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Watershed Analysis

Happy Camp and Ukonom
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Klamath National Forest

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DILLON WATERSHED ANALYSIS

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INTRODUCTION

WATERSHED ANALYSIS

The purpose of this watershed analysis is to develop and document a scientifically-based understanding of the functions, processes and interactions of the ecosystems occurring within the Dillon watershed. It serves to identify the trends, conditions and opportunities within the watershed and fulfills the ecosystem objectives as described in the President's Forest Plan, The Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (ROD), which amends existing management plans. The ROD provides the standards and guidelines that are to be implemented on applicable forest lands.

Watershed analysis is one of the four elements of the Aquatic Conservation Strategy, as described in the President's Plan. The maintenance and restoration of aquatic and riparian ecosystem productivity is the goal of these elements. The other three elements are riparian reserves, watershed restoration, and key watersheds. The Dillon watershed was designated a Tier I key watershed, identifying it as a crucial refugia for at-risk fish species.

It is important to clarify that watershed analysis is not a decision making document, but rather a synthesis of information of the ecological functions, environmental processes and human interactions. The process should aid in reducing the amount of time needed for project-level planning and provide strategies for making the best use of existing data and limited budgets.

Watershed analysis is an ongoing, iterative process. This document is intended to be revised and updated as new information becomes available. The analysis will be used as a vehicle for implementation of Forest planning direction. It is an intermediate analysis between land management planning and project planning. Again, it is not a decision making process. Project level planning will result from opportunities identified in the watershed analysis and decision making will be done through the National Environmental Policy Act (NEPA) process. Watershed analysis is a fundamental step in applying the goals of ecosystem management analysis to Forest Plan implementation.

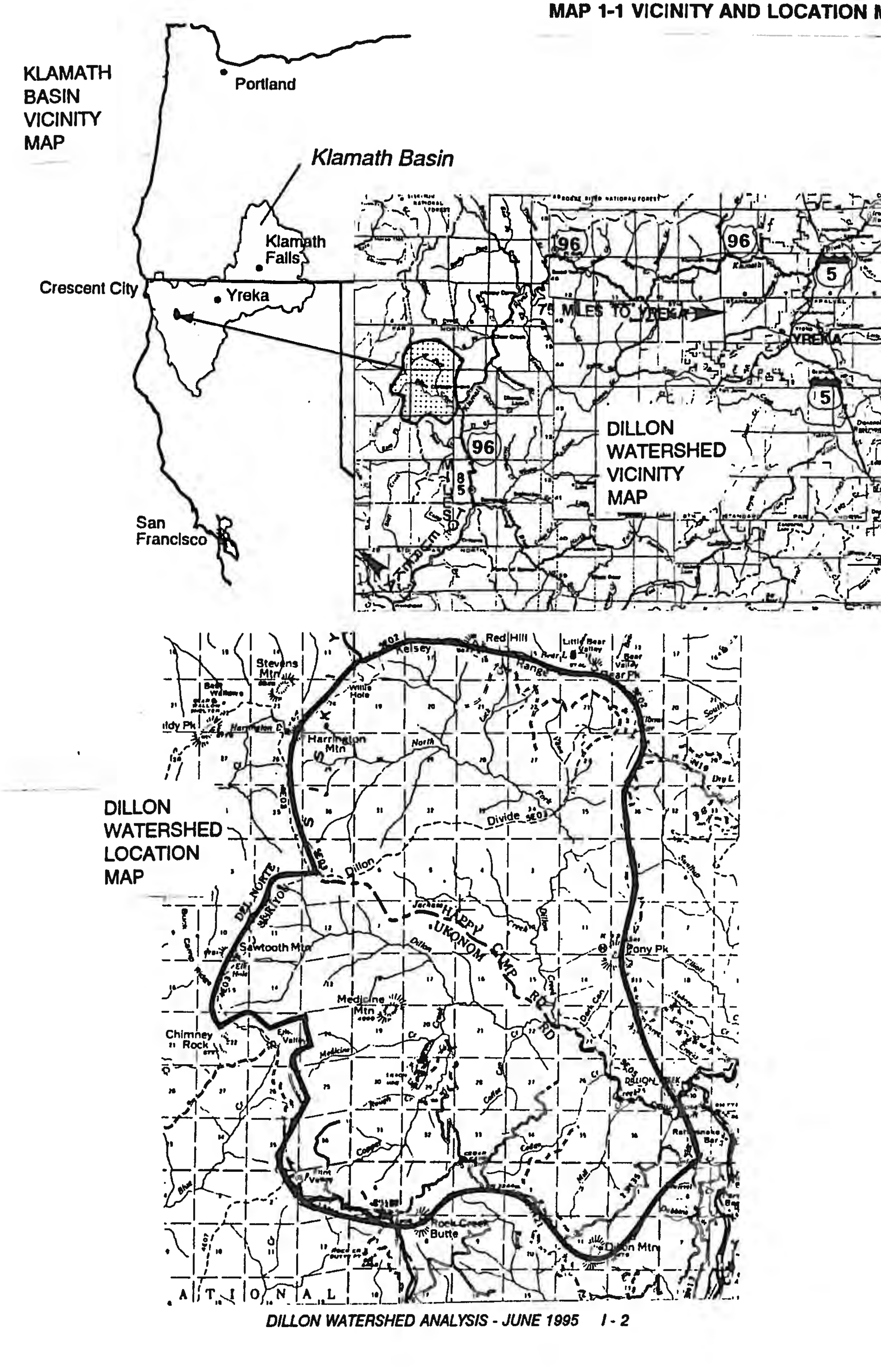
WATERSHED DESCRIPTION

The Dillon watershed is located in the Klamath National Forest approximately 20 miles southwest of Happy Camp in western Siskiyou County, California (See Map 1-1). The watershed is part of the Klamath Mountains Province and a tributary to the Klamath River. The northern boundary follows the historic Kelsey Trail and Kelsey Range and is encompassed by the Siskiyou Wilderness Area. The eastern boundary divides the Dillon and Clear Creek watersheds. To the south/southeast the boundary is the ridge dividing Dillon Creek watershed and the Klamath River. The western boundary borders the Six Rivers National Forest and the Smith River watershed. The North Fork of Dillon is separated from the mainstem by a ridge called Dillon Divide.

Dillon watershed is extremely rugged and mountainous with elevations ranging from just under 6000' along the western boundary of the assessment area to approximately 670' at the mouth of Dillon Creek. Much of the waterflow in the drainage is through very narrow canyons with steep walls and narrow gorges. The mainstem of Dillon Creek has several tributaries including the North Fork of Dillon, Mill Creek, Copper Creek, Coffee Can Creek, and Cedar Creek.

The watershed encompasses approximately 46,866 acres and drains directly into the Klamath River. Aside from one privately owned 150 acre parcel, the watershed is National Forest land. The Siskiyou Wilderness encompasses approximately 8,049 acres or 17% of the watershed. A significant portion of the watershed

MAP 1-1 VICINITY AND LOCATION MAPS



has been designated as Late Successional Reserves (LSRs). The 15,000 acres or 32% of the assessment area were designated through the ROD to manage, maintain, and enhance late-successional forest conditions. The outstanding and remarkable qualities of the mainstem and North Fork of Dillon, and their immediate environments, have led to the nomination of Dillon Creek and the North Fork of Dillon Creek as recreational waterways under the Wild and Scenic River Act.

On July 20, 1994, a number of lightning fires became the source of a wildfire that burned for more than six weeks in the Dillon watershed. This resulted in nearly 27,000 acres of underburned, partially, or fully burned stands, much in the administratively defined matrix and Late Successional Reserve areas. In the aftermath of the fire, there has been a heightened interest in management of the affected areas. The watershed analysis will assist in providing a comprehensive view of the existing condition, functions and processes influenced by the event, and the combination of opportunities that will best achieve Forest objectives.

DILLON'S RELATIONSHIP TO THE KLAMATH RIVER BASIN

It is important to understand how individual watersheds fit into the larger picture. This information provides the context for the geographic, social and ecological setting occupied by a particular watershed. The type and intensity of issues, values and concerns prominent in one watershed versus others can play a key role in the priority allocated for resource use, restoration and protection. Just as watershed-scale analysis is used to describe the distribution of resources and processes that influence them over landscapes of thousands of acres, river basin-scale assessment is intended to serve a similar role for landscapes of millions of acres in size.

Issues, concerns, and values are identified at the river-basin scale, in part to focus landscape analyses upon topics which may be more critical than others to increase our understanding of how an ecosystem functions. They are also an indicator of the proper geographic scale necessary for investigation. For example, while watershed-scale analysis may be sufficient to analyze the population stability of spring chinook or its habitat quality within a target watershed, issues pertaining to the viability of "at risk" fish stocks, such as summer steelhead, are more appropriately assessed at the provincial and river basin scales.

Aquatic resource management issues are among the most prominent throughout the river basins of the Pacific Northwest. Critical aquatic issues identified by the Forest Ecosystem Management Assessment Team (FEMAT) include: 1) at-risk fish stocks and species; 2) stream, riparian, and wetland habitat; 3) water quality; and 4) non-fish aquatic and riparian dependent species. Within the Klamath River Basin we know these are key issues for some watersheds, although for others they may not be. We would expect stream networks designated as "key watersheds" in the FSEIS to be places one or more of these issues are important.

Dillon Creek is one of 23 key watersheds designated within the Klamath River Basin, in no small part because it supports both an at-risk anadromous fish stock and exhibits high quality aquatic habitat. Three of the five at-risk anadromous fish stocks within the Klamath River Basin are presently found (summer steelhead) or could be potentially supported (coho, spring chinook) in Dillon Creek. All of these have been petitioned for listing under the Federal Endangered Species Act, and Klamath Mountain Steelhead (including Dillon Creek summer steelhead) was recently proposed by the National Marine Fisheries Service for threatened status consideration. Although Dillon Creek accounts for 0.5 percent of the Klamath River Basin in area, it accounts for more than 15 percent of the annual adult summer steelhead population found within the basin. Dillon Watershed is one of the highest-rated watershed within the basin due to its high fisheries habitat quality, and overall water quality. Aquatic habitat loss and degradation within the basin have limited spring chinook occupation to about 45 percent of their former range, elevating the value of the remaining high quality habitat. Although it would be inappropriate to assess the viability of any of these three at-risk anadromous stocks at the watershed scale, we can see from a basin context the maintenance of habitat to support these populations within the Dillon Creek watershed has implications on larger scales.

PUBLIC PARTICIPATION

Public participation in this analysis has occurred since the inception of the project. In September of 1994, a field trip to the Dillon watershed took place, attended by approximately fifteen members of the public along with a number of Forest Service employees. Fourteen letters containing comments and concerns were received in response to the trip. In January of 1995, a letter was sent to state and federal agencies and to those publics that had shown recent interest in the activities of the Ranger District. The letter was an introduction to the watershed analysis process and solicitation for comments. On February 9, 1995, a public meeting was held at the Ranger District to encourage participation by members of the public. They were contacted through a public mailing. The meeting involved a presentation by PSW researcher Carl Skinner on fire ecology and an update on the progress of the watershed analysis, as well as time for comments and questions.

The interdisciplinary team has worked closely with representatives from U.S. Fish and Wildlife Service and members of the Karuk, Hupa, Yurok and Tolowa Indian tribes.

ISSUES AND KEY QUESTIONS

The interdisciplinary team identified five issues that were considered critical to ecosystem management in Dillon Watershed. The team followed this step by developing key questions for these issues to assist in focusing the analysis. They include the following:

1) Fisheries and water quality: This includes sedimentation, stream channel integrity, riparian condition and viability of anadromous fish species. Key questions include:

- What are the important aquatic species in the Dillon watershed?
- What is the physical character of the watershed?
- What functions and processes affect aquatic species and habitats?

2) Forest health/condition: This includes fuel accumulation, stocking levels, insect and disease problems, and patterns of seral stage distribution. Key questions include:

- What is the basic character of the vegetation in the Dillon watershed?
- What processes influence or change the character of the vegetation?
- What are the significant ways the vegetation is needed and used by humans, wildlife, and fish?

3) Wildlife: This includes habitat characteristics, connectivity or fragmentation, and distribution of habitats. Key questions include:

- What wildlife species and species groups inhabit the Dillon watershed?
- What processes affect species and habitats?
- What is Dillon's place as a refugia for wildlife?

4) American Indian Interests: This includes the interest and values to the Karuk, Yurok, Tolowa and Hupa tribes. Key questions include:

•What are the traditional and contemporary uses in the Dillon watershed by Native American tribes?
•What is the significance of the Dillon watershed to these tribes?

5) Human uses and values: This includes recreational activities, economic opportunities, scenic quality and private property integration. Key questions include:

•What resource uses occur within the watershed?
•What are the psychological, spiritual and physical factors that give the watershed value to the users?

DOCUMENT ORGANIZATION

The material produced for the analysis has been divided into six chapters:

Chapter I: Introduction of the landscape area and analysis process.

Chapter II: Historical Summary describes the natural and human disturbances and events that have impacted the watershed over time and provide a way of characterizing the natural range of variability.

Chapter III: Existing Features describes the existing biological, physical, and human features in the watershed. Descriptions include what the features are and where they are located.

Chapter IV: Processes and Functions describes the important interactions, processes, and trends, as well as how the watershed is functioning relative to the identified issues.

Chapter V: Current Management Direction relates the goals and objectives of the *Draft Forest Land Management Plan* to the Dillon watershed and it's resources.

Chapter VI: Management Opportunities describes in general terms, the opportunities that will help achieve or maintain the desired condition. This provides the purpose and need for implementing projects designed to achieve or maintain desired condition.

Chapter II

Historical Summary

HISTORICAL SUMMARY

INTRODUCTION

This chapter discusses the physical, biologic, and human history as it relates to Dillon Creek watershed. The chapter will look at the important events, transitions, and disturbances that occurred in the analysis area and have affected the current conditions and trends.

GEOLOGIC HISTORY

The Klamath Mountains are constructed of marine rocks that have been scraped off the ocean floor as it collided with the North American continent. Near Yreka, the rocks are about 500 million years old and are progressively younger from east to west, toward the Pacific Ocean. At the coast, the rocks are as young as a few million years. The scraping continues today, generating the earthquakes that occur along the Pacific coast. The marine rocks are composed of igneous with sediments deposited atop. The sediments include fine grained mud deposited in the open ocean and limestone from reefs formed on islands. About 70 million years ago, volcanoes erupted through the metamorphosed marine rocks and were eroded away, exposing their roots. This produced the granite that is predominant at Pony Peak in the southeast portion of Dillon Creek basin.

The landform of the basin is very young compared to the age of the rocks from which it was formed. The lack of rocks younger than the granite indicates this area has been eroding during much of the past 70 million years. The presence of thick red soil and deeply weathered granite suggests that the landscape was of low topographic relief and under a moist climate, sometime within the last few hundred thousand years. Ongoing uplift and a drier climate resulted in deep stream gorges being cut into the low relief landscape. Thick soils that developed on the low relief landscape are now elevated above the stream channels and eroding rapidly. Glaciers that occupied high mountain valleys retreated about 10,000 years ago. Glacial action was likely accompanied by increased rates of sediment production to streams.

CLIMATE AND FLOODING

In the central Klamath Mountains, the coastal climatic influence is moderated by the mountains to the west. The annual precipitation during the period of record (1914 to present) at Happy Camp, which is about 15 miles northeast of the basin, ranges from 23-88 inches. The average annual precipitation at the weather station is about 51 inches. Annual precipitation generally increases to the west of Happy Camp. Precipitation in parts of the Dillon basin may be as much as 50% greater than in Happy Camp. Approximately 90% of the precipitation occurs from October through May from central and north Pacific cyclonic storms. The remainder occurs during summer thunderstorms.

The precipitation records indicate various dry and wet periods. The alternating periods seem to last for a few decades. The drier periods produce approximately 40 inches average annual precipitation. The period from 1911 to 1937 was a representative period of below average annual precipitation. From 1938 to 1975, a wet period brought an average of 54 inches annual precipitation. After 1975, very dry periods have been interspersed with very wet periods, lasting a few years with a prolonged dry period from 1985 until the present.

Floods have played a significant role in the conditions of streams and rivers in the Dillon area. Large floods are documented for parts of the Klamath River in 1861, 1864, and 1875 and are also believed to have occured around 1600 and 1750. Based upon geological and botanical records, periodic large floods naturally occur in the Klamath River Basin. Records indicate that major floods occurred in 1953, 1955, 1964, 1970, 1971, 1972, and 1974. The 1964 flood was the largest ever measured and reached 40 thousand CFS in Indian Creek, which is similar to Dillon Creek in many ways.

The occurrence of landslides on the Klamath National Forest has been and continues to be strongly influenced by weather and climate. They may also be triggered by human activities such as road building, timber harvest, and mining activities. Most of the landslide activity of the last 80 years occurred during the 1938 to 1975 wet period. Many landslides were reactivated by intense precipitation during 1982 and 1983.

FISHERIES

Prior to 1850, the number of salmon in the tributaries and Klamath River were sufficient for primary subsistence of the indigenous people of the Klamath Basin. After 1850 and the discovery of gold, impacts by a growing population of miners began creating changes. Near the turn of the century, salmon canneries opened at the mouth of the Klamath River and no limits were designated. The species of salmonids that were commercially fished included both runs of chinook salmon and coho salmon with an incidental catch of steelhead trout. By 1931, the Klamath River spring chinook population seemed to have almost disappeared and the depletion of other salmon runs was progressing at an alarming rate (Snyder 1931).

Artificial propagation of fish began within the Klamath River Basin in 1896. Eggs from the Sacramento River Basin were raised to fry and released in the Klamath basin several times in the early 1900s. A small hatchery was also established at the mouth of the Klamath River in the 1890s, with eggs from the Rogue River in Oregon. A hatchery was established below Iron Gate Dam following construction in 1960. Chinook, steelhead, and coho have been released numerous times into the Klamath Basin between 1960 and the present.

Very few specifics are known about the condition of fish populations and habitat in the Dillon drainage from earlier times. The following list gives a few historic facts that have been discovered about past conditions:

- Dillon Creek had been known as one of the most natural, non-hatchery influenced anadromous fish populations on the Klamath National Forest. However, during a fish and game survey in 1934, a local miner indicated some stocking occurred a few years earlier in the lower two miles.

- In 1934, water temperatures of 23 degrees Celsius (1 1/2 miles above the mouth of Dillon Creek) and 24 degrees Celsius (1/3 mile above the mouth of Dillon Creek) were recorded. These are comparable to the current recorded stream temperatures.

- In November 1967, the California Department of Fish and Game reported one redd and two adult female chinook salmon in the lower 1.25 miles of Dillon. This was considered an unusually low number compared to other streams like Clear, Thompson, and Indian Creeks for that year.

- Due to the remoteness and inaccessibility of Dillon Creek, the discovery of the last large population of summer steelhead (a sensitive species) on the District was confirmed in Dillon Creek in the summer of 1980. Summer steelhead had been counted on a regular basis in other drainages as early as the 1968 surveys in Wooley Creek.

VEGETATION

Dillon Creek lies within the Klamath Mountains geological province. This forested province is known to be extremely diverse. The complex species and plant community distributions and patterns are a result of the climate, rugged high relief, and soil parent material (Whittaker 1960). The distributions and patterns are also a result of various disturbances at the stand and landscape level. Evidence from aerial photos, repeat photography, and personal interviews has led to the conclusion that forest settings 200 years ago were, in general, more open than today.

The California Klamath Province is characterized by high fire frequencies. Prior to suppression, fires were more pervasive, yet less severe, than today's fire occurrences. Fire suppression efforts have resulted in significant fuel accumulations and shifts in tree species composition and forest stand structure. These changes may be increasing the susceptibility of the forests to large, high severity fires, epidemic attacks of insects, and to stress brought on by drought.

Historically, vegetation was also altered by the practices of American Indians. For thousands of years prior to Euro-American settlement, the American Indian lived in the Klamath Basin and used fire to affect the vegetation for many different purposes ranging from plant and insect control to alterations for wildlife habitat. Fire applications improved access for hunting and travel as well as altered vegetation in an effort to reduce the risk of severe fires. By the 1920s, federal enforcement and fire prevention laws prohibited indigenous burning practices.

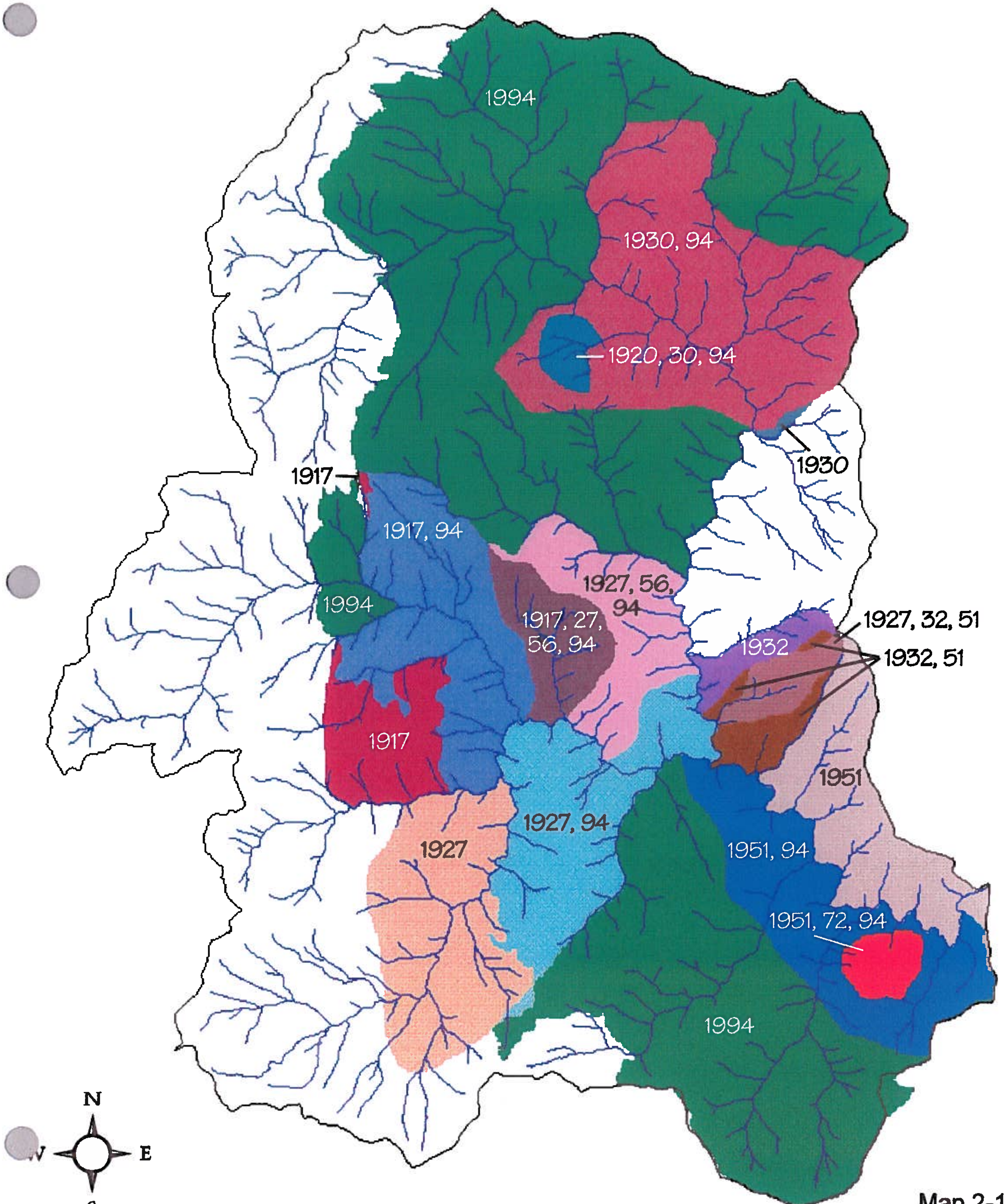
FIRE HISTORY

Fire has shaped the vegetative composition in the Dillon Creek watershed for thousands of years. This can be seen by the mosaic of vegetation, stand age, and stand composition in the drainage. Fire appears to be the dominant, most frequent disturbance in Dillon watershed and a major determinant of historical landscape diversity. Fires occurred at least once every ten to thirty years in most forested areas. Fire severity varied depending upon the weather, fuels conditions, and local topography. They were usually low to moderate severity fires with occasional stand replacement patches. Lower severity fires maintained open understories and kept levels of woody debris low.

Limited fire suppression began with the creation of the Klamath Forest in 1905. By the 1940s, it was very effective. Although fire records are incomplete, more than a hundred fires have been recorded as being suppressed in the Dillon Creek drainage over the last ninety years. Records from the 1930s indicated smaller fires, while the 1910 records reveal larger fires often over 200 acres. It is believed that the majority of fires have been caused by lightning. During the 20 year period between 1974 and 1993, the drainage averaged 1.6 fires per year.

In spite of fire exclusion efforts, nine fires since 1910 have been larger than 100 acres. The most recent was the 1994 lightning fires that involved 27,195 acres within Dillon Creek drainage. Several of these larger fires burned or reburned around previous fires (see Map 2-1). All nine of the larger fires were recorded to have started in July, August, or September and burned for several weeks before being controlled. It is also interesting to note that the majority of fires between 1910 and today burned during below average precipitation years. Only 14% were known to have occurred in average or above average precipitation years.

Known large fire history with year(s) of occurrence



Map 2-1

WILDLIFE

The complement of wildlife species within the Dillon watershed has been altered over the last century. Many factors played a part in these changes, most significantly man's direct and indirect influences through his activities.

Roosevelt Elk were once plentiful in the Klamath Mountains. Their complete extermination at the turn of the century was due to over hunting and habitat loss. Bald eagles, peregrine falcons, and osprey were common within the Klamath River corridor prior to the late 1960's. These species suffered extreme losses due to the detrimental effect of the pesticide DDT upon their reproduction. Grizzly bear and gray wolf were exterminated largely due to a successful government predator control program and to habitat encroachment by humans. Many of the furbearer populations were reduced as a result of trapping, particularly fisher, marten, and beaver.

Historical records and aerial photographs indicate that fire suppression has allowed dense forests to develop where a more open forested environment once existed. There has been a corresponding increase in fuel accumulation. These dense forests currently provide shelter, food, and nesting or denning opportunities for many interior forest species such as spotted owl, Vaux's swift, and northern flying squirrel. In contrast, these stands may no longer be suitable for species such as the goshawk, whose habitat requirements are for older forest with little or no understory.

AMERICAN INDIANS

In northwestern California, American Indian settlements prevailed for thousands of years. For the early inhabitants living in riverside villages, life included seasonal travel up and down the mountainsides to procure, store, and process food. Acorns from tanoaks were the main diet supplemented by salmon, deer, or other available foods.

Dillon watershed is predominately in the ancestral land of the Karuk, although the Yurok and Tolawa tribes also historically frequented the western highlands of the watershed. For centuries the Yurok, Tolawa, Karuk, and more recently the Hupa, have made religious pilgrimages to locales along the Siskiyou Crest, on the western boundary of the watershed.

River and major stream banks were centers of activity for American Indians. They were important because they provided a center for resource supplies, cultural/social life, commerce, and a common transportation system between villages. Travel was either on foot or by canoe. Summer and fall activities involved a greater dispersion from these areas to harvest and gather resources, practice religion, and trade.

Research suggests that past watershed activities were seasonal and varied. Activities were typically related to prayer rituals, the seeking out of spiritual power, the search for food, medicinal plants or construction materials, and the trading of valuable commodities with neighboring tribes. Trade and medicine trails at one time traversed many ridge corridors. Seasonal snows restricted use in the higher elevations between October and May.

The land supplied abundant resources for hand made products, as well as edibles for sustenance, including elk, deer, fish, herbs, and acorns. Sacred locations were used for building altars and fires during religious observances. Occasionally, tribal gatherings were held at specific locations to regulate ritual law and mediate with natural forces when natural disasters occurred on the land (Wyle and Heffner 1976).

In the high country, regional tribal trade included the trading of obsidian, flint, deer skins, woodpecker scalps, dentalium, oliella and abalone shells, along with other foods and items that were difficult to obtain. Trade gatherings may have been events where gambling, reunions, or marriages occurred.

Neither explorers nor trappers had much impact upon the Indians, but occupation and exploitation of the region by miners, prior to the establishment of Indian rights, alienated tribes. Conflicts with miners reduced American Indian populations; many died and many were displaced to reservations during the last half of the 1800's.

Ethnographic and archaeological investigation and consultation with Indian tribes help define how the mountainous environment of the assessment area was used and the significance the environment plays in contemporary and historic religious practices. A more detailed account of the American Indian land use is assessed in *Chapter IV, Processes and Functions.*

EURO-AMERICAN SETTLEMENT

The first Anglo exploration of the region was led by Jedediah Smith in 1828. The Hudson Bay Company followed soon after Smith's excursion. The Company trapped beaver in northwestern California until 1843, when it was deemed unprofitable. In June of 1850, California prospectors crossed the Trinity Alps and at the Forks of the Salmon found rich deposits of gold. At the same time, another expedition headed up the mouth of the Klamath River, also discovering gold. Numerous miners quickly entered the region. For the next five decades, it is estimated that several thousand miners from various ethnic backgrounds, including large numbers of Chinese, worked local river bars and stream channels.

Most of the mining during this era was not in the Dillon watershed but nearby in the Klamath River corridor. There were several mining camps associated with placer mines up and down the Klamath River from Orleans north to the mouth of the Shasta River. Information is sketchy on the actual numbers of miners who worked the vicinity's gold deposits after 1850. By 1870, many who came in the 1850s had left as easy surface deposits were taken. The population of Siskiyou County in 1880 was estimated at 8,162. Happy Camp, 25 miles to the north was the area's largest town. The Happy Camp 1880 census population was 597, including 97 American Indians and 250 Chinese. By 1900, very few Chinese remained. Smaller towns located to the south of the Dillon area were Somes Bar and Orleans.

Around 1865, a mining camp was established at Ferry Point, north of the Dillon watershed. The camp provided a dance hall, hotel, store, and river ferry. The Kelsey Trail crossed the Klamath River at this spot, and nearby there were a number of productive mines. There were also mines or small camps at Cottage Grove and the mouth of Dillon, Blue Nose, Carter, and Burns Creeks.

Due to the remoteness and ruggedness of the terrain, habitation by Euro-americans rarely occurred within Dillon watershed. A few dwellings existed at the mouth of Dillon Creek and there were seasonal inhabitants who worked at the Siskon Mine during the 1950s and 1960s.

In the late 1890s, the government began to withdraw unreserved lands from public entry to establish forest reserves, which eventually resulted in the establishment of the Klamath National Forest in 1905. Early on, forest policies focused on fire suppression and road or trail construction. By the 1950s, management reflected congressional desires for higher timber harvests. Towns in the Klamath basin that had previously been inhabited by miners became home to individuals and families supported by the timber industry. Many prospered for 20 to 30 years working in this industry. The past ten years have brought many changes to this industry. Environmental constraints and timber supply have caused a steady decline in timber production and thereby resulted in declining populations in timber dependent communities.

MINING HISTORY

Mineral deposits known to occur in Dillon Creek watershed and vicinity include placer gold and platinum, surface and underground lode gold, silver, copper, manganese, graphite and chromite. The most significant past mining exploration and production activities were placer gold operations at the Dillon Hill, Burns T, and Blue Nose mines, exploration for manganese at the High Light No. 1 mine, and open pit mining of gold and silver at the Siskon mine (See Map 2-2).

