Roaded Natural, and Rural.

Outdoor recreation actimties on the Forest take place in many different settmgs. The way the Forest is managed can affect, either directly or indirectly, those recreation settings as well as visitors' recreation experiences. The relative mixture of reereation settings and expenences that are available to Forest visitors are determned by the land allocations established for each alternative Land allocations would also determine to some extent the Forest's capacity for meeting present and future demand for various recreation opportunities.

Impacts to the recreation resource would vary through the range of alternatives. These impacts are the result of management activities that affect the quality of the recreation setting.

Activities such as timber harvests, livestock grazing, mining, and wildhfe management would all affect the recreation expenence by varying degrees Recreation facilities and services under each alternative can also affect recreation opportunities, especially in developed recreation areas. Management of recreation facilities and services includes operating and maintaining campgrounds, trailheads, trails and associated facilities, boat ramps, wnter sport sites, visitor information centers, and parking lots; and providing access to recreation areas.

a. Direct Effects

Developed Recreation Opportunities Alternatives may affect developed recreation settings in three basic ways: by eliminating sites, by the manner in which individual sites are maintamed, and by the type of management that is proposed in adjacent areas.

The elimination or closure of some developed sites may affect other sites The users of sites proposed for closure will be displaced to other developed sites, or will seek alternative experiences in dispersed and undeveloped areas. Subsequent effects include: the possible overuse of other developed sites, the loss of a preferred user expenence, and the increased potential of human-caused wildfire in dispersed camping sites. In addition, an mcrease in litter, human waste, vandalism, and related effects can be expected in dispersed sites.

Based on current estimates, the Forest will be able to meet overall demand for developed recreation through Decade 3 in all alternatives

Developed sites that are rehabilitated and maintained at the standard service level will provide a more satisfying recreation experience than those sites maintamed at the limited service level Well maintained sites are reduce the incidence of vandalism, and the nsk of site closure due to continued degradation.

Timber harvest and road construction activities in areas adjoining developed sites could alter the setting of those sites and the expenence of users. In either case, harvest activities can change the character of the surrounding area in a manner that may alter the quality of experiences and opportumties typically associated with developed site use such as hiking, fishing, sight-seeing, and nature study. Projects adjacent to developed sites will be carefully planned to avoid impacts on the recreation expenence.

Road construction and harvest actinties could mcrease sedimentation, affecting fish habitat and fishing quality. They may also result in a heightened sense of commercial activity in the area from mcreased noise levels, and lead to a reduction in quality of the overall recreation experience. Best Management Practices are designed to minimize sedimentation, and to protect fisheries habitat and water quality for recreational enjoyment

All alternatives provide a high degree of protection for the settings of existing developed recreation sites from surrounding management influences Developed sites will be managed under the D (Developed Recreation) Prescription which permits only low levels of harvest and road development. These areas are, therefore, buffered from the normal effects of logging operations.

Dispersed Recreation Opportunities The alternatives vary as to the quality of the recreation expenence, and the quality of access provided in particular ROS settings as shown in Table 2-7 in Chapter 2

In addition, alternatives with higher levels of activity for other resources, such as timber harvesting, can affect the recreation environment, and resulting quality of experience. Indirect effects, such as temporary loss of trails or access changes, will occur with those alternatives that involve higher levels of ground disturbing activities.

The ability to meet the projected demand for primitive (P) ROS settings varies among the alternatives by the amount of proposed wilderness. Primitive recreation opportunities are only available in designated wilderness. Existing and proposed wilderness acreage for each alternative is also displayed in Table 2-7. Both EGP proposing the most acres, and CUR and TGP recommending no additional wilderness.

Projected demands for dispersed recreation opportunities would be met in all alternatives. However, the alternatives vary considerably in the amount of dispersed unroaded recreation opportunities that would be offered in Semi-Primitive Non-Motorized (SPNM) areas.

The availability of SPNM recreation opportunities would depend on whether a number of currently unroaded areas would be managed for other resource development. The PRF and EGP Alternatives, which strongly emphasize unroaded recreation, would provide the greatest opportunities for SPNM types of recreation activities. The CUR and TGP Alternatives emphasize Roaded Natural (RN) settings, i.e. commodity development, and would therefore offer the least opportunity for unroaded recreation. Unroaded areas with SPNM settings that are managed for Roaded Natural (RN) or Rural (R) opportunities until, in 10 to 20 years, be altered dramatically by roads and harvest units. Over time, these areas would not provide for user needs of isolation, solitude, and primitive type recreation in an unmodified natural environment. Through alteration of landforms and vegetation in SPNM settings, areas for this opportunity type would shrink in both extent and quality, and fewer users could be accommodated. The sights and sounds of forest management, such as logging traffic and harvest activities, will be common and occasionally in close proximity. This will result in a loss of isolation and solitude normally associated with unconfined recreation in SPNM settings.

The alternatives provide varying amounts of Semi-Primitive Motorized (SPM) opportunities. The CUR, EGP and TGP Alternatives provide no SPM areas on the Forest, while PRF allocates 17,000 acres to this setting. As SPM settings are converted to RN and R settings, primarily through timber harvest and road construction, opportunities for challenging motorized access to unroaded and undeveloped areas become limited or are lost. Typically, road development associated with timber harvest activities shortens access routes, bisects or replaces trail access, and improves road surfaces, thus altering or eliminating previously difficult or challenging semi-primitive motorized recreation opportunities for Off-Highway Vehicle (OHV) users.

The opportunity for OHV access on the Forest is related to the (1) the number of acres where OHV use is prohibited such as wilderness, special and SPNM areas, (2) the number of acres where the use is permitted, but restricted to designated roads and trails, and (3) the number of acres where the use is permitted as long as it does not compromise other resource uses or values. There is no appreciable difference among the alternatives in the number of miles available for summer or winter OHV use. Areas open to OHV use are more restricted under the PRF and EGP Alternatives because of the number of acres recommended for wilderness and SPNM allocations.

Roaded Natural (RN) and Rural (R) settings provide the greatest opportunities for dispersed roaded and off-highway recreation. Both of these settings are important to the majority of Forest visitors. The major difference between RN and R is the evidence of management activities associated with each. The frequency and design characteristics of management activities in the R setting will result in an obviously altered, rather than a natural appearing landscape typical of the RN setting. All alternatives manage the same number of acres in an R setting (9,700). The CUR and TGP Alternatives would have the greatest effect on RN settings. The natural appearance of the RN setting would change through alteration of vegetative cover and landforms as a result of timber harvest and road construction. The effects of road construction and harvest activities such as exposed soil on steep slopes, cutbanks and unnatural vegetation patterns will be apparent.

Under the PRF, EGP, and TGP Alternatives, the emsting trail system is improved and expanded. No additional trails are proposed under CUR The effects of the alternatives on the Forest trail system are discussed under the Facilities section of this Chapter

b. Indirect Effects

The supply/demand information in Chapter 3 of this document illustrates that the future demand for unroaded recreation opportunities outside of wilderness is uncertain. Currently, the Forest is below its projected maximum carrying capacity for all dispersed recreation. If demand exceeds supply in later decades, there are at least three possible indirect effects: 1) use could continue beyond the capability of the area resulting in possible adverse effects on the social and physical attributes of the setting; 2) use may be displaced to wilderness areas, placing more demands on the wilderness resource; 3) users of unroaded areas may choose to take part in leisure activities in roaded settings.

Providing recreational opportunities, through specific land allocations to Semi-Primitive Motorized and Non-Motorized settings, produces an indirect, but significant effect on other resource users. Some effects are more appropriately descnbed as foregone "opportunity costs" rather than as specific actions, because management for these SPM and SPNM settings reduces or eliminates more commodity oriented endeavors such as timber harvest, mineral exploration, and recreational pursuits associated with roaded settings

Areas managed for SPNM opportunities provlde quahty hunting expenences not found throughout more intensively managed, roaded areas. These "islands" of unroaded, non-manipulated vegetation offer seclusion and escape for many unldlife species, providing a challenge for those hunters wishing to use backcountry skills in pursuit of game species.

Sights and sounds of increased recreation may reduce the quality of habitat for some wildlife Forest-wide Standards and Guidelines are designed to minimize this effect.

Forest health is more difficult to maintain in areas allocated for Semi-Primitive recreation. Opportunities for using silvicultural techniques are limited due to accessibility problems. Options include prescnbed fire and, in some cases, salvage harvestmg

Motonzed recreational use (OHV) causes damage to other resources when users fail to obey laws and regulations or when the Forest fails to properly manage it. Soil erosion can be excessive in steep areas, or in areas with low vegetation cover Large numbers of motorized users can create erosion and air quality problems from dust. Riparian areas tend to receive hgher resource damage than other areas because of the high level of access within them Standards and Guidelines are designed to limit this damage to within acceptable levels, but public trust and respect for the land is a necessary component of the overall management scheme to control motorized use and protect other resources.

Recreational facilities such as campgrounds, dispersed campsites, trailheads, and trails impact soils and watersheds by taking land out of production for construction purposes, and by exposmg, compacting and displacing soils in areas of heavy traffic

Vegetation in areas providing Semi-Primitive Non-Motonzed recreation experiences would develop naturally and the species composition would depend on random disturbances (i e. windstorms, fire, insects, and disease). Increased recreational use would increase the risk of human caused fires that may change the vegetation. This would also indirectly increase the risk of erosion in watersheds due to the temporary loss of ground cover.

The presence of developed or expanded recreation sites near fishable streams and lakes could contnbute to the reduction of local fish populations. Heavy fishing pressure could reduce wild populations of trout and salmon in smaller bodies of water to the extent that habitat would be underutilized. Conversely, access to streams and lakes for recreational purposes encourages stocking of hatchery fish.

Construction of developed sites or trails would increase traffic along roads leading to them and may mcrease vlsual sensitivlty. This may create conflicts with land disturbing activlties adjacent to these recreation areas. Construction of devel-

oped recreation sites may also result in local conditions that do not meet the vlsual quality objectives for the whole viewshed.

More recreational opportunities would enhance the appeal of communities adjacent to the Forest and could increase jobs and income in tounst industnes.

e. Cumulative Effects

Cumulative effects for recreation relate mamly to the development of areas which currently offer Pnmitive, and Semi-Primitive Non-Motonzed recreation opportunities Alternatives which would allocate emsting unroaded areas for timber harvesting and other resource development would gradually reduce opportunities for &spersed recreation in an unroaded setting The rate that unroaded areas would be developed indicates how some of the recreation opportunities in a particular area would be modified from a Pnmitive **or** Semi-Primitive Non-Motorized setting to a Roaded Natural setting. The CUR Alternative would reduce unroaded recreation opportunities much more rapidly than the other alternatives

d. Mitigation Measures

Measures designed to mitigate the effect of various activlties are identified in the Forest-wide Standards and Guidelines, and Management Prescnptions in Chapter 2 Some of the major mitigation measures are listed below

To maintain semi-primitive recreation opportunities, some unroaded areas are designated as N (Semi-Primitive Non-Motorized Prescription) areas. Vehicle use is not permitted in these areas

Scemccorndors are designated to maintain natural landscapes along specific roads and trails.

Road systems are designed and maintamed to accommodate different types and levels of recreation traffic

Developed sites are protected from nnneral entry through the mthdrawal procedures These sites are also maintained, managed and protected dunng timber harvest through clauses in the timber sale contract. Areas where soil compaction is unacceptable will be rehabilitated and/or rested

Cross-country ski opportunities may be segregated from snowmobile routes by issuing a Forest closure order prohibiting snowmobiles on certain trails

Traffic controls can be initiated to restnct log haul on weekends and holidays to facilitate recreation traffic and public safety

Roads can be closed after log haul to further protect mldlife habitat resulting in more nonmotonzed recreation (hunting) opportunities.

Timber sale areas can be left open for several seasons after harvest for people to gather firewood.

PRF Alternative

Developed Demand for developed recreation would be met through decade **3** by maintaining emsting facilities or constructing new fee campgrounds early in decade **1** in areas of highest demand. This campground construction, coupled with construction of trailheads, Forest entrance stations and other developments, rehabilitation of existing campgrounds, mamtenance at the standard semce level, and provision of an interpretive semces program, would provide for high quality recreation expenences Since part of the Butt Mountam Further Planning Area would be reserved for ski area development, the potential for meeting future demand for alpine skiing would be retained.

Dzspersed A full range of dispersed recreation opportunities would be provlded **A** total of 48,000 acres would be assigned to the Semi-Primitive Non-Motorized Prescnption, provlding ample opportunities for a pnnntive recreation expenence and avoiding overcrowding of similar areas In addition, 17,000 acres would be assigned to the Semi-Primitive Motonzed Prescnption, maintaining opportunities for a high quality, sen-primitive expenence for OHV users. Roaded Natural-appeanng areas would provlde the balance of acres for OHV use The total acreage open to OHV use (763,000 acres) would be moderately low in comparison to the TGP and EGP Alternatives, but it would still be substantial. New construction and reconstruction of trails, and a high level of trail maintenance, would further enhance vlsitor expenences over current conditions

CUR Alternative

Developed No increase in developed recreation facilities would be provlded. **As** demand grows, over 260,000 RVD's would be turned away annually by decade 5 No rehabilitation of developed sites would be performed, but maintenance would be sufficient to prevent a loss of facilities Maintenance at the limited service level would result in some site degradation and a lower quahty recreation experience. This would be somewhat mitigated by using volunteers such as campground hosts.

Dispersed A limited range of dispersed recreation opportunities would be provided. Little would be done to meet demand for unroaded recreation, and opportunities for solitude and a primitive recreation experience would decline. In decade **1**, some of the remaining further planning and unroaded areas would not be committed to other uses, but by decade 5 most probably would be Roads would be constructed, forest stands would be logged, and recreation would have a vehicle orientation. A gradual crowding would cause vlsitors to seek out the remaining unroaded areas. This alternative would provide the greatest acreage open to OHV use, but no SPNM or SPM areas Reduced management and mamtenance would discourage dispersed use and lessen the quality of the recreation expenence Due to a low level of trail maintenance, the trail system could decline.

EGP Alternative

Developed Demand would be met through decade 3 by use of existing campgrounds and other developed recreation sites New construction or campground expansion would occur in decade **4** to meet 40 percent of the expected increase in demand Rehabilitation of major campgrounds and maintenance at the standard service level dunng decade **1** would enhance the recreation experience at these sites. Continuing the present program of interpretive services would enhance recreation opportunities for some users Since the Butt Mountain Further Planning Area would be recommended for wilderness, the opportumty to provlde a developed ski area there would be foregone

Dcspersed A limted range of dispersed recreation opportunities would be provlded; 55,000 acres would be assigned to the Semi-Pnmitive Non-Motonzed Prescnption. There would be no acres assigned to the Semi-Primitive Motonzed Prescnption Opportunities for OHV use in a semi-pnmitive setting would be few. However, most of the remaining Forest would be in a Roaded Natural setting and provlde opportunities for OHV use. Construction of new trails, reconstruction of existing trails, and maintenance at the standard level would enhance trail users' expenences.

TGP Alternative

Deueloped Demand would be met through decade 3 by constructing fee campgrounds early in the planning penod in areas of highest demand. This campground construction, together with construction of trailheads, Forest entrance stations and other developed sites, rehabilitation of existing campgrounds, maintenance at the standard service level, and provlsion of an interpretive semces program, would result in a high quality recreation expenence. Since the Butt Mountain Further Planning Area would be reserved for ski area development, the potential for meeting future demand for alpine skiing would be retained.

Dispersed A limited range of dispersed recreation opportunities would be provided. Little would be done to meet unroaded recreation demand Since no acres would be assigned to the Semi-Pnmitive Non-motonzed or Semi-Primitive Motorized Prescriptions, opportunities for solitude and semi-pnmitive recreation would decline In decade **1**, most remaining unroaded acres would not be committed to other uses, but by decade 5 the majonty would be. Roads would be constructed, forest stands would be logged, and recreation would have a vehicle onentation Most of the Forest would be in the Roaded Natural setting and would offer extensive areas for challengmg OHV use Due to a low level of trail mamtenance, and limited construction and reconstruction, trail users' recreation expenences would decline

16. SENSITIVE PLANTS

The Sensitive plants issue relates to how the Forest should provlde protection for its rare plant populations, enhance Sensitive plant habi-

tat, if possible, and educate the public on the importance of rare species protection for biological dwersity and other values The primary management objective is to nunimize negative impacts to Sensitive plant populations.

Timber harvestmg and road buildmg are the most significant land-disturbing activities impactmg populations of Sensitive plants within and adjacent to project areas. Other land-disturbing activities, such as trail work, wildhfe habitat and fisheries enhancement projects may impact Sensitive plants. Land-disturbing activities whch change the hydrologic regime of site conditions can also affect Sensitive plant habitats.

A few Sensitive plants prefer the habitat provided by early seral stages. Timber harvesting may be beneficial to these plants, although the vegetation changes may have to be designed to benefit the intended plant species. However, most Sensitive plants are restricted to specific, unusual habitats such as serpentine soils, sphagnum bogs, or vernal pools. In most cases, the best management for these species is protection of their habitat from significant change.

Grazing allotments can create impacts on Sensitive plants species and their habitat by livestock consuming the plants or by trampling Livestock grazing can also encourage the introduction of competing plant species

Natural and prescribed fire can be detrimental, neutral, or beneficial to Sensitive plant populations, depending on the plant species, the season, and the intensity of the burn.

Recreation facilities and activities could have an adverse effect on some Sensitive plant species, especially those plants which occur in meadows or in subalpine habitats

Land allocations affect Sensitive plant communities Designations such as Research Natural Areas, Special Interest Areas, wilderness, Wild and Scenic Rivers, spotted owl habitat areas, marten and fisher habitat management areas, and npanan areas can pronde protection to Sensitive plant populations. Areas where land disturbing actinties are emphasized could potentially have an adverse effect on populations of Sensitive plant species that occur within or adjacent to these areas

All **Alternatives**

a. Direct and Indirect Effects

The management objective for Sensitive plants is to provide habitat capable of indefimtely supporting Sensitive plant species. Altematives that emphasize intensive timber harvest activities (CUR and TGP) are most likely to have an impact on habitat suitable for Sensitive plants. Alternatives that allocate more land to prescnptions other than timber management (PRF and EGP) result in better protection for Sensitive plant habitat Altematives with lower timber harvests also have fewer roads, and this means less potential impact on Sensitive plants. Table **4-15** summarizes the risk analysis for Sensitive plants

b. Cumulative Effects

Without mitigation (primanly avoidance), timber harvest, road construction, and other ground disturbing activities would cause habitat modification, which could result in the loss of individual plants or entire occurrences of Sensitive plants. This is hkely to cause a loss of genetic dwersity over time and result in a decline of populations of Sensitive plant species. Those alternatives that emphasize timber management (CUR and TGP) are likely to have greater cumulative effects than the PRF and EGP Alternatives which have less ground disturbing actinties

c. Mitigation Measures

Forest-wide Standards and Guidelines for all management activities contain measures to prevent overall loss of Sensitive plant species and their habitats. These Standards and Guidelines would apply no matter which alternative is selected. Under all alternatives, surveys would also be conducted prior to land-disturbing activities on potential habitat, thereby reducing the chances of impacting unknown populations of Sensitive plants. Effects on known populations can be mitigated pnmarily by avoiding the occurrence, or in some cases by project design which maintains or enhances Sensitive plant habitat Because of this, the possibility of disappearance of a Sensitive plant species from the Forest due to project activity is remote However, the dis-

Table 4-15

Sensitive Plant Analysis

Risk Factors	Base Year 1982	Decade	Alternative			
			PRE	CUR	EGP	IGP
Land Disturbance Index (Effects of timber harvesting, road construction, and fires)	44.9	1	36.5	44.3	36.6	40.2
		5	34.1	42.1	32.2	37.1
Reforestation Acres/Year	600	1	3,600	5,900	3,600	5,000
		5	3,200	5,600	3,000	3,400
Road Construction (Miles/Year)	15	1	16	*	16	21
		5	4	*	3	4
Fuel Treatment Acres/Year (Fire-related and range/ wildlife fuel treatments)	2,640	1	2,450	3,760	2,450	2,450
		5	2,450	4,100	2,450	2,450
Grazing (M AUM's)	49.7	1	48.5	49.7	48.5	48.5
		5	48.5	49.7	48.5	48.5
Semi-Pnmitive Non-Motonzed (M Acres)	146 4	1	48 0	0	550	0
		5	48 0	0	550	0
Wilderness (M Acres)	78.1	1	99.6	78.1	121.1	78.1
		5	99.6	781	121.1	781
Risk			Low	High	Low	Mod

* Updated mileage figures separating new construction from reconstruction are not available

tribution and abundance of populations can vary as a consequence of implementing the various alternatives.

The Forest has begun writing specific management guides for its Sensitive plants. Once approved by the Forest Supervisor, these guides will provide management direction for project planning in regard to site-specific populations of a particular species, and help mitigate their disturbance

The followmg general measures may be employed to mitigate impacts to the Sensitive plant resource:

- Avoiding populahons;
- Limiting the degree or magnitude of a proposed action;
- Timing of action to reduce negative impacts;
- Repairing, rehabilitating or restorating after the action;
- Using alternate methods to achieve project goal

17. SOILS

Changes in the productive qualities of the soil resource have been related to disturbances arismg from management actions on the ground. The magnitude of change is associated with the type of hsturbance, the size **or** extent of the affected area and inherent soil properties governing productimty. Erosion, nutnent loss, mass movement (landslides) and Compaction are effects associated with management induced changes to soil. Additional discussion about erosion and landslides may be found in the Geology/Groundwater section of this Chapter. Declines in productinty occur due to alterations of the soil's complex nutnent cycling system, as is the case with broadcast bunnng. Other disturbances affect the physical characteristics of the soil resource. Compaction and surface erosion are examples of disturbances that modify the moisture holding capacity of soil, reducing moisture available for seedling growth.

Physical disturbances related to log harvesting practices may increase surface erosion rates by exposing the soil surface. Growing site potential can **be** lost through soil compaction. Tractor harvesting operations and machine piling of slash can compact soils. The use of fire to reduce fuel build up mcreases soil exposure and reduces surface orgamc matter. Nitrogen, considered a limiting nutnent to tree growth, is lost to the atmosphere when organic matter is consumed by fire. **Some** activities, like fertilization, improve soil productinty for a short period of time

With timber harvest and removal of the conifer canopy, changes occur in the natural forces **regulating** slope stability Higher levels of rainfall reaching the soil increase soil pore pressures. Timber harvest and the subsequent loss of resistant forces of decaying tree roots increase the potential for mass movement **or** debns flows. Construction of roads can alter natural forces of slope stability and promote mcreases in the rate of mass wasting in naturally unstable soils

a. Direct Effects

Timber harvest and road construction have the greatest potential to affect the soil through compaction, displacement, **or** erosion Concentrated grazing and recreation use may adversely impact soils, especially in sensitive nparian zones Intense fire may volatilize soil nutrients. Direct effects on soils are:

Effects from Energy Geothermal and small hydroelectric energy sources could **be** developed on the Forest Geothermal exploration and construction actinties can cause erosion. The small size (approxlmately one acre) of exploration sites minimizes the impacts. Subsequent geothermal site development could create additional erosion problems and also reduce local soil productivity.

Small hydrologx projects can cause erosion, sediment delivery and loss of land productivity. Construction actimties for diversions and penstocks usually results in soil disturbance and sediment delivery to streams. Concentration of land disturbing activities in a stream will likely move sediment into the stream Construction of the generation facilities would use land that could produce future timber growth and yield

Biomass harvestmg for energy production may decrease soil productimty over the long-term through compaction and the removal of woody material which can remove nutrients. Refer to the section on Biomass in this Chapter

Effects from Fire The effects of fire on soils are highly vanahle, dependmg on: **(1)** he intensity and duration of the fire, and (2) the transfer of heat into the soil (dependent on the physical properties of the soil affected). Significant beneficial effects of low to moderate intensity fires are: (1) exposure of mineral soil/ash seed beds for natural tree regeneration, (2) improved nutnent cycling; and (3) reduced levels of some pathogenic micro-organisms Significant adverse effects of high-to-extreme intensity fires are: (1) accelerated erosion (due to excessive mineral soil exposure and/or creation of hydrophobic conditions); (2) excessive nutrient volatilization (especially nitrogen and potassium); (3) loss of beneficial microorganisms, and **(4)** loss of organic matter for nutnent holding capacity of soil

After extreme heating, air and water movement can be altered and the biological and chemical properties of the soil can be affected, causing reduced availability of nutnents for plants. Topsoil loss and intensive bunnng can modify a soil's nutrients and create a nitrogen deficiency. Nutnent losses from fires will **be** most severe on

high elevation, volcanic ash soils. This is because nitrogen deficiencies are already common on colder soils (higher elevations) and are worsened on sites where topsoil has been displaced or altered through intense burning

Effects from **Fisheries** Soil disturbances from habitat improvement projects in streams can increase delivery of sediment to streams. The impacts will be located at equipment access points and where logs or boulders imbedded in the stream bank are moved or anchored. Such sediment sources are usually small and heal quickly.

Effects from **Grazing** Effects from cattle grazing tend to be localized. Use of areas by cattle early in the spring when soils are high in moisture or in areas where soils are seasonally wet will result in compaction of the surface soil layers. The magnitude of the impact is greater where the concentration of animals is higher or when the period of use is long. Reduced infiltration rates in compacted areas will result in increased surface erosion and, depending on proximity to streams, a higher likelihood of sediment delivery to streams.

Trampling by cattle breaks down protective vegetative cover and mechanically breaks off the soil surface along stream side slopes. The slope destabilizing effect of trampling promotes erosion and sediment delivery in streamside areas.

The number of Animal Unit Months (AUM's) does not vary greatly among the alternatives (see Table 2-10, Chapter 2). With adoption of more restrictive utilization standards in riparian areas and range improvements designed to disperse livestock, soil compaction and vegetation loss in riparian areas will be reduced. Livestock also add organic matter to the soil from feces and urine. Under some moisture conditions, hoofaction can break up surface crusts and improve water infiltration into soils

Effects from Minerals Development of mineral sites on most of the Forest has been confined to excavation of rock or cinders for road construction. Several mining operations have occurred. The largest, Carr Mine, was developed and patented for private ownership. Forest productivity of mining sites are lost when development occurs. Where developed sites promote channelling of water, off site erosion and possible sedimentation of streams can result.

Effects from Released Roadless Areas Roadless areas have provided protection for the soil resource by eliminating road construction and maintenance activities that contribute to soil disturbance and erosion. The decision to enter roadless areas with roads and harvest would have the same effect on forest soils as management actions on intensively managed lands. Some productive land would be lost to new road construction Erosion from exposed road surfaces would have the potential to enter streams.

Effects from Road Construction and Reconstruction (Also see the Facilities section of this Chapter.) Roads are the major nonpoint source of disturbance and removal of the soil mantle, which can result in soil erosion and increased sediment in streams This effect varies by the amount of roads constructed, the season of construction, the types of soils, road surfacing and design (including ditch and culvert specifications), and the steepness of slope on which the roads are constructed.

Constructing roads during the wet period of the year (November through May) will encourage surface runoff, erosion, and sedimentation. New roads are highly erodible during the first rains and/or snowmelt following construction

Roads having high cutbanks produce more sediment than roads with low cutbanks. Freezing and thawing, heating and cooling, and raindrop action dislodge soil particles which travel into drainage ditches and are transported to streams. Road construction on slopes exceeding 70 percent often produces gravelly sidecast material that can bury downslope vegetation and create a drought condition, resulting in reduced soil-site productivity. Sidecast can cause overloading of the fill slope and subsequent loss of roadfills.

Improper compaction, and logs and debris in fills can cause road failures. Improper location and inadequate number or size of drainage facilities can increase the incidence of road failures and road surface erosion.

Roads lacking adequate surfacing lead to larger quantities of sediment reaching streams The worst conditions exist on roads constructed on granitic soils, but only a few such roads exist on the Forest.

Road reconstruction on the Forest is a source of sediment that occurs when an old road is cleared of protective vegetation Similar to new road construction, exposed soils will tend to erode for one to several years after reconstruction

Since most of the Forest's transportation system is already in place, new construction does not vary significantly by alternative (see Table 2-7, Chapter 2)

The potential to increase sediment production lies mainly in accessing currently unroaded areas, since new road construction creates more sediment than emsting roads Alternatives with the least impact on these areas are PRF and EGP, which continue management of some of these areas in an unroaded condition. The CUR and TGP Alternatives pose an increasing nsk of soil loss from these areas.

Effects from Timber Harvest Due to the relatively gentle terrain on the Lassen National Forest, tractor yarding is the most common method of timber harvest, especially on slopes under 35 percent. Multiple trips over the same area with a tractor or rubber-tired skidder can cause detnmental soil compaction and displacement

Soil compaction reduces site productivity by reducing the pore space in the soil, creates a physical barrier to plant roots, and reduces the infiltration and percolation rates of water into and through the soil. Seedlings growing in densely compacted soils show lower growth rates compared with seedlings growing in undisturbed sites. Researchers have identified a relationship between soil bulk density increases and decreases in tree growth.

Displacement occurs when fertile surface soil is removed or pushed aside, exposing subsoil. Displacement can occur over large areas dunng machine site preparation or on smaller areas on skid trails and landings.

Machine piling of slash and other site preparation actinties can tnple the area of ground disturbed beyond that caused by timber harvest, greatly increasing soil damage caused by compaction, puddling and displacement. Dramatic growth reductions have been demonstrated on areas where surface soil has been pushed mto windrows or piles along with stumps and loggmg debns Since surface soil displacement or removal is a long-term or nearly permanent site disturbance, effects on nutrient cyclmg are significant

The amount of soil compaction depends on the number of acres affected by ground-based logging equipment (e.g. tractor or rubber tired skidder) and by the method of post-harvest site preparation. Cable yarding systems move logs with at least one end suspended These systems cause less soil disturbance than tractor yarding and can be used on steeper slopes where tractors are not suitable.

For each harvest entry, the extent of soil disturbance depends on the logging system and associated road network, terrain and soil factors, volume of timber removed, size of logs, weather, soil condition and skills of indimdual equipment operators. The most complex, expensive yarding systems are designed to operate in the steepest terrain and to have the least impact in terms of soil compaction and displacement; thus, careful practices in difficult, erosion-prone terrain may have soil erosion impacts comparable to poor practices carried out on naturally stable flat ground Generally, downhill cable yarding tends to concentrate runoff and snowmelt, creatmg a greater erosion hazard at receiving landmgs.

Overall, acres of compaction on the Forest will increase in the short term as previously unentered timber stands are harvested The Forest will only begin to reduce the degraded acreage when previously entered (and compacted) areas are reentered and rehabilitated Forest-wide Standards and Guidelines emphasize the need to maintain an aggressive rehabilitation program. The alternatives can be rated in terms of how well they manage for compaction over time, based on rate of timber harvest, percent of tractor versus skyline logging, use of even-aged versus uneven-aged management, and total acres available for timber harvest.

