# Step 4 - Reference Conditions

## INTRODUCTION

Forest ecosystems are dynamic and constantly changing. Historic conditions are used to better understand how time influences watershed conditions. This step describes historic conditions and reference conditions. By comparing current conditions as described in **Step 3**, with past and reference conditions, the Team gains a better understanding of the processes and interactions taking place in the watershed and how management activities influence them. The time period varies by ecosystem features and data availability. Where actual data is lacking, descriptions of historical conditions are constructed from a multitude of sources, inferences, and professional judgement.

This step begins with an historic overview that sets the framework for the step. Following the overview are answers to key questions by issue as presented in Step 2.

## Historic Overview

### Pre-European Settlement and Use

American Indian settlement within the analysis area included the Karuk and Shasta. Identified primarily by their language, which belongs to the Hokan family, the Karuk occupied the Klamath River area from Bluff Creek to Seiad Valley, while the Shasta occupied areas east of Seiad. These tribal territories may have overlapped during the course of centuries of habitation. Early settlement patterns centered around the most advantageous fishing, hunting, and food collection sources. Northwestern California Indian Tribes, including the Karuk and Shasta, had well-established trade networks overland. The Klamath River served as a lifeway and thoroughfare for settlement and use.

In terms of food supply, the Shasta and Karuk were oriented to river and stream resources, where major salmon runs occurred in the spring and fall. The Karuk had a very elaborate cultural system governing local fishing uses and rights. Deer and acorns were also important food components for both groups. Large numbers and species of plants were used for food and crafts, such as basketry. Both Tribes would seasonally travel up and down the mountain sides, camping at seasonal sites, gathering and collecting the diverse resources found within the analysis area.

Tribal reliance on forest resources caused them to be highly integrated with ecosystem functions. Conservation practices included judicious harvesting, cultivating, planting, weeding, burning, and pruning. It is well-documented that native peoples used fire as a major land management tool (Arno 1985, Boyd 1986, Bowden 1992, Gruell 1985, Pyne 1982, Williams 1989, Williams 1994). Aboriginal land management, especially fire-based management, was widespread throughout the analysis area. Low intensity understory fires were intentionally set to improve and promote regrowth of fire-dependent plant communities, optimize soil nutrients, and reduce pest and plant diseases. While there is no specific scientific data, the Karuk Natural Resources Department acknowledge and contend that aboriginal settings were more fire resistant, provided more meadows, grass openings, edge habitats for wildlife, and a more open forest than is found today.

Soon after 1850, the Karuk and Shasta experienced traumatic displacement and population reductions as a result of confrontations with miners and disease. Prospectors severely affected the Karuk and Shasta by impacting their settlement areas, food supplies, and other resources. As a result of miner settlement, confrontations lasted for more than two decades.

### Historic Summary and Heritage Resources After 1850

Accounts of long time residents who grew up in rural western Siskiyou County can help provide the richest source of social and cultural histories and valuable details on past land uses. As of 1850, mining, logging, and small-scale ranching have dominated rural living. Life-styles historically have been complemented by subsistence uses, such as hunting, fishing, and growing gardens.

Many non-aboriginal place names in the analysis area such Tom Martin Peak, Sarah Totten Campground, and Fort Goff Campground are associated with events, land surveys, or individuals who settled or explored the region. Fort Goff was named partly after a miner, John Goff, and partly by an army troop who camped at the site for only two weeks, attaching "Fort" to the name before leaving for the Rogue Valley Indian Wars in 1858.

## The Gold Rush Era

In 1850, the news of gold strikes could result in the arrival of one to two thousand miners in a few weeks time. Hamburg and nearby Scott Bar were a whirl of mining activity. Historical accounts vary about the specific numbers of miners residing in the analysis area from 1850 to 1890. Available information indicates that there may have been as many as 5,000 residents in the analysis area during this time period. One account notes that in 1853, miners at Hamburg were making a good income. Another account stated that Hamburg had only few residents in 1863. This would indicate that the population dramatically fluctuated as a result of mining opportunities in the west. By 1920 most of the historic mining activity in the analysis area had declined and the communities that remained were populated by a core of established residents.

Immigrant miners included prospectors from Britain, Germany, Australia, Hawaii, Chile, Peru, Mexico and China. The Chinese were the most numerous foreign group in the area from 1860 to 1890, making up a considerable portion of the miner population. By 1870, the Chinese owned and operated a large number of placer mines. By the early 1890s very few, if any, Chinese remained in the area.

Early mining camps sometimes only consisted of a collection of tents and shelters, since miners had no intention of remaining for any length of time and planned to move on, after quickly "striking it rich". Gold production in Siskiyou County followed State and National trends, where the overwhelming majority of those who tried mining did not succeed in making enough money to support themselves. Meager incomes forced many to move on after the easiest surface deposits were recovered. Seasonal miners, who often mined the summer six-month season accounted for 43% of the gold recovered.

After the initial surface deposits were removed, mining technologies advanced and required a larger labor force and mechanized equipment. Hardrock tunneling, wing dam, derrick, and pick and shovel mining occurred in addition to extensive hydraulic activities. There were many independent and corporate mines within and near the analysis area from 1850 to 1890. These included wing dams operated at Hamburg by Bill Kettlewood, Tom Miner, Bill Offield, Ben Maplesden, and Martin Andrews. East of Seiad at Walker Bar, the Chinese mined with derricks. The Chinese also worked a hardrock tunnel in Mill Creek drainage west of Hamburg. Hydraulic mine locations included the Johnny O'Neil Placer, Seattle Placer, Cap Lowden, Mapleden, Jonnie Everill, and Ladd Chrome Mine. W. T. Grider and sons operated a hydraulic mine near Grider Creek. At Portuguese Creek, James Camp and Charles Bailey had a hydraulic operation. Another Chinese mine, called the Hoskins Bar Mine, was worked opposite Portuguese Creek. By 1880, hydraulic mining had reached its peak.

Hydraulic mines required vast systems of reservoirs, ditches, flumes, and pipelines and, at one time, altered most major tributaries which flowed in the analysis area. Richardsons Bedrock was the largest hydraulic mine in the watershed and diverted water from Elk Creek for a distance of nearly five miles. Other mines near Happy Camp included Gordons Ferry and Muck-a-Muck or Minnie Reeves hydraulic mine at Morgan Point, opposite the Richardsons Bedrock. Water from China Creek, four miles east of Happy Camp, supplied Joe Reeves Placer and the Silva and Lee Mines. The Williams Point and Jones Hydraulic Mine also carried water from China Creek over the Klamath River by bridge. At Thompson Creek, water was diverted to supply Minetta B Placer Mine. The Minetta operation included a 20 inch suspension pipe which crossed over the Klamath River. On the south bank of the Klamath River the Lee Yet Hydraulic Mine had a crew of 25 Chinese and utilized water from Seiad Creek. Chinese also worked the Masonic Bar mine south of Seiad, taking water from Grider Creek.

## Homesteading, Ranching, and Rural Agriculture

The community of Hamburg was named by Sigmund Simon, a German immigrant. Today, remains of the historic era town include foundations and building remains such as the Caldwell store, the Bailey Post office, and the Bucket of Blood Saloon.

The first European Americans to settle in Seiad Valley vicinity were the Reeves Brothers. They were accompanied by Daniel Cook and William Green who trapped for the Hudson Bay Company. The Reeves Brothers homesteaded 480 acres in Seiad, supplying the mining community with vegetables. William Grider, who also settled in Seiad, operated a hydraulic mine there. Other rural developments in the valley that followed included a Civilian Conservation Corps (CCC) Camp built in the 1930s (Winthrop 1983). In 1940, a gold dredge mined nearly 300 acres in the valley, recovering substantial gold. By the 1960s, more emphasis was placed on logging and two small saw mills were built at Grider and Seiad Creeks. The lumber mills were no longer operating by the end of the 1970s.

Another small historic settlement named Norton was located at the mouth of Thompson Creek. There are no remains of Norton today, but in 1880 it consisted of a post office, store, and boarding house. In 1940, the Grey Eagle mine, located in the Indian Creek drainage, transported ore overland for 3.4 miles by aerial tramway to the mouth of Thompson Creek. The copper ore was trucked east to Highway 99. Grey Eagle mine, which only operated a short time, also helped bring electrical power lines into the area.

Because of difficult access, mining camps were dependent on food sources packed in from other areas. As early as 1852, grains and vegetables were grown in Siskiyou County. The earliest farms and ranches were established in 1852 to readily supply the mining communities. Difficulty clearing the land and the lack of availability of flat land in western Siskiyou County influenced agricultural uses. Raising livestock generally dominated agriculture.

**Transportation Development**

The Siskiyou mountains presented rugged obstacles to the development of a transportation system, thereby limiting the use of the analysis area. The only access prior to 1850 were aboriginal foot trails, which were used by the flood of gold prospectors. Many of these paths later developed into trails and roads. With the sudden growth of settlement in the 1850s, pack trails were constructed overland to supply the thriving mining communities.

Trails and roads generally followed development and population growth. The Kelsey and Waldo Trails were the first two most important overland routes built in the region. These trails, along with a primitive trail on the Klamath River, provided a means to transport materials in and gold out of the area. Scores of mule trains brought in everything from food to hydraulic mining pipe. Horse or mule, wagon, or foot transportation was the major mode of access before World War I. Roads were not constructed in the watershed until 1891. The Klamath River trail eventually evolved to a wagon road and then the modern highway.

The Gordons at Gordons Ferry operated a ferry crossing. It once was an important stop for travellers between Seiad and Happy Camp. From Gordons Ferry, people used China Grade going east which served as the early travel route. Improvements in the 1930s and 1940s, especially projects completed by the CCCs, advanced travel access for recreation, hunting, fishing, backcountry access, and tourism. After World War II, road development into more remote areas was largely associated with logging and/or fire suppression and recreation use. Steelhead fishing from 1930 to 1980 was important to the rural economy, because fishing attracted visitors.

In 1941, county residents initiated a colorful and well-publicized movement to secede from the state of California and form the State of Jefferson. In a proclamation, defense-minded participants protested the poor condition of local roads which accessed strategic minerals. The movement was quickly dissolved with the start of World War II. Highway 96, which runs through the analysis area is now part of the historic Jefferson Scenic Byway.

**The Klamath National Forest**

The Forest Reserve established the Klamath National Forest in 1905 through provisions of the Organic Act of 1897. Forest Service management from 1906 to 1940 consisted primarily of improving trail and road access, mining regulation enforcement, grazing management, recreational service, logging activities, and fire suppression. The Works Progress Administration - Conservation Corps (CCC) in the 1930s also played an important role in developing road systems, constructing fire lookouts and administration facilities, trails, and fire suppression. The Pacific Crest Trail which runs through the center of the analysis area was partially developed by the CCCs.

**The Timber Industry**

Prior to World War II, the timber industry was limited in western Siskiyou County due to rugged terrain and access. The earliest records show the first industrial timber harvest was associated with mining activities. Miners used only some of the vast timber resources found in the assessment area to build flumes, sluices, mine structures, and houses.

After 1950, the Administration placed a greater emphasis on timber production in response to National needs and desires. The regional population increased in response to the timber based economy. From approximately the 1950s through 1990, the analysis area experienced alteration of established natural stands due to harvest activities. These practices developed much of the current road system now evident in the analysis area and utilized clear-cut logging as the harvest method of choice.

Since the late 1980s, timber harvest has declined, leaving local communities to undergo economic transitions similar to those experienced at the end of the mining era. Currently, environmental laws, endangered species, land use demands and allocations, past alteration, and political pressures have significantly reduced logging in the Pacific Northwest. Economic opportunities today are more dependent upon recreational tourism, cottage industries, and Government employment.

## Sport Fishing Guide Services

Sport fishing on the Klamath River has always been a popular activity; in fact, the Klamath River has been called one of the "Top Ten Steelhead Streams" in the country. The native runs of steelhead trout are well known for their fighting ability and this resulted in a boom time for the commercial sport fishing guiding industry. While numerous fishing lodges existed in and around the analysis area since early in this century, fishing styles were limited to bank casting or wading into the river to fly fish. The late 1960s to early 1970s saw the arrival of white-water driftboats. These boats quickly became very popular as they opened up large areas of the river for fishing and provided a unique experience. The reach of the Klamath River that runs through the assessment area has the type of conditions that are ideally suited for these types of boats. With several boat ramps available in this area many driftboat guides had favorite "runs" in the assessment area. This industry, while seasonal, helped support numerous individuals who guided and also had spin-off benefits to area businesses with cabin rentals, groceries, supplies, etc.

While available records for the tracking of guide services do not go back very far in time, these records indicate that as many as 26 guides were licensed up into the late 1980s. This points to far greater numbers of guides working the river in earlier peak times such as the mid-1970s when some guides services were know to put out four to six boats a day. Today, a total of 6 guides were licensed for the 1998-1999 fishing season, defined as running from April 1st to March 31st.

This industry has declined since the mid-to-late 1980s due to a drop-off in fish populations and the increase in sport fishing restrictions associated with the protection of fish species. It continues at a very low level today with only a few individuals able, or willing to try, and supplement their income through commercial guiding on the river.

## Brewer's Journal

The following paragraphs are excerpts from "Up and Down California in 1860-1864; the Journal of William H. Brewer". Edited by Francis P. Farquhar.

*"We passed what was once the town of Hamburg, two years ago a bustling village--a large cluster of miners cabins, three hotels, three stores, two billiard saloons, and all the other accompaniments of a mining town now all gone. The placers were worked out, the cabins became deserted, and the floods of two years ago finished its history by carrying off all the houses, or nearly all--the boards of the rest are now built into a cluster of a dozen huts. A camp of Klamath Indians on the river bank is the only population present."*

*"The population has not entirely left this portion of the river. Here and there may be seen a white man and industrious Chinamen patiently ply with rockers for the yellow dust."*

*"About midway between Scotts Bar and Happy Camp a side stream of considerable size comes from the northeast called Sciad Creek, and here is a fertile little flat of about a hundred acres, the best ranch perhaps in the entire county of Siskiyou. It is known as Seiad Ranch. We crossed the river by a ferry to it, and stopped two days. It is a delightful spot, it seems an oasis in the desert. Here lives a thriving New York farmer from Ulster and Orange County, named Reeves, and he is making money faster than if he were mining gold. He treated us very kindly indeed and we luxuried on delicious apples, pears, and plums. His table groaned under the weight of well cooked food, in pleasing contrast with the miserable taverns of the last few days. He came here in 1854 and says that the first year he raised twenty thousand pounds of potatoes per acre, which he sold for fifteen cents a pound! But times and prices have changed. His potatoes yield this year about fifteen thousand pounds a acre and he only gets four cents per pound now and fruit goes for 12 1/2 cents per pound. The place is a pretty one, picturesque, and fertile. But he wants to get away. He has some pretty little girls growing, who are cadged up from the world, from society, from schools, and all means of improvement--no wonder he wants to sell out."*

*"Just north of this ranch are several high peaks. I climbed one of these. Three conspicuous points are known as the three devils. It was a steep slope about four thousand feet above the valley, but several higher peaks lay back of us."*

*"The day was very smoky, and the landscape spread out around us rough in the extreme-the whole region a mountainous one-peaks five thousand to seven thousand feet high. The hills are covered with scattered timber, not dense enough to be called forests, or places with shrubby chaparral. The whole of this wide landscape was bathed in smoky vapor, and the mountains faded in it at no great distance."*

# AQUATICS

## HILLSLOPE PROCESSES

**Key Question 1- What were historical (pre-Euro-American settlement) and reference erosion rates, and what natural processes and post-European activities affected them?**

The metamorphic rocks of the Klamath Mountains originated over 200 million years ago under the ocean as igneous bedrock (peridotite, gabbro and basalt), upon which fine grained mud was deposited. These rocks were emplaced on the margin of the continent by the processes of plate tectonics. About 60 million years ago, volcanoes, similar to the modern Cascade Range, erupted through the marine rocks. These volcanoes have been completely eroded away, exposing their roots, the granitic rocks. There are no rocks younger than the granitic rocks in the Klamath Mountains.

Thick red soils in the project area are formed of slope and channel deposits, relicts of times in the past million years that erosion and uplift rates were different from today. If the erosion rate was higher than today, as would be expected during the time that glaciers occupied the high canyons, sediment might accumulate at a higher rate than today. When the Klamath River or one of the tributary streams was dammed by a landslide or differential uplift, sediment would locally accumulate at a higher rate than today. If the climate was drier than today, sediment would be less efficiently produced and transported, so sediment sources would tend to accumulate on the hillslope, but channels may tend to deplete stored sediment.

In reality, the long-term sediment budget is controlled by the interaction of climate, uplift, and erosion. Although rare, movement of dormant landslides may be associated with seismic shaking. Although the environment is erosion-dominated, some sediment is stored for as long as tens of thousands of years. Thick red soils lying within a few hundred feet elevation of the modern river channel often contain rounded cobbles. Well-rounded cobbles are interpreted to have been deposited by the river and streams; elsewhere more angular cobbles indicate debris flow deposits. Some thick red soils are interpreted to be at or near the rocks from which they formed. At higher elevations, river and landslide deposits are more deeply weathered, indicating greater age. Deeply weathered granitic rocks are similarly interpreted as stored products of weathering. As these deposits are uplifted and undercut by the river, they are remobilized by landslides and erosion. The rate of landsliding is occasionally accelerated by strong earthquakes. Eruptions of and earthquakes associated with the Mount Shasta volcano have likely put large pulses of sediment into the Klamath River, although no deposits have been found. The rate of landsliding and erosion vary through time.

In historic time, man has greatly increased the rate of landsliding and erosion by hydraulic mining of old river deposits, dredging of younger river deposits and road construction. Road construction and maintenance have also increased the rate of erosion, landsliding, and sediment production. Man-made dams influence river channel form by retaining sediment and reducing stream power in flood flows. In theory, clear water flows below the dams make up their sediment load by transporting channel deposits at an accelerated rate.

## RIPARIAN AREAS

**Key Question 1- What are the historic and reference riparian conditions in the analysis area?**

Little is known about riparian and stream channel characteristics and aquatic habitat conditions prior to the onset of activities such as mining, road building, and timber harvesting that began in the mid 1850s. It is assumed the habitat was in good condition to support the salmon and steelhead populations that were said to exist by miners and R.D. Hume in Snyder's (1931) report. The extent of damage mining and other human activities had on the physical characteristics of the streams, including pools, fine sediments, riparian vegetation, and stream channels, is unknown, however, can probably be considered extensive. In 1934, streams were lower than they had been during the previous decade and hydraulic mining was still occurring in areas of the Klamath Basin. Water quality conditions were considered fair and had "improved over 1933 when the Klamath River was at times very badly polluted" (Taft and Shapovalov 1935). Moffett and Smith (1950) state that the Klamath River and many of its tributaries "ran silty".

Factors affecting riparian habitat quality may vary from stream to stream; however, the physical and biological components that create and maintain aquatic habitat are similar. These components are important within the aquatic, semi-aquatic, and surrounding riparian and upslope area, and are able to sustain the character of a stream corridor. They are also continually changing as ecological processes within the watershed modify and reshape the habitat. Together, these components maintain and restore productivity and resilience in a fully functioning aquatic ecosystem. The following describes how these components contribute to a fully functioning aquatic ecosystem.

Upslope processes are critical in providing and maintaining suitable amounts and intensities of water flow, and natural delivery mechanisms of sediment without accelerated rates of erosion and sediment yield. The timing, magnitude, and duration of peak and low flows are critical to sustaining aquatic habitat and patterns of sediment, nutrient, and wood routing.

Riparian areas are essential in maintaining stream temperature, dissolved oxygen levels, and other elements of water quality. They also ensure large wood recruitment, stabilize the channel, provide for filtration of sediment, and increase habitat diversity. Forested riparian ecosystems should have a diversity of plant communities. Late-seral stages should predominate and consist of endemic conifer and hardwood species, with intermingled areas of early-seral stages such as grasses and forbs. Ideally, this should be a multi-layered canopy including signs of decadence, such as standing and fallen dead trees. An overstory of conifers should provide future recruitment of large wood, shade, and thermal cover of streams and lakes. An intermediate layer of mixed deciduous and coniferous vegetation should provide thermal buffering, nutrient cycling, bank stability, and recruitment of terrestrial insects as an aquatic food source. The vegetative canopy should provide stream surface shading during the summer and should be at site potential.

Wet meadow areas should have stable overhanging banks with herbaceous vegetation and or woody vegetation providing canopy cover, bank stability, and sediment filtration. The water table should be near the meadow surface, with the stream meandering through the meadow. Few signs of gullying or compaction should be apparent.

Diverse and complex instream habitats are essential for all life stages of aquatic species and should include large deep pools for holding and rearing. Large woody material is critical for maintenance of these diverse habitats as flows and seasonal conditions change. A diverse substrate is necessary with small percentages of fines and embeddedness for successful egg and alevin development. Sub-surface interstitial areas are also critical for invertebrates and juvenile fishes. An abundance of cool, well-oxygenated water, free of excessive suspended sediment, is important for aquatic species production and survival.

## AQUATIC DEPENDENT SPECIES

### Key Question 1- What were the distribution and population sizes of aquatic dependent species?

It is difficult to determine the historical population size of salmon and steelhead in the analysis area, however, fish numbers were sufficient to supply the primary subsistence food and be the basis for the economy of the indigenous people prior to the mid-1800s. After 1850 and the discovery of gold in the area, fish populations were subject to additional human impact including mining, commercial timber harvest, water diversions and dams, artificial propagation, and other historical activities.

Stocks and species of salmonids that existed at the time of cannery development on the Klamath in 1912 included spring and fall run chinook salmon, coho salmon, and steelhead trout. Three fish canneries were operating at the mouth of the Klamath River which was heavily fished for salmon with no limits. Steelhead trout were an incidental catch since migration times coincide with the salmon. Both Snyder and R.D. Hume in Snyder's (1931) report state that historically, the spring run of chinook salmon was the "main run" of salmon and the population was very pronounced. "These spring salmon may be caught in the smaller streams fed by melting snow at the headwaters of Klamath River streams during the month of June..." and have "...now come to be limited..." and "...practically extinct..." while the fall run was reduced to "very small proportions" (Snyder 1931). By the mid 1930s, it was reported that anadromous fish populations within the Klamath Basin were already significantly jeopardized (Taft and Shapovalov 1935). They also reported "...unfortunately no exact recorded facts exist concerning the size of the present and past runs of steelhead in the Klamath River. It would, nevertheless, be perfectly safe to say that the general consensus of opinion of fishermen and residents on the river is that these runs have decreased alarmingly, particularly during the past few years." Suggestions during the early 1930s to determine the decline of the spring run chinook included mining operations, overfishing both in the river and ocean, irrigation, and the building of Copco Dam.

Mining also had other impacts to the Klamath fishery. "During the period of placer mining, large numbers of salmon were speared or otherwise captured on or near their spawning beds, and if credence is given to the reports of old miners, there then appeared the first and perhaps major cause of early depletion" (Snyder 1931). Taft and Shapovalov (1935) studied occurrence of benthic invertebrates in Klamath River tributaries and found mined areas had consistently fewer organisms than non-mined areas.

Many dams were built in the Klamath River system to divert water for mining, agriculture, and domestic use. These dams and diversions blocked salmon and steelhead from more than 200 miles of spawning and rearing habitat along Klamath River tributaries (CDWR 1960, from CH2MHill). Unscreened or poorly screened water diversions and ditches resulted in a significant loss of juvenile fish in which Taft and Shapovalov (1935) reported as the "most serious present loss of trout and salmon". During their review of Klamath River ditches, most were found to contain juvenile fish.

Artificial propagation began within the Klamath River Basin in 1896, when eggs taken from a tributary to the Sacramento were raised to fry and introduced into the upper Klamath. Eggs from the Sacramento River were also taken in 1907, 1911, 1913, and 1917, for a total of 4,950,000; these were released in the Klamath River. A small hatchery was established at the mouth of the Klamath River in the 1890s that released fry originating from the Rogue River. Also after Copco Dam was established, a hatchery was developed at Fall Creek (Snyder 1931). The affects these historic hatcheries and resulting fish had on the Thompson/Seiad/Grider analysis area is unknown. A hatchery was also built to mitigate the effects Iron Gate Dam would have on the salmonid fishery. Since 1991, fish plants have decreased within mid-Klamath River tributaries because of increasing concern over genetic pollution of the wild fish and competition for food and space between hatchery and wild stocks.

# TERRESTRIAL

## FIRE

### Historic Overview

The following is a historic overview of Fire/Vegetative reference conditions. Short answers to the Key Questions are provided after this discussion.

To visualize the condition of the vegetation prior to fire suppression, it is important to think of the documented fire return intervals known to have occurred in the Thompson Creek drainage. Research done there on fire-scarred trees by Taylor and Skinner (1996) indicated that the fire return interval on south slopes was 8 years, and on the east aspects it was 16 years for the time period between 1627 and 1992.

The frequency of these fires was the same high on the ridges as low on the slopes. So what did the vegetation look like before fire suppression?

In late October of 1863, the journal of William H. Brewer recounts hiking from Seiad (then Sciad) Valley to the Three Devils, about a 4,000 foot elevation climb on a south aspect. "The hills are covered with scattered timber, not dense enough to be called forests, or in places with shrubby chaparral. The whole of this wide landscape was bathed in a smoky vapor, and the mountains faded in it at no great distance (Farquhar 1930)." Brewer mentions the smoke in the air twice more during his short stay in Seiad Valley.

An 1855 lithograph of the mountains around Scott Bar also depicts the trees as very scattered, and somewhat denser on north aspects and in draws. Notable from these historical items: it was routine to be smoky in the fall, and that dense, old-growth Douglas-fir forest was not what caught early journalist's eyes, it was hills with scattered timber not dense enough to be called forests.

Taylor and Skinner's work on Thompson Ridge included analysis of age groupings. By looking at the arrangement of age classes which indicated past stand-replacing or initiating events, were able to draw som conclusions abut the patterns of past fire intensity. Their study indicates that higher intensity fires were more frequent higher on slopes and on southerly aspects. Conversely, moderate to low intensity events were more common on north and east aspects particularly low on the slopes. This would have allowed the densest Douglas-fir forest cover, as fewer overstory trees would be killed in a typical fire.