Historic mining activities substantially altered the ground. Placer mining operations typically started by working placer deposits at their surface. Then material below the surface was mined using ground sluicing methods. During this operation, river or stream bed deposits were mined by constructing dams to divert the area to be worked. This also required the building of ditches and channels. Many of the effects of these activities can still be seen today. Remnants of this era include mine tailings and ditches, metal remains and collapsed structures.

Within the Dillon watershed, nine mine locations are known from historic to recent past. This information was retrieved from the Bureau of Mines Minerals Availability System Database and other literature sources (See Map 2-2). Three of the eleven mining operations were recorded as placer, one being located in the North Fork of Dillon Creek and the others at the mouth of Dillon Creek. There were two chromium mineral locations, one northwest of Flint Valley and one on Dillon Creek. One manganese prospect was located on a ridgetop at the headwaters of Medicine Creek and a copper prospect in the headwaters of Dillon Creek. A graphite prospect is located south of the mouth of Dillon Creek.

The largest operation was Siskon Mine, a gold, silver and copper open pit mine. It is located in the Copper Creek sub-watershed. As one of the biggest gold and silver producing mines in Siskiyou County during the 20th century, Siskon Mine has a notable history.

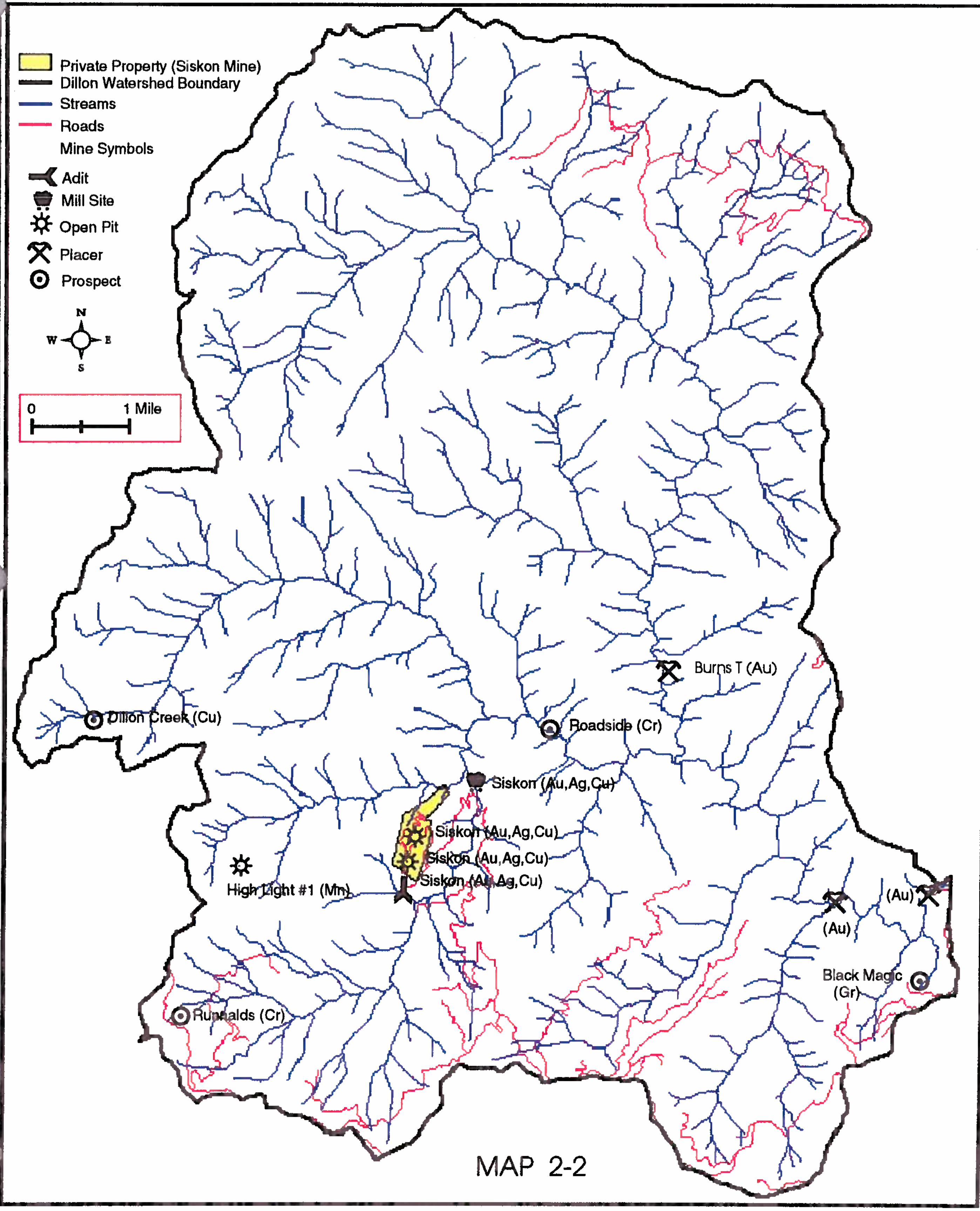
The first entry in the area, eventually to be operated by Siskon Corporation, was believed to have occurred in the early 1900s with about 1,200 feet of drifts in two adits that had been constructed. During the 1920s or early 1930s, the first tunnel was driven by hand at what became Siskon mine. The first ten original claims were located during the 1930s. By 1950, more than 30 additional claims were located and 10 miles of road built from Cedar Camp to the mine. A mining camp was built along Copper Creek.

The period between 1950 and 1960 was the height of operations at Siskon Mine. At this time, the mine property included 1 mill site and 62 unpatented lode and placer claims. All the claims were contiguous. Mine operations during this period were extensive, with more than 400,000 tons of ore being extracted from three open pits. These pits and adjacent lands are now patented claims. The ore was trucked approximately 2.5 miles downhill to a cyanide processing plant. A solution of cyanide and lime was used to dissolve the metals and the resultant slurry then washed in large agitators to dilute the cyanide. Zinc dust was used to concentrate and amalgamate the gold and silver. Siskon extended five adits several thousand feet and the processing capacity reached a maximum of 400 tons per day. The gold and silver retrieved at this time valued more than $3.7 million. Gold and silver bullion were taken to Tacoma, Washington for smelting and then to the U.S. Mint in San Fransisco.

During this period of operation, thirty to thirty-five men and women were employed and lived at the mine, including a mess hall crew. Most of the employees were from Happy Camp and families lived and worked at the mine during the summer months, with wives and children going home when school was in session. The mine operated from March through November and was shut down through the winter months. The mine operated three shifts, twenty-four hours a day. The camp had electricity, bunkhouses, a recreation hall and a television. Wages for most employees were $2 an hour, with $1.25 per day deducted for room and board.

In 1961, six of the claims became patented claims. From 1960 to 1992, the sixty-three unpatented and patented claims were held by a succession of mining companies and individuals. Present owners have retained the six patented claims and relinquished the remainder. The current claimant has conducted exploration efforts to define the ore body and is interested in future development. Environmental problems remain today at the site, resulting from the 1950's mining period.

Dillon Watershed Mine Sites



MAP 2-2

ACCESS DEVELOPMENT AND HARVESTING

During the 1850s, the Kelsey Trail was built to move supplies inland and gold overland to the coast. From Crescent City the trail followed the South Fork of the Smith River to Harrington Mountain, east to Bear Peak, descending to the Klamath River, and overland through the Marble Mountains. Eventually the trail reached Scott Valley. Other historic trails followed rivers inland or to the coast.

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 Dillon area was by foot, mule, or horse over early historic trails with a few rough wagon roads.

The development of a transportation system in the landscape began in the early 1920's with the construction of Highway 96 from Happy Camp to Orleans. Further development did not occur until the mid 1930's when the CCC's constructed the main access roads to Cedar Camp, Dillon Mountain, and Elk Valley. Roads accessing the Siskon Mine and Pony Peak were constructed between 1944 and 1955.

Most of the remaining roads in the area were constructed to access timber harvest beginning in the late 1950's. Examination of road construction plans and aerial photos from 1944, 1955, 1964, 1971, 1987 and 1990 show the progression of road building within the landscape. A summary of post 1955 transportation system development follows (Table 2-1):

Table 2-1 - TRANSPORTATION SYSTEM DEVELOPMENT

1955-1964		1964-1971		1971-1981		1981-1987	
ROAD	MILES	ROAD	MILES	ROAD	MILES	ROAD	MILES
13N18	2.90	13N50	1.13	15N30	0.51	13N37	2.48
13N19	0.67	14N03	1.14	13N17	2.38	13N37B	0.22
13N35	4.23	14N17	3.94	15N19	4.56	13N37C	0.50
		15N19	1.63	15N56	1.03	14N21B	0.65
		15N67	2.74	15N65	1.17	14N31A	0.94
						14N69	0.79
						13N35C	0.50
MILE TOTALS	7.80	—	10.58	—	9.65	—	6.08

Initial entry into the Dillon watershed for timber harvest occurred in 1963. Early road development to access timber occurred on the south end of the watershed from the roads described above. The Sidewinder Road (14N69) was constructed during the mid 1980s to replace an original access road that crossed Soldier Creek and was washed out in the 1964 floods. Timber access to the north end of the watershed occurred as an extension of the Bear Peak Road (15N19) into Vann Creek in 1964 and extended further, out to Lick Creek, in 1980.

Chapter III

Existing Features

EXISTING FEATURES

INTRODUCTION

Existing features that distinguish Dillon watershed include its clear water, its relatively untouched character, and its importance to regional American Indian tribes. Much of the watershed is characterized by steep slopes and narrow gorges with bedrock cliffs. This rugged terrain has restricted human use and slowed down information gathering about terrestrial and aquatic systems in the watershed. Information that has been collected, primarily in the past two decades, has been used in modeling for the existing features in this chapter, and for the interactions in *Chapter IV.*

CLIMATE

In the central Klamath Mountains, the coastal climatic influence is moderated by the mountains to the west. The average annual precipitation at Happy Camp is about 51 inches. Annual precipitation generally increases to the west of Happy Camp. Precipitation in parts of the Dillon basin may be as much as 50% greater than at Happy Camp. The precipitation record is characterized by distinct climate trends (Table 3-1), and Happy Camp has been in a dry trend since 1976. The area has generally warm, dry summers and cool, wet winters.

TABLE 3-1 NUMBER OF YEARS IN ANNUAL PRECIPITATION RANGE SHOWING CLIMATIC TRENDS, 1915-1990, Happy Camp, California.

INCHES	1915-90	1915-37	1938-75	1976-90
20-30	4	3	0	1
30-40	20	10	5	5
40-50	15	6	6	3
50-60	19	3	12	4
60-70	8	1	7	0
70-80	3	0	3	0
80-90	6	0	4	2
AVERAGE	50.7	40.6	57.6	48.8

Range of Observations: 23.3 - 88.5 inches

GEOMORPHOLOGY

Bedrock in the Dillon Creek basin consists of structurally complex, metamorphic, marine volcanic and sedimentary rocks that were deposited on mafic and ultramafic igneous, oceanic basement. The marine rocks have been strongly deformed while being scraped off the ocean floor and pushed onto the continent. They have been intruded by younger granitic rocks of intermediate composition, the roots of andesitic volcanoes. Contrast in the character and behavior of the bedrock units is the basis of the geomorphic terranes described below. Together, these rocks have been rapidly uplifted and deeply eroded. Rapid uplift and erosion continue today. Earthquakes felt in Happy Camp in recent years originate from subduction-related coastal faults and movements related to Cascade volcanoes. Although there is no historical record of local active faults or strong shaking, there is insufficient information to preclude the possibilities.

The topography of the area consists of steep slopes (greater than 40%), and dispersed benches up to about 500 acres in size on moderate slope gradients (less than 40%). Soils on the steep slopes are thin in comparison with the thick soils on the benches. Differences in the origin and hydrology between these two slope classes result in strong contrasts in landslide and erosion processes.

GEOMORPHIC TERRANES

Geomorphic terranes are identified by differences in composition, history, topography, and hydrology (see Map 3-1). They are the units used in describing ecological relationships and landslide processes. Each terrane has a unique set of characteristics and associated habitats. By relating terranes with the management activities, a practical estimate of the landslide contribution to stream sediment and opportunities to apply mitigation measures can be determined. Definitions for these terranes can be found in the Glossary section of this document.

Alluvial Terrane-This terrane occupies less than one percent of the Dillon Creek watershed.

Glacial Terrane-This terrane occupies five percent of the Dillon Creek watershed. Most is found in the Siskiyou Wilderness in the northwest corner of the basin.

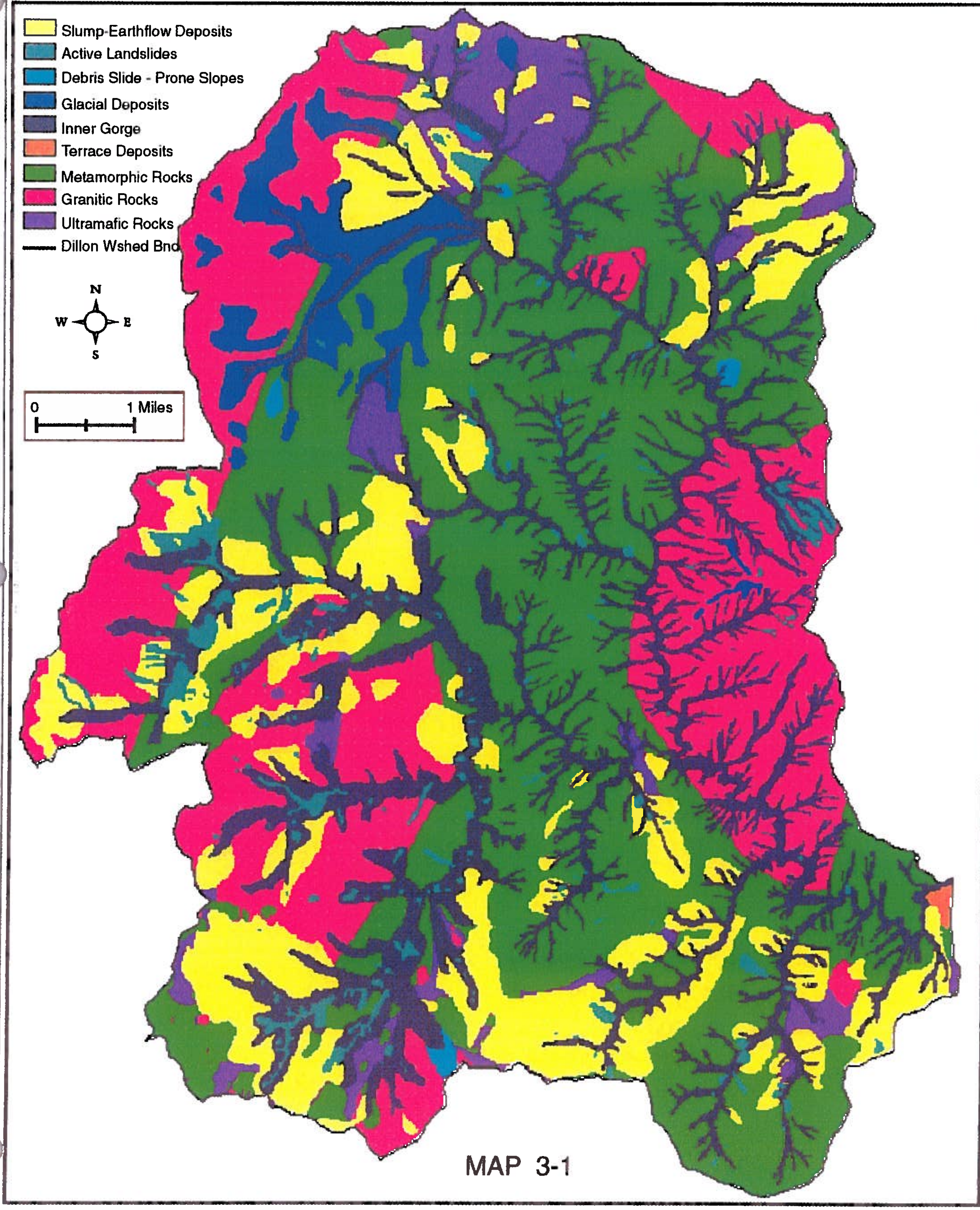
Old Landslide Terrane-This terrane occupies about 20% of the Dillon Creek watershed. Most is found along the south and west margins of the basin. A preliminary map of these deposits, Map 3-2, has been constructed by extracting slopes of 2% to 40% grade from the digital elevation model. This image was median filtered to simplify the map and includes some gently sloping ground that is not Old Landslide Terrane (glaciated valleys, deeply weathered granitic rock and stringers of ridge top and stream channel). Much of the area of this terrane has been involved in earthflow-slump landslides, some as large as up to a square mile. The sensitive toe zones of these landslides have not been completely mapped. Small portions of this terrane are involved in active landslides during wetter years. Active earthflows in the assessment area are recognizable by stands where trees are tilted from vertical (jack-strawed) and distinctive, hummocky landforms. Active earthflow landslides are frequently associated with the gentlest slopes, as seen in Map 3-2. Soil moisture in active landslides is typically high. Ephemeral ponds are found in association with landslide scarps and very gentle slopes. Road construction can locally activate or accelerate activity of these landslides by altering drainage and/or the distribution of mass on the slope.

Granitic Terrane-This terrane occupies about 20% of the Dillon Creek watershed. These thick, soft soils are extremely susceptible to debris sliding.

Metamorphic Terrane-This terrane occupies about 45% of the Dillon Creek watershed. Landslides in this area typically involve thin soil mantles. Also found are debris slides and slumps that originate in old landslide deposits that are too small to be mapped as Old Landslide Terrane. Natural landslides often occur in soil accumulated at the head of draws (also known as zero-order basins) and along stream channels in soil accumulated from up-slope. The large number of potential landslide sites and low short-term probability of occurrence at any given site make them difficult to predict. Clastic sedimentary rocks in this terrane are typically resistant to weathering, so they form thin, coarse soils of distinctive vegetation.

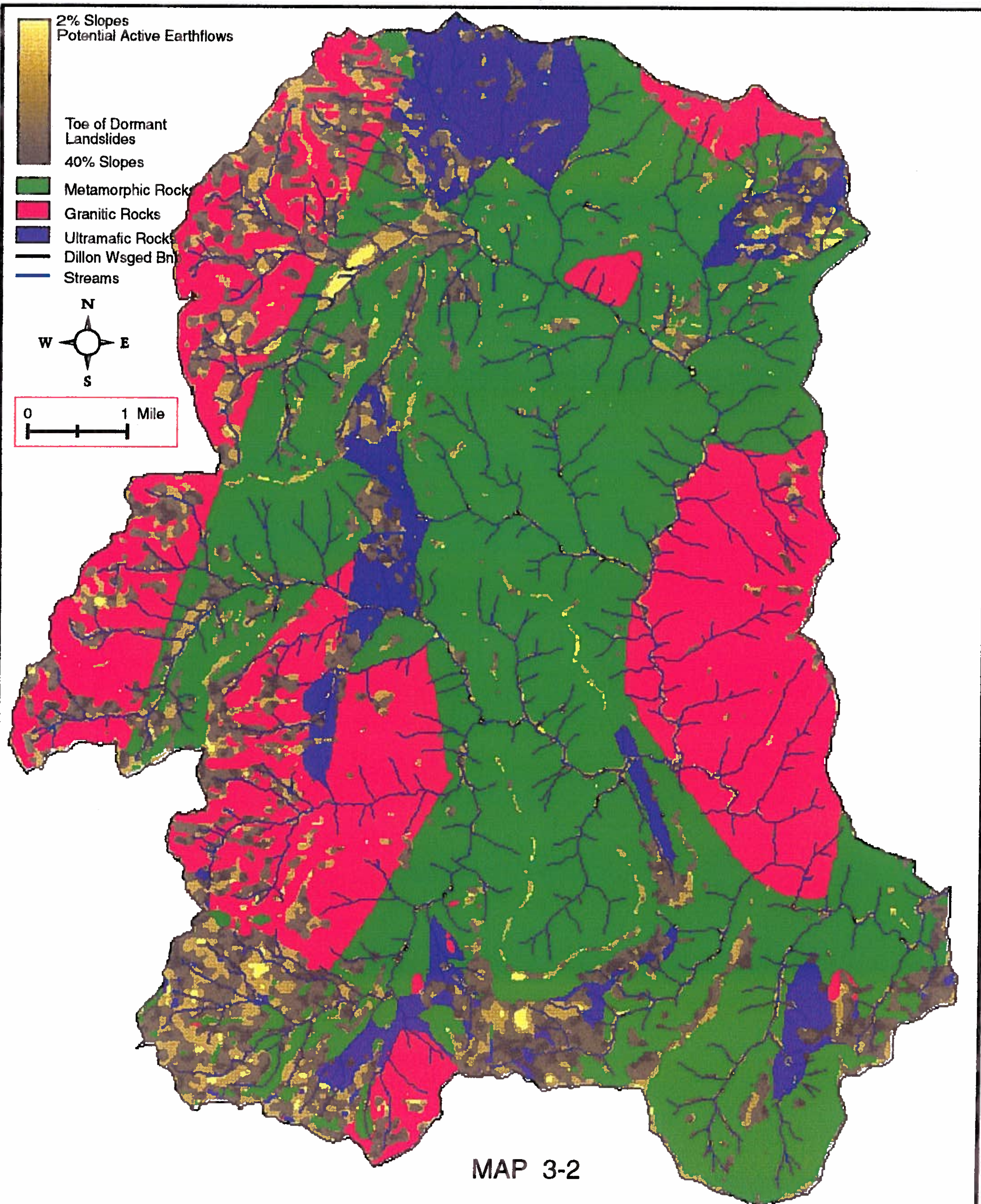
Ultramafic Terrane-This terrane occupies about seven percent of the Dillon Creek watershed. The chemical character of these rocks (high magnesium, low potassium) results in distinctive biotic habitats.

Dillon Geomorphic Terranes on Bedrock



MAP 3-1

Dillon 2% - 40% Slopes on Bedrock



MAP 3-2

FISHERIES AND WATER QUALITY

STREAM FLOW AND GRADIENT

Water quality of streams in the assessment area is very good. Turbidity is very low, except during periods of intense precipitation or landslide activity. The water quality data available include 15 years of documented observations of daily turbidity in Elk Creek, a similar basin located south of Happy Camp, and undocumented observations of turbid flow. Average daily discharge-rate record exists for nearby Indian Creek since 1957.

Streams in the Dillon Creek basin are high-gradient, coarse-bedded and, due to on-going uplift and climate of the region, erosion dominated. Channels typically run in steep, narrow gorges. Although influenced by large landslides and bedrock structure and composition, channel patterns are dendritic (branching).

Indian Creek, similar in many ways to Dillon Creek, has summer low flows of about 40 cubic feet per second (CFS). The average flow (exceeded 50% of the time) is about 400 CFS. Storm flow (with a return probability of once in a few years) is about 4,000 CFS. The peak discharge during the flood of 1964 has been estimated to be 40,000 CFS. Roughly half of the total annual discharge of the streams occurs in close association with storms. The remainder is delayed by movement through soil and bedrock, emerging at springs and feeding summer flow. Poorly integrated drainage networks and thick soil in old landslide terrane result in less efficient drainage. The steep slopes, thin soils, and well integrated drainage of the Metasedimentary Terrane result in more efficient drainage.

FINE AND COARSE SEDIMENTATION

Aside from a few broad, coarse alluvial deposits in Dillon Creek, relatively little sediment is stored in stream channels. Channels in Metasedimentary and Granitic Terrane are typically cut in bedrock. In the Old Landslide Terrane, channel banks are commonly of earthflow landslide deposits, so there is less mechanical resistance to erosion. Most of the coarse sediment generated to stream channels is delivered by landsliding. Fine sediment is generated by surface erosion of disturbed areas, as well as landsliding.

RIPARIAN RESERVES

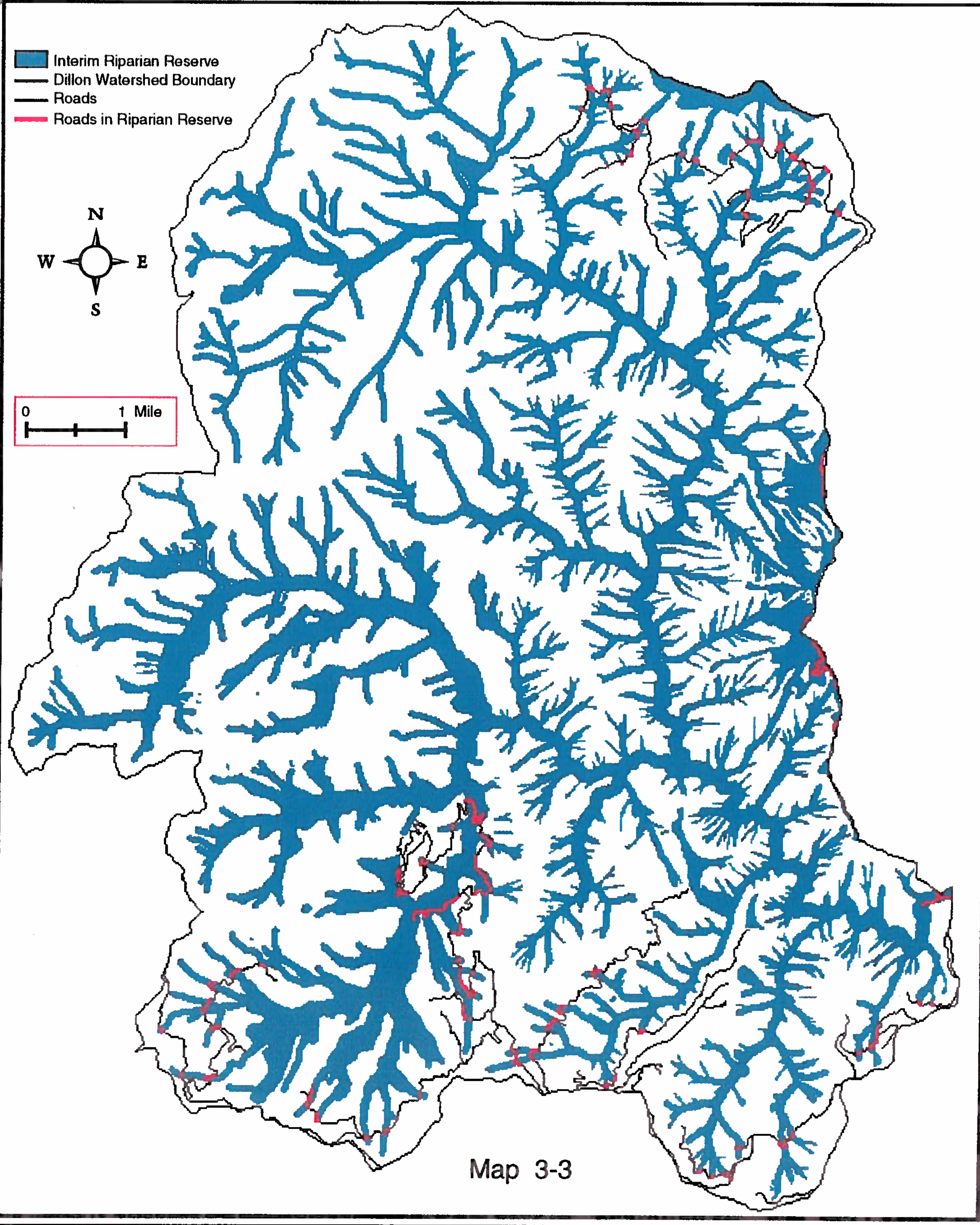
The Riparian Reserve (Map 3-3) consists of lands where riparian dependent resources receive primary emphasis, and where special standards and guidelines apply. This includes those portions of a watershed required for maintaining hydrologic, geomorphic, and ecologic processes that directly affect standing and flowing water bodies such as lakes, ponds, wetlands and streams. Also included are the habitat needs of a variety of animals such as mollusks, amphibians, lichens, fungi, bryophytes, vascular plants, American marten, red tree voles, bats, marbled murrelets and northern spotted owls.

Riparian Reserves include the land adjacent to all permanently flowing streams, constructed ponds and reservoirs, wetlands, lakes and natural ponds, seasonally flowing or intermittent streams, floodplains, and unstable and potentially unstable land (including earthflows).

Interim Riparian Reserves

The Record of Decision for the President's Forest Plan identifies Riparian Reserve widths to be applied in the interim period until watershed analyses are completed. Map 3-3 exhibits the reserves as described by site-potential tree height and unstable ground. These widths are as follows:

Dillon Roads and Interim Riparian Reserve



Map 3-3

a. Fish-bearing streams: 2 site potential trees or 300 feet, whichever is greater.

b. Permanently flowing, non fish-bearing streams: 1 site potential tree or 150 feet, whichever is greater.

c. Constructed ponds and reservoirs, along with wetlands greater than one acre: 1 site potential tree or 150 feet, whichever is greater.

d. Lakes and natural ponds: 2 site potential trees or 300 feet, whichever is greater.

e. Seasonally flowing or intermittent streams: 1 site potential tree or 100 feet, whichever is greater.

f. Floodplains.

g. Wetlands less than one acre: to the outer edge of the riparian vegetation.

h. Unstable and potentially unstable land: (active landslides, including earthflows, inner gorge, toe zone of dormant landslide deposits and deeply dissected granitic terrane).

DISTRIBUTION OF FISH POPULATIONS

There are approximately 33.3 miles of fish bearing streams in the Dillon Creek watershed. Fish bearing streams were determined by various stream surveys such as walking the stream, use of PVC pipe to observe below the water, and mask and snorkel diving. Fall-run steelhead trout are found in the North Fork of Dillon, mainstem Dillon, and Copper Creek, approximately 21.1 miles total. Spring-run steelhead, a sensitive species, are found within the North Fork of Dillon up to Vann Creek, mainstem Dillon to the confluence with Copper Creek, and up Copper Creek for approximately one mile. Spring-run chinook salmon, a sensitive species, have not been seen. Coho salmon have not been seen. Fall-run chinook salmon are found in the lower 3.2 miles of the mainstem of Dillon. Resident trout occupy all the fish bearing areas which include perennial streams (see Map 3-4): Jackass, Lick, and Vann Creeks on the North Fork, Medicine Creek on Copper Creek, and Coffee Can Creek on the mainstem.