Effects from Vegetation Management actinties usually cause disturbances in the soil surface that will cause changes in the type of vegetation that reestablishes The greatest changes in vegetation will occur on road surfaces and associ-

ated cut and fill slopes The removal of soil and replacement with rocks eliminates vegetation from the road pnsm Natural vegetation growing on cut and fill slopes has lower vlgor Road cut and fill slopes are often seeded with grasses to control erosion.

Temporary spur roads and roads no longer needed in the transportation system can be cultivated and revegetated, but the site's soil productinty cannot be totally restored Subsequent vegetative growth unll be stunted for many years.

On hot, dry sites, surface evaporation rates increase when protective litter layers are removed. Vegetation establishment is slowed on disturbed areas where surface soils are hotter and dner than before

Disturbances associated with timber harvest and site preparation favor the establishment of pioneenng plants on the site. When nitrogen fixing species such as Ceanothus revegetate the site, an increase in soil nitrogen levels will result. Such pioneering brush species often build soil productivity

Effects from Water High energy hydrologic events from high hourly rainfall rates **or** rapid melting of snow packs have the potential to detach and transport large qualities of soil material. Erosion rates are dependent on the soil properties, slope gradients and the extent and configuration of soil exposure. Erosion rates from exposed road surfaces can be high Gullying and rilling often result from high rainfall events Compacted soils, unth reduced infiltration rates, can have higher erosion rates than nearby undisturbed soils. Surface runoff from compacted areas delivers sediment to streams. In areas where hot prescribed fires have produced water repellent layers below the soil surface, rates of surface erosion will be greater

The size of soil particles relates closely to sediment delivery Because smaller sized soil particles are transported farther distances in overland surface flow, soils havlng a high percentage of such particles will be more likely to increase turbidity levels in nearby streams

Effects from Watershed Improvement Projects Improvement projects seek to correct degraded soil conditions of erosion, sediment delivery and compaction associated unth management actinties Improvement measures include gully stabilization, seeding to control erosion, road obliteration, and npping of compacted soils

Effects from Wild and Scenic Rivers Wild and scenic river recommendations afford more protection for the soil resource by restricting management actions that would result in disturbance. The Wild sections of nver *courses* would receive the greatest protection from management actinties. Alower level of protection would be provlded by a Scenic designation. A Recreation designation would allow the most development

Effects from Wildlife Wildlife improvement activlties often prescribe grass seedlng in harvested areas **or** willow and alder plantings along streams. Such vegetative cover holds soil particles in place and promotes nutnent cycling.

Logging Residue Management The extent of residue management is determined in part hy silvicultural and fuel treatment objectives Treatment options include machine piling, broadcast burning, hand piling and yarding unutilizeable material

Machine piling, involvlng crawler tractors, has the greatest potential to harm the soil resources by compacting soil, removlng nutrient enriched surface organic **or** mineral soil layers and exposing the soil surface to agents **of** erosion. Machine piling often results in the entire harvest area being travelled over The increased use of smaller track hoe and shovel equipment in piling operations has resulted in less impacts to the soil **resource** from machinery operation

The amount of surface organic matter consumed dunng broadcast burns is a concern for continued fertility of the site Important nitrogen reserves held in the surface litter layer are volatilized with fire. Nitrogen is a limiting nutrient for tree growth. Hot fires that totally consume the surface litter layers and transfer heat into the upper soil surface can cause the vohtization and loss of nitrogen needed for growing new trees. Prescribed spnng fires are typically low intensity burns that expose only small areas of soil and create only minor nitrogen losses.

Another fuel treatment tool is the removal of unmerchantable material from harvested areas Removal of this material may reduce levels of large woody debris on the site below levels capable of sustaining long term productivity Cleaning up fuels can create undesirable losses in fertility.

Recent findings suggest that large woody material is a conduit for maintaining healthy ecosystems by providing habitat for small mammals, acting as a substrate for beneficial fungi and serving as nutrient storage over long periods of time

b. Indirect Effects

Changes in soil characteristics can affect water quality. An increase in soil compaction, erosion or displacement can cause an increase in stream sedimentation. The effect **of** sedimentation on fish habitat is discussed in the Fish section of this Chapter.

Reduced site productivity caused by compaction, volatilization or erosion can, in turn, reduce the growth rate of future stands and can influence the density and diversity of both cover and forage for wildlife. The actual reduction of site productivity is difficult to predict due to the complex interrelationship among stand stocking, genetic improvement, mitigation measures, soil disturbance, natural recovery, climate, and other factors Though potential impacts to site productivity are real, they do not vary significantly by alternative

c. Cumulative Effects

Impacts to soil productivity occur on site Off site effects occur when eroded material or mass movements deliver material to stream systems. There are no impacts to the soil resource from off-Forest management activities

Separate management actions prescribed on the land have the potential to create soil disturbances that are cumulative in their effects on soil productivity Compaction disturbances attributed to site preparation would be in addition to compaction damage from logging operations Productivity reducing effects of broadcast burning would also be cumulative to compaction damage on the site

Erosion and compaction impacts are localized and typically discontinuous or scattered in harvested areas Regeneration after soil disturbance can occur in a three to five year period on the west side of the Forest For the drier east side, revegetation may require seven years or longer

The length of time natural forces need to act to restore compacted soil to normal bulk densities is not known In environments where freeze thaw action is present, the upper two inches of the compacted zone eventually returns to precompacted conditions In more moderate climates, freeze thaw action does not alleviate compaction The effects of soil compaction following tractor harvest can last longer than 40 years.

Commercial and pre-commercial thinning with ground based equipment may add to existing compaction damage from previous harvest activities Compaction from successive thinning entries is also cumulative

Cumulative effects to soil productivity will be greatest with those alternatives with the largest timber harvest and road construction program. With higher harvest levels, more acres will be compacted by tractor harvest operations, and by road construction and reconstruction Higher harvest levels will also result in more site preparation activity that can cause soil erosion, nutrient loss from prescribed burning, and the removal of woody material important for ecosystem stability.

The greatest, adverse cumulative effects on soil productivity are anticipated with the CUR Alternative, which schedules 7,900 acres of regeneration harvest, **3,000** acres of commercial thinning and 19,000 acres of intermediate harvest in decade **1** Additional cumulative effects would occur, from combined timber harvest and site preparation activities and from multiple timber harvest entries occurring with thinning treatments. Cumulative effects to soil productivity with the TGP Alternative is somewhat less than in CUR, with 5,400 acres of regeneration harvesting in the first decade, 4,700 acres of commercial thinning and 5,800 acres of intermediate harvests

The PRF and EGP Alternatives schedule the lowest levels of timber harvest Regeneration

harvest cuts and thinnings total 4,000 and 4,700 acres, respectively, with 5,500 acres proposed for intermediate harvest A smaller acreage will be disturbed by management activities, and fewer acres will be treated with multi-entry thinnings

d. Mitigation Measures

Specific Standards and Guidelines, presented in Chapter 4 of the accompanying Forest Plan, address the management concerns related to soils The intent of the standards is to place thresholds on acceptable resource impacts *for* compaction, erosion and broadcast burning. Rehabilitative treatments are required if soil damage exceeds the threshold value

In addition to Standards and Guidelines, other management practices have been used to reduce the amount of compaction in harvested units. Such measures include. 1) avoidance of the impact by harvesting with cable logging systems, 2) limiting tractor harvest to periods when soil moisture is relatively low; 3) prescribing low-ground-pressure tracked vehicles; and 4) designating skid trails that operators must use during harvest. Alternatives to piling slash by tractor include broadcast burning, lopping and scattering, hand-piling, and shovel and track hoe piling. These methods (especially hand-piling) are costly, and broadcast burning can adversely impact soil fertility and air quality, while increasing the risk of creating unwanted wildfires.

Once compaction damage has been sustained, mitigation includes deep subsoil ripping. The effectiveness of ripping depends upon the type of implement used, soil properties, and soil moisture content. Data can be collected to help evaluate the effectiveness of ripping in restoring the productive qualities of compacted soils. Such information is needed to quantify the effects of compaction-related growth reductions in managed stands. The effectiveness of measures to mitigate compaction will be monitored using a point transect sampling system Long term changes in productivity may be evaluated through measurements of tree growth taken at ten year intervals, and by comparing the results with data from similar, uncompacted stands

Mitigation techniques for erosion beyond the listed Standards and Guidelines include water barring roads, skid trails and log drag corridors, designating streamside management zones, leaving down woody material, and applying a grass/mulch mixture to areas of exposed soil and bare cut and fill slopes of forest roads Using cable systems to reduce acreage harvested by tractors can minimize erosion impacts Broadcast burning can be timed and executed to avoid removing the duff layer. Prescribed spring broadcast burning is an effective measure in reducing duff consumption and exposure of soil on steeper slopes

Where general seed and mulch applications are not adequate to control erosion, "roll down" nets or mats can be applied The effectiveness of erosion control measures will be monitored during and after project implementation

Practices to reduce sedimentation in streams include leaving strips of timber and brush along creeks to serve as sediment filters, use of water bars in situations where channelling can occur, minimizing soil exposure, and spacing culverts frequently enough to prevent water in roadside ditches from traveling long distances A variety of retaining structures can be used to channel water flow and prevent soil movement Roads that have served their purpose can be ripped and seeded, "put to bed," so that the area can once again support vegetation The surface of heavily used roads, *or* roads in sensitive areas, can be stabilized by paving or surfacing with gravel to reduce sediment production.

Nutrient losses caused by removal of woody material can be mitigated by leaving five down logs of 40 cubic feet or more in volume per treated acre. Effectiveness of this mitigation is uncertain because the amount of material needed for maintaining long term productivity for different ecosystems has not been determined Mitigation provides for a minimum level of organic material be left as a source of organic carbon to fuel the microbiologic populations important to the nutrient cycling process.

Base nutrient concentration requirements for different Forest soil types must be developed to adequately evaluate the impacts of harvesting on nutrient depletion.

Research has demonstrated that applications of nitrogen, although expensive, are highly effec-

tive in increasing short term productivlty More information is needed about Forest stand responses to fertilization on different Forest soil types

See the Facilities section of this Chapter for additional mitigation measures related to roads.

All Alternatives

Since several factors affect soil productivlty, the Land Disturbance Index (LDI) is used to compare each alternative's potential effect on soil productivlty The LDI is an estimate of the "equivalentroaded acres" created by an alternative. The LDI represents Forest-wide effects of major land-disturbing activlties, such as timber harvesting, road building, and fire. For further definition of LDI, see section a. of the Water and Ripanan Areas section of this Chapter

PRF Alternative

The Land Disturbance Index (LDI) for decade 1 would be 36.5. Increased disturbance from road construction and increased recreational use and site development would be offset hy a lower timber harvest and watershed stabilization or improvement projects There is a steady decrease in LDI to 34.1 by decade 5.

CUR Alternative

The LDI would be 443 for decade 1 and decreases to 42 1 in decade 5 Minor loss of soil productivity could result in decades 2 and 3 due to timber harvesting, livestock grazing, and use of developed recreation sites. Fewer projects would be done to rehabilitate deteriorated watersheds

EGP Alternative

The LDI for the first decade is 36.6, declining to 32.2 by decade 5 Timber harvesting in this alternative is group selection, rather than clearcutting, whch accounts for a lower LDI than CUR and TGP In addition, watershed improvement projects would help mitigate any effects of harvesting activlties

TGP Alternative

The LDI would be 40.2 in decade 1, declining to 39.8 by decade 5 Increased timber harvesting is the main cause of the increase in LDI Watershed improvement projects would help mitigate effects of increased timber harvesting and meet minimum management requirements

18. SPECIAL AREAS

The issue for Special Areas focuses on two questions. what new areas should be recommended, and what management should the Forest's emstmg and proposed Special Areas receive Special Areas include. (a) Experimental Forests, (b) Research Natural Areas, (c) National Natural Landmarks, and (d) Special Interest Areas. This section describes the general environmental consequences of the alternatives to each of these. Appendices F, G, and H, respectively, describe in detail the consequences to the latter three categories.

To summarize the effects on all types of special areas together, all alternatives will continue current management on the existing special areas, whch are two experimental forests and two Research Natural Areas totalling 20,695 acres (1.8 percent of the Forest) The CUR Alternative would add no new special areas The TGP Alternative would add the six candidate Research Natural Areas established for scientific and/or natural baseline purposes for a total of 30,507 acres (27 percent of the Forest) The PRF Alternative would add six candidate Research Natural Areas, and seven Special Interest Areas, for a total of 32,812 acres. The EGP Alternative would add the six candidate Research Natural Areas, plus one recommended National Natural Landmark, and seven Special Interest Areas, for a total of 32,912 acres (2.9 percent of the Forest). These would be established under 36 CFR 294.1 for scientific, natural baseline, and/or recreational/ecological significance.

a. Direct and Indirect Effects

The direct and indirect effects for each type of special area are descnbed below

(1) Experimental Forests

Expenmental Forests are managed by the Pacific Southwest Forest and Range Expenment Station Because management responsibility for expenmental forests does not lie at the National

Forest level, the Blacks Mountain and Swain Mountain Expenmental Forests would continue to be managed according to emsting management plans under all alternatives Thus, the consequences of each alternative on experimental forests are negligible

(2) Research Natural Areas

All alternatives will involve protection of the existmg RNA's: Blacks Mountain and Cub Creek (4,443 acres). They will continue to be managed to preserve their natural condition, under provisions of their existing establishment reports, and will be available for scientific study as baselines of undisturbed ecological conditions and processes Development activities will continue to be prohibited, mcluding timber management, road bmlding, concentrated recreation, mineral exploration and development. See Appendix F, Research Natural Area Evaluation, for more specific consequences of RNA designation.

PRF, EGP, and TGP Alternatives

Six candidate areas totalling 9,812 acres would become RNA's (pending completion of evaluation and establishment by the Chief of the Forest Service) and be managed to preserve their natural condition for scientific study They are Green Island Lake, Indian Creek, Soda Ridge, Timbered Crater, Mayfield, and Graham Pinery The Forest would prepare an establishment report for each, specifying management pronsions. Development activlties would be prohibited, and the areas would be withdrawn from mineral entry All candidate RNA's will be managed to maintain their inherent qualities until final selection and approval by the Regional Forester and Chief.

CUR Alternative

No new RNA's would be recommended. The 9,812 acres of candidate RNA's would be available for development activlties.

(3) National Natural Landmarks

The consequence of national natural landmark (NNL) listing would be to preserve sites illustrating the geological and ecological character of the Nation, and to draw attention to their educational and scientific values Seven areas on the Forest are considered possible NNL candidates. The consequence of not listing would be to leave the sites available for activities that may degrade some of those values including timber harvest, road construction and mning The specific consequences of listing or not listing each candidate National Natural Landmark are listed in Appendix G, National Natural Landmark Evaluation General consequences for each alternative are descnbed below

PRF, CUR and TGP Alternatives

No areas would be recommended for national natural landmarks. The candidate areas would be available for a full range of possible development activlties including timber harvest, and geothermal, oil and gas, and mneral development. Public interest and recreation would not be heightened by NNL listing, and the lack of special protective measures could allow the unique natural values to be degraded

EGP Alternative

One 100 acre area would be recommended to the National Park Semce for listing as a National Natural Landmark Deep Hole The area would be protected in its natural condition by withdrawing it from mneral entry and precluding timber harvest on the floor of the crater. More specific management provlsions would be established in an NNL area management plan prepared by the Forest after listing by the Secretary of the Interior Listing would increase interest in, and bring recreation to the area. It would also facilitate more protection and interpretation of its unique features

(4) Special Interest Areas

The consequence of special interest area (SIA) classification (establishment) would be to preserve and draw attention to the recreational, ecological, educational, and research potential of areas havlng particularly important natural history values. The consequence of non-classification would be to leave the areas available for activities that may degrade some of these values such as timber harvesting, mining, road bulding, concentrated recreation, and livestock grazing. The specific consequences of classification and non-classification for each candidate special interest area are descnbed in Appendix H, Spe-

cial Interest Area Evaluation General consequences of each alternative are descnbed below.

PRF and EGP Alternatives

Seven areas totalling 2,305 acres would be classified as special interest areas under 36 CFR **294.1** Black Rock, Crater Lake, Deep Hole, Homer/Deerheart, Montgomery Creek Grove, Murken, and Willow Lake Bog. They would be protected in their natural condition for public enjoyment, and managed to protect the specific geologic, scenic, or botamcal features for which the areas were estabhshed Specific management provlsions would be established in SIA management plans, which the Forest would prepare after area classification hy the Regional Forester Withdrawal from mineral entry would be recommended, and timber harvesting and other vegetation manipulation would be prohibited in the Montgomery Creek Grove, Willow Lake Bog, and Murken botanical areas. Livestock grazing would continue in the areas until **SIA** plans reconsider the issue. Timber harvesting conforming to a visual quality objective of Partial Retention could continue in the others. SIA status would increase recreational and educational use of the areas; it would also facilitate more interpretation and protection of the unique features

CUR and TGP Alternatives

No areas would be classified as special interest areas. The candidate areas would be available for the full range of possible development activlties noted above Public interpretation and recreation would not be heightened, and lack of special protective measures could allow the special natural values to be degraded.

b. Cumulative Effects

Land allocations that call for more intensive management such as timber production are most likely to affect potential Special Areas that are not recommended for designation. This could result from the alteration of natural settmgs In many mstances, retention of the natural environment is crucial to imparting and protecting the values which qualify an area as a Special Area The CUR and TGP Alternatives have the greatest potential impact on Special Areas from proposed management activities, while PRF and EGP have less.

Calling attention to an area by designating it as an SIA has the potential to increase vlsitor use, which may have an adverse effect on the feature for which the SIA was established, such as the Willow Lake bog **An** SIA management plan (to be developed for each area) will specify measures to protect significant features while provlding mterpretative opportumties for SIA visitors.

c. Mitigation Measures

If an area is not selected for Special Area designation, vegetative and recreation visitor management techniques could be used to help mitigate any potential adverse impacts on nonselection If management of nonselected Special Areas were to follow closely the Standards and Guidelines for selected areas, these could be considered as mtigation measures to help offset the potential negative impact of nonselection. Momtonng dunng project implementation could also be done to maintain the suitability of nonselected areas for future designation.

19. TIMBER

Harvest actinties associated with the vanous altematives will affect the structure and species composition of future stands of timber. In turn, timber harvest and related activlties (thinning, planting, slash treatment, etc) have significant effects on nearly all other components of the envlronment (indirect effects) Each alternative provides substantially different levels of timber production Increases or decreases from current programmed harvest levels can have significant and cumulative effects on both the socio-economic setting in northeast California, and on long-term productivlty of timber and other forest resources.

Even-aged management (clearcutting and shelterwood cutting) will be the pnmary silvlcultural treatment used in three of the altematives--PRF, CUR, and TGP Uneven-aged management in the form of group selection harvests would be used in sensitive view areas and in selected wildlife management areas Group selection mll be emphasized in the EGP Alternative.

The effects of the alternatives on the timber resource are displayed in this section Environmental effects from timber outputs are displayed throughout all of Chapter 4 In particular, the sections on Economic, Social, Fire, Soils, Vegetation and Diversity, Water and Ripanan, and Wildlife display some key envlronmental effects due to timber harvest

All **Alternatives**

a. Direct Effects

The overall timber management issue is twofold what areas should be allocated to timber production, and what practices should be conducted there To predict the envlronmental consequences of each alternative on the timber resource, the following aspects are addressed.

- Determination of suitable timber lands.
- Timber management on suitable timber lands
- Allowable sale quantity, long-term sustained yield, growth, and departure.
- Silvlcultural and harvest practices
- Projected future condition of the timber resource

The conceptual background of these aspects is gwen in the next section, "All Alternatives," which also describes consequences that are common to all alternatives. Consequences that differ between alternatives are shown on Table 4-16, and are described in the subsequent subsections

(1) Determination Of Suitable Timber Lands

Suitable Timber Lands The ability of the Forest to produce timber is mainly determined by the quantity and quality of lands allocated to timber production. The procedure for determining which lands are "suitable" is descnbed in Appendlx N, "Identification of Lands for Timber Production ·· Using this procedure, the Forest identified 770,110 acres as tentatively suitable, whch represents about 68 percent of the total land base. Each alternative started out with the same tentatively available and smtable landbase for timber management. Based on the theme of each alternative, some of these acres were later determned not to be smtable. This occurred if the land was (1) assigned to other resource uses that precluded timber management, (2) needed to meet minimum management requirements or other objectives that precluded or limited timber management; or (3) determined not to be cost efficient in meeting management objectives over the planning honzon. These lands are classified as "not sutable" for timber production in the alternative.

Removing land from the suitable land base reduces the potential allowable timber harvest The magnitude of this reduction depends not only on the amount of land removed, but also on its relative productinty Reductions can be somewhat mitigated by increasing timber management intensity on the remruning suitable acreage

Unsuitable Timber Lands Forest lands not available for timber production are considered unsuitable. These include classified areas such as Wilderness and Research Natural Areas In addition, timbered lands lying within semi-primitive motorized and non-motorized areas are considered unsuitable. Spotted owl, marten and fisher habitat areas, and proposed Wild and Scenic Rivers are also considered unsuitable for timbermanagement On unsuitable timber lands, harvesting may occur on rare occasions to reduce unacceptable losses from forest pests or drought, and to improve or maintain wildlife habitat

(2) Timber Management On Suitable Timber Lands

Timber management on suitable timber lands is categonzed as full, modified, or limited. Full management is high yield forestry charactenzed by silvlcultural practices such as clearcutting, shelterwood, and group selection cutting Available acres considered for full timber management are denved from Timber (T) Prescnption lands

Modified management uses these same practices, but may require modified sizes and shapes of harvest areas or longer rotations of regener-

Table 4-16

Timber Consequences of Each Alternative

		Alternative			
		PRE	CUR	EGP	TGP
Suitable Timberland		596,341	744,577	585,881	633,796
Suitable Acres by Production Category	Full	245,082	394,418	280,083	283,977
	Modified	87,958	148,792	47,552	111,232
	Limited	254,301	201,367	258,246	238,587
Average Annual Sale Quantity, (MMBF)	Decade 1	96	171	94	118
	Decade 5	113	171	94	124
Long-Term Sustained Yield Capacity, (MMBF)		139	215	95	157
Average Annual Growth, (MMBF) 1/	Decade 1	201	216	190	210
	Decade 5	119	153	95	146
Regeneration Harvest (Acres)					
Clearcut	Decade 1	16,000	38,000	0	33,000
	Decade 5	16,000	39,000	0	30,000
Shelterwood	Decade 1	10,000	21,000	0	2,000
	Decade 5	7,600	17,000	0	700
Overstory Removal	Decade 1	9,000	20,000	9,000	9,000
	Decade 5	7,100	0	7,600	6,200
Group Selection	Decade 1	5,000	0	31,000	10,400
	Decade 5	5,000	0	25,000	0
Timber Stand Improvement (acres)	Decade 1	4,700	8,000	4,700	4,700
	Decade 5	7,000	5,100	4,100	10,400
Expected Plantation Acres Burned	Decade 1	72	100	73	73
	Decade 2	72	500	73	73
	Decade 3	97	1,100	98	98
	Decade 4	530	1,600	182	914
	Decade 5	1,038	1,600	102	2,120
Minimum Rotation Age (yrs):		120-150	60-90	120-150	70-110
Stand Character At Minimum Rotation 2/	Min Diameter (Inches)	18-45	14-30	18-45	14-35
	Ave. Diameter (Inches)	32	22	32	24
	Min Height (Feet)	80-170	70-130	80-170	70-150
	Ave. Height (feet)	125	100	125	110

1/ Includes growth on suitable acres only

2/ 50-100 trees per acre would exceed these sizes

atedstands, comparedtofullmanagement Modified timber management is applied to a vanety of lands, including those assigned a Visual Quality Objective (VQO) of Partial Retention, and can result in the extension of rotation ages by 15-25 years Available acres considered for modified timber management are denved from View/Timber (V) Prescription lands.

Limited management primanly involves individual tree cutting. Limited management is applied to lands assigned a VQO of Retention as well as other areas such as mldlife habitat, old growth retention areas, and npanan zones Available acres considered for limited timber management are derived from Riparian/Fish (F), Old Growth/Goshawk (G), and Rocky/Sparse (K) Prescription lands Successively lower yields per acre are expected to result from modified and limited management; economic losses will also occur Discussion of these management concepts is found in Appendlx N. The discussion of the appropnate use of even-aged and uneven-aged management methods is found in Appendix O.

(3) Allowable Sale Quantity and Long-Term Sustained Yield

The Allowable Sale Quantity (ASQ) is based on the sutable or scheduled acres modeled in FORPLAN analysis The suitable acres associated with the ASQ vary by alternative and range from 585,881 acres with the EGP Alternative to 744,577 acres with CUR Although ASQ is expressed as an average annual quantity, it actually applies on a decade basis because the amount of timber sold each year may vary The principle of nondeclining yeld applies to all of the alternatives, this requires that the ASQ for any decade must be equal to or greater than that of the previous decade Additional non-scheduled harvests (not included in the ASQ) may be obtained by salvage cutting on some land classified as not suited for timber production. The Forest's previous Timber Management Plan (1975) had an original ASQ of about 28 million cubic feet (179 2 million board feet) per year

The long-term sustained yleld capacity (LTSYC) is a prediction of the maximum timber volume that can be sustained annually from the available and suitable timber lands on the Forest, consistent with the multiple use objectives of each alternative The differences in long-term sustained yleld capacities between each alternative reflect both (1) the number of acres available for timber management, and (2) the intensity of timber management scheduled for those acres LTSYC would be larger for alternatives havlng more acres allocated to full timber management ASQ would likewise be higher, but the existing timber inventory and growth on suitable timber land, cost-efficiency, management constraints, and budget limitations (if any) reduce it below the LTSYC The LTSYC is the theoretical upper limit for the ASQ.

The CUR Alternative has the most acres assigned to full timber management and the highest LTSYC, followed by the TGP Alternative On a decadal average, all stand growth is periodically harvested on lands allocated to full timber management, no increase in inventory is seen over the long term. Harvesting practices on lands receiving modified and limited timber management are designed to achieve additional resource objectives, such as vlsual quality, and do not capture all the growth in these stands

As stands become more regulated across the Forest, the ASQ for the PRF and TGP Alternatives approaches long-term sustained yleld For example, by decade 5, the ASQ for the PRF Alternative increases to 127 MMBF in both sawlogs and other products This represents 91 percent of LTSYC The ASQ for the TGP Alternative in decade 5 is 140 MMBF or 89 percent of LTSYC

Similar increases for decade 5 are not shown for CUR and EGP In EGP, no use of herbicides is planned to regenerate stands. This will preclude some areas from being considered for harvesting where herbicide applications would be essential to achieve fully stocked conditions after regeneration Lands not considered are typically so steep that mechanical site preparation is not possible, and manual release is not practical due to economic, safety and other factors

Departures from the ASQ (in cubic feet) are allowed under certain circumstances (36 CFR 219.16), including those where implementation of the normal base sale schedule would cause a substantial adverse impact upon a community in the economic area in which a Forest is located By definition, departure requires a future decrease in the timber sale and harvest schedule to

bring the ASQ in line with long-term sustained yield Harvest levels are monitored and adjusted every ten years to insure that long-term sustained yeld is not reduced

Growth and inventory of forest stands is measured in units of cubic foot volume because it is dependent on numerous product requirements occurring within a locale, region, or the nation as a whole. Board foot volume measurement varies with size of trees and is designed for certam product specifications and current technology It is presently Forest Service policy (FSM 1922 15) to use cubic foot volume as a measurement of long-term sustained yield, as well as to regulate the amount of timber to be offered and sold as specified by the allowable timber sale quantity.

Tables were constructed for MBF and MCF per acre, resulting in vanable board footlcubic foot ratios between existing strata and second growth over time In existing stands, strata which have higher volumes per acre tend to also have higher board foot/cubic foot ratios. In second growth stands, the board footlcubic foot ratios increase as the stand gets older and tree chameters increase.

The stands scheduled for harvest in the first decades are those with the highest economic value while meeting the management objectives of the alternative. These stands happen to also have a higher board footlcubic foot ratio As second growth stands are harvested with a lower economic value, they will have a lower board footl cubic foot ratio. Hence, board feet harvested over time declines while cubic feet remain constant.

(4) Silvicultural And Harvest Practices

(a) Cutting Practices

Historically, the Lassen National Forest has used intermediate (sanitation and salvage) harvesting extensively. Until recently, very few plantations were established outside of reforesting wildfires. The net result of this is an age class structure of stands heavily skewed to the middle age classes In some cases, past intermediate cutting has left sites under-stocked Here, even-aged silvlcultural systems can be used to· (1) improve stocking levels; (2) improve growth rates; and (3) aid in reducing the incidence of disease In addition, even-aged management is used to increase the occurrence of shade intolerant species such as ponderosa and Jeffrey pine Even-aged silvlcultural systems are emphasized in all alternatives except EGP

Of the 770,110 acres suitable for timber production on the Forest, 57 percent are in mixed conifer type, 29 percent are in eastside pine, and 10 percent are in red fir, and 4 percent are in lodgepole pine All of these types are suitable for even-aged management as described in Agricultural Handbook No 445, Silvlcultural Systems for the Major Timber Types of the United States. Dunng the past three decades, harvesting on the Swain Mountain Expenmental Forest (located within the administrative boundaries of the Almanor Ranger District) in the red fir timber type has demonstrated success in obtaining natural regeneration using small clearcut, shelterwood, and seed-tree systems. For eastside pine and mixed conifer timber types, artificial regeneration followmg clearcuts has been successful over the past three decades in northern Cahfornia provlded that good site preparation, tree handling, and nursery practices are adhered to

Clearcutting will be used on the Lassen National Forest in all alternatives except EGP only when it can be shown that it provldes the best silvlcultural system for managing a stand while meeting other resource objectives. Reasons for selecting clearcutting are site-specific and may include:

1) To regenerate under-stocked stands.

2) To encourage shade intolerant conifer species

3) To reduce fire hazard

4) To minimize nsks due to insects and disease.

5) To lessen the extent of ground disturbance and watershed impacts.