If the south aspects had widely spaced trees, how did they accumulate enough fuel to burn so often? With a fire-return interval of eight years, shrubs that are present now would have had to be much less dominant, as eight year old deerbrush, scouler's willow, and snowbrush normally will not carry a fire even in August, they do not accumulate a lot of litter at that age and have high live fuel moisture. The most likely answer is that perennial grasses and forbs were much more prevalent in the past. This would have been possible with more open stand conditions. The grasses and forbs would cure out in the fall and would be capable of carrying fire at the short intervals indicated by the fire scar history. The make-up of the grass/forb layer is not well-documented in the historical record, but given the large numbers of grazing animals such as horses, cattle, and sheep that were supported during the early settlement days, the grasses had to be more prevalent.

On north and easterly aspects with slightly longer fire intervals, a different vegetation regime would likely have been present. Due to topographic and fuel variations resulting in fire intensity variations, the landscape would have had much more structural diversity than the homogeneous one that developed with longer fire intervals due to recent fire suppression. More common now is either stand-replacement areas where fuel buildups were great (Grider Fire of 1987, Thompson Fire of 1987, and the Indian Ridge Fire of 1966), or denser, fuel-ladder bearing areas where fire exclusion has been successful.

Historic conditions were very likely to have been somewhere in between. Patchiness of stands would have been at a finer scale than is now occurring. Areas now considered as having old-growth conditions would have been less prevalent, while areas where stand replacing fires have occurred would also have been smaller and less common.

To again quote Taylor and Skinner's work, "Structural definitions for late-successional forests were developed from stands that have not burned in recent decades because of fire suppression. Therefore, structural attributes (i.e. multiple canopy layers, coarse woody debris, snags) often associated with late-successional forests may be, in part, an artifact of vegetation changes associated with 20th century fire suppression policies."

Thus, trying to achieve late-successional characteristics over large areas on the landscape may be outside the historical range of variability. A more stable situation can be achieved with the careful use of prescribed fire to slowly progress toward a more frequent, low intensity fire regime similar to what occurred historically.

**Key Question 1- What were the historic disturbance regimes (i.e., fire, insects, disease)**?

As cited above, the fire regime was frequent on south aspects, averaging eight years, and less frequent on east aspects, averaging 16 years. These frequent fires would remove damage caused by insects and disease, clean up the forest floor, and reduce the amount decay available for insect and disease habitation. Outbreaks of insect and disease were much less widespread than they are currently. Isolated small-scale outbreaks were typical in older stands.

**Key Question 2- What is the history of fire suppression and fuels treatment in the analysis area**?

Prior to the establishment of the Klamath National Forest in 1905, fire fighting was only done to keep wildfires from spreading to homes, cabins, and improvements such as barns, outbuildings, and corrals. These efforts usually did not result in suppressing wildfire. In many cases, fires were encouraged to spread to improve grazing conditions. Fire suppression activities were initiated after the establishment of the National Forest. In the early years of the Forest Service, very few personnel were available for fire suppression efforts and locals were in favor of frequent burning to improve grazing conditions. It was not until the 1930s with the establishment of the Civilian Conservation Corps. (CCC) camps in and near the analysis area, that successful fire suppression was accomplished. With this influx of manpower and equipment, suppression of all fires could be successful. With advances in fire fighting equipment (engines, airtankers, helicopters, etc.) and in fire fighting techniques and training, successful fire suppression efforts have been the norm. Discussions with men that fought wildfire in the 1930s, '40s, and '50s describe firefighting as having been for the most part much easier, with less vegetation and fuels to impede fireline construction. They describe fires mostly as having less intensity and less severity due to the lesser amount of fuels. With successful fire suppression, fuels have increased and fires have become more intense and difficult to control. Occasionally an event such as the 1987 dry lightning storm will occur and overwhelm the fire suppression forces.

Fuels treatment following timber harvest has been practiced since the 1960s. Burning of harvest units to remove slash and prepare the units for planting has been done on approximately 22,000 acres within the analysis area. In recent years, burning to improve wildlife habitat and reduce fuel hazard has been implemented. At this time, very little of the analysis area has been received prescribed underburning.

**Key Question 3- Based on the historic disturbance regimes, what were the vegetative conditions?**

Please refer to the historic overview for the answer to this question.

## LATE-SUCCESSIONAL HABITAT

**Key Question 1- What was the historic distribution of late-successional habitat and what was its condition?**

### Late-Successional Forest

The Thompson, Seiad and Grider Analysis Area is very diverse, it is characterized by complex species and plant community distributions resulting from the variable climate; steep, rugged terrain; and diverse soil parent material. Vegetative characteristics across the landscape are constantly changing. Therefore, several sources of information are needed, in addition to the existing condition, to get an idea of what the landscape looked like in the past. The best available information on past vegetative conditions in the analysis area comes from the journals of early explorers, literature dealing with past fire regimes, old growth studies, and review of the 1944 aerial photographs (the oldest set of aerial photographs on the Forest). The interpretation of literature, vegetative conditions, and the photographs are designed to set a framework for historical conditions.

An excerpt from the journal of William H. Brewer (Farquhar 1930) describes the landscape around Seiad Valley: "The hills are covered with scattered timber, not dense enough to be called forests, or places with shrubby chaparral. The whole of this wide landscape was bathed in smoky vapor, and the mountains faded in it at no great distance." This statement, and others, suggest that late-successional forests, in the mid and late 1800s, were much more open that they are today and that fire was a common occurrence.

Earlier accounts from European settlers that came to the area in the 1850s describe very open conditions with ample grass to sustain livestock. Much of the area was described as a hardwood/conifer savanna. It was described as mostly grass covered with scattered hardwoods and conifers. Conifers were found mostly near drainage bottoms and the lower half of north slopes. Douglas-fir was the dominant conifer, but higher proportions of ponderosa pine and sugar pine were present when compared to today.

Within the analysis area, it is expected that dense, late-successional forest habitat was found only near drainage bottoms and on the lower third of north aspects. Late-successional habitat was limited to sites which experienced fire less frequently. These were found mostly on cooler, more moist north and east aspects of the hardwood/conifer communities and the higher elevation true fir community. More open stands were found throughout the analysis area, especially on south and west aspects. Scattered hardwoods and conifers with open understories were found through much of the low to mid elevations.

Review of research conducted over the past several years can provide additional information on the historical vegetative patterns that existed within the analysis area. Skinner (1995) compared vegetative patterns as depicted in two sets of aerial photos taken 41 years apart in areas of the Happy Camp Ranger District. Significant changes were noted in the spatial characteristics of the openings, meadows and brush, in the landscape studied between 1944 and 1985. The pattern of change suggests a more continuous cover of forest has developed over the last half-century, with less variation in the pattern of forest openings. Additionally, it has been noted that snag and log densities were likely lower than at present because of frequent fires (Taylor and Skinner 1995; Agee and Edmonds 1992).

A study of historical fire frequency was recently conducted on the west side of the Forest. This study concluded that prior to European settlement, fires occurred at 4 to 24 year intervals (Skinner 1994). It is very apparent when looking at forest stand conditions from aerial photos taken in 1944 that large fires were a common occurrence in the area. Fire scars are visible and vegetative patterns indicate the occurrence of large disturbances. These fires were of varying severity, but severity was obviously higher on exposed south aspects and ridges.

Fires within the analysis area appear to have been the most frequent disturbance event to shape the historical landscape. Fires occurred much more frequently in most areas than they do today. At lower and mid-elevations, historic occurrence has changed from frequent, low intensity ground fires to infrequent, high intensity stand replacing fires. At higher elevations, historic occurrence has changed from infrequent, low and moderate intensity ground fires to infrequent, low, moderate and high intensity surface or stand replacing fires. The lower severity fires of the past maintained open understories and kept levels of woody debris low. Fire severity varied depending upon the weather, fuels conditions, and local topography.

## TERRESTRIAL WILDLIFE

Wildlife habitats depend upon vegetation communities and disturbance regimes that determine the characteristics of the vegetation. This discussion of historic wildlife habitats is based on the descriptions of the historic vegetation patterns, accounts of early explorers and naturalists, and the known habitat needs of wildlife species.

**Key Question 1- What was the historic distribution of habitats and populations for the identified species?**

**Threatened and Endangered Species**

BALD EAGLE

Historically the nesting and foraging habitat along the Klamath River and it's tributaries was probably similar in amount and distribution to what it is today, The historic anadromous fish runs would have provided an excellent food source and the old-growth forests near the river would have provided nesting habitat. The Klamath River corridor would have been very good bald eagle habitat. The territoriality of bald eagles would most likely have been the limiting factor for population density, not a lack of habitat. Today, human activities such as timber harvest, homesteading, road building and clearing for agricultural purposes has reduced the large tree component along the Klamath River. In addition to reduced nesting and roosting structure, pesticide contaminants, human disturbance and reduced salmon fisheries have probably reduced the number of bald eagles along the Klamath River from historic times.

NORTHERN SPOTTED OWL

Historically, NSO nesting habitat probably occurred low on north and east aspects and in cool, moist drainage bottoms where historic fire regimes had the least affect on stand structure. More open stands that burned more frequently, stands suitable for foraging and dispersal, occurred on south and west slopes and higher in the drainages. Habitats in the analysis area were well distributed, with the possible exception of the ultramafic soils in the Devil's Peak area and higher elevations. Suitable nesting/roosting habitat, even limited to the above areas, would still be found across most of the analysis area. As the mixed conifer gradated into true fir, larger blocks of suitable nesting/roosting habitat would be found, due to less frequent fire in these vegetation communities. Suitable nesting/roosting habitat in these vegetation types would have been somewhat linear, following the north and east aspects of the drainages, with foraging/dispersal habitat covering most of the area in-between.

Historic distribution of NSO was probably more uniform in the watershed with a somewhat higher density. Areas impacted by timber harvest, roads, wildfire, and subsequent fire salvage logging would have supported NSO in drainages where few are known to occur now (e.g., the area west of Grider Ridge, the Cade Mountain area, lower Thompson Watershed, and Walker Creek). In addition, current fragmentation in the home ranges of individual birds may be exposing owls to greater risks of predation and competition, leading to decreased reproduction and survival from historical times.

MARBLED MURRELETS

There is no information on historical distribution of murrelets in the analysis area. Late-successional forest habitat, which may be suitable for murrelets, existed in the area, but it is not known if murrelets nested this far inland. Data shows that murrelet numbers on the California coast are much reduced from historic times due to loss of nesting habitat; based on extrapolation from currently known population numbers in relation to remaining available nesting habitat, it has been estimated that at least 60,000 marbled murrelets may have been found historically along the coast, compared to an estimated 2,000 today (US Fish and Wildlife Service 1997).

**Forest Service Sensitive Species**

GOSHAWK

Goshawks prefer mature coniferous forests with moderately dense canopy closure and an open understory for foraging through the forest. Their preferred nesting sites are in large trees located at middle and higher elevations on north slopes near water (CDFG 1990). Suitable habitat in the analysis area is similar to that used by NSO. Historically, the more open stands created by a frequent fire interval, would have provided good habitat for goshawks. The higher diversity of habitat types, such as conifer forest interspersed with oak woodlands, meadows, and riparian areas, would have provided a diverse and abundant prey base for goshawks. It is expected that much of the analysis area below the true fir zone would have been good goshawk habitat. The effect of past and present land use activities on goshawk habitat is poorly understood. Activities such as timber harvest, road building, recreational uses, and mining have reduced the available habitat and increased disturbance potential in the analysis area since historic times. Fire suppression activities have lead to forested stands that are more dense than in the past. These stands are more susceptible to catastrophic fires, insect epidemics and disease, resulting in higher tree mortality in the older age classes important to goshawks. Very dense conifer stands currently found in the analysis area may limit the northern goshawks access to prey. These changes to stand structure and habitat availability suggest that current reproductive success and survival of goshawks may be lower than in historic times.

FISHER

At the time of European settlement, fishers were found throughout the northern forests of North American and Pacific Coast Mountains. Between 1800 and 1940, fisher populations declined or were extirpated in most of the United States and in much of Canada due to over trapping and habitat destruction by logging (Ruggiero et al. 1994). Closed trapping seasons, habitat recovery programs, and reintroduction programs allowed fishers to return to some of their former range. Populations are still extremely low in Oregon and Washington (the Pacific Northwest) and parts of the northern Rocky Mountains (Ruggiero et al. 1994).

Fishers have been categorized as "closely-associated" with late-successional forests (Ruggiero et al. 1991; Thomas et al. 1993). Riparian areas are also considered important for fishers in California and Idaho. Habitat for fisher within the analysis area, prior to European influence, was most likely similar to what currently exists. However, human activities, such as logging, mining, agricultural practices, roads and homesteading, have reduced the amount of late-successional forest habitat and increased the potential for disturbance in the watersheds.

MARTEN

American martens have been trapped for fur since aboriginal times and are primarily known as furbearers over much of their range. The distribution of martens has undergone regional contractions and expansions, some of them dramatic. The American marten has a smaller distribution now than in pre-settlement historical times; the total area of its geographic range appears similar to that early in this century, when it was at its historical low (Ruggiero et al. 1994).

American marten occupy a narrow range of habitat types, living in or near coniferous forests. More specifically, they associate closely with late-successional stands of mesic conifers, especially those with complex physical structure near the ground. Habitat for marten, prior to European influence, would have been similar to what occurs now in the analysis area; however, it is expected that the upper elevation conifer stands were generally more open with fewer large clearings (clear cuts or burned areas) and numerous, natural, small openings compared to what currently exists within the analysis area. Human activities, such as logging, mining, agricultural practices, roads and homesteading, have reduced the amount of late-successional forest habitat and increased the potential for disturbance in the watersheds.

WILLOW FLYCATCHER

Willow flycatchers use extensive thickets of low, dense willows along the Klamath River and in wet meadows or near ponds. It is expected that willow flycatchers were historically common in willow thickets along the Klamath River and in montane meadows where willows occurred. It is expected that numbers have declined since historic times due to habitat destruction, grazing in montane meadows, fire exclusion which allowed conifers to encroach on meadows, and possibly cowbird parasitism. Extensive mining in the watershed during the gold rush era altered riparian habitats considerably. Hardrock tunneling, wing dam, derrick, and pick and shovel mining occurred in addition to extensive hydraulic activities. Hydraulic mines required vast systems of reservoirs, ditches, flumes, and pipelines and at one time altered most major tributaries which flowed in the watershed area. Homesteading and clearing for agricultural purposes along the Klamath River and the larger creeks also removed riparian willow habitat early in this century.

**Survey and Manage Species**

RED TREE VOLE

There is no information on red tree voles within the analysis area either currently or historically. Recent surveys with positive detections of red tree voles in the Applegate Watershed of Oregon indicate that further surveys are needed to determine if red tree voles occur in northern California. Habitat for red tree voles is similar to that described above for northern spotted owls, the historical perspective of suitable habitat for spotted owls would apply here for red tree voles.

BATS

Although little is known abut the historical occurrence of these bat species, it is reasonable to assume that they have always occurred within the analysis area. Changes in harvest methods, the amount of timber harvest, and the effects of fire suppression over the last 50 years have likely affected bat populations in positive and negative ways. Mining activities during the last century, where deep mine shafts were carved into hillsides, may have had beneficial effects on bat species by providing roosting habitat.

SALAMANDERS

There is little or no historic information on Del Norte and Siskiyou Mountains Salamanders. Recent surveys have suggested that these species' ranges are much broader than previously thought. Within the analysis area it is expected that the abundance and distribution of salamanders was historically similar to what exists now. However, changes in forest structure may have affected local abundance, for example: fire suppression activities have created more dense forest stands which may have lead to better conditions, an increase in abundance, and wider distribution locally (e.g. south slopes); conversely, forest practices, such as timber harvest, road building and mining, may have reduced suitable habitat in patches, leading to extirpation of small populations. It stands to reason that salamanders were adapted to the historic fire regime and, due to fires occurring during the hot, dry time of year, they were below the surface and protected from flame and excessive heat. The abundance and distribution of individual populations would have changed through time depending on the intensity and distribution of the fires.

MOLLUSKS

Reference conditions prior to European influence are difficult to determine for the mollusk species of concern in this analysis. It wasn't until recently that scientists began to conduct surveys and identify the various species locally. Based on the current condition of the species' habitat, reference conditions were most likely very similar to what exists now, except that the forested stands were more open as a result of a more frequent fire regime.

**Klamath Forest Emphasis Species, Species of Local Concern**

PEREGRINE FALCON

Peregrine falcons are limited by suitable cliffs and ledges for nest sites. Several large rock outcroppings in the analysis area provide this type of habitat. Historical nesting habitat for peregrines was probably not very different from what exists today. The amount and distribution of foraging habitats, including oak woodlands, riparian areas, conifer forest, and meadows, was probably similar to what currently exists in the analysis area. Although habitat for peregrines has not changed appreciably, numbers of animals may be down from historic populations due to drastic declines in the last several decades from pesticide contamination. Through recovery efforts, peregrine numbers are increasing.

DEER

Prior to settlement by European man (before the 1700s), deer in California appear to have been abundant, but less so than in modern times because of the lack of large-scale habitat disturbance (wildfire, clear cutting). Deer are well known to be a "seral" species that thrive on disturbed (early successional) habitat dominated by shrubs and herbaceous plant species that are succulent and nutritious (Leopold, 1950). Deer are less abundant in densely forested areas.

Before the arrival of European man, the area in which the Happy Camp and Klamath deer herds occur was occupied by the Karuk and Shasta Indians. These native Americans utilized deer extensively for food, clothing, and utensils. According to Indian history, the Marble Mountains (Klamath Mountains) abounded in deer, elk, and bear (CDFG 1989).

The descriptions of early 1800s explorers and settlers provide the closest estimate of what deer and other wildlife populations may have been like before European settlers. From these accounts, it appears that deer were originally numerous in the coastal mountains from San Diego to the Klamath River in foothills and valleys, but were apparently scarce in the dense forests in the northwest.

Jedediah Smith traveled over much of California in 1827-1828. He indicated that deer were abundant along the Trinity and Klamath Rivers, but when his party explored the mountains north of the Klamath, they saw no deer.

The Gold Rush Era saw a dramatic decline in deer numbers due to high levels of unregulated market hunting to supply venison and hides for the mining camps. From 1850 until about 1903, commercial deer hunting camps and market hunters operated throughout the State of California.

By 1892, when the first National Forests were established, most of the timber areas of California were being exploited, and tremendous areas had been slashed and burned. In subsequent years, the clearings developed into brush fields, which supported many more deer than the original forest; hence the process of timber clearing, while it might have been enormously destructive of resources as a whole, was only temporarily deleterious to deer. In addition, the elimination of unrestricted hunting, combined with increasingly effective enforcement, contributed substantially to the increase of deer first noticed in the period 1910 to 1920 (CDFG 1993). Predator control apparently contributed to the rapid increase of deer in the period 1910-1930 and may have contributed to local overpopulation of deer in the 1950s (Longhurst et al. 1952).

By the 1960s and 1970s deer numbers declined. The current deer population trend is lower than it was from 1950 through the early 1970s, but greater than most estimated historical levels prior to 1940.

ELK

Elk are grazers that move up and down the slope, depending on the season. Historically, the more open oak woodlands and conifer forests with grassy understories provided excellent elk habitat. Roosevelt elk were once abundant in the Klamath Mountains, but were extirpated at the turn of the century due to high levels of unregulated market hunting and habitat loss.

Elk became a major food source for thousands of immigrants moving into the gold fields of the Salmon Mountains (Klamath Mountains) after 1850. Accounts of meat hunting by the miners are numerous. The demand for meat brought such high prices that many miners abandoned their claims to make a good living market hunting. The effect of such uninhibited shooting decreased elk numbers in many areas. Market hunting prospered for over half a century. Records show hide, meat, and jerky camps existed in Happy Camp and Cecilville from 1850 to about 1903.

The Forest began a reintroduction program on the Happy Camp and Oak Knoll Districts in the 1980s in cooperation with the CDFG. The populations in Elk Creek and Horse Creek, to the west and east of the analysis area respectively, have grown steadily through successful reproduction and continued re-introductions.

BEAR

Bear, mountain lion, coyote, and bobcat populations were reduced in the early 1900s through unregulated hunting, trapping and, in some cases, poisoning. Wolf and grizzly bear populations were exterminated in California by the early 1920s (Grinnell et al. 1937).

The areas of California occupied by black bear and the areas of the State occupied by the California grizzly bear were relatively distinct at the time of the arrival of the European explorers and settlers. As Nevis is quoted by Storer and Tevis (1955), "he (black bear) is the bear of the forest, while the grizzly bear is the bear of the chaparral." Consequently, the black bear was not as negatively affected by the settlement of California as was the grizzly bear. In fact, as the grizzly bear was eliminated from coastal areas of California by unregulated killing due to conflicts with European settlers, the black bear expanded its range into these areas.

However, some long-term and lasting impacts on black bear began with the arrival of European settlers. Habitat capability was reduced in some areas as land was converted to agricultural uses. As indicated above, however, because the black bear is generally restricted to the more forested types, the impacts of early agriculture in valley and foothill grasslands were not as significant on black bear as they were on other wildlife species such as the grizzly and elk (CDFG 1992).

TURKEYS

The wild turkey was not a part of the fauna when the first settlers arrived in California. Turkey-like birds are known from the Pleistocene or Ice Age but those species disappeared during more recent times for unknown reasons. It is believed that ecological or geographic barriers, in the form of the deserts of the southwestern United States and the high north-south mountain ranges, prevented the spread of wild turkeys to the westernmost states. These western states, formerly devoid of wild turkeys, evidently possessed the prerequisites for good turkey habitat, as evidenced by the recent successful introductions (starting in the late 1800s to the present) (Sanderson and Schultz, eds., 1973).

PLANTS

Reference conditions prior to European influence are difficult to determine for the plant species of concern and Botanical Special Interest Areas. Based on the current condition of species' habitat, reference conditions were most likely very similar for Baker cypress, Klamath Mountain buckwheat, Siskiyou lewisia, and Howell's lousewort. The habitat requirements for these species (open serpentine slopes, rock outcrops, forest openings) have been altered very little since the introduction of European influence. The rarity of these species is primarily a reflection of the natural rarity of the habitat, and not the result of man-caused impacts. The Botanical Special Interest Areas are also likely to be unchanged since the advent of European influence. The two areas within the watershed are found within relatively high-elevation open areas that have had little man-caused disturbance.

For the sugar stick, clustered lady-slipper orchid, and mountain lady-slipper orchid, reference conditions are more difficult to determine. Species habitat has been reduced by large timber harvest operations and stand-replacing catastrophic fires that have resulted from years of fire suppression. Habitat for these species was likely more abundant prior to European influence.

## HUMAN DIMENSIONS

### ROADS

**Key Question 1- Why and how was the road system developed?**

Prior to inception of the Forest Highway Program in 1915, the Forest Road Development Program in 1925, and the Works Progress Administration, the normal method of travel in the analysis area was by foot, mule, or horse over early historic trails with a few rough wagon roads. The transportation system in the landscape has developed over the years primarily in association with resource development and/or extraction.

When the Klamath Forest Reserve was established in May of 1905, transportation in the western half of Siskiyou County was primitive, with roads established only to Happy Camp on the Klamath River and to Forks of Salmon on the Salmon River. Travel was by horse drawn wheeled vehicles or horseback. Early road construction followed old trail alignments and centered around providing access for workers and equipment to mines.

The road from Walker Creek to Happy Camp across Grider Ridge, and the lower portion of the Seiad Creek Road were constructed in the mid 1920s. Further development did not occur until the early 1930s when the Civilian Conservation Corps began a road construction program primarily directed toward developing a transportation system to meet the requirements for adequate fire protection. Their earliest recorded accomplishments in the analysis area are the roads to Slater Butte Lookout, Thompson Ridge road from the Gray Eagle Mine to Tanner Mountain, China Creek Road, Grider Ridge Road, Grider Creek Road, Walker Creek Road, China Mountain Lookout, and further construction of the Seiad Creek Road.

In 1935 a Klamath Transportation study was developed. The primary objective was to enhance the fire protection in Region 5. In 1942, emphasis was redirected to mineral access roads in support of war related activities.

Most of the remaining roads in the area were constructed to access timber harvest beginning in the late 1950s. Examination of aerial photos and Forest Visitor Maps show the progression of road building with the analysis area. See **Figure 4-1** Road System Development, contained in the Map Packet located at the end of this document.

### HUMAN USES

**Key Question 1- What were the prehistoric and historic human uses in the analysis area?**

See the Historic Overview write-up at the beginning of this step.

**Key Question 2- What and where were the historic uses in relation to recreation/community interests/commodities of the analysis area?**

See the Historic Overview write-up at the beginning of this step .

**Commercial timber harvest** has occurred in the watershed since the 1930s. A total of 21,640 acres (15%) of the analysis area has had some level of timber harvest, with regeneration cutting being the primary silvicultural prescription. The highest levels of timber harvest occurred in the 1960s and 1980s decades, following large catastrophic fires such as the 1966 Indian Ridge Fire in the Cade Creek drainage and the 1987 Fires (Ft/Copper, Gulch, China, Slater, Thompson, and Lake). The 1990s had the third highest harvest level and consisted of completing the salvage logging from the 1987 fires. For the locations of areas harvested, see **Figure 4-2** Historic Logging By Decade, contained in the Map Packet located at the end of this document.

The acres harvested by decade are identified in **Table 4 - 1**.

**Table 4 - 1 Acres of Plantations by Decade**

| Decade | Acres | % of Plantations | % of Total Area |
|---|---|---|---|
| 1990-Present | 3,720 | 17 | 3 |
| 1980-1989 | 4,060 | 19 | 3 |
| 1970-1979 | 2,180 | 10 | 1 |
| 1960-1969 | 8,100 | 37 | 5 |
| 1950-1959 | 1,170 | 5 | <1 |
| 1940-1949 | 760 | 4 | <1 |
| 1930-1939 | 40 | <1 | <1 |
| Non-Stocked Plantations | 1,610 | 7 | 1 |
| **TOTAL** | **21,640*** | **100** | **15** |

* Source: *Forest Plan* Vegetation layer

# Step 5 - Interpretation

## INTRODUCTION

This step compares existing, historical, and reference conditions of specific landscape elements, and explains significant differences, similarities or trends, and their causes. Issue-specific desired conditions based on *Forest Plan* guidance and landscape characteristics are discussed.

This chapter begins with a brief outline of planning direction as it applies to the Thompson/Seiad/Grider analysis area. A brief overview of management areas and their corresponding goals and objectives is Included with the planning direction. Answers to the **Step 5** key questions by issue, as outlined in **Step 2**, follow the management area overviews.