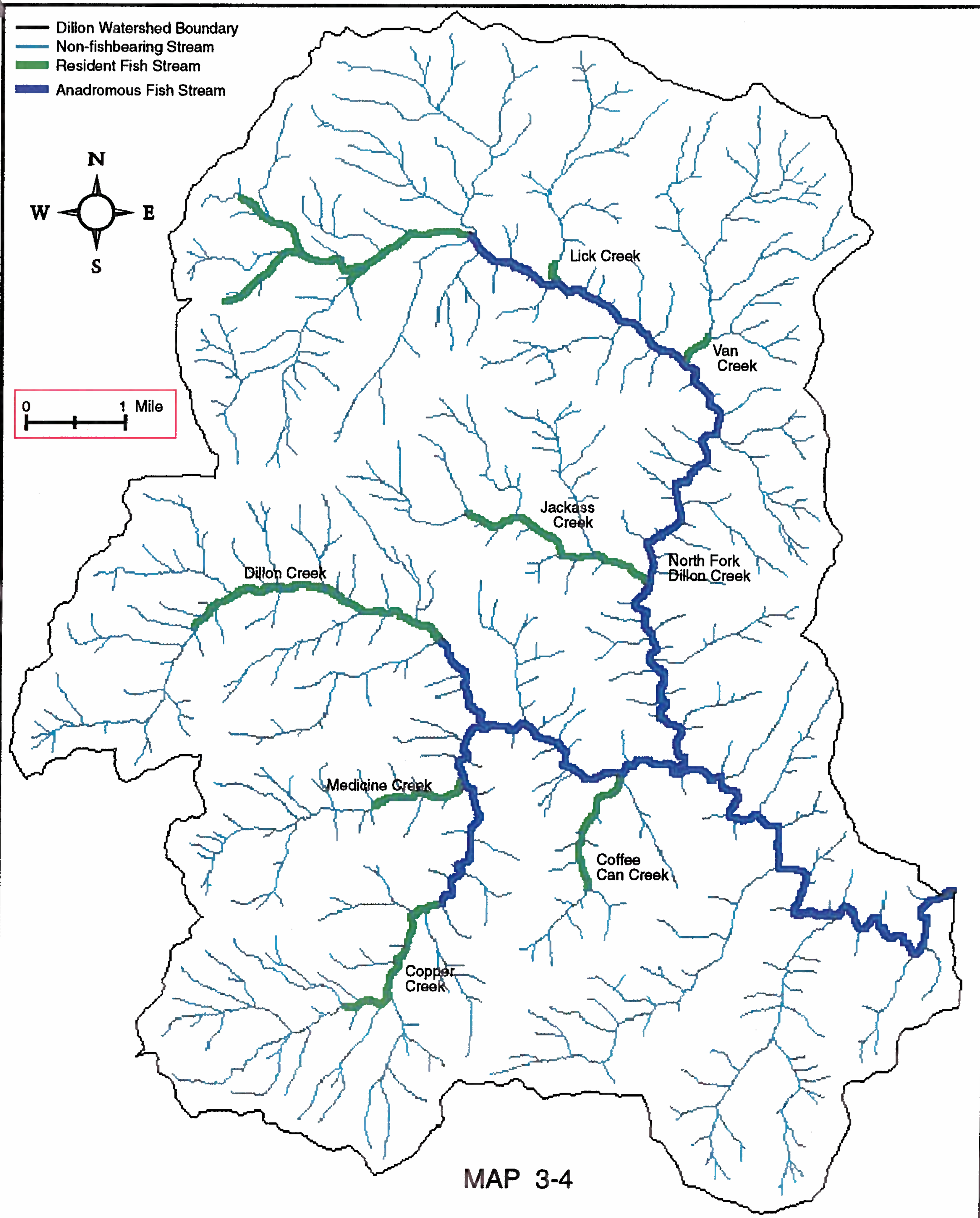
The above species rely on the streams within Dillon Creek for all lifestages (migration, spawning, incubation, rearing, and holding). Fish populations move up and down all the streams listed above with anadromous fish also using the migration paths leading to, from, and within the Pacific Ocean. Adult fall-run chinook are within the watershed from late September to early November, adult spring-run steelhead are present July to April, adult fall-run are present October to April, and adult winter-run are present November to May. Young salmon are present at least through mid-August, with steelhead remaining up to three years before outmigrating to the Klamath River.

Other anadromous species include the Pacific lamprey. Pacific lamprey spawn in the spring. The lamprey young (ammocete) remain in the substrate up to seven years before outmigrating to the Klamath River and the Pacific Ocean. Other resident species, including the Klamath smallscale sucker, are located in the lower two miles of mainstem Dillon Creek.

SIZE OF FISH POPULATION

Due to the steep bedrock composition and inaccessibility of Dillon Creek, only summer and fall surveys have been completed. Population trends can be suggested by summer steelhead counts in the summer and chinook salmon redd counts in the fall. Based on stream surveys conducted in 1989, spawning gravel availability exceeds the requirements of returning adult chinook salmon. Since 1990 redd counts for chinook salmon have been completed on the lower 3.2 miles of mainstem Dillon Creek (see Table 3-2).

Dillon Fish-Bearing Streams



MAP 3-4

Table 3-2 - REDD COUNTS FOR CHINOOK

YEAR	REDDS
1990	28
1991	7
1992	3
1993	23
1994	21

A barrier just below Cedar Creek at stream mile 3.2 was thought to block anadromous fish as reported by the California Fish and Game as late as 1970. After reports of adult steelhead above that point, summer steelhead counts were started in 1980 (see Table 3-3). The differences in miles surveyed indicate varying degrees of effort up the North Fork of Dillon Creek. These summer steelhead numbers are significant when compared to a total population in the state of between 2,000 and 4,000 depending on the year.

Table 3-3 - SUMMER STEELHEAD COUNTS

YEAR	MILES SURVEYED	STEELHEAD
1980	13.5	236
1981	14.0	187
1982	15.0	295
1983	5.8	500
1987	10.5	77
1988	10.5	294
1990	10.7	74
1991	not reported	88
1993	13.8	161
1994	no counts due to fire activities	---

The fish populations in Dillon Creek are believed to be natural with little hatchery mixing. Three marked juvenile chinook were found among 101 captured one mile up Dillon Creek on July 30, 1984. These marked juvenile chinook were released at Iron Gate Hatchery and represented seven percent of the juveniles released. On August 13, only one juvenile chinook was found (Mills 1990). While not producing large numbers of chinook salmon, Dillon Creek provides a refuge for "at risk" species, and a temporary refuge for downstream migrating juveniles. The National Marine Fisheries Service has proposed steelhead for listing as a threatened species.

HABITAT CONDITIONS

Stream surveys were completed in 1989 on the North Fork of Dillon Creek, Copper Creek, and the mainstem below its confluence with the North Fork. In 1991 the mainstem above the North Fork was completed. Key habitat conditions in Dillon watershed are displayed in Table 3-4.

Table 3-4 - EXISTING FISHERIES HABITAT CONDITION IN DILLON WATERSHED

PARAMETERS	MAINSTEM DILLON	N. FK. DILLON	COPPER	LMP DESIRED
Riffle Embeddedness - % average	13	5	12	20
Fine Sediment Spawning Areas - % average	22	6	19	15
Primary Pools per 6 - bankful widths	.9	.8	.1	1
Coarse Woody Material - per 1000 linear feet	.7	--	--	20

Mainstem Dillon and Copper Creek exceed recommended percent fines in spawning gravels. Watershed restoration efforts along existing roads can reduce the amount of fine sediments reaching these streams.

Primary pools and coarse woody material are below desired conditions. Pools in higher order streams are more likely to meet the depth requirement for this habitat criteria. Coarse woody material was only measured in the mainstem. However, it appears from observations in unmanaged portions that the high gradient streams in this watershed were unlikely to ever have coarse woody material in the numbers recommended in the current land management plan.

Water Temperatures

Stream water temperature is primarily increased by removing riparian vegetation and exposing the stream to direct solar radiation. Adjacent air temperatures also influence stream water temperature at the air/water interface. In 1970, summer temperatures in the mainstem were reported as 15 degrees Celsius just above Copper Creek, 17 degrees Celsius just above the North Fork, and 21 degrees Celsius at the mouth. During stream surveys in 1989 and 1991, summer temperatures varied from 9-12 degrees Celsius in Copper Creek, 11-16 degrees Celsius in the North Fork, and 13-20 degrees Celsius in the mainstem. From 1992-1994 a recording temperature gage has been located above the mouth of mainstem Dillon and has indicated average seven day maximum temperatures of 23.1, 19.7, and 22.6 degrees Celsius respectively.

The draft Forest LMP desired maximum temperature is about 20 degrees Celsius. It would appear that Dillon watershed generally meets this desired condition with the exception of the mainstem below its confluence with the North Fork, and that temperatures have not radically changed in the recent past. These temperatures should have little impact on steelhead populations, but could impact chinook populations. The steelhead receive little impact because most of their habitat is higher in the watershed where temperatures remain cooler. As water temperature increases, less of the benefit from food intake is converted to growth and improved fitness. The aquatic species must use more calories to maintain a higher metabolic rate. In some species this can increase mortality rates.

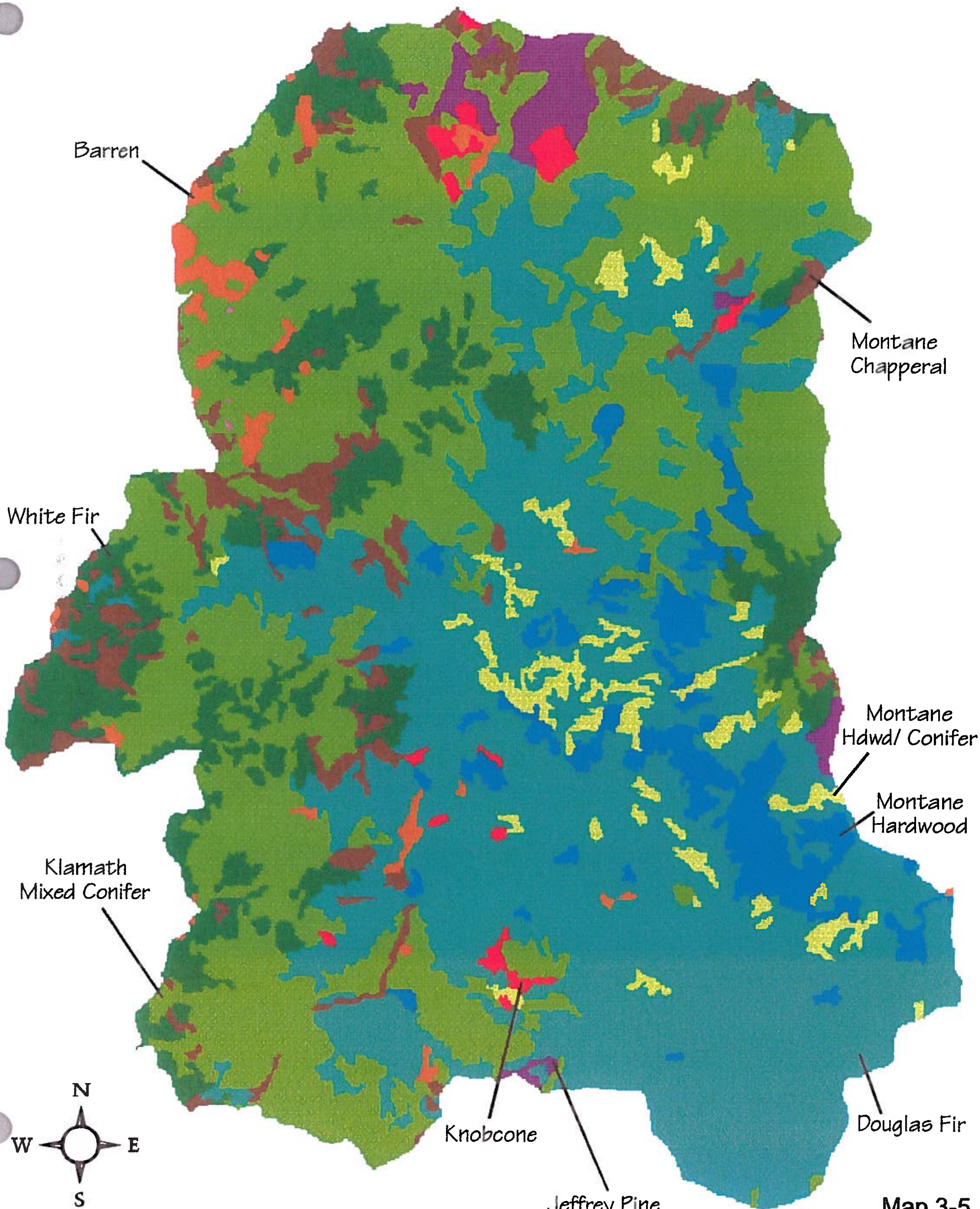
VEGETATION

EXISTING VEGETATION TYPES

The vegetation of Dillon Creek watershed is predominantly characterized by Douglas-fir and Klamath mixed conifer (Map 3-5). Sixty-five percent of the watershed has a conifer canopy closure of less than 40%, while 56% of the watershed has a combined conifer/hardwood canopy closure of less than 40%. Five percent of the the watershed has been harvested.

The vegetation in Dillon Creek is described in terms of dominant plant communities and the seral condition of the communities by adapting aerial photography-based information to local conditions. Groupings of

Existing vegetation types using WHR criteria.



Map 3-5

timber strata and timber type have been reclassified to conform to the Wildlife Habitat Relationship (WHR) criteria (Mayer and Laudenslayer 1988). Use of WHR types allow a standardization of terminology between various agencies and the use of wildlife habitat models developed for California which facilitate analysis of habitat change. Characteristics associated with each type are summarized below.

Douglas-fir - In this type, Douglas-fir comprises at least 75% of the overstory trees, with sugar pine and ponderosa pine frequently represented. The understory tends to be tanoak and madrone on more mesic soils, with black oak or canyon live oak present in minor amounts on drier areas of Douglas-fir dominated sites. On the wettest sites of the Douglas-fir type, particularly in riparian-influenced areas, Port-Orford-cedar and Pacific yew are often present.

Klamath Mixed Conifer - This type is known as Klamath enriched mixed conifer type to distinguish it from its Sierra Nevada counterpart. It generally occurs just above the Douglas-fir type in elevational gradient, and in Dillon Creek it is transitional between Douglas-fir type and the cooler and moister white fir type. Several overstory species are usually present and include sugar pine, Douglas-fir, white fir, incense-cedar, and ponderosa pine. Port-Orford-Cedar is occasionally present in riparian influenced areas. In the Dillon Creek drainage, there are relic populations of Brewer spruce, mountain hemlock, and western white pine. Alaska yellow cedar occasionally occurs at the higher elevations in this type. Common understories include chinkapin, black oak, saddler oak, thimbleberry, and other members of the montane chapparal type described later.

White fir - While white fir is present in much of the Klamath enriched mixed conifer type, it is considered a distinct type and to have different ecological characteristics than the Klamath Mixed Conifer type when it occurs in 70% to100% of the overstory. The stands often have overlapping crowns and cast deep shade after the early seral condition. The stands are typically arranged in a mosaic of distinct size/age groups that are at different seral stages. Understory vegetation, where present, consists of chinkapin, mountain whitethorn, snowbrush ceanothus, or saddler's oak. Forbs that are common in this type are white vein shinleaf, prince's pine, bracken fern, vetch, and vanilla leaf.

Jeffrey pine - Jeffrey pine occurs as a distinct type almost exclusively on ultramafic soils in Dillon Creek. It comprises 70% to 100% of the overstory layer, with incense-cedar and sugar pine present in lesser amounts. The understory is typically huckleberry oak, coffeeberry, manzanitas, or mountain whitethorn. It occurs on poor sites that generally support only a low density scattered overstory. Where large areas have been killed by intense wildfires, natural regeneration of this Jeffrey pine type is often very slow, perhaps 40-60 years (Laven 1982). Ponderosa pine (and hybrids) sometimes occur in or at the fringes of this type. Ponderosa as a distinct type occupies very little area in Dillon Creek, and is nearly the same in its wildlife habitat utility, so it is included with the Jeffrey Pine type in this analysis.

Montane Hardwood-Conifer - In the definition used here, at least one-third of the overstory is conifer and one-third to two-thirds of the overstory is broad-leaved hardwoods. This type is frequently in a mosaic pattern with the Douglas-fir type. On slightly better adjacent sites, the conifers readily overtake the hardwood layer, but this type refers to areas where the hardwoods persist and occupy up to two-thirds of the overstory layer. Some of this type may have the potential to progress to a Douglas-fir type, but the arrangement is often stable for relatively long time periods and has some distinct differences in wildlife habitat usage. Douglas-fir, sugar pine, ponderosa pine, black oak, madrone, tanoak, chinkapin, bigleaf maple, and dogwood are typically the primary components.

Montane hardwood - This type is normally characterized by a canyon live oak overstory with a poorly developed shrub layer and a sparse herbaceous layer. The overstory is typically widely spaced and crowns seldom overlap, reflecting the low site potential conditions of rocky, shallow soils. Some incense-cedar, Douglas-fir, or sugar pine may be present, but usually only at one or two trees per acre that probably represent favorable microsite conditions within the live oak-dominated areas. This type rarely occurs on sites that have the potential to progress to conifer types, as they are usually very poor sites. Stand replacement events are uncommon in this type. The sites produce dead-fuel loadings very slowly, more slowly than the fire frequency available to them, even in the era of fire suppression.

Montane chapparal - This general type has two forms that are typical. One type is a short-term (20 years or less) seral condition following a stand replacement fire in Douglas-fir, Klamath Mixed Conifer, or White Fir type, and the other is a fire-maintained climax that does not readily progress to a conifer type. For this analysis, the shrub-climax condition is classified as Montane Chapparal in Dillon watershed. It is generally on the mid to higher elevation slopes and on steep, southerly aspects. It occurs on sites where the fuel moisture is often lower than elsewhere on the terrain. Fire events in this type tends to be of high intensity, and more frequent than the ability of conifers to successfully invade and become fire-resistant. It contrasts with adjacent sites that have better growth potential and where conifers can grow to fire resistant size more quickly. Adjacent sites also have slightly higher moisture retention in the soil and in the fuels which creates fires of lower intensity compared with the Montane Chapparal type. These persistent brushfields are composed of several combinations of fire-adapted shrub types, most of which resprout after fires and produce abundant seeds. Some seeds, in particular snowbrush and deerbrush ceanothus, can lie dormant in the soil until the heat of a fire activates them. Due to variations in individual site conditions and disturbance histories, the dominant shrubs will vary among different Montane Chapparal sites, but all tend to serve as valuable forage sources. Within Dillon watershed, there are Montane Chapparal areas that have snowbrush ceanothus, huckleberry oak, pinemat manzanita, deerbrush ceanothus, chinkapin, juneberry, yerba santa, and whitethorn present in varying proportions and presence.

Knobcone pine - This type occurs in areas that are dominated by pure or nearly pure knobcone pine overstory. It often exists on areas with ultramafic soil influence and moderate moisture availability, which contrasts it with otherwise similar conditions to Montane Chapparal areas. It too undergoes periodic intense stand replacement fires, and regenerates by means of serotinous cones and very early (sometimes as young as five to seven years) cone production.

Barren - Barren areas are less than ten percent vegetated.

Map 3-5 shows the vegetation type distribution, based on post 1994 Dillon fire condition. The acres of each type and how much of the watershed is covered by that type is represented in Table 3-5.

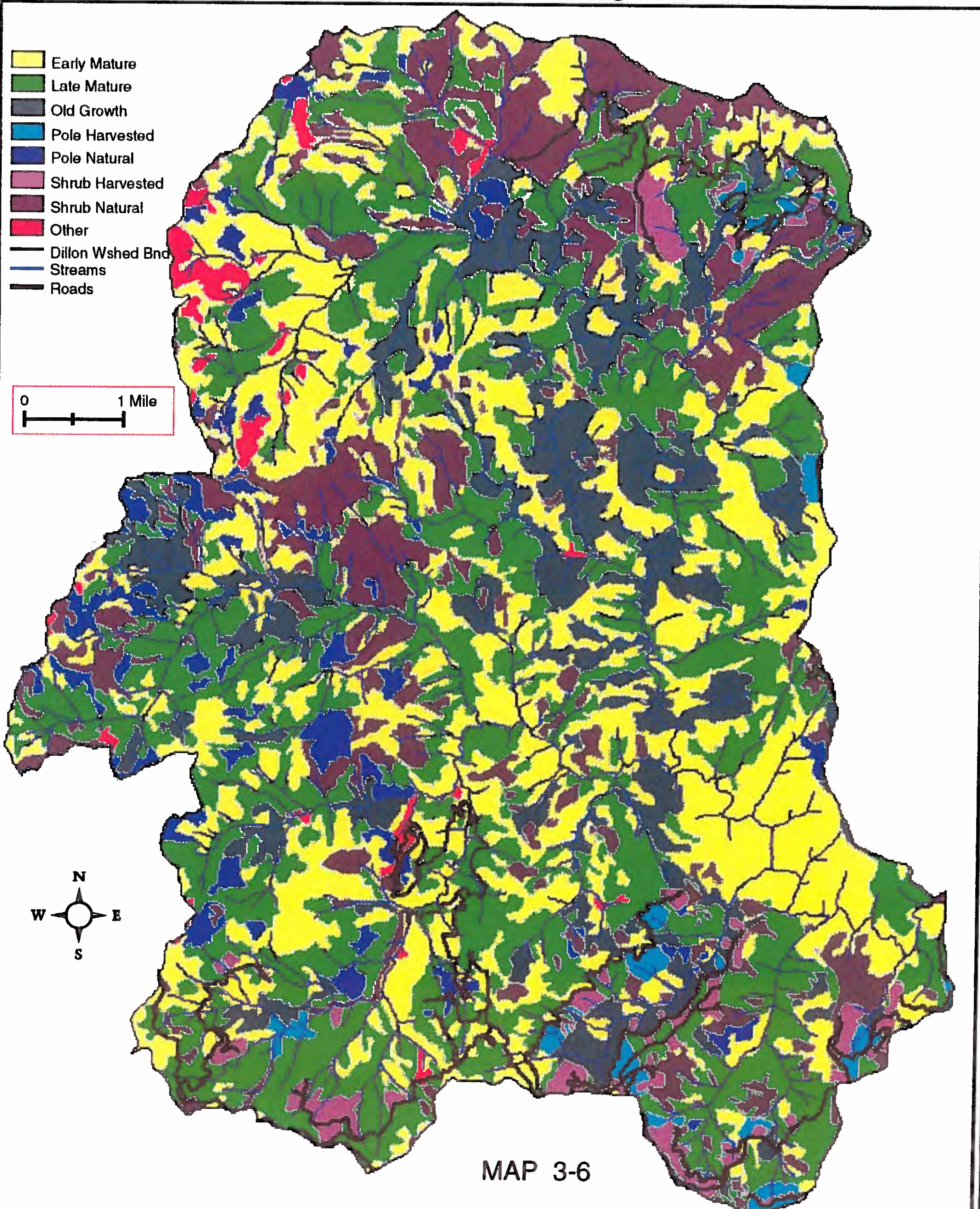
Table 3-5 - DISTRIBUTION OF WHR VEGETATION TYPES WITHIN THE WATERSHED

VEGETATION TYPE	ACRES	PERCENT OF THE WATERSHED
Douglas-fir	17,705	38.0
Klamath Mixed Conifer	16,530	35.0
White Fir	4,748	10.0
Jeffrey Pine	760	1.6
Montane Hardwood-Conifer	1,395	3.0
Montane Hardwood	2,305	5.0
Montane Chapparal	2,341	5.0
Knobcone	386	0.8
Barren	680	1.5

SERAL CONDITIONS

The concept of seral conditions is a description of the age and development of forest communities and the physical canopy characteristics present during the various stages of succession. It focuses on the size of the larger vegetation and the development along a continuum that goes from grasses and forbs to old-growth conditions. Map 3-6 shows the seral stage distribution, based on post 1994 Dillon fire condition. Table 3-6 displays acres and percent of each seral condition for 1994.

Dillon Seral Stage



MAP 3-6

Table 3-6 - SERAL STAGE BREAKDOWN

CATEGORY	ACRES	PERCENT
Grass/forb	682	1
Shrub/seedling (natural)	6,744	14
Shrub/seedling (harvested)	1,115	2
Pole stands (natural)	1,836	4
Pole stands (harvested)	709	2
Early mature	14,342	31
Late mature	15,475	33
Old-growth	5,962	13

PORT-ORFORD-CEDAR

Populations of Port-Orford-Cedar (*Chamaecyparis lawsoniana*)(POC) occur generally in the Dillon watershed in pockets and narrow, non-continuous arrangements near streamsides or seep areas (Map 3-7). Of the 249 total miles of stream in Dillon, 87 miles have POC adjacent to them. Stands with POC as a component cover approximately 3,730 acres, of which 1,236 are within wilderness boundaries.

Phytophthora lateralis causes a fatal root disease of Port-Orford-Cedar (POC). It is a soil-borne, root-inhabiting fungus that infects POC roots, kills the roots and girdles the tree at the root collar. The presence of the root disease is widespread within POC's range in Oregon. The disease in California remains essentially confined to the Smith River watershed on the Six Rivers National Forest and three widely separated locations along Highway 101. Although the disease was first reported in California on portions of the Smith River watershed in 1980, it was likely present in that drainage much longer, probably since the mid-1960s. The disease has spread within some drainages of the Smith River watershed since monitoring by the Forest Service began in 1980. The distribution of the POC in these drainages is generally more continuous than in the Klamath watershed, including the Dillon watershed. This lethal disease poses a serious threat to the Port-Orford-Cedar resource throughout its range, which is limited to western Oregon and scattered locations in northern California.

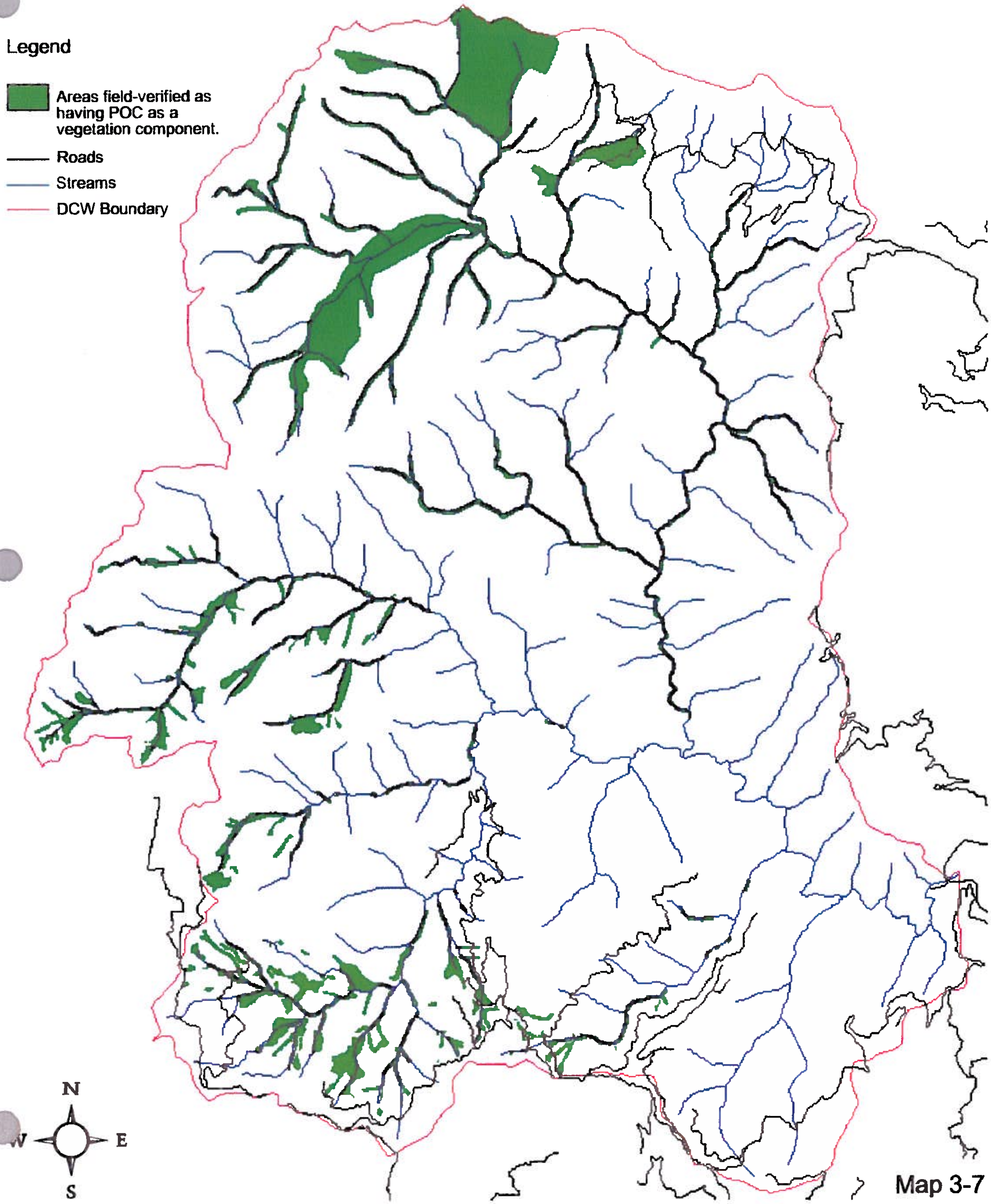
There are no known sites of POC root disease within the Dillon watershed; the threat is associated with the potential introduction of the disease from outside sources. A number of mitigation measures to minimize the risk of importing the fungus and to reduce further spread have been implemented successfully in timber sales and other projects in stands with POC. These include the washing of equipment used in road building and harvesting, restricting activities to the dry season, and restricting access.

A combination of an inherent low risk of establishment and effective mitigation measures have presented spread and establishment of the disease in watersheds other than the Smith River watershed in California. Despite numerous, and in many cases uncontrollable, opportunities for disease spread, such as through public access and use, timber management, and recreational activities, the Klamath, the Upper Trinity and the Sacramento Rriver systems remain uninfested and free of the disease. This indicates that spread and establishment of the disease to new watersheds is a rare or unusual event and that mitigation measures may have contributed to the exclusion of the disease from our area.

No genetic resistance to the pathogen among POC individuals has been documented, although there are indications that some may exist (Hansen 1989). Some level of genetic variation in the rate of how fast infected trees die has been observed. The Forest Service is conducting a research project to acquire the information necessary to determine the amount of genetic variation in POC.

The gene pool of POC on the Happy Camp Ranger District has received protection through seed collection and storage activities in the seed bank. Additional protection to the species is gained due to the fact that over 1,000,000 acres of set-aside areas of National Forest System land have POC present within their boundaries. This includes but is not limited to wilderness areas, research natural areas, etc., with another

Known Port-Orford-cedar locations



Map 3-7

30,900 acres proposed for set-asides in the near future. Over 74,000 acres of set-asides with POC have been established or are proposed on the Happy Camp Ranger District. With set-aside areas, and the fact that not all of the POC found in heavily infected areas have succumbed to the root disease, the prognosis for protection and long-term survival of the species is optimistic.

SENSITIVE PLANTS

Botanical surveys are conducted as part of the standard management practices specified in Forest Service procedures for environmental analysis and project planning. The purpose of the surveys is to identify sensitive and managed species to assure that they do not become threatened or endangered because of human activities.

PLANT SPECIES OF CONCERN

Sensitive plants are those species which may occur in few to large numbers in a small localized area, or which may occur in a wide geographical area but in few numbers in restricted specialized habitats. These are often negatively impacted by land management ground activities, although some sensitive plants show a positive response to disturbance. Plants for which there is a concern for species viability have been listed as sensitive by the Regional Forester. Thirty-three sensitive plant species are known, or thought likely to occur on Klamath National Forest (USDA KNF 1995).

Managed plants are those which occur in greater numbers or less specialized habitats but need to be monitored to assure that they do not become listed as sensitive. All Klamath National Forest managed species have approved species management guides which direct management actions to ensure that species viability is maintained. Four plant species are designated as managed on Klamath National Forest.

An additional list of plant species that may occur on the Klamath are designated for special management in the President's Plan (USDA 1994 Table C-3). These species are designated as survey and manage species (C-3).

Only those species of concern that have suitable habitat or documented occurrences in the Dillon assessment area are discussed in this document.

Of the thirty-three sensitive species of concern on the Klamath National Forest, the following ten species have known populations or suitable habitat located within the Dillon Creek watershed.