6) To improve stand growth

Group selection is considered an uneven-aged silvicultural system This system creates small openmgs of two acres or less within the forest canopy The PRF, EGP, and TGP Alternatives, by design, incorporate group selection harvesting The PRF Alternative designates compartments within three Management Areas in which

group selection will be emphasized These selected Management Areas are located to provide a good test of group selection in the eastside pine, mixed conifer, and red fir timber types EGP relies entirely on group selection for all regeneration harvests where planting is necessary TGP strives for a balance (in terms of acres treated) between clearcutting and harvests with group selection, shelterwood, and individual tree selection

Individual tree selection is the other uneven-aged silvicultural system This system is incorporated into all alternatives and is primarily reserved for acres managed for resources other than timber such as riparian zones, visually sensitive areas, or wildlife areas

Commercial thinning (included as an intermediate harvesting technique) is included in all alternatives. Commercial thinnings are proposed in existing stands to maintain acceptable stocking levels, and to promote the growth and vigor of residual trees In the future, commercial thinnings will become more important in regenerated areas as these stands grow and mature. Sanitation/salvage harvesting (an intermediate harvesting technique) will be done for all alternatives to reduce losses due to insects, disease, and fire Thinning, sanitation, and salvage intermediate harvest systems, along with individual tree selection, will also be the primary harvest methods on rocky sites

(b) Logging Systems

Use of all logging systems to harvest timber will continue on the Forest under all alternatives Selection of appropriate systems will be done at the project level and will be based on silvicultural needs, watershed protection, operational feasibility, and costs The proportion of harvest by the various systems would not vary significantly by alternative, since all slope classes are harvested similarly in all alternatives.

(c) Rotation Age

The time period between plantation establishment and final harvest is known as the rotation age The minimum rotation for a stand is determined by the point in time where growth in cubic feet of wood no longer is increasing To foresters, this concept is defined as the culmination of mean annual increment of cubic foot growth Intermediate commercial thinning harvests trees which would die, and promotes vigor of the residual trees increasing the productive life span (rotation) of the stand

For Forest modeling purposes, minimum rotation ages are defined This is needed to determine a potential yield for the Forest and is most useful in modeling yields from plantations. Rotation ages for existing stands is difficult to determine as past growth history, harvest, and tree mortality are, in most cases, unknown. Again, for modeling purposes and based on data collected for the major timber types (normal yield tables), certain size classes in existing stands are assumed to reach culmination of mean annual growth. For individual project proposals, rotation ages for individual stands will be based on site specific information and resource needs

Modeling rotation ages varies by timber type and land management objectives The PRF and EGP Alternatives assign minimum rotation ages of 120 years and emphasize commercial thinning CUR and TGP have minimum rotation ages set between 60 to 110 years

(d) Reforestation and Timber Stand Improvement

Regenerated even-age stands will generally be 5-20 acres in size and much more uniform in size and species composition than most existing stands. Regenerated group selection stands will be less than two acres in size All existing species will be maintained, but proportions will differ

On the east side of the Forest, ponderosa pine and Jeffrey pine will be the major species planted On the west side, white fir, red **fir** and ponderosa pine will be the major species planted Incense cedar would not be extensively planted because it grows slower than the other species. Douglas-fir will be planted where it naturally occurs.

Until recently, planting sugar pine has been discouraged. Sugar pine is susceptible to the fungal disease, white pine blister rust, which is well established on the Lassen National Forest as it is in most of California While older trees can survive with blister rust infections, seedlings can not Hence, investments associated with planting sugar pine were a poor risk

The Forest is actively participating in a program designed to identify disease resistant, mature,

seed producing sugar pine These trees are being protected from harvest Through testing procedures, trees can be identified as resistant to the disease or not. The Forest is currently planting rust resistant seedlings grown from seed from identified rust resistant parent trees. By the year 2000, all projected sugar pine reforestation needs are expected to be met with rust resistant seedlings

Incense cedar and white fir will continue to occur naturally both in uncut islands of young growth inside regeneration units and areas adjacent to most regenerated areas. These species are more shade-tolerant than ponderosa pine, so natural seed dissemination would maintain these two species as a vlable component of the new stands

Red fir will continue to dominate in its habitat. Sbelterwood cutting for natural regeneration will be used to a greater extent in true fir stands than in other timber types

Increasing the dominance of planted species and growing trees of uniform size generates environmental nsks. Such stands are believed to be susceptible to widespread insect and disease damage. This belief is based on the premise that uniform stands provide a greater host source for damaging organisms, and that pure stands overly tax critical soil nutrients However, maintaining trees in a healthy, vigorous condition is the best defense against insect and disease damage. The control of competing vegetation and proper stocking through release and thinning will foster such favorable conditions under all alternatives.

Site Preparation Reforestation will rely heavily on tractor piling and burning of slash to reduce fuels and provlde access to the ground for planting Broadcast burning will be used on steeper slopes where tractors cannot operate See the Fire and Soils sections of this Chapter for further discussion on site preparation impacts for each alternative

Timber Stand Improvement (TSI) Substantial timber stand improvement, mcluding release from competing vegetation and precommercial thinning, will be practiced under all alternatives

Christmas Trees Under all alternatives, Christmas trees will be harvested mth the objective of maintaining timber productivity and providing an enjoyable family outing Because it is difficult to control the cutting of proper trees, the individual Christmas tree program has the potential to reduce timber productivity Damage to wet roads on both the Forest and pnvate lands may continue However, the Forest will continue the program under all alternatives to maintain a quality recreational expenence

(e) Effects Of Wildfire On Plantations

To maintain the allowable harvest on the Forest, planted trees must reach merchantable size However, young, well-stocked plantations are more susceptible to destruction by wildfire than many emsting stands **As** more of the Forest becomes even-aged, increasing acreages will be in this hazardous condition. The expected plantation acreage that would burn is shown by alternative in Table 4-16

Losses due to mldfire have been accounted for in the calculation of the allowable sale quantity (ASQ) for each alternative. The fire management program selected for each alternative is the most cost-efficient program expected to keep the burned plantation acreage near these acceptable levels. Reforestation **of** burned areas is part **of** the annual reforestation target.

(5) Projected Condition of the Timber Resource

On land areas allocated to full or modified timber management, regeneration harvests will continue the conversion of existing timber stands toward a mosaic of even-aged stands of differing ages. Depending on the alternative, by the end of decade 5, a projected 25 to 60 percent of the presently poorly-stocked stands and 40 to 80 percent of the well-stocked stands will be regenerated, improving overall forest vlgor. Most existing timber stands will be regenerated by decades 9 to 12. After that time, harvests will come from regenerated stands where tree size and species will vary with site productivlty and other resource management goals

Where full timber management is used, stand size will range from 5 to 20 acres (or larger in special circumstances) and the minimum rotation will be 60-150 years. Where modified timber management is needed to preserve mldlife habitat or meet a vlsual quality objective of Reten-

tion or Partial Retention, stand size will generally range from 1 to 20 acres, the minimum rotation age will be 80-170 years, and trees will range from 20 inches to 48 inches or more in diameter Tree density (50-100 per acre) and height would be similar under both full and modified timber management

In areas allocated to limited timber management, changes will not be readily apparent for many decades, since harvest of individual trees or small groups will tend to maintain the present appearance Shade intolerant species such as ponderosa and Jeffrey pine will gradually be replaced with shade-tolerant species such as white and red fir

b. Indirect Effects

The rate at which timber is harvested (particularly mature and overmature timber), plus the level of management intensity, has significant effects on future stand structure, distnbution of size/age classes, species composition, productivity, and ultimately future harvest levels on the Lassen National Forest In those areas of the Forest allocated for long-term production of timber, it is an objective to establish a "regulated forest" in which there are reasonable assurances of a "sustained y e l d of timber products over the long term Economic and administrative reasons are the basis for this objective But both overcutting and undercutting of timber under a planned regulatory condition can create future deficits of both size and volume because such cutting controls the rate of new stand formation through regeneration A regulated forest can be mamtained with either even- or uneven-aged management **(or** a combination of the two).

The "regulated" Lassen National Forest of the future would contain a vanety of size classes and species of timber Modeling techniques are not currently available to portray an accurate description of the Forest by alternative, but estimates of future successional stages (found in Tables 4-17 and 4-18) provide some insight into the future forest. As can be seen, large sawtimber and old growth age classes (Stage 4) will compnse the highest percentage of total forested acres in future decades for all alternatives except CUR Stages 2 and **3** reflect timber stands in which sites are fully occupied and timber stands are growing at near maximum rates (assuming proper stand management) These stages compnse the second largest percentage of total growing stock for all alternatives in future decades. The PRF and TGP Alternatives may exhibit higher levels of diversity of stand structure due to a mix of both even- and uneven-aged management The EGP Alternative may have higher percentages of w h t e fir, and other more shade tolerant species, in younger age classes due to successional pressure afforded through uneven-aged management. The CUR Alternative will exhibit lower levels of structural diversity due to even-aged management and associated harvest levels The species composition in even-aged, younger stands (and future growng stock) will be pnmanly early successional species such as ponderosa pine and Douglas-fir.

Table **4-17**

Large Sawtimber and Old Growth Maintained Under Each Alternative (Thousands of Acres) a/

Base Year		Alternative			
1982	Decade	**PRF**	**CUR**	EGP	**TGP**
123	**2**	**106**	**131**	**97**	**110**
	5	**243**	**162**	**236**	**228**

a/ Stands with greater than 40 percent crown cover

The volume of timber harvested today has significant effects on the economic structure and social fabric of local communities Timber provides Jobs both directly (through local loggmg and timber manufacturing) and indirectly (through secondary support industnes and services) These effects are also cumulative in that timber produced on the Forest is used in other communities wthin an area referred to as the "Extended Area Of Influence" Future timber supplies will affect the ability of pnmary manufacturers of timber products to compete in a market plagued with uncertainties, as well as the ability of local communities to finance county school and road programs See the Economic and Social sections of this Chapter for analysis of timber harvest and effects on local communities.

Timber harvest impacts almost all other resources on the Forest, some positively and some

Table 4-18 a

Vegetation Diversity by Alternative
Percent of (a) Conifer Forest Formation and (b) Chaparral and Sagebrush Formations in Various Age Classes, and Diversity Index Values for Alternatives

a. Conifer Forest Formation 1/

Successional Stage 2/	Base Year 1982	Decade	Alternative PRF	CUR	EGP	TGP
1	4	2	6	7	8	9
		5	12	8	25	12
2	48	2	4	8	3	3
		5	14	18	7	20
3	32	2	67	68	68	67
		5	17	53	14	15
4 (Including Old-Growth)	16	2	23	17	21	21
		5	57	21	54	53
Diversity Index	0 82	2	0 65	0 69	0 65	0 66
		5	0 83	0 85	0.82	0 86

1/ Conifer forest formation consists of mixed conifer, red fir, lodgepole pine, and eastside pine habitat types

2/ Successional stages indicate dominate tree size classes 1) seedling, 2) saplings, 3) poles and small sawtimber, and 4) medium and large sawtimber, including old growth.

Table 4-18 b

Vegetation Diversity by Alternative

b. Chaparral and Sagebrush Formations 3/

Age Class (years)	Base Year 1982	Decade	Alternative PRF	CUR	EGP	TGP
0-20	8	1	17	21	17	17
		5	34	21	34	34
20-40	9	1	14	10	14	14
		5	2	14	4	4
40+	83	1	69	69	69	69
		5	62	65	62	62
Diversity Index	0 52	1	0 76	0 74	0 76	0 76
		5	0 72	0.80	0 72	0 72

3/ Chaparral and sagebrush formations consist of sagebrush, bitterbrush, wedgeleaf ceanothus, and manzanita types

negatively. Timber harvest reduces old growth. Harvesting also changes (but does not necessarily reduce) biologxal diversity of both plants and animals existing on the Forest Effects on these two environmental components (old growth and biological diversity) can be cumulative; effects are discussed in detail in the Vegetation and Diversity section of this Chapter.

Also see the Air Quality, Cultural Resources, Fish, Forest Health, Recreation, Soils, Visual Resources, Water and Riparian, and Wildlife sections of this Chapter.

c. Cumulative Effects

Cumulative effects of timber harvest on other envlronmental components are discussed under those relevant headings mentioned above In summary, the cumulative effects of the alternatives on timber relate pnmanly to social and economic issues and are discussed in detail in the Economic and Social sections of this Chapter. The cumulative effects on timber per se are reflected in projections of productivlty and composition of future stands, which have been calculated as current and future volume available for harvest (ı e long-term sustained yield and ASQ) It is assumed that application of proper silvicultural systems, including specific cultural treatments such as thinning and planting with genetically improved seedlings, will increase future productivity of forest stands.

d. Mitigation Measures

Mitigation measures are designed to protect or enhance forest resources Management activities in all alternatives will be governed by Forest-wide Standards and Guidelines which mclude management reqmrements and Best Management Practices. Direction provided in the management areas is another source of mitigation measure description.

The effectiveness of any mitigation measure will depend on a complex vanety of site-specific conditions The conditions and resultant impacts are analyzed dunng project level planning in an environmental analysis. Project planners and appropnate line managers will select the combination of mitigation measures which best address the nature and degree of risk of the impacts from the specific project Most mitigation techniques have been developed from research results, as well as from practical on-the-ground experience on what is effective. Monitonng will also be used to determine the effectiveness of mitigation measures.

Dispersing harvest units reduces effects on watershed, wildlife populations and habitat, and scenery. Dispersal can increase windthrow because it increases the amount of edge per unit area

A vanety of different species and ages of vegetation for wildlife, fish, soil and watershed resources will be provlded on the Forest at all times through planting, seeding, and encouraging natural regeneration. Health and stand **vlgor** would be improved through encouragıng species diversification in all management practices

Prescribed burning, and other forms of site preparation and vegetative management, will be planned to limit the intensity of treatment This helps to preserve the ability of the plant community to return to the desired ecologxal diversity through normal succession in the years after harvest.

The Forest Plan includes a monitoring strategy to evaluate how well the standard for diversity is being met.

Planting would increase biomass production and shorten the time trees are absent Bare soil would be held in place by litter layers and new live root masses Created openings would be reforested more quickly than if left to natural regeneration

In many cases, it is possible to save advanced regeneration on sites where clearcutting, group cutting, and shelterwood cutting is implemented The size of the advanced regeneration ranges from seedlings to poles The number of trees left vanes due to the following factors

- thriftiness of regeneration;
- actual number of trees in the understory;
- slope,
- number of larger trees harvested (logging damage).

Acceptable stocking levels would be achieved within five years of regeneration harvest Natural regeneration, wlnch is dependent on periodic seed crops, cannot always be assured within five years Where natural regeneration is the preferred method, adequate stoclung would, in most cases, occur within five years. It would always she followed by continued efforts to achieve minimum stoclung, assuming the full range of management tools are available.

Snags and logs left for wildlife should provide at least minimum amounts of nutrients for recycling through the soil to replace harvested and burned vegetation. Down logs are a component of stable ecosystems and contnbute to long-term productivlty

Threatened, Endangered, and Sensitive plant and animal species would he protected from degradation. Biological evaluations will determine presence, location, amount, and extent of Sensitive species. This information will be used in the decision-making process for every management activity. Project design would consider species viability for all Threatened, Endangered, and Sensitive species.

Even-aged management is the predominant silvicultural strategy on the Lassen National Forest for three of four alternatives. Spatial distribution of units will, over time, develop a mosaic of age classes and heterogeneous fuel profiles that will be more resistant to the spread of major wildfires than would a homogeneous arrangement. Interlocking crowns, large accumulations of surface fuels, and understory vegetation, would be broken up by areas with relatively low flammability. Fire suppression effectiveness would be increased as a result of discontinuous fuel profiles and improved access.

Units would remain relatively fire-resistant until silvicultural activities, such as precommercial thinning, begin to contribute to the buildup of fine fuels. Plantations often shade old logging slash, presentmg a hazardous fuel complex. The potential rate of spread will drop sharply and then start to increase again after each thinning operation and fuel treatment.

Harvest cutting methods such as shelterwood, single-tree selection, and group selection also modify vegetation. This serves to reduce spread of major fires, but to a lesser degree than clearcutting. Any activlty taking place on a timber sale area would be covered in the timher sale contract, which would include requirements for equipment and operating procedures that reduce the potential for fire. These precautionary measures would be used in each alternative. In spite of these measures, some fires would probably escape, hut there would not be any significant change from histonc levels.

PRF Alternative

This alternative would harvest about 96 million board feet per year. The alternative would regenerate 26,000 acres in decade Ibyclearcut and shelterwood methods and 5,000 acres by the group selection method. During the 16-decade planning honzon, timber would be harvested from about 596,341 smtable acres, which is 77 percent of the tentatively suitable timber land About 43 percent of this sutable land would receive full timber management, 15 percent would receive modified timber management, and 42 percent would receive only limited timber management

About 8,200 acres of the lodgepole pine timber type would he managed for firewood production rather than sawtimber production. Firewood harvests would remove mdividual trees or groups ranging from 1 to 40 acres. These stands would be regenerated with lodgepole pine or a mixture of species.

During the planning horizon, the following factors would affect the timber resource: (1) the View/Timber Prescription is applied to 168,000 acres of land. Less intensive management through individual tree or small group selection would be required on these lands. The time interval for harvesting adjacent timber stands would be extended from 15 to 25 years; (2) maintaining 40 spotted owl temtones, one Habitat Conservation Area (HCA), 19 marten and five fisher management areas would allocate about 98,000 acres of timber land to a no scheduled timber harvest prescnption; (3) managing riparian zones under hmited timber management would extend rotations to 400 years and affect 28,000 acres; (4) managing old growth retention areas and goshawk territones would extend rotations to at least 200 years and affect 20,300 acres.

CUR *Alternative*

This alternative would harvest about 171 million board feet per year, the highest among all alternatives It would regenerate 59,000 acres in decade 1 by clearcut and shelterwood methods By decade 5, a projected one-third of all poorly-stocked stands and two-thirds of all well-stocked stands would be regenerated Dunng the 16-decade planning honzon, this alternative would harvest timber from about 744,577 sultable acres, which is 97 percent of the tentatively suitable lands About 53 percent of this sultable land would receive full timber management, 20 percent would receive modified timber management, and 27 percent would receive only limted timber management

Dunng the planning honzon, the followng factors would affect the timber resource: (1) the View/Timber Prescription would affect 111,000 acres of land by requiring less intensive management through individual tree **or** small group selection, and by extending the time interval for harvesting adjacent timber stands from 15 to 25 years; (2) maintaining 39 spotted owl terntones, one HCA, 19 marten, and five fisher areas would allocate 96,000 to no scheduled or limited timber harvest prescnptions; (3) limited timber management in npanan areas would extend rotations to 400 years and affect 31,000 acres

EGP Alternative

This alternative would harvest about 94 million board feet per year, reflecting the emphasis on a broad array of resource outputs It would regenerate 31,000 acres in decade 1 by the group selection method. During the 16-decade planning horizon, timber would be harvested from about 585,881 suitable acres, which is 76 percent of the tentatively suitable timber land About 48 percent of this suitable land would receive full timber management; 8 percent would receive modified timber management; and about 44 percent would receive only limited timber management

Dunng the planning honzon, the followng factors would affect the timber resource (1) the View/Timber Prescnption would affect 127,000 acres of land by requinng less intensive management through individual tree or small group selection, and by extending the time interval for harvesting adjacent timber stands from 15 to 25 years, (2) scheduling no timber harvest on 1,650 acres in each of 40 spotted owl temtones and one HCA, as well as in marten and fisher habitat, would affect about 98,000 acres of smtable timber land, (3) limited timber management in ripanan areas would extend rotations to 400 years and affect some 28,000 acres, (4) managmg old growth retention and goshawk terntones would extend rotations to at least 200 years and affect 20,300 acres

About 8,200 acres of the lodgepole pine timber type would be managed for firewood production rather than timber production. Firewood harvesting would remove indindual trees ranging from 1 to 40 acres. The stands would be regenerated with lodgepole pine or a mixture of species

TGP Alternative

This alternative would harvest about 118 million board feet per year. It would regenerate 35,000 acres in decade 1 by clearcut and shelterwood methods, and 10,400 acres by the group selection method. Dunng the 16-decade planning horizon, this alternative would harvest timber from about 633,796 suitable acres, which is 82 percent of the tentatively suitable timber land About 45 percent of this sultable land would receive full timber management; 18 percent would receive modified timber management, and only 37 percent would receive limited timber management.

Dunng the planning honzon, the following factors would affect the timber resource: (1) the View/Timber Prescription *is* applied to 146,000 acres of land Less intensive management would be required on these acres and the time interval for harvesting adjacent timber stands would be extended from 15 to 25 years, (2) maintaining 40 spotted owl territories, one HCA, 19 marten and four fisher management areas to no scheduled timber harvest would affect 98,000 acres; (3) limited timber management in ripanan areas would extend rotations to 400 years and affect 35,000 acres of suitable timberland; (4) managing old growth retention areas and goshawk temtones would extend rotations to at least 200 years and affect 20,300 acres

20. VEGETATION AND DIVERSITY

Introduction

This planning issue covers how the Forest's vegetation resources should be managed through time, and how vegetation and wldlife diversity should be provided while continuing other resource outputs. Diversity is the variation m vegetation, and thus habitat, that exists in the Forest. It may be described as the richness, evenness, and pattern exhibited among habitat types, habitat stages, and special habitat elements (snags, down wood, hardwoods, etc) In this discussion, diversity is addressed at four different levels: 1) Habitat Type Diuersity--the relative amounts ofvarious habitat types; 2) Habitat Stage Diversity—the distribution of each habitat type within various age, size, and canopy cover classes; 3) *Within-Stand* Diversity--the species composition and abundance of special habitat elements within individual habitat stages; and 4) Pattern—the sizes and juxtaposition of habitat stages. These four components of diversity are discussed separately below

An important element of the diversity issue is the amount of old growth that would remain under the various alternatives. Late seral forest stages are important to the many old growth dependent species of animals and plants. With a general reduction of old growth forests in the Pacific States, habitat for these species is decreasing and some species have become endangered. The Forest Service is directed to provide for diversity in terms of distribution and abundance of all different plant and animal communities. The National Forest Management Act of 1976 states through the implementing regulations found in 36 CFR 219.26, "Forestplanning shall provide for druersity *of* plant and animal *communities* and tree species consistent with the overall multiple-use objectives *of* the planning area."

Old growth stands are important for maintainmg biological diversity of plant and animal communities, and genetic vanability within species, all of which may be useful to present or future generations as a chemical or genetic reservoir for medicines, food products, or other commodities. In addition to old growth values for plant, wildlife or fishenes habitat, the stands are valuable as recreation areas For instance large, old trees provide shade and are visually pleasing on hiking trails Old growth stands also have value in maintaining soil productivity due to the large amount of organic matter left to decompose and enrich the soil, which also maintains high water quality by reducing erosion.

Old growth is included in successional stage "4". This successional stage serves as a useful indicator of the relative number of acres of mature stands in each of the altematives. Old growth acreages are discussed under Habitat Stage Diversity and are displayed in Table 4-18. When an increase in successional stage "4" acres is projected, it is worth noting that many of the ad&tional acres will not have old growth characteristics initially (such as decadence and age). Medium sawtimber (successional stage "3") that grows into large sawtimber stands would still require additional time to acquire all of the charactenstics associated with old growth.

Forest-wide Standards and Guidehnes provide that at least five percent of the acreage of each vegetative type and seral stage be mamtained in each management area It was assumed that sufficient acres would exist in the early seral stages without designatmg specific areas. However, late successional stands are most at risk from intensive timber management and have, therefore, been identified in each management area.

Late successional stands needed to meet the five percent diversity minimum were modeled for FORPLAN analysis with the following considerations: The stands contain relatively large trees (greater than 24 inches, timber size class 4, 5, or 6) with moderate to high cover (greater than 40 percent crown cover, cover class N or G). If stands meeting these requirements were not present in the management area, then the "next best" stands were chosen, with the assumption that they will develop old growth characteristics over time Tentative old growth retention areas were identified for this modeling Old growth retention areas will be verified for each management area as part of the enwonmental analysis of proposed projects.

All stands meeting these requirements found in wlderness areas, SOHA's, furbearer habitat,

goshawk temtones, Special Interest Areas, proposed Wild and Scenic Rivers or other reserved areas were counted first toward meeting the seral stage diversity acreage figure for the management area. Additional stands reqmred to meet the five percent minimum figure were selected based on their proximity to reserved areas or nparian comdors whenever possible. This will reduce fragmentation, facilitate management, and provide a logical network of smtable habitat and travelways for old growth dependent species. These stands are to be managed under a limited timber management prescnption. Timber harvests would be designed to improve habitat for the species being emphasized, and no more than five percent of the standing volume would be removed in any decade.

By setting aside stands for old growth retention, other **resources** will be impacted to a greater or lesser degree The decrease in timber harvest and accompanying road construction in these stands will potentially have a positive effect on cultural resources, fishenes, Sensitive plants, soils, vlsual resources, water quality, and many wildlife speciesby reducing the amount ofground disturbance. However, the reduced timber yleld will decrease the amount of wood available for biomass and/or sawlog products. Effects on range forage availability and early seral stage habitat wildlife species are less clear, but outputs for these resources will be somewhat reduced Forest fuels loadings may be significently affected by old growth management, since an old growth standischaracterizedby relatively large amounts of standing and fallen dead material, which potentially increases the fire hazard

All **Alternatives**

a. Direct and Indirect Effects

Habitat Type Diversity Forest activities will alter only three of the components of diversity—habitat stage diversity, within stand diversity, and pattern. Habitat type diversity is the relative amounts of various habitat types on the Forest, such as red fir forest, montane chaparral, dry meadow, etc. Since no major habitat type conversions are planned, no significant changes in the amounts of the various habitat types would occur under any alternative, thus, the habitat type diversity component is not discussed further

Habitat Stage Diversity Table 4-18 (page 4-88) summarizes the forest and shrub habitat stage component of vegetation diversity, specifically, the relative extent of each size and age class is shown Acreages of the seedling, small sawtimber, and large sawtimber sizes will increase (Table 4-18a) The "Diversity Index" values in Table 4-18a show the degree to which the acreages of the vanous stages approach maximum diversity—a value of 100, where the acreages of each stage are identical. Diversity index values for forest habitats indicate that all alternatives are relatively high and fairly similar, and that habitat stage diversity will decrease initially and then increase over time in all alternatives Shrub age class diversity also increases in the planning penod (compared to base year conditions) under all alternatives as a portion of the old decadent brush is converted to young brush stands by prescribed burning and other treatments (Table 4-18b). At least a minimum amount of old growth conifer habitat would remain from retention of wlderness, streamside, semi-pnmitive, spotted owl and furbearer areas, and old growth retention areas under each alternative However, some of the old-growth acreage reported is rocky, sparse timberland that does not necessarily provlde habitat for species requinng denser old-growth forest

The only other vegetation change common to all alternatives is a projected decline in blue oak (*Quercus douglasii*) numbers due to natural mortality and a lack of regeneration. The cause of regeneration failure is not well understood, but is under study. It is expected that a management recommendation to resolve this problem will be available toward the end of decade 1

Within-Stand Diversity The increase in regeneration under all alternatives will result in Forest-wide declines in vertically-diverse timber stands, hardwoods, snags, and down logs. However, a certain amount of this type of diversity will be maintained in all stands through use of Forest-wide Standards and Gmdelines intended to insure that vlable populations of all native species remain in each alternative In particular, management is used to insure that tree species diversity remains similar to that found in the natural stand for the area. For example, sugar pine has been declining in California and elsewhere because of mortality from the non-native blister rust fungus The Forest is working

on a program of identifying blister rust resistant strains of sugar pine for replantmg, to insure that this species remains a component of mixed conifer stands where it is naturally found.

Vegetative diversity is also maintained by management of special areas such as wetlands, nparian zones, wild and scenic river corridors, lava flows, Research Natural Areas, and Special Interest Areas. Many of these contain unusual vegetative types which are maintained in their natural states, and may contain unusual plant species, whch increase the species richness aspect of vegetative diversity. These special areas mterspersed with managed forest land also increase spatial drversity, which is desirable for species that prefer ecotones on the edges of different habitat types.

In addition, a number of management prescnptions would provide for within-stand drversity by maintaining multi-layered canopies, snags and other structural elements, and species' diversity. The use of modified, limted, or no timber management will be applied in various amounts under all alternatives. The total number of acres receiving the Late Successional, Semi-Primitive Motorized and Non-Motonzed, Special Areas, Riparian/Fish, View/Timber, Wilderness, and Minimum Management Prescnptions serve as indicators of within-stand diversity.

Pattern Maximum sizes of regenerated timber stands and the length of time between cutting adjacent stands are defined in Forest-wide Standards and Guidelines. This will maintain a minimum level of spatial diversity in all alternatives

Fragmentation is a particular concern. Fragmented or discontinuous habitat restricts the ability of some species to migrate, colonize, reproduce successfully or exchange genes between populations. The ecologxal and evolutionary interactions between species in isolated forest stands becomes similar to those in island ecosystems These stands typically have low population numbers, small habitat area, empty ecosystem niches, and low genetic variability. Their species and communities are more vulnerable to catastrophic disturbance, deletenous genetic dnft, and changes in habitat capability.

The degree of fragmentation of old growth and mature forest is dependent on:

- Amount of old growth and mature stands harvested;
- Distnbution of harvest units and remaining uncut stands;
- Shape of harvest umts and remaining uncut stands;
- Number and distnbution of roads;
- Natural distribution patterns of old growth and mature forest.

Although arrangement and shape of harvest units can be designed to reduce fragmentation, the amount of old growth and mature forest harvested has a larger effect on the degree of fragmentation. For example, if 70 percent of the old growth and mature forest in a geographic area is harvested and converted to young stands, fragmentation would occur regardless of shape and distribution of harvest units Shape and distribution of harvest units may be designed in a manner that retains corndors and reservoirs of diversity, but these cannot substitute for lost habitat

Roads are significant contributors to forest fragmentation. A number of small mammals, amphibians, and invertebrates will not cross roads. Roads also introduce grazmg animals, machinery, and humans which can be detrimental to native plant and animal species.

Road construction and maintenance is closely tied to the timber harvest program. Roads generally are built where harvest occurs, and the density of roads in a gwen area is correlated with intensity of harvest in that area

Differences in pattern among the PRF, EGP and TGP Alternatives would, for the most part, be nnnor. The CUR Alternative with its higher harvest level and reliance on even-aged management would lead to greater fragmentation of old growth stands.

b. Cumulative Effects

The total numbers of plant and animal species on the Forest should change httle or not at all as a result of the alternatives All alternatives are expected to maintain vlable populations of all

plant and animal species Their distnbution and abundance will vary according to natural range and location of suitable habitat, and the alternative chosen for the Forest Plan

c. Mitigation Measures

Mitigation measures for vegetation and diversity include

- Forest-wide Standards and Guidelines,
- Monitonng of mldhfe and vegetative diversity,
- Federal and State laws, and Forest Service policies, regarding Threatened, Endangered and Sensitive species.