## PLANNING DIRECTION

The planning direction for determining desired conditions is derived from all appropriate laws and administrative direction, including the *Record of Decision of the Northwest Forest Plan* (*ROD*). The *ROD* provides standards and guidelines for management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl. The *ROD* establishes a system of Late-Successional Reserves (LSRs) to provide habitat and connectivity for late-seral dependent wildlife species. The *ROD* also establishes the *Aquatic Conservation Strategy* (*ACS*) to restore and maintain the ecological health of watersheds and aquatic ecosystems. The *ACS* includes establishment and management of Riparian Reserves and Key Watersheds, completion of Watershed Analyses, and watershed restoration. The *Forest Plan* incorporates the *ROD* and *Aquatic Conservation Strategy*. The *Forest Plan* identifies land allocations, desired conditions, and standards and guidelines for the National Forest lands. This analysis incorporates and relies on the *Forest Plan*. A brief summary of *Forest Plan* land allocations applicable to the Thompson/Seiad/Grider Analysis Area, follows to provide a basis for the desired conditions presented by issue later in this chapter.

National Forest lands in the analysis area are divided into nine *Forest Plan* management areas; Wilderness, Late-Successional Reserve (LSR), Special Management, Backcountry, Riparian Reserve, Retention Visual Quality Objective (VQO), Recreational River, Partial Retention VQO, and General Forest. **Figure 1-2** *Forest Plan* Management Areas Updated During This Analysis, contained in the Map Packet at the end of this document, shows the distribution and **Table 5-1** Management Area Acreage, displays acreage of each area and percent National Forest Lands.

**Table 5-1 Management Area Acreage**

| Management Area | Acreage 1/ | % NF Lands |
|---|---|---|
| Wilderness | 4,476 | 3 |
| Late-Successional Reserve | 82,270 | 58 |
| Special Habitat | 2,596 | 2 |
| Backcountry | 9,488 | 7 |
| Riparian Reserve | 15,450 | 11 |
| Retention VQO | 4,897 | 3 |
| Recreational River | 2,391 | 2 |
| Partial Retention VQO | 14,728 | 10 |
| General Forest | 5,075 | 4 |
| **TOTAL** | **141,366** | **100** |

**1/** The reported acreage contains updates of land allocation estimates from the *Forest Plan,* particularly Riparian Reserve; and does not include the 6,997 acres of private lands in the watersheds.

## WILDERNESS

The Marble Mountain Wilderness is partially in the Thompson/Seiad/Grider analysis area. Wilderness areas are to be managed for wilderness characteristics, natural conditions, and ecological processes. They are to provide primitive or semi-primitive, non-motorized recreational opportunities. Lightning caused fires are to be treated as prescribed natural fires provided they meet management objectives, otherwise they will be treated as wildfires and suppressed with minimum impact suppression techniques. Wilderness management objectives have not been completed for the Marble Mountain Wilderness and most lightning fires are suppressed. A fire plan is needed to define objectives and prescriptions for prescribed natural fire. Management ignited fires are permitted to allow fire to return to a more natural role, although planned ignitions in wilderness have not been attempted on the Klamath National Forest.

## LATE-SUCCESSIONAL RESERVES (LSRs) and OTHER SPECIAL HABITAT

Portions of the Seiad and Johnny O'Neil LSRs are within the analysis area. These two LSRs occupy the largest portion of the analysis area (58%) and include lands in the upper portion of Thompson Creek, Portuguese Creek, Fort Goff Creek, the upper portion of Seiad Creek, the upper portion of Walker Creek and Grider Creek. Several 100 acre LSRs are located in the area between these large LSRs. The goal of late-successional reserves and special habitat areas is to provide habitat for late-seral dependent wildlife and other terrestrial T&E species over the long-term.

**BACKCOUNTRY**

Backcountry areas provide a semi-primitive non-motorized recreational setting where activities such as mountain biking, hiking, cross country skiing, and horseback riding are encouraged. The Kangaroo Backcountry area lies in the Northern portion of the analysis area occupying Canyon Creek and headwaters of Portuguese Creek.

**RIPARIAN RESERVES**

Riparian Reserves are for the protection of aquatic dependent species and to provide late-seral connectivity between LSRs. Riparian Reserve acreage is approximated for this analysis as described in **Step 3** and **Step 5** Riparian Reserves. The value in **Table 5-1** includes only National Forest lands outside Wilderness, LSR, Special Habitat, or Special Management Areas. Riparian Reserve boundaries on-the-ground are to be determined by project and may vary from mapping done for this analysis. Riparian Reserve Standards and Guidelines apply on any National Forest land, within and outside Wilderness, LSR, and Special Management areas, but do not apply on private lands.

**RECREATIONAL RIVERS**

The Klamath River is a designated National Wild and Scenic River. The boundaries of the Wild and Scenic River corridor have been established. The portion of the Klamath River within the analysis area is classified Recreational River. In the Recreational River management area, timber harvest is allowed but should meet Partial Retention VQO. Timber output expectations are the same as for Partial Retention.

**RETENTION, PARTIAL RETENTION, AND GENERAL FOREST**

The Retention VQO, Partial Retention VQO, and General Forest management areas have timber harvest expectations and scheduled yields. The primary difference is the visual quality objectives. Retention VQO provides attractive scenery by maintaining natural or natural appearing conditions. The expectation for timber output is low, about five percent of standing volume per decade, because of the visual considerations. Partial Retention is intended to provide an attractive landscape where management activities remain visually subordinate to the natural character of the landscape. General Forest areas have less restrictive VQOs of either modification and maximum modification. Timber outputs are considered moderate for the Partial Retention and General Forest areas, approximately 16% of the standing timber volume harvested per decade.

**AREAS MASKED BY OTHER MANAGEMENT AREAS**

**Special Interest Areas**

The analysis area contains two SIAs, Cook and Green Pass, and Seiad Baker Cypress. SIAs are sites designated for recreation experiences where education and interpretation of unique or special natural resource values are emphasized. Cook and Green Pass SIA highlights the diversity of crest zone plant species, and peridotite rock outcrops. Seiad Baker Cypress SIA highlights a large stand of this rare conifer species. These areas do not show on **Figure 1-2** because they are masked by LSR (refer to **Figure 6-5** for SIA locations).

**Wild and Scenic Rivers**

Segments of Grider Creek are recommended for Wild and Scenic River designation. Outstandingly remarkable values of fisheries, vegetation, and wildlife are to be maintained for recommended rivers within a corridor approximately 1/4 mile on each side. These areas do not show on **Figure 1-2** because they are masked by LSR (refer to **Figure 6-5** for Wild and Scenic River locations).

**Critical Habitat Units (CHUs) and Released Roadless Areas** are also found in the analysis area. Critical Habitat Units were established by the Fish and Wildlife Service for long-term protection of habitat for the northern spotted owl. Most of the CHU areas have been incorporated into Late-Successional Reserves but small portions extend outside of LSRs. Designation as a CHU will not likely impact the management of LSRs and Riparian Reserves but may have implications in other management areas. Management implications of CHUs will be discussed in more detail under the Terrestrial Wildlife issue.

Released Roadless Areas were unroaded (RARE II) areas released for multiple use management under the *California Wilderness Act*. Some of these areas have since become roaded, about 1,970 acres in this analysis area, but are retained in the database as released roadless. Controversy concerning entry into roadless areas affects management of these areas. Released roadless designation has some present impacts on those management areas available for scheduled timber harvest and may affect management in LSRs and Riparian Reserves as well. The management implications of Released Roadless Areas will be discussed in more detail under the Commercial Timber Harvest Outputs on Public Lands issue. The acreage of Released Roadless Areas is displayed for each management area in **Table 5-2** Released Roadless Areas.

**Table 5-2 Released Roadless Areas**

| Management Area | Released Roadless Area Acreage 1/ |
|---|---|
| Late-Successional Res. | 40,266 |
| Special Management | 362 |
| Backcountry | 9,487 |
| Riparian Reserve | 959 |
| Retention VQO | 275 |
| Recreational River | 548 |
| Partial Retention VQO | 2,539 |
| General Forest | 2,282 |
| **TOTAL** | **56,718** |

1/ The acreages listed include 1,970 acres of released roadless area that is roaded.

# AQUATICS

## HILLSLOPE PROCESSES

**Key Question 1a- What changes are there between current and reference/historical runoff and erosion rates and what causes these changes?**

**Key Question 1b- What are the hydrologic/erosional concerns in the analysis area and in each subwatershed? What management strategies should be used or changed to improve watershed conditions?**

Without roads and hydraulic mine tailings, the prehistoric rate of sediment production was about half of the modern rate of sediment production (see landslide production estimates in the King-Titus Fire Recovery EIS, Baldy Fire Recovery EIS, Poker, Deadrun and Greenmill Environmental Assessments, Salmon Sub-basin Sediment Analysis). At lower levels of sediment production, the stream bed is less mobile and more stable, resulting in better aquatic habitat. Riparian habitat is also disturbed less by floods, so more mature stands of vegetation are likely to be maintained in the riparian zone.

There are two important modes of sediment production: 1) **chronic sediment production**, the fine sediment produced from exposed soil surfaces during runoff-producing rainfall. Exposed surfaces can be natural, road surfaces, or the result of timber harvest or fire; and 2) **episodic sediment production**, the sediment produced under intense rainfall resulting from natural and management-related landslides.

Chronic sediment production occurs every year, when and where runoff occurs on recently disturbed soil. Runoff occurs when and where the precipitation rate (or melt rate in the case of snow) exceeds the infiltration rate of the soil. Soil particles detached by abrasion of dry soil, disturbance of saturated soil, and ripping are carried by overland flow. Some overland flow arrives at stream courses or drainage ditches leading to stream courses. Burned surfaces produce ash, fine organic material, and soil particles. Local areas may experience runoff-producing precipitation during summer thunderstorms, but most fine sediment is produced by runoff of wet-season, cyclonic storms. Once loose particles have been removed by early runoff, the rate of fine sediment production declines. Without continuous disturbance of soil surfaces, fine sediment production carried by runoff would decline noticeably.

Chronic fine sediment production is a concern where sediment charged stream waters infiltrate gravels in stream channels, depositing sediment in spawning gravels in slower flow areas. This process interferes with respiration of salmonid eggs in the stream bed as well as other biological processes in other aquatic species

Road surfaces are the major controllable source of chronic sediment production. The primary management-related component of chronic sediment originates from erosion of abraded, dry road surfaces, ditch erosion and wet weather use and disturbance of roads. Chronic fine sediment production from roads is controllable by surfacing roads with aggregate and control of road use during the times that the road surface is susceptible to abrasion and wet-weather disturbance.

Episodic sediment production occurs less frequently, about 5% probability in a year (a twenty year event), with more intense rainfall (10 or more inches of rain in 10 or less days for mid-winter). Episodic sediment production may also occur under intense precipitation of summer thunder storms (an example is the debris flow in Pitchfork Creek, tributary of Seiad Creek, in 1990). Natural and road-related landslides, road-associated fill and cut failures, and road/stream crossing failures are the common sources of episodic sediment production.

Natural landslides that contribute to episodic sediment production include large, active earthflow landslides of the dormant landslide and residual soil terrane and debris slides of shallow soil mantle that occur in all of the geomorphic terranes.

The primary management-related component of episodic sediment originates from road-associated landslides, road-associated fill and cut failures, and road/stream crossing failures. According to "The Flood of 1997: Klamath National Forest" (de la Fuente et al. 1998), 83% of flood damage sites resulting from the January, 1997 flood were the result of these three sources of episodic sediment.

Road-related landslides account for about 18% of road damage sites from the 1997 flood. Roads through, or immediately adjacent to, active landslides pose the greatest risk to large volumes of episodic sediment delivery. Areas of toe zone, inner gorge, and dissected granitics have high potential of producing road-related earthflows. Some landslides can be small in size and easily handled by routine road maintenance. However, most are significantly large failures that are difficult or financially unfeasible to repair. In some cases the failure is slow and not readily or immediately apparent.

Road fill failures account for about 14% of the road damage sites as reported in the flood damage study. Numerous failures of the road cut face and natural foundation of the fill are observed in unconsolidated inner gorges and toe zones. Many fill failures are called wash outs or blow outs due to the erosive action of flowing water on poorly compacted fills. Fill failures can also result in mudflow landslides which are often very destructive for a long distance down stream.

Most significantly, road/stream crossing failures account for about 51% of the road damage sites. In this count are all damage sites at stream crossings, regardless of cause, including culvert failures, landslides, and soil saturation. Many culverts were unable to pass the high volume of water and debris during the flood. Portions of roads and adjacent hillslopes were severely eroded, as culverts plugged or were overtopped. Streams were routed across or down roads and down slopes not capable of handling the large amount of flow.

Episodic sediment production of rare, intense storms produces large amounts of sediment to streams, resulting in significant changes in channel form, channel location, and disturbance of floodplain vegetation. Transport of such large influxes of sediment continues at an elevated rate for ten years after the original flood. During this time, the channel bed remains relatively unstable. Channel wandering and channel bank erosion occurs as flows find a way around deposits of coarse sediment. This has most obviously occurred at and near the mouths of Thompson, Seiad, and Walker Creeks. Movement of the unstable substrate can result in loss of developing fish eggs and subgravel embryos. The worst case scenario for episodic sediment production is strong seismic shaking coincident with high soil moisture of the winter season.

Episodic sediment production is most effectively controlled by avoidance of construction in unstable terrane, site-specific mechanical stabilization measures, and control of drainage. There are only a few feasible opportunities to stabilize natural earthflow landslides, as most are too large and complex for reasonable fixes. There are, however, many opportunities to reduce the destabilizing effects of roads on earthflow landslides, toe zones, and stream crossings.

One of the best approaches to managing unstable ground, which are areas where large road-related earthflows are most likely to occur, is avoidance. High maintenance road segments in toe zone, unconsolidated inner gorge, and dissected granitics are good candidates for road decommissioning. Earthflows may continue to move, but suspending activities that keep the road open will often result in significant abatement of landslide processes. If a road on unstable terrane must be kept open, then road aggravated damage by active earthflows can be reduced by minimizing the size of cuts and fills and avoiding disturbance of both surface and subsurface natural drainage patterns.

There are several techniques effective in preventing fill failure. Many local roads were constructed without controlled compaction. Achieving maximum compaction in construction of fills and repair of fill failures is key to preventing a subsequent failure at the same site. Soil moisture in the fill must be within a narrow range to achieve optimum compaction. Well-compacted soil has fewer and smaller voids, so it absorbs less water and remains stronger when inundated. By controlling soil compactive effort and soil moisture the possibility of fill failure can be minimized. Increased soil density can significantly improve the stability of road fills. Mechanical reinforcement of fill (such as layered geotextile) and surface and subsurface drainage also serve to improve the strength of fills. This is an effective technique in situations where location of the road or soil properties make good compaction difficult. Improvement in soil strength from good compaction, mechanical reinforcement, and drainage can prevent and/or reduce, damage by flowing water, such as by culvert failure.

In some cases structural repairs of fill failures, especially on unstable ground, toe zone, unconsolidated inner gorge, and dissected granitics, can be effective when a competent local foundation can be achieved. Foundation failures may be stabilized by over-excavating the foundation to competent material. Without achieving a competent foundation, repairs often won't survive subsequent flood events, failing in much the same way as before. Cut failures on unstable ground can often be stabilized with a drained, reinforced earth buttress behind the cut. An inventory to identify low-density fills, fills constructed of cohesionless soil (decomposed granite) or other unsuitable material, and sites where surface or subsurface drainage threatens stability is needed to develop an effective watershed restoration program that reduces episodic sediment delivery.

There are also some techniques effective in reducing the risk of road/stream crossing failure. The standard design practice when most Forest roads were built included specifications for stream crossings to withstand 20 year floods. These crossings are at risk to fail during larger storm events. Construction and reconstruction now require stream crossings designed to withstand 100-year floods. To minimize impacts, road/stream crossings should be upgraded to pass water and debris during a 100-year or larger flood. Upsizing culverts is one way to achieve this. Another is to design crossings so, if culvert capacity is exceeded, water over-topping the road will cause minimal damage, erosion, and sediment delivery. An effective design may incorporate a culvert with rock-fill and a rolling dip to allow passage of water and debris over the road if necessary, while keeping the natural drainage channel in its original location. A site-specific road/stream crossing inventory should be completed to determine sites most in need of upgrading. Drainage design is of key importance in reducing episodic sediment production at stream crossings.

The processes of erosion, landsliding, and flow hydraulics are complicated, but reduction of both chronic and episodic road-related sediment production in the tributaries stands out as the way to achieve sensible improvement in riparian and aquatic habitat conditions.

**Cumulative Effects Assessment**

An assessment of cumulative conditions in Thompson/Seiad/Grider 7th field subwatersheds was conducted to examine watershed conditions, processes, and functions. *Forest Plan* Cumulative Watershed Effects (CWE) components, using current Forest data layers and professional interpretation were utilized. These models evaluate mass wasting, surface erosion, and Equivalent Roaded Area (ERA) divided by a Threshold of Concern (TOC) and provide an index of existing conditions relative to disturbance and land sensitivity. They can be used to identify areas where, over time, the accumulation of management-related disturbances have reached a level where they inhibit or prevent the proper functioning of the watershed, in particular its ability to absorb and respond to catastrophic events, such as flood or wildfire. (Elder 1998)

The mass wasting model is based on landslide rates quantified in the *Salmon Sub-Basin Sediment Analysis* (de la Fuente and Haessig 1993), methodology developed in Amaranthus, et al. (1985), the Grider EIS (1989), and the *Forest Plan*. Two landslide volumes are compared in this assessment. The first is a hypothetical background or reference condition, assuming the watershed is in pristine condition with no natural or management disturbances. The second is the current condition, modeled by overlaying timber harvest, road, and wildfire acres (displayed in **Step 3**, **Table 3-3**) with geomorphic terranes and multiplying by landsliding rates. Background sediment rates do not reflect actual historic condition, which would include the influence of fire (as discussed in **Step 4** ), but does provide a consistent basis for comparison. Mass-wasting sediment production values, expressed as percent over background, appear in **Table 5-3**. In this assessment, subwatersheds with mass wasting sediment production values exceeding 200% over background were classified as "over threshold" for this model. Although they provide a basis for comparison, modeled landslide volumes are estimates and should not be used as absolute values.

**Table 5-3 Subwatershed Mass Wasting Volumes**

| Watershed Name | Back-ground (Sediment /Decade) | Total Sediment (Current Condition) | % Over Back-ground 1/ | Road % | Fire % | Timber Harvest % | Undisturbed % |
|---|---|---|---|---|---|---|---|
| Walker Creek | 26,077 | 104,213 | 300 | 59 | 3 | 21 | 17 |
| Caroline | 7,571 | 25,203 | 233 | 70 | 0 | 1 | 29 |
| China Creek | 23,000 | 70,237 | 205 | 59 | 11 | 11 | 20 |
| Mill/Slide | 18,232 | 52,896 | 190 | 49 | 15 | 29 | 7 |
| Canyon Creek | 11,390 | 30,520 | 168 | 1 | 79 | 0 | 21 |
| Horse/Cade | 36,822 | 98,201 | 167 | 47 | 7 | 23 | 24 |
| Rancheria Cr. | 14,146 | 35,287 | 149 | 18 | 41 | 21 | 20 |
| ONeil/Schutts | 23,296 | 58,089 | 149 | 53 | 0 | 10 | 37 |
| West Grider/ Bittenbender | 13,587 | 32,840 | 142 | 55 | 3 | 9 | 34 |
| Panther | 10,075 | 23,405 | 132 | 46 | 12 | 8 | 34 |
| Lower Grider Cr. | 31,803 | 72,160 | 127 | 23 | 32 | 11 | 34 |
| Upper Seiad Cr. | 19,643 | 44,290 | 126 | 22 | 30 | 28 | 20 |
| Seattle/Joe Miles | 18,164 | 39,466 | 117 | 45 | 4 | 17 | 33 |
| Fort Goff Cr. | 24,581 | 47,620 | 94 | 0 | 73 | 0 | 27 |
| Cliff Valley | 13,455 | 25,047 | 86 | 38 | 10 | 7 | 45 |
| Ladds/Tims | 10,458 | 19,472 | 86 | 34 | 18 | 10 | 38 |
| Portuguese Cr. | 13,890 | 25,496 | 84 | 2 | 65 | 2 | 31 |
| Lower Seiad Cr. | 8,402 | 15,403 | 83 | 1 | 68 | 0 | 31 |
| Cedar/Morgan | 29,673 | 49,498 | 67 | 32 | 11 | 7 | 49 |

| Watershed Name | Back-ground (Sediment /Decade) | Total Sediment (Current Condition) | % Over Back-ground 1/ | Road % | Fire % | Timber Harvest % | Undisturbed % |
|---|---|---|---|---|---|---|---|
| Tom Martin/ Kuntz | 38,377 | 54,738 | 43 | 27 | 0 | 6 | 67 |
| Upper Grider Cr. | 25,387 | 30,084 | 19 | 14 | 0 | 2 | 83 |
| Upper Thompson Cr. | 19,925 | 23,591 | 18 | 14 | 2 | 2 | 82 |

All landslide volumes are expressed as cubic yards per acre, based on a landslide producing event or events with similar impacts to the floods of 1970-1974 (approximately equivalent to one 20 year flood).
**1/** Percent over background is calculated by subtracting background sediment production from total sediment then dividing by background. For example, 100% over background is equivalent to two times (or 200% of) background.

Surface erosion is predicted using the Universal Soil Loss Equation (USLE). Roads are the primary disturbance influencing surface erosion model outputs. Site specific conditions, such as road surfacing, are not used in this analysis due to modeling complexities and lack of data. In this assessment, subwatersheds with surface erosion sediment production values exceeding 800% over background were classified as "over threshold" for this model. Verification of USLE parameters, and therefore, surface erosion model outputs, is not as straight-forward as the verification of landslide model parameters.

Surface erosion model outputs can be highly variable depending on assumptions and should, like the landslide model outputs, be used as a comparative tool rather than as an absolute measure. Surface erosion model outputs are shown in **Table 5-4**.

**Table 5-4 Subwatershed Surface Erosion Volumes**

| Watershed Name | Back-ground Sediment | Total Sediment | % Over Back-ground 1/ | Road % | Timber Harvest % | Undis-turbed % |
|---|---|---|---|---|---|---|
| China Cr. | 48.5 | 631.57 | 1202 | 86 | 8 | 6 |
| Horse/Cade | 135.01 | 1575.94 | 1067 | 78 | 16 | 6 |
| West Grider/ Bittenbender | 35.87 | 328.94 | 817 | 85 | 5 | 10 |
| Walker Cr. | 87.67 | 800.53 | 813 | 81 | 10 | 9 |
| Panther | 38.12 | 308.91 | 710 | 79 | 11 | 10 |
| Mill/Slide | 97.48 | 773.22 | 693 | 84 | 5 | 12 |
| Caroline | 15.35 | 113.17 | 637 | 87 | 0 | 13 |
| Upper Seiad Cr. | 157.49 | 998.11 | 534 | 61 | 28 | 11 |
| ONeil/Schutts | 84.91 | 535.22 | 530 | 83 | 2 | 15 |
| Seattle/Joe Miles | 74.13 | 442.56 | 497 | 77 | 8 | 15 |
| Cliff Valley | 74.5 | 422.91 | 468 | 83 | 0 | 17 |
| Ladds/Tims | 57.02 | 284.78 | 399 | 75 | 6 | 19 |
| Rancheria Cr. | 47.58 | 219.39 | 361 | 61 | 21 | 18 |
| Tom Martin/Kuntz | 139.84 | 528.22 | 278 | 73 | 1 | 26 |
| Lower Grider Cr. | 98.18 | 354.96 | 262 | 70 | 4 | 27 |
| Cedar/Morgan | 181.37 | 545 | 200 | 60 | 8 | 32 |
| Upper Thompson Cr. | 152.38 | 253.65 | 67 | 35 | 6 | 59 |
| Upper Grider Cr. | 128.05 | 210.99 | 65 | 38 | 2 | 60 |
| Lower Seiad Cr. | 47.58 | 73.91 | 55 | 33 | 3 | 64 |
| Portuguese Cr. | 134.14 | 151.15 | 13 | 4 | 9 | 87 |

| Watershed Name | Back-ground Sediment | Total Sediment | % Over Back-ground 1/ | Road % | Timber Harvest % | Undis-turbed % |
|---|---|---|---|---|---|---|
| Canyon Cr. | 102.55 | 103.7 | 1 | 1 | 0 | 99 |
| Fort Goff Cr. | 185.27 | 187.21 | 1 | 1 | 0 | 99 |

All surface erosion volumes are expressed as cubic yards per acre.
**1/** Percent over background is calculated by subtracting background sediment production from total sediment then dividing by the background.

The third modeling technique used in this assessment is the Equivalent Roaded Area (ERA) methodology. The ERA model provides a simplified accounting system for tracking disturbances that affect watershed processes. It estimates changes in peak run-off flows influenced by disturbance activities. This model, while not intended to be a process-based sediment model like the previous two models, does provide another indicator of watershed conditions. The methodology uses coefficients which equate regeneration timber harvest and high and moderate intensity fire disturbances to an equivalent acre of road. These equivalent roaded acres are combined with actual roaded acres to calculate a total equivalent roaded acre disturbance. The amount of roads and regeneration harvest and fire are presented in **Step 3, Table 3-3** for each subwatershed in this analysis area. These are multiplied by coefficients presented in **Appendix B** Cumulative Watershed Effects. The sum of the disturbances (ERA) is divided by the area of each subwatershed to arrive at a relative disturbance rating, percent ERA.

The percent ERA is then compared to a Threshold of Concern (TOC), or theoretical maximum disturbance level acceptable. The TOC is a measure of subwatershed sensitivity. It is calculated based on beneficial uses, channel sensitivity, soil erodibility, hydrologic response, and slope stability for each subwatershed. These factors are combined in a formula that determines the TOC (refer to **Appendix B**). In general, a lower TOC value indicates a greater chance of watershed impacts than a higher TOC value, given the same amount of watershed disturbance. The TOC is compared to the percent ERA for each subwatershed.

The ERA/TOC, or risk ratio, estimates the level of hydrologic disturbance. It reflects relative risk of increased peak flows, potential for channel alteration, and general adverse watershed impacts. A percent ERA/TOC greater than 1.0 means that a watershed or subwatershed has exceeded its natural capacity to "absorb" these disturbances, and is considered "over threshold" for this model. The ERA and TOC values for each subwatershed are displayed in **Table 5-5**.