Table 3-9 - KNOWN OR POTENTIAL SENSITIVE PLANT POPULATIONS

SPECIES NAME	HABITAT	DISTRIBUTION AND RARITY	MANAGEMENT SENSITIVITY
Arabis aculeolata, Waldo rock cress	Rocky serpentine slopes of high metal content. 1000 to 8000'.	Klamath Mountains endemic. Siskiyou and Del Norte Counties and Southwest Oregon. >3 populations on the Klamath National Forest.	Tolerance to disturbance unknown. Information lacking of incomplete due to the rarity of this species. All populations should be protected.
Arabis serpentinicola, Preston Peak rock cress	Rocky serpentine slopes. > 5700'	Klamath Mountains endemic. Known from only three locations in the Siskiyou Wilderness.	Tolerance to disturbance unknown. Information lacking or incomplete. Occurs in area with little or no resource or land use conflict. Due to rarity of the species, all populations should be protected.
Castilleja elata, Siskiyou paintbrush	Wet bogs, seeps, meadows and streamsides, on ultramafic soils.	Western Klamath Region, Southern Oregon, Del Norte County. No verified populations on Klamath National Forest.	Information lacking or incomplete.

Table 3-9 con't.

SPECIES NAME	HABITAT	DISTRIBUTION AND RARITY	MANAGEMENT SENSITIVITY
Eriogonum hirtellum, Klamath Mountain buckwheat	Ultramafic outcrops or gravelly slopes and ridges. 2000' to 8,500'	Local endemic, Northwest Siskiyou County near Humboldt County and Oregon Borders. Tom Martin Peak. 38 populations on Klamath National Forest.	Some historic populations have apparently been destroyed by past logging activities.
Lewisia cotyledon var. heckneri, Heckner's lewisia	Rock outcrops, more or less dry environment. Low to mid elevations. Often on ultramafics.	Trinity, Siskiyou, and Humboldt Counties. 4 populations on Klamath National Forest.	Generally easy to protect, as rock outcrop habitat is easily recognized.
Lewisia cotyledon var. howellii, Howell's lewisia	Rock outcrops, more or less dry environment. Low to mid elevations.	Shasta County to Southern Oregon. 88 populations on Klamath National Forest. Doubtfully distinct from above species.	Generally easy to protect, as rock outcrop habitat is easily recognized.
Pedicularis howellii, Howell's lousewort (also C-3)	Edges of openings or in shade within conifer forests. 4000' to 6500'	Restricted Siskiyou Mountains endemic but >20 populations within the Klamath National Forest.	Species Management Guide being developed.
Sedum laxum ssp. flavidum, pale yellow stonecrop	Rock outcrops, sometimes ultramafic.	Northwestern California. >40 populations, 16 on the Klamath National Forest.	Probably more common than known, but hard to identify.
Silene marmorensis, Marble Mountains catchfly	Yellow pine to Douglas fir forests predominately in openings with little competition. <4500'.	Salmon and Marble Mountains. >40 populations.	Information incomplete. Species may be able to tolerate some disturbance. Species Management Guide being developed.
Tauschia howellii, Howell's tauschia	Exposed, dry ridges. 6500' to 7500'. Red fir forests, on DG soils.	Three population areas. The Marble Mountains, Siskiyou Crest, and Bear Peak.	Due to the rarity of this species, all populations should be protected. Occurs in areas with little or no resource or land use conflicts.

The Dillon Creek watershed contains habitat or known populations for four species that are managed on Klamath National Forest under approved Species Management Guides (designated as Managed). In addition, the Dillon Creek watershed contains habitat or known populations for four species listed in Table C-3 of the ROD (designated as C-3). These plants are listed as species of late-successional forest habitats that will require special management.

Table 3-10 - KNOWN OR POTENTIAL MANAGED PLANT POPULATIONS

SPECIES NAME	HABITAT	DISTRIBUTION AND RARITY	MANAGEMENT SENSITIVITY
Allotropa virgata, sugar stick (C-3)	Closed canopy, mature and old-growth forests. Sea level to 9,000'.	Pacific Northwest, to British Columbia, Idaho, Montana. Wide distribution common, but in small isolated populations. >10 populations on the Klamath National Forest.	Tolerance to disturbance unknown. Information lacking of incomplete. Need to document known populations.
Cypripedium californicum, California lady's slipper (Managed)	Seeps, springs, bogs, streambanks within lower montane coniferous forests, on ultramafics. 200' to 6600'.	Local endemic. Northwest California to Southwest Oregon. 24 populations on the Klamath National Forest.	Tolerance to disturbance unknown. Information lacking of incomplete. Approved Species Management Guide.
Cypripedium fasciculatum, clustered lady's slipper (Managed and C-3)	Shady sites within mature to old-growth forests. 300'-5,000'	Uncommon but widespread. Pacific Northwest to British Columbia, Montana, Colorado. >50 populations on the Klamath National Forest.	Tolerance to disturbance unknown. Information lacking or incomplete. Approved Species Management Guide.
Cypripedium montanum, mountain lady's slipper (Managed and C-3)	Shady sites within mature to old-growth forests. 600'-6,500'	Uncommon but widespread. Pacific Northwest to Alaska, Montana, Wyoming. >50 populations on the Klamath National Forest.	Tolerance to disturbance unknown. Information lacking or incomplete. Approved Species Management Guide.
Lilium wigginsii, Wiggin's lily (Managed)	Seeps, springs, bogs, streambanks within montane coniferous forests 2400' to 6000'. Northwestern California to Southwestern Oregon.	Local endemic. Northwest California to Southwest Oregon. >225 populations on the Klamath National Forest.	Tolerance to disturbance unknown. Information lacking or incomplete. Approved Species Management Guide.

1994 DILLON FIRE HISTORY

The west side of the Klamath National Forest was hit by a dry lightning storm during the night of July 20 and morning of July 21. The Happy Camp and Ukonom Districts were faced with approximately 30 individual fires, 15 of those in the Dillon watershed. Most of these fires were in the steep, inaccessible terrain of the North Fork of Dillon and Jackass Creeks.

The strategy on the day of July 21 was to staff as many of the fires as possible to contain or control them while they were still small. Personnel and aircraft support were in short supply due to all of the fire activity from lightning storms in northern California and southern Oregon. Only a handful of fires were staffed by afternoon, when thunderstorms moved back into the area. The thunderstorms brought strong, erratic winds with no rain, and several of the fires (staffed and unstaffed) reached blow up conditions and increased greatly in size.

Firefighter safety became a concern under these conditions, and all personnel on fires on the west side of Dillon Creek were removed by helicopter late on July 21 or the morning of July 22. The initial attack on the Pony Peak Fire went better, and the decision was to continue to staff it. Maintaining control of this fire would confine fire to the west side of the main fork of Dillon. This was the only fire staffed in Dillon Creek for the next few days and it was controlled at 30 acres. All the other fires in Dillon Creek burned together between July 22 to August 7.

The Klamath Province with its steep topography and deep canyons is known for temperature inversions. The cool air settles down at night and with it the smoke. The smoke may not allow much sun penetration the next day, and without the sun to warm the slopes and wind to move the smoke and cooler air out, the inversion may not lift for days. These inversions greatly reduce visibility for aircraft, and the cool, moist air trapped underneath them reduces fire intensity. The expanding fires in Dillon Creek contributed to a significant inversion. The poor visibility reduced the use of aircraft for direct suppression, support, or reconnaissance of the fires for many days. Fire activity can rapidly increase when inversions lift and attempting direct attack on fires with poor location information can place firefighters at risk. For safety reasons, a decision was made to not attempt direct attack on the fires in remote areas in Dillon Creek under these conditions.

Eventually the weather changed. Marine air pushing in from the coast in combination with the inversion significantly slowed the fire spread. These conditions allowed for more aggressive fire fighting tactics. There was an expectation that the North Fork and main stem of Dillon would hold the fire. This strategy appeared to be working well and the fire continued to burn within the perimeters until August 7.

On August 7, the fire spotted across the North Fork of Dillon Creek near the mouth of Lick Creek. This coincided with a continuing loss of the coastal marine influence and a weakening of the inversion. Again, a decision was made to abandon direct attack strategies, and instead establish an indirect control line along the ridge from Red Hill to a point east of the mouth of Vann Creek and then tie into the North Fork. This perimeter was then backfired to secure the line. Aerial ignition was used to "lead" the fire down the slope to meet the wildfire coming upslope from the North Fork and reduce the number of high intensity runs. This effort was successful. The fire continued to burn out islands within the perimeter until early November.

1994 DILLON FIRE EFFECTS

Burn intensity varied considerably throughout the fire area depending upon the fuels and weather conditions that existed when a particular area burned. During much of the fire a temperature inversion, with its top around 4,000 to 5,000 feet, moderated fire intensity and kept the fire confined to the ground. The highest burn intensities occurred on those few days or hours of the day when the inversion lifted and the weather was clear. During the periods when the inversion was in effect, burn intensities depended on the available fuel load.

Stands with the most visible fire damage were identified from aerial photography taken in early October, 1994. Damage estimates were based on kill to the overstory and midstory layers of forest stands or canopy layer of brush or hardwood areas. Map 3-8 displays the fire effects to vegetation in Dillon Creek overall, and Map 3-9 is a translation of that information into gross amount of fire-killed timber concentrations. Map 3-9 also depicts the interim riparian reserves so the reader can estimate the extent of fire-killed timber in the riparian reserve areas.

Approximately 4,895 acres were identified as having suffered a high intensity burn (70% to 100% canopy kill), where all of the overstory vegetation was killed outright and partly consumed, and most of the ground fuels were completely consumed. There is little vegetation left on these sites except dead, blackened, standing tree stems and bare, exposed, discolored soil and rock.

Another 2,336 acres were identified as suffering moderate intensity damage (30% to 70% canopy kill), where the majority of the vegetation was crown damaged, and approximately half was killed outright. Nearly all of the understory vegetation has been killed. Most of the ground fuels have been consumed, and the continuity of the remaining large fuels and any green or scorched vegetation is broken. In general, higher fire intensities occurred in areas of heavy fuel concentrations.

The remainder of the burned area (19,963 acres) experienced a low intensity fire where less than 30% of the overstory was killed as either scattered individual trees or small pockets (less than five acres). The understory suffered damage which varied from scorching of smaller conifers, hardwoods and brush, to mortality of all hardwood trees and smaller conifer saw timber. Here also, much of the surface organic matter and ground fuels were consumed. In areas where the fire intensity was low, there are occasional unburned or less burned "islands" where ground fuels, duff, and litter were not completely consumed.

Due to low fuel moisture, ground fires developed a great deal of heat where heavy fuels existed. Most trees in the watershed were under moderate to severe drought stress in the summer of 1994. Experience indicates that hidden fire damage, coupled with high pre-fire or post-fire drought stress conditions will likely cause many apparently undamaged trees to die in subsequent years. Prediction from visual indicators of which trees will die within the next several years is imprecise, as latent mortality has been found to be extremely variable.

WILDLIFE

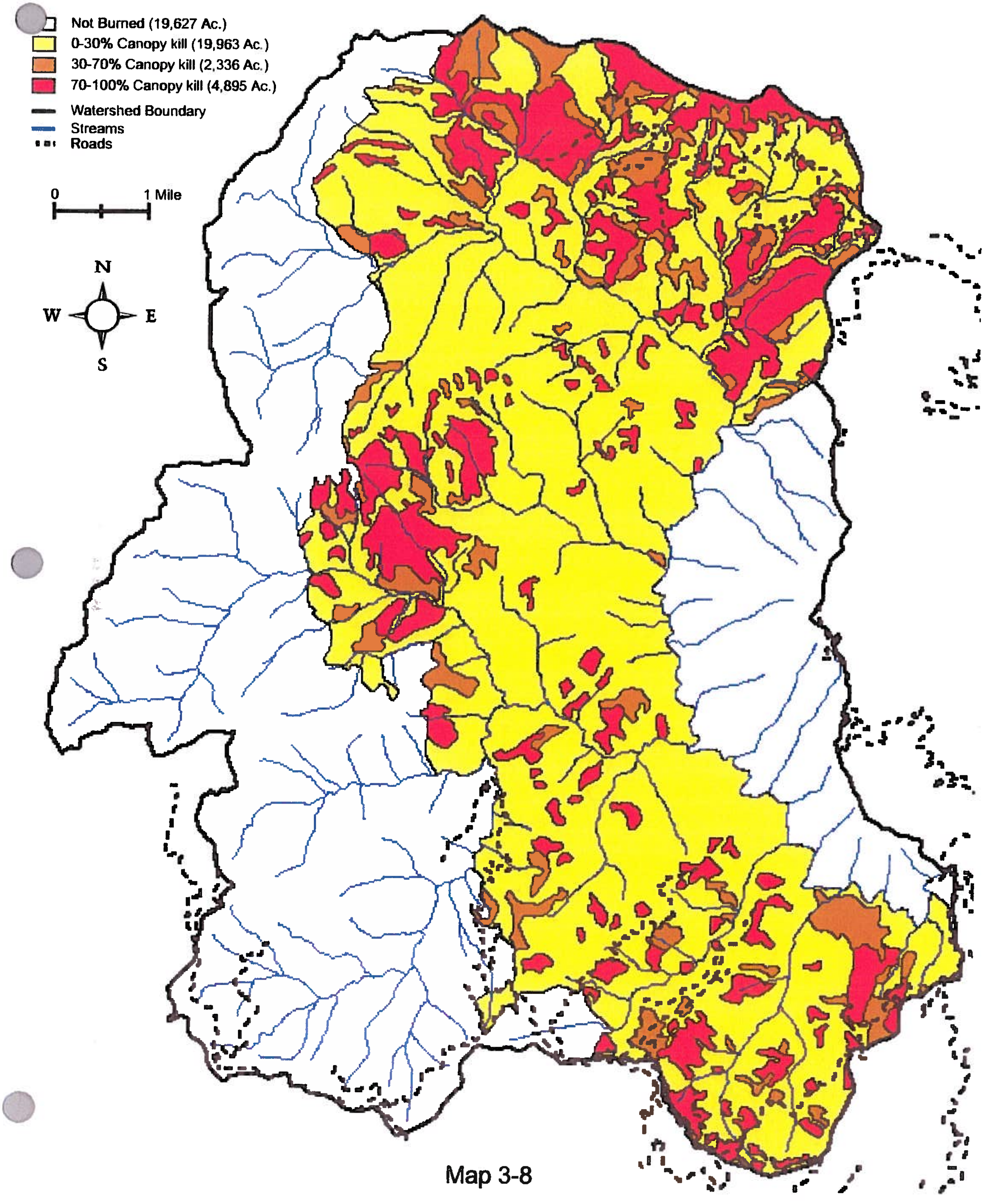
INTRODUCTION

Wildlife abundance and distribution is largely influenced by habitat. Wildlife habitats are determined by the distribution of vegetation communities on the landscape, by their structure and by the mix of species within a community. Although all of these are important to some species of wildlife, most species respond more to vegetation structure than to plant species composition (Thomas et. al. 1990).

The Dillon Creek drainage supports a variety of wildlife species, representative of animals found throughout northwestern California. It may be especially diverse because of the range of habitats found within the 46,866 acre watershed from small intermittent streams to high mountain meadows in the Siskiyou Mountain Wilderness Area. All seral stages are represented here with a corresponding complement of wildlife species.

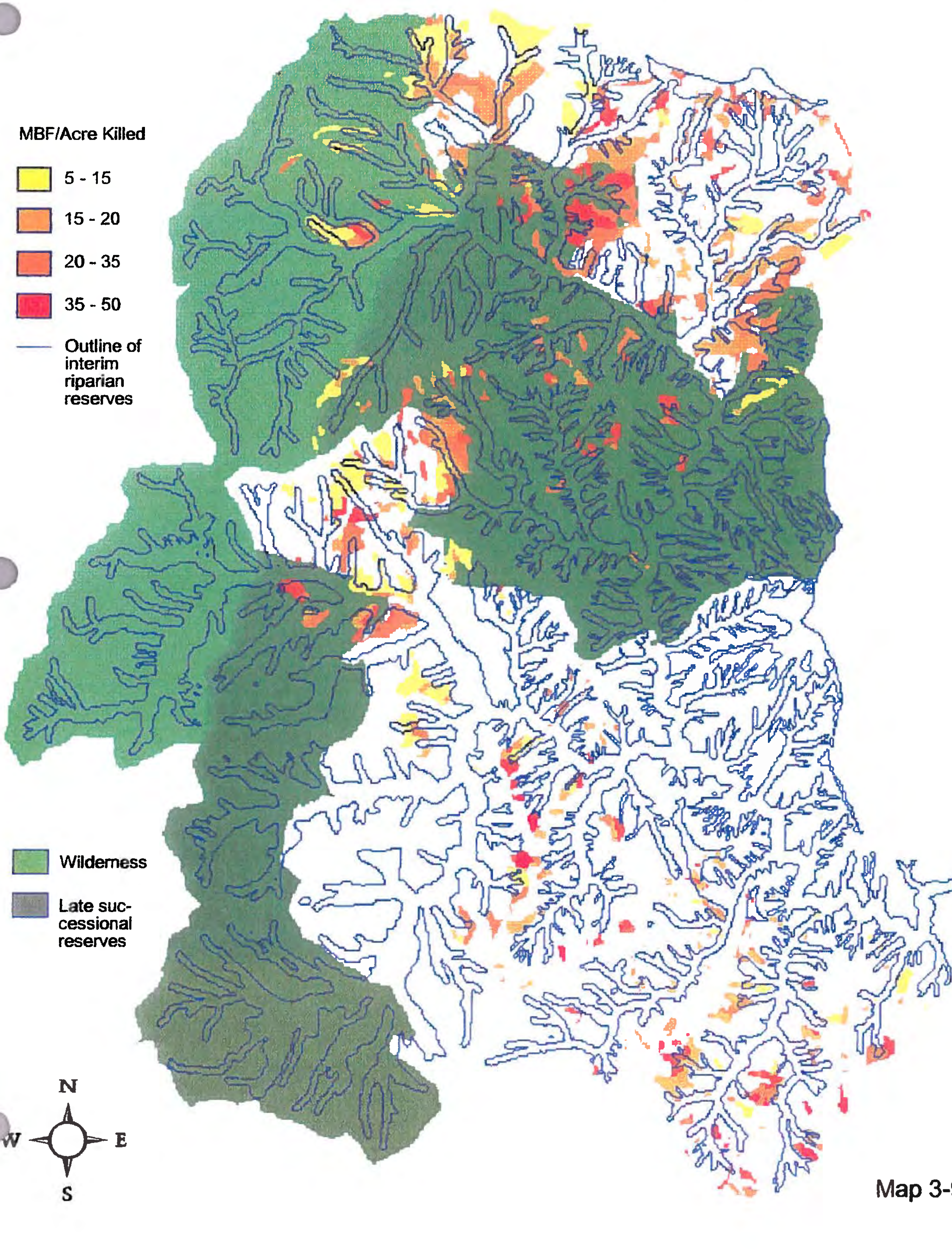
For this analysis, wildlife species have been grouped into guilds using home range size and general habitat use as parameters. Definitions for the parameters can be found in the Glossary of this document. The purpose is to design an analysis that will address habitat needs for any species. As issues change in the future and different species are highlighted, the document and data would still be applicable.

1994 fire effects



Map 3-8

Estimated fire mortality by President's Plan categories



Map 3-9

Maps and discussion on seral stage distribution across the watershed are presented previously in this chapter under Vegetation.

Dillon contains large blocks of unfragmented forest. The vegetation in the watershed offers a diverse range of species habitat. The species that utilize this area are representative of those found throughout north-western California. The Wildlife Habitat Relationship (WHR) system, which was developed by the California Interagency Task group, can be used to generally display the components of wildlife habitats. WHR identifies and classifies existing vegetation types important to wildlife.

Table 3-7 is a list of habitat associates and indicator guilds. These associations will be used throughout the analysis to describe wildlife relationships.

Table 3-7 - WILDLIFE GROUPS AND ASSOCIATED SPECIES

Group	Species
Migratory/early seral	Elk, Nashville warbler
Migratory/late seral	Vaux's swift, tree swallow
Migratory/riparian	Yellow-rumped warbler
Large home range/early seral	Gray Fox, Ringtail
Large home range/late seral	Goshawk, pileated woodpecker, spotted owl
Large home range/riparian	Raccoon, mink
Small home range/early seral	Blue grouse, rufous-sided towhee, western skink
Small home range/late seral	Northern flying squirrel, douglas squirrel
Small home range/riparian	Killdeer, American dipper, Pacific giant salamander and most other amphibians

THREATENED, ENDANGERED, AND SENSITIVE SPECIES

There are several species found in the watershed which have special and unique habitat needs. They are recognized as threatened, endangered, or sensitive based on current population estimates and threats to their habitats. Federally listed threatened and endangered species include: northern spotted owl, marbled murrelet, bald eagle and peregrine falcon. Forest Service Region 5 sensitive species include: goshawk, willow flycatcher, fisher, western pond turtle, great gray owl and marten. This analysis will identify opportunities to improve habitat for these species where appropriate.

The **Watershed Analysis Guidelines** (1994) include specific questions about peregrine falcon, bald eagle, spotted owl, marbled murrelet, and amphibians. These questions are addressed in the Appendix.

NORTHERN SPOTTED OWL

The Klamath definition of suitable nesting and roosting habitat (5/17/93) for the northern spotted owl is defined as multi-layered, multi-species with greater than 60% total canopy cover for nesting/roosting, with large (greater than 18") overstory trees, large amounts of down woody debris, presence of trees with defects or other signs of decadence in the stand. Determinations of suitability also consider size of stand and adjacency to other habitat types which the owl can use. Small, isolated pieces are not regarded as suitable. This Forest definition is typical of the owl habitat found within the Dillon drainage.

Definitions of habitat types are included in the Section 7 Consultation Guidance on Critical Habitat for the Northern Spotted Owl (U.S. Fish and Wildlife Service letter, August 5, 1992). These terms were used to describe owl habitat: nesting/roosting, foraging, dispersal, and capable. These habitats were identified based on tree density, horizontal and vertical diversity, decadence, and canopy closure. Nesting and roosting habitat could not be identified separately using the Dillon vegetation data base and have been identified as one habitat condition for purposes of this analysis. Based on these definitions, there is approximately 28,123 acres of owl habitat within the Dillon watershed.

Forest wide, Late-Successional Reserves (LSR's) total 396,600 acres. Within these, 151,564 acres are considered currently suitable owl habitat, and 207,344 acres of potentially suitable habitat. Habitat quality and quantities vary between each, however the late-successional habitat within them is added to when combined with the habitat within the wilderness. There are portions of two LSR's in the Dillon Creek watershed, RC350 (Dillon) and RC304 (Rock Creek Butte and Medicine Mountain). Both LSR's abut the Siskiyou Wilderness. These LSRs will effectively provide protected linkages to other areas inside and outside Forest boundaries. There is approximately 10,037 acres of owl habitat (defined above) within these LSR's.

The Final Rule for northern spotted owl Critical Habitat was published on February 15, 1992 (USDI F&WS 1992). Approximately 290,700 acres of Critical habitat occurs within LSRs and 36,960 acres occur within other land allocations. Critical habitat outside of LSR's will be managed as directed in the Final Draft Recovery Plan until such time as the critical habitat designation has been modified in the Federal Register. Management on the Klamath for all CHUs is to manage for late-successional species and all primary constituent elements for the CHUs. A portion of a Critical Habitat Unit (CHU), CA-20, lies within the Dillon Creek watershed in the southwest portion of the drainage. This CHU portion also lies within the LSR, RC304. There is approximately 1,059 acres of owl habitat (defined above) within this Unit.

There are six spotted owl activity centers in the Dillon drainage. Table 3-8 describes each site's history to date. Owls have been more easily located on the south side of the drainage due to the better road access. Some surveys have been conducted on the north side but the access problems and terrain have proven to be obstacles in conducting complete surveys. Limited surveys were conducted in 1990 in parts of the Jackass Creek drainage and along Dillon Divide. Three single owls were located as well as one barred owl. No surveys have been conducted since 1990 except where road access has allowed. No protocol surveys have been done in any part of the drainage. The first year of owl surveys will begin in the late spring, 1995.

Table 3-8 - SITE HISTORY OF SPOTTED OWL ACTIVITY CENTERS WITHIN THE DILLON WATERSHED.

Site Name (Number)	Last Surveyed	Results	Best Data	Year of Best Data
Dillon Mountain (4081)	1990	No Response	Reproduction	1987
Cedar Creek (4090)	1991	Presence	Occupancy	1989
Coffee Can Creek (4091)	1989	Reproduction	Reproduction	1989
Rock Creek Butte (4092)	1989	No Response	Reproduction	1987
Sawtooth (4093)	1989	Occupied	Reproduction	1992*
Lick Creek (4226)	1994	Occupied	Occupied	1994

*The 1992 information presented for this site is from an incidental sighting. The site was not surveyed that year, however, reproduction was confirmed.

The activity center for Lick Creek owls is uncertain. The owls are typically located in the late evening or night and we believe they are called in from deep in the drainage. Follow-up surveys have repeatedly been unsuccessful.

There is sufficient habitat to allow for dispersal of young owls out of the Dillon drainage. In areas surrounding the drainage there have been no timber sales of large enough volume to disrupt dispersal opportunities. The 1987 wildfires did not affect the Dillon Creek watershed. The closest fire was nearly five miles away. Recovery from the 1987 wildfires began immediately following the fires and would have no cumulative effects with the Dillon fires in 1994. Natural barriers such as the Kelsey Ridge may be more of an impediment to dispersing owls that the habitat changes affected by the Dillon wildfire.

BALD EAGLE

On the Klamath National Forest, bald eagles nest near lakes and rivers in large trees in open, uneven-aged mature/old-growth forests. They often roost in groups of several individuals. The majority of the Klamath's eagle population is found on the Goosenest Ranger District, however nesting pairs are being located regularly on the west side of the Forest.

One nesting pair has been located on the Happy Camp Ranger District. It is nearly 18 miles from the mouth of Dillon Creek. A second nesting pair is located near the town of Orleans on the Ukonom Ranger District. It is also approximately 18 miles from the mouth of Dillon Creek. Adult bald eagles are being sighted regularly along the Klamath River between Dillon Creek and Clear Creek. Extensive surveys were conducted in this area in 1994 and will be conducted again in 1995. No nest has been located to date.

AMERICAN PEREGRINE FALCON

Peregrine falcons nest on cliffs, feed primarily on birds, and prefer foraging in riparian forest habitat along lakes and rivers. The diet of peregrine falcons consist almost entirely of birds (Bent 1938; Herbert and Herbert 1965).

The Klamath currently manages for 14 active peregrine falcon eyries. These areas are managed for nest sites and protective zones around nest sites. There are three eyries within 15 miles of the Dillon Creek watershed. Indian Bluff is located 13 miles south of the Dillon Creek watershed; King is located 5 miles northeast of the watershed; and Rock Creek is located 2 1/2 miles south of Dillon Mountain and outside of the Dillon watershed. Each known breeding territory is monitored annually to determine occupancy and reproductive success. Inventories of unoccupied suitable nest cliffs are also conducted each year to document establishment of new territories. An aerial reconnaissance was conducted in July 1989 by Joel E. Pagel of potential cliff sites. He concluded that there would be little opportunity for nesting within the drainage.

MARBLED MURRELET

Suitable nesting habitat for the marbled murrelet is considered to be mature to over mature coniferous stands, or those younger stands with interspersed large trees which may provide nesting opportunities. Generally, the habitat characteristics associated with murrelet nesting are large trees with large lateral branches, extensive mistletoe infection, witches broom and a mature understory that extends into the canopy. These elements provide nesting substrate. Such characteristics usually do not develop until trees are 150 to 175 years of age. Also, the majority of murrelet observations to date have been below 2,000 feet elevation, with some detections between 2,000 and 3,000 feet (Paton et. al. 1992). The existing condition owl habitat map (Map 4-3) best illustrates the distribution of suitable murrelet habitat within the drainage by considering nesting, roosting, and foraging habitat also as habitat for marbled murrelets.

Paton and Ralph (1988) have found that stands of old-growth larger than 500 acres in California were more likely to have more detections, and presumably support larger murrelet populations. Stands less than 100 acres lack the qualities and microclimates associated with forest interior (Spies and Franklin 1990). Murrelets have been detected in stands less than 100 acres, however detections were few (Paton and Ralph 1988).

Little is known regarding the nesting chronology of the murrelet. Carter and Sealy (1987) have made estimates based on a variety of indicators. Egg-laying appears to begin in the latter part of April. A 30 day incubation period would put the hatch date in mid to late May. The latest fledgling dates have been recorded in the month of September. However, fledglings have been found at sea as early as mid-June and as late as the first week of October. To date, nine nests have been located in California. All nest trees were located in old-growth trees greater than 32 inches DBH. Nests are not constructed, rather eggs are laid on large or deformed branches with moss covering, in crooks of the tree; or can be situated on clumps of conifer needles or sticks. Murrelets forage primarily on fish and invertebrates in near-shore marine waters.

FEMAT has described recommendations provided by the marbled murrelet working team. Two zones were identified based on observed use and expected occupancy. Zone 1 is closer to the marine environment and is associated with most known murrelet activity (FSEIS 1994). This zone extends approximately 25 to 35 miles inland on the Klamath, including primarily the Ukonom Ranger District and the western-most portion of Happy Camp. Zone 2 occurs from approximately 35 to 45 miles inland. This area is defined for survey purposes and is less likely to support murrelets. The Dillon watershed is within Zone 1 and between 23 and 28 miles from the ocean. Proposed critical habitat for the murrelet is found within the Late-Successional Reserves in Zone 1 and Zone 2 (proposed January 1994). Critical habitat for the marbled murrelet is in LSR RC304 and RC350 within the Dillon Creek drainage.

Limited surveys have occurred on the Klamath in relation to specific timber sales on Happy Camp and Ukonom Ranger Districts. There were four detections of murrelets on Happy Camp District, approximately 35 miles inland, in 1994. This area is approximately 12 miles northeast of the Dillon drainage and just within the Zone 2 boundary. Based on this information, we must assume murrelets are also using the Dillon drainage. Surveys to protocol within the drainage began in late spring, 1995.

NORTHERN GOSHAWK

In addition to habitat included in Late Seral Reserve Areas, the Klamath National Forest has a network of Goshawk Management Areas established around 59 known activity centers, most of which include 200 acres of late seral stage habitat. Management direction towards protection and enhancement of the habitat components for goshawks applies to these areas. There are no Goshawk Management Areas within the Dillon Creek drainage. Goshawk surveys have been initiated at Happy Camp and will continue through the 1995 field season, including surveys in the Dillon Creek drainage.

Nesting goshawks in northern California use mature, and old-growth conifer forests with relatively dense canopy closures, usually little understory vegetation, and flat or moderately sloping terrain. Moderate and high quality habitats contain abundant large snags and large logs for prey habitat and plucking perches (Hall 1984). One specific study on the Goosenest District found that compared to surrounding habitat, goshawk nest stands were composed of larger, denser trees, and had strong association with natural openings such as meadows and riparian habitats (Allison, Woodbridge, in press). Results of radio telemetry studies on goshawks in California and elsewhere in the West suggest that foraging goshawks avoid dense young forest stands and brush, and concentrate their foraging in more open, mature stands, forest openings, and meadows (Fisher 1986; Austin 1993; Hargis et. al. 1992).

Juvenile goshawks were located in the upper North Fork of Dillon Creek during the 1994 fires but there is little data, beyond historic, about other occupied sites within the entire Dillon drainage.

GREAT GREY OWL

The great grey owl is the largest North American owl. Currently listed as State Endangered, this owl is most commonly seen in wet meadows of the Sierra Nevada. It has also been occasionally documented in northwestern California in winter and in the Warner Mountains in summer (McClaskie et. al. 1988).

The great grey owl is dependant on wet meadows for foraging. Nesting habitat typically consists of old-growth red fir, mixed conifer, or lodgepole pine stands that are adjacent to meadow complexes. Many of the high elevation meadow complexes on the Klamath contain habitat which would be suitable for the great grey. Goosenest Ranger District has sporadically conducted surveys in the northern portion of the district, along the California/Oregon border, but have had negative results. There have been isolated detections by reliable sources on the western portion of the forest although no formal surveys have been conducted to date to establish pair status. There have been no detections in the Dillon Creek drainage.