Current knowledge concerning all the components necessary for the maintenance of diversity is inadequate Planmng concepts for providing diversity may become better developed in the future Project planning for "landscape" diversity (spatial distribution **of** diversity elements) will be more frequently employed in the envlronmental assessment process for site-specific project actinties

PRF Alternative

Habitat Stage Diversity Diversity index values in Table 4-18 indicate habitat stage diversity for conifer forests would decline from the 1982 base year value through decade 2 and then increase Large sawtimber and old growth acres would decrease to 106,000 acres by decade 2, but by decade 5 would increase to 243,000 acres, 198 percent of the 1982 level In shrub types, diversity would increase markedly in decade 1 due to continuation of the recently-begun program of prescnbed burning, but would decline slightly by decade 5

Within-Stand Diversity This alternative has 40 SOHA's and a relatively large number of acres assigned to prescnptions that maintain high amounts of snags, down wood, mixed plant species, and vertical structural diversity. Wildlife dependent on these elements would occur at moderate population levels

CUR *Alternative*

Habitat Stage Diversity Stage diversity of conifer types would decline initially in the first two decades and then increase through decade 5 Large sawtimber and old growth acres would increase to 107 percent of the base year in decade 2, and increase to 132 percent of the 1982 level (162,000 acres) by decade 5 Shrub stage diversity would reach a high level in decade 1, and increase slightly by decade 5

Within-Stand Diversity This alternative provides 39 SOHA's and a relatively low number of acres in prescnptions that would maintain high within-stand diversity Therefore, few forested areas would exceed minimum standards for snags, logs, and hardwoods Vertical foliage diversity would be low in most areas Dependent wildlife would occur in low densities.

EGP Alternative

Habitat Stage Diversity Stage diversity in conifer types would decrease initially, but return to the 1982 level by decade 5 Large sawtimber and old growth acres would decline to 79 percent of the 1982 level during decade 2 and increase to 192 percent (236,000 acres) by decade 5 Shrub age class diversity would be similar to the PRF Alternative

Within-Stand Diversity A network of 40 SOHA's is pronded A relatively large number of acres are assigned to prescriptions that maintain high amounts of snags, down wood, mixed plant species, and vertical structural diversity Wildlife dependent on these elements would occur at moderate population levels

TGP Alternative

Habitat Stage Diversity Habitat stage diversity for conifer forests would decline initially in the first two decades, then increase through decade 5. Large sawtimber and old growth habitat would decrease to 89 percent of base year in decade 2, and then increase to 185 percent (228,000 acres) by decade 5 Shrub stage diversity would be similar to the PRF Alternative

Within-Stand Diversity This alternative has **40 SOHA's** and a moderate number of acres assigned to prescriptions that maintain high amounts of snags, down wood, mixed plant species, and vertical structural diversity. Wildlife dependent on these elements would occur at moderate population levels.

21. VISUAL RESOURCES

Introduction

Effects on scenic quality are measured by the degree of change from the natural condition of an area. A landscape may appear natural or heady altered depending on the extent of the management activities in the area.

The most significant effects on the visual resources are from vegetation and landform alterations typically associated with resource management activities such as timber harvest, road construction, recreation facility development, and mineral exploration and development.

Visual quality objectives (VQO's) have been established across the Forest based on the National Forest Visual Management System (VMS). The VMS process is bnefly discussed in Chapter 3. These VQO's are descnbed as follows: *Preservation*, which allows management activities that are not obvious to the casual observer; Retention, which has management activlties that are noticeable, but do not dominate the landscape; Partial Retentzon, which has changes that are noticeable, but do not attract attention; ***Modification***, where management activities are obvious, but blend in with the surrounding landscape; and Maximum *Modification* where management actinties are obvious and dominate the landscape

Effects on visual resources from other management activities are descnbed below

a. Direct and Indirect Effects

Effects from Wildlife and Fisheries Management Some habitat improvement projects, such as prescribed burns and aspen regeneration cuts, could change the short-term character of the landscape in some local areas Project design will consider nsual resources under any alternative, so that such habitat improvements will appear natural.

Effects from Vegetation-Range Management Heavy grazing by livestock results in a generally altered landscape appearance. Structural improvements, especially fences, may be visually evident, and could detract from the natural landscape. Generally, improvements are small and localized, and they have a minor effect on the scenic quality of the surrounding area. There is little difference among the alternatives in amount of grazing use proposed.

Effects from Timber Management Timber harvest can impact **vlsual** quality because the removal of trees creates strong visual contrasts of line, form, color, and texture when compared to natural landscapes. These impacts are of most concern when seen from primary and secondary travel routes and visitor destinations. Viewsheds seen from such areas are classified as havlng sensitivity levels one or two. Alteration of undisturbed landscapes by timber harvest may be considered negative even if the VQO is met, because the existing visual conditions will be changed. In general, the visual effects of timber management are more acceptable where there is existing disturbance to the natural landscape than in places where no change in natural scenery has occurred. Timber management may also be used to improve visual quality, particularly where there are opportunities to rehabilitate unacceptable modification of the landscape or to remove unwanted view-screening vegetation.

The visual management system will be used in the design and layout of timber harvest units, regardless of alternative. Projects will be designed to meet visual quality objectives. However, the existmg visual condition (EVC) of the Forest would differ by alternative. The CUR Alternative has the greatest number of acres proposed for timber management, predominately with even-aged methods. Effects **on** the visual quality will be highest with CUR and proportionally lower with TGP, PRF and EGP

Effects from Minerals and Energy Development Mineral **or** energy exploration and subsequent development could have an effect on visual resources in any alternative Although efforts

will be made to reduce the vlsual effect of minerals activity, the nature of developments is such that Visual Quality Objectives may be difficult to meet In some cases, VQOs would likely not be met over the short term, although long-term mitigation through effective siting and other measures could result in VQOs being attained Existing mneral nghts would be honored Special stipulations to protect surface resources would apply in all alternatives The CUR and TGP Alternatives have the greatest potential for mneral and energy activities to affect vlsual quahty PRF and EGP recommend more acres for mineral withdrawal and, therefore, have less potential of adversely impacting vlsual quality from exploration **or** development

Effects from Utilities Development Utility comdors are long, wide, and usually straight clearings with high contrast to natural landscapes Corndors on the Forest are few and will not change by alternative, but their impacts are severe and persistent Under all alternatives, it is possible that vlsual quality would be damaged by placement of new utilities, **or** replacement and improvement of emsting ones.

Effects from Roads Roads create a dominating vlsual contrast on steeper slopes. Cuts and fills accentuate that contrast. The alternatives that provlde for construction of more roads in undeveloped areas have the greatest potential to change exlsting vlsual conditions. The CUR and TGP Alternatives would have the most impact on visual quality from road construction, because they bmld more roads

Effects from **Trails** On some trails, current levels *of* trail mamtenance are not sufficient to protect soil and stream banks, and there are vlsual effects associated with erosion and damage to stream crossings The PRF and EGP Alternatives provlde the greatest emphasis on trail construction and reconstruction Under these alternatives, the vlsual effect of trails in poor condition would be reduced Visual effects would be greater under CUR and TGP which call for less trail construction and reconstruction.

Effects **from** Fire Under all alternatives, wildfire could alter the character **of** the landscape. Prescnbed burn plans for other resource management activlties would include consideration of vlsual resources to blend bums in with the natural landscape

b. Cumulative Effects

Forest Standards and Guidelines for visual resource management would apply to any alternative Although each alternative would result in a change in EVC level in some areas, the overall vlsual character of the Forest would not change greatly dunng the first decade. Dunng the 50-year planning penod, significant changes in EVC could result from road construction and timber management Special Consideration would continue to be given to areas that are visible from sensitive travel routes Factors such as visual sensitivlty, scenic quality, and distance from viewers would continue to be used to direct project design

The EVC level would be most likely to change from natural to more altered landscapes under the CUR and TGP Alternatives **A** larger part of the Forest would be managed to meet VQO's of Modification and Maximum Modification Visual management would emphasize timber sale and other project design to meet vlsual quality objectives. Efforts to mitigate potential negative effects on scenic quahty would increase. More areas of the Forest would remain in natural landscapes in the PRF and EGP Alternatives, and more areas would be managed to meet VQO's of Retention and Partial Retention The EGP Alternative would maintain scenic values over most of the Forest with its emphasis on uneven-aged management

On pnvate lands adjoining the Forest, timber harvest has occurred and will continue Pnvate land owners are not expected to change their land management activities, therefore, there may be cumulative adverse impacts on Forest viewsheds where the pnvate lands are seen from campgrounds, communities, and pnmary travel routes.

c. Mitigation Measures

Mitigation in all alternatives would occur dunng Forest Plan implementation and project design stages Standards and Guidelines in the Forest Plan and the Forest Semce Handbook senes on visual resource management would guide mitigation efforts. Examples of mitigation that would commonly be used include

- Clcarcut units can be positioned so they hlend into the landscape Roads can be designed to limit their visual effect on the landscape

- Intensities of management actinties can bc rcduccd so they are evident, without dominating the landscape

- Unattractive views can be softened by feathenng the edges of harvest units, maintaining vegetative corridors between units and planting vegetation.

- Viewshed management plans can he developed and implemented that will protect, enhance and/or perpetuate the scenic values of an area.

- Uneven-aged timber management can he implemented to retain a relatively unbroken canopy and diversity in sizes of trees in an area

- Harvest unit size can be reduced to lessen the visual impact to an area. Residue from timber harvests can be eliminated through various slash disposal techniques and fuelwood gathering

- Low VAC areas can be avoided VAC (Visual Absorption Capability) is the ability of the landscape to absorb modifications and retain its aesthetic qualities Landscape areas that show change more than others (e.g., open meadows **or** ridgetops) can be avoided when designing activities such as roads **or** harvest units

Many other design techniques can be utilized to mitigate visual impacts of management activities. These are descnbed in the National Forest Landscape Management Series (USDA, Vol **2,** Chapter 6, 1973-1985).

Other management prescriptions will mitigate the effects of land disturbing actinties by maintaimng the natural appearance of the landscape These include the: Wilderness, Special Areas, Semi-Pnmitive Non-Motorized, Semi-Primitive Motonzed, Old Growth/Goshawk, Late Successional, Riparian/Fish, and Rocky/Sparse Prescnptions.

The effects of mitigation include increased costs to resource developers and permit holders, potential loss of revenues to federal and State governments, increased levels and costs of Forest Service administration, and potential inconvenience for visitors who are trying to reach **or** use parts of the Forest.

All Alternatives

Forest Standards and Guidelines **for** visual resources require that the highest possible visual quality be maintained throughout the Forest, commensurate with other resource needs. In all alternatives, campgrounds will retain a natural looking appearance in the foreground distance zone. The existing wilderness areas (Canbou, Thousand Lakes, and Ishi), amounting to 78,060 acres, will retain their completely natural appearance. The Eagle Lake backdrop is protected in all alternatives by meeting Inventoried VQO's, resulting in a natural-appeanng landscape as viewed from the lake and its shoreline. All alternatives will meet at least Partial Retention in foreground and middleground along State Highways 299 and 89, as part of the Pacific Southwest Region's Minimum Implementation Requirements (See Appendix B)

Full timber management is restncted by VQO requirements in Preservation, Retention and Partial Retention areas This results in less volume being available to contribute towards the allowable sale quantity for all the alternatives Timber stands are managed at less than their **full** potential. On the other hand, Retention and Partial Retention areas can often provlde suitable wildlife habitat **or** travel corndors for species that require stands with more dense canopy cover and structural diversity. Soil erosion and compaction would be less in stands that are only partially cut to maintain VQOs A protective vegetative cover will reduce the likelihood of stream sedimentation with its accompanying effects on water quality and fish habitat. There is less impact on recreational opportunities and user expenences in areas managed with a VQO of Retention **or** Partial Retention. Management actinties are blended with the surrounding landscape to reduce sharp contrasts in line, form, color and texture This is generally more pleasing to the Forest vlsitor.

Each alternative allows varymg levels of alternation within the landscape These levels of change are represented by the Visual Quality Objectives of each alternative. Management prescriptions can also be used as a measure of Visual Quality Objectives Alternatives can then be compared by their respective VQOs and management prescnptions. For example, the Timber (T) Prescnption represents a VQO of Modification or Maximum Modification because full timber management will occur on these lands The View/Timber (V) Prescnption is generally compatible with a VQO of Retention or Partial Retention, as only modified timber management is permitted In some cases, constraints imposed by a management prescnption could place an area in a higher VQO than its present designation These constraints may allow less alteration of the landscape than the VQO

PRF Alternative

This alternative would meet Preservation or Retention on 365,500 acres (32 percent) of 1,129,585 total Forest acres There would be approxlmately 454,200 acres of Partial Retention and 309,900 acres of Modification or Maximum Modification Visual Quality Objectives. Modification and Maximum Modification Visual Quality Objectives represent a decrease of 113,500 acres from 1982.

Along all State highways, county paved roads, and other key roads and trails, the foreground would appear natural to the traveling public, the middleground would appear slightly modified. The background would be dominated by obvlous alterations to the landscape, primarily due to timber harvesting and road building For other primary and secondary travel routes, foreground zones would appear almost natural to partially modified (with minor evldence of human changes) Middleground and background areas would appear to be dominated by obvious landscape alterations

Most visually-sensitive foreground zones would retain a natural appearance, many views that extend into middleground and background would be visually dominated by timber harvests

Two designated wilderness areas, four proposed wildernesses (Heart Lake, Mill Creek, Trail Lake B, and part of Wild Cattle Mountain), along with several semi-primitive non-motonzed areas, eight Research Natural Areas and seven Special Interest Areas would provlde 164,600 acres of completely natural-appearing landscape Several other areas with high scenic values would be managed to retain their natural appearing landscapes such as proposed Wild and Scenic River comdors.

As landscapes in the general forest area become increasingly modified, those Forest visitors seeking naturally-appeanng landscapes will have more opportunities than under the CUR and TGP Alternatives, but slightly less than the EGP Alternative Overcrowding of naturally-appearing areas due to population growth and increased vlsitor use is less likely to occur in this alternative than under the CUR or TGP Alternatives, but more likely than the EGP Alternative

CUR Alternative

The CUR Alternative would meet Preservation or Retention on 283,000 acres (25 percent of the Forest.) There would be 318,800 acres in Partial Retention and an average of 528,600 acres of Modification or Maximum Modification Visual Quality Objectives Modification and Maximum Modification VQOs represent an increase of 105,200 acres from 1982. The overall visual quality that would result is below the midpoint of all alternatives

Along most State highways, foreground distance zones would appear natural to the traveling public; middleground would appear slightly modified Background areas would be dominated by obvlous alterations to the landscape, pnmarily from timber harvesting and road construction For other primary and secondary travel routes, foreground zones would appear almost natural to partially modified, with minor evidence of human changes Middleground and background areas would be dominated by obvious landscape alterations.

While most visually sensitive foreground zones would retain a natural appearance, many views into middleground and background would be visually dominated by timber harvests No new areas would be designated for wlderness **or** semi-pnmitive recreation, Research Natural Areas or Special Interest Areas Therefore, no additional areas would be retained for completely

natural-appeanng landscapes. Most of the general forest would appear partially modified; about 12 percent would appear dominated by land disturbing activities such as timber harvest.

EGP Alternative

This alternative would meet Preservation **or** Retention on **392,600** acres **(35** percent) of the Forest There would be **457,000** acres in Partial Retention, and approximately **280,000** acres of Modification Visual Quality Objectives The Modification/Maximum Modification VQO indicates a decrease of **143,400** acres from **1982** This alternative has the most acres in the Preservation VQO due to the highest amount of proposed wilderness The overall visual quality that would result is the highest of all alternatives, due to the reliance on group selection harvests

Along State Highways, the foreground and middleground view corridors would appear natural to travelers Background areas seen from these highways would vary from natural appearing to partially modified Other high use roads, recreation areas, lakes, and National Recreation and Scenic trails would appear natural in foregrounds and slightly modified in middleground and background. Views from the remaining secondary roads and use areas would vary from natural appearing to slightly modified

As landscapes in the general forest areas become increasingly modified, visitors seeking naturally-appeanng landscapes will have more options available to them than under the other alternatives Additional wilderness areas will be designated; Wild and Scenic River corridors will be established along Mill, Deer and Antelope Creeks; and additional acres would be managed for semi-primitive non-motorized recreation Areas managed for spotted owl, marten, fisher, and goshawk habitat would also provide naturally-appearing landscapes.

TGP Alternative

This alternative would meet Preservation **or** Retention on **325,900** acres **(29** percent) of the Forest. There would be **479,700** acres in Partial Retention and approximately **324,000** acres of Modification and Maximum Modification Visual Quality Objectives Modification and Maximum Modification VQOs show a decrease of **99,400** acres from **1982** The overall visual quality is slightly lower than the PRF Alternative

The visual corridors of State Highways **32, 36, 44, 89,** and **299** would appear natural. Views from other primary and secondary travel routes and recreation use areas would vary from natural appearing to modified. Most of the general Forest area would appear partially modified; about **4** percent of the general Forest would appear dominated by management activities.

As landscapes away from the major roads become increasingly modified, those forest visitors seeking naturally-appearing landscapes will tend to concentrate in designated wilderness, areas managed for spotted owl, marten, fisher, and goshawk habitat, and other areas with special designations that preclude **or** limit timber harvesting No additional wilderness would be recommended with this alternative No acres would be managed for semi-primitive non-motorized recreation settings. **As** the population grows and visitor use increases, overcrowding may occur

d. Visual Resource Indicators

Visual Quality Index Visual quality index (VQI) is a measure used to compare the impacts of the alternatives on visual resources relative to the existing visual condition. Figure **4-2** illustrates the estimated change in visual condition over time. The assumption is made that by decade 5 the visual condition that is represented by the VQI will equal the Adopted Visual Quality Objectives. Also refer to Chapter **2** for a discussion on the impacts of alternatives on visual quality

Visual Rehabilitation Needs The existing visual condition of some areas on the Forest would not meet the Visual Quality Objectives proposed in the alternatives **As** a result, visual rehabilitation is needed to bring those areas into conformance with the proposed VQO's Rehabilitation would take the form of natural vegetative growth **or** it could require active measures The number of acres not meetmg visual quality objectives of each alternative is illustrated in Figure **4-3**

Future Visual Condition Table **4-19** shows the Future Visual Condition (FVC) expected to result from each alternative by decade 5. It

Figure 4-2

Visual Quality Index (VQI), Decade 5

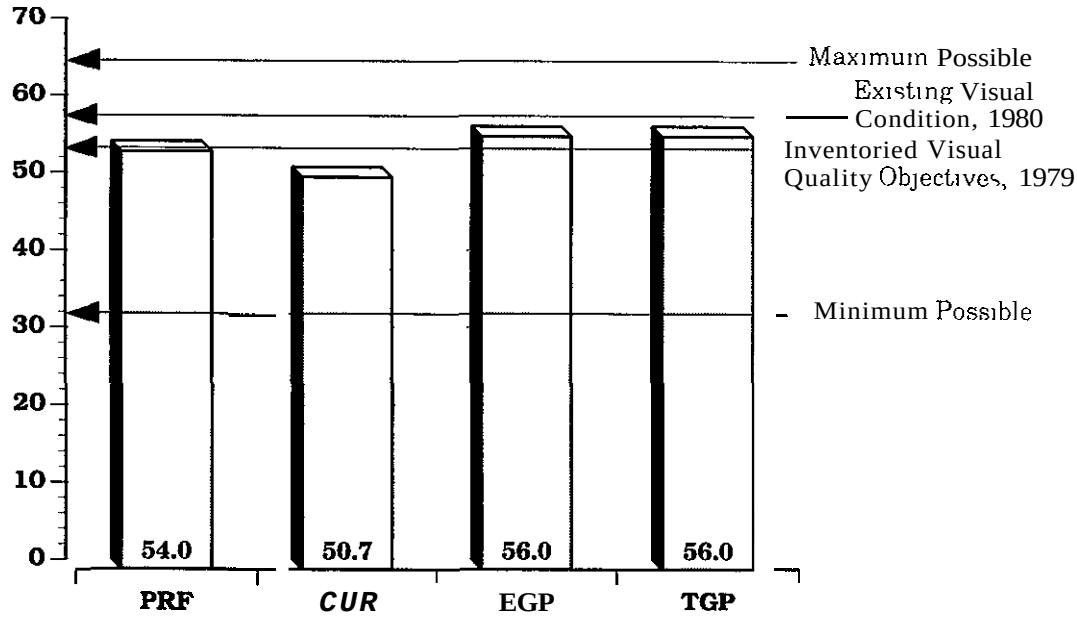


Figure 4-3

Visual Rehabilitation Needs, Decade 1 (M Acres)

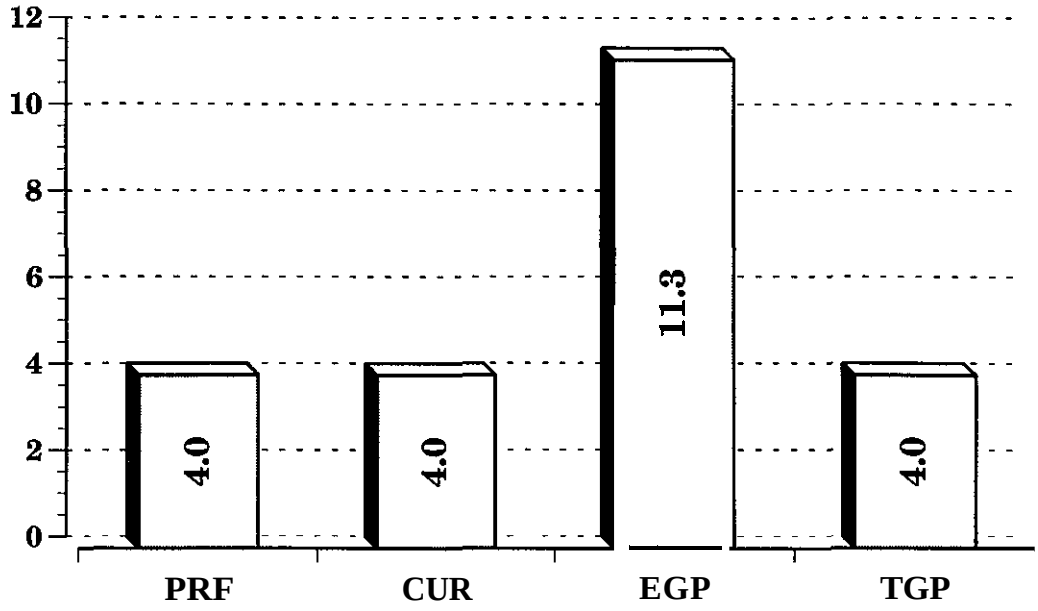


Table 4-19

Acres of Existing and Future Visual Conditions By Variety Class and by Alternative in Decade 5 (Thousands of Acres)

Note. Future Visual Condition (FVC) is assumed to be the same as the alternatives' Visual Quality Objectives by decade 5.

Visual Condition a/	Variety Class b/	Inventoned Visual Quality Objective c/	Existing Visual Condition (1982) d/	Alternative			
				PRE	CUR	EGP	TGP
I/P	A	17 4	62 7	36 2	20 9	46.8	22.3
	B	54 3	147 2	59.1	47 0	62.9	49 1
	C	27 5	72.5	15 9	13 6	24.7	15 9
II/R	A	77 5	45 9	63 6	68 5	25.8	50 1
	B	88 7	471.7	165 3	122 9	142 0	145 6
	C	0.0	137.6	25.4	10.1	90.4	42.9
III/PR	A	20 8	8 9	40.8	28 6	13 7	52 e
	B	310 0	109 6	304.4	206 7	338.2	278 3
	C	110 0	28.3	109 0	82 7	105.1	148.6
IV/M	A	0.0	2 8	0.0	7 9	0.0	0 a
	B	231.7	21 9	160 1	303 7	168.0	218 7
	C	73.8	9 2	94 0	82 7	112 0	65 3
V/MM	A	0.0	3	0.0	0 0	*0.0*	0 a
	B	0.0	3 1	0.0	0 0	*0 0*	0 a
	C	117.9	3 9	55 8	134 3	*0.0*	40 a
VI/UM	A	*0.0*	0 0	*0.0*	*0.0*	*0.0*	0.0
	B	*0.0*	4.0	*0 0*	*0.0*	*0.0*	0.0
	C	*0.0*	0 0	*0 0*	*0.0*	*0 0*	0.0

a/ The six Visual Condition levels measure degrees of human-caused alteration of the landscape. They indicate levels of alteration ranging from untouched, pristine lands :Visual Condition I) to extremely altered, unnatural landscapes (Visual VI). See Figures 3-20 and 3-21 Beside the Visual Condition number is a letter designating the equivalent Visual Quality Objective as follows: P for Preservation, R for Retention, PR for Partial Retenixon. M For Modification, MM for Maximum Modificahon, and UM for Unacceptable Modification

b/ The three Variety Classes mdicate the natural scenic quality of landscapes. Variety Class A refers to highly scemc, distinctive areas, Variety Class B is associated with common or typical landscapes; and Variety Class C corresponds to dull, monotonous landscapes

c/ Inventoned Visual Quality Objectives are denved from an inventory system that does not generate any Preservation acres unless the land has been or is awaiting classificationas wilderness, Research Natural Areas, etc The initial VQO is the result of an inventory process and sets preliminary goals on predicted acceptable amounts of landscape alteration pnor to the consideration of other resource values.

d/ The Existing Visual Condition is a baseline measure of the current level of visual quality on the Forest (inventory completed in 1982) It is displayed here to allow comparison of current conditions to the Future Visual Conditions that would be generated by each altemative in order to show how conditions will change.

shows the predicted distnbution of acreage for each FVC subdivided by vanety class By decade 5, vlsual condition is expected to reach the same level as the Adopted Visual Quality objectives for each alternative. The Inventoned Visual Quality Objectives (IVQO's) and Existing Visual Condition (EVC) are shown on the left side of the table to allow for compansons. In this way one can compare how altered the land would look under each alternative (FVC) compared to how it presently looks (EVC).

Predictions **of** Future Visual Conditions are in large part based on the percentage of land to be harvested each decade since-timber harvests generate the most vlsual impacts of any management actinty By decade **5,** the overall vlsual condition is expected to reach a steady state as the regrowth of harvest units balances the effects of new harvesting.

22. WATER AND RIPARIAN AREAS

Water

The planning issues for water deal with both ***water quantity*** (yleld) and ***water quality,*** including cumulative watershed impacts, water allocations in dry areas, effects on pothole lakes, hydroelectnc generation effects, and protection of riparian areas Water is a basic resource that has high economic value for domestic, power, and irrigation uses It also benefits other resources, including timber, range, fishenes, vlsual quality, and recreation. Any activlty that disturbs the land surface **or** alters vegetation could affect water quality and nparian resources. Management alternatives could affect water resources by influencing water ylelds and timing, changing water quality, and causing adverse cumulative watershed impacts. Each is discussed below

Water Yield **and** Timing Vegetation affects water yield and timing directly by evapotranspiration (plantuse) and indirectly by influencing the timing of snowpack melting. Removal of vegetation by timber harvest, road construction, **or** fire reduces evapotranspiration and thus increases total water yleld. Removal of vegetative cover in areas with snowpack can increase snowmelt, due to loss of shade and increased exposure to wind and evaporation. Both effects could alter the yield and timing of runoff

Two types of water yleld are predicted in the Forest's FORPLAN analysis "Totalwater" is the total annual **runoff** from Forest lands and is altered by timber harvesting and by prescnbed fire in brushlands. Some unnter high flows often "spill" past hydroelectnc and irrigation company &versions unthout being used "Use-season water" is the portion flowing during the irrigation season to downstream agncultural areas and is affected primarily by vegetation removal in snowpack areas. "Use-season water" has a higher market value than water that flows off in the winter months because it can be fully used to generate power and for irrigation In the discussion of each alternative below, changes in water ylelds are compared against the estimated 1982 base year ylelds.

Water Quality Water quality is directly ***af***fected by Forest land conditions and is an indicator of general Forest health. This impact analysis of the alternatives considers three aspects of water quality. the land condition, the expected water yield meeting State water quality objectives, and the potential for water yield to deviate from these objectives. Land condition is estimated by a Forest-unde Land Disturbance Index (LDI) The LDI is an estimate of the "eqruvalent roaded acres" created by an alternative. LDI is used to compare the Forest-wide effects of alternatives because it expresses the disturbance created by management activities such as timber harvesting, road building, and fire Each activity is assigned an "eqruvalent roaded acres" (ERA) value, which is a per-acre disturbance value relative to the maximum possible disturbance (defined as that created by one acre of recently constructed road). The ERA's of all activities are summed and added to the ERA total from the exlsting Forest road system to give the total LDI for an alternative The LDI model accounts for healing of harvested stands and prescnbed burn areas. The method used ***to*** calculate LDI is described in the Forest Planning Records. Figure **4-4** shows the components that add up to form the LDI for the PRF alternative

Because the Forest lacks detailed information on the current amount of land disturbance, no direct compansons of alternatives with the 1982 base year are possible. For the purposes of this

analysis, the base year (1982) LDI is assumed to be the same as for the CUR Alternative in decade 1.

Changes in potential for water yield to meet Federal and State water quality objectives and the deviation therefrom are estimated by considering three factors:

1. The Land Disturbance Index,
2. Sensitivity of Forest streams to upland disturbance,
3. Proposed mitigations and watershed management program emphasis.

The first factor, LDI, was just discussed. The second factor, sensitivity of Forest streams, is an environmental constant under all alternatives that is not discussed further. The third factor considers inventoried watershed improvement needs and the degree of emphasis placed on proactive watershed management and rigor in implementing BMPs.

Cumulative Watershed Impacts. Forest Standards and Guidelines common to all alternatives require cumulative watershed impact analyses when planning for management activities. These analyses require Forest managers to adjust the extent, intensity, or schedules of projects to keep cumulative watershed impacts below the "threshold" above which water quality would worsen. In areas where a formal cumulative watershed effects analysis is not feasible or where streams are in isolated, closed-basin watersheds, Forest Standards and Guidelines restrict surface disturbance on sensitive watershed lands to five percent per decade.