**Table 5-5 Equivalent Roaded Area and Threshold Of Concern**

| Watershed Name | Acres | % ERA | % TOC | Risk Ratio (ERA/TOC) |
|---|---|---|---|---|
| Upper Seiad Cr. | 6,896 | 13.1 | 7.5 | 1.75 |
| Mill/Slide | 5,576 | 15.5 | 9 | 1.72 |
| Rancheria Cr. | 4,398 | 12.4 | 7.5 | 1.65 |
| Fort Goff Cr. | 8,281 | 12.2 | 7.5 | 1.63 |
| China Cr. | 6,190 | 12 | 8 | 1.5 |
| Portuguese Cr. | 5,605 | 11.8 | 8.5 | 1.39 |
| Canyon Cr. | 4,289 | 11 | 8.5 | 1.29 |
| Horse/Cade | 12,923 | 10.8 | 9 | 1.2 |
| Lower Seiad Cr. | 3,540 | 11 | 9.5 | 1.16 |
| Walker Cr. | 7,622 | 7.6 | 7 | 1.09 |
| Panther | 3,734 | 8.1 | 9.5 | 0.85 |
| Lower Grider Cr. | 9,613 | 5.8 | 7 | 0.83 |
| Seattle/Joe Miles | 6,270 | 7.3 | 9 | 0.81 |
| West Grider/ Bittenbender | 4,145 | 6.9 | 10 | 0.69 |
| Ladds/Tims | 4,743 | 7.5 | 11 | 0.68 |
| Cedar/Morgan | 9,199 | 5.2 | 9 | 0.58 |
| Cliff Valley | 5,044 | 3.7 | 8 | 0.46 |
| O'Neil/Schutts | 8,224 | 3.2 | 8.5 | 0.38 |
| Caroline | 1,989 | 2.7 | 9.5 | 0.28 |
| Tom Martin/Kuntz | 13,788 | 2 | 9 | 0.22 |
| Upper Thompson Cr. | 8,401 | 1.1 | 7 | 0.16 |
| Upper Grider Cr. | 8,493 | 1.1 | 8 | 0.14 |

This cumulative watershed effects assessment includes consideration of all three model results individually and by using a combined index. The combined index models were weighted equally, with one-third to the ERA model and two-thirds to the two sediment production models. Model-derived sediment production (in cubic yards/acre/year) suggest that 75% of the total is from mass wasting and 25% from surface erosion. Therefore, the mass wasting model is weighted three times more than the surface erosion model. The final weighting for the three watershed models is 50% for the landslide model, 17% for the surface erosion model, and 33% for the ERA model. Results of the three models along with the combined index are shown in **Table 5-6** Summary of Cumulative Watershed Effects Models.

**Table 5-6 Summary of Cumulative Watershed Effects Models**

| Watershed Name [7th field] | Area (acres) | Mass Wasting (% Over) | Surface Erosion (% Over) | Risk Ratio (ERA/TOC) | Com-bined Index |
|---|---|---|---|---|---|
| Walker Cr. | 7,622 | 300% | 813% | 1.09 | 1.28 |
| China Cr. | 6,190 | 205% | 1202% | 1.50 | 1.26 |
| Mill/Slide | 5,576 | 190% | 693% | 1.72 | 1.19 |
| Horse/Cade | 12,923 | 167% | 1067% | 1.20 | 1.04 |
| Upper Seiad Cr. | 6,896 | 126% | 534% | 1.75 | 1.01 |
| Rancheria Cr. | 4,398 | 149% | 361% | 1.65 | 1.00 |
| Canyon Cr. | 4,289 | 168% | 1% | 1.29 | 0.85 |
| Caroline | 1,989 | 233% | 637% | 0.28 | 0.81 |
| Fort Goff Cr. | 8,281 | 94% | 1% | 1.63 | 0.78 |
| Panther | 3,734 | 132% | 710% | 0.85 | 0.76 |
| West Grider/ Bittenbender | 4,145 | 142% | 817% | 0.69 | 0.75 |
| Portuguese Cr. | 5,605 | 84% | 13% | 1.39 | 0.67 |
| Seattle/Joe Miles | 6,270 | 117% | 497% | 0.81 | 0.67 |
| Lower Grider Cr. | 9,613 | 127% | 262% | 0.83 | 0.65 |
| Lower Seiad Cr. | 3,540 | 83% | 55% | 1.16 | 0.61 |
| O'Neil/Schutts | 8,224 | 149% | 530% | 0.28 | 0.58 |
| Ladds/Tims | 4,743 | 86% | 399% | 0.68 | 0.53 |
| Cliff Valley | 5,044 | 86% | 468% | 0.46 | 0.47 |
| Cedar/Morgan | 9,199 | 67% | 200% | 0.58 | 0.40 |
| Tom Martin/Kuntz | 13,788 | 43% | 278% | 0.22 | 0.24 |
| Upper Thompson Cr. | 8,401 | 18% | 66% | 0.16 | 0.11 |
| Upper Grider Cr. | 8,493 | 19% | 65% | 0.14 | 0.11 |

**Key Question 2- Which subwatersheds have continued watershed concerns, when will they be considered recovered, and how can recovery be promoted and maintained?**

A cumulative effects assessment should also include consideration of riparian area and stream conditions, land allocations for each subwatershed, and other relevant site-specific information that cannot been included in watershed models. Riparian area and stream conditions are displayed under the Riparian Areas issue. Land allocations by subwatershed were also considered in the recommendations. Detailed information for each subwatershed, including recommendations for future management, is contained in the following paragraphs.

**The China Creek, Horse/Cade, and Walker Creek Subwatersheds** are each over threshold in at least two of the watershed models, with Walker Creek and China Creek over threshold in all three models. The primary reason for the high watershed impacts in each of these subwatersheds is the high road densities: 5.4 miles per square mile in China Creek, 4.5 miles per square mile in Horse/Cade, and 3.7 miles per square mile in Walker Creek ***(***refer to Table 3-3***)***. These subwatersheds also have extensive past timber harvest, with greater than 20% of the total acreage harvested in each. ***<u>China Creek, Horse/Cade, and Walker Creek should be considered Impaired Watersheds, based on the results of watershed modeling and these other considerations.</u>*** In impaired watersheds, activities should consist of restoration (such as road decommissioning) or stand tending activities aimed at long-term watershed health. The extensive plantations in these subwatersheds may be in need of precommercial thinning, including those plantations in Riparian Reserve. Prescribed fire may be appropriate to protect these areas from future wildfire.

**The Caroline, Mill/Slide, Rancheria Creek, Upper Seiad Creek, and West Grider/Bittenbender Subwatersheds** are each over threshold in one of the watershed models and have combined ERA indices of 0.75 or greater. The primary watershed impacts for

Mill/Slide, Caroline, and West Grider/Bittenbender are from roads. All have high road densities: 3.4 to 3.8 miles per square mile. In addition, Mill/Slide and Bittenbender have over 20% of their acreages harvested. The primary watershed impacts for Rancheria Creek and Upper Seiad are from timber harvest and burned areas. Upper Seiad has 27% harvested and 29% burned and Rancheria Creek has 20% harvested and 34% burned. ***Caroline, Mill/Slide, Rancheria Creek, Upper Seiad Creek, and West Grider/Bittenbender should be considered Impaired Watersheds, based on the results of watershed modeling and these other considerations.*** Again, in impaired watersheds, activities should consist of restoration (such as road decommissioning) or stand tending activities aimed at long-term watershed health. Some areas with extensive plantations may be in need of precommercial thinning, including those plantations in Riparian Reserve. Prescribed fire may be appropriate, especially in the previously burned areas, to protect them from future wildfire.

**The Panther, Seattle/Joe Miles, and O'Neil/Schutts Subwatersheds** are below threshold in all watershed models, but are approaching threshold in one or more model. Road densities are moderately high in each subwatershed (2.4 to 3.2 miles per square mile) with some timber harvest and some wildfire impacts. These three subwatersheds should not be considered impaired. Future activities may include additional disturbance (timber harvest) where appropriate, but should include watershed restoration to prevent them from becoming impaired. Prescribed fire may be appropriate to reduce risk of future catastrophic wildfire.

**The Canyon Creek, Fort Goff Creek and Portuguese Creek Subwatersheds** are over threshold in the ERA/TOC model. These three subwatersheds are unroaded and essentially unharvested, but have extensive areas burned in 1987 (52 to 58%). These subwatersheds should not be considered impaired watersheds. However, the 1997 flood impacted Fort Goff and Portuguese Creeks and their tributary stream channels. These three subwatersheds are almost entirely within Late-Successional Reserves or Backcountry, therefore, are withdrawn from programmed timber harvest. Activities within these areas should include restoration and stand tending to promote late-successional habitat, improve watershed health, and reduce the risk of future catastrophic wildfires.

**The Lower Grider Creek, Lower Seiad Creek, Ladds/Tims, Cliff Valley, and Cedar/Morgan Subwatersheds** are below threshold in each watershed model (except Lower Seiad, which is over the ERA/TOC model due impacts from 1987 wildfires). Road densities are moderate to low, two to less than one miles per square mile. Combined indices are 0.65 and below. These subwatersheds should not be considered impaired. Activities should consist of restoration , where appropriate, and other actions consistent with the land allocations and subject to project-level NEPA analysis.

**The Tom Martin/Kuntz, Upper Thompson Creek, and Upper Grider Creek subwatersheds** are all well below threshold in the models run for this analysis. Road densities are low (1.6 miles per square mile or less) and most roads in the subwatersheds avoid unstable lands. These subwatersheds should not be considered impaired. Activities should consist of those consistent with the land allocations and subject to project level NEPA analysis.

**Key Question 3a- What watershed processes are of concern with the current road system?**

**Key Question 3b- What are the criteria used to assess roads for the Access and Travel Analysis included in Appendix E of this document?**

The following factors were determined to be of concern in relation to watershed processes and the current road system: reducing accelerated sediment delivery from both mass wasting and surface erosion, reducing the alteration of hydrologic integrity, reducing road-related impacts to riparian reserve integrity, and giving special consideration to areas with high CWEs. These items were intended to focus the Access and Travel Analysis on the most relevant processes affecting roads and the aquatic environment. They were based on findings and discussions contained within the Thompson/Seiad/Grider Ecosystem Analysis. They were not intended to cover **all** potential impacts roads may have on aquatic systems.

Mass wasting is indicated by potential landslide sediment delivery to stream channels. This is determined based on the stability of the geomorphic terrane typed each road segment passes through. For example, a road segment that passes through an active landslide, toe zone, inner gorge, or dissected granitic land has a high sediment delivery potential.

Surface erosion is indicated by potential surface sediment delivery to stream channels using a combination of four indicators: soil type, road surface type, proximity to stream, and human use level. All four indicators received equal weighting. Soil type was identified using the erosion hazard rating (EHR) based on soil type and slope.

Alteration of hydrologic integrity is indicated by a roads's potential to: alter physical stream channel dynamics, divert a stream, or extend a stream network. This was measured by the number of road and stream intersections on a given road segment.

Road-related impacts to Riparian Reserve integrity is indicated by an overall loss of riparian habitat. This was measured by length of road segments within Riparian Reserves. Since the focus here is on riparian habitat, the unstable lands components of Riparian Reserves (dissected granitic lands and toe zones of slums and earthflows) are not included. These components are included in the mass wasting indicator.

Special consideration is given to areas with high CWEs based on the CWE assessment from this analysis. The combined index values of 7th-field watersheds are used to determine a road's rating.

The aquatic processes, indicators, and rating criteria used to assess roads for the Access and Travel Analysis (**Appendix E**) are shown in **Table 5-7**.

**Table 5-7 Access and Travel Analysis Aquatic Criteria**

| PROCESS | INDICATOR | HIGH | MODERATE | LOW |
|---|---|---|---|---|
| **Reduce Accelerated Sediment Delivery:**<br><br>**Mass-Wasting.** | **Sediment delivery potential based on geologic type.** | Roads through or immediately adjacent to active landslides.<br><br>Roads on toe zone, inner gorge, and dissected granitics. | - Roads on other granitics (granitics not included in "high" rating.)<br>- Roads on dormant landslides with greater than 20% slopes.<br>- Other roads on slopes greater than or equal to 60%. | Other roads on dormant landslides with less than 20% slope.<br><br>Other roads on less than 60% slope. |
| **Reduce Accelerated Sediment Delivery:**<br><br>**Surface-Erosion.** | **Surface sediment delivery potential based on a combination of four indicators a) soil type, b) road surface type, c) proximity to stream, and d) use level.** | Three or four "high" ratings in any of the four indicators. [high Erosion Hazard Risk (EHR), 0.25 miles within one site potential tree of stream, native or crushed surface, high human use.] | Any combination of two "high" and two "low" ratings. | Three or four "low" ratings in any of the four indicators. [low EHR, greater distance than one site potential tree from stream, pit-run, chip seal, or other paved surface, low human use.] |
| **Reduce Alteration of Hydrologic Integrity.** | **Potential to: alter physical channel dymnamics, divert stream, extend stream network, based on road stream intersections.** | Road segments with more than four stream crossings. (Stream crossings are counted on perennial and intermittent streams using a 20 acre accumulation model.) | Road segment with three to four stream crossings. | Road segment with zero to two stream crossings. |
| **Reduce Road-Related Impacts to Riparian Reserve Integrity.**<br><br>**(RR includes stream buffers, active slides and inner gorge.)** | **Overall loss of riparian habitat (shade, wood recruitment, species travel corridors) based on miles of road in RR.** | 0.75 or more miles of road within riparian reserve. | 0.25 to 0.74 miles of road within riparian reserve. | Less than 0.25 miles of road within riparian reserve. |
| **Give Special Consideration to Areas With High Cumulative Watershed Effects (CWE).** | **CWE Assessment from this analysis based on 7th field watersheds.** | Combined CWE analysis is one or greater. | Combined CWE analysis is 0.6 to 0.9. | Combined CWE analysis is less than 0.6. |

**Key Question 4- What are the trends for hillslope processes in the analysis area?**

Unstable areas will continue to unravel as natural processes and management activities occur in the analysis area. Landslides and surface erosion will continue, especially when the area is subject to heavy, sustained rainfall or flooding. Accelerated erosion rates resulting from past fires (1987) and the 1997 flood will continue to recover. The probability of future severe fire affecting hillslope processes will increase as fuel levels continue to increase. Sediments from the 1997 flood are expected to be re-worked over the next ten years. Sediment produced from similar future flood events are expected to be relatively unstable for a decade after the event. Direct management impacts from timber harvest will decline overall compared to the past several decades, primarily due to the designation of many areas as administratively withdrawn from programmed timber harvest. The extent of the road system will likely decrease. Unless opportunities in the Access and Travel Analysis are implemented, long-term lack of road maintenance will render culverts less effective. Roads will continue to suffer damage during floods due to inadequate road/stream crossings, inadequate surfacing, landslides, and other road stability problems.

DESIRED CONDITIONS

--Watersheds are resilient to natural disturbance and management activities. Management activities lead to recovery of impaired watersheds. Future management activities in other subwatersheds do not lead to impaired conditions so over the long-term, none of the watersheds are impaired or approaching impairment threshold.
--Management of the road system is adequate to manage the land while minimizing impacts to aquatic resources.
--Fuels conditions are such that the risk of catastrophic wildfire is small throughout the watershed.

## RIPARIAN AREAS

**Key Question 1- How have Riparian Reserve acreage estimates evolved from the *Forest Plan* through this analysis?**

Three Riparian Reserve mapping estimates are available for the analysis area; the *Forest Plan* estimate, the current Forest-Wide streams and unstable lands estimate, and the estimate derived from the Forest-Wide coverages supplemented in this analysis. The acreages for each are displayed in **Table 5-8** Riparian Reserve Acres, and the mapping extent displayed in **Figure 5-2** Post-Analysis Riparian Reserves, contained in the Map Packet at the end of this document. The supplemented Forest-Wide estimate is the most likely to depict actual Riparian Reserve extent, although it is still an estimate, made at a watershed scale. Actual Riparian Reserve boundaries need to be ground verified at the project level.

**Table 5-8 Riparian Reserve Acres**

| Description | Acres Outside Wilderness and Administratively Withdrawn Areas | Total Acres |
|---|---|---|
| Original Klamath *Forest Plan* | 6,430 **1/** | Not Available |
| Updated with Forest-Scale Unstable Lands & Stream Mapping **2/** | 11,100 | 38,520 |
| Updated Mapping supplemented in this analysis **3/** | 15,450 | 48,120 |

**1/** The *Forest Plan* assumes that 44% of remaining Matrix lands is considered unmapped Riparian Reserves.
**2/** uses unstable lands mapping as of September, 1997 and updated stream buffers, using 20 acre accumulation model for stream mapping and 170 ft. buffer on each side of stream.
**3/** uses additional unstable lands mapping done for this project.

*The Northwest Forest Plan Record of Decision (ROD)* and the *Forest Plan* designated Riparian Reserves as a land allocation. Mapped Riparian Reserves are displayed and used for acreage estimates in the *Forest Plan*. The mapped Riparian Reserves consist of unstable lands mapping available during the *Forest Plan* analysis, but does not include stream buffer mapping, not available at that time. Due to the lack of stream buffer mapping, an additional 44% of Matrix land (land allocations outside of wilderness and administratively withdrawn areas) are assumed to be unmapped Riparian Reserves in the *Forest Plan*.

The Riparian Reserve acreage estimates described in **Step 3** Riparian Areas, are derived from updated geomorphic and stream buffers mapping (update version for each, September 1997). The Riparian Reserves include the unstable lands geomorphic types; active landslides, toe zones of dormant landslides, and all types of inner gorge. The stream buffer mapping includes 340 foot buffers (approximately two site potential tree heights for the area) on fish-bearing streams and lakes, and 170 foot (one site potential tree) on non-fish bearing perennial and intermittent streams, marshes, and springs. The streams, marshes, and springs mapping is based on USGS 1:24,000 quad maps supplemented with additional streams based on a 20 acre accumulation model. The 20 acre accumulation model predicts the beginning of a stream, assuming 20 acres of land draining to a single point will initiate an "annual scour" stream, "Annual scour" is used as described in the *ROD* and the *Forest Plan*. The model has been spot tested in Elk Creek, Beaver Creek, Callahan, and the Lower South Fork of the Salmon River watershed analysis areas, and has shown to give a good estimate of stream extent in those areas. The 20 acre accumulation model streams have been incorporated into Forest wide streams and stream buffers coverages.

In addition, **project level** delineation of Riparian Reserves will result in changes to the unstable lands geologic data layer. This will be due to both under-mapping or over mapping of unstable geomorphic terranes (active landslide, toe zone, inner gorge, dissected granitic lands) at the Thompson/Seiad/Grider ecosystem analysis level.

Based on project level mapping samples done on the Salmon River District, the following changes to Riparian Reserve acreage may occur at the project level in the Thompson/Seiad/Grider area. Mapped active landslide acreage will likely increase (primarily slumps and earthflows not visible on air photos). This proportion increase would be very small since active slides usually occupy less that one percent of the land base. Mapped toe zone acreages will likely increase. Mapped inner gorge acreages will likely decrease on smaller streams (first to third order), and on floodplains. However, much of the over-mapped portion in these areas may still be in Riparian Reserves due to proximity to streams. Dissected granitic lands can increase or decrease. There is not a good sample of project level mapping of these areas to draw conclusions from.

**Key Question 2- What are the natural and human causes of change between historical/reference and current riparian area conditions, including the impacts of roads and other disturbances?**

The wildfires of 1987, and the 1997 flood were natural events that impacted many acres of riparian area by changing vegetation seral stage and increasing erosion potential. Mining was the probably the earliest Euro-American activity to impact riparian areas in the analysis area. Placer mining along the Klamath River and several tributaries disrupted stream channels and riparian vegetation, primarily in the 1890 to 1920 time period. Most of these old placer workings have become revegetated although evidence of past workings can still be seen. Mining that occurred in ore deposits generally had little effect on riparian areas. Currently, the mining that occurs in the analysis area is primarily suction dredging in the Klamath River.

Roads and timber harvest are the primary human-caused disturbances affecting the riparian areas today. Roads are the greatest impact due to the long-term loss of growing site for vegetation and potential sources of eroded sediment. Roads constructed adjacent to streams generally result in a loss of riparian vegetation to improve driver visibility, and reduce hazard trees falling on roadways. As a result there is reduced stream shading, causing increased stream temperatures, reduced large wood recruitment, and overall loss of habitat for aquatic and riparian species (USFS 1999). Timber harvest is a temporary change in erosion potential and vegetation seral stage, also affecting sediment inputs to streams, stream shading, and large wood recruitment.

**Key Question 3- How do the current riparian habitats compare to optimum habitats, and how can riparian areas be protected and/or restored? What poses problems to stream channel stability and resilience?**

Information from stream habitat surveys can be useful as a descriptive tool for assessing aquatic habitat conditions. Various problems arise, however, when attempting to set standard thresholds for stream habitat parameters. One set of criteria cannot fit all streams. The most troublesome problem is how to scale stream habitat parameters to the size of a stream and to the geologic morphology of its watershed. Pools in smaller streams tend to be shallower than pools in larger streams. Streams in a watershed having large areas of decomposed granitic terrane generally have a higher percentage of fines in the substrate than streams within watersheds where most of the terrain is composed of competent bedrock. Other problems arise because there is very little information on reference stream habitat conditions and ranges in reference data vary widely.

Because optimum habitat conditions for Thompson/Seiad/Grider streams are largely unknown, reference habitat parameters from three sources are used in this analysis. Reference conditions for instream habitat components have been identified in measurable elements in the *Forest Plan.* National Marine Fisheries Service (NMFS) has established measurable indicator criteria to determine if stream ecosystems are at a properly functioning condition. Habitat parameters from two relatively unmanaged watersheds, Dillon and Wooley, are also used as reference conditions. **Table 5-9** Reference Habitat Components, summarizes the three sets of reference habitat values (only water temperature and fish habitat parameters presented in **Step 3** are displayed).

**Table 5-9 Reference Habitat Components**

| Parameter | *Forest Plan* | NMFS Matrix | Wooley/Dillon Reference |
|---|---|---|---|
| **Water Temperature** | Below 70°F | Below 69°F | 62°F |
| **Pool Frequency** | One Pool Every Three to Seven Bankfull Widths | One Pool Every Three to Seven Bankfull Widths. | 12 Primary (≥3 feet in depth) Pools/Mile |
| **Maximum Pool Depth** | At Least 3 Feet | At Least 3 Feet | Not Applicable |
| **Canopy Cover** | 80% Surface Shading | Not Applicable | 34% Surface Shading |
| **Coarse Woody Material** | 20 Pieces Per 1,000 Lineal Feet (24" Diameter x 50' Length) | >20 Pieces/Mile (>24" Diameter x >50' Length) | 4 Pieces/Mile (>24' Diameter X 50' Length) |
| **Substrate** | Not Applicable | Not Applicable | Gravel, Cobble Dominate |
| **Fine Sediment** | <15% in Spawning Gravel | <15% in Spawning Gravel | 12% Overall |
| **Embeddedness** | <20% in riffles | <20% in cobble | 15% |

Determination of habitat criteria from the *Forest Plan* is based on the "Draft Proposal For managing and Monitoring Streams For Fish Production" (Sedell 1988), local data and current literature. Sedell's proposal was intended to provide direction for *Forest Plan* application in Oregon and Washington Forests in the Columbia River Basin. These may be adjusted to the Klamath National Forest as additional information is obtained.

The *National Marine Fisheries Service Matrix of Factors and Indicators* is used to document baseline stream and watershed conditions. Current aquatic conditions for each surveyed stream in the assessment area are compared to NMFS indicator criteria to determine "Functioning", "At-Risk", or "Not Properly Functioning" habitat components. The indicator criteria used for this assessment are shown in **Table 5-10** Matrix of Factors and Indicators. **Appendix C** - Aquatic Habitats, contains completed comparison tables titled "Justification of Matrix of Factors and Indicators" for each surveyed stream. These tables display determinations of "Properly Functioning", "At- Risk", and "Not Properly Functioning" habitat components and the justification behind the determinations. The NMFS matrix criteria must be used for each Klamath National Forest proposed project to meet obligations of compliance under the *Federal Endangered Species Act*.