WILLOW FLYCATCHER

The flycatcher is listed as State Endangered due to marked decline of populations throughout significant portions of its range. These declines have been attributed to habitat loss, cowbird parasitism, livestock grazing, loss of meadow habitat due to hydroelectric power development, and pine encroachment in meadows (Harris et. al. 1987; Serena 1982). As a neotropical migrant species, the willow flycatcher breeds in riparian and mesic upland thickets in the United States and Canada, wintering from Veracruz and Oaxaca, Mexico south to Panama (AOU 1983). Wintering habitat losses may also be contributing to current declines. Historical information of this species occurring in the Klamath Mountains is practically non-existent. The only recent Forest surveys were conducted on the Oak Knoll Ranger District from 1991 through 1993. As a result of these surveys, four detections of willow flycatchers were recorded along the Klamath River and one in high elevation meadows. Fifteen willow flycatchers were banded in 1993 at the Seiad Valley constant effort mist net site. On the Klamath, willow flycatchers are late migrants to this area, nesting between mid-May through mid-July (S. Cuenca, pers. comm.)

Breeding habitat in California is typically moist meadows with perennial streams, lowland riparian woodlands dominated by willows, cottonwoods, or in smaller spring fed boggy areas with willow or alders (Serena 1982; Harris et. al. 1987; Whitfield 1990). Elevational limits occur at 8000 feet (Ron Schlorff, pers. comm). River riparian areas with a dominant component of willow are also likely habitat (S. Cuenca, pers. comm.).

Availability of this type of habitat is widespread across the Forest, most notably along portions of the Scott, Salmon and Klamath Rivers, as well as in high elevation meadows. Within Dillon Creek, this habitat is found within riparian areas along the larger creeks, notably Dillon and North Fork Dillon, and potentially in high elevation meadows within the Siskiyou Wilderness.

WESTERN POND TURTLE

The geographic range of the western pond turtle extends from northwestern Oregon, south through California, narrowing along the west coast of southern California and northern Baja. Their range has been steadily fragmented by habitat loss such as development and agricultural conversions of riparian habitats. Human activities such as non-native species introductions have also resulted in loss of some populations. The effects of predation, particularly on hatchlings and juveniles by bullfrogs and largemouth bass are well documented (Holland 1991). The largest remaining known populations are thought to be located within the Klamath River watersheds and other north coast tributaries such as the Mad and Eel Rivers (Ibid).

Western pond turtles are known to occur in both intermittent and permanent aquatic habitats such as rivers, streams, lakes, ponds, and other wetlands, with many populations found in smaller, montane streams. Turtles are also occasionally found in man-made water developments such as irrigation canals, farm ponds, or reservoirs. Most of the populations within the Klamath River drainage system occur in low lying areas (Holland 1991).

A variety of habitats are used for different life stages and daily needs. Females excavate nest chambers in May, June or July in which they deposit eggs. This occurs upland from the riparian area, at distances ranging from 50 to 1,200 feet from water source (Holland 1991; Storer 1930), typically on south or southwest slopes which are well drained and dominated by grasses or herbaceous annuals (Holland 1991). In observations of both captive and wild turtles, incubation has been observed to range from 73 to 104 days (Feldman 1982; Holland 1991). Although not much is known with regards to habitat use for overwintering, some data indicates that turtles can use logs, vegetation, and duff/litter for burrowing under. One of the most important habitat components for pond turtles is the availability of basking habitat. Turtles use partially submerged logs, rocks, branches, or matted emergent vegetation such as tules, cattails, and pond lilies (Holland 1991).

No formal surveys have occurred to date by Forest personnel. It is uncertain if pond turtles inhabit areas beyond the mouth of Dillon Creek.

PACIFIC FISHER AND MARTEN

Denning and foraging habitat for fishers and martens is included within Late-Successional Reserves. These areas include large, contiguous stands of mid- to late-seral stage, mixed conifer or Douglas-fir forest and also provide large snags and down logs as denning and resting sites. Marten are most abundant in forested areas adjacent to meadows or riparian corridors. Region 5 Draft Furbearer Guidelines indicate that both species can have large home ranges and they show a preference toward old-growth for denning. Although fishers are generally considered to use habitat below 5,000 feet, two recent detections of fisher have occurred on the Scott River District (using Trailmaster camera systems) at 6,000 feet. Martens generally use habitat above 5,000 feet.

The Forest initiated a furbearer camera station location project using "Trailmaster" camera systems in 1992. Methods are described in Kucera (1992). Numerous fisher detections with this method have been made on the Scott River and Oak Knoll Ranger Districts. As more locations are made Forest-wide, this method will allow the Forest to better understand local habitat use by this species. There have been no detections of marten using this method.

The Happy Camp District has also conducted limited track plate surveys in conjunction with the Pacific Southwest Range and Experiment Station, Redwood Sciences Lab. A track was obtained in 1994 which has been identified as either a fisher or a marten in the Elk Creek drainage. Further survey efforts have been unsuccessful in positive identification of this animal. Track plate and camera station surveys are being conducted in the Dillon Creek drainage through the 1995 field season.

There is one historic sighting of fisher in the Dillon Creek drainage and no marten sightings.

OTHER WILDLIFE SPECIES OF INTEREST

General salamander surveys were conducted for the first time during the spring of 1995 on the Happy Camp Ranger District. The objective of this initial survey was to locate Del Norte and Siskiyou Mountain salamanders. Several Del Norte sites were located on the District. No Siskiyou Mountain salamanders were located. The ROD lists these species to be protected in the survey and management standards and guidelines (table C-3, page C-59). Due to the long winter and the ensuing access limitations, surveys will not be conducted in the Dillon Creek watershed. The onset of summer weather has also caused salamanders to move deeper into the substrate making surveys difficult.

The Forest began re-introducing Roosevelt elk on the district in 1986 in cooperation with the California Department of Fish and Game. The population has grown steadily through successful reproduction and continued re-introductions. The current estimate is over 400 individuals. There have been sightings of individuals in the Dillon Creek drainage but there is no indication that groups are frequenting the area. Dillon has been proposed as a potential future release site.

HUMAN ENVIRONMENT

TRANSPORTATION SYSTEM

The road network is considered by many to be the most important, most costly, and the most damaging component of forest land use. In addition to providing access for forest management activities, it allows for the efficient movement of people and resources, creating direct economic and recreational benefits to the local communities. Roads are associated with high sediment inputs and altered hydrology, both of which can strongly influence downstream channel habitats. Roads are also important as a source of indirect human impacts and as an agent of vegetation change and wildlife disturbance.

The Dillon Creek watershed contains approximately 56 miles of road. The roads are distributed in the northeast and southern portions of the drainage. Of these roads, 49 miles of system road and 4 miles of temporary non-system road are under Forest Service jurisdiction, three miles within the Siskon Mine area is under private jurisdiction, and Highway 96 (of which less than a quarter-mile is in the watershed) is under State jurisdiction.

Seventy-two percent of the drainage is more that one half mile from any road. Approximately seven miles of road are located within riparian reserves. The road density varies from zero to five miles of road per square mile. Average road density within the portions of the watershed outside wilderness is 1.20 miles per square mile.

State Highway 96 provides access to the watershed and communities along the Klamath River from I-5 to State Route 299 at Willow Creek. It crosses Dillon Creek just above its confluence with the Klamath River at the south eastern edge of the analysis area.

Forest Service system roads within the watershed were constructed for administration of National Forest lands. Maintenance levels of the the 49 miles of Forest Service system roads are as follows: 7% are maintained to provide a high degree of user comfort and convenience; 2% are maintained to provide a moderate degree of user comfort and convenience at moderate travel speeds; 26% are maintained for travel by a prudent driver in a standard passenger car; 42% are maintained for use by high clearance vehicles; 23% are intermittent service roads not maintained for use. The seven miles of temporary and private non-system roads receive no Forest Service maintenance.

Road surfaces in the watershed vary with considerations of soil type, slope stability, steepness of grades, proximity to stream courses, and patterns of use. Approximately 8% of the roads are paved, less than 1% are chipseal surfaced, 30% are aggregate surfaced, and 62% are native soil.

Year round access to the watershed is provided by 17 miles of open road, although snow frequently limits winter travel. Seasonal access is provided by 25 miles of road, which are closed to vehicular traffic during the wet weather season. The remaining 14 miles of road in the watershed are closed by structural barriers and/or vegetation.

SCENERY

People who visit National Forests have high expectations for scenery, especially near streams, lakes, meadows, vistas, or campsites reached by roads and trails. Campers, fishermen, hunters, wilderness users, and American Indians are the most frequent visitors to appreciate the Dillon watershed's scenery.

EXISTING LANDSCAPE CHARACTER AND SCENIC INTEGRITY

The Dillon area is known for its relatively unaltered scenic condition. Uniform textures of mixed conifers cover the canyon and ridge formations, which combine to create a unifying landscape character.

Dillon Creek scenery contains "outstandingly remarkable" characteristics under study for inclusion in the National Wild and Scenic River Systems. Here, deeply incised scenic canyons intersect numerous streams which merge to form Dillon Creek.

Nearly 17% of the watershed is in the Siskiyou Wilderness where settings are especially scenic and picturesque, displaying patterns of dramatic variety associated with "alpine high country" scenery. Along the Siskiyou Crest and the northern watershed boundary, scenic ridges ascend above forested canyons.

The most viewed area in the watershed is seen near the mouth of Dillon Creek by Highway 96. Vegetation patterns as viewed from the Klamath River corridor appear slightly unnatural due to human activities. The most unnatural contrast is a recent fireline opening on Dillon Mountain viewed from Highway 96.

For American Indians, the cultural value of the watershed is strongly dependent on scenic qualities. Visually obtrusive land modification disturbs images strategic to religious observances. Disturbance may be experienced at all distances, even over vast stretches to some far off mountains which are sacred. Currently, scenic disturbances moderately interrupt the scenic integrity of sacred use. The most noticeable scenic disturbances are roads and logged areas within the watershed and beyond.

Less than six percent of the landscape has been altered by human activities. However, due to very steep slopes, human alterations are highly visible. The magnitude of dominant contrasts have a greater disturbance impact than the six percent figure would imply since canopy openings affect the vicinity of modified settings. Based on the forest visual condition inventory, which considers the scenic integrity of disturbances, about 80% of the scenery displays an unaltered, undeveloped natural landscape character. Scenic integrity is partly based on the ideology that most visitors value natural appearing scenery.

The Siskon Mine, which last operated in 1960, removed trees and topsoil from 60 acres. This created a bare earth area of strong contrast south of Little Medicine Mountain. The mining disturbance is visible from road 14N21 north of Rock Butte and other areas south and eastward including Pony Peak.

WILDFIRE INFLUENCES ON SCENERY

In 1994, fire events continued to adjust the mosaic of vegetation patterns resulting in a more open vegetation character across most of the landscape. Patterns from the fire are most noticeable in the North Fork of Dillon Creek and vicinity and near Dillon Mountain. In the short term, fire has a strong effect on scenic character in foreground and middleground views. Views beyond three miles are not as noticeable.

The most noticeable roadside firelines are experienced from road 14N21 at Cedar Camp, from road 13N35 above Mill Creek, and on roadsides to Pony Peak. The most noticeable fireline impacts along the Kelsey Trail are north of the Elbow Springs trailhead for a distance of one mile below Bear Peak and on the trail north of Bear Peak where brush fields have burned.

MINING

Mineral deposits known to occur in Dillon Creek Watershed and its vicinity, include placer gold and platinum, surface and underground lode gold, silver, copper, manganese, and graphite, and chromite. The most significant mining operation was at Siskon Mine.

The Siskon Mine, located in the Copper Creek subwatershed, is an inactive gold, silver and copper surface mine. The ore deposit is similar in geology to those found in the Clear Creek mining district, at Grey Eagle Mine up Luther Gulch, and at Buzzard Hill Mine up Buzzard Creek. It began full production in 1952 to 1953, and continued until 1960. Six claims were patented on the Siskon Mine property in 1961. From 1960 to 1992, the 63 claims comprising the Siskon Mine claim group were held by a succession of mine companies and individuals. During this time, several exploration studies were undertaken to define the extent of gold and silver mineralization and potential copper reserves at depth. Though no active mining has occurred since the 1950's, the possibility of cyanide heap leach operations there was considered during a surge of gold prices ($800/oz) in 1979. Today, only the six original patented mining claims are maintained. All the other 57 unpatented lode and placer claims have been relinquished and are presently abandoned. There are several environmental problems at the mine, remaining from the period of mine operations. The problems are currently being investigated.

The current claimant contracted out drilling, sampling and exploratory work at the mine during the years 1988-1991. This recent exploratory work has extended the strike and depth of the ore zone. The claimant has indicated interest in developing the mine in the future, and has conducted some very limited environmental assessment at the site.

Currently, there are no other active lode or placer claims within the Dillon Watershed. The few placer claims that appear on Bureau of Land Management (BLM) filing indexes are located on the Klamath River. Many placer claims along the Klamath River and tributaries into it have lapsed since the late 1980's and early 1990's. This is likely due to two factors. Suction dredging was allowed in Dillon Creek and its tributaries until 1982. Since that time, Dillon Creek has been closed to suction dredge mining. The annual maintenance (rental) fee requirement of $100 per year per mining claim became effective in the 1993 and 1994 assessment years. BLM mining claim indexes show an increase in mining claim case closure and abandonment beginning in 1993.

Past production and exploration for copper and associated gold and silver, in Siskiyou County and including the Dillon area, suggest that economic to sub-economic ore deposits may still be discovered. Undiscovered ore bodies could exist beneath the ground surface in geologically favorable areas. The costs of mine development, environmental compliance, reclamation, transportation, and other factors could limit future exploration and development of new gold, silver, and copper deposits. Particularly for copper, the small size of most copper deposits, milling costs and lack of nearby smelters, and environmental costs are for the most part prohibitive.

CURRENT RECREATION USE

Factors which influence recreation activities in the Dillon watershed include remote location, rugged topography, limited road access, and management direction. The first three factors are responsible for the relatively light recreation use that the watershed receives, and for keeping the majority of the watershed in a natural unaltered state. The majority of recreation use is associated with either roads, trails, or Dillon Creek itself.

There are 56 miles of roads in the watershed. These roads are predominately located in the higher slopes of the watershed. Examples of road-based recreation activities in the watershed include dispersed camping, hunting, pleasure driving, wood-cutting, mushroom picking, wildlife viewing, and OHV (off highway vehicle) use. Road 15N19 provides access to the Siskiyou Wilderness from the Elbow Springs trailhead. There is no road access to Dillon Creek except at its confluence with the Klamath River and Highway 96.

Recreation activities which are associated with trails include hiking, dispersed camping, fishing at back-country lakes, viewing scenery, wildlife observation, and hunting. Harrington Lake is the only lake located in the watershed. It receives little use due to its small size, its difficult nine mile access hike, and poor fishing. Bear Lake is just outside the boundary of the Dillon watershed, and receives more use due to an easier hike and good fishing.

Creek associated activities include: swimming, fishing, gold mining, and kayaking. Nearly all of this activity takes place in the vicinity of Dillon Creek campground, which provides the only easy access to the creek. Dillon Creek runs through extremely steep rugged canyons for most of its length which makes access too challenging for most of the recreating public.

TRAILS

There are three system trails located within the Dillon Creek watershed. These are the Kelsey National Recreation Trail (NRT), the Dillon Creek Trail, and a three mile segment of the Boundary Trail. The Kelsey NRT is ten miles in length and is accessed from the Elbow Springs trailhead. This trail runs along the dividing ridge between the Dillon Creek and Clear Creek watersheds, and provides access to Bear Lake, Harrington Lake, and the southern portion of the Siskiyou Wilderness. The first three miles of the Kelsey NRT (which goes to Bear Lake) receives moderate use during the spring and summer months primarily from fishermen and campers hiking to Bear Lake. Bear Lake provides one of the few opportunities to day-hike to a lake on the Happy Camp Ranger District. The Kelsey NRT beyond Bear Lake currently receives low use, however, use should increase with the completion of the West Fork of Clear Creek trail. This trail will provide a route between the Kelsey NRT and the Clear Creek NRT. There are also long range plans to build a trail called the Coast to Crest Trail, from Crescent City to the Pacific Crest Trail, by using the Kelsey NRT as part of the route.

Approximately 6.5 miles of the Kelsey NRT (Elbow Springs to Red Hill) was burned-over during the 1994 Dillon Fire. During the fire suppression activities, the first mile of the Kelsey NRT (from Elbow Springs to Bear Peak) was widened with a dozer and used as a fireline. The Elbow Springs Trailhead was also impacted by suppression activities, but these impacts may lead to future opportunities to improve the trailhead over pre-fire condition.

The Dillon Creek Trail begins near Dillon Creek Campground along Highway 96 and travels up the north side of the creek. The trail is located approximately 500 feet above the creek and traverses vertical canyon walls of solid rock for six miles until it finally descends to its terminus on the North Fork of Dillon Creek. Although this trail provides some outstanding scenery, it receives very little use because Dillon Creek cannot be accessed until the end of the trail.

A three mile segment of the Boundary Trail (which generally follows the boundary between the Six Rivers and Klamath National Forests) is located within the Dillon Creek watershed. The Boundary Trail is accessed from the Elk Valley trailhead and is primarily used by Native Americans to access traditional religious and ceremonial areas. General public use is not encouraged.

RECREATION SITES

The only developed campground within the Dillon Creek watershed is the Dillon Creek Campground which is located at the confluence of Dillon Creek and the Klamath River. The campground has easy access from Highway 96 and is used by both recreational vehicles and tent campers. There are 21 campsites which rent for $6 per night. This is a full service campground with handicap accessible restrooms and domestic water. Total potential occupancy is 105 persons at one time. The campground is open from May 1 through October 31. Fee collections for the past two years (1993 and 1994) indicate an occupancy rate of almost 40% daily through the six month season which equals about 8,000 recreation visitor days (RVD's) of use annually. The campground also serves as a Day Use Area with a separate parking area, Dillon Creek Access Trail and a $2 fee per day. Visitors to the campground come for the experience of camping in the Dillon/Klamath ecosystem and/or for swimming in crystal clear Dillon Creek which is one of the most popular swimming areas along the Klamath River. Watching wildlife and fishing in Dillon Creek or the Klamath River are two popular recreational pursuits for visitors to Dillon Campground.

There are a few dispersed campsites along road 15N19 near the Elbow Springs trailhead that are primarily used during hunting season. There are also several dispersed campsites located along the Kelsey NRT.

RECREATION OPPORTUNITY SPECTRUM (ROS)

For management within the Dillon watershed, recreation opportunities can be expressed in terms of activities, settings, and experience. For visitors, probable mixes of activity, settings, and experience have been identified and inventoried under what is called the Recreation Opportunity Spectrum (ROS). ROS is divided into the following six classes: primitive(P), semi-primitive non-motorized(SPNM), semi-primitive motorized(SPM), roaded natural(RN), rural(R), and urban(U). Table 3-11 gives the number of acres and the percent of the Dillon watershed in each of the six classes.

Table 3-11 - RECREATION OPPORTUNITY SPECTRUM

ROS class	# of acres	% of the total watershed
P	15,296	33
SPNM	15,700	34
SPM	406	1
RN	6,704	14
R	8,607	18
U	0	0

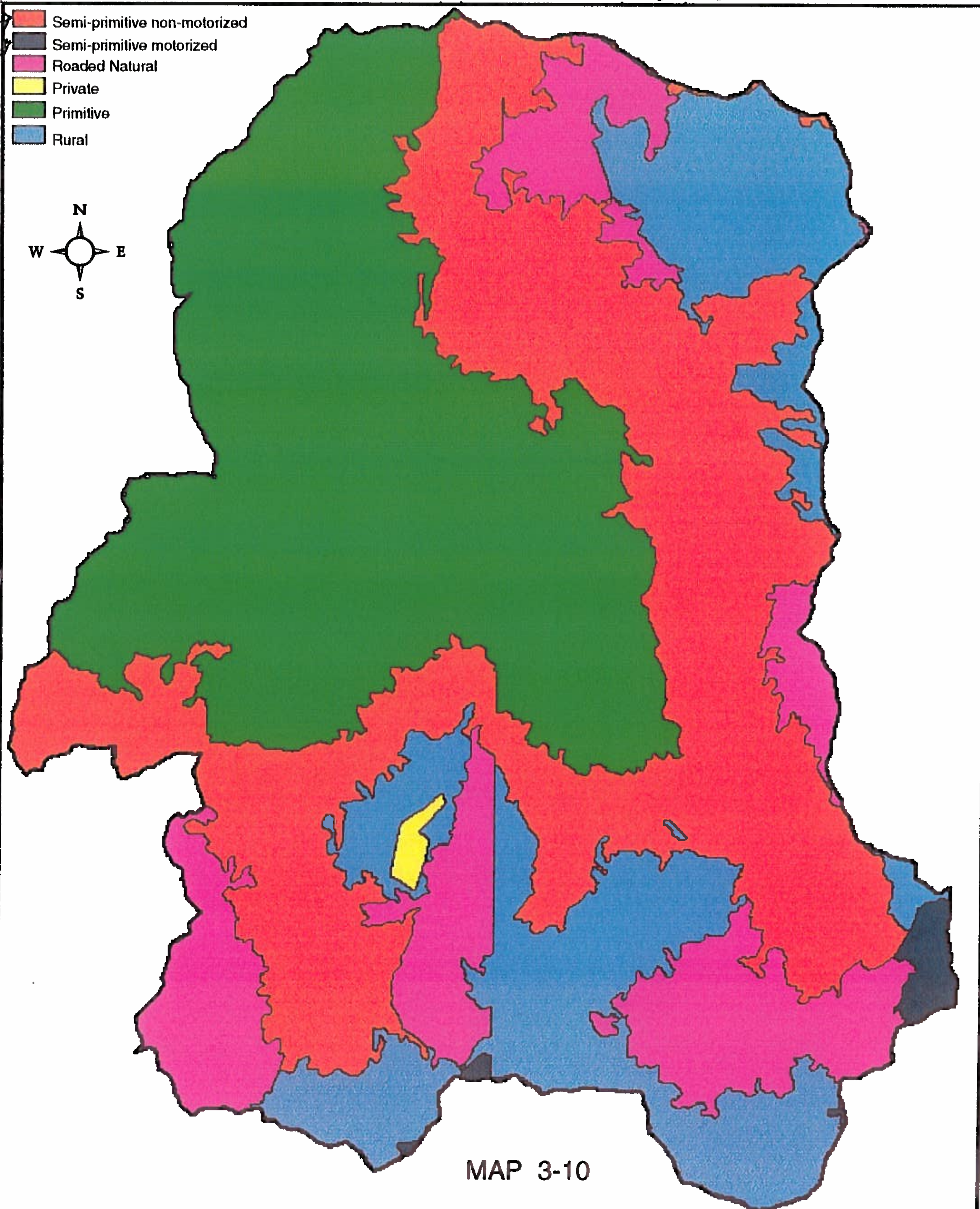
(Map 3-10 shows the distribution of these classes).

The table displays that 64% of the Dillon watershed falls into the primitive or semi-primitive non-motorized classification. These classes are defined as areas where settings and experiences are characterized by unmodified or natural appearing environments, interactions between users is low, and motorized use is not permitted. These wild, unaltered landscapes provide recreational settings of extremely high value. As visitor use increases with population in this region, landscapes such as these will become increasingly more important for visitors seeking solitude and a primitive recreational experience.

WILDERNESS

The 8,047 acres of wilderness within the watershed is located along the southern boundary of the Siskiyou Wilderness and represents seventeen percent of the total watershed and encompasses approximately five percent of the Siskiyou Wilderness. There are two trailheads which provide access to this portion of the Siskiyou Wilderness. These are the Elbow Springs trailhead and the Elk Valley trailhead. This portion of the Siskiyou Wilderness is located in the upper Dillon Creek watershed, and contains only one small lake

Dillon Recreation Opportunity Spectrum



MAP 3-10

(Harrington Lake) and no major creeks or streams. Although this portion of the wilderness contains some spectacular scenery and unique plant species, it currently receives only light use, probably due to the dry terrain and lack of large fishable lakes. This portion of the wilderness provides a unique opportunity for visitors seeking extreme solitude in a setting which has remained basically unchanged by man.

HUNTING

Deer are the main game animal hunted in the Dillon Creek watershed although bear, quail, grouse, and other small animals are also hunted. Legal hunting seasons are in the fall and range from six to eight weeks from September through December.

Most hunting is done within one-half mile of a drivable road. Many people hunt in open logged areas or burned areas where game is more visible and the best forage is available. Since the Dillon watershed has relatively few roads and accessible open areas, hunting pressure has traditionally been low.

Local residents account for approximately half of the hunting pressure. Most of the hunters from outside of the local area are from the Crescent City, Redding, and Sacramento areas. These people often buy extra supplies in town and may spend some nights in a local motel.

FISHING

Fishing activity in Dillon Creek is relatively low due to decreased populations of steelhead and salmon, strict size limitations (you can not keep any fish over 14 inches in total length), and the extremely limited fishing access to the creek.

COMMERCIAL VALUES

Dillon watershed has not been as economically significant to the local community as more accessible watersheds such as Indian and Elk Creeks. Saw logs and mining have been the main economic activity associated with the watershed. Minor commercial activity is associated with other special products such as mushrooms, poles, hardwood, and firewood. Most of the economic value resulting from fisheries are realized off site. The economic benefits from recreation are relatively insignificant.

TIMBER

Approximately 2,284 acres have had some harvest activities over the last 40 years. Of these acres, 1,898 were clearcuts and other types of regeneration harvest, and 446 acres have been partial cuts. The clearcut acres include 60 acres that are within the Siskon Mine private holding. Map 3-11 shows where different types of harvest were implemented in the Dillon Creek watershed.

Using estimates of 40 thousand board feet (MBF) per acre for clearcuts and 12 MBF per acre for partial cuts, approximately 81 million board feet has been harvested from the Dillon Creek watershed over the last 40 years. The past land base available for harvest activities included all forested lands outside wilderness. This covered approximately 29,000 acres. To compare growth to harvest rates using 200 board feet per acre per year, this area has been growing nearly 6 million board feet per year. Availability of timber from plantations is dependent on them reaching merchantable size without being killed by fire or disease. After the 1994 fires, 747 acres of plantations were damaged enough to need replanting.

Within the watershed, nearly thirteen-thousand acres of Forest Land are in matrix. These are lands where timber commodity production is not excluded by other objectives, so they are available for harvest. These acres include stands of mature timber as well as plantations. Assuming a growth rate of 200 board feet per year, this area is growing approximately 2.6 million board feet per year. Ecosystem management objectives direct forests to manage in terms of outcomes instead of output. Commodity production is an important aspect of management activities, particularly on matrix lands.

Timber related jobs draw people into the community, provide income for a tax base, and allow for residents to earn an adequate income while living in this remote, rural area. Using statewide data compiled for the Timber Sale Program Information Reporting System (TSPIRS), it is estimated that every job created is worth $42,000 to the economy as a whole. Approximately 60% of this income would be in the form of wages and salaries paid to the local area. The remainder of the income (profits and rents) may not all be paid to local residents.

In September 1994, the last remaining lumber mill in Happy Camp was closed and offered for sale. One of the major factors cited for the closure was the decrease in the supply of federal timber. The mill employed 80 people and was the largest single employer in the area excluding the Forest Service. Because employment opportunities are limited in Happy Camp, many families are leaving the area. Local retail service businesses and schools are cutting back on their employees with the reduction in business from the mill closure.

It is largely the present condition of limited employment opportunities that makes timber related employment so important to the community. Information derived from 1990 Population Census for the Klamath River area, encompassing Happy Camp, indicates that the most important industries employing people are manufacturing of durable goods (mostly lumber and wood products), agriculture and natural resources (mostly government), and the retail trade. The median family income was $27,039. Thirteen percent of all persons live below the poverty level. Unemployment generally runs two to six percent above the state average. This is common for primarily rural areas lacking economic diversification. The unemployment rates show seasonal fluctuations due mainly to the intermittent nature of natural resource based work. Recently, unemployment rates have been as high as 18% during some winter months.

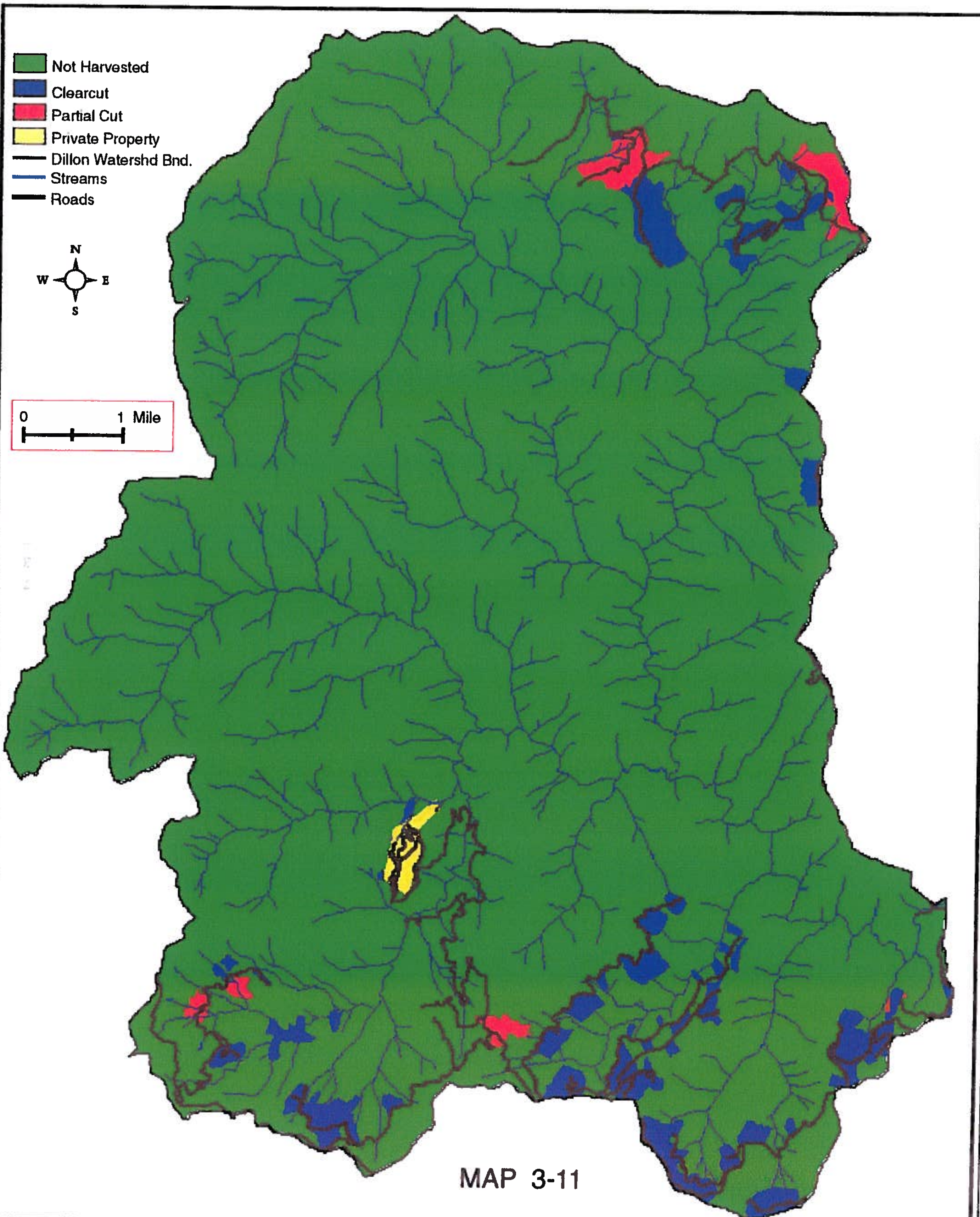
FOREST PRODUCTS

Mushrooms are the most significant commercial use of non-timber forest products. The variety often picked is the tanoak mushroom which often grows in association with tanoak trees. This commercial use affects traditional use by local American Indians. Other interactions created by this activity include the influx of mushroom buyers and pickers from outside the area and opportunities for residents to pick and sell mushrooms. Tanoak mushrooms sell for $10 to $75 per pound. An individual can pick ten gallons or more per day if he/she can locate good areas. Due to limited access, Dillon has not been a high use area for mushroom picking.