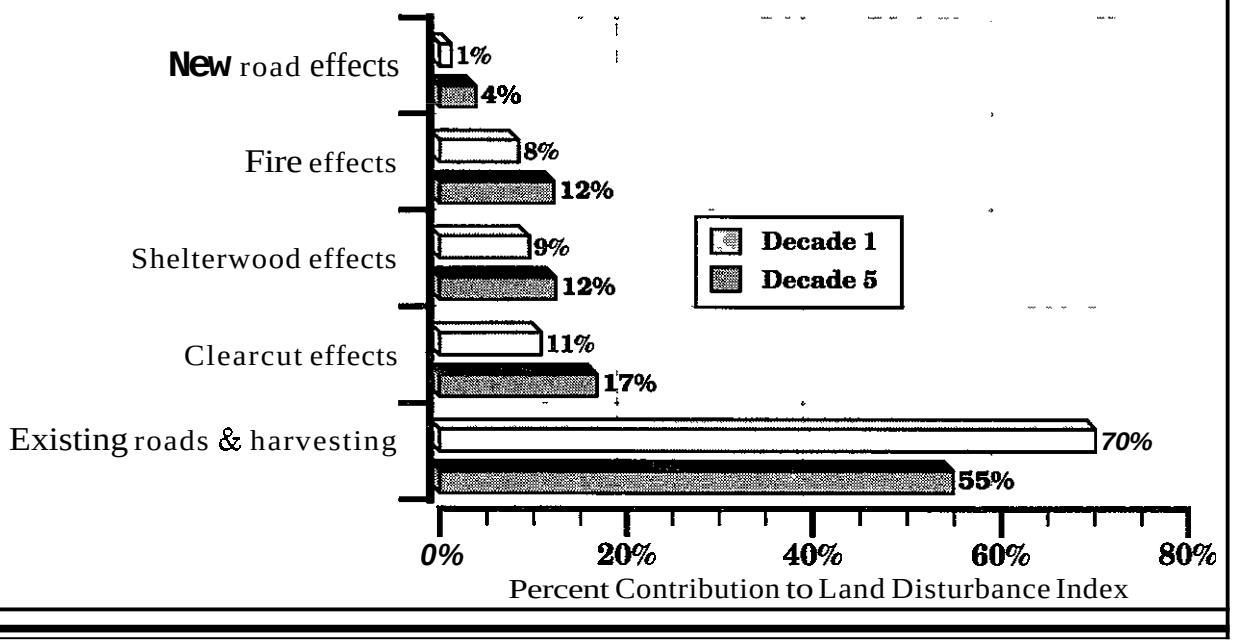
Riparian Areas

Riparian areas, floodplains, and wetlands form the transition between the upslope terrestrial ecosystem and the aquatic ecosystem. Riparian areas provide shade, large woody materials, structural and vertical diversity, stability, and vital niches in the food chain. Ripanan areas are also a particularly diverse part of the ecosystem, providing critical plant and wildlife habitat diversity and a substantial portion of the Forest's dispersed recreation. Ripanan areas commonly have highly productive timber sites and frequently seem to offer the most expedient and accessible locations for roads, landings, stream crossings, and other land-disturbing facilities.

Trees in and adjacent to ripanan areas contribute large woody material to the aquatic and

igure 4 4

and Disturbance Index Components, PRF Alternative



npanan ecosystems. Large woody matenal is recruited into stream channels when trees are blown over, or the tops are broken out. This matenal influences the creation and stability of stream channels by armonng streambanks and by directing and dissipating streamflows.

Practices within **or** adjacent to npanan areas which could affect water quality and stream conditions are those which influence shade, streambank stability, the rate of input of large woody material, floodplain charactenstics, and wetland characteristics These are discussed further on.

Streamside management zones, lakeshores, and other nparian areas described in Chapter **3** will be managed by the Riparian/Fish (F) Prescription, except in special areas managed under more restnctive conditions (e g., mlderness areas). (Refer to the Forest-wide Standards and Guidelines under Water and Ripanan Areas, and Appendix R for an example of more specific guidelines) Under the F Prescription, only limited timber management would occur in ripanan areas Timber harvesting must maintain nparian values

a. Direct Effects

The National Forest Management Act **(NFMA)** and the Clean Water Act (CWA) provlde the direction for evaluating the direct, indirect and

cumulative effects of proposed altematives. Other laws and regulations are cited where applicable. Specifically, NFMA requires that:

". soil, slope, or other watershed conditions will not be irreversibly damaged;"

". . .protection is provided for streams, streambanks, shorelines, lakes, wetlands, and other bodies of water from detrimental changes in water temperature or chemical composition, blockages of water courses, or deposits of sediment. . . likely to seriously and adversely affect water conditions or fish habitat."

The Clean Water Act declares a policy to "restore and maintain" clean water and directs each state to adopt antidegradation policies. The State's antidegradation policy (as descnbed in the Regional Water Quality Control Boards' basin plans and in waste discharge requirements) and implementation of Best Management Practices will safeguard emsting water uses. **No** degradation is permitted in "Outstanding National Resource Waters" which include designated Wild and Scenic Rivers

In order to assess the effects of the various proposed alternatives on water, it is necessary to analyze and discuss interactions with various watershed components including geology, soil, fish and vegetation The reader is encouraged to refer to other sections in this Chapter for a more detailed discussion and understanding of effects related to these other components.

Assumptions for predicting effects on watershed resources and values include

- Timber harvest and road construction can increase soil erosion rates and the magnitude and frequency of peak flows, similar to that observed in the past and reported in the current scientific literature

- Erosion rates and the occurrence of peak flows are directly related to the amount of timber harvest and road construction within a watershed, and the location of such disturbances relative to sensitive watershed lands (ripanan areas, unstable lands, etc.)

- Adverse effects will be minimal if watershed disturbance is kept below each third order watersheds threshold of concern (TOC) (See Glossary).

- Mitigation measures, such as the implementation of Best Management Practices, will reduce erosion rates and the potential for management-induced peak flows, but will not eliminate these effects. Such measures are less effective if disturbance exceeds a sub-basin's TOC.

- Stream systems and watershed charactenstics are in dynamic equlibnum. Significant changes in erosion rates and mstream channel stability upset the equilibrium, leading to degraded water quality and fish habitat.

- Some watersheds are more sensitive to management disturbances than other watersheds. Watershed sensitivity is a function of various inherent watershed characteristics including soil erosion potential, occurrence of unstable lands (earthflows, etc.), channel characteristics and condition, and the percentage of the watershed area lying within the transient snow zone. Appropriate thresholds of concern for each watershed are determined during project planning.

- Alternatives which avoid or reduce the amount of management disturbance within sensitive watersheds will result in less potential for adverse watershed effects.

- Dispersing watershed impact areas (areas disturbed by timber harvest and road construction) over time and avoidance of sensitive lands is effective in minimizing adverse watershed effects

- Watershed impact areas "recover" hydrologically as a function of vegetative regrowth. Hydrologic recovery varies by locations, the type of vegetation, and the degree of initial disturbance.

In the absence of mitigation measures, the following effects may occur.

Effects from Management Activities Significant interactions with the water and riparian resources are possible from any management activity that disturbs the soil, reduces root strength on steep slopes, reduces organic matter, disrupts watershed drainage, or reduces riparian vegetation Road construction, timber harvest, fuels treatment, recreation use, grazing, fire and the development of energy resources or mineral deposits are the principal resource management activities with potential for adverse impacts on water and riparian-dependent resources.

Effects from Timber Management Timber management activities, including timber harvest, slash treatment and site preparation can affect the water resource in varying degrees through the removal of vegetation; the exposure, compaction or disturbance of mineral soil, and changes in sediment yield and shade along streams

Consequences can include reduced infiltration rates and capacity, water channelization, overland water flow, and increased susceptibility of the soil to detachment and displacement due to the impact of raindrops Ground disturbance is the first step in a process that eventually leads to soil movement and reduction of water quality from sedimentation (see the Soils section in this Chapter). The potential for impact becomes greater on steeper slopes and more erodible soils.

Removal of streamside vegetation can have a direct effect on water temperature with potential for increased temperatures during summer months, and for lower temperatures in winter. Increased ice formation can result in stream bank damage. Increased water temperatures also reduce the amount of oxygen that can be dissolved in water At higher temperatures more rapid decomposition of organic debris (needles, leaves, branches) in streams may reduce dissolved oxygen below critical levels for fish. Higher stream temperatures in conjunction with increased availability of nutrients and sunlight may contribute to the formation of nuisance blooms of algae

Removal of large woody material, or the sources of future material, by timber harvesting activities may lead to the eventual widening of channels on low gradient (generally Class I and II) streams This, in turn, may result in the loss of productive land area, filling of pools, and shallower, more exposed aquatic habitat. On steeper gradient Class III and IV streams, instream wood controls the movement of sediment through the system by trapping silts, sands, gravels and cobbles Loss of instream wood and the source of future recruitment may accelerate the release of these sediments to downstream Class I and II streams. Moreover, removal of instream wood and its stabilizing role may increase the frequency and extent of debris torrents originating in these upper headwater streams.

Effects from Roads While road effects are often difficult to separate from timber harvest effects, it is generally agreed that roads account for the majority of severe sediment problems and are often the conduits between sediment source areas (skid trails, landings, cut/fill slopes) and

stream channels The magnitude of the impact is determined by such factors as season and amount of use, soil charactenstics, terrain, vegetation, and the likelihood of sediment from source areas reaching a watercourse Roads constructed adjacent to (parallel to) streams deliver up to twice the amount of sediment as that frommid-slope orndgetop roads. Roads parallel to streams may reduce shade on some sites by as much as 43 percent (Skeesick and Stewart, 1981).

In addition to road location, construction methods and design elements may directly influence waterquahty and channelstability. Uncompacted fills and sidecast construction techniques, where excess soil matenal is pushed over the side, are pnmary sources of sediment and a cause of debris slides and debns torrents. Roads and fills constructed with uncompacted soil matenal become saturated and fail more readily than roads constructed with compacted fills. Low standard or temporary roads remaining open after the penod of intended use may become chronic sources of erosion and sediment.

Effects from Off-Highway Vehicles The operation of off-highway vehicles (OHV's) can affect water quality through the destruction of vegetation; compacting and rutting road surfaces; and breaching of water bars, berms or cross drains The magnitude of the impact is determinedhy such factors as season and amount of use, soil characteristics, terrain, vegetation, and the proximity to a watercourse

Effects from Recreation Intensive recreation can affect water quality primarily through the destruction of vegetation and compaction of soil. This results in reduced infiltration and channelization of water, subsequent accelerated erosion, and entry of sediment into watercourses. Roads and trails providingaccess for recreational use may have associated impacts as discussed prevlously.

Summer homes, developed campgrounds, marinas, and ski areas all have the potential to impact water quality. In addition to vegetation alteration and soil disturbance, other potential impacts maymclude septic systemmalfunctions, spills or inappropriate disposal of hazardous matenals, etc. Many recreational developments and recreational residences are located adjacent to streams and lakes, increasing the nsk of adversely affecting water quality.

Fislnng trails andheady-used "dispersed campsites along steams and lakeshores can be exposed, leading to erosion and movement of sediment into nearby waters.

Effects from Livestock Grazing Vegetation removal and soil compaction (especially of moist npanan soils) by grazing animals can reduce mfiltration and increase the potential for overland flow and soil erosion. This can change sedimentation, peak flows, and channel morphology Grazing is reported to be ***25*** to **60** percent heavier on streambanks in nparian areas than on adjoining uplands (Nelson and Platts, 1985) This concentration can lead to sigmficant soil disturbance and compaction mthin the riparian areas Removal of streamside vegetation through excessive browsing has a direct effect on stream temperature, especially on sites where shade trees are insufficient or lackmg or where grasses and shrubs provlde a large proportion of the effective shade

Heavy grazing of riparian areas and the resultant loss of vegetative cover and livestock trampling can lead to bank sloughing and collapse. Streamside grazing frequently collapses overhangmg banks that provlde valuable overhead and thermal cover for fish Such streambank degradation increases sediment loading, fills pools, and creates wider, shallower channels. Impacts to the chemical quality of water are quite vanable and difficult to monitor, but increases in organic matter and bactena often occur as a result of grazing

Effects from Fire Wildfire effects on water quality come about pnmanly through increased sedimentation and mass soil movement following the destruction ofvegetation and exposure of mneral soil to increased runoff. The flushing of ash deposits into streams may alter the concentration of some chemical elements, hut this effect on water quality is bnefandnot wellunderstood. Runoff from burned areas usually washes fire-released nitrates and phosphates into streams where they are quickly assimilated by aquatic life In addition, the loss ofvegetationin ripanan areas exposes the water surface to increased solar radiation which directly affects water temperature and the growth of algae.

The negative effects of mldfire on water quality may be increased as a result **of** measures taken to bnng a fire under control (e.g , from fireline construction or dnft of fire retardant drops into lakes or streams) or through salvage loggmg operations followng a major fire

Prescribed burning has the potential to affect ripanan areas and the water resource directly throughthedestructionofvegetatnandchanges in the character of some soils causing them to become water repellent or hydrophobic Wildfires, although they have potential for great impact, are not a planned event and their effects are difficult to predict. Proper planning for prescnbed fires can reduce possible adverse effects on water quality.

Effects from Mining Activities Mining activities can affect water quality by exposing spoil piles and tailings to erosion, increasing the potential for sedimentation. Poorly designed or maintained settling ponds are a hazard to downstream water resources Chemicals can leach into streamcourses from spoil piles or treatment processes. Mineral and geothermal exploration and development may have potential impacts related to vegetation removal, road construction, and possible disruption of aquifers or mixing of groundwater The full extent of such potential impacts is not fully understood and is difficult to assess Potential water quality effects are further considered dunng environmental analysis of proposed mining actinties

b. Indirect Effects

Indirect effects are often difficult to separate from direct effects, they interact with almost every aspect of the water/riparian resource, and they are some **of** the most important impacts to be dealt with by land managers

The ultimate effect on water quality is determned by how much sediment reaches a watercourse and the value placed on the use of that water, e **g.,** fish production, irngation, recreational or domestic use Natural erosion and periodic flood events introduce a certain amount of sediment into aquatic ecosystems, at the same time as they scour the streambeds and rearrange rock and gravel that fish need for spawning Major floods can transport bedloads of spawning and hiding cover to the lowlands Properly managed actinties should not produce significantly hgher levels of sediment than natural occurrences If mitigation measures should fail, excessive sediment can smother fish eggs and fry, smother and scour stream bottom plants and aquatic orgamsms that anchor the food chain, cloud water, abrade fish gills, and reduce vlsual appeal of waters used for recreation Sedimentation also increases the cost of treating water destined for human use Filling in of reservoirs is another cost of sedimentation

c. Cumulative Effects

Cumulative effects are the sum total of individually minor, but collectively significant actions taking place over a period of time. The distribution of actinties through time and space should greatly reduce the potential for cumulative effects Each of the alternatives included constraints on the amount and location of timber harvest over time The goal of this harvest dispersion is to spread out the effects of individual actinties.

The methodology developed for assessing watershed sensitivlty and estimated threshold of concern (TOC) levels for watershed disturbance provides a framework for assessing cumulative effects, and dispersing activities over time and space. Project level planning is the most appropnate level for a focused cumulative effects analysis and site-specific design of mitigation measures and Best Management Practices (BMPs) Project plans consider activities on both National Forest land and non-National Forest land within major watersheds and subdrainages during a cumulative watershed effects analysis. The Lassen National Forest will cooperate with private owners of large land areas, to minimize the potential for adverse, cumulative watershed effects by consideringthe timing of both public and pnvate land disturbance. Cumulative watershed effects analysis will be conducted in accordance with R5 FSH 2509 **22,** Chapter **3D** Potential effects of increased peak flows and sediment will be mitigated pnmanly by dispersion of activities in space and time and the implementation of BMPs

d. Mitigation Measures

A very important mitigation measure which will be applied to all alternatives is avoidance Sim-

ply put, if the risk of producing undesirable effectsaretoogreat, **theprojectoraportionofthe** project will not he implemented

The National Forest Management Act requires that timber harvesting and other management activities occur only where watershed conditions will not be irreversibly damaged Each alternative has the potential **to** affect the quantity and quality of water and the conditions of floodplains, wetlands, and other npanan areas. Mitigation measures are designed and intended to minimize the nsk of adverse effects on the water resources See also mitigation measures under the different envlronmental components in this Chapter

The most important means by which water quality will be protected is the implementation of Best Management Practices (BMP's) associated with vanous management activities. Protection of water quality with BMPs is developed and implemented at the project level to best meet site conditions and resource needs Best Management Practices will eliminate or minimize impacts to waterquahty. They augment and complement Forest-wide and management area Standards and Guidelines (Chapter **4,** Forest Plan). A discussion of BMPs and their application in protecting water quality is presented in Appendix Q of the Forest Plan.

Mitigation measures, which include designation of streamside management zones (SMZ's) along streams or around other water bodies, reduced harvest levels and frequency of entry, use of designated skid trails, and specific cntena for stream crossings, are designed to achieve a high rate of success (90 percent or greater) The success of particular applications, however, varies Unexpected or unusually severe climatic events, availabihty of funding and staffing, knowledge and understanding of a measure by operators and administrators are factors which can reduce effectiveness In addition to mitigation built into the Standards and Guidelines, site-specific measures can be implemented if conditions warrant

Specificmeasures to mitigate potential increases in stream temperature may include implementation of timber harvest prescriptions which maintain nparian shade, or revegetation of' disturbed or burned nparian areas with rapidly growing deciduous vegetation to provlde summer shade in minimal time The Riparian/Fish Prescnption requires maintenance of shade, except where other nparian resources could benefit from shade changes For example, removal of overstory conifers could promote the establishment or rejuvenation of riparian hardwoods Acres assigned to the RipananlFish Prescnption vary between alternatives, because some are protected by more restrictive W (Wilderness) or S (Special Areas) Prescnptions

Measures to minimize direct disturbance to stream channels may include use of yarding equipment capable of suspending logs over the channel and streamhanks and directional felling of harvest trees Mitigation of surface erosion from harvest units or other site disturbances is accomplished by measures which retain or replace soil cover The choice of yarding system (e g ,tractor, cable or helicopter) and fuel reduction prescnptions directly influences the potential for soil erosion Maintenance of streamside and nparian groundcover vegetation and woody material is required by Forest Standards and Guidelines, and good cover can he effective in preventing the transport of soil to streams

Potentially unstable lands occur on less than one percent of the Lassen National Forest. Localized potential for sediment delivery to the stream system through mass wasting or the occurrence of debris torrents can be mitigated by retaining the root strength of live trees in potentially unstable areas, as identified during project planning Specific prescnptions will consider the interaction of root strength, soils, geologx characteristics, groundwater, and proximity to a stream, lake, or wetland, etc Retention or addition of large woody material, and provisions to insure future recruitment of large woody material can reduce the frequency of debris torrents, particularly in steep headwater stream channels (Class III and IV). This, in turn, reduces the rate at which debris torrents enter Class I and II streams.

To reduce the sediment production potential associated with roads or other site developments, extensive or intensive mitigation measures will be incorporated in project design These measures may also be costly A key measure is to avoid sensitive, unstable areas Other mitigations may include, but are not limited to, special

road design and construction considerations at stream crossings, on steep slopes, or on potentially unstable areas Typical construction considerations include specified compaction of fills and prevention of soil sidecasting on steep slopes and adjacent to streams. Providing stable road surfaces through paving or rocking, while initially more costly, reduces overall impacts on water quality and runoff over time. Mulching and revegetating road cutbanks, fillslopes, or other disturbed soil surfaces near stream crossings, follow-up applications of fertilizer to vegetated roads cuts and fills, slash filter windrows below road tills, and obliteration of temporary roads following harvest activlty are additional examples of effective mitigation measures. Parallel road construction will be avoided in the streamside management zones of perennial streams.

Mitigation after the fact is often not as effective in reducing impacts as conducting the activity in a manner which reduces or controls the impact. Ripping and tillage following harvest is seldom as effective in maintaining the hydrologic properties of a soil as is the use of designated skid trails to control the amount of an area impacted.

In addition to mitigation measures, all the alternatives incorporate features (e g , soil and water improvement projects and nparian zone improvement targets) which contnbute to an overall betterment in watershed condition. Structural and nonstructural improvements are more site specific than BMPs. They are designed to improve productivity, stability or diversity of an area in order to increase its ability to absorb impacts. Examples include: water developments, salt block placement and grass seeding designed to draw grazing animals away from riparian areas, fencing or herding to reduce pressure on sensitive areas, and altering the grazing system. Structural and nonstructural improvement measures also include installing weirs to control water and sediment delivery, planting willow and alder to improve streamside shade or managing beaver populations to rehabilitate degraded watersheds. Each alternative mcludes targets for watershed improvement projects.

All Alternatives

All alternatives will maintain an acceptable level of water flow and quality, and acceptable watershed and riparian conditions due to implementation of Forest Standards and Guidelines In all alternatives, the Forest wlll use Best Management Practices (BMP's) and analyze and mitigate cumulative watershed impacts of land-disturbing projects, in accordance with Forest Plan direction. Areas treated by the Riparian/Fish (F) Prescription vary between alternatives, because EGP and PRF protect some ripanan areas wlth more restnctive Wilderness (W) or Special Areas (S) Prescnptions

Total water ylelds will be similar under all alternatives, varying within one percent of the **1982** base year ylelds. By decade **5,** use season water yleld would increase one percent for all alternatives except CUR. Potential effects on water quality and riparian disturbance, and planned watershed improvement efforts, differ slightly among the alternatives, (see specific alternative discussion) Alternatives' effects on water are displayed in Table **4-20.** Emergency fire rehabilitation work would be done after most wildfires, to mitigate suppression-related disturbance (e g., fireline construction) and to the extent needed to protect instream and downstream uses from adverse, post-fire effects

PRF Alternative

Land disturbance in decade **1** would be **18** percent lower than the assumed **1982** base year value and would be **23** percent lower by decade **5.** This disturbance includes impacts of livestock grazing in stream corridors, and limited timber harvest in streamside management zones. Water yields would continue to meet State standards. Due to less clearcutting than in the CUR Alternative, there would be a steady decline in the LDI and water quality would be better maintained or improved. The proportion of ripanan and adjacent terrestrial zones potentially affected by resource management activities over decades **1** through **5** would be **69** percent. Any timber harvesting impacts in ripanan zones would be minor (around ***2.5*** percent of the inventory) per decade. All identified watershed improvement projects would be completed by decade **2,** and five acres per year would be restored thereafter to solve presently-unidentified, new, or recurring problems **An** ongoing program would improve **20** acres of ripanan area per year.

Table 4-20

Water Resources and Riparian Effects

Effect	Base Year 1982	Decade	Alternative PRF	CUR	EGP	TG?
Total Yield (Thousand Acre Ft/Yr) a/	1,308	1	1,304	1,308	1,303	1,305
		5	1,301	1,308	1,299	1,302
Use Season Water (Thousand Acre Ft/Yr)	536	1	546	536	546	543
		5	551	536	556	548
LDI (Thousand Equivalent Roaded Acres) b/	44 3	1	36 5	44 3	36 6	40 2
		5	34 1	42 1	32 2	37 1
Riparian and Adjacent Terrestrial Zone Affected (% of Acres/Decade) c/	60	1-5	69	72	69	69
Potential Decline in Water Yield Meeting Objectives (%)	0	1	0	0	0	0
		5	0	0	0	0
Watershed Improvement (Acres/Year)	10	1	75	75	150	75
	5	5	5	5	5	
Riparian Zone Improvements (Acres/Year)	5	1	20	5	20	10
		5	20	5	20	10

a/ All flows are expected to continue to meet Federal and State quality standards

b/ Estimated

c/ Reflects estimated livestock grazing impacts Timber harvesting has been reduced to a minor level in ripanan areas

CUR *Alternative*

Land disturbance in decade 1 would be the same as that assumed for 1982, and 5 percent lower in decade 5 Water quality would still meet Federal and State water quality objectives by decade 5 Water ylelds would continue at base levels Over 50 years, 72 percent of npanan and adjacent terrestrial zones would be affected by resource management activities, resulting in continued damage to some riparian areas Timber harvesting would remove 5 percent of the inventory per decade, twice that of the other alternatives Watershed improvements would be accomplished in two decades Ripanan areas would continue to be improved at 5 acres per year

EGP Alternative

Land disturbance would decrease over the assumed 1982 level by 18 percent in decade 1, and by 27 percent in decade 5 Water ylelds produced would meet Federal and State water quality objectives in all decades, with a potential for improvement of water quality and channel conditions by decade 5. Over 50 years, the proportion of ripanan and adjacent terrestrial zones potentially affected by resource management activities would be moderate (69 percent), showing a slight decrease when compared to CUR All identified watershed improvement projects would be completed during decade 1, and any presently-unidentified, new, or recurring problems

would be corrected promptly An ongoing program would improve 20 acres of riparian area per year

TGP *Alternative*

TGP burning and harvest levels would create a LDI nine percent below the assumed 1982 base level in decade 1 and 16 percent below base level in decade 5 The potential for ripanan and adjacent terrestrial zone effects from management activities would be the same as PRF and EGP, because of a similar assignment of sensitive watershed lands to a reduced Regulation Class III yield at 2 5 percent of the inventory per decade Watershed improvements would be accomplished in two decades An ongoing npanan area improvement program would treat 10 acres per year.

23. WILD AND SCENIC RIVERS

Introduction

The Wild and Scenic Rivers Act of 1968 (Public Law 90-542 as amended) established a method for providing federal protection for our remaining free-flowing nvers, and preserving them and their immediate environments for the use and enjoyment of present and future generations

The setting of a Wild and Scenic River provldes for a wide range of recreational opportunities which are enhanced by the river's free-flowing condition, its outstandingly remarkable values and the quality of its surrounding environment As required by the Wild and Scenic Rivers Act, the area within designated river corridors will be managed to protect, and where possible, enhance the nver's outstandingly remarkable values, and protect its free-flowing condition and designated classification. Eligible rivers will be managed as if they were designated until they are found unsuitable or are released from further consideration by congressional action.

The Wild and Scenic Rivers Act defines three classes of rivers *wild,* scenic, and recreataonal Wild nver areas are those rivers, or sections of nvers, that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially pnmitive and waters unpolluted These represent vestiges of primitive America Scenic river areas are those rivers, or sections of rivers, that are free of impoundments, with shorelines or watersheds still largely pnmitive and natural appearing Limited access by roads and dispersed campground facilities may occur in places. Recreational nver areas retain mostly natural, free-flowing characteristics, but shorelines may show evidence of some agncultural or forestry uses, past water diversions, or existing minor improvements or diversions

Mill Creek, Deer Creek, and Antelope Creek are the three candidate Wild and Scenic Rivers. The alternatives recommend various mixes of their segments for wild, scenic, recreational, and no special designation, as descnbed in Chapter 2, Section E (Alternatives Considered in Detail), and shown in Tables E-11, E-12, and E-I3 of Appendix E

a. Direct and Indirect Effects

The kinds and amounts of activities and changes acceptable within a nver corridor depend on whether it is designated as a wild, scenic or recreational river. Because the Forest Plan is not site specific, it is not possible to descnbe precisely how an individual stream may be affected by future projects when their exact location and nature have not yet been determined It is possible, however, to describe and to &splay the general effects of various management activities on the eligibility and potential classification of rivers by refernng to groupings of management prescriptions which allow intensive development, moderate development, or retain an essentially unmodified natural setting. These potential effects are descnbed below in general terms The effects on each tentatively eligible nver are described in more detail in Appendur E in Tables E-14, E-15, and E-16.

Specific kinds of forest activities and uses can affect the classification or eligibility of nvers These are

Effects from Timber Harvesting Timber harvesting, and associated road and landing facilities, can have a major effect on the potential for a river to be considered eligible, and which classification it meets if eligible Extensive, highly

vlsible and ongoing timber harvesting within a river corridor could result in the river becoming ıneligible for wild and scenic status Where timber harvest maintains the natural appearance of the forest as seen from the nver and its banks, it may qualify for scenic classification

Effects from Water Project Development Any major impoundment for water storage or hydroelectnc power would cause a river segment to be ıneligible. None of the tentatively eligble nvers is actively being considered for such a project at the present time Low dams and diversions, penstocks, transmission lines and other facilities may affect the classification of the river, depending on their visibility and extent Where they are vlsually subordinate, the river may be classified as a recreational nver Where such features dominate the landscape, the nver is likely to be ıneligible

Effects from Mining Large scale mining activity could result in a tentatively eligible nver becoming ıneligible, or result in its being eligible only in the recreational classification Some types of mineral exploration which are vlsually subordinate may not affect the classification of a river as scenic or recreational

Effects from Recreation Development Development of trails and dispersed campsites would not affect the wild classification of a nver. Development of major recreation sites, boat launches, and other visitor facilities would generally cause a nver to meet only the recreational classification.