## Table 5-10 Matrix of Factors and Indictors

| FACTORS | INDICATORS | PROPERLY FUNCTIONING | AT-RISK | NOT PROPERLY FUNCTIONING |
|---|---|---|---|---|
| WATER QUALITY | Temperature | 69 °F or less | 69 to 70.5 °F | >70.5 °F |
| | Turbidity | Turbidity Low | Turbidity Moderate | Turbidity High |
| | Chemical/Nutrient Contamination | Low levels of contamination from agriculture, industrial, and other sources: No excess nutrients | Moderate levels of contamination from agriculture, industrial, and other sources: some excess nutrients | High levels of contamination from agriculture, industrial, and other sources: high levels of nutrients |
| HABITAT ACCESS | Physical Barriers | Man-made barriers allow upstream and downstream passage at all flows | Man-made barriers do not allow upstream and/or downstream passage at base/low flows | Man-made barriers do not allow upstream and/or downstream passage at a range of flows |
| HABITAT ELEMENTS | Substrate | Less than 15% fines in spawning habitat and cobble embeddedness less than 20% | 15 to 20% fines in spawning habitat and/or cobble embeddedness is 20 to 25% | Greater than 20% fines in spawning habitats and cobble embeddedness greater than 25% |
| | Large Woody Material | More than 20 pieces of large wood per mile and current riparian vegetation condition near site potential for recruitment of large wood | 20 pieces or less of large wood per mile or current riparian vegetation condition below site potential for recruitment of large wood | Less than 20 pieces of large wood per mile and current riparian vegetation condition well below site potential for recruitment of large wood |
| | Pool Frequency | One pool every 3-7 bankfull widths. Pools should occupy 50% of the low flow channel width and all have a max depth of at least 36 inches | One pool every 3-7 bankfull widths. Pools should occupy 50% of the low flow channel width and half have a max depth of at least 36 inches | Less than 1 pool every 7 bankfull channel widths and/or less than half of the pools have a max depth of at least 36 inches |
| | Off-Channel Habitat | Backwaters with cover and low energy off-channel areas | Some backwaters and high energy side channels | Few or no backwaters or off-channel ponds |
| | Refugia | Refugia exist and are adequately buffered, sufficient in size, number and connectivity | Refugia exist but are not adequately buffered, are insufficient in size, number and connectivity | Adequate refugia do not exist |
| CHANNEL CONDITIONS AND DYNAMICS | Width/Depth Ratio | W/D ratio <12 on all A, G, and E channel types. W/D ratio >12 on all B, F, and C channel types | More than 10% of the reaches are outside of the W/D ranges given for properly functioning | More than 25% of the reaches are outside of the W/D ranges given for properly functioning |
| | Streambank Condition | >90% stable i.e.. on average <10% of banks are eroding | 80-90% stable | <80% stable |
| | Floodplain Connectivity | Off-channel areas are frequently linked to main channel. Overbank flows occur and maintain wetland functions, riparian vegetation and succession | Reduced linkage of wetland floodplain and riparian areas to main channel. Overbank flow reduced as evidenced by moderate degradation of wetland function, riparian vegetation, and succession | Severe reduction in connectivity between off-channel wetland, floodplain, and riparian areas. Wetland are drastically reduced and riparian vegetation and succession altered significantly |
| FLOW HYDROLOGY | Changes in Peak/Base Flows | The Risk Ratio in the ERA model is less than 0.5 | The ERA Risk Ratio is between 0.5 and 1.0 | The ERA Risk Ratio is greater than 1.0 |
| | Increase in Drainage Network | The density of road/stream crossings is less than 3 per square mile | The density of road/stream crossings is between 3 and 6 per square mile | The density of road/stream crossings is greater than 6 per square mile |
| WATERSHED CONDITIONS | Road Density | Less than 2 miles per square mile | Between 2 and 4 miles per square mile | Greater than 4 miles per square mile |
| | Disturbance History (landslide model) | Current condition in the landsliding model is less than 100 percent over background | Current condition in the landsliding model is between 100 and 200 percent over background | Current condition in the landsliding model is greater than 200 percent over background |
| | Disturbance History (surface erosion model) | Current condition in the surface erosion model is less than 400 percent over background | Current condition in the surface erosion model is between 400 and 800 percent over background | Current condition in the surface erosion model is greater than 800 percent over background |
| | Riparian Reserves | Less than one percent of Riparian Reserve is roaded and less than 10 percent is <40 year old plantation or stand replacing fire | Between one and two percent of Riparian Reserve is roaded or between 10 and 20 percent is <40 year old plantation or stand replacing fire | Greater than two percent of Riparian Reserve is roaded or greater than 20 percent is <40 year old plantation or stand replacing fire |

Streams in the Dillon and Wooley watersheds were surveyed by the USFS in the early 1990s and results were published by EA Engineering, Science and Technology (1995 Draft). These reference streams are either wilderness streams or reaches that are unroaded and primarily unmanaged. They are considered to have pristine conditions for the mid-Klamath River area. Comparison values from Dillon and Wooley streams are taken from Rosgen "B" channel types (Rosgen 1996) because most of the surveyed streams in the assessment area are "B" channels.

Many of the values for fisheries habitat criteria in the *Forest Plan* and environmental indicators in the NMFS matrix may be inappropriate, especially when applied to moderate to small streams in the Thompson/Seiad/Grider assessment area. In some cases this may have resulted in a determination of **Not Properly Functioning** or **At-Risk** when the negative connotation of these labels may not always be warranted. Thresholds for habitat parameters in the *Forest Plan* and NMFS matrix may need refinement. More thorough analysis of existing data and further surveys of undisturbed streams could help refine appropriate ranges of conditions for comparing current to reference aquatic habitat quality.

Successful recovery efforts will conserve and restore the long-term dynamics of watersheds, rather than just habitat attributes. Meeting any given management imposed habitat standard may or may not reflect the health of a stream. Maintenance of critical stream processes, such as the regimes of water, sediment and woody material delivery are more likely to result in the successful conservation of aquatic dependent species.

Overall, most of the stream habitat condition values are in line with properly functioning habitat conditions from both the *Forest Plan* and the NMFS Matrix of Factors and Indicators. Most exceptions are low pool frequencies, high amounts of fine sediments, and low numbers of key large woody material.

Cool, deep pools are critical for summer holding and rearing habitat. Spawning takes place in the deposited gravel in pool tailouts. Several amphibian species require cool, deep pools high in dissolved oxygen for successful breeding. Pools can also be highly sensitive indicators of changes in watershed conditions (EPA 1991). The smaller streams found in this analysis area generally do not meet the primary pool depth criteria of three feet. Pool frequencies are highest in China Creek. Walker Creek has extremely low pool frequencies. Additionally, Fort Goff and Portuguese Creeks had high pool frequencies before the 1997 flood, however, it is now suspected that they do not meet the NMFS properly functioning standard.

Stream temperatures are related to water temperatures in headwater streams, solar radiation, air temperature, stream gradient, and flow. The amount of solar radiation hitting the stream is influenced by the amount of vegetative and topographic shade. During the summer months, temperatures greater than the optimum required for salmonid growth can occur in the mainstem Klamath River. Over 85 percent canopy closure exists in China and Horse Creeks. Walker, Seiad, Portuguese, and Fort Goff Creeks do not meet *Forest Plan* canopy closure criteria. All streams, except Walker Creek exceed the Wooley/Dillon reference stream canopy closure value of 34%.

Large wood provides a source of cover and habitat diversity for fish through a range of flows and seasonal conditions. It is important for diversifying the habitat of amphibians and other riparian dependent species. Wood serves an important role in maintaining healthy stream channels. Two streams in the assessment area, Walker and Seiad Creeks did not meet the Wooley/Dillon reference large woody material (LWM) value of four pieces/mile. China Creek, with six pieces/mile, met the wilderness reference value, but none of the surveyed streams that had wood data met or exceeded the NMFS properly functioning value of 20 pieces/mile. Likewise, none of the streams met or exceeded the *Forest Plan* value of 105 pieces/mile.

The composition of stream bed material influences the flow resistance in the channel, stability of the bed, and quantity as well as quality of aquatic habitat available to developing eggs, small fish, and invertebrates (Olson and Dix 1993). Streambed quality for aquatic organisms is highly dependent on amounts of surface fines and substrate embeddedness; a measure of the extent that large streambed particles are surrounded or buried by fine sediment. Excessive fines and embeddedness decreases embryo and fry survival and emergence, decreases or alters invertebrate populations that serve as a food base, decreases rearing habitat available for juvenile salmonids, and decreases pool frequencies. Walker Creek did not meet fines or embeddedness values for the *Forest Plan*, NMFS matrix, or reference streams. Fines were also high in Lower Ukonom, Panther, Sandy Bar and Rogers Creeks. Embeddedness was high in Portuguese, Fort Goff, and China Creeks.

**Key Question 4- What are the trends for riparian areas in the watershed?**

Riparian areas affected by the 1987 wildfires will continue to recover, especially in the Canyon, Fort Goff, and Portuguese Creek subwatersheds as trees become established and grow. Lands affected by the 1997 flood will also continue recovering throughout the assessment area; riparian vegetation will slowly increase and shade will improve. In stream channels not severely affected by the flood or fires, the proportion of dense, late-seral vegetation in riparian areas will increase as trees grow larger and older. Some dense, early-seral stands may stagnate as tree densities approach site capacity. Poor site quality areas will probably change little over time. Overall instream aquatic habitat should slowly improve over time as the impacts of the fire and flood continue to diminish. Pool habitat will increase in heavily scoured streams over the next decade. Riparian area conditions will continue to fluctuate with future intense storm events and wildfires.

Streams within subwatersheds with high road densities, poor road conditions, and high disturbance histories will continue to experience chronic sediment inputs. Repair of known road-related erosion problems, decommissioning of unneeded roads, and appropriate logging practices in matrix will decrease sediment impacts in the long-term. Provided future flood events, wildfires, road building, and timber harvesting activities do not severely impact large areas, watershed processes should continue toward reference conditions.

**DESIRED CONDITIONS**

**--**Mid to late-seral stands in Riparian Reserves are maintained over the long-term at a percentage consistent with reference conditions. Connectivity for late-seral wildlife is also maintained.

**--**High quality aquatic habitat exists in all streams with adequate amounts of pools and LWM in streams as site capacity allows.

**--**Habitat is sufficient for sustainable populations of indigenous aquatic species. Fine sediment input, accumulation, and transportation in streams are reduced to levels consistent with good quality aquatic habitat.

**--**Roads, dispersed recreation sites, and other human developments in riparian areas are maintained to achieve attainment of *Aquatic Conservation Strategy* objectives and there is reduced habitat disturbance from management activities.

**--**Riparian features are well identified on maps and on-the-ground.

**AQUATIC DEPENDENT SPECIES**

**Key Question 1- What are the natural and human causes of change between historical/reference and current species distribution and population sizes?**

The natural and human causes of change that may have influenced current species' distributions and population sizes are the same as those impacting riparian areas and aquatic habitat conditions (refer to Step 5 Riparian Areas, Key Question 2). Changes between historical and reference habitat conditions may result in changes in aquatic community compositions, or the area a species utilizes at a given time. The presence of non-native, warm water species, such as brown bullheads, green sunfish, and yellow perch, in the Klamath River may impact the native cold water community by competing for food and space.

The origin of many resident trout populations is variable; some may be native resident fish, and others may consist of native fish that were historically moved upstream above barriers into previously barren reaches. Some resident populations may exist because of hatchery stocking efforts, and the origin of the stocks used is often unknown. This hatchery practice is no longer used, and influences of these stocks on present populations and their adaptability is unknown.

Road culvert and crossings have restricted and disrupted the natural movement of watershed products (water, large woody material, and sediment) and fish passage into some of the Thompson/Seiad/Grider watersheds. Efforts to promote fish passage have been completed on China Creek and have been planned on Walker Creek, when final flood repair is completed.

**Key Question 2- What areas are critical for maintenance, protection, and recovery for at-risk species?**

Anadromous salmon and steelhead species are comprised of populations called stocks that originate in specific watersheds as juveniles. Each stock is uniquely adapted to particular sets of environmental conditions that exist in their natal streams. Adaptation to local environmental conditions increases the survival success and fitness of a stock. Genetic, morphological, and behavioral differences have been shown to exist between stocks inhabiting different watersheds.

Clusters of stocks in large geographic areas (such as the Klamath River Basin) are called metapopulations, and collectively comprise a distinct population segment that: 1) is reproductively isolated from other population units, and 2) represents an important component in the evolutionary legacy of the species (Waples 1991). The streams within the Thompson/Seiad/Grider watersheds containing stocks of salmon and steelhead that are critical for the survival of the metapopulation because of their genetic diversity. The most important of these for salmon and steelhead include China Creek, Fort Goff Creek, Horse Creek, Grider Creek, Portuguese Creek, Seiad Creek, Thompson Creek, and Walker Creek.

Streams that are not accessible to anadromous species or do not provide suitable habitat are critical in providing high quality water, especially in summer, to the Klamath River. These streams are generally small, well-shaded with substantial base flows, and are located next to the migration corridor to upstream and downstream habitats. This helps insure that connectivity between habitats for all life stages and sub-populations is maintained, especially through stressful periods. The continuing need for mid-Klamath tributaries (that cool and improve water quality in the Klamath River) is one of the most important functions in determining the viability of salmon and steelhead metapopulations in the Klamath Basin. In addition, the increased frequency and duration of high water temperatures, and their resulting fish kills within the mainstem Klamath River underscore the need to maintain cool, high quality water in tributary watersheds.

**Key Question 3- What are the population trends for aquatic dependent species in the watershed?**

Fall chinook populations within the Klamath Basin are generally on an increasing trend, with population peaks in 1987 and 1995. This is primarily due to severe restrictions on the ocean harvest of the species. Coho salmon and steelhead populations remain largely unassessed but general observations and local input from residents indicate that populations have declined over the last two decades. The anadromous fish populations within the analysis area will continue to be influenced by ocean conditions, harvest levels, and inland habitat conditions. Long-term solutions for this area will require continued improvement of habitat factors, including obtaining a suitable temperature regime, especially in the mainstem Klamath River, suitable sediment regimes in the tributaries, and proper installation of a new culvert for fish passage in Walker Creek.

DESIRED CONDITIONS

--Management activities maintain or improve the high quality, cold water contribution of analysis area tributaries to the Klamath River.

--Aquatic populations, especially threatened and endangered species, within the analysis area increase toward habitat carrying capacity. Current fish range resembles historic range.

# TERRESTRIAL

## FIRE

**Key Question 1- How have the vegetation communities changed over time and what have been the agents of change?**

Based on information available for this analysis, the pre-settlement condition of the analysis area contained a mosaic of disturbance adapted vegetation communities. Based on soil capability, aspect, elevation, the historic disturbance regimes, and vegetative response to disturbance, the vegetation communities were remarkably stable. The seral stage distribution, vegetation density, and relative abundance of plant species within many of these vegetation communities has changed. The pre-settlement landscape was probably exceptionally patchy containing complex mosaics of different age and size classes in the mixed conifer dominated communities. Large uniform patches created by infrequent catastrophic fire were broken up by more frequent medium and small-scale disturbances (Wills and Stuart 1994). Much of this landscape was described as a conifer/hardwood savanna, with large areas found within the river corridor and along ridges covered with grass, scattered conifers, and hardwoods.

The European settlers coming into the area in the 1850s were pleased to find abundant grass and turned out large numbers of domestic livestock. The large amount of grazing removed the grass and encouraged growth of shrubs, hardwoods, and conifers. The native grasses were the primary carrier for the frequent low intensity fires as the grass was lost, shrubs and thickets of small trees became more numerous. Lack of grass to help spread the fires helped early fire suppression efforts. By the 1930s, the more frequent medium-scale fire disturbances had been removed and continued fire suppression efforts allowed conifers and hardwoods to fill in almost all openings.

Approximately 90 years of fire suppression effort has been the most significant agent of change to the vegetation communities. As identified in the fire history study done on Thompson Ridge in the analysis area (Taylor and Skinner 1996) fires were a frequent disturbance. Fires were recorded in the study area 94 years during the period 1626-1992 (mean=3.9 years between fires). 85% of the fires occurred late in the summer and fall. During the pre-settlement period (1626-1849) the median fire return interval was 14.5 years.

There was some spatial variation in fire return intervals; drier south and west aspects burned more frequently than other aspects. South aspects had a fire return interval of eight years and west aspects a fire return interval of 13 years. Fire severity was studied on east and west aspects and by slope position. By far, upper slopes of west aspects experienced the most high severity fires. Lower slopes of east aspects experienced the most low severity fires. The cumulative effect of fire severity variation across slopes suggests that given capable soils, areas with late-successional characteristics (multi-layered canopy, high density of large diameter trees, snags, coarse woody debris) were found on lower slopes of all aspects, and on mid-slopes of north and east-facing slopes. Upper slopes as well as mid-slopes on south and west aspects were more likely to display a pattern of scattered, remnant, older trees and patches, exhibiting some late-successional characteristics within a coarser-grained pattern largely of younger stands.

Fire suppression efforts and the resulting fire severity have been the most significant agent of change for vegetation communities. Fire suppression has allowed stand densities to increase, and for the understory to fill in with shade-tolerant conifer and hardwoods. The greatest evidence of this is in the mixed conifer communities. With successful fire suppression, shade-tolerant fire intolerant conifer species have been able to expand and now dominate the understory of these fire adapted communities. Many of the fire-adapted species, such as ponderosa pine and black oak, have trouble reproducing under these conditions.

There currently are not many good references that address the number of life-forms that are being lost due to this encroachment. Scientists are currently focused on the study of species that they believe depend on dense fire-intolerant conditions. Following are some references that speak to the diversity of this area and that frequent fire disturbance is instrumental in developing and maintaining this diversity. "Few forested regions have experienced fires as frequently and with such high variability in fire severity as those in the Klamath Mountains. This highly variable fire regime may be an important factor contributing to overall diversity in the Klamath Mountains" (e.g., Martin and Sapsis 1992). "The Klamath Mountains harbor the most structurally and floristically diverse forests in the western United States" (Whittaker 1960, 1961).

With the dense understories and ladder fuels currently found and increasing in the analysis area, the fire regime has changed from one of frequent, low to moderate intensity fires to a less frequent, moderate to high intensity regime. These future fires will cover large areas with higher severity fire than was experienced in the past and will have severe effects on terrestrial and aquatic habitats.

Timber harvest within this analysis area has been the next most significant agent of change. Since the 1930s, approximately 22,000 acres within the analysis area have been harvested. Much of this was timber salvage harvest after fires. Only 9% of these acres were harvested prior to 1960. In the 1960s decade, 37% of these acres were harvested. In the last 30 years, an average of 3,860 acres have been harvested per decade. These harvest units have removed late mature and old-growth seral stages and replaced them with seedling to pole seral stages. The success rate for establishing new plantations is 93% within the analysis area. Most of these plantations have been growing very vigorously, both planted conifer species and naturals (including hardwood and shrub species). To ensure adequate stocking, most areas were planted with tight spacing. With good survival, dense young stands have developed.

These investments in the forest's future are very susceptible to fire. Older plantations are in need of thinning and removal of fuels to promote growth to larger sizes, as well as, develop resistance/resilience to fire disturbances. Younger plantations should be protected by treating nearby areas with underburning until these stands are able to withstand treatments from within.

Large, moderate to high severity fire is an effective agent of change on vegetation communities. The fires of 1987 burned 62,000 acres of the analysis area and nearly 32,000 acres burned with moderate to high severity. Overstories in these areas received greater than 30% mortality. Approximately 14,000 acres were taken completely back to early seral stages. Historically, fire-killed vegetation would be consumed in the following fire or fires. The frequency of fires would ensure that fuel accumulations would not reach high levels. With the long time period for fuels to accumulate until the fires of 1987, much more vegetation was available to be fire-killed. Without any follow-up fire or fuels treatment in these areas, vegetation has grown up through these high fuel loadings. Without a second cleanup type burn, much of the 1987 fire areas are now set to burn with high severity stand-replacing fire.

Due to the long duration of the 1987 fires (approximately eight weeks) where most of these acres were burned under a temperature inversion, the effects were less severe than would have been expected, given the amount of available fuels. Areas that burned with low to moderate severity currently present an opportunity to apply underburning to reestablish conditions that existed with the influence of frequent fire disturbance.

**TRENDS -** Currently within the analysis area, fire behavior potential modeling has identified 43,620 acres as having high, 47,850 acres as having moderate, and 54,490 as having low fire behavior potential. Approximately 3,000 acres within the analysis area are identified as non-flammable. The current conditions will burn with more intensity and higher severity than any vegetative condition that has existed in this area in documented history. Investments made for future forested conditions, i.e., plantations are very susceptible to high severity fire. Even with active fire suppression efforts, there is a high likelihood that much of the analysis area will be involved in large-scale wildfire events in the near future.

With dense multistoried stands, an unstable vegetative condition has been created in an area where fire is the dominant disturbance agent. Opportunities to reestablish fire-adapted mixed conifer communities currently exist, but can be lost in an instant. Current policies are too restrictive and expensive to apply projects at a large enough scale to make a significant difference at a landscape scale. As budgets are reduced, the fire suppression and militia organizations are reduced. Also with budget reductions and appeals to road repair projects, road maintenance is reduced and access for fire suppression and forest management is even more limited.

**Key Question 2- Where are large areas at risk from catastrophic disturbance and what areas are important to treat or protect?**

Fire starts have occurred within the analysis area every year of the 76 year history of fire start data. Based on the size of the analysis area and the number of starts that have occurred over the 76 year period (1,026), a risk rating of moderate has been calculated. The natural disturbance regime for the analysis area was dominated by large fires, with mostly low to moderate severity. Fire suppression efforts over the last approximately 80 years have been, for the most part, very successful in limiting fire spread and effects in the analysis area. This has allowed for vegetation, standing dead, and down available fuels, to increase dramatically from the amounts that were historically maintained.

The current fire suppression organization is still successful most of the time, but can be quickly stretched to its limits during multiple start events. With the high fuel accumulations creating higher fire intensities and making it more difficult to build fireline, fire suppression forces will have less success in the future. In addition, a damaged and poorly maintained transportation system hinders or can make initial attack with engines impossible in areas with high fire behavior potential. With the continuation of a successful fire prevention program, lightning storms igniting multiple fires will continue to be the source of most fire starts. Based on continuing increases in fuels, these fires will more often overwhelm fire suppression forces, escape initial attack, burn more area, and burn with higher intensities.

Fire behavior modeling has identified 61% of the watershed as having high to moderate fire behavior potential. See **Figure 3-8** Fire Behavior Potential, contained in the Map Packet located at the end of this document. Fires occurring in these areas have the potential of becoming large, high intensity burns. These fires have the potential of reducing the amounts of pole, early/mature, mid/mature, late/mature, and old-growth seral stages, while increasing the amounts shrub/forb seral stages.

Vegetation communities in the analysis area developed, adapted, and were maintained by variations in soils, aspect, precipitation, microclimate, and disturbance. The removal of fire as a frequent disturbance has changed these vegetation communities. In attempting to protect them from fire, some have been made more vulnerable to being lost to fire. Some communities are more extensive due to their ability to establish and persist in undisturbed areas. With continued protection from fire, some species dependent on fire disturbance to persist may cease to be found in the analysis area. Fire disturbance is necessary in order to maintain a wide variety of vegetative communities, species, and seral stage diversity.

It is extremely important to protect people living in the analysis area and their residences from fire. All residents in the watershed should be concerned and take precautions to protect themselves and their homes from wildfire. Wildfires will continue to threaten residences in the analysis area. Area residents should be encouraged to clear fuels and use defensible space precautions around their homes. Cooperative efforts can be taken to reduce fuels on Public lands adjacent to private property.

As stated in the Aquatic Dependent Species Step 5 write-up, "Streams that are not accessible to anadromous species or do not provide suitable habitat are critical in providing high quality water, especially in summer, to the Klamath River". Streams providing high quality water also have adjacent vegetative conditions that are prone to high severity wildfire. The complete removal of vegetation , as in a stand-replacing fire, can increase sedimentation, change the flow regimes, and increase stream temperatures, thus degrading aquatic species habitats. This makes it critical to protect these areas from catastrophic fire, which can be made possible by making the upslope areas more resilient to the effects of fire.

With frequent fire disturbance, mixed conifer communities were maintained with light fuel loadings (Fuel Models 8 and 9). With fire exclusion, these communities have been allowed to accumulate high fuel loadings (fuel model 10). These communities were historically maintained with frequent low to moderate intensity fires. To continue to maintain these communities, it is important that they be treated i.e., underburned. Areas modeled as Fuel Model 10 tend to correspond with areas of late-successional habitat. Many areas of late-successional habitat have accumulated high fuel loadings and are modeled as having high fire behavior potential. These factors impact the health of stands by increasing stand densities, inner tree competition, and reducing the ability for early and mid-seral trees to grow larger, and the ability of larger trees to survive large-scale fire disturbance.

Plantations on good sites are valuable investments. Protecting these sites is important for wildlife values, visual quality enhancement, and future harvest opportunities. These stands should be evaluated for treatment needs. Wildfires respond to breaks in topography and vegetation (natural and/or constructed fuelbreaks). Some natural fuelbreaks exist in the analysis area, as well as some fuelbreaks which are remnants from wildfire suppression and fuels treatment activities.

Some very important wildlife habitats are found in the analysis area, along with private residences and other Forest investments. Fire behavior potential modeling has identified 61% of the analysis area as having high to moderate fire behavior potential (hazard). Based on the number of fire starts that occur in the analysis area, risk is determined to be moderate. In order to enhance and protect these important features, the development of a coordinated system of natural and managed shaded fuelbreaks was identified in the Klamath National Forest, *Forest-Wide LSR Assessment* (1999) as a first step.

As part of the development of the Access and Travel Analysis portion of this analysis (**Appendix E**), some roads that could be utilized for developing these shaded fuelbreaks have been identified, as well as other roads and ridges that are important for fuels treatment and fire suppression efforts. Once developed, this system can be used for fire suppression and for implementing fuels treatment activities that use prescribed fire, along with other types of fuels removal, to protect important features now found in the area and to develop desired conditions. See **Figure 6-2** Fire Opportunities, contained in the Map Packet located at the end of this document.

**Key Question 3a- What is the desired role of fire in the analysis area and how can fire be incorporated as an ecological process?**

**Key Question 3b- What are some expected future trends that will effect fuels management within the analysis area (i.e., survey and manage, workforce, road closures, air quality, budget)?**

One of the highlights from the *Forest Plan* is "an aggressive Fuel Management Program treating about 27,000 acres per year will reduce fuels with the intent that future fires will be less intense and less destructive. A primary objective of the Fuel Management Program is to allow fire to play its regulating role in the ecosystem. Prescribed fire and Prescribed Natural Fire (PNF) will be emphasized. PNF will be used in Wilderness, the larger LSRs and in Backcountry." (*Forest Plan* Pages 3-18, 3-19) Through this analysis, we have defined the desired role of fire as a natural ecological process that has the ability to: control vegetation density and fuel loadings; maintain vegetation communities in conditions that are more resistant and resilient to the effects of high intensity disturbances; reduce the probability of a large catastrophic fire occurrence; promote vegetation species diversity; enhance and maintain disturbance-adapted plant species; enhance and maintain important wildlife habitats; and protect private residences and important investments. In response to *Forest Plan* goals and objectives, the Forest can implement fuels treatment projects within the analysis area. The 27,000 acre Forest-Wide target equates to approximately 2,300 acres of prescribed fire per year in this analysis area. In addition to this, there is also an opportunity to allow natural ignitions to burn in Wilderness, LSR, and Backcountry.

This analysis has identified fire as a tool which if utilized can develop and maintain desired conditions. High and moderate severity wildfire is a threat to current and desired conditions. Managed fire in this analysis area by itself and/or in conjunction with other vegetation management can be used to develop and maintain desired conditions. Large-scale catastrophic wildfire, on the other hand, will setback the development of these same desired conditions.

Managed fire will cause some small-scale detrimental effects, but these effects will be short lived and the long-term benefits will far outweigh these short-term small-scale effects.

Following is a quote from the Thompson Ridge Fire History Study (Taylor and Skinner 1996) regarding late-successional habitat: "The cumulative effect of fire severity variation across slopes suggests that forests with late-successional characteristics (e.g., multi-layered canopy, high density of large diameter trees, snags, coarse woody debris) were more commonly found at lower slope positions as well as on north and east facing slopes. Upper slope positions as well as intermediate positions on south and west facing slopes were more likely to display a pattern of scattered, remnant, older trees and patches, exhibiting some late-successional characteristics within a coarser-grained pattern largely of younger stands. Managers designing activities to reduce the likelihood of large, severe fires (e.g., prescribed fires, thinning, fuelbreaks) while still providing for long-term, late-successional conditions in the LSRs may find it advantageous to pattern the severity and extent of treatments after these historical patterns of severity." Based on the results of the Taylor and Skinner study a map of fire return intervals has been developed. See **Figure 6-3** Fire Return Intervals.