Other special plant products that are collected in small quantities are boughs, trees, shrubs, cedar posts and conifer cones. Other potential products do exist, but do not have wide commercial use. These things include burls and stumps of hardwoods, foliage, berries, seeds, wildings (live trees and shrubs transplanted as ornamentals), vines, lichens, ferns, herbs, and mistletoe.

Various forest products have also been historically important to the Karuk Tribe. The Tribe has relied on supplies of salmon, acorns and mushrooms for subsistence. Beargrass and hazel are the most commonly used basket making plants. These resources continue to be highly valued by tribal members.

Dillon Watershed Harvested Areas



MAP 3-11

TRADITIONAL AND CURRENT USES BY AMERICAN INDIANS

Ethnographic and archaeological investigations, and consultation with Indian Tribes build an understanding about how the Dillon watershed was used, the prevalence of religious use, and its contemporary significance. Historic resource inventories in the watershed have primarily been conducted to provide clearance for ground disturbing activities. In addition, some areas suspected of having high archaeological sensitivity were surveyed in 1989. An independent archaeological investigation also occurred in 1979 in relation to American Indian religious use areas.

Regional Northwestern California Indian Cultures are the most culturally complex in the United States (Ecological Subregions of the United States, 1994). The Karuk, Yurok, Tolawa, and Hupa cultures are evolving as societies which retain tribal identity with the Dillon area in a manner consistent with their culture over time. Understanding the significance of contemporary use and important ethno-geographic relationships is vital to protecting their intrinsic values. Specific geographic environments reflect symbols unique to regional Indian history, philosophy, and view.

American Indian perceptions of the land are specific to their reference and views. Tribal individuals and governments are actively involved in natural resource management, often through formalized processes outlined by NEPA and other Federal mandates. Consultation is necessary when a proposed land modification is planned or when other management may conflict with traditional uses and values.

To American Indians, features of the land unite people with creation, heritage, and the future. Concepts of religious experience are interwoven into all aspects of life which are guided by historic ideologies that man is not separate from the land, plants, or animals. Plants and animals have spirits or souls, much like man, and are not separate, but are all part of the "whole of nature" (Heizer 1978:650). Land and life relationships are appreciated as being whole, not independent of each other.

Cultural use specific to the watershed has shown up in terms of gathering food and plant sources for basketry, sweathouses, woodcarving, and medicinal use; of hunting and fishing; and of other traditional use. Gathering resources is often interrelated with sacred use.

THE ELK VALLEY (I'SHYUUX TISHRAAM) DISTRICT

The headwaters of Dillon drainage was made part of a religious use district, which was made eligible for the National Register of Historic Places in 1981 because of the areas cultural significance. The Yurok refer to the religious use vicinity as "Helkau" meaning inland mountains, while the Karuk call the area " I'shyuux Tishraam", meaning Elk Valley. The current Klamath National Forest designation delineates an area of almost 10,000 acres in the watershed with pertinent standards and guidelines. For centuries the ridge top corridor has continued to enhance religious Indian traditions. The district is indispensable because of its powerful symbolic sacred character. Most mountains above river canyons have spiritual significance, but the high country in the southwestern Siskiyous is esteemed as a strong center of the spiritual world. The district supports spiritual life of those living below. Forces present, including mountain spirits, are considered to carry the burden of the people's culture, health, and well being (Buckley 1976).

Although the district is designated as an important traditional sacred area, there are other locales within the Dillon watershed that traditionally serve religious use. These locales relate to traditional pathways and points of religious emphasis and use. Consultation processes before activities take place and field investigations generally will help identify and preserve religious use in these areas. Close tribal consultation is vital to identify possible management conflicts in order to protect the viability of cultural use.

OTHER TRADITIONAL USE AND PROCUREMENT

Traditional Indian relationships with the land are based on concepts that man shares his life with plants and animals and is responsible for them. Plants are essential for ceremony, healing, subsistence, and crafts. Certain plants are a means of contacting the spirits, as in burning angelica root or smoking tobacco (Heffner 1984). Plants taken from the high country are used to open the Klamath River each year (Theodoratus 1978). Traditional uses and procurement will be further described in *Chapter IV*.

WILD AND SCENIC RIVERS

The Draft Klamath Land Management Plan (LMP) identified both Dillon Creek and the North Fork of Dillon Creek as being suitable for inclusion in the National Wild and Scenic Rivers System. Appendix E of the draft EIS contains the Wild and Scenic River study.

The highest identified potential classification of both Dillon Creek and the North Fork of Dillon Creek is Wild. The Preferred Alternative of the LMP recommends that Dillon Creek and the North Fork of Dillon Creek be designated as Recreational. It remains for Congress to make the final determination. Both Dillon Creek and the North Fork of Dillon are named as part of a California Omnibus Rivers Bill that may be introduced into the Congress in the near future.

The Wild and Scenic River Act calls for the protection of rivers found suitable for inclusion in the system until Congress has had the opportunity to act on the designation. This protection calls for a 1/4 mile corridor on both sides of the stream until boundaries are set through the actual designation.

Chapter IV

Processes and Functions

PROCESSES AND FUNCTIONS

INTRODUCTION

In this Chapter is a discussion of the physical and biological processes and functions in the Dillon watershed. Interactions and trends are also included to further describe what factors influence ecosystem processes. This chapter has a separate section for each issue category described in *Chapter I* and answers the key questions relative to processes and functions.

PROCESSES AND FUNCTIONS THAT AFFECT AQUATIC SPECIES AND HABITATS

The Dillon watershed is an important drainage for aquatic species. Habitat elements for aquatic species are built from stream channel form, riparian condition, stream flow, and water quality. Landslides and stream flows which influence stream channels and riparian condition are dependent on climatic events. Slope processes have great influence over how the aquatic environment is affected by climatic events. This section focuses on aquatic species and their habitats and the processes and interactions that influence their survival.

FISH HABITAT

The major factors influencing habitat quality are: stream flow and gradient, sedimentation, available spawning gravels, the number and frequency of primary pools, cover, and the number and volume of pieces of coarse woody material within the perennial stream.

Fishes in small streams utilize specific habitat types throughout their fresh water life cycles in response to different spawning, feeding, and over-wintering requirements (Gorman and Karr, 1978). Pools are critical holding and rearing habitat. They must be deep enough to provide overhead cover from predators and reduced velocities for improved food accessibility. Pool habitat types are created by bedrock and boulders with the larger pools formed by bedrock. Spawning gravels are generally associated with tailouts of these lower velocity pool areas. A large portion of aquatic invertebrates, the basic food for all fish populations, reside in run and riffle habitats.

Terrestrial insects are important food for aquatic species. Leaves and pieces of wood are important food for aquatic invertebrates. Algae growing on gravel and cobble substrate is the major primary producer of food for some aquatic invertebrates. However, in most streams in this area, the benefit from exposing substrate to solar radiation for increases in primary production of algae is outweighed by the need for canopy to reduce water temperature.

COVER

Cover provides protection from predators and reduces negative impacts on aquatic populations as a result of changes in streamflow and temperature. Population densities tend to increase with increased cover (Bisson et. al. 1981), which is used for escape, feeding, hiding, or resting. Instream cover consists of physical structures such as bedrock ledges, spaces between boulders or cobble, and coarse woody material which are preferred over whitewater as cover. Cover structures are not as effective at increasing fish populations where other conditions such as food supply, water depth or velocity are not adequate. Overhead cover provides shade canopy that is important for maintaining water temperatures, especially during afternoon hours.

TEMPERATURE

As water temperature increases, less of the benefit from food intake is converted to growth and improved fitness. The aquatic species must use more calories to maintain a higher metabolic rate. In some species this can cause increased mortality.

Riparian vegetation is important in maintaining optimal stream water temperature. Stream water temperature is primarily increased by removing riparian vegetation and by exposing the stream to direct solar radiation. Some temperature moderation in Dillon is caused by shading from topographic features, especially in the main stem. Adjacent air temperatures also influence stream water temperature at the air/water interface.

COARSE WOODY MATERIAL

Riparian vegetation is an important recruitment source for coarse woody material (CWM). In streams, CWM provides a diversity of spawning and rearing habitats for aquatic species and anadromous fish. In general, studies indicate that close to 100% of the CWM found in stream channels comes from trees growing within a distance from the channel that is equal to the height of one average tree (FEMAT 1993). Steep slopes can facilitate entry of CWM. Larger order streams (4th or larger) tend to recruit CWM during storm and/or fire events when debris torrents or high flows deposit organic material from the smaller order tributaries.

Management activities have had minor influence on the amounts of CWM found in Dillon Creek. CWM data from 1989 surveys represent expectations for "natural" amounts and distribution.

Coarse woody material can enhance deposition of spawning gravel, increase complexity, improve winter survival, and increase the use of summer holding habitat.

STREAM HYDROLOGY

Most of Dillon Creek is considered a relatively high gradient, high energy stream. Although these conditions do not constitute the most valuable fish habitat, Dillon is important to fisheries in the Klamath Basin. As humans have populated the upper reaches of the Klamath Basin, some of the best spawning and rearing habitat in low gradient streams have been converted into farm land. That has left less desirable, high gradient streams to provide for the various life cycle needs of basin fish populations.

The amount and timing of rain and snow have the most influence on stream flow. Humans influence stream flow by changing drainage patterns. Roads increase direct runoff. This contributes to increased peak flows and decreased summer flows. However, the road density is low enough in Dillon Creek that changes would be hard to detect.

In the long-term, discharge driven by average annual rainfall in excess of fifty inches, provides erosional power that exceeds that necessary to transport the fine sediment delivered to channels. Sediment is generated and transported primarily during peak discharge. There are two important aspects of this general behavior that are most relevant to the assessment of effects: 1) fine sediment in traction or suspension may infiltrate into spaces in the coarse framework of the channel bed, and 2) deposition of coarse sediment and included fine sediment delivered by landslides. Fine sediment generation and transport is evident a number of times every year (see Figures 4-1 **[average monthly turbidity]**, 4-2 **[maximum monthly turbidity]**, and 4-3 **[monthly precipitation]**). Turbid stormflow occurs about five percent of the time. Storm-flow turbidity typically lasts a few hours to a few days after cessation of rainfall. The coarse fraction is less easily transported and may be temporarily stored in stream channels as bars, terraces and debris jams (Lisle 1987) and local alluvial plains. Madej (1987) found the residence time of coarse sediment in Redwood Creek to be on the order of decades for active alluvium and hundreds to thousands of years for alluvium stored in older stream terrace deposits. In a study of stream bed elevation from U.S. Geological Survey stream gages, Lisle (1981) found a decade of high rate of channel bed adjustment due to the large input of sediment from the 1964 flood.

FIGURE 4-1 AVERAGE MONTHLY TURBIDITY (JULY 1980 - DEC 1989) AT HAPPY CAMP

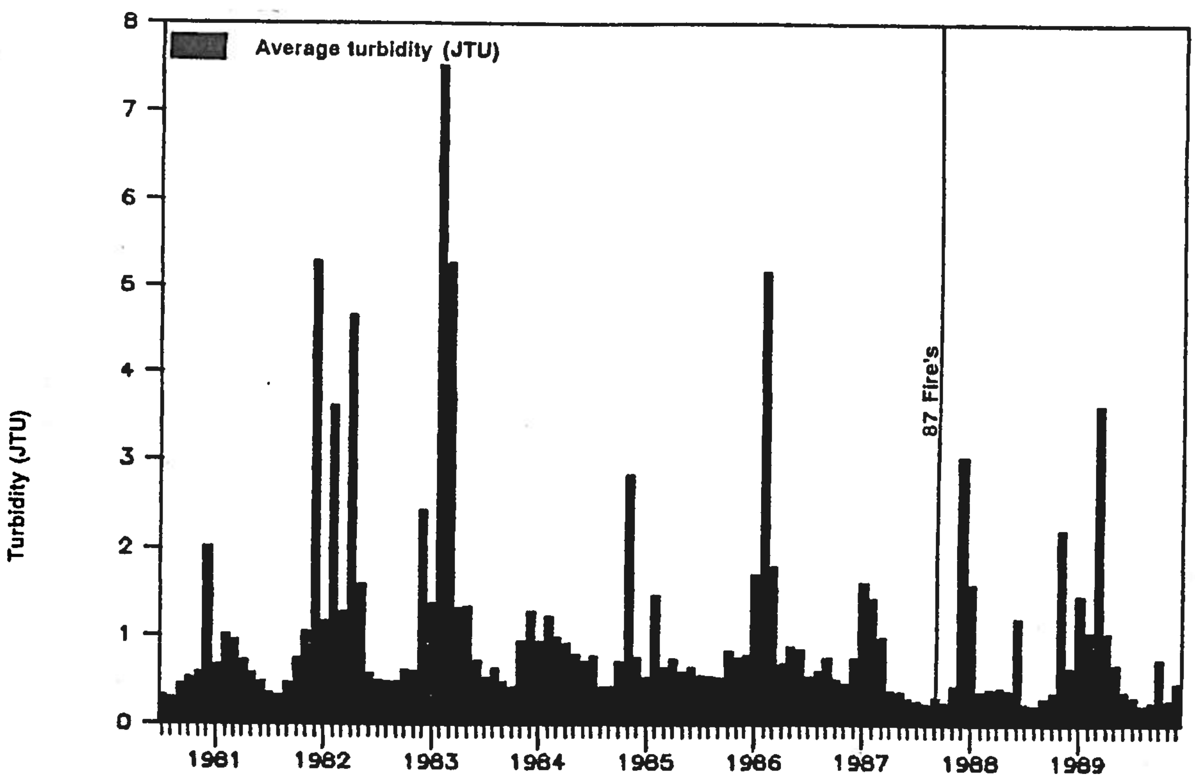


FIGURE 4-2 MAXIMUM MONTHLY TURBIDITY (JULY 1980 - DEC 1989) AT HAPPY CAMP

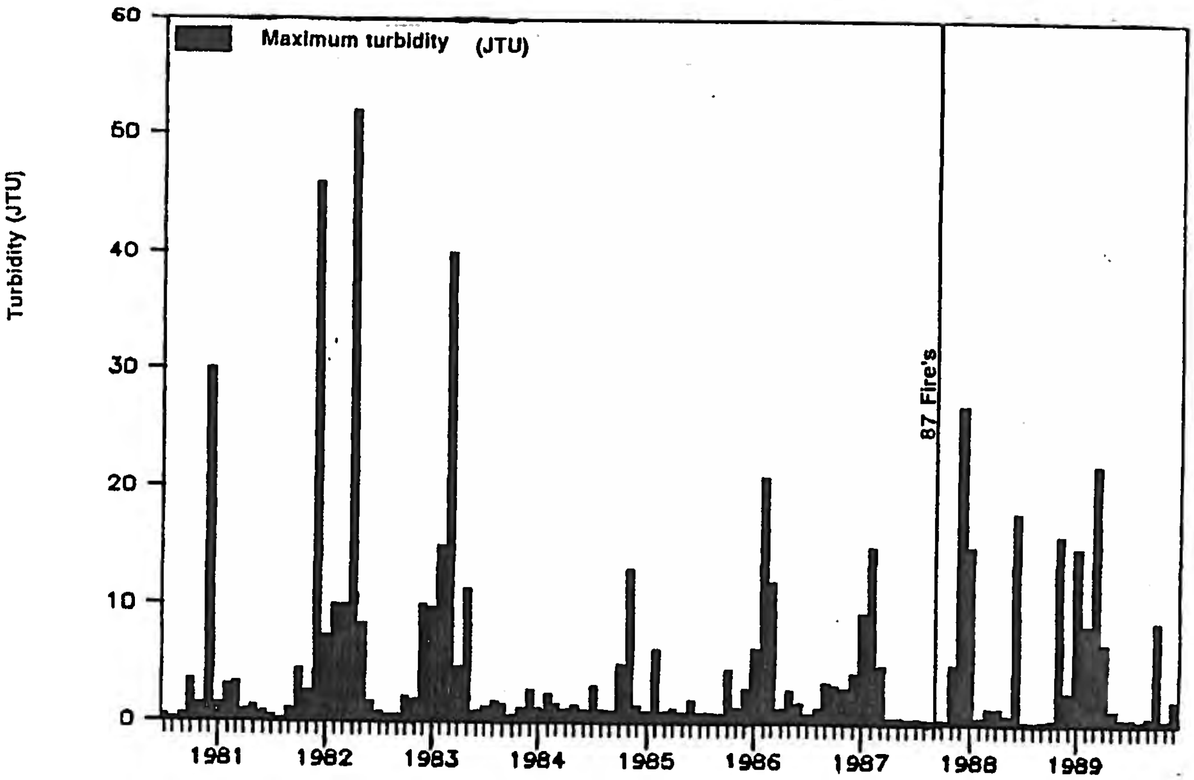
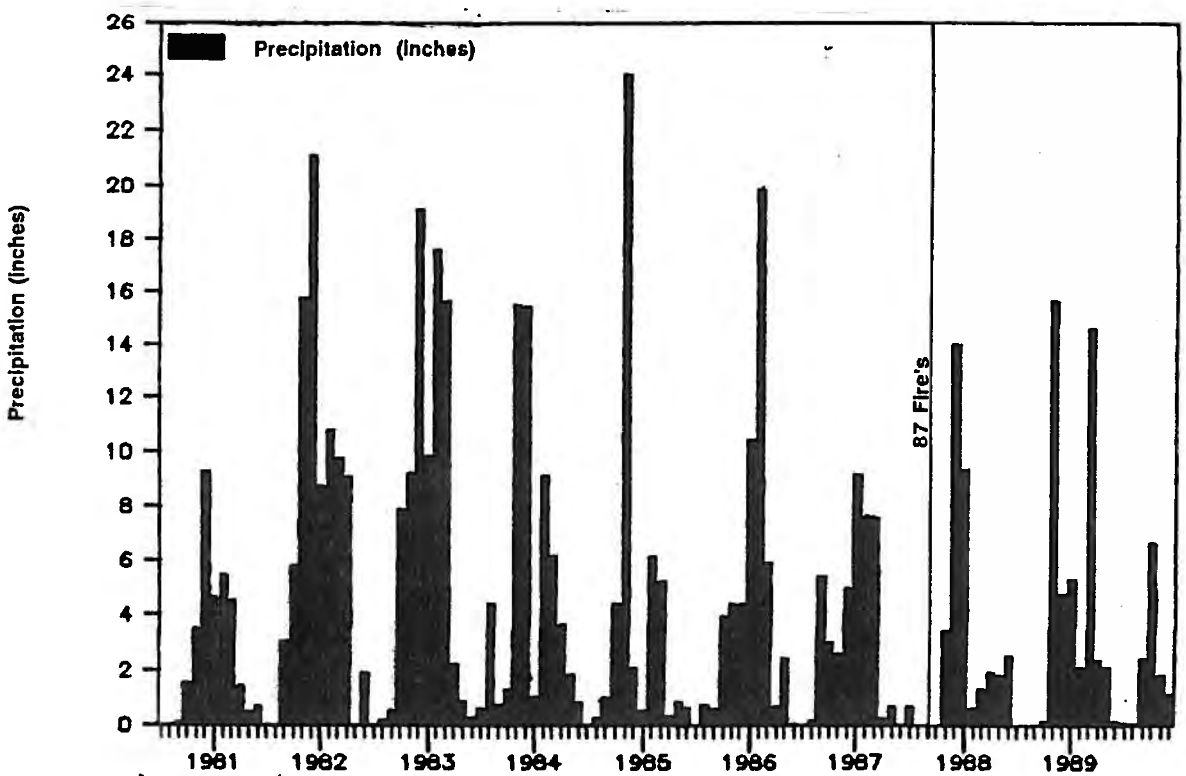


FIGURE 4-3 MONTHLY PRECIPITATION (JULY 1980 - DEC 1989) AT HAPPY CAMP



One of the delivery mechanisms of coarse woody material (tree stems, roots and branches) to stream channels is by debris flow. Such material often accumulates as debris jams that form in first through fourth order streams. Temporary dams formed by landslide deposits or debris jams in channels have occurred at Murderer's Bar (circa 1955), Nordheimer Flat (1964), North Russian Creek (circa 1974) of the Salmon River (Klamath Mountains) (Juan de la Fuente personal communication, 1989) and at Happy Camp (1964). Such dams occur on a variety of scales and may fail suddenly, resulting in floods.

Low discharge can prevent access to spawning grounds or dewater existing spawning gravels. Low discharge conditions tend to increase stream temperature. Eggs within a redd require stream flow within the gravel to remove metabolic wastes and promote hatching. Low discharge conditions reduce the amount of rearing habitat available. Less rearing habitat allows fewer salmonids to remain in the watershed, and more fish are forced into the less hospitable environment of the Klamath River. However, during winter and spring these lower flows can increase survival of eggs in spawning gravels and of juveniles remaining in the creek because less of the streambed is likely to be moved and the potential for crushing them is reduced.

SLOPE PROCESSES

Slope processes vary by geomorphic terrane. The geomorphic terranes mentioned below are defined in the glossary and described in *Chapter III* of this document.

LANDSLIDES

Landslides introduce large volumes of coarse sediment to streams during rare episodes of intense precipitation. This results in changes in the form of stream channels and the texture of the bed. Landslides also damage roads and other improvements. Fine sediment produced from landslides contributes to the supply of fine sediment that may infiltrate into spawning gravels and increase the turbidity of stream water.

Landslides include movement of soil, rock, and organic debris under the influence of gravity. Movement is initiated as a result of reduction in strength and increase in stress. Most landslides occur in response to surface drainage, intense rainfall or melting snow, but are always of multiple causes. Typical causal elements include, soil strength reduced by water saturation, redistribution of mass by natural processes or management activities, the existence of dormant natural landslides, and earthquakes. Patterns of landslide behavior are associated with geomorphic terranes (Table 4-1). Landslides are also distinguished as being natural, natural influenced by management activities, and activity associated.

Table 4-1 LANDSLIDE HAZARDS OF THE GEOMORPHIC TERRANES

GEOMORPHIC TERRANE	CHARACTER OF LANDSLIDE PROCESSES	RELATIVE MAGNITUDE AND FREQUENCY OF HAZARD
METAMORPHIC	Thin soil, small landslides, moderate tendency for coarse debris flow, steep slopes	Low to Moderate
OLD LANDSLIDE	Thick soft soil, large landslides, moderate tendency for debris flow, earthflows may be persistent sources of large quantities of coarse and fine sediment, moderate to high surface erosion potential, susceptible to reactivation	High
GRANITIC	Thick soft soils, moderate size landslides, high tendency for fine-sediment rich debris flows, high surface erosion potential	Moderate to High
ULTRAMAFIC	Thick soils, larger landslides, moderate tendency for debris flow of coarse and fine sediment	Moderate to High

Most recent landslide movements are storm related: the result of intense rain that occurred during the years 1955-1975 and 1982-1986. Two types of landslides are distinguished here, debris slides and earthflows. Debris slides originate in shallow soil on steep slopes. Debris slides often move off the source site as debris flows (also known as mud flows). Debris flows typically move through ephemeral and intermittent channels as thick slurries, to deposit on low gradient channel or be diluted by water in higher order channels. Such shallow slides are less likely to be reactivated at the same site. Some of the landslides are debris slides that occurred on earthflow landslides and may reoccur at the same site. Although there are patterns in occurrence of debris slides, prediction at a site is not feasible. Similar landslides occur at new sites under similar precipitation conditions, at rates that may only be approximated from past experience under similar conditions. Debris slides occur in all of the geomorphic terranes. The highest rates of debris sliding occur in granitic and old landslide terranes.

Earthflow landslides are the smallest number of all the mapped landslides, but are typically large and reactivated by a series of intense storms, occurring in years with above average precipitation. Earthflow landslides are significant contributors of coarse and fine sediment to streams. Earthflows are found exclusively in Old Landslide Terrane. It is expected that there are as yet unidentified earthflows in the Dillon basin.

Vegetation is a significant element in the strength of soil. The fiber reinforcement of roots provides strong resistance to erosion. There are many effects of vegetation on slope stability (see Table 4-2). In most cases vegetation has a net beneficial effect on soil strength.

TABLE 4-2 INFLUENCES OF VEGETATION ON SLOPE STABILITY (Modified from Greenway, 1987)

Key: (+) Tends to increase stability
(-) Tends to decrease stability
(+/-) May increase or decrease stability

	HYDROLOGICAL INFLUENCES
+	Canopy interception and retention of precipitation
+	Retention of precipitation by duff
+/-	Decayed roots provide paths for subsurface drainage
+/-	Depletion of soil moisture by evaporation and transpiration: beneficial if pore-water pressures are reduced, adverse if desiccation results in cracks that subsequently admit water to the soil
-	Increased surface roughness and permeability enhances infiltration
	MECHANICAL INFLUENCES
+	Roots increase shear strength of the soil
+	Roots anchor soil to competent foundation, provide buttress and arch support
+/-	Surcharge of tree mass increases normal and down-slope stress
-	Roots reduce soil density
-	Trees transmit dynamic wind stress to the soil

Table 4-2 con't.

CHEMICAL INFLUENCES	
+/-	Chemical reactions among organic materials, ash lechate and soil that effect friction, cohesion, wettability and mineral content of the soil

SEDIMENTATION

Sediment alters substrate composition and pool/riffle ratios. It also reduces the ability of the bottom substrate to support food organisms important to many aquatic and terrestrial species. Sediment can affect spawning gravels by filling voids and reducing water circulation. Well oxygenated water is needed by embryos for higher survival. After hatching, alevins must work their way through the gravel to enter the stream. This effort can be impeded and even blocked by excessive sedimentation. Channel aggradation resulting from sedimentation can reduce channel stability, increase egg loss during high flows, and reduce pool area in the streams. Winter habitat deteriorates when sediment fills streambank and streambed crevices (embedding) reducing winter holding capacity and/or hiding places during high flows.

Except for a few broad, coarse alluvial deposits in Dillon Creek, relatively little sediment is stored in stream channels. Channels in Metasedimentary and Granitic Terrane are typically cut in bedrock. In the Old Landslide Terrane, channel banks are commonly of earthflow landslide deposits, so there is less mechanical resistance to erosion. Most of the coarse sediment generated to stream channels is delivered by landsliding. Fine sediment is generated by surface erosion of disturbed areas, as well as landsliding.

Coarse sediment production associated with rare, intense storms has been estimated by projecting the volume of landslide movement during the period 1964 through 1975 (see King-Titus Fire Recovery Project FEIS). Landslide production rates (Table 4-3) for natural, harvested acres and road were used to assess the relative contribution of these activities on geomorphic terranes. The conclusion of this estimate is that management related ground disturbance results in approximate doubling of intense-storm related landslide production in intensively managed basins compared to an undisturbed basin. This change is likely expressed as an increase in the magnitude and duration of disturbance of the riparian habitat that results from such episodes of precipitation and sediment production. The relatively light disturbance by past human activities in the Dillon basin suggests that the sediment production potential is near natural in all but the Copper, Mill and Cedar Creek basins. The dominant mechanisms of sediment production are described in Table 4-4.

TABLE 4-3 LANDSLIDE PRODUCTION ESTIMATES FOR GEOMORPHIC TERRANES

	LANDSLIDE PRODUCTION (Cubic Yards Per Acre)		
Geomorphic Terrane	Natural	Harvested	Road
Metasedimentary (1)	1.4	1.6	145
Metavolcanic (2)	3.0	15.0	180
Old Landslide (1,3)	9.0	27.0	329
Granitic (1)	4.8	22.2	198
Ultramafic (1)	0.4	7.0	34.2

(1) Data modified (annual rate to period) from Amaranthus and others, 1985.
(2) Relative rate based on local conditions.
(3) Mean of Colluvial and Hummocky terranes of Amaranthus and others, 1985.

TABLE 4-4 CLASSIFICATION OF SEDIMENT SOURCES

	CHRONIC - FREQUENT, FINE SEDIMENT	EPISODIC - RARE, FINE AND COARSE SEDIMENT
NATURAL	•SURFACE EROSION OF BARE SOIL -BURNED SURFACE -UNVEGETATED SURFACE •CHANNEL EROSION	•DEBRIS SLIDES OF THIN SOIL ON STEEP SLOPE •REACTIVATION OF EARTHFLOW LANDSLIDES OF THICK SOIL ON GENTLE SLOPES
MANAGEMENT RELATED	•SURFACE EROSION OF ROADS -DUST FROM DRY ROAD -MUD FROM WET ROAD -EROSION FROM BURNED, LOGGED, PILED SURFACE	•DEBRIS SLIDING OF ROAD FILL OR CUT •DEBRIS SLIDING DUE TO CONCENTRATED DRAINAGE FROM ROADS •AGGREVATION OF EARTHFLOW BY CHANGE OF DRAINAGE OR SOIL DISTRIBUTION

RIPARIAN VEGETATION

Riparian vegetation is an important link between the aquatic and terrestrial ecosystems. Riparian corridors provide travel routes for both plants and animals within the watershed and between watersheds.

Riparian vegetation exists in a dynamic system that is influenced by aquatic disturbances (floods), and by terrestrial disturbances (fire), as well as landslides and wind. The riparian vegetation in Dillon reflects the character of stands upslope described in the *Vegetation* sections of this document. As discussed later in this chapter, fires in riparian areas tend to be less severe due to increased moisture and shade. With increased moisture and lower fire severity, stands tend to be maintained at higher densities.

TRENDS

Since the 1964 flood, Dillon Creek has been removing sediments and recreating pools in the vicinity of bedrock. Spawning gravels are reappearing in the tailouts of pools. Streamside vegetation has regrown to where the tributaries are usually fully canopied.

The general trend for Dillon Creek is for the aquatic habitat to continue to improve until reset by either large flood or wildfire. The 1994 wildfires are not considered to have been of an intensity to reset riparian conditions. Most of the riparian vegetation was not burned. CWM is likely to increase. Based on summer steelhead counts, populations appear to be decreasing. Chinook seem to be maintaining at relatively low numbers.

PAST, PRESENT, AND POTENTIAL FUTURE ENVIRONMENTAL EFFECTS OF MINING ACTIVITY IN THE WATERSHED

ENVIRONMENTAL IMPACTS ASSOCIATED WITH MINING

Uncontrolled release of acid mine drainage is considered to be the most serious environmental impacts mining can have on the environment. Acidic mine drainage from metal mines can contain dissolved heavy metals in toxic concentrations. Other environmental impacts associated with mining include: 1) seepage, leaching and runoff from open pits, ore stockpiles, tailings ponds, waste dumps, or tailings piles; 2) environmental problems associated with modern techniques of ore recovery and ore processing (cyanide heap leach), 3) mass failures of unstable ore stockpiles, mine waste, tailings or overburden piles, 4) sedimentation, stream channel and riparian damage resulting from placer mine operations; and 5) slope stability problems associated with nonmaintained or poorly designed mine roads.