Effects from Roads Any construction of a public use road in the river corndor would eliminate that segment of river from classification as a wild nver Construction of roads and bridges which occasionally cross or reach the nver would not affect the classification of a scenic river, assuming such roads are infrequent and relatively inconspicuous Construction of a major highway or extensive road system could limit a river to the recreational classification

Effects from Fishery Improvements Constructed fish passages and other structures associated with enhancement of fish habitat may occur in the wild classification, if the facility does not significantly alter the free-flowmg character of the river or conflict with the values for which the nver is designated

Effects from River Designation Conversely, designation of a river as a component of the National Wild and Scenic Rivers System can affect the management of various resources The Wild and Scenic Rivers Act provides that the study boundary include, at a minimum, the area within one quarter mile either side of the high water mark of the nver. Final boundaries can and do vary from this minimum, but generally follow the one quarter mile guideline. Upon designation by Congress, final boundanes will be determined when the management plan for each nver is prepared Where nvers are designated in wilderness, the Wild and Scenic Rivers Act provldes that the most restnctive provlsions of the laws apply

Designation as a ***wild river*** results in the area being withdrawn from mineral entry Timber harvest is generally unacceptable and outputs of timber from tentatively suitable forest lands that might have occurred are essentially foregone Construction of major recreation facilities, roads, powerlines and other features are not allowed The potential for hydroelectric power generation is also foregone. Designation would not affect the rights of landowners within a wild nver area unless zoning **or** other regulatory changes were enacted by local governments Designation, particularly where tributary streams or important vlsual features he outside the corridor, could affect the management of lands adjacent to a wild nver by requiring more constraints on water quality and visual effects of projects. The Wild and Scenic Rivers Act also requires that upstream water projects may not significantly degrade the river values within the designated segments and that downstream impoundments may not back water up into the designated segments

Designation as a ***scenic river*** places significant constraints on the management of timber in the river corridor, although small sales generally out of view of the river or recreation sites could occur. The area is not withdrawn from mineral entry, but costs of mining could increase as a result of standards for visual quality The potential for hydroelectnc power generation is foregone. Construction of major recreation facilities would not

occur. Roads, while allowed, could be more expensive as design seeks to minimize the vlsual impact and the number of bndge crossings. Effects on management of adjacent lands would be less than for a wild river, although activities affecting sensitive vlsual features may be constrained resulting in increased cost or reduced output

Designation as a recreational river places fewer constraints on management and development activlties, although the potential for new diversions and hydroelectric power generation is foregone Timber may be harvested, although vlsual constraints can increase the cost of loggmg or reduce outputs slightly

Suitability In Appendix E, Tables E-1, E-2, and E-3 summarize the number of river segments and miles for Mill, Deer, and Antelope Creeks Tables E-11, E-12, and E-13 display the allocation of indivldual streams by classification (wild, scenic, and recreational) in the alternatives In some cases, a stream is shown in a wild classification in one alternative and in a different classification in another The intent of this is to show the nver designated in its current (most undeveloped) condition in one alternative, and to provide development opportunities in another alternative, while still indicating the nver is suitable to be considered as a wild, scenic or recreational nver

Again, any Wild and Scenic River recommendation in a Forest Plan is a preliminary administrative recommendation that will receive further review and possible modification by the Chief of the Forest Service, the Secretary of Agnculture, and the President of the United States Congress has reserved the authority to make final decisions on the designation of rivers as part of the Wild and Scenic Rivers System Therefore, Wild and Scenic River recommendations are not appealable under the agency's administrative appeal procedures

b. Cumulative Effects

For the PRF, EGP and TGP Alternatives, no cumulative effects on the outstandingly remarkable values for recommended Wild and Scenic Rivers are anticipated. Forest-wide Standards and Guidelines require that those values be protected and/or enhanced, including the vlsual features outside the nver corridor as viewed from the river and main travelways along the river. The river's free-flowing character and classification will be protected until there is congressional action River specific management plans, scheduled for completion within three years after designation, will provide further direction to protect and/or enhance nver values

For the CUR and TGP Alternatives, the landscape character outside the corridor as mewed from the nver, ***or*** main travelways along the river, would be degraded through time as intensive timber harvest takes place on adjacent areas

For rivers not recommended, the cumulative effects of a vanety of activlties may change their outstandingly remarkable values and free-flowing condition as described in the Wild and Scenic Rivers Act This could limit a nver's future consideration for inclusion into the National Wild and Scenic Rivers System

c. Mitigation Measures

The direction set forth in the Standards and Guidelines for all recommended rivers provldes the basis for protection of a nver's free flowing character and values for which it was found eligible Use of the Standards and Guidelines, the Riparian/Fish (F) and Special Areas (S) Prescriptions will mitigate effects of management activlties Additional direction will be developed in each management plan once a river is designated The effects of crowding on campsites and trail systems can be reduced by substituting facilities and dispersing recreation use Access to the nver corndors, provlded by the construction and maintenance of signs and trails, will govern the location and degree of effects to these areas from public use

Some management practices on lands adjacent to a river corndor can be employed to insure that effects of vegetation manipulation remain subordinate to the general scene of the area These practices include adjustments in the size and location of timber harvest units and created openings, the regulation of harvest rates, the use of uneven-aged management practices such as group selection or individual tree selection, hand piling and burning of harvest debris; immediate

reforestation of disturbed sites, and locating roads to be visually inconspicuous from the river surface and nverbanks

PRF and EGP Alternatives

A total of 76 miles on three creeks are recommended for Wild and Scenic Rivers On Mill Creek, a total of 32 miles are recommended PRF and EGP recommend 16 5 miles for wild (8 0 within the Ishi Wilderness and 8 5 within the proposed Mill Creek Wilderness), 6 0 miles for scenic, and 9 5 miles for recreational On Deer Creek, **30** 0 miles are recommended 18 0 miles for wild (8 0 miles within the Ishi Wilderness), **4** 0 miles for scenic, and 8 0 miles for recreational On Antelope Creek, **14** miles are recommended Both PRF and EGP recommend all **14** miles for wild The amenity values (cultural resources, resident and anadromous fisheries, wildlife, primitive recreation, visual quality, and water quality) would receive a moderately high degree of protection In the wild segments, the commodity opportunities such as hydroelectric projects, mineral exploration and development, recreation developments, timber harvest and road construction would be mostly foregone Also, major fish habitat improvement structures would be incompatible, but inconspicuous ones would be acceptable About 0 6 MMBF potential annual timber yield would be foregone

CUR Alternative

No segments would be recommended for wild, scenic, or recreational designation Deer and Mill Creeks (outside the Ishi Wilderness) and Antelope Creek would remain open to hydroelectric development, mineral entry, leasing and development, recreation development, major fish habitat structures, full timber harvests in the upper forested segments, and full road construction To the degree that such projects are conducted, fisheries, visual quality, and water quality would be reduced below existing levels About 0 6 MMBF per year would be available for harvesting

TGP Alternative

This alternative would recommend small amounts of wild river, and leave most of the segments open for commodity developments, including new campgrounds which would attract use from the wild designations The recommendations all he within the Ishi Wilderness On Mill Creek, 8 0 miles are recommended for wild On Deer Creek, 8 0 miles are recommended for wild All of the segments outside the wilderness would be available for hydroelectric development, fish habitat projects, mineral entry, leasing and development, extensive fee campground development, full timber harvesting, and road construction About 0 6 MMBF per year would be available for harvesting However, water quality and scenic quality may decrease to the degree that development occurs outside the wilderness

24. WILDERNESS *AND* FURTHER PLANNING AREAS

Introduction

The environmental qualities of naturalness and solitude characterize designated wilderness. Wilderness will continue to provide a range of recreation opportunities that interweave the physical and biological features of water, air, soil, geology, vegetation, fish and wildlife with particular social factors such as isolation, remoteness and personal challenge

The Wilderness Act of 1964 states that Wilderness is to be managed in such a manner "deuoted *to* the public purposes of recreataonal, scenic, scientific, educational, conseruataon and historical use" only to the extent that the essential wilderness character of the area is protected Managers are faced, therefore, with the problem of accommodating human use yet preserving an area's wilderness quality. Given that any use of the environment produces at least some impact, managers must identify where, and to what extent, varymg degrees of change are appropriate and acceptable within wilderness settings

All alternatives will permit present grazing use to continue within existing and recommended wilderness Grazing activities will be managed through allotment management plans (AMPs). Distribution, number of cattle, and season of use will be modified as needed with the AMPs Grazing will not be permitted in proposed wilderness where not currently established.

Although activities, such as timber harvest, can cause localized effects near wilderness boundaries, the most significant effects on wilderness settings are relative to access and the amount and type of recreation use that a particular area receives

Roads provide access to wilderness settings, and trails facilitate and organize recreation use within designated wilderness Trails allow people to take advantage of pnmitive and unconfined types of recreation opportunities ***An*** extensive trail system can result in fewer contacts between users, but could cause increased effects to physical and biologxal aspects of the environment Increased access can also cause overuse of desirable campsites and attractions For example, horseback riders need water and meadow areas for maintaining their stock, and tend to utilize larger campsites

a. Direct and Indirect Effects

Management activities on non-wilderness lands have direct as well as indirect consequences on wilderness These potential consequences of the alternatives can be grouped by two kinds of land allocation decisions

- Management of lands located adjacent to the wilderness boundary
- Management of lands which are currently unroaded and available for backcountry/non-motorized recreation activities

Timber harvest would result in harvest units and new roads adjacent to wilderness As logging continued over the long-term, the potential for wilderness visitors to see and hear nearby timber management activities would increase The scenic quality of adjacent areas as viewed from within wilderness may be reduced Road systems developed for timber harvest could result in increased access lvisitation to the adjacent portion of the wlderness, causing a change in the wilderness setting for that area This could reduce the opportunities for solitude and the kind of recreation experience many wilderness visitors seek In short, as more timber management activity occurs immediately adjacent to wilderness, the greater the potential effect on nearby wilderness character

The disposition of currently unroaded (but non-wilderness) areas can have indirect consequences to existing wilderness If the unroaded acreage now available for backcountry lnon-motorized forms of recreation is eliminated or significantly reduced, persons who seek that kind of recreation on the Forest would be limited to designated and proposed wilderness This, in turn, could lead to crowding and to a reduction in the amount of land that provides solitude or a quality wilderness experience If use is causing unacceptable resource degradation, administrative restrictions may be imposed to maintain wilderness quality

b. Cumulative Effects

There are cumulative effects on wilderness as a consequence of any of the proposed alternatives One such effect is the designation or non-designation of lands as wilderness by Congress Approximately seven percent of the Forest is currently designated wlderness This has the effect of preserving a wide range of natural resources in their natural condition In wilderness, water, vegetation, soil and air quality will be maintained in a natural state The non-designation of further planning areas may result in the development of such land Over time, these areas may become unsuitable for future wilderness consideration All the alternatives allocate portions of some roadless areas to commodity development This will increase the **nsk** that semi-primitive non-motorized recreation expenences of some roadless areas may be reduced

c. Mitigation Measures

Wilderness settings will be managed in all alternatives through the application of Forest-wide Standards and Guidelines. Mitigation measures consist of a broad range of actions that avoid, minimize, rectify, reduce, or compensate for environmental effects

Establishment and monitoring of wilderness carrying capacities and limits of acceptable change (the LAC process) will aid in reducing the consequences of potential over-use within wilderness The LAC process gwes primary attention to maintaining acceptable wilderness conditions, and prescribing actions to protect or achieve the desired conditions If the conditions are not met, action will be taken to bring them into an accept-

able range Such actions can include outreach and education efforts aimed at wilderness visitors, as well as more formal measures Some of these formal measures are trail closures, restricted capacity trailhead designs, campsite closures, wilderness entry permits, and restrictions on group size or length of stay

Typical areas receivlng high use are arterial trail corridors, areas where major trails intersect, converge, or lead to places of high interest or destination, and staging areas and trailheads More groups will encounter each other in these locations

Popular campsites can be degraded by overuse These are typically sites adjacent to lakes and rivers. To mitigate these effects, campsites can be designated if resource damage indicates a need Dispersal of camps from each other and from attractive features within the wilderness can reduce the effects of concentrated use To manage high intensity use and resource degradation, camping may be prohibited in specific areas to facilitate recovery of natural conditions.

Grazing use will be managed through allotment management plans (AMP's)to mitigate impacts on wilderness values Impacts from equestrian users will be mitigated by designating campsites for their use, by temporarily "resting" sites that show resource degradation from concentrated use, and by restricting the number of nders or group size if needed

Although all prescribed burning on the Lassen National Forest will be scheduled for times when winds are expected to disperse smoke concentrations, smoke and haze may be evident in the airshed over or adjacent to wilderness The Clean Air Act and its **1977** Amendments mandate air quality and visibility protection for the Caribou and Thousand Lakes Wildernesses Both of these wildernesses are Class I areas while the Ishi Wilderness is designated as Class II Additional mitigation measures for reducing the impacts of prescribed burning on wilderness air quality values include the scheduling of burns to avoid high wilderness recreation use periods, increasing woodutilization on harvest units, and decreasing suspended particulate emissions production from slash burning (See also the discussion on Air Quality in this Chapter)

Dunng the past 80 years, natural fires in wilderness have generally been suppressed. Because of this change in the fire regime, there has been some increase in forest residues, although the buildup has not generally reached a critical level Over time however, this may develop into a greater problem and larger, more intense wildfires can be expected in the future The longer fire is kept out of these areas, the more the vegetation develops towards a climax seral stage with higher accumulations of natural dead and downmatenal This was evldenced by the 131,000 acre Campbell Fire, a wildfire that burned 80 percent of the Ishi Wilderness in **1990** Prescribed burns may be considered in wilderness where necessary to perpetuate natural ecosystem succession without threatening public safety or adjacent non-wilderness lands For additional information on prescribed burning and fire suppression in wilderness, see the Fire and Fuels section in this chapter

Relative to adverse impacts adjacent to the wilderness boundaries, some of the mitigation measures available include: seasonal loggmg restrictions, design of harvest units (sensitive to visual concerns, potential windfall problems and slash disposal needs), road closures and the use of aerial loggmg systems (which eliminate the need for road access)

All Alternatives

Any wilderness recommendation in a Forest Plan is a preliminary administrative recommendation that will receive further review and possible modification by the Chief of the Forest Semce, the Secretary of Agriculture, and the President of the United States Congress has reserved the authority to make final decisions on wilderness designation Therefore, this wilderness recommendation is not appealable under the agency's administrative appeal procedures

Opportunities for solitude and a wilderness recreation experience will continue to be provided in all alternatives by the Thousand Lakes, Caribou, and Ishi Wildernesses (78,060 acres) Each area will be managed under its respective wilderness implementation plan to provide a quality wilderness experience

A complete discussion of the environmental consequences of committing each further planning

area to wilderness or to other uses is included in Appendix C, Further Planning Area Description and Analysis Other unroaded areas on the Forest are covered under the Recreation section in this Chapter and in Appendix M The following is a summary by alternative

PRF Alternative

Approximately two percent of the Forest, (21,584 acres) would be recommended for new wilderness (Heart Lake and portions of Wild Cattle Mountain, Mill Creek, and Trail Lake B further planning areas). The Heart Lake and Wild Cattle Mountain areas are contiguous to Lassen Volcanic National Park Wilderness, and the Trail Lake B area to the Canbou Wilderness Mill Creek is adjacent to the Ishi Wilderness These areas would complement emsting wilderness. Designation as wilderness would preserve the opportunities for solitude and challenge associated with pnmitive recreation Recreation use is now estimated at 8,800 RVD's for these four areas and would be expected to increase over time

The remaining further planning areas would be managed under non-wilderness prescnptions. These include Minimal Management, View/Timber, Rocky/Sparse and Timber for Butt Mountain, Semi-Primitive Motonzed, Semi-Pnmitive Non-Motorized, Special Areas and View/Timber for Ishi B, and View/Timber, Late Successional management prescnptions for the southern portion of Wild Cattle Mountain These prescnptions would provide varying degrees of motorized, non-motorized, and primitive recreation The Butt Mountain prescriptions preserve the opportunity for a possible downhill ski area Opportunities to harvest 4 7 MMBF annually would be foregone from the areas recommended for wilderness, 0 9 MMBF would be available on the remaining lands with timber management prescriptions

CUR and TGP Alternatives

All further planning areas (51,686 acres) would be considered and planned for non-wilderness management The opportunities would exist to harvest up to 5 6 MMBF annually on 24,864 suitable acres, to produce energy through geothermal and hydroelectnc developments in certain areas, to improve range, watershed, and wildlife resources and their outputs, and to increase non-motonzed and motorized recreation experiences through access and site developments

Natural-appeanng areas available for solitude and freedom from man's actinties would be gradually reduced The opportunity for additional wilderness acres would be foregone The quality of wilderness expenence would remain at the current level. Minimum management requirements for cultural resource protection would be met

EGP Alternative

The EGP Alternative would recommend 43,086 acres for the new wilderness, all of the further planning areas except Butt Mountain and a portion of Trail Lake B Butt Mountain would be classified as semi-pnmitive non-motonzed, and be unavailable for a possible ski area) The Heart Lake and Wild Cattle Mountain areas are contiguous to Lassen Volcanic National Park, and the inclusion of their 14,254 acres in the wilderness system would complement the Park wilderness Lying adjacent to the Ishi Wilderness, the addition of the Ishi B and Mill Creek further planniiig areas to wilderness (28,017 acres) would create a 69,117 acre Ishi Wilderness Complex

Wilderness designation would preserve the opportunity for solitude and challenge associated with pnmitive recreation Recreation use for all the further planning areas is now estimated at 13,600 recreation visitor days (RVD's) Of that total, 1,800 visitor days are estimated to be off-highway vehicle use in the Ishi B further planning area The inclusion of Ishi B as mlderness would eliminate the use of motorized vehicles and associated RVD's There would be a moderate increase in wilderness use because of expected recreation trends, population pressures, and public knowledge Wilderness designation would protect cultural resources and wildlife habitat, and maintain scenic values, and water quality The mlderness attnbutes in a vanety of high elevation, canyon, and foothill wildlands would be preserved for future generations Opportunities to harvest 5 6 MMBF annually would be foregone

25. WILDLIFE

Introduction

This section describes the potential effect each alternative may have on the habitat conditions and population trends of Management Indicator Species (MIS) MIS are the species for which population and habitat objectives have been established They are vertebrate or invertebrate species whose population changes are used to assess the effects of land management activities Through the MIS concept, the total number of species that occurs within a planning area is reduced to a manageable set that collectively represent the complex of habitat, species, and associated management concerns MIS are used to meet the requirements of the National Forest Management Act (NFMA) for maintenance of population vlability and biologxal diversity, and to establish management goals for species in public demand. Population viability is the ability of a population to sustain itself naturally MIS are also the species which, along with each one's habitat, will be monitored following implementation of the Forest Plan

Management Indicator Species selected on the Lassen represent Federally listed Threatened and Endangered species, Forest Service Sensitive species, important harvest species, and groups of species associated with key habitats that are likely to be at risk as a result of management activities on the Forest If habitat requirements for Management Indicator Species are met, habitat quantity and quality are assumed to be adequate for those species represented by the Management Indicator Species

Management Indicator Species identified on the Forest include bald eagle and peregrine falcon (both Federally listed as Endangered), northern spotted owl (Federally listed as Threatened), California spotted owl, northern goshawk, fisher and marten (listed as Sensitive by Region 5 of the Forest Service), bufflehead, osprey, hairy and pileated woodpeckers (snag dependent species), deer, pronghorn, black bear, gray squirrel and mallard (harvest species), and chinook salmon, steelhead trout and rainbow trout (water and riparian dependent species)

NFMA implementing regulations direct that *"Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species* in *the planning area For planning purposes, a viable population shall be regarded as one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed* in *the planning area 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 those individuals can interact with others in the planning area"* (36 CFR 219 19) **All** alternatives must comply with this direction

"Viability" is an attribute that is difficult to define in absolute numbers An exact number for viable populations is not known without considerable detailed population dynamics information for each species This level of precision is not available for most of the species on the Lassen because extensive Inventories of population levels and habitat conditions have not been done The MIS habitat capability models in Appendix O of the Forest Plan were used to identify the amount of habitat and condition class needed to sustain long-term Viability

"Well distributed" is also an attribute that is difficult to define It is assumed that viable populations will remain well-distributed within the planning area by the establishment of units of suitable habitat and connecting corridors between them. These units and corndors will allow for the genetic interchange and successful reproduction of individuals within a population

The main effects of the alternatives on wildlife would occur from changes in habitat types and in diversity of forest condition classes Changes in habitat result in changes in populations of associated species No single set of habitat conditions will meet the needs of all wildlife species Managing for one species that requires early successional stages or vegetation condition classes could adversely affect those species that need old growth and vice versa To evaluate the effects of each alternative on wildlife, the impacts on each species or group of species must be determined

Vegetative change, and subsequent changes in wildlife populations, are caused by many man-

agement activities In forested stands, changes result mainly from timber management (harvest, site preparation, release, thinning) In nontimbered areas, grazing and fire are dominant influences Human disturbance results both indirectly from road construction and its resulting increase in human use, and directly from recreation development Additional factors that influence the actual number of animals found in an area include the effects of hunting, predators, disease, yearly changes in weather and forage production, and competition with other animals All of these factors have an effect on animal populations

Threatened and Endangered Species Federally listed Threatened and Endangered species are those plant and animal species formally listed by the U S Fish and Wildlife Service under the authority of the Endangered Species Act of 1973, as amended An Endangered species is defined as one which is in danger of extinction throughout all or a significant portion of its range A Threatened species is defined as one which is likely to become endangered within the foreseeable future throughout all or a significant portion of its range

Bald eagle, peregrine falcon, Shasta crayfish and northern spotted owl recovery goals are management objectives in all alternatives The Forest will continue to give these species priority in all resource management decisions Habitat that is currently occupied or has high potential for future use will be managed to maintain its suitability This will be done by applying special management prescriptions, some of which may include limiting human disturbance in critical time penods such as the nesting season

Population levels and habitat management strategies will be based on current recovery plans or on the biological data that was used to establish listing The Forest's recovery goal for bald eagles is 16 reproducing pairs and three pairs for peregrine falcons Not all nesting sites for bald eagles and peregrine falcons have been identified on the Forest to meet recovery goals, although potential habitat has been located For bald eagles, potential habitat exists for an estimated maximum of 19 nesting pairs At least five areas are considered suitable eyries for use by peregrine falcons as their population recovers

The Shasta crayfish is the only invertebrate species found on or near the Forest that is a Federally listed Endangered species It occurs in the Fall River and Hat Creek subdrainages, and that portion of the Pit River which connects them A recovery plan has not been adopted for the species at this time The Forest will protect and/or enhance all known and potential habitat for Shasta crayfish

In January 1987, the U S Fish and Wildlife Service received a petition requesting the listing of the northern spotted owl as an Endangered species under the Endangered Species Act On June **23,** 1989, the Fish and Wildlife Servlce proposed to list the northern spotted owl as Threatened Following this proposal, a committee of scientists and researchers was formed to gather known information on the habitat requirements of this sub-species Their task was to develop a scientifically credible conservation strategy for the northern spotted owl in Washington, Oregon, and the Klamath province of northern California This group was called the Interagency Scientific Committee to Address the Conservation of the Northern Spotted Owl, or better known as the ISC In April 1990, the ISC recommended the creation of Habitat Conservation Areas (HCA) to replace the SOHA concept. One HCA, comprising 9,548 acres is located on the Shasta-Trinity National Forest on land partially administered by the Lassen Two SOHA's were within the HCA One was located outside of the HCA, but still within the area of study by the ISC These SOHA's are no longer being managed as part of the Forest's SOHA network now that they fall under the HCA strategy

Pending enactment of new legislation, any applicable action by the Endangered Species Committee, adoption of a recovery plan by the Fish and Wildlife Service, or the results of further biological consultation between the Forest Service and the Fish and Wildlife Service, the Forest Service will conduct timber management activities in a manner not inconsistent with the Interagency Scientific Committee recommendations

Sensitive Wildlife Species The Regional Forester has identified several "Sensitive" species They are animal species whose population viability is a concern on National Forests within the Region Sensitive species may also be species whose current populations and/or habitats are

reduced or restricted, or species that are considered vulnerable to various management activities Special management emphasis is needed to prevent the species from becoming Threatened or Endangered Identification of Sensitive species and emphasis on the management of Sensitive species habitat are Forest Service policy goals Management for Sensitive species is not directly related to Federally designated Threatened and Endangered species which are protected under the Endangered Species Act The Forest Service goal for Sensitive species management is to insure that species numbers and distnbution are adequate so that no Federal listing will be required and no Forest extirpation will occur California spotted owl, marten, fisher, northern goshawk, Sierra Nevada red fox, great gray owl, and willow flycatcher are Region 5 Sensitive species that occur on the Forest The effects on Sensitive species that are not MIS are also briefly discussed below

Calıfornıa Spotted ***Owls*** Habitat sufficient to maintain a minimum vlable population of California spotted owls was determined from the model described in the Final Environmental Impact Statement for the Pacific Southwest Regional Guide (1984) Direction m the Regional Guide stated that suitable spotted owl habitat is composed of mature and over-mature timbered stands having multi-layered conditions, a canopy closure of 70 percent or greater, and obvlous decadence Each SOHA must have 1,000 acres of base habitat consisting of 300 contiguous acres for a nesting core, and an additional 300 contiguous acres to serve as an alternate nesting core The remaining 400 acres may occur in three or less blocks, none of which are to be less than 60 acres in size In addition, 650 acres of replacement habitat is required within the SOHA

SOHA's are grouped in a network throughout the known range of the species to allow for continued dispersion and random interchange between members of the population The network consists of groups of three or more SOHA's separated by not more than 1 5 miles The groups are spaced between six and twelve miles apart Using these criteria for vegetative condition and spatial arrangement, the Lassen developed a network of 39 SOHA's as the minimum needed to maintain long-term species viability on the Forest This network meets the requirements of the Regional Guide

The PRF, EGP, and TGP Alternatives provide a network of 40 SOHA's and the HCA, totalling 75,100 acres. No scheduled timber harvesting will occur in these areas, resulting in a 27 MMBF per year loss of yield Salvage and some thinning activities may be appropriate under certain circumstances to remove timber killed from fire, drought, or insect infestations For any of these alternatives, timber management will only be proposed when it can be demonstrated through a biological evaluation and NEPA analysis that quality owl habitat will be maintained after treatment

The CUR Alternative provides the minimum network of 39 SOHA's and the HCA Scheduled timber harvesting would occur in these areas in accordance with specifications in the Regional Guide In this alternative, each SOHA is defined as a circle within a 1 5 mile radius around a core nesting area (the maximum radius used by spotted owls in areas of high habitat capability) This circle is equivalent to 4,500 acres, of which 1,000 acres of suitable base habitat were identified along with 650 acres of replacement habitat Even-aged management would be deferred in the 300 acre nesting core during the first decade

The objective of harvesting within the 4,500 acre circle is to reach regulated stand conditions over time to insure a steady supply of volume from the SOHA network while still meeting habitat suitability requirements The implied rotation is approximately 240 years Using even-aged silvicultural methods, about 30 MMBF per year could be harvested Within SOHA's that do not currently have 1,000 acres of suitable base habitat, silvicultural prescriptions would be designed to grow this habitat as soon as possible Timber management would only be proposed when it could be demonstrated through the SOHA Management Plan and NEPA analysis that quality owl habitat would be maintained by treatments

The current amounts of suitable habitat in the Lassen's SOHA network are below the habitat requirements and the population viability standards set forth in the Regional Guide Of the 40,000 acres designated as base habitat, 68 percent (or 27,200 acres) are suitable, 32 percent do not contain the vegetative conditions necessary to maintain population viability at this time All SOHA's will have the required acres of suitable habitat within the next three to five decades

Surveys since 1985 have located 191 spotted owls on the Forest Of these, 87 are paired There were 17 reproducing pairs on the Forest in 1990 and 36 in 1991 Within the SOHA network, reproduction has been recorded in 24 sites over the past five years, 19 SOHA's have had occupancy, and three SOHA's had presence Seven SOHA's have more than one pair of owls Also see Appendix S in the Plan

It is important to note that spotted owls (both single birds and pairs) have been found in habitat that does not meet the habitat capability model described in Appendix 0 in the accompanying Forest Plan This phenomenon may result when suitable habitat is eliminated on a significant portion of the owl's range, and there is displacement of owls into the remaining available habitat or forced occupancy of generally unsuitable habitat During this interim period, which can extend over several years, actual population numbers can be far above the remaining habitat's carrymgcapacity Under these circumstances, population surveys may be of httle value Long-term viability on the Forest is a minimum of 39 pairs sustained by a habitat network of 39 SOHA's The effects of alternatives vary by the number of SOHA's provided, and the amount of forest land in an old growth condition for interim, non-network owl management

Because the present SOHA network does not contain the required acres of suitable habitat as defined in the Regonal Guide to maintain population viability, the Forest developed a management strategy to protect non-network owls during the interim Under this strategy, an additional 125 acres will be protected for each non-network pair of owls inventoried This 125 acre size delineation was developed from the standards and guides in the ISC report for known pairs of owls outside of HCA's The report recommends 80 acres or a 1/4 mile radius circle (125 acres) for these pairs. The Forest agreed that 125 acres for known pairs outside of SOHA's would provide for minimal nesting habitat and the opportunity for dispersal into the SOHA network If a single owl is found, 125 acres will be protected for up to two field seasons to allow enough time for biologists to determine the status of the bird Management of non-network owls will continue until there is a reproducing pair within each SOHA in the network, an estimated three to five decades from now

The ISC report raised senous questions about the establishment of a SOHA network to maintain long-term viability for spotted owls At present an interagency task force has been established to evaluate other management options in place of the SOHA network Until more information **is** known or management direction changes, the Forest will continue using the SOHA concept In the meantime, all proposed land disturbing activities will undergo cumulative effects analysis (CEA) to assess their impact on suitable owl habitat outside of the SOHA network In order to preserve future management options, no degradation ***of*** presently suitable habitat will occur Continued monitoring each field season will assess current populations and habitat use This information will be used to determine if the SOHA network, as well as interim protection of non-network owls and the CEA, is maintaining species viability as planned

Fisher and Marten The management objective for marten and fisher is to maintam and enhance their population where possible, to insure they do not become federally listed as Threatened or Endangered Marten and fisher are elusive species, and little **is** known about their habitat requirements or current population levels on the Forest Suitable marten and fisher habitat was identified based on the latest scientific knowledge as summarized in a comprehensive regional literature review in November 1989

The Forest will manage for marten and fisher by designating management areas and corridors that contain enough suitable habitat as identified in the regional literature renew Habitat management areas are connected by corridors that permit movement between them along riparian zones or through saddles over ridges. This will allow for successful recruitment and integration of offspring into the gene pool Habitat areas and corridors have also been located to provide, to the greatest extent possible, for movement of individuals between areas of suitable habitat on adjacent National Forests

Under the medium habitat capability model in Appendix **O** of the Forest Plan, the home range for fisher comprises 9,800 acres with a minimum stand size of 80 acres Habitat areas are spaced 3-8 miles apart Travel corridors between the areas are 600 feet wide These areas are continuous blocks of land with a majority of the area

comprised of well stocked, large sawtimber and old growth stands Five fisher areas have been identified on the Lassen, totaling 63,380 acres Two of these areas also overlap with four marten areas

Marten requirements under the medium habitat capability model call for 2,100 acres of home range with a minimum stand size of 80 acres Again, large sawtimber and old growth stands are considered suitable for marten habitat Management areas are spaced approximately three miles apart with an average corridor width of 600 feet to provide a travelway to other areas A total of 19 management areas were established on the Forest for marten comprising 30,395 acres

The current amounts of suitable habitat within fisher and marten habitat management areas are below the habitat requirements and the population viability standards set forth in the literature review Of the 94,000 acres tentatively identified as habitat, 33 percent do not contain the vegetative conditions necessary to maintain population viability In addition, little is known about the current population levels of these elusive species Until habitat areas are inventoried and population surveys are conducted, the Forest cannot reliably predict the effect land disturbing activities would have on marten and fisher

Scheduled timber harvesting is deferred in marten and fisher management areas (and in their connecting corridors) in the PRF, EGP and TGP Alternatives, resulting in a 7 MMBF per year decline in yield The management areas are located primarily in places with a history of sightings and on lands already withdrawn from full timber management Establishment of these management areas and corridors is expected to provide sufficient habitat to maintain populations at levels that will contribute to long-term viability in the Sierra Nevada and Klamath provinces

As with SOHA's, some salvage or thinning activities may be appropriate under certain conditions to remove timber killed by fire, drought or insects, or to improve and protect habitat for these species Timber management will not occur unless proposed treatments maintain habitat suitability

Great Gray Owl This owl, probably the rarest owl in the Sierra Nevada, has been confirmed as a resident on the Forest It prefers dense, older timber stands bordering meadows and may change its territory seasonally Large snags are required for nesting and perching

Little is known about the great gray owl's population or distribution on the Forest However, its habitat will be protected by managing meadow ecotones under the F Riparian/Fish Prescription, as outlined in Chapter 4 in the Forest Plan The Forest's snag management levels, discussed in Appendix O in the Plan, will provide snags to meet the requirements of this species

Population levels and habitat conditions would probably mot be affected by the PRF and EGP Alternatives Effects would be more significant under the CUR and TGP Alternatives with their greater emphasis on timber management, regeneration harvesting, and road construction

Northern Goshawk A network of 113 goshawk management areas (GMA's) has been established over the Forest that meets the standards in the Pacific Southwest Regional Guide Goshawk territories were established to maintain a density of at least one territory per 18 square miles Distances between territories or clumps of territories do not exceed **12** miles Each territory contains a minimum of 50 acres of suitable habitat which is composed of mature and over-mature, multi-layered timbered stands Each GMA was located with preference given to known active or historic nest locations The remaining areas were located based on habitat suitability and spatial distribution requirements As new goshawk nests are located, a GMA will be created around the nesting pair to replace an existing, unused GMA

Timber management activities may occur within goshawk territories, except during the nesting season when there is occupancy Treatments are restricted to salvage and sanitation harvests to maintain the structural integrity of the stand and habitat suitability Thinning may also occur