Survey and Manage requirements are currently increasing costs and causing severe delays in implementing projects, and also with the discovery of any species, reducing the size of project areas. The Forest needs to challenge the scientific community that single species management approaches are not appropriate outside of laboratory settings. The Forest is managing one of the most diverse areas for flora and fauna in the world. This diversity developed with the influence of frequent fire disturbance To attempt to remove this disturbance threatens the existence of these disturbance-dependant species.

Fire suppression and fuels organizations are at a historic low, and the Forest's budget is expected to decline further. An area likely to be reduced as budgets decline will be fire prevention personnel. Reductions in fire prevention causes less compliance with fire prevention regulations, and a probable increase in human-caused fires, loss of private residences, and greater threats to human life by fire. Detection (the number of lookouts) will likely be cut with budget declines, allowing fires to burn longer and become larger prior to suppression action. Mortality and heavy fuels buildup, combined with fewer prevention personnel, lookouts, and suppression forces, will inevitably allow more fires to escape initial attack. These fires will destroy wildlife habitat, commodities, and contribute to erosion and increased sedimentation to stream channels on both public and private lands.

To meet air quality objectives, prescriptions for fuels treatment (underburning) include weather parameters that are favorable for smoke to quickly disperse from residential areas and viewsheds in the analysis area. This is one advantage of using prescribed fire over wildfire to meet desired conditions. Managers should try to avoid burning under a stable air mass (inversion). Temperature inversions are common in the analysis area during late evening and morning hours. Burns should be timed so that the majority of smoke generated is transported out of the area during afternoon hours. Prescriptions can be developed that will avoid extended periods of smoldering. Large-scale wildfire events will not meet air quality guidelines. Temperature inversions and long-term smoldering will work together under a stable air mass to hold smoke and particulates in the analysis area for long periods. Depending on size and timing of the fire event, this could last from several days to months.

**Key Question 4- What are desired conditions based on vegetation communities, site classes, and land allocations (including late-successional habitats and connectivity)?**

DESIRED CONDITIONS

The use of fire will likely be an integral component of management plans that successfully provide long-term, late-successional conditions in the newly established LSRs of the Klamath Mountains (Taylor and Skinner 1996).

**--**Stand conditions that don't promote high severity fires.

**--**Disturbance-adapted mixed conifer communities are maintained/increased.

**--**Fire-adapted plant species are maintained in the analysis area.

**--**Area is more resilient to catastrophic fire and drought disturbances.

**--**Fire plays a natural role allowing for development and maintenance of late-mature/old-growth stands.

**--**Management activities consider and are consistent with overall fire management strategies.

**--**A diversity of seral stages similar to pre-settlement conditions are maintained across the analysis area. This mosaic of moderate and small patches will provide habitats for the variety of wildlife that use the analysis area.

**--**Poor sites, which are mostly hot and dry and for the long-term can only support shrubs, are managed for wildlife values.  These areas are important deer and elk winter and spring range.

**--**In LSRs and RRs where vegetation communities are mixed conifer and/or true fir, are managed for the maintenance of 50-75% of these stands with large tree character (mid/mature, old-growth).  This is in line with natural conditions of the vegetation types in the analysis area.

**--**Conifer plantations growing on good sites in this watershed are protected from catastrophic fires. These same plantations are managed to promote tree growth and make them more resilient to fire. This will provide future mid/late-seral habitat and also commercial timber.

**--**A viable system of shaded fuel breaks (including ridge-top roads) is established and maintained throughout the analysis area.  This system can be utilized for both fire suppression and fuels treatment activities.

--Reduce the severity/change the fuels profile to be conducive with historic vegetative patterns.  Increase stability and diversity.

--Loss of mature forest cover to wildfire would be unusual.

--Plantations are put into a fire-stable condition.

--Human residents, their homes, and property are safe from the effects of wildfire.

--A road system that provides access for fire suppression and prescribed fire.  These roads are utilized as control features for prescribed fire.  During this analysis the terrestrial subgroup identified roads that were important for fire suppression and fuels treatment access and those that could be utilized as fuel breaks.  **Table 5-11** Terrestrial Road Rating Criteria, describes the criteria used by this subgroup for rating roads within the analysis area.

**Table 5-11 Terrestrial Road Rating Criteria**

| ACCESS NEEDS: | Ratings: H, M or L * | | |
|---|---|---|---|
| Criteria | H | M | L |
| **Fire suppression access** | All roads under private, state or county jurisdiction and all ML 3, 4 and 5 roads and ML 2 roads on ridges or with main access | ML 1 and 2 roads that provide primary access or better access than alternate routes. | ML 1 and 2 roads that are not needed for primary access. |
| **Prescribed fire access** | All Forest Service ML 3, 4 and 5 roads and ML 2 roads on ridges or with main access | ML 1 and 2 roads that provide access for prescribed fire mgmt. and/or are strategically located for potential fuel-breaks. | ML 1 and 2 roads that are not needed for prescribed fire access or use. |

* **H** = High need for open and maintained road, **M**= Moderate need for open and maintained road, **L**= Low need for open and maintained road
**ML=road maintenance level.**

## LATE-SUCCESSIONAL HABITAT

**Key Question 1a- How has the amount, distribution, and condition of late-successional habitat changed across the watershed?**

**Key Question 1b- What have been the agents of change (timber harvest, roads, 1987 fires, fire suppression)?**

Late-successional forest habitats are naturally diverse within the project area.  Historically, the distribution and condition of forest habitats were shaped by disturbance processes, such as weather events and/or fire.  The natural fire regime had direct and indirect effects on species composition and species abundance.  Prior to the influence of European settlers, it is expected that the landscape was patchy, containing a variety of different age and size classes in the forested communities. Large-scale fires were infrequent, while frequent low-to-moderate fires broke up the larger patches of forest and maintained fuels at a sustainable level.  Dense, late-successional forest habitats were found along drainage bottoms, on the lower portions of north and east aspects, and in higher elevation true fir types (refer to Fire discussion).  More open stands of late-successional forest (consisting of pine or pine/mixed conifer) occurred on south and west aspects. According to early accounts, south and west aspects in the vicinity of Seiad Valley were covered by scattered conifers and hardwoods with chaparral, grasses, and forbs in the understory.

During the late 1800s and early 1900s, frequent burning by local residents had a profound effect on the local fire regime by maintaining early successional vegetation in openings, maintaining open understories, excluding fire-intolerant species (such as white fir), and maintaining lower levels of ground fuels. Fire exclusion became policy for National Forests shortly after the turn of the century, but didn't have much effect until the 1940s when suppression efforts were mechanized after the war. Effective fire suppression since that time has changed the distribution and structure of late-successional forest by allowing stand densities to increase, allowing the understory to fill in with shade tolerant conifer and hardwood reproduction, increasing the buildup of fuels, promoting development of ladder fuels, and promoting development of closed canopies that can sustain crown fire (refer to Fire discussion). With this change in stand structure, fire suppression has also allowed for the development of more dense forested stands on south and west aspects, and higher on slopes, where historically stands were much more open.

Changes to forested stands within the analysis area over the last century have lead to large landscape-level fires burning with varying degrees of intensity. These wildfires have reduced and fragmented late-successional forest in the landscape. Large fires occurred in 1951, 1966, and 1987, and have burned almost 50% of the analysis area.

Forest management activities have also influenced late-successional forest habitats in the analysis area. Timber harvest and road building have accounted for most of the management that has impacted vegetation and influenced the amount of late-successional habitat currently found today. Roughly 22,000 acres (15% of the analysis area) of forested land have been cleared through timber harvest since the 1930s. In addition, there are approximately 530 miles of roads within the analysis area. Clearing through timber harvest and road building has reduced the amount of late-successional habitat and fragmented larger blocks of habitat.

Areas that have been harvested in the matrix will be managed for maximum tree growth and yield, and future commodity outputs. Within LSRs, areas that have been harvested will be managed for development of late-successional forest habitat that will persist over time. It is not expected that LSRs will consist of homogeneous stands of late-successional forest, rather it is expected that the landscape will contain a mosaic of seral stages and structural components as described in the following **Key Question 2 - Desired Conditions**.

Many of the features that make late-successional habitat suitable for late-successional forest-related species also make it susceptible to catastrophic loss from wildfire or pest epidemic. Large downed wood, dense canopies, and understory vegetation all contribute to habitat suitability and to high fire behavior. The higher stand densities on south and west slopes, resulting from fire suppression, leave them susceptible to mortality from inter-tree competition, insect epidemic, and loss to fire. Treatments to reduce fire risk, such as reducing continuity of canopies, removing ladder fuels, and reducing ground fuels, may reduce the quality of habitat for late-successional forest-related species. Therefore, within LSRs it is important to seek balance in an approach that reduces risk of fire while at the same time protects large areas of fire-prone late-successional forest.

Currently, there are 31,167 acres of dense late-successional forest habitat within the analysis area (28% of the capable land). It is estimated that dense late-successional forest occupied roughly 51,000 acres of the area in the early part of this century (45% of capable land), with the remainder of the capable land in a variety of seral stages or open conifer stands. Using these acreage figures, late-successional forest habitat has been reduced by roughly 40% since the 1930s (18% of total capable land). The overall distribution of late-successional forest is similar to historic patterns; however, larger stands of forest have been fragmented by wildfire, timber harvest, fire salvage, and roads. Average patch size has decreased, and there has been a loss of large diameter trees in the mixed conifer zone. Within the Seiad and Johnny O'Neil LSRs, late-successional forest has been reduced by 28% and 64%, respectively, within this analysis area.

**Key Question 2- What is the desired condition of late-successional habitat within LSRs and across the watershed?**

The desired condition for late-successional forest habitat focuses on reserves (LSRs) that have been set aside for the purpose of maintaining and enhancing late-successional forest habitat and other land allocations that are expected to provide dispersal for late-successional forest related species across the landscape (100-acre LSRs, RRs, and special habitat areas). The desired conditions described here have been adapted from the *Forest-Wide LSR Assessment* (USDA 1999).

The desired condition within reserves and special habitat areas is to provide late-successional forest in which structure and composition is consistent with site conditions and ecological processes. Important structural attributes include live old-growth trees, standing dead trees, fallen trees or logs on the forest floor, and logs in streams. Additional important elements typically include multiple canopy layers, smaller understory trees, canopy gaps, and patchy understory. These conditions typically begin to appear when forest stands are between 80 and 140 years in age, depending on site conditions, species composition, and site history.

A generalized desire for LSRs is to promote and maintain late-successional conditions in the maximum amounts sustainable through time. Processes that historically have created late-successional ecosystems include: tree growth and maturation; death and decay of large trees; low to moderate intensity disturbances (such as fire, wind, insects and disease) that create canopy openings and gaps in various strata of vegetation; establishment of trees beneath the maturing overstory trees either in gaps or under the canopy; and closing of canopy gaps by lateral growth or growth of understory trees. These processes result in forests moving through different stages of late-successional conditions that may span several hundred years.

It is desirable to have variability in late-successional vegetative characteristics across the analysis area. Multistoried conditions will be scattered throughout the landscape, but will be more prevalent on the lower half of the more mesic north and east aspects, and in riparian areas. South and west facing slopes will have fewer multilayered conditions and potentially different species composition. Canopy closure will vary across the landscape, ranging from less than 50% on south and west slopes to greater than 50% on north and east slopes and riparian areas. Upper portions of all aspects, except in the true fir type, will generally have lower densities as compared to lower on the slopes. Snag and down log accumulations will be higher on the lower portions of slopes and decrease as one moves up slope.

It is anticipated that plantations are capable of supporting mature and late-successional forest, and therefore, the desired condition is to manage them as such. Residual snags, hardwoods, and down logs from the previous stand will be desired components to maintain within these plantations. Hardwoods should be carried through the life of the stand. In the interim, the stands should be healthy and fast growing with stocking levels and fuel accumulations that reduce the likelihood of loss to catastrophic fire.

The introduction of prescribed fire into late-successional forest stands will help encourage the processes and attributes that define late-successional ecosystems. It is expected and even desirable to have low to moderate intensity fires burn in LSRs and RRs. Low intensity fires will reduce fine fuels and ladder fuels, create a seedbed for a diversity of herbaceous plants, and create a patchy understory. Moderate intensity fires are desirable if they create small openings in the canopy of one to five acres in size. This allows for regeneration of forest stands and creates snag patches and concentrations of down woody debris which are important habitats for some late-successional forest-related species. Burn openings are most desirable if they occupy only a small percentage (5-10%) of the stands providing habitat. In addition, the introduction of a fire cycle more similar to that which occurred in pre-suppression times will reduce the risk of catastrophic fires. Large, stand-replacing, high intensity fires are not desirable within reserves or special habitat areas. Throughout the area, fuel conditions should generally range from low to moderate fire behavior. Variability of fuel conditions across the landscape is desired, with some high concentrations of fuel (CWD) intermixed with areas of low fuel accumulations. It is reasonable to expect that heavier scattered pockets of fuels (CWD) will occur on relatively cool, moist sites, such as those found on north and east aspects, or low on the slope adjacent to perennial riparian areas. South and west aspects and upper slope positions, which are typically drier and harsher, will generally contain lighter fuel loadings with fewer scattered pockets of heavy fuel. Site capability will also influence the amount of fuel or CWD.

It is desirable to continue to have insect and disease populations at endemic levels within late-successional forest habitats. Insects and diseases create gaps and are important for creating many of the decadence attributes desired in old-growth stands. It is important that they don't reach levels that will create situations that will prevent the long-term sustainability of late-successional habitats.

In addition to the general desired conditions described above, the following are aspect and site-based desired conditions that have been identified in the *Late-Successional Reserve Assessment* (*LSRA*) (USDA 1999). They are intended to be employed once it has been determined that a treatment (thinning, prescribed fire, etc.) is warranted within one of the two LSRs in the analysis area (refer to **Step 6** Management Recommendations and **Figure 6-4** Late-Successional Reserve Opportunities). The descriptions are to be used to guide the development of the prescriptions at the project-level, with development and maintenance of late-successional habitat as the ultimate objective of the treatment. For more specific, project-level information on desired basal area in stands, desired number of snags, amount of downed wood, and number of trees, refer to the *LSRA* Chapter 3 (USDA 1999).

### Mixed Conifer on North and East Facing Slopes

Late-successional forest conditions will be structurally diverse. It is desirable to have dense stands with total canopy closure greater than 60% and tree species best suited to the site conditions. Due to the nature of the steep slopes and associated fire behavior, canopy closure should be less on the upper 1/3 of the slopes. Canopy closure of 40 to 60% would be more common on the upper slopes. This condition should not be uniform across the landscape as variability is important. Patches of denser stands should still be intermixed with the more open nature on the upper slopes. Decadence should be present or even obvious in the stand; snags and coarse woody material would be common, although in varying concentrations throughout the stand. Deformed, broken and diseased trees would also be common enough to provide nesting and roosting opportunities for wildlife. There will be gaps created by natural mortality where early seral vegetation is present. Due to the nature of the aspects, fuel accumulations may be higher than those found on the south and west slopes. Pockets of higher fuel concentrations may be more frequent. Conifer species should contain a mixture of Douglas-fir, white fir, ponderosa pine, sugar pine, and incense cedar. Dominant hardwoods should be black oak, madrone, and maple.

**Mixed Conifer on South and West Facing Slopes**

Late seral conditions will be structurally diverse. These stands will generally be open grown with canopy closure ranging from 40 to 60%. Decadence should be present or even obvious in the stand; snags and coarse woody material would be common, although in varying concentrations throughout the stand. Deformed, broken and diseased trees would also be common enough to provide nesting and roosting opportunities for wildlife. There will be gaps created by natural mortality where early seral vegetation is present. Snags and down logs will occur scattered and/or concentrated in clumps. Pockets of high fuel concentrations will be less frequent than those found on north and east aspects. Pockets of high fuel concentrations should be located lower on the slopes were it is cooler and more moist. These sites will contain vegetation that is dominated by conifers. Hardwoods will be present in the stands. Due to the fire behavior on steep slopes, the upper 1/3 in some locations may have canopy closure as low as 25%. The stands will be single layered with some hardwoods present in the understory. Diversity of age patches will be scattered over the landscape on these aspects, but a majority of the stands will contain late mature to old-growth characteristics. Ponderosa pine will be the dominant conifer species, but will be intermixed with Douglas-fir, sugar pine, and incense cedar. Hardwood species will consist of black oak, madrone, and canyon live oak.

**True Fir Sites**, **Any Aspect**

At elevations above approximately 5,500 feet, the vegetation changes from a mixed conifer to true fir. Species will be dominated by white fir, but red fir will be found as a secondary species. Stands will be dense with crown closures greater than 60% on north and east aspects, with less dense stands on south or west aspects. Stands will generally be single layered stands with very little understory present. Decadence will be present in most of the stands. Snags and down logs will occur scattered and/or concentrated in clumps.

**Sites Not Capable of Growing Dense Mixed Conifer Stands**

These stands will be open, with 10-50% total crown closure. Many of the stands will be dominated by canyon live oak, montane chaparral, black oak, and/or ponderosa pine, with scattered madrone and conifers. Overstory conifers will be Douglas-fir and ponderosa pine. Conifer density will range from one to ten per acre. Snag levels will generally be between one to two per acre and down woody debris averaging less than five per acre.

**Key Question 3- How will connectivity of late-successional habitat be maintained within and between LSRs?**

Connectivity between LSRs, and between LSRs and wilderness, in the analysis area is considered good for two reasons. First, the distance between the two LSRs and between the Seiad LSR and wilderness is less than six miles, giving it a "very good" rating in the Forest-Wide *LSRA*. Second, 5th field watersheds within the analysis area have more than 50% of capable ground in dispersal habitat (average diameter at breast height of 11 inches and average crown closure greater than 40%), putting them below the threshold for formal consultation on habitat removing projects (USDA 1999) (refer to **Table 3-35**). Given these two methods of rating, connectivity between reserves in the area is determined to be good.

Maintenance and/or improvement of existing connectivity between large reserves will be achieved through project planning that maintains more than 50% dispersal habitat in all 5th field watersheds in the analysis area, through road decommissioning in areas with high road density, through maintenance of RRs and 100-acre LSRs, and through management of plantations and burned areas to promote growth of mature trees.

Connectivity of late-successional forest within the Seiad LSR is well-distributed, but patchy. The total amount of habitat is lower than what is desired and management should focus on increasing the amount of late-successional forest on north and east slopes in the LSR, especially Grider Ridge, Walker Creek, and the lower portion of Thompson Creek.

Connectivity is good within the Johnny O'Neil LSR outside of the analysis area. Late-successional forest in the LSR within the Seiad Creek drainage (within the analysis area) has been heavily impacted by fire and salvage logging. Management in this portion of the LSR should focus on increasing the amount of late-successional forest through thinning and fuels reduction.

In order to maintain connectivity within and between large reserves, it is important to consider the potential for catastrophic loss of habitat through fire or disease. High stand densities and large amounts of ground and ladder fuels indicative of fire exclusion increase the risk of wildfire and insect epidemic. Thinning of dense stands and utilizing prescribed fire to reduce fuels will aid in maintaining existing habitat connections across the landscape.

**Riparian Reserves**

Approximately 48,000 acres of RRs occur within the analysis area, 27,000 of which are within LSRs. Riparian Reserves that have been identified in this analysis as important for connectivity between LSRs (see **Step 3**) include Canyon Creek, Portuguese Creek, Kuntz Creek, Mill Creek, Jim Creek, Mack's Creek, Tom Martin Creek, Horse Creek, Fryingpan Creek, Ottley Gulch, and Wood Creek.

Management activities and disturbance events reduced late-successional habitat within riparian corridors prior to the designation of RRs. Approximately 2,600 acres of plantations exist within RRs. Thinning and fuels reduction in those stands would accelerate development of late-successional forest habitat for movement and dispersal of late-successional forest related species.

Habitat condition trends within RRs are toward later successional stages in the upland forested areas and a variety of stages in riparian/wetland areas dependent on hydrologic processes and events.

Desired conditions for RRs are described in the *Forest Plan*. Generally, for the analysis area, desired conditions include a diversity of vegetative structure with later structural stages of vegetation in the conifer zone and a mix of seral stages in the riparian/wetlands.

**Key Question 4a- How will the effects of high road density on late-successional habitats be minimized?**

**Key Question 4b- What are the criteria used to assess roads for the *Access and Travel Analysis* included in Appendix E of this document?**

Road construction in the analysis area was generally done to access timber harvest units or mining claims. Road building opened up areas to higher levels of human use through recreation, hunting, or collection of forest products. Human access has effects on wildlife by providing a source of disturbance, which can reduce the effectiveness of the habitat. It also provides access to once remote areas, which can cause an increase in the illegal harvest of wildlife. Roads also permanently alter habitat within the roadway itself, they divide larger blocks of forest into smaller fragments which impacts species of low mobility by splitting habitat and making portions of the habitat inaccessible.

Impacts to late-successional habitat and disturbance to wildlife populations can be minimized by closing roads, thereby eliminating disturbance from motorized vehicles and reducing access, or by closing/decommissioning roads and allowing the roadbed to be recolonized by the local vegetation or replanted.

Land allocations, such as LSRs and RRs, have management goals/objectives where commodities and logging are not the primary land use. The reserves are established to protect, enhance and restore habitats and ecosystems. Portions of the current road system are not consistent with these land allocations and have been reviewed as part of this ecosystem analysis. Refer to **Appendix E** - Access and Travel Analysis, which provides a starting point for developing road improvement, maintenance, and decommissioning opportunities.

The road network within the analysis area was assessed for effects on late-successional forest habitat and deer/elk range using road density criteria as displayed below in **Table 5-12**. These criteria were used to rate each road within the analysis area, combined with criteria from other resources including human use, as described in **Appendix E**. Areas rated as "high resource impacts associated with roads" (see below) were highest priority for road closure or decommissioning in order to reduce disturbance and/or reduce habitat fragmentation in those areas most heavily impacted.

**Table 5-12 Road Rating Criteria for the Thompson/Seiad/Grider Analysis Area**

| RESOURCE IMPACTS: | Ratings: H, M or L | | |
|---|---|---|---|
| Criteria | (H) - high resource impacts associated with roads* | (M) - moderate resource impacts associated with roads* | (L) - low or negligible resource impacts from roads* |
| **Reduce road density in LSRs** | Areas within LSRs with >4 miles per sq. mile of roads | Areas within LSRs with 1-4 miles per sq. mile of roads | Areas within LSRs with < 1 mile per sq. mile of roads |

| RESOURCE IMPACTS: | Ratings: H, M or L | | |
|---|---|---|---|
| **Criteria** | **(H) - high resource impacts associated with roads*** | **(M) - moderate resource impacts associated with roads*** | **(L) - low or negligible resource impacts from roads*** |
| **Reduce road density in deer/elk range** | Areas within deer/elk range with >4 miles per sq. mile of roads | Areas within deer/elk range with 1-4 miles per sq. mile of roads | Areas within deer/elk range with < 1 mile per sq. mile of roads |
| **Site Specific Criteria:** 1) Roads that access plantations, that have been identified for closure within LSRs, should be considered for gating to allow access for thinning of plantations, decommissioning should be planned for the future. 2) Roads that intersect blocks of late-successional habitat within LSRs should be considered for decommissioning in order to reduce fragmentation of late-successional forest habitats. 3) Maintenance level 1 and 2 roads within 1/2 mile of bald eagle or peregrine nests should be considered for closure. *Road density ratings are based on total road density for system roads, including roads with seasonal or year-round closures. Therefore, open-road related disturbance is less than is implied by the above density ratings. | | | |

DESIRED CONDITIONS

--Road densities are reduced to an average of less than two miles per square mile within LSRs.
--Road densities in the matrix are reduced to between one and four miles per square mile.

--Roads in the vicinity of known nest sites or important habitat areas are closed.

--Fragmentation of late-successional habitat is reduced by decommissioning of roads in areas that exceed four miles per square mile.

## TERRESTRIAL WILDLIFE

**Key Question 1- For these wildlife species, what has changed from historic to present and what have been the agents of change (fire suppression, timber harvest, cattle grazing, private land)?**

**Key Question 2- What are the expected future trends for these wildlife species?**

**Key Question 3- What are the desired conditions for these wildlife species and their habitats?**

**Key Question 4- Are there any management implications with regards to wildlife populations and habitats?**

**Key Question 5- What are the effects of exotic species on the ecosystems within the watershed?**

**Key Question 6 - How will the effects of high road density on wildlife species be minimized?**

Key Questions for wildlife have been combined and will be answered together for each species.

### Bald Eagle

Suitable habitat along the Klamath River and its tributaries has remained fairly constant over time, with some reduction in nesting and roosting habitat along the river since historic times. Foraging opportunities along the Klamath River and the larger creeks have decreased with lower numbers of salmon. Without specific data on historic numbers of bald eagles, it is assumed that there were more nesting bald eagles along the Klamath River prior to European settlement than there are now. Currently eagle populations are on the increase from lowest population levels in the 1970s due to their protection under the ESA and the restrictions on use of pesticides such as DDT (Dichloro-diphenyl-trichlorethane). The carrying capacity of the habitat within the analysis area is unknown. It is expected that the area cannot support more than two, or possibly three nesting territories due to limited low gradient reaches of the river characteristic of nesting/foraging areas.

TRENDS

--It is expected that there will be a healthier and larger bald eagle population on the Forest, but with only two or three nest territories within the analysis area.

--Protection of late-successional forest within RRs and LSRs will ensure adequate nest and roost sites.

--Recovery efforts for anadromous fish are expected to increase foraging opportunities along the Klamath River.

DESIRED CONDITIONS

--There are late-successional forest conditions, with large trees/snags for nesting and roosting, along the Klamath River, in RRs and within the Caroline Creek Management Area, with emphasis on large pines and low to moderate fuel loading.

--Nest sites have limited or no road access with minimal disturbance from humans.

--There are only low levels of disturbance from recreationists around known nest sites.