EXISTING ENVIRONMENTAL PROBLEMS ASSOCIATED WITH MINING IN DILLON WATERSHED

Significant environmental problems are associated with the Siskon Mine, which was the largest producing gold and silver mine in the watershed. The patented portion of the mine is inactive; the unpatened claims are abandoned. Siskon Mine was identified as a hazardous waste site in 1993 after uncontained mill tailings, a slurry tank filled with mill tailings, acidic mine drainage, and more than 250 open, empty cyanide drums with cyanide residues were found on site. Other environmental problems associated with the mine include a large debris slide formed from mass failure of overburden stockpiles, and several rock slides and debris slides associated with the mine road, and tunnel portals. Acidic drainage occurs in Medicine Creek where the ore body (pyrite-bearing schist) intersects the creek. This acidic drainage is considered to be natural in occurrence, and not accelerated by mining.

LANDSLIDES AND ROAD FAILURES

There are approximately five miles of road on patented and unpatented mining claims of the Siskon Mine claim group. The road miles were map wheeled off of a Mineral Survey Map dating from 1955. All the roads were built prior to 1950. There are approximately 1.7 miles of road on the patented claims. The mine road is the 14N31 road, a Level 2 road. There are no easements associated with this road. Most of the mining-related landslide and erosion problems occur on unpatented lands managed by the forest.

Small road failures (fill failures) show up on the 1955 aerial photos. Several other debris flows in discarded waste rock material are also found downslope of tunnel portals. The largest debris slide that is still raw today, occurred adjacent to the largest pit, the Florida Pit. It appears that either a large overburden waste rock pile failed, or more simply, that overburden material was sidecast and wasted on the steep mountain slopes above Medicine Creek. Subsequent severe wet winters and flood events enlarged the debris slide, formed gullies, and scoured out a channel to Medicine Creek.

The severe rains and floods during the winter of 1955-1956 caused significant damage to roads and mine property from landslides and flooding. Other failures occurred in road fills, and in waste rock dumps outside of tunnel portals. The large rock failure that forms a distinctive scar on the eastern slope of the mine failed during the 1955 flood event. The debris scoured out a channel to Copper Creek. The mine road is impassable to vehicles today due to this landslide.

The 1964 flood caused further damage to the mine road. Large gullies were formed in the debris slide near Florida Pit. Another new landslide occurred near the mill site. This landslide likely was initiated on a wide road fill where the many empty cyanide drums were stockpiled. The landslide scattered all of the drums downslope. Other cut failures occurred on the mine road near this landslide.

The 1971 aerial photos show that the landslides initiated in 1964 or earlier had not revegetated very much. The channel of Copper Creek was still raw and showed little new riparian vegetation. The 1986 and 1990 photos show considerable vegetative growth from 1964. Though the largest landslides remain unvegetated the smaller ones have partially filled in with young conifers and other shrubs. The scoured out portions of the larger debris flows have almost fully revegetated near stream courses. Willow and alder have grown in thickly along the Copper Creek stream channel.

INTERRELATIONSHIPS BETWEEN SISKON MINE CONTAMINANT SOURCES AND RESOURCES

The most significant contaminant pathway of concern is surface water. In addition, the uncontained mill tailings and cyanide drums with residues could pose a threat to wildlife species inhabiting the area. Public safety and human health concerns are low at this site because of its remote location and lack of on-site or nearby residents. As there are no groundwater drinking wells within the watershed affected by the mine site, groundwater contamination is not a significant concern.

Copper Creek is an anadromous fishery supporting summer and winter steelhead fish populations and important fish habitat upstream and downstream from the mine and mill site area. The mill tailings and tailings pond area are entirely within the riparian reserve, annual floodplain, and 100-year floodplain of Copper Creek. The effects of erosion of mill tailings on the water quality, and aquatic life of Copper Creek are unknown at this time. No analyses of surface water, stream sediments, or macro-invertebrates, have been conducted to assess the degree of contamination or its effects.

Acidic discharge from Scott Tunnel has the potential to impact Rough Creek and Copper Creek. Further evaluation is needed of metals loading from the tunnel discharge, and water quality above and below the estimated point of entry of the discharge into Rough Creek. The metals content of sediment in Rough Creek also requires further evaluation.

Though several sensitive plant species have potential habitat or known populations in the area, no botanical surveys have been conducted in the mine or mill site area. A Late-Successional Forest Reserve is within two miles of the mine site and mill site area. Two known nesting pairs of northern spotted owls have been recorded within two miles of the mine site and mill. The mine is also within the habitat range of the marbled murrelet, but no surveys have been done in the area. Habitat associated with the Del Norte salamander occurs in the area but no surveys have been done to identify the presence of the salamander, or other herpetofauna. Deer and bear have been seen in the mill site and tailings area, and both deer and bear tracks have been observed in the slurry tank. The mill tailings are used as a "salt lick" by both deer and bear.

FOREST HEALTH/CONDITION

This section describes the factors that influence the character of the vegetation. It also includes predicted trends in vegetation pattern. The conditions described below are key processes that affect the development and maintenance of the ecosystem. An understanding of ecosystem processes is necessary for identifying the ecological values of the watershed and determining desired conditions.

FACTORS THAT INFLUENCE THE CHARACTER OF THE VEGETATION

Generally the landscape vegetation patterns result from a combination of the following three factors: 1) distribution of plant communities along gradients of limiting environmental factors, 2) plant species response to changes in the environment, and 3) patterns resulting from portions of the landscape responding to disturbance with different outcomes and at different points in time.

Slope gradient, elevation and aspect influence the amount of solar energy and water a given site receives, the degree of evapotranspirational stress, and variations in temperature. Slope position and gradient also affects the flow of material (above and below ground water, and organic and inorganic particulates), and air subsidence, by guiding flow paths or wind, and by forming barriers to movement (Swanson et. al. 1992). These local conditions combine with parent material and soil forming processes to provide gradients of environmental conditions and consequently different plant habitats. The limiting environmental factors primarily influencing plant communities are available moisture, elevation, soil parent material and development, and types of disturbances present.

The basic requirements for growth of vegetation are sunlight, water, and nutrients. On any particular site, the total amount of sunlight delivered to a site changes very little from year to year. The total mineralized nutrient availability also tends to change very slowly. The limiting factor on the vegetation growth that changes most is available moisture. The deep, red soils present in portions of Dillon provide the highest water holding capacity, and are largely responsible for the best growing conditions. These areas are termed good sites. Shallow, skeletal soils hold less water which tends to limit the rate and amount of vegetation growth they can produce. These areas are considered poor sites.

CLIMATE

The climate of Dillon Creek is influenced by its proximity to the coast. Moist, cool, maritime air commonly pours over the crest of the Siskiyou's during the dry season influencing vegetation patterns and fire behavior in the watershed. Increased moisture also improves growing conditions. This contributes to why Dillon has been slower to suffer insect infestations than watersheds farther inland. The better growing conditions can support more vegetation before they become overstocked and suffer from intense competition and possible mortality. The coastal influence has also resulted in several plant communities with unusual species compositions.

Climate data indicate that there can be significant short- and long-term fluctuations in precipitation for the watershed. There are short-term year to year variations and long-term decadal to centuries trends. Table 3-1 in *Chapter III* displays historic precipitation records for 1915-1990. Even during wetter times, there are years with significantly below average precipitation. Reconstruction of long term (1600-1961) climate trends from tree rings (Fritts and Gordon 1980) indicate that the current century has been generally wetter than the 1700's or 1800's. Long severe droughts occurred from around 1750 to the early 1800's and again in the late 1800's.

DISTURBANCE

Forest ecosystems are dynamic, forever changing in response to successional trends, long-term fluctuations in climate, and the more immediate effects of natural disturbance from disease, drought, fire, insects, storms, and the movements of earth, wind, and water.

Disturbance is an essential ecological process, necessary at some level of intensity and periodicity for the long-term sustainability and productivity of this ecosystem in its present form. Recurrence of disturbance and recovery within ecosystems is an important mechanism for energy flow, nutrient cycling, and for maintaining age, species, genetic, and structural diversity, all attributes of ecosystem health.

The major effects of disturbance in ecosystem dynamics include: changes in successional pathways, changes in stand structure, and changes in density of vegetation. Disturbance results in the redistribution of nutrients, light, and moisture and makes these available for new growth by existing or replacement species. As a consequence, species adapted to either survive a given disturbance or reproduce and grow in the post disturbance environment are given a competitive advantage.

Several types of disturbance have been important in the Dillon watershed. Fire exclusion and timber harvesting were discussed in *Chapters II* and *III*. The following discussion focuses on drought and fire.

DROUGHT

Total precipitation and its distribution during the year greatly influence available soil moisture for plant growth. The plant communities in Dillon Creek responded with increased growth during the wetter years from 1938-1975. More plants were able to occupy a given site with more available moisture. This period also coincided with the beginning of effective fire suppression. During drier years since 1976, this increased vegetation density and the lack of disturbance has left some areas with more vegetation than can be sustained. When the functioning of a tree becomes impeded by lack of moisture (from competition with other plants or from drought) it is less able to defend itself from insects and/or pathogens. Tree mortality can result with a subsequent increase in fuel loadings.

Drought can also influence fire occurrence and severity. Prior to fire exclusion policies, fires were more common in dry years than wet ones (Swetnam 1993). In the current fire suppression era, fires are also more common and extensive in drought years. However, the accumulation of large fuels and understory vegetation resulting from reduced fire frequency has significantly increased the severity.

FIRE

Fire appears to be the dominant, most frequent disturbance in Dillon Creek and a major determinant of historical landscape diversity. Other disturbances, such as mass movement (landslides), floods, wind, and insect or disease epidemics have also played a role, although a more localized and/or infrequent one.

Potential ecological effects of fire can be categorized by fire regimes. A fire regime is defined by patterns of similar fire frequency, severity, extent and seasonality. Over the long term, fire regimes are not stationary and the frequencies (mean time between fire events) and extent change through time (Swetnam 1993; Agee 1991).

Fire frequency and severity vary depending on annual-to-centennial climate patterns and the complex interactions of vegetation with soils and topography, succession, and fuel accumulation and decay rates. Fire occurrence is dependent on an ignition event, a fuel bed that will carry a fire, and weather conditions conducive to fire spread. Generally warmer and drier sites will have more frequent fires than cooler and moister ones, as there are more days when the conditions are conducive to fire spread on dry sites than moist ones.

Fire frequency and severity influences and is influenced by the vegetation found in an area. Vegetation types occur in different environments which affect the association of plants present, fuel flammability, the rate of fuel accumulation, and the drying and availability of fuels to burn. However, the size and interspersion of plant communities with typically different fire frequencies on the landscape can result in a mixing of fire regimes (Agee 1991). This may result in reduced fire frequencies for frequent fire sites and increased frequencies for infrequent sites.

Fire severity is largely dependent on the quantity, type and distribution of available fuels and the rate at which they burn. There is a tendency for fire severity to be inversely related to fire frequency in forested ecosystems. Low severity surface fires tend to occur in vegetation types where frequent fires maintain fuels at low levels. High severity crown fires tend to occur in forests where large amounts of fuel accumulate between infrequent fires.

The complex topography in Dillon Creek forms many barriers to fire spread, such as riparian areas, sharp ridge tops, rock outcrop and talus slopes, and changes in aspect and plant communities which affect fire severity. This irregular landscape exhibits great variation in slope gradient, fuel accumulation and drying rates, and hence variable rates of combustion and fire spread. These factors alter fire behavior and produce variable intensities, and patchy fires.

FIRE REGIMES IN DILLON

The landscape vegetation patterns in Dillon Creek are a composite of plant species responses to environmental conditions and past fire regimes. Disturbance has created changes to the structural characteristics, density and species composition of stands, and the distribution, size and shape of patches on the landscape. Fire can disrupt seral stage progression and return plant communities to an earlier successional stage or maintain the plant community by frequent low intensity fires. Fire has apparently helped maintain mature conifer cover in the Dillon watershed, as the presence of forested cover is the most common vegetation feature.

No fire history studies have been completed in the drainage. Several studies have been completed in the Klamath Mountains Province (Wills 1994; Agee 1991), and a major study is in progress on the Thompson Ridge area of the Happy Camp District (Carl Skinner, PSW, Redding; and Alan Taylor, Pennsylvania State University). These studies provide insight into the fire regimes of Dillon Creek.

Historic Fire Regime

The historic fire regime, prior to fire exclusion policies in the 1920's, was one of generally frequent, low to moderate severity fires. Fires were low intensity surface fires with occasional higher intensity, stand replacement patches. Large scale stand replacement events of hundreds to thousands of acres were uncommon for the landscape as a whole.

Fires were apparently extensive. Early newspaper accounts speak of large fires that burned for weeks to months in the mountains. Tree ring records and fire scars indicate that fires occurred during drought periods and after the cessation of conifer diameter growth (after early summer). These fires burned through a landscape of complex topography, diverse vegetation and prior areas of disturbance which affected fire severity. The overall result was a patchy landscape.

Frequent, low to moderate severity fires served as a selective stocking control mechanism that reduced vegetation density. This regime favored vegetation best adapted to these fire conditions. Stand density was lower, improving the growth of larger, older trees.

Lightning ignitions were likely the cause for fire frequencies found. American Indians were known to have used fire, but their influence may have largely been on specific sites for acorns, basket making materials, ceremonial purposes, etc.

Several fire regimes are recognizable within the Dillon drainage associated with elevation, aspect and vegetation types. In general, lower elevation sites burn more frequently than upper elevation sites, south tending aspects more frequently than north tending aspects, and vegetation types that rapidly produce flammable fuels more frequently than those with lower production rates and/or less flammable fuels. As previously discussed, the complex topography, diverse interspersed vegetation types, and extensive nature of fires mixes the regimes and creates a mosaic of variable fire intensities.

Fire regimes are discussed here by low and high elevations, and short return interval crown fires. Although many factors influence fire regimes, the strongest trends correlate with elevation. An exception occurs where stand replacement fires were common in vegetation types such as knobcone pine and montane chapparal.

Low Elevation Fire Regime

The lower elevation (below 3,500') Douglas-fir, montane hardwood, montane hardwood-conifer, and portions of the Klamath mixed conifer vegetation types (see *Chapter III*) were characterized by frequent low to moderate intensity fires. Mean Fire Return Intervals (MFRIs) of 16-28 years were found on Thompson Ridge and 12-17 years on the Salmon River Ranger District (Wills 1994) for similar vegetation types. A low elevation, extensive south slope area in Indian Creek (Happy Camp Ranger District) had MFRIs of seven years with a range of three to eleven years between fire events.

Aerial photographs from 1944 show south tending slopes with lower conifer densities than north tending slopes. Many of these aspects, particularly where south slopes are less extensive and mixed into diverse topography, were dominated by hardwood trees or brush. North tending slopes varied from fairly uniform, dense stands of conifers and hardwoods to patch openings which were larger towards the ridgetops.

Lower slopes tended to have fewer large openings and more uniform conifer distributions where the sites were not limited.

These patterns resulted from a generally warm, dry environment, the topography, and differences in fuel production and flammability of the vegetation. Generally, the moister productive sites at lower to mid-slope positions supported Douglas-fir in association with tanoak. Tanoak is very shade tolerant, produces fuel slowly, does not have particularly flammable foliage, and its dense canopy shades ground fuel. The lower slope positions also moderate fuel moisture through air subsidence, topographic shading and proximity to perennial streams. These factors tended to reduce fire intensity and resulted in a finer scale mosaic of small patches where occasionally one to several large overstory trees were killed. There were a few larger patches where either fuel accumulations or topographically induced fire runs increased fire severity.

The warmer, drier, productive upslope positions and drier aspects were more conducive to fire spread and burned with a higher intensity. Douglas-fir and associated sugar pine, ponderosa pine, black oak and madrone rapidly produce fuel and the stands were generally more open than lower tanoak sites. Although fire frequencies were similar, the patch sizes were larger and more common than in the tanoak areas. The upper-slope positions, particularly on lower elevation, minor ridges, would also have contributed to higher fire intensities from uphill running fires.

The least productive sites were dominated by canyon live oak (Montane Hardwood). These sites accumulated fuel slowly and fire intensities were low.

High Elevation Fire Regime

The high elevation (above 3,500') Klamath Mixed Conifer and white fir types were characterized by generally less frequent, more severe fires. MFRIs varied from 21-33 years in mixed conifer stands to 60 years in white fir types on Thompson Ridge. Agee (1991) found 43-61 year MFRIs for mixed conifer and 64 years for white fir stands in the Siskiyou Mountains in Oregon. In the Klamath Mixed Conifer type, fire frequency is related to the mix of Douglas-fir to white fir. Stands with greater white fir overstory composition had less frequent fires.

The 1944 aerial photographs show that high elevation conifer stands were generally denser and composed of larger patches of uniform aged conifers than at lower elevations. Patches were often large, to several hundred acres. Brushfields were also large, prevalent towards the upper-slope and major ridgetops, and most common on south tending aspects.

These patterns are a result of the cooler and moister environment, differences in vegetation flammability and fuels accumulation rates, and numerous barriers to fire spread. White fir has a dense closed canopy growth habitat and produces fuel at irregular rates. Increased snow pack and type of litter contributes to a compact fuel layer. Understory vegetation, whether herbaceous or brush, does not burn well until cured late in the fire season. These characteristics tend to shorten the time period when this vegetation type would burn and reduce fire intensity in all but the driest years. It is probable that fires starting and burning in drier and warmer low elevation sites did not burn through this vegetation type regularly. This would allow greater accumulations of fuel until a fire event occurred in a drier year. Burning under more severe fire conditions and occurring in upslope topographic positions probably contributed to the larger patch sizes and more severe fires.

The upper elevation Klamath Mixed Conifer and Jeffrey Pine type patterns were also influenced by the species mix, site productivity, slope position, and barriers to fire spread. Fires appeared to be patchy and were probably influenced by the burning characteristics of the different brush species, especially on poorer sites. Fires were also extensive and burned under a variety of fire conditions. Poor sites would slowly recover to a condition where they could carry a fire again. Productive sites could carry a fire sooner, but may have been isolated from a fire event for several cycles by adjacent sites still recovering from a past fire or other natural barriers.

Short Return Interval Crown Fires

Montane chapparal and knobcone pine vegetation types were characterized by high intensity fires. No fire history studies have been completed, but the age of most stands in Dillon Creek correlate with past major fires. Fire return intervals were estimated to be 15-40 years.

The 1944 aerial photographs show extensive brushfields on the upper-slopes, south aspects and harsher sites in Dillon Creek

This fire regime/vegetation pattern resulted from the vegetation's flammability and fuels accumulation rates (see *Chapter III*), harsh south aspects, and the fire regime in adjacent forest stands. These persistent brush and knobcone stands usually burned with a stand replacement crown fire. After a stand replacement event, a site would not burn until the brush crown cover became nearly continuous and there was some decadence. At this point, the vegetation was highly flammable and it stayed in this flammable condition for a long period of time. Fires do not back nor underburn well in this vegetation type, as there is little understory fuel to carry a ground fire. Adjacent conifer stands can produce enough ground fuel to carry a fire within five to ten years of a low intensity ground fire. This resulted in these knobcone and brush areas skipping fire events until the brush was very flammable and would burn with a high intensity.

Current Fire Regime

Effective fire suppression beginning in the 1920's changed the fire regimes in Dillon Creek. Large fires have continued to occur, but suppression has lengthened the fire free interval. As the fire regime changes, the structure of the vegetation and fuels profile changes at both the stand and landscape level. Understory vegetation has increased, fuels have increased, continuity between the understory and overstory vegetation has increased, and the vegetation/fuel profile is more uniform over the landscape. These conditions have created the potential for severe wildfires that are difficult to suppress.

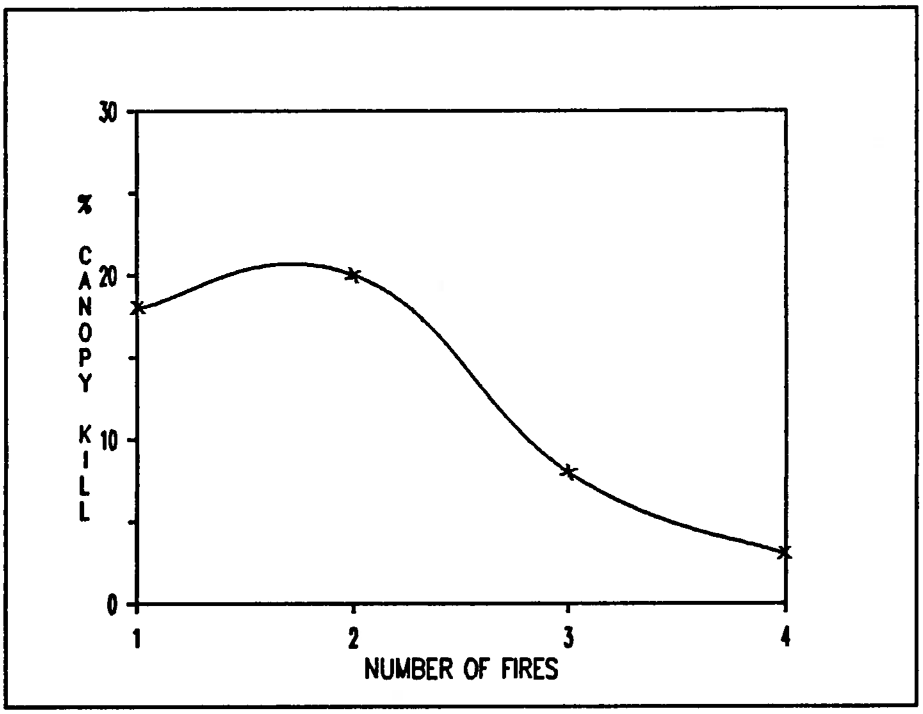
The 1994 Dillon fire is an example of this changing fire regime. The dry conditions and large number of fire starts along with an unmanageable vegetation/fuel profile combined to create a situation where suppression forces were overwhelmed. In the suppression era, fires rarely escape initial attack except under severe fire weather conditions which contributes to large fires burning under the most severe conditions. The new fire regime is one of less frequent, hot ground fires with larger stand replacement patches.

Fire suppression has changed the landscape vegetation pattern. A comparison between 1944 aerial photographs and recent (pre-fire) aerial photographs showed an increase in general vegetation density and many early brushfields have filled with conifers. Skinner (1995), in a study of forest openings in Dillon and Clear Creek drainages, noted this increase in vegetation density and a corresponding reduction in the size of forested canopy openings from 26% of the 1944 landscape to 16% in 1985. This amounted to a 39% reduction in the area occupied by openings in non-management influenced areas.

Without frequent fires, forest stands changed from open stands of conifers and hardwoods to denser stands with more shade tolerant conifers and hardwoods. For example, shade tolerant and less fire resistant white fir has encroached into lower elevation Douglas-fir stands. This in-growth created multi-storied stands, but the increased density stressed the vegetation as moisture and nutrients became limited. Vegetation mortality and the lack of fires has increased the down woody fuels, and the multi-storied stands create ladder fuels for crown fires. It is likely that future fires in these stands will be more intense, and create larger patches.

The fire history map (Map 2-1) presented in *Chapter II* was used to compare fire intensity with fire frequency in the current fire regime. Large fire perimeters may be somewhat incomplete or less accurate prior to 1940, but following that time the confidence in historical fire perimeters is high. The high intensity burn areas in the Dillon fire (70%-100% of the overstory killed) were compared to the historic fire perimeters. This shows a trend of greater fire damage correlated with longer fire exclusion periods. Where no fires were recorded or one fire occurred early in the century with a subsequent long exclusion period, the damage was greatest. Where four fires occurred the loss of overstory was lower. Figure 4-4 shows the relationship between fire intensity and fire frequency.

Figure 4-4 - FIRE FREQUENCY OVERSTORY KILL



The fire history map also shows no recent large fires on the far west side of Dillon watershed. Although air photos show evidence of at least one large stand replacement fire over 100 years ago, other factors indicate that fire risk is somewhat lower for this area. The fire free area has less productive sites, and many barriers to fire spread. Without the bio-mass production found on better sites, fuels are generated and accumulate slowly. This area is also closer to the coast and influenced by cooler, moister air. However, given a long enough fire-free interval where the slow rate of fuel accumulation exceeds the even slower decomposition rates, a wildfire is likely to occur in the future.

FIRE AND FUEL LOADING

Fuel loading is dynamic and difficult to predict over time. Fuel loading is of particular interest to the land manager because it is the only aspect of the fire regime that can be manipulated. Neither the climate, topography or probability of natural ignition can be changed, but the amount, size, and distribution of fuels can be managed to influence fire severity, rate of spread and suppression difficulty.

Prior to the 1994 fire, the fuel loading in unmanaged stands was variable due to past fire history, stand ages, and the different vegetation types. Low accumulations (less than 10 tons/acre of dead and down surface fuels) were found in hardwood stands where litter decomposes faster and stands had not suffered competition-induced mortality. Loadings as high as 70 tons/acre were found in stands with accumulations of large downed logs that were a result of mortality from past fires or insect attacks.

Managed stands also had variable fuel loadings for different reasons. Management activities had occurred in the drainage for over thirty years and during this time different silvicultural treatments, harvest systems, and fuel treatments were applied. There were partial cuts without fuel treatment, partial cuts that were underburned or tractor piled, numerous salvage sales and many clearcuts. These received fuel treatments from no treatment, yarding of unmerchantable material (YUM) without burning, to hot broadcast burns. Total fuel loadings probably varied from as little as 5 tons/acre in clean tractor piled units to as much as 80 tons/acre in units which were neither YUMed nor broadcast burned. Typical cable logged and fall broadcast burned units had loadings from 20 to 40 plus tons/acre depending on YUM treatment and specification.

The 1994 wildfires have temporarily reduced the dead and down fuel loadings. Most of the surface fuels were consumed in the high and moderate fire intensity areas. The continuity between remaining large fuels and any green or scorched vegetation has also been broken. In low intensity areas there are still occasional unburned or partially burned "islands" where surface fuels and understory vegetation were reduced but not always completely consumed.

Fuel loading and vegetation will change over time depending on 1994 fire intensity. Where extensive damage to above-ground vegetation occurred, such as in the moderate to high intensity burned stands, the natural vegetation succession began soon after the fire. Grass and shrubs germinated; hardwoods sprouted; and conifers may regenerate. Where the overstory was consumed by a crown fire, there will be little fine fuel accumulation for several years. If the overstory was scorched, the fine needle and leave accumulation would provide some fine fuel loading.

With continuing decay, twigs, branches, and tree boles would fall on the brush, hardwoods and conifer reproduction. Supported by the green vegetation, these above ground fuels would increase the fuel bed depth and be drier and slower to decompose than fuels on the ground. A fire carried by this fuel would be intense enough to cause crowning, spotting and rapid rates of spread.

Fuel loading will continue to increase as the fire-killed stands further deteriorate. A majority of the smaller dead trees and portions of the larger dead trees will fall within 10 to 20 years. This deterioration would provide horizontal continuity for the ground fuels, while the standing fire-killed trees and regrowth of conifers, brush, and hardwoods add vertical continuity. The combination of heavy fuel loading and horizontal and vertical continuity will present the potential for development of extreme fire behavior such as crowning and spotting. The fire hazard will remain high for 30 to 60 years. Fire suppression difficulty would also be high for many decades. The potential for erratic fire behavior, high rates of spread, and heavy fuel loading would limit suppression ability.

In low intensity burned areas, the effects depend on the degree of damage to understory and overstory vegetation. In many areas the fire reduced the amount of downed fuel and broke the vertical continuity by killing understory vegetation and lower limbs on trees. A fire would be carried in light litter that has fallen from overstory vegetation and would be a low intensity, easy-to-control ground fire. Where more understory vegetation was killed, the deterioration of trees and brush will provide increasing amounts of downed fuel. A more open canopy provides the light and growing space for germinating brush and invading grass and forbs. These areas will have similar fuel and vegetative characteristics to the high intensity areas except that their fire potential is reduced by small size and lack of fuel continuity.

Experience within the 1987 wildfires has shown a dramatic decrease in the number of fire starts after 1987. This is attributed to the reduction in fine fuels, duff, soft snags, large down logs, and defective green trees in the fire areas. Until the fine fuels and fuel continuity increase in the fire area, a similar result is expected in Dillon Creek. Fine fuels will increase most rapidly in the lightly damaged stands where the overstory is still intact. Severely burned areas may require 5 to 20 years depending on site quality and vegetation type to recover sufficient fine fuels to carry a fire. When these areas can burn, they have the potential to burn severely again.

LANDSCAPE PATTERN

The 1994 fire burned a substantial portion of the watershed. Much of this area had not burned in more than fifty years. This more than doubles the historic MFRIs for most vegetation types in the drainage. The resulting burn patterns are different from the historic pattern after missing several fire cycles this century. Patch sizes in the 1944 aerial photographs show a different texture than the large, uniform blocks that have been created by the recent fire. This is especially evident in the Douglas-fir, Jeffrey Pine, and Klamath mixed conifer vegetation types. Using barren areas and grass/forb, shrub/seedling seral stages including sapling stands as openings, the amount of area in openings increased after the fire. Before the fire, approximately 17% of the fire area was in openings. After the fire, this increased to approximately 30% within the fire perimeter. The area of these forest openings, post 1994 fire, exceeds by more than 4% the 26% forest canopy openings found for 1944 by Skinner (1995). The 30% mentioned above included openings 5 acres in size and greater; Skinner included all openings greater than 1/4 acre in size for his analysis. Another indication of pattern change is that using the same vegetation typing criteria, the average polygon size within the watershed increased by 30% after the fire.

Most of these areas will revegetate with early seral stage vegetation comprised of grass, forbs, brush, hardwoods and conifer regeneration. This early seral vegetation, like the persistent montane chapparal vegetation type, will not burn well for several years. Over time, increasing vegetation continuity, brush decadence and fuel accumulations from the breakdown of fire-damaged stands, will eventually cause these stands to be very flammable.

Many low intensity burn areas also have potential for a rapid increase in larger fuels. This is due to the wildfires killing variable amounts of the overstory and understory vegetation that had established without prior frequent fires. These areas will soon have unnaturally high fuel loadings and potential for even more severe reburns.

Reburns of large fires on the Klamath National Forest have occurred within as little as ten years after the original fire. The 1987 fires reburned 36,000 acres on the Happy Camp Ranger District that had burned in previous large fires since 1917. Examples of reburns include the Slater, Thompson, and Slide fires of 1987 which reburned over half of the 1966 Indian Ridge fire (12,500 acres) on the Happy Camp Ranger District, and the Glasgow and Yellow fires of 1987 which reburned nearly two-thirds of the 1977 Hog fire (46,500 acres) on the Salmon River Ranger District. These reburns occurred in both unmanaged and salvage logged areas. They often burned more where combinations of early seral vegetation and/or high fuel loadings from natural breakdown of fire-damaged stands or untreated logging slash increased fire intensity.

Fires will continue to occur within the Dillon drainage. The reduction in fine fuels, duff, snags, large down logs, etc. will reduce the occurrence of lightning fires in the short-term. This affect will last from five to ten years, depending on the burn severity, site quality and vegetation type.

In the long term, the vegetation/fuel profile will change as fine fuels accumulate and the dead standing vegetation sheds needles/leaves, limbs, and tops. The potential severity of a future wildfire event (10-40 years) will depend upon the 1994 burn severity, vegetation type, seral stage, and site quality.

Post-fire vegetation conditions were used to display possible patch size increases with future wildfires. This display is based on an assumption that a combination of early seral vegetation and the 1994 understory and overstory kill in moderate to high intensity burn acres will result in an unacceptable vegetation/fuel profile within fifteen years. Where the number (volume) of dead overstory trees is small, less downed fuel will be created. A reburn in these areas is less likely to be intense enough to kill all the early seral vegetation, remaining green overstory trees or adjacent stands. Where the dead overstory is greater, dead fuels accumulations are likely to increase fire intensity enough to: kill regeneration on these sites, threaten residual overstory and adjacent stands, and damage soils.