On September 26, 1991, a petition was filed by several conservation groups to list the northern goshawk as Threatened within its western range

The U S Fish and Wildlife Service announced in the Januaiy 7, 1992 Federal Register that the northern goshawk in thr "forested West" is not a listable entity However, the USFWS is in initiating a Status Review on their own due to the high level ofconcern and indications of declining populations and habitats The goshawk is currently being upgraded to a Category 2 species throughout its range in the United States The USFWS will make a finding on the status renew in one year They will then decide whether to propose the species for listing by January 7, 1993 If it is proposed for listing at that time, the USFWS will determine whether Federal listing is warranted by January 7, 1994

Sierra Nevada Red Fox Our knowledge of the Sierra Nevada red fox on the Forest is based on widely scattered sighting records covering many diverse habitat types These records indicate that the red fox is rather general in its habitat requirements and not particularly abundant in any habitat type Actual population levels would probably not be affected to a significant degree by any of the alternatives

Willow Flycatcher This uncommon summer resident has been identified on the Forest It is found in riparian, deciduous habitats and in wet meadows with willow thickets Willow flycatcher populations are declining due to the destruction of riparian habitat throughout California and nest parasitism by brown-headed cowbirds (Johnson 1963, 1966, Gaines 1977)

Riparian habitat will be protected in all alternatives by using Best Management Practices (Forest Plan, Appendix &) and by managmg riparian zones under the F Riparian/Fish Prescription, discussed in Chapter 4 in the Forest Plan

Management effects on population levels and habitat conditions would be greatest under the CUR Alternative as riparian areas are more intensively managed for timber production The PRF, EGP, and TGP Alternatives propose timber harvesting in riparian areas only when riparian values can be maintained or enhanced They also place more emphasis on range management and the restoration of degraded nparian conditions

Snag Dependent Species Habitat capability for snag dependent species (such as woodpeckers) is most accurately depicted by the Forest's snag management levels, discussed in Appendix O These levels are based upon snag densities that have been found to support desirable populations of snag dependent species However, maximum populations have not been established for most snag dependent species, and the Forest's existing snag habitat levels are not completely known

Each alternative will provide snags to meet the viability requirements ofthese species An average of at least 1 5 snags per acre will be provided through time in all forested areas Snags will be of various diameters and condition classes, and will be located near water, riparian zones, meadows and other openings where possible Green, "cull" trees can be substituted for dead snags, provided at least one dead snag remains per acre Green snags must be live trees at least 30 feet tall, showing defects including at least one of the following charactenstics broken top, spike top 1/4 of tree dead), large dead limbs that would provide cavity forming potential, existing cavities, or defects in the bole that could become cavities

Down wood is a habitat component that affects habitat quality for most snag dependent species by providing foragmg habitat and increased amounts of prey Each alternative will provide down wood averaging at least 15 logs per acre in eastside pine, 3 per acre in mixed conifer and 4 per acre in true fir Logs are to be a minimum of 15 feet long and a minimum of 15 inches in diameter on the small end of the log

Continued removal of snags and down wood for firewood in all alternatives will reduce habitat for species dependent on these elements The difficulty of enforcing minimum snag levels with firewood cutters can make this a significant problem in certain areas

Harvest Species All alternatives will provide habitat to support harvest species above viable population levels Deer and antelope habitat will be most influenced by the amount and types of timber practices, amount of prescribed burns and wildfires, and rangeland conditions There is significant highway mortality of deer on the Forest, particularly during migrational periods, due to automobile accidents Tables 2-3 through 2-6 show total deer numbers and habitat im-

provementforeach alternative Table **4-21** shows the capability (capacity) of deer mnter range that lies wthin the Forest for each alternative

Antelope are dependent upon the quality of rangeland resources, Unless management activlties are proposed within their habitat, few impacts are anticipated under any of the alternatives

Minimum management requirements outlined in Appendix **O** of the Forest Plan for oaks and wetlands mll maintain populations of western gray squirrels and mallards

Table **4-21**

Deer Winter **Range** Capability

	Base Year 1982	Alternative PRF	CUR	EGP	TGP
Winter Range Deer **Numbers** (Thousand Deer)	296	281	329	284	285

Water and Riparian Dependent Species Chinook salmon, steelhead and rainbow trout are selected fish Management Indicator Species for water and ripanan areas. Under all alternatives, habitat mll be provided to support populations above vlable levels for each species Constant to all alternatives are Best Management Practices for water quality and ripanan area management, Forest Standards and Guidelines for fish, and specific nparian area management measures as directed under the **F** Riparian/Fish Prescnption Implementation of these management practices and guidelnes will insure that the characteristics and functions of nparian areas will be buffered during forest management activlties, and that they will provlde current and future fish habitat requirements and maintain overall channel integrity. Since fish are considerednparian-dependentresources, they aregiven preferential considerationinnpananareas where conflicts among land use activlties might occur

Predicted production levels for MIS vary by alternative, depending on the level of watershed disturbance and the added effort required to insure maintenance and restoration of aquatic resource values Water and riparian dependent fish species are discussed in more detail in the Fish section of this chapter (In this section, rainbow trout are discussed under resident fish; chinook salmon and steelhead are discussed under anadromous fish)

All Alternatives

a. Direct and Indirect Effects

The effects of implementing the various alternatives on wildlife were evaluated considering the direct and indirect risk to populations and habitat conditions from resource management practices Generally, all alternatives except CUR provide for improved habitat diversity

Effects from Recreation Management Increased recreational use **of** the Forest is projected in all alternatives except CUR Four recreation-associated activlties (motonzed vehicle use, developed campgrounds, dispersed recreation use and consumptive use of wildlife) would provlde the greatest risk to mldlife

Motonzed vehicle use, both on-highway and off-highway, would be evaluated annually and changes in access would be made to diffuse effects to a level consistent with the goals and objectives of each alternative

Use associated with developed campgrounds can affect distnbution **of** some wildlife species, their habitat, or increase the risk of conflict with certain species such as the black bear Dispersed recreation can also directly affect wildlife by reducing available habitat and increasing the nsk for conflict between man and species that require remote habitat

New, developed campgrounds are proposed with all of the alternatives to meet anticipated demand through decade **3,** except CUR Only the PRF Alternative would provlde a full range of dispersed recreation opportunities on 65,000 acres of semi-primitive areas A limited range of dispersed recreation would be provlded in the other three alternatives New campgrounds and dispersed recreation opportunities will be evaluated, and mitigation measures will be proposed to reduce or diffuse the effects on mldlife

Effects from Wilderness Management Wilderness and proposed mlderness areas allow natural ecological change to take place. **A** positive effect of wilderness is the low-risk management scheme which reduces the potential for human disturbance to mldlife and their habitat Wilderness most benefits those species that are dependent upon late successional ecosystems and prefer remote habitat Wilderness designation of forested lands does not usually benefit early successional species

Wilderness excludes opportunities to improve wildlife habitat through vegetative manipulation or to increase habitat diversity that would he beneficial to species such as blacktail or mule deer Vegetative manipulation such as prescnbed burning is often restncted, although wildfires may be allowed to burn mthout suppression in some cases

The EGP Alternative provides the most area managed as mlderness with 121,146 acres. PRF proposes 99,644 acres for wilderness management No additional wilderness areas are proposed with the CUR or TGP Alternatives, existing mlderness would remain at 78,060 acres

Effects from Range Management Livestock grazing affects many wildlife species Though modification of habitat, there is a high risk for grazing to adversely affect species which rely on openings, early successional stages, and riparian areas Wildlife, particularly deer and antelope, compete with livestock for forage, space and water in nparian and mnter range areas Livestock grazing can also affect wildlife by reducing cover or by making available green forage through the removal of mature foliage.

Range treatments can have both positive and negative effects for wildlife due to modification of plant species composition and distnbution Structural improvements such as water developments can also increase habitat for some species of wildlife Another potential effect on mldlife can come from fencing used to control livestock movement, especially around ripanan areas Fences can cause injuries or block wildlife movement

All alternatives would maintain the current grazing level or have a slight reduction (2 percent) in **AUM's** The range condition would be maintained or enhanced under all alternatives This would result in little change in the present level of nsk to mldlife Emphasis is placed in the Forest Standards and Guidelines, and Management Prescnptions to meet mldhfe habitat and forage needs, as well as maintain ripanan values

Effects from Timber Management Risk to the wildlife resource in terms of population viability and distribution of habitat vanes by the amount and intensity of timber management applied Timber management can have both positive and negative affects on wildlife Through coordmation, harvesting can 1) create more habitat for species dependent on openings, 2) be used as a tool to establish and maintain a diversity of forest communities and habitats that are favorable to many species of wildlife, 3) regenerate aspen and oak stands where conifers are invading, **4)** and restore meadows or wet areas by removing encroaching lodgepole or other species

Timber management also has a nsk of negatively affecting wildlife The loss of mature forest and old-growth habitat affects those species that are dependent upon old growth ecosystems and decadent conditions Harvesting can also increase the nsk to wildlife from higher levels of human disturbance, increased road access, reduced hiding/thermal cover, and loss of remote, undisturbed habitat

The CUR Alternative treats the most acres by even-aged methods (5,900 acres/year) followed by TGP with 3,500 acres/year, and PRF with 2,600 acres/year This form of regeneration benefits species that rely on openings, early successional conditions, and transitory range The EGP Alternative proposes 3,100 acres/year in group selection ("patch') cuts, two acres or less in size. Effects on wildlife from this form of uneven-aged management need to be studied to determine utilization by early and late successional species

Timber harvesting in old growth forests reduces in habitat Capability for spotted owl, marten, and fisher The CUR Alternative has the highest allowable sale quantity and number of acres that are treated by even-aged management It has the greatest potential Forest-wide to reduce habitat capability for late successional species The EGP Alternative has the lowest allowable sale

quantity and the lowest potential to reduce habitat capability Under all alternatives, harvest units will be planned to minimize fragmentation of suitable habitat and provide connecting corridors between larger blocks of old growth areas In addition, habitat areas have been established for old growth dependent species to maintain population viability, and insure that they remain well-distnbuted throughout their range.

Effects from Roads and Trails Interaction between humans and wildlife, particularly where wildlife is hunted, has a high risk of negatively affecting many wildlife species For certain species, such as the black bear, conflict can lead to a loss of individuals or reduced habitat value Motorized accesstends to increase the frequency of these interactions

All alternatives would have restrictions on off-highway use to reduce the risk to wildlife In some areas, the restrictions would also limit motorized access to trails Non-system roads would be evaluated and those not necessary for management purposes would be closed to eliminate casual vehicle use Some of the closed roads could be used as trails for off-highway vehicles

Wildlife and wildlife habitat is disturbed by new road construction Roads constructed to timber harvest areas allow the public greater access to the Forest, and provide increased opportunities for human and wildlife interactions Although roads also provide travelways for wildlife, roads which remain open may result in increased huntingpressure, traffic, and wildlife mortality Road construction can also displace one population into the territory of another, resulting in increased competition for space, cover and forage

The number of roads constructed reconstructed or maintained for use is proportional to the level of an alternative's commodity production, primarily timber production and recreation The CUR Alternative, presumably, ha5 more road construction and reconstruction than the other three alternatives TGP has the second highest with 88 miledyear in decade 1 PRF and EGP have 66 miledyear of road construction and reconstruction in the first decade Maintained roads are approximately the same for all four alternatives (3,472 miles) in decade 1 Roads and trails open to off-highway vehicle use in the summer and in the winter are also virtually the same for all the alternatives Overall, the CUR Alternative has the greatest risk to wildlife from roaded access and disturbance.

Effects from Prescribed Burning Preplanned ignitions can be used as a tool to manipulate vegetation and improve wildlife habitat This is particularly true for deer, but also true for other species that require a diversity of cover and food types Preplanned ignitions to benefit wildlife are prohibited in wilderness PRF, EGP, and TGP Alternatives treat 1,300 acres/year in decade 1 for the benefit of wildlife CUR proposes 1,760 acres/year

b. Cumulative Effects

Effects from road building, timber harvest, recreation activlties, and habitat changes can all contribute to the cumulative effects on suitable habitat for old growth dependent species Activities on adjacent private land will also reduce old growth habitat outside of National Forest ownership On the other hand, timber management activities may improve the quantity of food resources for deer, antelope and other early seral species

All alternatives would be expected to maintain the viability of California spotted owl populations through the current SOHA network The CURAlternative calls for scheduled timber management in SOHA's Harvesting may reduce suitable habitat below the medium habitat capability level descnbed in Appendix O of the Forest Plan However, SOHA management direction may change as a result of continuing research and monitoring of the habitat requirements for this subspecies Northern spotted owl viability would be maintained with established Habitat Conservation Areas throughout Oregon, Washington and the Klamath Province in northern Californa

Using current information and management direction, all alternatives would maintain the viability of marten and fisher populations The CUR Alternative calls for limited timber management, in marten and fisher areas Harvesting may reduce suitable habitat below the medium habitat capability level described in Appendix O ofthe Forest Plan Extensive harvesting activity on National Forest and adjacent private lands will reduce the opportunity for individuals to

interchange and mix gene pools between unconnected blocks of suitable habitat The greatest adverse, cumulative effects would be in those alternatives that would cause the most reduction in habitat The CUR and TGP Alternatives have the highest risk

The recovery plans for bald eagles and peregrine falcons consider the requirements on all ownerships and assign habitat protection goals to public land agencies Adverse, cumulative effects would be prevented by adherence to the recovery plans for these two species in all alternatives

c. Mitigation Measures

Wildlife can be managed on the Forest in two ways (1) by protection and (2) by the application of Standards and Guidelines Protection involves specific land allocations such as the HCA's, SOHA's, marten and fisher habitat management areas In other areas, Forest Standards and Guidelines for wildlife resources will guide timber management, road building, fuels management, mining, and livestock grazing

The management objective for wildlife resources is to provide a mix of habitat capable of indefinitely supporting all native and desirable nonnative wldlife species Protection of Management Indicator Species is achieved through management of specific habitat types and/or structures, including snags, dead and down woody debris, deer range, mature/old growth, riparian/hardwood habitat, and Threatened, Endangered and Sensitive species habitat.

In all alternatives, Threatened and Endangered species will be protected as required under the Endangered Species Act In the PRF, CUR and EGP Alternatives, greater emphasis is placed on protecting additional habitat by the fifth decade for bald eagles and peregrine falcons The TGP Alternative maintains habitat at recovery goals

Spotted owl nests and roosting sites found outside designated Spotted Owl Habitat Areas (in areas managed for timber production) will be protected through Forest-wide Standards and Guidelines The Standards and Guidelines direct that 125 acres be protected around every non-network nesting pair of owls and around single birds for up to two field seasons until pair status can be determined Owl surveys and cumulative effects analysis will be conducted pnor to any land disturbing activity that may impact owl habitat Designated SOHA's will be monitored annually to determine pair occupancy and reproductive status General population trends for spotted owls can be determined by monitonng across the Forest The Forest will maintain the flexibility to manipulate the spotted owl network in response to information gathered through monitonng or as new management direction is developed

Old growth habitat lost to timber harvest, fires or natural catastrophes cannot be mitigated If new silvicultural methods are established to harvest timber while simultaneously providing for "old growth structural charactenstics at an early stand age, these methods may provide mitigation possibilities in the future Under all of the alternatives, old growth habitat for cavlty nesters, martens, fishers, pileated woodpeckers and spotted owls would decline

Some alternatives preserve significantly more wildlife habitat with old growth charactenstics than others In all alternatives, this habitat type will gradually diminish and by the fifth decade will be greatly reduced in commodity-oriented alternatives However, all alternatives would increase the number of acres in large sawtimber stands by decade 5 which would partially offset the decline of old growth The PRF and EGP Alternatives protect a significantly larger amount of wildlife habitat with old growth characteristics than the other alternatives The PRF and EGP Alternatives provide old growth habitat through SOHA's, wilderness, semi-pnmitive and special areas, riparian zones, old growth retention areas, and marten and fisher habitat.

Mitigation for loss of snag habitat involves the retention of current and future snags for primary cavity excavators on lands suitable for timber harvest Retention of cavlty nester habitat may be best achieved by retaining habitat "islands" as opposed to single trees Islands retain some habitat integnty, while individual snags provide a single nest, foragmg or perch site only Nest boxes and the drilling of nest holes in trees are used to supplement habitat, but are generally viewed as a last resort, to be used only when natural habitat is unavailable Mitigation for dead and down woody material includes retention of slash piles and large woody debris on new

harvest units Mitigation for loss of dead and down habitat on existing harvest units may also be feasible Logs, root wads or other woody debris can often be placed in adjacent uncut stands

All bald eagle and peregnne falcon habitat is protected in all alternatives A specific land allocation for bald eagles is included under the Late Successional (L) Prescnption

The management objective for deer is to provide habitat capable of indefinitely supporting these species All alternatives are designed to meet this objective in at least a minimally adequate fashion Alternatives with lower timber harvests have fewer roads, which result in less disturbance to deer and antelope and thus higher habitat capability Each alternative has a different potential for deer habitat Capability, as displayed in Table 2-7 in Chapter 2 Increased forage will be available on transitory range created by timber harvesting The CUR Alternative has the most regenerated acres, and therefore, a higher proportion of transitory range In all alternatives, projects such as creation of permanent meadows, forage seeding and road closures would occur, but the amount differs by alternative

The PRF and EGP Alternatives provide for more old growth habitat while CUR and TGP provide less Loss of old growth includes loss of optimal thermal cover This would decrease habitat capability for deer, especially when significant loss of optimal cover occurs within winter range There is a subsequent increase in deer forage with the reduction of old growth However, increased forage does not compensate for the loss of thermal cover Alternatives that maintain quality thermal cover, particularly in winter range, would also result in better long tem protection

The suitability of vegetative cover for wildlife is modified by the amount of roads open to the public The effectiveness of wildlife hiding cover is reduced by an increase in roads and road use Specific roads can be closed to protect wildlife travel corridors or hiding cover Closed roads can be seeded to provide some forage for wildlife Deer use of otherwise suitable feeding and resting areas is reduced adjacent to open primary and secondary roads

All alternatives provide for various habitat Improvement projects through implementation of the Sikes Act (Public Law 93-452) as well as **K-V** (Knutson-Vandenburg) projects Implementation of habitat improvement projects would increase deer habitat capability More projects may also be done if alternative funding sources are available

PRF Alternative

Threatened and Endangered Species This alternative would protect all Threatened and Endangered species and their habitat. Consultation with the U S Fish and Wildlife Service will be done any time a project is proposed that may affect a Threatened or Endangered species Potential effects will be mitigated by evaluating the needs of the species in each management decision Measures such as seasonal avoidance or relocation of planned activities will be used to avoid negative effects At least 19 current or potential bald eagle nest territories would be protected and managed to provide long-term habitat The Forest's goal of **16** nesting pairs is expected to be reached by the first decade, and possibly exceeded, due to habitat protection and recent increased population size for the species over its range

The Forest would continue to protect five suitable breeding areas for peregnne falcons and would actively participate in population recovery activities, in conformance with species recovery plan objectives This includes nest monitoring, collection of eggs for artificial hatching, etc until the recovery goal of three nesting pairs for the Lassen is met By decade 2, Forest Plan direction calls for five nesting pairs of peregrine falcons

Shasta crayfish habitat will be protected A species recovery plan has not been adopted at this time No planned management actions are expected to affect this species or its habitat

The recent listing of the northern spotted owl as Threatened requires development of a species recovery plan The recovery plan, when adopted, will be followed by the Forest in all management decisions

Sensitive Species Population densities for California spotted owl, goshawk, marten, and fisher

would be lower in areas under full timber management (Timber Prescription lands) New road construction and even-aged timber management, in particular clearcutting, would reduce habitat suitability for these species in some areas

Designated habitat areas for fisher, marten, spotted owl, goshawk, plus old growth retention areas, Research Natural Areas, Special Interest Areas, proposed Wild and Scenic River corridors, semi-pnmitive areas, and wildernesses will all contribute late seral stage vegetation They contain abundant snag and down log densities which are important habitat components for these species Forested areas receiving no scheduled or limited timber management (228,794 and 254,301 acres respectively) could provide suitable habitat where crown condition and structural diversity requirements can be met

The PRF Alternative would provide for 106,000 acres of large sawtimber in decade 2, a decrease of 14 percent from 1982 By decade 5, however, there should be 243,000 acres, an increase of 120,000 acres from 1982 as young sawtimber stands mature Compared to the other alternatives, PRF ranks highest in the total number of acres of large sawtimber provided by decade 5 Large sawtimber stands have many attnbutes of old growth such as percent canopy closure, average diameter, and structural attnbutes However, they may lack other qualities such as decadence Large sawtimber stands are considered suitable habitat for these Sensitive species if they are greater than 80 acres in size, and are spatially arranged to permit movement and successful interaction and reproduction As such, these areas will add to the vegetative diversity found on the Forest, and contnbute to species viability and distribution of habitat for wildlife dependent upon late successional ecosystems

The SOHA network will provide 40 habitat areas for the California spotted owl Currently, there is not enough suitable habitat wthin the network to maintain species viability Until sufficient habitat is available, spotted owl pairs would be protected outside of the management areas by locating nest or day roost sites, and protecting at least 125 acres of suitable habitat around them Day roost sites will be protected for up to two field seasons to determine if there is pair status When the SOHA network is up to regional standards in the next three to five decades, the additional protection for non-network owls will no longer be needed

A network of 113 goshawk management areas would be established, based on known nest sites and suitable habitat where nest history is unknown Goshawk management areas will provide for distribution of this species over the Forest

Five fisher management areas and **19** marten areas would provide adequate amounts of habitat spatially arranged to provlde for successful recruitment of young and dispersal across the length of the Forest and to adjacent lands

Snug Dependent *Species* Species dependent on snags and/or down logs for nesting or foragmg will have improved habitat suitability over the existing situation due to higher snag and down log retention levels In addition, there would be 243,000 acres (by decade 5) maintained in large sawtimber stands that will acquire the characteristic decadence of old growth stands overtime In the future, species such as hairy and pileated woodpeckers that are dependent on snags for nesting, would be expected to have improved habitat conditions on the Forest with this alternative Management prescriptions that are compatible with the maintenance of high snag and down log density levels are Wilderness, Special Areas, Semi-Primitive, Old Growth/Goshawk, Late Successional, and Rocky/Sparse

Harvest Species Summer range habitat for deer and to a lesser extent, pronghorn, would be improved by the regeneration of up to 4,000 acres of forested habitat per year, including 600 acres regenerated by the Early Successional Prescription Additional habitat improvement would result from prescnbed burning 1,300 acres per year Summer deer habitat capability would decrease according to the habitat capability model used to predict population levels based on management activities In decade one, population levels would decrease seven percent from the 1982 level to 45,600 By decade five, habitat capability would improve to 47,200 deer Winter range habitat Capability for deer would decrease by five percent to 28,100 in decade 1 and remain stable thereafter Road construction would increase human disturbance of deer

Wetlands maintenance and development for waterfowl would occur on 20 acres per year dunng decade 1, providing a moderate increase in waterfowl population Moderate timber harvest would retain more hardwoods for squirrels

Additional road building and even-aged timber management would reduce escape cover, and increase human disturbance factors for black bear These effects will be mitigated by the number ofacres that wlll receive no scheduled or only limited timber management.

CUR Alternative

Threatened and Endangered Species This alternative protects Threatened and Endangered species Higher levels of road construction and timber harvest activlties would potentially affect habitat quality for bald eagles in some areas Nineteen terntones for bald eagles and five eynes for peregnne falcons would be maintained by decade 2 Recovery goals for these species would be met in decade 1 The recovery plan objectives for the northern spotted owl wlll be followed when they are developed.

Habitat for the Shasta crayfish will be protected where it occurs A recovery plan has not developed, however no planned management actions are expected to affect this species or its habitat

Sensitive Species This alternative provides habitat for 39 pairs of spotted owls in a network of management areas across their range on the Forest Each SOHA would be managed to maintain 1,000 acres of old growth or mature sawtimber as base habitat and 650 acres as replacement habitat Over time, the base habitat area would be moved to the replacement habitat to allow those stands to be harvested Currently, there is not enough suitable habitat mthin the spotted owl network to maintain species viability Timber harvesting is scheduled in the SOHA network in an effort to accelerate the growth of suitable habitat and capture yleld in excess of suitabihty requirements. Designated stands within 1 5 miles of the nesting core would be harvested using even-aged methods It is estimated that the **SOHA** network would meet regional standards in the next three to five decades Spotted owl pairs would not be protected outside of the management areas Because of the intensity of timber management under CUR, spotted owl populations are expected to decline to just those pairs mthin SOHA's

Nineteen marten, five fisher and **113** goshawk management areas would provlde suitable habitat, spatially arranged to allow for reproductive success and genetic interchange between management areas and adjacent lands Timber harvesting is scheduled within goshawk, marten, and fisher areas under this alternative. Pnmary treatments wlll be the removal of salvage and sanitation volume Silvlcultural prescnptions wlll be designed to maintain habitat conditions at the medium habitat capability level as shown in Appendix O of the Forest Plan Effects of harvesting on population viability and distribution are unknown at this time, and would be monitored as projects are implemented.

By decade **5,** there will be fewer acres in large sawtimber stands than any of the other alternatives, resulting in reduced habitat for these Sensitive species There are no proposed Research Natural Areas, Special Interest Areas, Wild and Scenic River corndors, wildernesses, or semipnmitive areas that would be managed under a late seral prescnption. The CUR Alternative has more acres under full timber management (394,418) and proposes more even-aged management (5,900 acres/year) than the other alternatives While this management strategy can benefit species dependent upon early successional vegetation, it does not provlde vegetative diversity, suitable cover or food sources for late successional species.

Snag Dependent Species These species would occur at low to moderate populations under this alternative, especially in eastside pine stands A large number of acres would be assigned to prescnptions that utilize full timber management and therefore, provlde low snag habitat capability Compatible management prescnptions are the same as those listed under the PRF Alternative

Haruest Species About 1,760 acres per year would be burned to improve deer forage and approximately 7,900 acres per year would be regenerated. None of the regenerated forested lands would receive the Early Successional Prescnption Deer summer range capacity would increase to 49,700 in decade 1, a one percent increase over the 1982 level, but nine percent

below the population goal. By decade 5, the population would reach 52,600 (seven percent above 1982) Deer mnter range capacity would increase by 11 percent, to 32,900 deer in decade 1. Pronghorn summer range would be improved as a result of rangeland improvements for livestock and deer habitat improvement. Wetlands maintenance and development would continue at the rate of 5 acres per year Habitat quality for black bears and gray squirrels would decline Roadbuilding would reduce escape cover for deer and black bear High timber production and firewood utilization would reduce hardwoods and snags in many areas, along with populations of dependent species

EGP Alternative

Threatened and Endangered Species This alternative provides protection and management of 16 bald eagle nesting territories in the first decade to meet recovery plan objectives Nineteen nesting territories will be provided by decade 2 Five peregrine falcon eyries will be protected to exceed the recovery plan goal of three nesting pairs for this species, also by decade 2 The Forest would actively participate in population recovery activities such as nest monitoring, collection of eggs for artificial hatching, etc until recovery objectives are reached.

The recent listing of the northern spotted owl as Threatened requires development of a species recovery plan. The recovery plan, when adopted, will be followed by the Forest in all management decisions. It may allow some activities that could reduce habitat suitability for northern spotted owls in certain areas However, no management actions would be implemented that would diminish viability of this species on the Forest

Shasta crayfish habitat will be protected Although a recovery plan has not been adopted for this species, there are no planned management activities that are expected to affect them or their habitat

Sensitive Species Population densities for California spotted owl, goshawk, marten, and fisher would decline in areas under full timber management (Timber Prescription lands) Timber would be harvested primarily by group selection cuts two acres or less in size It is unknown how this method of uneven-aged management will affect these Sensitive species, particularly marten and fisher which are more tolerant of openings within dense stands. Monitoring during and after project implementation would determine how population levels and distribution are being affected by harvest activities and road construction.

Designated habitat areas for fisher, marten, spotted owl, goshawk, plus old growth retention areas, Research Natural Areas, Special Interest Areas, proposed Wild and Scenic River corridors, semi-primitive areas, and wildernesses will all contain late seral stage vegetation with abundant snag and down log densities which are important habitat components for these species Forested areas receiving no scheduled or limited timber management (239,254 and 258,246 acres respectively) could provide suitable habitat where crown condition and structural diversity requirements are met

This alternative would provide for 97,000 acres of large sawtimber in decade 2, a decrease of 21 percent from 1982. By decade 5, however, there would be 236,000 acres, an increase of 113,000 acres over 1982 as young sawtimber stands mature. EGP would provide the second highest amount of habitat in large sawtimber stands Large sawtimber stands have many attributes of old growth such as percent canopy closure, average diameter, and structural attributes, but they may lack other qualities such as decadence. Large sawtimber stands are considered suitable habitat for these Sensitive species if they are greater than 80 acres in size, and are spatially arranged to permit successful interaction and reproduction As such, these areas would add to the vegetative diversity found on the Forest, and contribute to species viability and distribution of habitat for mildlife dependent on late successional ecosystems

The SOHA network would provide 40 habitat areas for the California spotted owl. As with the PRF Alternative, there is not enough suitable habitat within the network at the present time Spotted owl pairs would be protected outside of the management areas by locating nest or day roost sites, and protecting at least 125 acres of suitable habitat around them When the SOHA network is up to regional standards in the next three to five decades, the additional protection for non-network owls would no longer be needed

A network of 200 goshawk management areas would be established, based on known nest sites and suitable habitat where nest history is unknown Goshawk management areas would provide for distnbution of this species over the Forest

Five fisher management areas and 19 marten areas would provide adequate amounts of habitat spatially arranged to provide for successful recruitment of young and dispersal across the length of the Forest and to adjacent lands

Snag Dependent Species Species dependent on snags and/or down logs for nesting or foragmg will have improved habitat suitability over the existing situation due to higher snag and down log retention levels In addition, there would be 236,000 acres (by decade 5) maintained in large sawtimber stands that will acquire the charactensticdecadence ofoldgrowth stands overtime In the future, species such as hairy and pileated woodpeckers that are dependent on snags for nesting, would be expected to have improved habitat conditions on the Forest with this alternative. Compatible management prescnptions where high snag and down log densities would occur are the same as those listed under the PRF Alternative

Harvest Species About 1,300 acres per year of non-timbered deer habitat would be burned in summer and winter ranges A moderate number of timbered acres (average 4,000 per year) would be regenerated including 600 per year under the Early Successional Prescription Deer summer habitat capability would decrease by 11 percent from 1982 in decade 1 to 43,600 deer By decade 5, deer capability would increase to 49,400, one percent above 1982. Deer winter range capability wouldddecrease by four percent to 28,400 deer Moderate timber harvest levels would retain more hardwoods for squirrels and provide less road disturbance for bears Wetlands maintenance and development for waterfowl would occur on 40 acres per year during decade 1, providing a moderate increase in waterfowl population

TGP Alternative

Threatened and Endangered Species Minimum recovery goals would be met Sixteen existing or potential bald eagle terntones and three potential peregrine falcon sites would be maintained Shasta crayfish habitat will be protected where it occurs When developed, recovery plan objectives for the northern spotted owl would bc followed

Sensitive Species Moderate amounts of habitat would be available for spotted owls, goshawks, marten and fisher Forty spotted owl habitat areas would beprotected, and 113 goshawk management areas would be maintained Fisher and marten management areas and corridors would exist as in the other alternatives

Population densities for these species would be reduced in areas under full timber management (Timber Prescnption lands) Under this alternative, there are no Special Interest Areas, no semi-pnmitive areas, no proposed wilderness areas, and fewer miles in proposed Wild and Scenic River corridors that could provlde potential habitat for late successional species

The TGP Alternative would provide for 110,000 acres of large sawtimber in decade 2, a decrease of ten percent from 1982 By decade 5, however, there would be 228,000 acres, an increase of 105,000 acres over 1982 as young sawtimber stands mature Compared to the other three alternatives, TGP ranks third in the total number of acres of large sawtimber provided by decade 5 As with PRF and EGP, these areas would add to the vegetative diversity found on the Forest, and contribute to species viability and distribution of habitat for wildlife dependent on late successional ecosystems

A total of 283,977 forested areas would receive full timber management, the second highest among the alternatives TGP also proposes the secondhighest amount of timber harvesting with even-aged management methods (3,500 acres/year), primarily clearcutting This management strategy would benefit species dependent upon early successional vegetation, but would not provide vegetative diversity, suitable cover or food sources for late successional species Group selection cuts are also proposed Monitoring would determine how population levels of these species and habitat use would be affected by uneven-aged management methods.