### Northern Spotted Owl

The change in frequency and severity of fires through effective fire suppression over the past several decades has had an effect on the structure of suitable spotted owl habitat. Mixed conifer forest in the analysis area has become more dense with multi-layered stands, larger numbers of shade-tolerant species and accumulations of ground fuels. Understory trees and shrubs have encroached into normally more open stands (e.g., south and west aspects) due to the lack of ground fires. This change to forest structure is creating a condition that will most likely lead to large stand-replacing fires similar to those already experienced during 1987. The continuous accumulation of small surface fuels, vertical fuels, and large woody material have created a situation in which crown fires will occur with greater frequency and fires will be larger and far more destructive of suitable habitat. In order to reverse the trend, fire would have to be reintroduced into the landscape. Fuels reduction efforts would have to be focused on areas where fuels were naturally lower, such as south and west aspects and higher on slopes.

It appears that the amount and distribution of conifer vegetation has changed in this analysis area as fire exclusion has allowed conifer growth or encroachment into other plant communities. It also appears that the amount of suitable spotted owl habitat (dense late-successional forest) has decreased as a result of timber harvest, fire salvage, and road building. Currently, within the analysis area, there are 64,676 acres of suitable nesting/roosting/foraging spotted owl habitat; this is roughly a 24% reduction in habitat since the 1930s based on historic logging. Of the habitat that has been affected by timber harvest and road building in the analysis area, approximately 50% is located within large LSRs. Current management direction in LSRs calls for the protection and enhancement of late-successional forest within LSRs. Given this direction, the long-term objective in this analysis area is to develop previously logged and roaded areas within LSRs into late-successional habitat suitable for northern spotted owls. There are approximately 11,000 acres of previously harvested land that can be developed into suitable habitat over the long-term.

Surveys for spotted owls within the analysis area are not "current" as defined by the most recent protocol, but most surveys occurred as recently as the 1980s and early 1990s. The population, based on the surveys, is approximately 26 activity centers, but it is estimated (USDA 1999) that there may be up to four additional activity centers in the analysis area if additional surveys are conducted; additional activity centers are predicted in upper Grider Creek, Fort Goff Creek, Portuguese Creek, and Cedar Creek, all within the Seiad LSR. Natural vegetation patterns, disturbances, fire exclusion, recent timber harvest, and road building have contributed to the current distribution of owls.

TRENDS

--The amount of suitable spotted owl habitat will increase over time, provided there are no large-scale wildfires, as harvested areas and areas affected by fire recover within the LSRs.

--Dispersal and foraging habitat will increase as cut-over areas within the forest Matrix mature.

--Successful fire suppression has created conditions within suitable habitat that have increased the potential for large-scale disturbance events, such as wildfire or disease epidemics; large-scale disturbance would increase the fragmentation of suitable habitat.

DESIRED CONDITION

--Northern spotted owl populations are at or near full potential in the planning area.

--Recovery of spotted owls is promoted or achieved through development and protection of suitable habitats.

--The amount of suitable habitat within LSRs is at the maximum amount sustainable through time.

--Dispersal habitat for owls is provided at 50% of capable ground in all 5th field watersheds, within 100-acre LSRs and within RRs.

**Marbled Murrelet**

Historically marbled murrelets have been documented nesting in dense stands of conifers near the coast. They have more recently (through an expanded survey effort) been documented nesting in old-growth forest further inland. Nesting farther from the coast exposes murrelets to more predators including peregrine falcons, crows, ravens, and great horned owls.

Within the analysis area, habitat for murrelets is described as similar to that of northern spotted owls, therefore, the discussion of habitat changes over time for spotted owls (above) applies for murrelets.

Limited surveys on the Forest have detected murrelets in the Indian Creek drainage (west of the Thompson Creek Watershed). No occupied behavior has been witnessed, and no other detections have occurred. It is not known if murrelets occur in the planning area. Additional surveys and research will more clearly define the eastern extent of the marbled murrelets range.

TRENDS

--The amount of late-successional habitat, potentially suitable for murrelets, will increase over time as harvested areas and areas affected by fire recover within the LSRs.

--Successful fire suppression has created conditions within suitable habitat that have increased the potential for large-scale disturbance events such as wildfire or disease epidemics, large-scale disturbance would increase the fragmentation of suitable habitat.

--With continued fire suppression, increased density in developing early and mid-successional stands may preclude the development of large limbs for nesting in conifer stands.

DESIRED CONDITION

--Marbled murrelet populations are at or near full potential.

--The eastern extent of the marbled murrelet range is well defined and suitable nesting habitat has been identified.

--Recovery of marbled murrelets is promoted or achieved through development and protection of suitable habitats.

--The amount of suitable habitat within LSRs is at the maximum amount sustainable through time.

**Goshawk**

This species has been documented in the analysis area. The majority of the known activity centers were located incidentally to spotted owls surveys. Goshawks utilize habitat that is similar to the northern spotted owl, including a variety of mature forest types. High canopy closure is desired. They commonly have more than one nest within their territories and use them on a rotating basis. Goshawks forage below the canopy on a variety of mammals and bird species.

Within the analysis area, habitat for goshawks is described as similar to that of northern spotted owls; therefore, the discussion of habitat changes over time for spotted owls (above) applies for goshawks. Goshawks, however, are known to use stands that are much more open than those used by spotted owls (e.g., ponderosa pine stands); therefore, changes in stand structure as a result of fire suppression may have more impact on the ability of goshawks to forage under the canopy. This change to forest structure has also created a condition that will most likely lead to large stand-replacing fires and subsequent large scale habitat loss.

TRENDS

--The amount of late-successional habitat will increase over time as harvested areas and areas affected by fire recover within the LSRs; however, dense stand conditions as a result of fire suppression may preclude the ability of goshawks to forage in dense stands.

--Habitat in the Matrix will increase as cut-over areas within the forest mature.

--Successful fire suppression had created conditions within suitable habitat that have increased the potential for large-scale disturbance events, such as wildfire or disease epidemics; large-scale disturbance would increase the fragmentation of suitable habitat.

DESIRED CONDITION

--Goshawk populations are at or near full potential in the planning area.

--The amount of late-successional habitat within LSRs is at the maximum amount sustainable through time, more open stands are maintained on south and west aspects through the use of prescribed fire.

--Late-successional and mid-successional forest habitats are provided at 50% of capable ground in all 5th field watersheds, within 100-acre LSRs, and within RRs.

**American Marten & Pacific Fisher**

Due to the lack of historical and current data regarding fisher and marten populations within this analysis area, it is difficult to assess population changes from the historical to the current time period. Information in the literature on changes in fisher and marten populations focus on declines that occurred due to over trapping and logging in the United States and Canada. There is little information on how trapping and habitat loss affected populations locally. There are no recent records of fisher or marten within the analysis area. It is expected that both species occur here. Logging, road building, and fire suppression have changed the structure of the forest, but suitable habitat is still abundant in the area. The description of habitat changes over time from **Key Question 1** (late-successional habitat) and the northern spotted owl discussion (above) apply to fisher and marten.

TRENDS

--Management for late-successional forest within LSRs, with emphasis on large coarse woody material and snags, will provide for fisher and marten for the long-term.

DESIRED CONDITION

--Marten and fisher populations are at or near full potential in the planning area.

--Late-successional habitat (denning/resting/foraging habitat) within LSRs is at the maximum amount sustainable through time.

--Foraging/dispersal habitat is provided in the matrix at 50% of capable ground in all 5th field watersheds, within 100-acre LSRs, and within RRs.

**Willow Flycatcher**

Habitat for willow flycatchers in the analysis area consists of willow thickets along the Klamath River and its tributaries, higher elevation streamside alders/willows, and high elevation meadows with willows and alders. Habitats in the analysis area have been impacted by floods, mining, clearing for settlement, and road building.

During mist netting efforts at Seiad Creek in the analysis area, 186 willow flycatchers were banded in the period 1994-1999. There is a pattern of seasonal fluctuations at the banding station throughout the breeding season with the peak numbers being caught in the early summer and again in the late summer. There is indication that breeding does take place in the area (possibly at higher elevations or in adjacent watersheds), but not necessarily at Seiad. One known willow flycatcher nest has been recorded at Seiad and has been confirmed for three years 1996-98. It is evident that the riparian habitat surrounding Seiad Valley provides important habitat for willow flycatchers during the early breeding and dispersal periods.

TRENDS

--Management and protection of RRs and implementation of the ACS objectives will improve willow and alder habitat conditions along the Klamath River and its tributaries. The amount and distribution of willow habitat will remain dynamic as influenced by hydrologic events (e.g. floods).

--Alder and willow patches will continue to expand in upper elevation meadows, which may provide nesting habitat.

--Protection of riparian habitats may lead to an increase in willow thickets and an increase in willow flycatcher nesting habitat. As a result, numbers of nesting birds may increase in the area.

DESIRED CONDITION

--Riparian reserves provide nesting habitat and dispersal corridors across the landscape.

--Breeding and dispersing willow flycatchers are at or near full population potential in the analysis area.

--Bird watching opportunities in the analysis area are identified and promoted.

--Important migratory and dispersal routes along the Klamath River are developed and maintained through cooperative management efforts with private landowners.

**Red Tree Vole**

Very little is known about red tree voles in the analysis area. These species will be better understood and protected as more information about populations, habitat occurrence, and distribution are found through surveys and research.

TRENDS

--It is unknown if red tree voles occur in the mixed conifer forest found in the analysis area, therefore trends for this species cannot be predicted. If red tree voles occur in this landscape, it is expected that habitat will increase over time as harvested areas and areas affected by fire recover.

DESIRED CONDITION
(within the range of the species)

--The range of red tree voles in California is clearly defined through surveys and research.

--Viable populations of red tree voles in suitable habitat with adequate corridors of habitat in the Matrix for dispersal between LSRs (it is yet to be determined whether this applies in the analysis area).

**Bats**

Very little is known about bats in the analysis area. Potential roost and foraging sites, such as caves, buildings, mine shafts, and late-successional forest occur within the analysis area. Caves, abandoned buildings, and abandoned mine shafts will be surveyed or protected as outlined in the *Forest Plan*. These species will be better understood and protected as more information about populations, habitat occurrence and distribution within the Thompson/Seiad/Grider Analysis Area are found through surveys and research.

TRENDS

--Decadence within late-successional forest habitats will increase with continued fire suppression; snags, dying trees and hollow logs will provide additional habitat for roosting.

--The amount of late-successional forest will increase as plantations and burned areas develop.

--Caves and abandoned mine shafts will remain constant, bat habitat will be protected as per *Forest Plan* S&Gs.

--Foraging habitat provided by riparian habitat may increase as RR guidelines and ACS objectives are implemented. Habitat in riparian areas is dynamic and driven by hydrologic events.

DESIRED CONDITION

--Undisturbed roost sites, such as caves, abandoned mine shafts, and abandoned buildings, occur within the landscape.

--Forest structure in the vicinity of roost sites is maintained to provide foraging habitat and to limit the temperature fluctuations and intensity of sunlight penetrating caves and mines.

--Caves and abandoned mines known to be occupied by bats (through surveys), but that pose a hazard to the public, are closed using devices which do not preclude use by bat species (e.g., bat gates).

--Late-successional forest habitat is abundant and sustainable in the analysis area. Forested habitats provide adequate numbers of snags, dying trees, and hollow logs for roosting of bat species.

**Del Norte and Siskiyou Mountains Salamanders**

Recent surveys for Del Norte and Siskiyou Mountains salamanders have more clearly defined the range of both species on the Forest and in this analysis area. Surveys have also indicated that these salamanders occupy a wider variety of habitats than previously suspected.

Del Norte and Siskiyou Mountains salamanders are associated with deep, rocky substrates; they are dependent on cool, moist environments. The presence of dense canopy closure may help to maintain optimum surface conditions. During periods of inhospitable environmental conditions, the salamanders retreat below the forest surface, utilizing intersticial spaces provided by deep layers of rock and talus. Management activities in the analysis area that may have affected suitable habitats for salamanders include mining, road building, rock quarry development, and timber harvest. These types of activities have affected habitats by directly disturbing rock talus or by altering the microclimate surrounding the talus substrate.

The effects of fire on plethodon salamanders is not well understood. It is expected that these salamanders are adapted to the historical fire regime of frequent low-intensity fires. Fires of this nature usually occurred during late summer and fall when it is expected that salamanders were below the surface. Fire suppression over the past several decades has probably had both positive and negative effects; accumulations of fuels, downed logs and dense canopies have increased habitat over the landscape; however, large catastrophic fires have removed habitat elements over large areas and may have eliminated isolated populations of salamanders.

TRENDS

--Populations of plethodon salamanders will continue to be identified in the analysis area through implementation of available survey protocols.

--Management and protection of known sites will assist in maintaining the viability of known and newly discovered populations.

--Knowledge of these species gained through survey and research will aid in developing management recommendations consistent with Forest management.

--Fire suppression, development of plantations, and development of previously burned areas will result in an increase of vegetation over existing rock talus, thereby creating a favorable microclimate for salamanders. Populations may increase as habitats become favorable.

--Catastrophic fire could radically change the microclimate in localized areas, causing short-term losses of isolated populations.

DESIRED CONDITION

--Populations within the landscape contribute to the viability of both species.

--Talus habitats are protected within the landscape, especially the older, more stable talus slopes where large, deep cobble and rock provide the best habitat.

--Forest structure associated with talus habitat is maintained to provide food sources and protection of sites from high temperatures and low humidities associated with increased exposure.

--Rock and gravel quarries for road building are developed to minimize negative effects to isolated populations of plethodon salamanders; this is done by locating quarries in areas with the least desirable characteristics (e.g., unstable areas in sedimentary rock with large amounts of fine material that may not provide habitat).

**Mollusks**

Very little is known about mollusks in the analysis area. These species will be better understood and protected as more information about populations, habitat occurrence, and distribution within the Thompson/Seiad/Grider Analysis Area are found through surveys and research.
TRENDS

--Populations of mollusks will be located in the analysis area through implementation of available survey protocols.

--Management and protection of known sites will assist in maintaining the viability of known and newly discovered populations.

--Knowledge of these species gained through survey and research will aid in developing management recommendations consistent with Forest management.

DESIRED CONDITION

--Populations of mollusks within the analysis area contribute to the viability of the species over their ranges.

--Forest management practices are conducted congruent with maintaining viable populations of mollusks.

**Peregrine Falcon**

Peregrine falcons are limited by suitable cliffs for nesting and snags and large trees available nearby for perches. Nesting areas on large rock outcrops have remained constant in the analysis area since historical times. Foraging opportunities are abundant in the analysis area, with open areas around the Klamath River, riparian areas, meadows and other openings expected to be the preferred foraging areas. It is unknown what effect changes in forest structure, such as logging, burned areas, fire salvage, and road building, have had on peregrines in the analysis area. However, since peregrines are not adapted to close pursuit of prey among trees in closed canopy forests (Asay and Davis, 1984), it can be assumed that openings created by fire, timber harvest and road construction may have increased the foraging opportunities for peregrines within five or six miles of the existing nesting sites up Grider Creek and on China Bluffs.

Disturbance from humans was highest earlier in this century when mining and logging were at their peaks. Disturbance from humans has diminished in the last decade with the reduction in logging in the analysis area since the 1980s. Currently, recreational activities, wood cutting, and hunting are the most likely sources of disturbance for peregrines.

TRENDS

--Two peregrine eyries will continue to be occupied in the analysis area, with increasing forage opportunities within RRs due to implementation of standards and guidelines in the *Forest Plan* and ACS Objectives.

--The potential exists for an additional eyrie on Lower Devil's Peak, although it is currently unoccupied and it is unknown if the cliff is suitable for nesting peregrines.

--Peregrines may be nesting in the Red Buttes Wilderness (outside of the analysis area). Foraging opportunities within the analysis area will continue.

DESIRED CONDITION

--Undisturbed nesting cliffs (i.e., limited access to people, vehicles, helicopters etc.) with healthy riparian areas and vegetatively diverse areas within five or six miles of active nest sites (foraging distance).

--Reduced road access to known nest cliffs.

--Abundant large trees and snags in the vicinity of nest sites for perching.

**Deer**

Black-tailed deer are a Forest Emphasis Species and a species of local concern within the analysis area. Their needs are governed by the ability to find sufficient forage to meet their energy requirements, and cover to regulate body temperature and escape predation or harassment. Deer are a popular species in this area to view and hunt. They are habitat generalists and as such use a variety of habitats within the analysis area for various aspects of their life histories. The analysis area contains both winter range and summer range as displayed on the Step 6 Terrestrial Opportunity map (**Figure 6-6**). While specific population estimates and habitat suitability are not available for the area, a CD&G habitat model was used to predict where high quality habitat may occur.

It has been suggested that foraging habitat may be limiting for deer populations in the analysis area (S.Cuenca, pers. comm). According to the model, high quality foraging habitat occupies only 10% of the analysis area in scattered areas. Much of the area identified as "high forage value" is located within previously harvested or burned areas. Extensive areas burned in 1987 are becoming unusable for foraging due to age and size of plants. Areas identified by the model as "high cover value" are good quality cover close to high value forage; therefore, with limited forage, high value cover is also limited (10% of the analysis area).

**Roads:** Road construction in the analysis area was generally done to access timber harvest units or mining claims. In addition, roads opened up areas to higher levels of human use through recreation, hunting, or collection of forest products. Human access has effects on wildlife by providing a source of disturbance, which can reduce the effectiveness of the habitat. It also provides access to once remote areas, which can cause an increase in the illegal harvest of wildlife. Use of roads and motorized trails can cause animals to move away from certain areas of heavy use. Thomas (1979) shows that both deer and elk respond negatively to increasing road density.

TRENDS

--Deer habitat within the LSRs is expected to decrease due to management of habitat for late-successional forest-related species. In the present situation continued fire exclusion will reduce the amount of early-successional habitat created by low or moderate burning and timber harvest. Early seral habitat will be reduced unless a stand-replacing fire occurs.

--It has been suggested that local herds are declining (K. Nickell, pers. com., information from recent CDFG studies in California).

--In Matrix lands, large areas that were previously harvested or burned will be managed for later seral stages and this will reduce available forage in the analysis area. Under a continued policy of fire exclusion, early seral habitat would decrease except in areas of recent timber harvest or in the event of a stand-replacing wildfire.

--Under management direction in the *Forest Plan* and opportunities identified in the *Forest-Wide LSRA* and in this analysis, an ambitious prescribed fire program is proposed. In the event that this program is adequately funded and implemented, development of early seral habitat, maintenance of shrub communities and natural meadows, and maintenance of more open stands on south and west aspects would provide a vehicle for maintaining a larger forage base for deer herds in the area.

DESIRED CONDITION

--Maintenance of adequate cover in late-successional forest.

--High quality forage is maintained in the analysis area through underburning.

--In the Matrix, early seral vegetation provides high quality forage in openings created through timber harvest or prescribed fire.

--Road density and associated disturbance is reduced in the analysis area.

**Elk**

Elk are also a Forest Emphasis Species and a species of local concern within the analysis area. Their needs are governed by the ability to find sufficient forage to meet their energy requirements and cover to regulate body temperature and escape predation or harassment. Elk are a popular species in this area to view and hunt. They are habitat generalists and use a variety of habitats within the analysis area for various aspects of their life histories. Elk were hunted out of California early in this century and are now repopulating from animals released on the Happy Camp Ranger District and from herds in Horse Creek and Applegate Valley. Most of the elk use in this area is in upper Grider Creek and upper Seiad Creek. They use the road system to travel, forage in young plantations, and winter near the Klamath River. Currently, elk are not hunted to any great extent in the analysis area. When elk are hunted, they become very sensitive to open roads, and high open road density can greatly reduce habitat utilization by elk.

Potential elk habitat has been identified using the elk habitat model. The largest patches of potential habitat were identified in the upper Seiad Creek watershed near Copper Mountain, Upper Walker Creek, Upper Grider Creek and below Cade Mountain in the lower Thompson Creek watershed. Cover habitat within the analysis area appears to be increasing as plantations and burned over areas develop into mature stands. On the other hand, forage habitat appears to be decreasing as plantations and burned areas progress to later seral stages. Fire suppression has resulted in forested stands that have become more dense with multi-layered stands, larger numbers of shade-tolerant species, and accumulations of ground fuels. Understory trees and shrubs have encroached into normally more open stands (e.g., south and west aspects) due to the lack of ground fires. Natural meadows are being reduced in size by encroachment of conifers, due to lack of fire.

In the upper Grider Creek watershed, elk have been detected in the Cliff Valley and Stones Valley areas. Comparison of 1944 and 1995 aerial photographs shows that meadows and riparian areas in upper Grider Creek have been reduced in size through encroachment of conifers and expansion of alder stands. This assumption is supported by a study conducted in the Dillon, Clear, and Swillup Creek watersheds near Happy Camp (Skinner, 1995). Skinner found significant changes in the spatial characteristics of the openings in the landscape studied between 1944 and 1985. The primary differences between the characteristics were that the sizes of openings have decreased as distances between them have increased. Before the initiation of fire suppression activities, frequent fires were characteristic of landscapes in the vicinity of the study area. The changes observed are consistent with changes that would be expected when fire is removed from a landscape where frequent, low-moderate severity fire was a common ecological process. With continued fire exclusion, and in the absence of a large stand-replacing fire, it is expected that this trend will continue. An ambitious prescribed fire program, which includes burning through high elevation meadows, would reduce encroachment on natural meadows and maintain available forage for elk in the analysis area.

TRENDS

--Although few elk have been documented in the analysis area, it is expected that numbers will increase as herds in Elk Creek and Horse Creek (adjacent watersheds) expand.

--Elk foraging habitat will decrease as plantations mature and meadows shrink by encroachment.

--Elk transitory range (forage) (i.e., south and west aspects) will become less suitable as conifers and brush continue to encroach with fire exclusion.

--In the event of catastrophic fire events, burned areas would provide new forage areas.

DESIRED CONDITION

--High quality forage and cover are provided in the analysis area.

--LSRs include late-successional habitat in draws, north and east aspects and RRs, south and west aspects are more open (<50% crown) with forage below.

--Matrix lands consist of 50% of capable area in mid and late-successional condition (dense or open), the other 50% is early-successional, pole, and sapling, which will provide forage for elk.

--Natural meadows and brush fields are sustained by frequent, low intensity fire.

--Transitory range and winter range on south and west aspects has open, fire-adapted conifer stands with forage below, and are maintained by frequent low intensity fire.

--Roads are below an average of two mi/mi² (total road density) in LSRs. Areas in Matrix with current densities of four mi/mi² have reduced densities.

**Bear**

Suitable habitat for black bears can be characterized as forested areas with a mixture of vegetation types or seral stages providing both cover and a variety of food in good abundance. Bears occupy a wide range of habitats, with some habitats being more preferred than others. Bears tend to prefer vegetation types, such as conifer and hardwood, that have a mixture of shrubs as a major component.

The vegetative diversity in the analysis area provides good habitat for bears. Management activities (such as timber harvest, road building, and fire salvage) have contributed to the diversity of the area and have assisted in maintaining early seral conditions as foraging habitat. Areas with high open road density, such as Walker Creek, China Mountain, and Cade Mountain, are less suitable due to human access which provides a source of disturbance. It also provides access to once remote areas, which can cause an increase in the illegal harvest of bears.

TRENDS

--Denning habitat for bears, including large snags and decadent conditions, will increase in LSRs, as plantations and burned areas develop into older forest conditions.

--In Matrix lands, large areas that were previously harvested or burned will be managed for later seral stages. This may reduce available forage in the analysis area.

--Under a continued policy of fire exclusion, early seral habitat would decrease except in areas of recent timber harvest or in the event of a stand-replacing wildfire. Brush, hardwoods, and meadows may be reduced by encroachment of conifers.

--Bear are abundant in the analysis area. Although there is no specific data on population fluctuations, it is expected that numbers will remain fairly constant or may decline with a reduction in early seral conditions.

DESIRED CONDITION

--Conifer forests provide adequate cover and den sites for bears.

--High quality forage and vegetative diversity are maintained in the analysis area.

--Road density and associated disturbance are reduced in the analysis area.

--Bear populations are at or near their full potential in the analysis area.

**Turkey**

Turkeys have been introduced on the Forest. They are rare within the analysis area with a few sightings in the Seiad Creek watershed and near O'Neil Creek. Turkeys in the analysis area are thought to come from populations introduced in the Horse Creek watershed to the east.

Habitat for turkeys in the analysis area includes riparian areas, oak woodlands, canyon live oak and agricultural or pasture lands along the Klamath River and Seiad Creek. Habitat is limited and is primarily found low in the analysis area near these waterways.

TRENDS

--Turkeys are a fairly recent arrival in the analysis area. It is expected that populations will increase until available habitats are occupied.

--As turkey numbers increase it is expected that turkey hunting will increase in the area.

--Habitat for turkeys is maintained within the analysis area.

--Turkey populations are healthy, sustainable, and huntable.

**Plants**

The analysis area contains known populations and habitat for seven plant species of concern: sugar stick, Baker cypress, clustered lady-slipper orchid, mountain lady-slipper orchid, Klamath Mountain buckwheat, Siskiyou lewisia, and Howell's lousewort.

TRENDS

--Known populations of these species will continue to persist through time in their present abundance and distribution.

--Uncontrolled noxious weed spread and suppression of natural wildfires may contribute to declining habitat conditions for these species.

--With the exception of weed and wildfire influences, existing habitat conditions will remain unaltered to provide necessary habitat elements for known population sites.

--Additional suitable habitat will remain unaltered and available in its current condition to provide dispersal habitat for juvenile recruitment.

DESIRED CONDITION

--Sensitive plant populations are stable and increasing in size and distribution.

--Suitable habitats are intact and are managed to provide recruitment opportunities.

--Botanical diversity is maintained and enhanced.

--Late-successional forest associated plant populations are healthy and viable, and are not declining.

**Botanical Special Interest Areas**

There are two botanical special interest areas within the analysis area: Cook and Green Pass Botanical Area and Seiad Baker Cypress Botanical Area.

TRENDS

--The botanical Special Interest Areas will see increased Forest visitor use.

--These areas will not be managed to provide educational or recreational opportunities for Forest visitors.

--Uncontrolled noxious weed spread, increased Forest visitor use pressure, and suppression of natural wildfires will contribute to changes in species composition and ecological processes.

DESIRED CONDITION

--Natural vegetation features are maintained or enhanced to emphasize the unique plant communities of interest.

**Exotic Species**

Several species occur in analysis area that were introduced or that have expanded their range, such as bullfrogs, European starlings, cowbirds, and opossums. Introduced (range expanding) species compete with, or prey upon, native species. They are typically able to occupy a broader range of habitat conditions and they will continue to out-compete native species.

TRENDS

--Population densities for exotic/expanding species are unknown within the analysis area. Species associated with human activities (such as starlings and cowbirds) will most likely remain constant, as human populations are expected to remain about the same.

--More recently introduced species, such as opossums, may increase in numbers.

--Following current trends, bullfrogs will continue to expand their range.

DESIRED CONDITION

--Exotic species populations are controlled and do not present a threat to native species diversity.

**Noxious Weeds**

Within the analysis area, one noxious weed is known to occur. Scotch broom (*Cytisus scoparius)* is located along Highway 96 in the vicinity of Cade Mountain. The infestation is extensive along long stretches of roadside. This species is rated "C" by the state of California, which requires "control or eradication as local conditions warrant, at the county level."

No formal weed control strategy has been developed on the Forest. Weed treatment has been accomplished by Siskiyou County in the past. With the issuance of the recent Invasive Species Executive Order on March 2, 1999, Federal agencies are directed to address noxious weeds in all NEPA documents, and to fund and implement noxious weed control strategies.

Within the analysis area, the opportunity exists to plan control or eradication of the Scotch broom. Prevention of spread of this species should also be addressed in new NEPA documents produced within the watersheds.

TRENDS

--Scotch broom will continue to spread in the analysis area unless control measures are utilized.

DESIRED CONDITION

--Noxious weed populations are controlled and do not present a threat to native plant diversity.

# HUMAN DIMENSION

**ROADS**

**Key Question 1- How have road uses changed from the past and why?**

The types of road uses have changed considerably from the past. Historically, road use centered around resource use and extraction such as mining and timber harvest. Early road construction followed old trail alignments and was constructed to provide access for fire suppression and mining activities. Early timber harvest in the 1930-40s utilized existing roads, but as the Forest Service offered increasing numbers of timber sales in the late 1950s, new road construction was required to provide access for equipment and log transport. Road construction increased dramatically in the late 1960s through the late 1980s to provide access for the salvage logging following several large scale fires in the analysis area. Logging continued until the early 1990s, at which time the road use related to the timber resource declined significantly in response to reduced timber harvest levels in response to T&E species issues.

There has been a slow but steady increase in recreational use of the road system, with current recreational use probably exceeding all other uses. A variety of recreational uses such as river rafting, fishing, hunting, sight-seeing, trailhead access, etc. occur in multiple settings and are dispersed throughout the analysis area. Uses such as firewood, mushroom, and basketry materials collection, have created public expectations for relatively easy access to sites.

This is in direct conflict with the Forest's road maintenance budget which has declined rapidly the last few years as a result of reduced timber sales. In the past, timber sales were used as a means to accomplish road maintenance, supplementing road maintenance dollars. This allowed the Forest's road maintenance dollars to go further, creating an artificially higher level of roads than the Forest could maintain.

Several administrative road uses have probably stayed about the same, including fire suppression and law enforcement, while other uses such as silvicultural work have probably declined. Seasonal road closures have increased in the last ten years due to providing increased resource protection such as minimizing erosion in winter months, and reducing wildlife poaching and harassment.

**Key Question 2- What resource and social concerns exist with the current road system?**

Resource and social concerns include more immediate needs and longer-term concerns. The January, 1997 flooding and the heavy rainfall for the winter 1998 have significantly impacted the existing road system. Flood damage to the road system occurred across the analysis area, but was concentrated in the Walker and Grider Creek and Grider Ridge areas. For further analysis discussion on hydrologic factors and roads, see "Hillslope Processes" **Step 5**.

The Forest survey identified 241 sites in the analysis area which were damaged by the floods and require decommissioning or repairs. Twenty-three sites, providing critical access to private lands or administrative sites, were repaired immediately, while 218 sites await design and special funding to complete repairs. See **Figure 3-12** Flood Damage Sites, contained in the Map Packet located at the end of this document.

**Resource Concerns**

Immediate concerns include repairing sites so they do not become chronic sediment sources. Also the inaccessibility of some areas as a result of flood-damaged sites still needing repair, presents resource management concerns for fire suppression, future road maintenance, and administrative access.

Long-term resource concerns (not flood related) generally involve stream sedimentation from small fill slope failures, cut bank raveling, and road surface erosion. Another resource concern involves road densities and their effect on wildlife habitat fragmentation. Stream crossings have the potential to fail, thus delivering sediment to aquatic habitats. Refer to the "Hillslope Processes" and "Terrestrial Wildlife" sections for additional discussion on road related concerns.

**Social Concerns**

Social concerns about roads have been expressed at both the local and National levels.

At recent public meetings for the ecosystem analysis, local residents expressed concerns about the importance of keeping emergency access open into and out of the area by alternative routes from Seiad to Happy Camp and Seiad to Horse Creek; and access open to Fish Gulch and to the PCT.

Vegetation encroachment along the roadway on cut banks and ditches is a continuing safety concern. This vegetation restricts safe sight distances at road intersections or along road curves and requires periodic trimming.

Other social concerns include providing long-term access for recreational activities, mining, special forest product collection (i.e., mushrooms, basketry, etc.), firewood, fire suppression, administrative use, and maintaining a transportation system to support timber harvest activities.

At a National level in 1997, in response to concerns expressed about roads, the Chief of the Forest Service placed an 18 month moratorium on road construction in released roadless areas. The analysis area contains approximately 56,000 acres of released roadless areas. National Forests that had their plans revised by the *Northwest Forest Plan* are exempt from the moratorium. (The Klamath National Forest is exempt.) The objective of the moratorium is to provide time to develop a scientifically-based and long-term Forest road policy. The Chief is quoted as saying, "We anticipate that the final long-term road policy will apply to all Forests." (To date, the final policy has not been released.)

The agency has identified three expected outcomes for the final road management policy. *First*, fewer forest roads will be build and those that are built will minimize environmental impacts. *Second*, roads that are no longer needed or that cause significant environmental damage will be removed. *Third*, roads that are most heavily used by the Public will be made safer and promote more efficient use.

The original road system was primarily constructed to provide access for logging operations. The change in *Forest Plan* land allocations has created management goals/objectives where logging is either not allowed or is not the primary land use. Portions of the current road system (maintenance levels, density, miles, etc.) are not consistent with these land allocations and have been reviewed in this process. Refer to **Appendix E** - Access and Travel Analysis, which provides a starting point for developing road improvement, maintenance, and decommissioning opportunities.

**Key Question 3- What are future trends in road uses, needs, and management?**

TRENDS

--A variety of recreational activities (hiking, sight-seeing, etc.) will slowly increase in use, thereby placing greater demands on the road system.

--Road maintenance budgets will probably continue to decline slightly and eventually stabilize.

--Timber harvest will continue on Matrix lands in the analysis area, placing limited demands on the existing road system.

--There will probably be a limited amount of new road construction of National Forest system roads, primarily to support timber harvest.

--Total open road mileage will decrease.

--Local opposition to road closure will continue.

--There will be an ongoing need to retain emergency alternative access routes in and out of the analysis area.

--There is increased National emphasis on improving water quality and watershed restoration through road management and stabilization.

--Without routine road maintenance, roads will continue to deteriorate.

DESIRED CONDITIONS

--A road system that meets rural access, community/public needs, resource protection, and administrative needs.

--Roads are designed, constructed, or improved to minimize resource effects and meet Aquatic Conservation Strategy Objectives.

--Use Access and Travel Analysis process and more site-specific information to manage the road system.

**Key Question 4- What is the recommended travel and access network?**

As part of this ecosystem analysis, an Access and Travel Analysis (ATA) has been developed to make preliminary recommendations for road maintenance, improvement, and decommissioning. These recommendations are preliminary in nature, and will not be finalized until site specific environmental analysis (NEPA) has been conducted. The ATA considers potential resource costs and the need for access for each road in the analysis area. Both of these factors are considered, and then a recommendation is made based on the type and severity of the resource impact or access need or use. Recommendations include (but are not limited to): mitigate resource con-cerns, improve the level of maintenance, vary the season of use, or close the road.

One of the two considerations of the roads assessment is to determine the human access needs of the road system. A myriad of uses of the road system occurs: recreational activities - hunting, fishing, rafting, sight-seeing, wildlife viewing, hiking; private land access; administrative access; fire suppression; timber harvest; silvicultural access for stand treatment; firewood cutting; Christmas tree/bough collection; post/poles cutting; mushroom collection; Tribal gathering of culturally important materials; mining; and other uses.

To determine the human need for access in the roads assessment, all of the uses were "boiled down" into four categories: 1) Recreation, 2) Timber/Silviculture, 3) Public Access, and 4) Fire (this is discussed in the Terrestrial Wildlife section). Definitions of the access need as high, medium, or low were then developed and are listed below in **Table 5-13** Human Access Need - Definitions For Rating Roads In Access & Travel Analysis. The definitions were then applied to each road segment, and are displayed in **Appendix E** - Access and Travel Analysis.

| **Table 5-13 Human Access Need - Definitions For Rating Roads In Access & Travel Analysis** |
|---|
| **Recreation (evaluate as high, medium, or low)**<br>*High* **-** primary access to recreational facilities/sites identified on the 1997 Forest Visitors map. It includes campgrounds, trailheads, etc.<br>*Medium* - primary access to known dispersed camping sites, mountain bike routes, woodcutting areas, birding routes (primarily found in Ecosystem Analyzes), or trailheads not listed on the Forest Visitors Map.<br>*Low* - any open or closed road not included above. |
| **Timber/Silviculture (evaluate as high, medium, or low)**<br>*High* - primary access to Matrix lands and/or multiple plantations, or areas with potential future expansion for timber sales.<br>*Medium* - secondary access to Matrix lands and/or multiple plantations, or providing access to a small area of matrix).<br>*Low* - all other roads not included above. |
| **Public Access (evaluate as high, medium, or low) includes mining, Tribal gathering, firewood cutting, access to private land and/or uses (i.e. water sources)**<br>*High* - known location with high use<br>*Medium* - secondary access, limited quantity or quality<br>*Low* - little or no use, no known resource value present, or a Level 1 road |

## HUMAN USES

**Key Question 1- How have recreation uses changed from the past and what are their trends?**

TRENDS

--Recreational fishing has declined and will likely continue to decline with increased regulations and listing of fish. This will have a negative effect on the local economy.

--Use patterns have changed somewhat from an exclusively locally-dominated use to now include a Regional and National market. This is based on life-styles oriented to the outdoors, ability to travel further, and National designations such as Scenic Byway, Pacific Crest Trail, Wilderness, and Wild & Scenic Rivers which draw visitors from out of the area.

--There has been a slight increase in backcountry use, with use expected to continue to increase.

--Driving for pleasure, hiking, river rafting/kayaking, and camping have increased from past levels as a result of corresponding population increases. Their use is expected to increase .

--Hunting has always been a very popular use in the analysis area. Hunting use is expected to maintain at current levels or fluctuate slightly based on hunting regulations, herd size, and habitat conditions.

This analysis updated the Existing Visual Condition (EVC) data layer which was developed in 1989 using aerial photo interpretation (from photos dated 1985 & 1987) for the *Forest Plan*. The layer was revised to include new timber harvest activities; 1989-1999) and also to cross-check or verify that wildfires were not mis-typed as having an affect on visual condition. Overlays of plantations and fire history were used as a proxies for timber harvest and wildfire. From a visual perspective, plantations 30 years or older are considered visually recovered, and should therefore revert to a "Unnoticed" visual condition. Conversely, "new" plantations since the development of the EVC layer in 1989 would revise the layer to Drastic Disturbance. Again from a visual perspective, fire is considered a natural occurrence and therefore has no effect on visual condition --it is the fire suppression activities such as fire line construction or salvage logging (afterwards) that affect the visual condition.

**Table 5-14 Revised Acreage of Existing Visual Condition Levels**

| Visual Condition Level | *Forest Plan* Acres 1/ | Revised Acres 2/ |
|---|---|---|
| Untouched | 81,500 | 78,700 |
| Unnoticed | 12,800 | 13,100 |
| Minor Disturbance | 9,900 | 9,900 |
| Disturbance | 11,300 | 12,100 |
| Major Disturbance | 4,500 | 4,800 |
| Drastic Disturbance | 21,400 | 22,800 |
| **TOTAL** | **141,400** | **141,100** |

**1/** Source - *Forest Plan* data layer
**2/** Revised by overlaying *Forest Plan* EVC data layer with current fire and plantation layers.
**NOTE:** Although this information has been revised, it is still considered general in nature and requires further refinement at the project scale.

The overall visual condition has and will continue to improve as vegetation recovers. Any decline in the visual condition will occur at a reduced rate than in the recent past because current management activities are smaller in scope and number. Some potential rehabilitation opportunities exist to reduce visual contrasts from past management activities (i.e. line or edge effect). **Table 5-15** Visual Quality Objectives for the Analysis Area, lists the VQOs found within the landscape; see **Figure 5-4** Visual Quality Objectives, contained in the Map Packet located at the end of this document.

**Table 5-15 Visual Quality Objectives for the Analysis Area**

| VQO | Acreage | Percent |
|---|---|---|
| Preservation | 5,400 | 4 |
| Retention | 47,100 | 33 |
| Partial Retention | 83,300 | 58 |
| Modification | 3,600 | 3 |
| Maximum Modification | 2,900 | 2 |
| **TOTAL** | **142,300 1/** | **100** |

**1/** Includes VQO acres for all NF lands.

Past management activities have created visual impacts which sometime currently exceed the desired visual conditions or Visual Quality Objectives identified in the *Forest Plan*. An overlay of VQOs and EVC readily identifies discrepancies and will be used in **Step 6** to identify visual improvement opportunities.

DESIRED CONDITION

--Increase recreation opportunities, such as hiking, fishing, driving for pleasure, etc., to meet public need/demand while providing an economic benefit to the local communities.

**Key Question 2- How has community interest/ involvement changed from the past and what is likely to change in the future?**

The local community has always had an interest in Forest management activities. This interest has increased since the late 1980s to early 1990s. National concerns over the environment have brought about changes in the use patterns of the landbase in the form of constraints and additional restrictions on its use. This has served to heighten awareness and increase sensitivity to the issues effecting the landbase that surrounds them.

The community's primary economic dependence on Forest lands and waters from logging activities and the steelhead fishing industry has shifted to other tourist related activities (rafting, hiking, hunting) with the decline in timber harvest levels and fish populations.

TRENDS

--The desire by the community to be involved in land management decisions will continue to rise.

--There will be an increased community interest in water quality and domestic uses.

--The amount of private land in the analysis area is expected to remain the same.

DESIRED CONDITIONS

--Diversify economic opportunities to compliment natural resource objectives.

--Maintain high quality water for domestic use.

--Forest Service works closely with local communities through partnerships, collaboration, cooperative efforts, etc.

**Key Question 3- How have commodity uses changed from the past and what are their trends?**

The exploration for, and development of, commodities such as gold, chromite, and timber have been the most influential factor in the development of the area: large influx and exit of people in the area, numerous communities have sprung up - some disappearing while others have grown, and a fairly extensive road system has been developed. As readily available resources were depleted, demand for resources declined, or social values changed. Today's commodity uses have declined significantly from historic levels.

Overall firewood collection has declined in the last several years as the availability of easy firewood has declined in association with timber sales. Some locals have the perception that the Forest Service is not providing readily available firewood cutting opportunities. Although some people are converting their heating source from wood to heating oil, firewood continues to be the primary heat source. There will always be people who will use wood for heat, thereby maintaining a steady need for firewood.

**Mining**

Mineral extraction for gold, chromite, talc, graphite, copper, manganese, and asbestos were much greater land uses in the past, creating extensive disturbance. The type, amount, and location of mining operations varied as resources were depleted or market conditions changed. Today only gold mining occurs, with dredging operations found along the Klamath River and several tributary streams. Mining use will probably remain near current levels. However, mining activities fluctuate with the gold market and could increase.

**Other Wood Products**

The overall use of boughs, Christmas trees, posts, and poles will probably remain about the same or increase slightly.

**Timber Management**

At the Forest scale, attaining the timber program outputs has become increasingly difficult since 1997. Numerous changes in management direction and fiscal allocation to the Forest have cumulatively contributed to this difficulty. A number of factors have been introduced or gained clarity in the four years of implementation since the *Forest Plan* was adopted in 1995. Those factors include:

- Survey & Manage Species
- Areas With Watershed Concerns
- Released Roadless Areas
- Other Discretionary Areas
- 100-Acre Late-Successional Reserves

During this analysis, District personnel were asked to take a realistic look at the current Matrix landbase and identify lands that could realistically provide timber outputs in the next ten years. **Table 5-16** provides a summary of the landbase realistically available for timber outputs. A significant reduction of *Forest Plan* identified Matrix lands from 36,200 acres to 4,000 acres is expected to be available in the short-term. It should be pointed out that 36,200 are still designated in the *Forest Plan* until such time as a planning amendment formally changes the lands available. The 4,000 acres identified in the analysis are only to be used for timber planning purposes for the next decade.

**Table 5-16 *Forest Plan* and Ecosystem Analysis Comparison of Lands Available for Scheduled Timber Harvest (Matrix)**

| Land Allocation or Consideration | Updated Acreage for Short-Term Timber Program | *Forest Plan* Acreage |
|---|---|---|
| Initial Land Base | 140,200 | 140,200 |
| Congressionally and Administratively-Withdrawn (except riparian reserves) | -98,500 | -98,500 |
| 100 Acre Late-Successional Reserves | -300 | 000 |
| Riparian Reserves (mapped) | -15,500 | -5,500 |
| Lands Available for Timber Harvest **1/** | **25,900** | **36,200** |
| Unsuitable Ground **2/** | -2,200 | -4,300 |
| Areas With Watershed Concerns | -7,900 | -10,100 |
| Released Roadless (RARE II) | -3,000 | 000 |
| Other Discretionary: low regeneration potential, visual concerns, low existing volumes, river corridor | -4,800 | 000 |
| **SUBTOTAL** | **8,000** | **21,800** |
| Salamander Habitat - 50% reduction | -4,000 | 000 |
| **TOTAL** | **4,000** | **21,800** |

**1/** Lands available for timber harvest include Retention, Partial Retention, Recreational River, and General Forest land allocations, collectively referred to as Matrix lands.
**2/** These lands include areas mapped as water , barrens, meadows, and hardwood dominated stands.

See **Figure 5 - 5** Short-Term Timber Outlook, contained in the Map Packet located at the end of this document for locations of matrix lands, where timber outputs may be considered. An estimated 50% of the lands mapped are occupied by survey and manage species.

As shown in **Table 5-16**, several factors were highlighted during this analysis that reduced the Matrix land capability to produce timber outputs during the ten year period. These acres are still considered Matrix land allocation, but current issues and constraints make it difficult to predict timber availability with any certainty. Listed below are the constraining factors and a discussion of how the *Forest Plan* considered them and how they were applied in this analysis for a short-term timber program (next ten years).

### 100 Acre Late-Successional Reserves (LSRs)

These were not identified in the *Forest Plan*. Three spotted owl activity centers located on Matrix lands, have each been designated 100 acre late-successional reserves. As such they are permanently unavailable for scheduled timber harvest.

### Riparian Reserves

These areas have been updated for this analysis, and thus represent a refinement of the *Forest Plan* acres that were originally mapped. The revised reserve acres, which are unavailable for scheduled timber harvest, were removed from previously identified matrix lands. For a more detailed description of the Riparian Reserve revisions made during the ecosystem analysis process, refer to the "Riparian Areas" section Step 5.

### Unsuitable Lands

These areas include lands identified as water bodies, grass, barren, meadow, or hardwood dominated stands in the vegetation data layer. Occupying 2,200 acres, these acres were considered to be limiting in the future.

### Areas With Watershed Concerns (AWWCs)

The AWWCs in the analysis area as identified in the *Forest Plan* represent 10,100 acres. These areas are off-limits to timber harvest until such time as a watershed analysis has been conducted and they are considered fully recovered. This ecosystem analysis reassessed these areas and determined that eight are now considered "impaired watersheds" representing 7,900 acres. (See "Hillslope Processes" section **Step 5**.) Therefore these acres were considered to be limiting in the near future, unless specific management actions promote recovery. Future analysis determines when a watershed is no longer impaired.

### Released Roadless Areas

Portions of two roadless areas, Kangaroo and Tom Martin, are located in Matrix lands. These areas occupy 3,000 acres. Although these areas are *legally* available for timber harvest, they are currently very *political*. Therefore these acres are not planned for treatment in the foreseeable future.

### Other Discretionary Areas

These areas were not considered in the *Forest Plan*; District personnel identified these areas as realistically not available in the short-term. These areas occupy 4,800 acres and include such areas as: river corridor, visual concerns, low regeneration potential, low existing timber volume, and mostly hardwood areas. Because of either public sensitivity to logging or economics, these areas are not considered feasible for logging in the near future.

**Salamander Habitat:** Both Del Norte and Siskiyou Mountains Salamanders are found in Matrix as well as other lands in the analysis area. (See "Terrestrial Wildlife" section Step 3 for a more complete habitat description.) These salamanders are a Survey and Manage species included in the Northwest *Forest*

*Plan*, which contains provisions for maintaining habitat at 60% canopy closure; in essence making it uneconomical to log these areas. Based on local experience with past timber sales, 50% of the acres proposed for treatment have been found to have salamanders' present. Therefore 50% of the acres were considered to be limiting in the near future.

Using the updated acreage of available lands (from **Table 5-16**), the short-term timber yield was recalculated. The analysis method estimates 8.8 MMBF/decade yield for the analysis area. Using regeneration harvesting to meet *Forest Plan* assumptions and desired conditions, approximately 70-80 acres/decade of regeneration harvest would need to occur.

The *Forest Plan* requires that a minimum of 15% old-growth be retained in all 5th field watersheds. Thompson, Seiad, and Grider watersheds are each sixth field watersheds which make up the Grider/ Thompson 5th field watershed (149,000 acres). There is 28% (31,000 acres) old-growth when only size classes 4, 5, and 6 are used to define old-growth and 34% (39,100 acres) old-growth with size classes 4, 5, 6, and 25% of 3G stands.

The class 3 stands cover a wide range of diameters, 11-25 inches. Based on the old-growth inventory, 3G stands average 150 years of age. With the knowledge that stands have had an additional 20 years of growth since inventoried, the Forest Silviculturist conservatively assumes that 25% of 3G stands currently contain characteristics of late-successional vegetation. There are 39,100 acres (34%) of old-growth out of 112,800 acres of capable lands, thus exceeding the minimum retention of 15% old-growth in a 5th field watershed standard (per *Forest Plan*). This allows the option of using green tree retention as modeled in *Forest Plan* as a silvicultural practice in the analysis area.

TRENDS

The high public sensitivity to timber harvest in released roadless areas will probably continue making these lands in essence unavailable for harvest.

--The threat to plantations from large, stand-replacing wildfires is great.

--Survey and Manage species, cultural concerns, wildlife, released roadless, and unstable lands will continue to strongly influence timber project scheduling, location, and design.

--Mining activities will continue to fluctuate with market conditions and mining regulations.

--Demand for other wood products (boughs, posts, poles, etc.) will fluctuate with market and local economic conditions and may increase slightly.

--Commercial popularity of mushroom picking will fluctuate with market conditions.

DESIRED CONDITIONS

--Continue to meet public demands for commodities commensurate with resource objectives.

--Provide an even flow of timber products to help support local communities and meet National needs.

--Wildfire threats are minimized to commodity resources.

--The analysis area should be managed toward the desired mix of seral stages. **Table 5-17** Existing and Desired Seral Stage Distribution lists the existing and desired mix of seral stages for the Matrix land allocations (i.e. Retention, Recreational River, Partial Retention, and General Forest).

**Table 5-17 Existing and Desired Seral Stage Distribution for Available Lands for Thompson & Seiad Watersheds**

| Size Class | Existing Seral Stages (%) 1/ | Desired Seral Stages 2/ |
|---|---|---|
| Shrub/Forb | 1 | 5-20 |
| Pole/Early-Mature | 17 | 40-55 |
| Mid-Mature | 65 | 15-30 |
| Late-Mature/Old- Growth | 17 | 15-20 |

**1/** Source - *Forest Plan* vegetation layer data sort
**2/** Desired conditions are from the *Main Salmon Watershed Analysis (1995)*, assuming an even flow of timber yield, and are appropriate for use across the Forest.

OPPORTUNITIES

There are approximately 330 acres of plantations under 30 years of age that should be assessed for possible precommercial thinning with appropriated dollars. Plantations should be considered for thinning if they can be accomplished for no more than $275/ac.

With 15% Green Tree Retention, some of the regeneration harvesting should occur in older decadent late-seral stands, stands that are currently under-stocked, and mid-successional stands that have culminated. Based on this analysis roughly 70-80 acres should be regenerated in the late-successional stands with the remaining coming from mid-successional stands. Field verification will be necessary to determine stand conditions and actual seral conditions remaining in available ground.

**Key Question 4- What are the contemporary American Indian uses and trends and how have they changed?**

Modern land changes have affected the relationship between contemporary Native American use and contemporary resources now available. Federal land management practices and land uses have impeded traditional use once practiced mor freely. Changes affecting traditional uses have been restricted by Federal and state regulations, including Fish and Game Laws, permit requirements, land use and restrictions, and laws prohibiting Native Americans from burning basketry materials. Other concerns American Indians may have include road access and development, water quality, fisheries, logging and mining, and recreation development.

There are identified Native American contemporary uses located in the analysis area. These resources identified by the Karuk are important to contemporary basketry arts. Although the Karuk have not identified any tribal organized traditional ceremonial use in the watershed, two river recreation access sites were recently developed for rafters as a alternative to avoid Karuk ceremonial events held below Happy Camp along the Klamath River.

The Karuk Tribe and Klamath National Forest have developed Government-to-Government agreements to effectively work together on Karuk Tribe ancestral and contemporary uses. As Native Americans continue to reside in the area and practice their customs, forest management of resources such as beargrass, ferns, willow, and hazel will continue to be a important concern of the Karuk Tribe.

As more demands are placed on Federal lands, traditional use issues will increase in complexity. Decisions concerning future management of Tribal trust rights and resources will be reached outside the ecosystem analysis framework in ways consistent with the Federal Government's trust responsibility.

TRENDS

--Interaction will continue between the Forest Service and Tribe on trust rights/resources.

--Traditional use issues will increase in complexity as more demands are placed on Federal lands.

DESIRED CONDITIONS

--Opportunities between the Tribe and Forest Service are enhanced through working relationships, partnerships, and agreements.

--Cultural and natural resources are identified and managed to benefit Tribal members.