Snag Dependent Species Snag densities would be at a minimum on those acres receiving full timber management High snag and down log

densities would persist in areas assigned to the Wilderness, Special Areas, Old Growth/Goshawk, Rocky/Sparse, Semi-Primitive, and Late Successional Prescriptions, and large sawtimber stands that will develop decadence over time

Harvest Species About 1,300 acres/year of deer habitat would be improved by prescnbed hurning The Early Successional Prescription would not be applied to any regenerated forested acres Because 5,400 acres per year would be regenerated under the Timber Prescription, a considerable amount of low to moderate quality forage would be created Deer numbers would decrease to 44,500 in decade 1, nine percent below the 1982 population level Numbers would increase to 49,000 deer by decade 5 Deer winter range capability would decrease by four percent to 28,500 animals A higher timber harvest level than the PRF and EGP Alternatives would retain adequate hardwoods for squirrel However, there would be more disturbance for bears due to roaded access into harvest units and loggmg activities Twenty acres of ripanan habitat per year in decade 1 would be restored **or** improved, providing a moderate increase in waterfowl population

C. ADVERSE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED

Despite the application of mitigating measures to Forest management actinties, some adverse environmental effects cannot be avoided The most significant of these include

Air Quality Impacts to air quality cannot be avoided in the range of alternatives, however, all of the impacts will be temporary Wildfires will continue to occur, and generally at times and under conditions that produce more TSP than a prescribed fire of equal size In addition, these will usually take place under weather conditions which are not conducive to good smoke dispersal

An expanding program of prescnbed burning would create smoke that could impair vlsibihty for Forest users or nearby residents despite efforts to direct smoke away from populated areas This would be a short-term effect generally lasting less than one day each time it occurred

Short-term reductions of air quality will occur due to dust and engine emissions as a result of increased vehicle use

Cultural Resources The Forest-wide Standards and Guidelines and Forest Monitonng and Evaluation Plan are designed to insure that known cultural resources, and those discovered dunngland management activities, are protected and mitigated from adverse effects Current inventory methods are designed to locate all significant cultural resources However, due to variable field conditions, ground visibility during survey, the preservation qualities of cultural resources and other factors, all sites may not be located during the inventory If they are not discovered and protected during project actinties, some sites may be inadvertently damaged or destroyed Cultural sites located in wilderness, along wild and scenic nver corndors and in other areas where project actinty is limited would also limit cultural resource inventones. As a result, some cultural sites may be lost or damaged from natural agents or dispersed recreation use Such impacts are unavoidable pending advances in inventory methods and completion of surveys in limited project activlty areas.

Increased public access and dispersed recreation in some alternatives could ultimately lead to disturbance of cultural resources Timber management and road construction unavoidably increase the potential for inadvertent damage to cultural properties, regardless of the precautions Unavoidable disturbance from wildfires, landslides, and floods will continue

Fire Impacts to the total array of Forest resources from wildfire cannot he totally avoided Their occurrence will be random in both time and space, but areas wlth the highest probabilities for an ignition can be identified The severity of the impact will be dependent on the intensity of the fire, and this will be determined by site-specific parameters such as fuel loading, weather conditions, and topography

Short-term soil erosion and loss of vegetation wlll occur during construction of firelines, despite preventive measures The buildup of fuels will continue in areas protected by a fire exclusion philosophy Soil erosion and the use of aerially delivered fire retardants may result in short-term water quality degradation Recre-

ational opportunities may be interrupted or limited in fire areas for short penods of time The aftermath of small fires will remain visible for a short time The location of a major fire will remain visible through the vegetation for decades Smoke will be produced

Adverseimpactswll alsooccurtosomeresources, such as soil and air quality, from the use of prescribed fire in the treatment of activity and natural fuels, and from wildlife habitat maintenance The severity of these impacts will be dependent on the intensity and duration of the prescribed fire Normally, the prescnption will be designed so that the activity is implemented to achieve an acceptable level of impact to target and non-target resource values

Range Forest-wide Standards and Guidelines to improve nparian conditions may initially result in increased costs in grazing management; e g. in installation of improvements (fencingand water developments), herding and transport to control stock distnbution and use, and possible slight reductions in stocking levels

Recreation Areas currently suitable for undevelopedrecreation(ROS categoriesofSemi-Primitive Non-motorized or Semi-Pnmitive Motorized) would become unsuitable for this type of recreation expenence when they are allocated to uses that permit road construction and/or timber harvest Management practices could permanently destroy or modify the areas' remote, natural attnbutes, making them unsuitable for some forms of dispersed recreation

Developed recreation sites are susceptible to wear and vandalism effects Some impacts can be mitigated through maintenance, reconstruction, and various preventive or enforcement methods to reduce vandalism.

Social and Economic Levels of commodity and amenity resources provided by the Forest will significantly decrease in response to changing conditions and legal requirements Decrease in timber harvest levels in three of the alternatives or a decrease in amenity resources have direct effects on local communities, governments and businesses in terms of socio-economic variables such as occupational lifestyles, leisure, attitudes, beliefs, values and community institutions

Forest users will encounter more controls and restrictions as management intensity, resource competition and population levels continue to increase over time

Soil, Water, and Riparian Areas Although Forest-wide Standards and Guidelines, BMPs, and the Monitoring and Evaluation Plan have been designed to prevent significant adverse effects to soil and water, the potential for their occurrence does exist Sediment production will exceed natural rates as long as roads are built, timber is harvested, and other activities take place whichdisturbthevegetationandsoil Sediment will be produced by surface erosion, channel erosion, and landslides

State and Federal water quality standards for turbidity may not be met temporarily in some specific locations because of the difficulty in preventing all soil erosion from newly disturbed sites However, BMPs, Standards and Guidelines, and monitoring will prevent or mitigate any appreciable adverse soil and water impact to the established beneficial uses In addition, the Lassen National Forest will coordinate with the Forest Service Regional Office, the State Water Resources Control Board, the Central Valley and Lahontan Regional Water Quality Control Boards, and the Environmental Protection Agency in regard to BMP implementation Current practices will be continually updated when new information or improved methods are developed, which are both technically correct and practical in application

Sediment and turbidity originating from areas managed for timber production have the greatest potential to adversely impact fish habitat Stream water temperatures could increase in certain stream reaches if ripanan vegetation is inadvertently removed (such as blowdown), but should remain unchanged or be reduced under normal conditions over time

Drinking water may be contaminated by human use, especially when such use is concentrated along streams Domestic water supply, if diverted directly from Forest streams, could be adversely affected dunng or shortly after road construction or other activities, and for short periods during more intense winter storms However, the degree of impact will be both short in duration and limited due to site specific planning

requirements and mitigations provided through the Standards and Guidelines

Existing or potential conditions that could adversely impact the soil or water resource will be treated through watershed restoration or rehabilitation improvement projects

Soil displacement or erosion can be expected to result from planned management actinties, such as vegetation removal, slash disposal, log skidding, prescnbed fire, construction and maintenance of roads, trails, transmission facilities, recreation sites and others Soil productivlty will be maintained, except for sites dedicated to roads, skid trails, log landings, recreation sites and other facilities or uses that may compact the soil, alter soil profiles or deplete nutrients. **An** estimated less than one percent of the Forest area will be occupied by permanent roads or facilities Expenence has shown that temporary road surfaces can be revegetated, but the productivity is reduced Forest-wide, an estimated 15 percent of tractor logged areas will experience an increase in soil bulk densities or compaction Thesefactors, in turn, have indirect effects relating to reduced wildlife habitat, vegetative productivity, incidence and spread of noxious weeds, and increase in stream sedimentation over time

Direct disturbance of soils from off-highway vehicle use on open areas would result in some erosion and impairment of productinty, regardless of preventive erosion control efforts

Timber A loss of growth and yleld will occur on lands managed for other resource objectives than full timber production The resultant decline in the Allowable Sale Quantity will have direct social and economic effects in terms of lower employment levels in the timber industry and reduced revenues to county road and school programs

Vegetation and Diversity Forest vegetation will be altered in respect to species composition, stand structure and age With the exception of those acres retained in old growth, Special Areas, wildlife habitat, semi-primitive areas, and wilderness, existing mature forest on suitable lands will be subject to timber management Management treatments include overstory removal of old growth trees from multi-storied stands, clearcuts, group selection cuts, salvage and sanitation harvests, and removal of less desirable species in densely forested areas by thinnings Intensively managed or regulated forests may provide less habitat for species dependent on old growth, snags and down material Depending on the area, managed indimdual stands may or may not have less habitat and species diversity. Across a landscape, habitat and species diversity will generally be maintained with management

Visual Quality Standards and Guidelines for visual resource management specify Visual Quality Objectives (VQO's) for each management area The VQO's of Retention and Partial Retention provide for alterations which do not dominate the character of the natural landscape The VQO of Modification provides for alterations which dommate the natural landscape character, but borrow elements of line, form, color, and texture from the natural setting to the extent and scale that the alteration blends in with it In the foreground, and to some extent in the middleground distance, viewers may find the alterations to be excessive in terms of their own expectations

Short-term decreases in the nsual quality of foreground and middleground areas seen from travel corndors will result from periodic regeneration timber harvest and road construction Prescnbed burns create some textural and color changes in conifer landscapes, but the visual condition should deteriorate only slightly Firelines around large wildfires would create a strong, unnatural contrast on the landscape and, in some cases, a senous impairment of visual quality for the viewer

Wildlife Under all alternatives, the amount of old growth forest will be reduced over the planning period Populatrons of wildlife species dependent on old growth forests, such as pileated woodpecker, marten, and spotted owl, will decline in some areas

Although large sawtimber stands will increase over time for all four alternatives, old growth timber stands will not be replaced as fast as they are cut For example, although both fisher and marten habitat and populations were once widespread, these species may decrease to a corridor of 19 marten areas and five fisher areas Suitable habitat in areas managed under the Old

Growth/Goshawk, Late Successional, Riparian/ Fish, Semi-Pnmitive, Special Areas, and Wilderness Prescriptions may provide occupancy, and increase distribution of these species

Wildlife species will be temporarily and, occasionally permanently, displaced when habitat is disturbed or removed by timber management, facility development, recreation use, and road building

Decrease in snag habitat for cavity dependent wildlife will occur due to timber harvesting, firewood cutting, and salvage programs A corresponding decrease in cavity dependent wildlife species is expected under all alternatives

Habitat capability for deer will decrease in decade one for three of the alternatives according to the Forest habitat capability model This may be a reflection in the accuracy of the model or a decline in habitat quality or both

D. RELATIONSHIP BETWEEN SHORT-TERM USES *AND* LONG-TERM PRODUCTMTY

The relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity is complex Forest management of public lands is purposefully a long-term venture, but one that must serve the year-to-year needs of society

Some practices and activities proposed in the alternatives may produce benefits at the expense of long-term productivity of the land These uses are short-term in the sense that they may occur for a relatively short duration while their effects may last beyond the planning horizon, or possibly in perpetuity

Soil Long term productivity refers to the continued ability of the land to provide resource outputs This inherent ability is lost if soil productivity and hydrologic charactenstics are impaired, or if the physical character of the landscape is altered beyond short-term recoverability Long-term productivity depends on conservation of the soil and health of its living system

Some Forest uses may produce both short-term and long-term negative consequences For example soil exposure to harsh environmental conditions, such as desiccation, severe fire, nutrient removal, compaction or erosion, can result in a gradual decrease in timber and range supply for future generations It is soil protection, then, that is paramount both to a sufficiency of annual harvest and to a sustained yield

The Forest-wide Standards and Guidelines for soil and water are common to all alternatives and have the potential to maintain soil productivity Through project implementation, monitoring and improvement of practices, long-term productivity of the Forest can be maintained

Timber The most significant activity proposed by the alternatives is the management of vegetation for timber production, wildlife habitat, recreation, range use and visual resources Well-planned and carefully managed short-term projects can and do produce effects that will increase long-term productivity For example, harvesting unmanaged, stagnated stands of trees will lead to the creation of plantations of young trees trees that with proper management will increase long-term production

Lands identified as unsuitable for sustained yield timber management have been allocated for soil, watershed or wildlife habitat protection Dispersion of timber harvest activity, retention of old growth and protection of riparian areas have all been planned in order to prevent long-term impairment of the land and maintain resource productivity

Openings created by timber harvests increase the forage needed for the maintenance of deer herds Conversely, the construction of temporary project roads and landings, mechanical slash piling, and log skidding compact the soil. Unless proper mitigation measures are taken, these actinties reduce long-term timber productivity on a site-specific basis

Vegetation and Diversity In the long term, diversity is directly related to forest health and productivity Generally those alternatives that have larger land areas allocated to non-consumptive uses are dominated by natural processes In actively managed areas, the health and productivity of the Forest is a concern There-

fore, the risk of diversity loss and long-term productivity is least under the PRF and EGP Alternatives, which have less consumptive uses

Wildlife Wildlife species occurring within the Forest will be assured of long-term population viability However, fluctuations in populations will occur Those alternatives (CUR and TGP) with higher timber levels will support higher populations of wildlife species that use harvested areas The PRF and EGP Alternatives, which harvest fewer acres, will support relatively higher populations of wildlife species that are dependent on old-growth forests, hardwood stands, and snag habitat In all the alternatives, acceptable but long-term reductions of old growth and snag dependent species are expected to occur based on the information we now have on their habitat requirements Monitoring and additional research will tell us if large sawtimber stands will provide suitable alternate habitat for these species Large sawtimber stands will increase over time for all the alternatives

E. IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES

Irreversible commitments of resources are decisions causing changes that cannot be reversed, once used, the resources cannot be reinstated nor can opportunities be renewed Irreversible commitments apply to activities or events such as mining, road construction, cultural resource disturbance, and dam construction that affect nonrenewable or depletable resources

Irretrievable commitments are opportunities for production or use of resources that are foregone for a period of time because of land use decisions, allocations, or constraints Examples are loss of timber production, livestock grazing, or developed recreation outputs to provide for such benefits as enhanced wildlife habitat or visual quality The decisions are reversible, but the production opportunities foregone while the constraints are in effect are irretrievable

Air Quality There is no irreversible or irretrievable commitment of resources associated with the temporary impacts to air quality over the range of alternatives Mitigating measures such as Yarding Unmerchantable Material, chipping and burying will, however, require the irretrievable commitment of fossil fuels.

Cultural Resources Timber harvest, facility construction, visitor use, theft, and vandalism may destroy irreplaceable archeological and historical sites These sites can be damaged by project activities that disturb previously unidentified sites They can also be impaired by the recovery of cultural resources in conflict with project activities. The common mitigation method used before a site is removed is to undertake a data recovery or documentation program of the site Once undertaken, the effects of data recovery are an irreversible commitment to the resource These programs can only recover part, not all of the significant values contained by the site Much of the important aspects of cultural resources lies in their continued existence for future generations to study and enjoy as part **of** their cultural heritage Once a site is removed or irreparably disturbed, these values are permanently lost

Energy The use of fossil fuels in the administration of the National Forest is an irreversible resource commitment Alternatives vary only by the amount

Facilities The majority of the roads constructed on the Forest become permanent features on the landscape Roads which are scheduled for reclamation do not return the land to its prior productive state For all roads on the transportation system, there is a definite long-term loss of either some or all of site productivity within the excavated road prism

Construction of dams is one possible irreversible action that is beyond the scope of Forest planning, since the initiation lies outside Forest Service authority In the event of proposals stemming from external sources, site specific environmental analyses would explore the extent and consequences of irreversible commitments The role of the Forest Service would be to mitigate impacts on associated resources and seek to hold irreversible commitments to a minimum

Fire There is no irreversible commitment of resources associated with the fire prevention,

suppression, or fuels programs, as they could be curtailed at any time There will be a minor irreversible commitment of fossil fuels involved mth various fire management actimties

Minerals In all alternatives, development of the mineral resources would lead to an irreversible commitment of those resources and, in many cases, to the land thereby affected

Recreation The commitment of the Forest's unroaded areas to timber production constitutes an irretrievable loss of the primitive character required to maintain the physical settings necessary for primitive and semi-primitive non-motorized recreation expenences

Soil and Water There is an inherent risk of accelerating erosion, and other changes in the physical and biologxal properties of soils, when harvesting timber and building roads on the Forest Surface and channel erosion, severe soil compaction and displacement, damage to proper functioning of soil biological processes, etc , could lead to either ahmited or total loss of site productivity Productivity, once lost, requires a long time for natural processes to restore The soil and water protection measures identified in the Forest-wide Standards and Guidelines, and incorporated into Best Management Practices, are designed to minimize the potential for irreversible losses from proposed management practices

Timber Some forested acres are allocated to other than a timber prescription in each alternative; an average production of **265** board feet per acre per year that could contnbute to the allowable sale quantity (ASQ) would be irretrievably lost.

Vegetation and Diversity Grazing allotments may be restncted to protect other resource values such as riparian areas This would constitute an irretnevable loss to the permittees

Old-growth forests, once harvested, are considered an irretrievable loss To develop old-growth forest characteristics, again, will require approximately 200 years Insects, disease, and fire can also contnbute to this loss If left unmanaged, stand decadence may alter the old growth sufficiently to set the vegetative structure hack to an early successional stage The result would be a natural change, or loss, of old growth

Visual Resources The commitment of Forest land to development of permanent facilities, such as roads, rock pits, and utility corndors constitute an irreversible and irretnevable commitment of the natural appearance of the landscape in most cases, although efforts are made to mitigate these effects

Wild and Scenic Rivers Designation of the inventoried Wild and Scenic Rivers would permanently reduce or prohibit timber harvest Mineral exploration and development is also restncted or prohibited Construction of dams, diversions, and hydropower development will not be recommended

Wilderness and Unroaded Areas Wilderness potential (charactenstics) in those roadless areas allocated to management where development may occur is irretrievably lost This irretnevable loss, though, will occur only upon project implementation and not as a direct effect of the Forest Plan allocation

Wildlife Old-growth habitat for wildlife, once harvested, cannot be replaced through regrowth over the planning penod For example, a loss of old-growth mthin mnter range would equate to irretrievable loss of optimal cover for deer. Under all alternatives, overall acreages of old growth habitat would decline on the Forest during the planning period. There is some nsk that the number, size and dispersal of old growth habitat allocated to management indicator species may not be sufficient to maintain viable populations over time

F. POSSIBLE CONFLICTS WITH FEDERAL, REGIONAL, STATE, AND LOCAL LAND USE PLANS, INCLUDING INDIAN PLANS

There are no known conflicts with plans of cooperating or affected agencies, including.

1 United States Department of the Interior-Lassen Volcanic National Park
   a West Prospect Fire Lookout Operations
   b Prescribed Burns

2 United States Department of the Interior - Bureau of Land Management, PGT/PGE Pipeline

3 State of California - Department of Transportation
   a. Snow removal
   b. Deer Mortality Study

4. California Department of Fish and Game
   a. Vernal pool fencing
   b. Susan River Trout Habitat Enhancement
   c Deer Habitat Improvement

5 California Department of Boating and Waterways - Gallatin Manna Reconstruction

6 Californa State University at Chico
   a. Scenic Byways Nomination Report
   b Almanor Campground Masterplan

7 USDI Bureau of Land Management, USDI National Park Service, USDA Forest Service, California Department of Forestry and Fire Protection - Coop Fire Protection Agreement

8 Cooperative Law Enforcement Agreements with Plumas County, Tehama County, Shasta County, Butte County, and Lassen County Sheriffs Departments

9 Shasta County - Noxious Weed Eradication

10. Lassen County Economic Development Strategy Plan

Minerals The effects of implementing any alternative may conflict with the objectives of others and Federal mining laws. The Mining Law of 1872 predates all other laws that govern Forest Service activlty Conflicts do arise between administration of mining operations and management of other resource values such as visual quality, wilderness, water, Sensitive wildlife and plants, mld, scenic, and recreational nvers, and recreation

In the past, the Lassen National Forest and the counties have attempted to keep private and public land use compatible Where pnvate lands are scattered and intermingled mth the Forest, National Forest needs generally prevail Near communities, the Forest adjusts uses where feasible to respond to local public needs.

G. ENERGY REQUIREMENTS *AND* CONSERVATION POTENTIAL

With the emphasis on energy conservation, Forest management activities and energy programs have raised concerns that ment discussion The objective of this evaluation is to provlde additional considerations through which Forest Planning alternatives can be assessed and compared. The followmg analysis provldes a descriptive means to determine energy characteristics of Forest-based resources. Its purpose is to supplement economic and envlronmental considerations rather than to replace them

Energy is consumed in the administration and use of the natural resources of the Forest Major energy sources are gasoline, diesel fuel, liquefied petroleum, electricity, and wood

Energy is ylelded as hydroelectric power, fuelwood, red meat, and energy-use reduction The following discussion descnbes the estimated consumption and yeld of energy for all alternatives

Biomass and Firewood Energy can be consumed by (1) loggmg residue removal, **(2)** chipping, **(3)** chip transportation, and **(4)** firewood cutting and transportation Energy is now ylelded in home firewood use Additional energy is also ylelded from electrical generating plants

Facilities The Forest consumes about 42 billion Bntish Thermal Units (BTU's) each year in general admmistration, half for vehicles and half for buildings In an attempt to reduce energy consumption, the Forest uses fuel efficient vehicles such as motorcycles and compact pickups, and provldes van pooling from work centers to project areas Existing buildings have been retrofitted

with more efficient lighting and heating systems, additional insulation, and water heater blankets

A 1983 study showed that through a retrofitting program the Forest could save as much as 3 145 million BTU's per year A Savings-to-Investment Ratio (SIR) analysis performed for Forest buildings indicated a potential five percent savings through the use of weather-stripping, caulking, water heater blanketing, and similar measures As costs increase for energy and as technology advances, additional cost-effective retrofitting opportunities will become available, thus reducing the energy requirements of the Forest

Fire Management Fire management involves energy consumption in suppressing wildfires and treating fuels Both types of fire consume wood energy Fire management, or fire itself, yields no useful energy

Range Energy is consumed in forage and structural improvement, cattle transport, and travel of permittees Energy yield is from meat production

Recreation Energy is consumed by (1) operation, maintenance, and construction of recreation sites, (2) transportation to recreation sites, and (3) recreation use (e g , water skiing, off-highway vehicle travel, etc) Recreation yields no quantifiable energy

Timber Energy is consumed by (1) forest management, (2) loggmg, (3) road construction and maintenance, (4) log transport to mills, (5) log processing, (6) lumber transport to the consumer, and (7) building construction Energy is yielded by utilizing residue as fuel and by savings from constructive use of energy-efficient materials

Water Energy consumed in obtaining water is small Substantial energy is yielded by hydroelectric generating facilities

H. OTHER DISCLOSURES

Effects of Alternatives on Threatened and Endangered Species and Critical Habitat Regardless of the alternative, protection of listed species will take precedence over other land management direction The bald eagle, peregrine falcon and Shasta crayfish are the only Endangered species which occur on the Lassen The northern spotted owl is the only Threatened species found on the Forest

While some of the alternative5 would provide greater protection that others, none of the alternatives would have a significant adverse impact on Threatened or Endangered species The Finest will comply with all appropriate Threatened and Endangered species recovery plans, regardless of the alternative Provision is made in the Forest Plan to pursue informal or formal consultation as necessary during project design and environmental analysis

Effects on Prime Farmland, Rangeland, and Forest Land All the proposed actions in alternatives are consistent with the intent of the Secretary of Agriculture direction (FSH 1909 15) for protecting and managing prime lands

Effects of Alternatives on the Human Environment The civil rights of any American citizen are not differentially affected by implementation of any alternative

Effects on Wetlands and Floodplains No significant adverse effects within areas of wetlands and floodplains are anticipated This is largely due to the very small size of upslope wetlands, i e , tiny bogs and small ponds, and the limited amount of floodplains in stream and river areas Where floodplains exist, they are allocated to the Riparian/Fish Prescription which restricts management activities and development Other than existing developments, such as roads and campgrounds, management within riparian areas is extremely limited The Forest intends to increase the number of acres managed as wetlands Opportunities for wetland development will be implemented where feasible

Protection is also afforded to these areas through BMP's incorporated in the Standards and Guidelines, in requirements of the Riparian/Fish Prescription, in environmental analyses, and by Executive Orders 11988 (floodplains) and 11990 (wetlands) Collectively, these provide excellent direction to insure that management activities do not have unacceptable adverse impacts on the wetlands and floodplains Avoidance of these areas will also he a common practice

Effects of the Alternatives on Urban Quality, Including Historic and Cultural Resources This FEIS deals with wildland resources and as such does not directly affect urban quality, or historic or cultural resources within an urban environment

I. INCOMPLETE OR UNAVAILABLE INFORMATION

Forest management is not a definite science Knowledge is continually evolving on how to maintain healthy and diverse communities of forest plants and animals while providing commodity uses on National Forest lands In many instances, it was not possible to fully assess resource impacts from management activities because important information was not available This is particularly true for the management of Sensitive wildlife species There has not been enough research in the Sierra Nevada and Klamath provinces to determine how management activities, such as timberharvesting, affect Sensitive wildlife populations and habitat distribution Regional direction, a regional literature review and habitat capability models were used to establish habitat and/or vlable population levels However, considerably more research is needed to verify these assumptions This is the purpose of monitonng and other field studies The discussion in this chapter is based on the best information available to evaluate environmental consequences

Fish Additional research is needed on the abundance, distribution, and habitat conditions and habitat requirements for resident and anadromous fisheries Over the past decade, the spring-run chinook salmon population has declined dramatically This decline is partially attnbuted to downstream water uses outside of National Forest lands However, more information is needed on the relationship between anadromous smolt production and the number of adults which subsequently return and reach spawning grounds within the Lassen National Forest

Sensitive Plants Much is unknown about the distribution and abundance of Sensitive plants on the Forest Specific needs include a comprehensive inventory of all Forest land and detailed studies of habitat requirements of plants found on the Forest Also useful for management would be reproductive and genetic studies of Sensitive plant populations Some of this information will be gathered in the process of developing management guides for each Sensitive plant species

Timber Group selection harvesting has not been extensively used on the Lassen National Forest for the past three decades Prior to that, a system (called Unit Area Control) mimicked group selection harvests Small openings were created to encourage natural regeneration As explained in Appendix **O,** this system failed for three reasons (1) small groups of natural regeneration could not be efficiently managed, (2) the cutting guidelines could not be used consistently, and (3) many of the small groups were unavoidably destroyed when large trees in adjacent stands were felled

Because of this history, widespread application of group selection harvest is not recommended until additional information is obtained about the reliability of this treatment method in regenerating stands Factors to be studied include (1) the economic feasibility of this form of uneven-aged management, (2) the success in regenerating well-stocked stands within five years, **(3)** the effect on plant and animal diversity; and **(4)** he management implications of tracking numerous group selection units over time

Group selection harvest warrants a cautious approach until these studies have been completed Research will be on-going for the next several decades, both on the Lassen and elsewhere in the Pacific Southwest Region

Vegetation and Diversity Biological diversity is a rapidly evolving field of study within the scientific community This includes diversity of plant communities and species, as well as genetic diversity within species The Forest's management of diversity and Sensitive species is based on the best information currently available Changes in management may follow as our base of knowledge expands

Specific research needs for managmg vegetative diversity include refining the Characteristics that

define old growth stands and the specific parameters required by old growth dependent plants and animals, particularly Sensitive or unusual species There is uncertainty in the best way to manage old growth stands over time to insure that old growth values are retained and losses to wildfire, pests or other catastrophic events are minimized Other information needs include the best ways to manage younger stands required for future old growth when suitable old growth is not currently present in a management area Techniques are needed to manage younger stands so that they quickly develop desired old growth characteristics

Wildlife Much is unknown about wildlife species abundance, distnbution, and habitat needs on the Forest The marten, fisher, great gray owl, northern goshawk, California spotted owl, Sierra Nevada red fox, and willow flycatcher are all Region 5 Sensitive species that occur on the Forest However, information about their current population levels, distribution, habitat requirements and life history is not completely adequate for consideration in management decisions. Without this information, the Forest can not reliably predict to what extent timber harvesting or other land disturbing activities may affect these species It is also unclear what silvlcultural prescnptions are compatible with their needs During project analyses, the Forest will use the most current research data and incorporate new information as ithecomes available.

Quality, quantity, and spatial distribution of wildlife habitat across the Forest is not known **A** map with this information is needed to evaluate the cumulative effects of timber practices at the Forest level

It is unclear to what degree Management Indicator Species represent habitat quality for species that have similar habitat requirements The reliability of habitat modeling in statistically evaluating population levels has not been tested on the Lassen **As** a result, their accuracy is unknown For example, the deer models were based on information contained in State deer herd plans

California spotted owls have been found in what is considered to he less than suitable habitats Their presence in these habitats may be a result of displacement from more suitable habitat (both on and off the Forest) that has been modified or due to a lack of knowledge of what constitutes suitable habitat Long-term studies are needed to determine if these owls are maintaining viable population levels This type of displacement may also he occurring with other species

Continued monitoring is needed to evaluate the effectiveness of the SOHA network in maintaining population viability and species distnbution In addition, monitoring results will provide information on how non-network owl management is contributing to population viability **As** new information from research, inventories or monitoring is obtained, Forest management direction may change to provide healthy populations of all fish and wildlife species