No studies have been completed that compare fire damage from multiple fire events. One study of 1987 wildfire damage has been completed on the Shasta-Trinity National Forest and several others are in progress (Weatherspoon and Skinner, personal communication). These studies looked at resource damage from a single fire event and prior management history. Findings that can be applied to predicting future fire effects in a reburn of the Dillon fire include: greater fire severity within areas with untreated fuels, and intense fires in a particular area will tend to increase fire severity in adjacent areas.

Two categories of fire intensity and resulting canopy kill were used for this analysis. One is the high intensity burns where at least 70% of the overstory was killed by the fire. The other is the moderate fire intensity areas where 30% to 70% of the canopy was killed. These areas were further refined by identifying stands with 10 MBF or more per acre of dead timber as an indicator of where future down fuel accumulations will be the most significant.

Map 4-1 illustrates the potential for high to moderate severity burn patches to expand during a future wildfire. These are only estimates, and in most cases, the risk of stand damage is greater for upslope than down slope. Damage to these and adjacent stands would restart vegetation succession, increase the size of deforested area, and lengthen the time to late successional forest conditions.

The high intensity areas, (shown in red on the map) were assigned a risk of a 200 yard perimeter increase (shown in blue). This is supported by potential fire intensities of a future fuel bed in these patches and observations of perimeter increases of older snag patches from the 1987 and 1994 wildfires. The moderate intensity areas, (shown in yellow), were assigned a risk of a 100 yard perimeter increase. The mosaic of surviving trees, early seral vegetation and downed fuel accumulations are not likely to produce as intense a fire. Although the stand and any regeneration and residual overstory is likely to be severely damaged, less damage is expected in the adjacent stand.

LATE-SUCCESSIONAL STANDS

Succession is the term used to describe the development of a plant community over time. Many characteristics of the plant community change during succession. These characteristics can include: 1) growth and size of the dominant plants; 2) the species composition of the dominant plants; 3) species composition and abundance of understory plants; 4) physical structure of the vegetative canopy; and 5) the presence of dead vegetation.

The seral stages (*Chapter III*) describe the development and physical canopy characteristics present during succession of forest communities. The variety of plant species and their relative numbers can vary greatly in any one seral stage of any one forest type, depending upon the severity and frequency of the disturbance and history of the stand. Disturbances may erase, alter or accelerate forest succession. Furthermore, successional advance depends on many unpredictable occurrences such as seed production and dispersal, seed predation or disease, climatic conditions, existing species composition and individual species adaptations to persist following disturbance (Schoonmaker and McKee 1989; Noble and Slatyer 1977). The patterns that develop leading from early seral stages such as grass/forb and shrub to the old-growth seral stage are referred to as successional pathways. Multiple pathways exist for any one potential forest type (Jimerson 1991; Steele 1984). In the habitat types of northwest Montana, six to nine pathways have been found for each of the seven habitat types examined (Keane 1987). A study of successional pathways in one ecological type, the tanoak/Canyon live oak/evergreen huckleberry type, of northwest California revealed a possible six pathways depending upon management treatment (Jimerson 1991).

Stands with mature to old-growth characteristics are important biodiversity considerations due to the habitat they provide for some species of plants and animals. The structural characteristics that are the basis for old-growth include large trees, large standing dead trees, large down logs, and multi-storied stand condition (Franklin 1989).

The ability of a stand to achieve and maintain late-successional characteristics depends on a number of factors. These include: site quality, vegetation type, topographic location, species composition, and frequency and severity of disturbance.

Some sites and vegetation types are limited in their potential stand development. For example, knobcone pine or live oak stands (montane hardwood) do not have the potential for late-mature or old-growth characteristics. Poor sites may also be limited in development, but more commonly would take longer to develop late-successional characteristics due to slow tree growth. The best sites can support more vegetation, larger trees and faster growth rates.

Locations favorable for maintaining old-growth characteristics are mid to lower north facing aspects, flatter areas and lower slopes. Shading from topographic features, higher humidities and denser vegetation tends to moderate fuel moistures and subsequent fire intensity on the north and lower slopes. Flatter areas in the watershed which are often more productive sites tend to carry less severe fires. Fires on steeper slopes tend to run uphill, drying fuels ahead of them, which increases fire severity.

Reconstruction of the seral stages from 1944 aerial photographs was done for the Elk Creek watershed. This "snap shot" in time provides some comparisons for the Dillon Creek drainage. The majority of old-growth stands (59%) were in the mesic Douglas-fir tanoak type, 26% in the drier Douglas-fir and 15% in the white fir type.

Douglas-fir is very resistant to fire with increasing age and size. Large Douglas-fir have thick, fire resistant bark, lower branches that readily self prune when shaded, and are long lived. This puts tree crown above low to moderate intensity ground fire and facilitates steady fuels accumulations throughout the life of the stand. These characteristics reduce the likelihood of a stand replacing fire. Douglas-fir stands on warmer and drier sites were more open and had different associated species than the mesic tanoak. These stands apparently did not maintain old-growth conditions as long.

Shade tolerant white fir has thin bark, long crowns, and often develops in dense stands. Since the lower branches are very shade tolerant, little fuel is shed to the ground until the stand becomes very crowded. At this point, many trees will self-prune or succumb to insects causing a rapid pulse of fuel build-up. They then are at very high risk to intense fire. Stand replacement fires are more frequent and patch sizes larger.

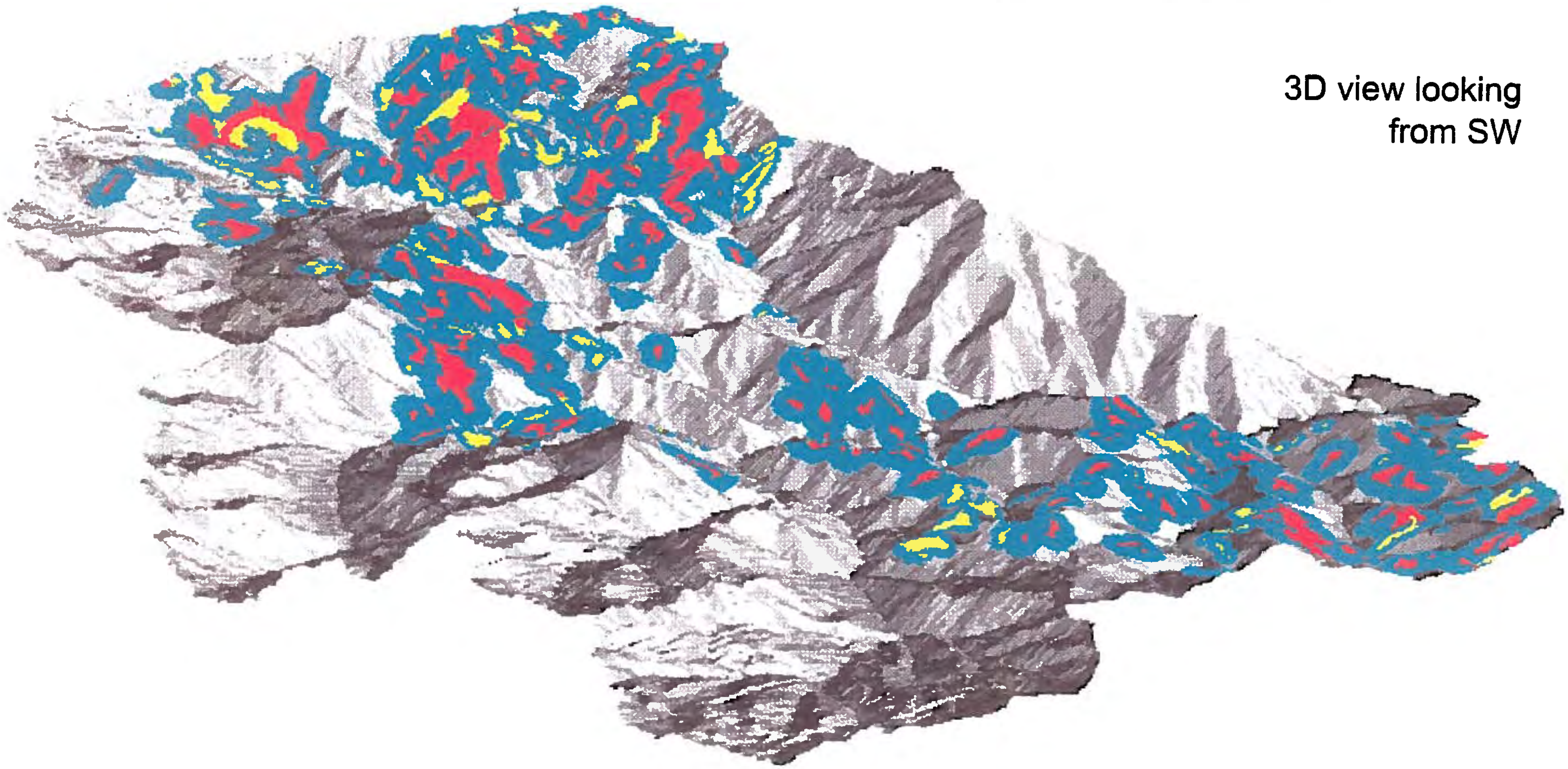
Late-successional and old-growth stands in Dillon developed with, and were probably maintained by fire. Stands with these conditions apparently persisted with repeated fires for many years. The Douglas-fir/tanoak and drier Douglas-fir vegetation types, with their fire resistant qualities, may have maintained late-successional to old-growth characteristics for hundreds of years. This pattern contrasts with white fir and upper elevation Klamath mixed conifer stands where late-successional to old-growth characteristics may have occupied a site for a relatively short period of time between stand replacement events.

A key concept that should guide management activities is the natural fire regime for an area. Forest stands were generally more resilient under the historic fire regime. A comparison with 1944 aerial photos indicates that even with timber harvest over the last forty years, there is more late-successional forest now than occurred historically. Stands are not as resilient under the current fire regime and prone to higher risk of mortality from competition and stand replacement fire.

Potential Fire Hazards

from fire-killed concentrations of standing dead timber.

3D view looking from SW



- Red: Areas with 10 mbf/a or more dead, with 70-100% of the crown cover lost
- Yellow: Areas with 10 mbf/a or more standing dead, with 30-70% of the original overstory still alive
- Blue: Areas within 200 yards of red and /or 100 yards of yellow

GRAY TONES Depict terrain by aspect and do not indicate vegetation condition.

Map 4-1

When applying human and ecosystem values, desired conditions may not be achieved by managing for the historic fire regime. In late-successional reserves, a higher percentage of mature forest is desired than occurred historically. On matrix lands, timber production is desired. Regeneration on these lands is likely to occur more quickly with protection from fire and with thinning than through managing for the historic fire regime. In most cases, the desired fire regime for a given area is likely to be somewhere between the current and historic regimes for that area.

A management scheme to reestablish a fire regime that can maintain late successional forests over time will require some type of fuel reduction/vegetation modification. This could include physically removing or burning fuels, thinning, or some combination of treatments. The alternative is to allow increasingly severe wildfires that could result in larger deforested areas. Over several decades, this could result in a larger portion of the drainage being left in an early seral condition, and cause a shift in the age class and habitat distribution that could greatly reduce the area having late-successional characteristics in the future.

SNAGS AND COARSE WOODY MATERIAL (CWM)

Snags are key habitat for numerous species of wildlife. They provide forage, cavities for nesting and protection, perch sites, and den sites. Snag characteristics such as state of decay, density, size, and species influence their use by wildlife (Jimerson and Fites 1989). Snags are also an important structural component of a forest and large snags are considered to be one of the distinctive features of the old-growth forest (Franklin et. al. 1981).

CWM in the form of stumps, root wads, bark, limbs, and large logs in various states of decay occur in most forest ecosystems (Brown 1985). CWM provides small birds and mammals, reptiles, amphibians, and numerous invertebrate species with forage areas, cover and protection, and nesting areas or dens. It provides diversity within a given stand and forms a physical-chemical link through the many stages of a forest (Maser 1988).

CWM accounts for up to 50% of the site organic matter excluding soil organic matter in Douglas-fir forests (Grier and Logan 1977).Nutrient concentrations in logs increase as wood decays. Logs in advanced states of decay can be important as germination sites and nutrient sources for forest vegetation (Sachs and Sollins 1986; Sollins et. al. 1986). Fallen decayed logs have two important functions that directly affect site productivity: 1) providing moisture to trees, and 2) supporting microbial activity. Most fires, whether prescribed or wild, consume CWM, with the amount of consumption dependent upon fire severity, fuel loading and log moisture.

Recent studies conducted under a variety of stand conditions by the Pacific Southwest Forest and Range Experiment Station show that the amount of CWM in a stand is variable and ranges from less than one ton per acre to thirty-six tons per acre. Input of CWM into the stand is slow and recruitment may occur in waves related to a disturbance event. Stands with histories of hot or frequent fire may contain small quantities of dead wood. Decay rate depends on species, size, microclimate, and cause of mortality. The amount and location of CWM is influenced by local fire history and the effects of gravity on steep slopes (Bruce Bingham, personal communication, April, 1989; Bingham and Sawyer, 1990).

In general, most CWM and soft snags were removed in high fire intensity areas during the 1994 Dillon fire. Live trees that make up the canopy and understory layers within older stands were also destroyed. Low to moderate severity areas showed variable effects. Some CWM is consumed, but large down logs and snags often remain. Tree mortality occurring in a mosaic pattern will provide a continuous supply of snags and CWM for many years.

Maintaining adequate CWM is critical for ecosystem sustainability. Standards and guides for snag retention in the Draft LMP recognize that the number of snags on a given acre will vary depending on the site and the number of snags within the landscape. The number of snags to be maintained in areas managed for timber production may vary from two to five depending on the amount available and desired condition for the area. These figures are to be applied at the watershed scale. Since it is preferable to maintain snags in clumps, some acres will exceed minimum numbers of snags and some acres will fall below desired numbers of snags.

Although different bird species utilize different diameter snags, retention of the largest snags is recommended. At larger diameters, these components tend to break down more slowly and retain more moisture so they are less likely to be completely consumed by a fire and stay in the system longer. Large snags also provide high quality habitat for the majority of the snag dependent species.

The Draft LMP provides guidelines for CWM retention until more site specific standards are developed. The amount of down wood to be maintained in areas managed for timber is generally 5-20 pieces per acre in varying states of decay. The pieces are to be at least twenty inches in diameter and forty cubic feet in volume when they are available.

Recommendations for snag and down wood retention are based on a variety of factors. From a fire suppression standpoint, this material creates fuels and when recommendations are exceeded, fire severity is substantially increased. This consideration is balanced with objectives to retain enough of these components to provide for habitat needs and ecosystem sustainability.

It is difficult to determine any historic range of variability for those components. Some snags are observed in historic photos but not in high numbers. The historic regime of frequent, low intensity fires would not have consumed all the snags. There are likely more snags now with fire suppression. Without frequent fire, snags are retained on the site longer and increased competition has increased tree mortality on dryer sites.

There is a range of variability for the amount of dead and down wood in an ecosystem that functions well. Dead and down wood are key elements for late seral conditions. There is a point where the numbers of dead trees can put stands at risk, especially where late seral conditions are desired. Distribution and location are key factors to snag retention. The 1994 fires left large concentrations of snags in some areas and added snags to some areas that were deficit. Snag felling as a result of fire suppression activities affected one wildlife significant area in critical habitat along the "Go Road".

VEGETATION USE

Vegetation is the ecosystem component most likely to be influenced by man. Aquatic species are affected by vegetation up-slope as well as riparian vegetation. The interactions between aquatic species and vegetation are described in the aquatic section of this chapter. Interactions between wildlife species and vegetation are described below. More detailed information on uses are in the Wildlife section. Human uses of vegetation are described later in this chapter under: *Current and Traditional Uses by Native Americans* and *Human Uses and Values*.

PORT-ORFORD CEDAR

The threat of introduction of *Phytopthora lateralis* fungus to Port-Orford-cedar is the highest risk when soil is cool and saturated with water. Resting spores, called chlamydospores, of *P. laterails* develop in the rootlest of POC and are released into the soil as the rootlets deteriorate. Chlamydospores remain dormant until the soil is saturated, then they form reproductive structures, sporangia, which release motile zoospores. These zoospores swim and spread in surface water and infect new root tips on contact. Infection is highly dependent upon the movement of surface water, as the zoospores can move only very short distances on their own, perhaps up to a few inches in the absence of water in motion.

Spores are moved from an infested area to an uninfested area by two primary means: 1) in infested soil transported by machinery, vehicles, humans, and animals; and 2) in surface water such as streams. The latter movement is more localized and restricted to the drainage where the fungus is present. If soils infested with chlamydospores are transported to uninfested areas, new infections can occur, but only if three exacting events occur in sequence. The spores 1) reach the root tips of POC; 2) germinate; and 3) penetrate the root to initiate infection. Each step requires precise environmental conditions of cool soil temperature and soil that is saturated to near-field capacity moisture over a period of time. If the roots of POC are not available to the spores, infection will not occur. Of the 3,730 total acres with POC in the Dillon watershed, approximately 1,360 (36%) are below any potential road introduction of root disease.

An introduction of *Phytophthora* to a POC population is lethal to the trees that become infected. Trees downstream from a point of infestation could get infected, since the trees are associated closely with the streamsides and many trees have direct root contact with stream channels. Potential spread upstream and upslope would come mainly from root-grafted trees which, given the spotty nature of the population, would be minimal. The disease could also be spread by inadvertent soil transport by machinery or possibly by animals. Should an initial infection become established locally, the availability of spore-bearing soil would increase the risk of transport by these methods. However, infection of individuals is not a certainty even if an infestation occurs nearby. When infection occurs, mortality is often rapid. Rarely, if ever, are all individuals killed over areas greater than two acres in size. Surveys done in areas where the fungus has been present at least ten to thirty years or longer verify that not all, nor even necessarily a major portion, of the Port-Orford-cedar are killed (Goheen et. al., USFS FPM Reports, Portland, Oregon).

WILDLIFE

Different animal species utilize different forest conditions and combinations of forest conditions. Many of these relationships can be displayed using the Wildlife Habitat Relationship model. Generally, higher diversity in forest types translates to higher wildlife diversity since there is a wider range of habitats. But, because each wildlife species tends to have different-sized home ranges and have different needs for types of vegetation conditions and patterns, there is usually no best condition for all at any given point in time. Since the total primary plant productivity of the forest's food web is finite, increasing the amount of habitat that favors one species or group of species often disfavors another species to some degree. Understanding the interactions between the animals and their habitats makes it possible to predict the response of populations to changes in their habitat and to plan our actions over time so that we can provide types and patterns of vegetation that achieve (or maintain) the diversity of habitats needed by our range of fauna.

WILDLIFE

PROCESSES THAT AFFECT WILDLIFE SPECIES

Habitat is the environment of and the specific place where an animal lives. It includes all the factors affecting an animal's chance to survive and reproduce in a specific place. There are directly acting factors: hazards, diseases, predators, genetics, resources, and humans; and a web of indirectly acting factors: climate, nutrients, energy, humans, water, and other animals (Patton 1992).

Some habitat components can be measured and analyzed to describe potential changes to wildlife species. For this analysis, vegetative seral stage, stand structure, and habitat modeling were used to illustrate wildlife trends and processes. Many of the processes that affect wildlife populations are a direct result of those that affect vegetation and its distribution. For the Dillon Creek watershed, fire is a process whose affects can be measured and assessed to determine potential impacts to wildlife habitat. The following discussion focuses on fire and the trends which can be measured from before the fire to after the fire, and potential long-term trends in habitat quality and quantity.

Species interact with their habitat in unique ways. Generalists utilize several seral stages to optimize their chance to survive and reproduce. They have a higher tolerance to environmental stresses. Specialists are likely to be found in one seral stage, where they find all their needs for forage, cover, and reproduction. These animals have little tolerance for environmental stress. Many threatened, endangered, and sensitive species are specialists.

There are 11,086 acres (23%) of early successional habitat within the Dillon watershed (see *Chapter III* for a map [3-6] and description of seral stages). This is an increase of nearly 4,000 acres as a result of the 1994 fire. Stands of late-successional forest were converted to early successional habitat. Early seral stages provide habitat for many wildlife species. Many birds, small mammals, and reptiles utilize early seral stages for reproduction, forage, and cover. Early seral stages are used by big game for forage and also for hiding cover. Maintaining areas in early seral stages is important to the overall biodiversity of a watershed.

There are 35,780 acres (77%) of late-successional habitat within the Dillon watershed. There was approximately 39,675 acres of late-successional forest prior to the 1994 wildfire. There are large areas which were destroyed, but the overall reduction of this habitat is scattered throughout the drainage. Less intense fires reduced down logs and soft snags and, in the short-term, reduced some understory components. Late-successional forests are important habitat for species such as goshawk, marten, fisher, several small birds, bats, and some amphibians and reptiles. It often provides a wide range of habitat functions for several species. Elk and deer use it as optimal cover because it provides forage and cover during temperature extremes and seasonal storms. For species such as goshawk, spotted owl and fisher, it serves as reproductive, foraging, and cover habitat through all phases of their life cycles.

Connectivity of late-successional habitat within the Dillon watershed changed little. There is sufficient habitat to allow for movement of wildlife in and out of the Dillon drainage. In areas surrounding the drainage there have been no timber sales of large enough volume to disrupt movement opportunities. The 1987 wildfires did not affect the Dillon Creek watershed. The closest fire was nearly five miles away. Recovery from the 1987 wildfires began immediately following the fires and would have no cumulative effects with the Dillon fires in 1994. Natural barriers such as the Kelsey Ridge may be more of an impediment to some species than the habitat changes affected by the Dillon wildfire.

The Wildlife Habitat Relationship (WHR) Model was used to describe changes in wildlife habitat from pre-fire to post-fire for several species which represent the guilds described in *Chapter III*. The model identifies three habitat functions and assigns them a value which reflects the quality of that habitat from low to medium to high. These three habitat functions are reproductive, cover, and forage. The model does not estimate animal populations, it only indicates relative changes in habitats. The model also is not spatial unless used in conjunction with GIS (Geographic Information Systems) modeling.

Table 4-5 illustrates the relative habitat values and the changes from pre-fire to post-fire for deer, gray fox, blue grouse, and yellow-rumped warbler.

TABLE 4-5 WHR RELATIVE HABITAT VALUES FOR FOUR WILDLIFE SPECIES WITHIN THE DILLON CREEK WATERSHED PRE-FIRE AND POST-FIRE.

SPECIES	FIRE CONDITION	REPRODUCTIVE	COVER	FORAGE
Deer	Pre-fire Post-fire	67.5 63.9	70.0 63.1	58.2 62.5
Gray Fox	Pre-fire Post-fire	47.2 41.8	47.3 41.8	52.2 56.1
Blue Grouse	Pre-fire Post-fire	58.0 55.5	60.1 57.6	73.6 72.7
Yellow-rumped warbler	Pre-fire Post-fire	76.8 55.5	82.4 57.6	83.2 72.7

Relative habitat values decreased for reproductive and cover habitat functions as a result of the fire for all species. However, the decrease was small which reflects overall fire effects within the watershed. Forage values increased for the deer and fox, both species who forage in open stands or in grass/forb and shrub seral stages.

In general, the quality and quantity of forage is the limiting factor for deer populations throughout this part of the Klamath Mountains. Deer populations are expected to increase within the next ten years due to the increase in quality and quantity of forage throughout the drainage. The decreases in cover and reproductive habitat should have little affect to overall deer use within the drainage. The mosaic of fire affects, particularly opening up forage areas within areas of cover, should benefit the deer as it improves the cover/forage ratio within Dillon Creek.

It is unclear how the gray fox will benefit or be impacted as a result of the fire. Certainly forage will continue to improve and increase as small mammals continue to re-colonize burned areas and as shrubs, grasses, forbs, and understory trees re-sprout and seed areas within the fire. Some cover and reproductive habitat (snags and down logs) were lost during the fire which may have short-term affects to successful reproduction for some pairs. However, gray fox also den in rocky areas, brush, slash and debris piles, and abandoned burrows, which are not limited as a result of the fire.

Yellow-rumped warbler habitat functions all decreased as a result of the fire. This may be a reflection of the loss of some understory components throughout the drainage. The warbler nests and forages within multi-layered stands. Warbler habitat should recover as shrubs and understory trees begin to resprout over the next several years.

The blue grouse habitat should improve in the long-term as brush and grass inhabit sites burned during the fire. The fire created openings in the forest stands which is an important component of grouse habitat. Forage will improve in both quality and quantity as revegetation continues to occur in the fire areas.

Fire affects stand scale dynamics by reducing or increasing the snag and down log components. Late-successional forests are an important reservoir for these elements. Low and medium intensity fires consume varying amounts of this material depending on slope, aspect, decay stage, and moisture content. These fires also provide recruitment of these elements to the stand by weakening and sometimes killing live trees which will become snags and future down wood. High intensity fires often consume all standing and down wood, in addition to killing the live vegetation component. Large down logs often survived the high intensities but are completely charred. The charring has changed the chemical composition of the logs, delaying the normal decomposition process, and making it difficult for wildlife species to utilize the wood until further breakdown occurs.

Nearly 5,000 acres of forest burned in high fire intensities within the Dillon watershed. These acres are generally small, scattered patches among the low and medium fire intensity areas. Tree mortality occurred in a mosaic of patterns and will provide a continuous supply of snags and down logs for many years. Trees killed in these areas will become available to cavity-dependent species as snags develop, and as decomposition by insects, weather, and animals takes place. Improvement in distribution and increases in snag numbers can be expected. As the habitat improves, a corresponding increase in snag-dependent populations should take place.

Snags and down wood provide habitat for species such as wood rats and flying squirrels. Since fires often remove or change snags and down wood, these animals are often exposed during and immediately after the fires. It is likely that spotted owls, other raptors, and carnivores take advantage of the abundance of prey. It is not clear how long it takes for these sites to be recolonized by small birds and mammals or what the short-term impacts are to their local populations.

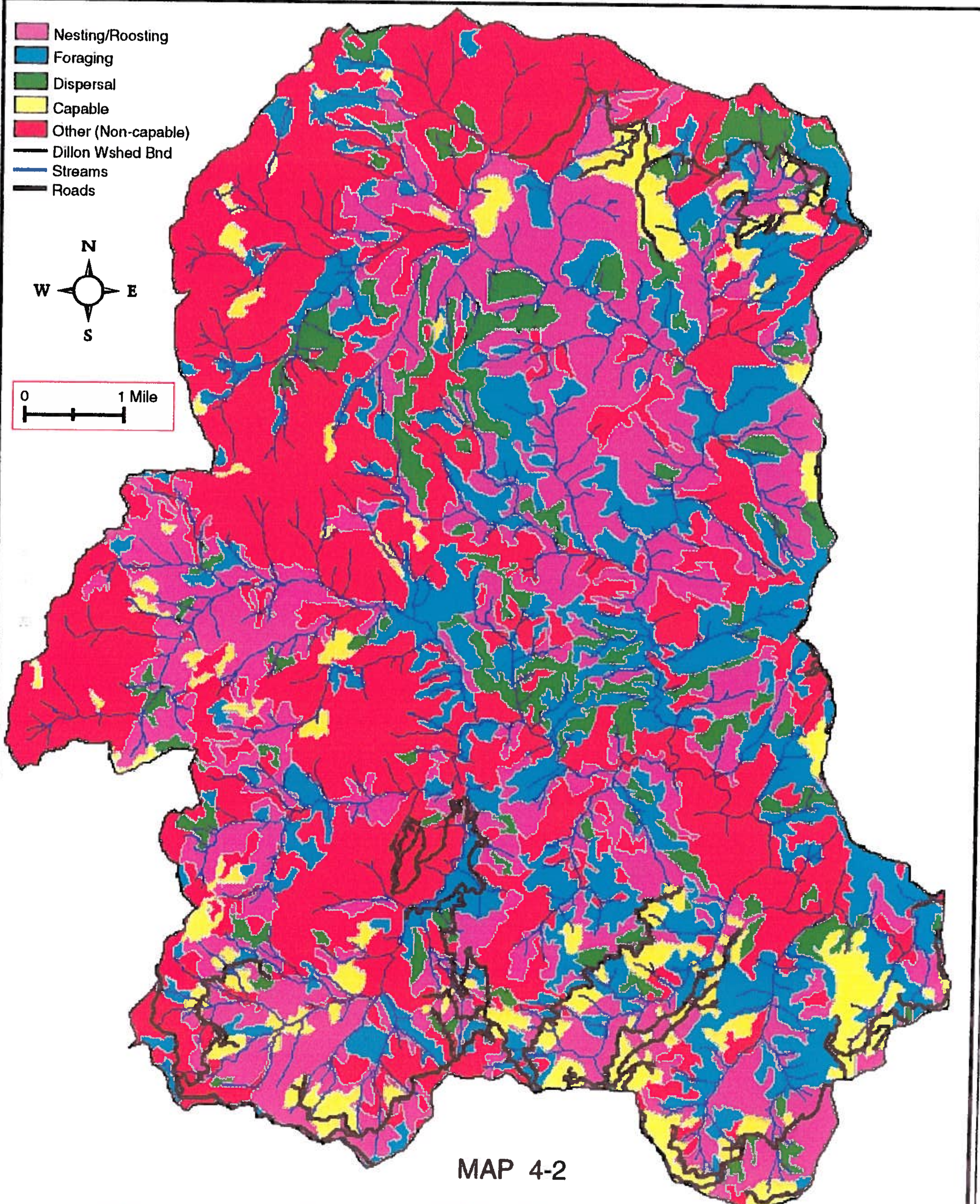
For species such as the pileated woodpecker, fire has both long-term and short-term affects to a key component of their habitat, soft snags. Soft snags provide cavity nesting sites and food sources. Many snags were destroyed throughout the Dillon watershed because they are so susceptible to fire. In the short-term, woodpeckers may have to forage over longer distances or may have fewer successful forage attempts. This may, in turn, affect nesting efforts. However, in the long-term there would be an increase in soft snags within the drainage. The amount and quality of woodpecker habitat should increase over the next ten years.

Habitat changes for riparian dependent animals, such as the Pacific giant salamander, appear to be minimal. There was very little intense, stand replacing fire in areas adjacent to perennial streams. Approximately one percent of the streamside area showed a decline in salamander habitat using WHR and the Riparian Reserves to generally model this species habitat. Overall there should be little change in wildlife use within Dillon watershed riparian areas.

It is difficult to qualify the effects of wildfire on individual animals and there are few opportunities to witness the potential long-term affects of this process on wildlife. However, the 1987 wildfires on the Klamath provided some experience of how spotted owls react to the process of fire within their activity centers. Most pairs did not abandon their activity centers after the fire. On the Happy Camp district, eight activity centers were burned to various intensity levels. Although surveys have been sporadic since 1987, owls have been found in all eight sites and reproduction has been confirmed in at least five sites (Kathy Nickell, personal communication). On the Ukonom district (Tony Hacking, personal communication), a pair of owls carried radio transmitters as part of Pacific Southwest Forest and Range Experiment (PSW) study of home range and habitat use. These birds were monitored daily during and after the fire. The owls moved out of the area as it burned but went back into the site soon after to presumably take advantage of the reduced prey cover. Another activity center in Ukonom Creek burned in medium and high intensities in 1987 and was presumed to be unsuitable. A pair was located there in 1989 but has not been located since. There are similarities in the range of effects between the 1987 fires and the Dillon fire and we anticipate verifying owl occupancy at historic sites plus locating additional pairs in the remote areas of Dillon Creek.

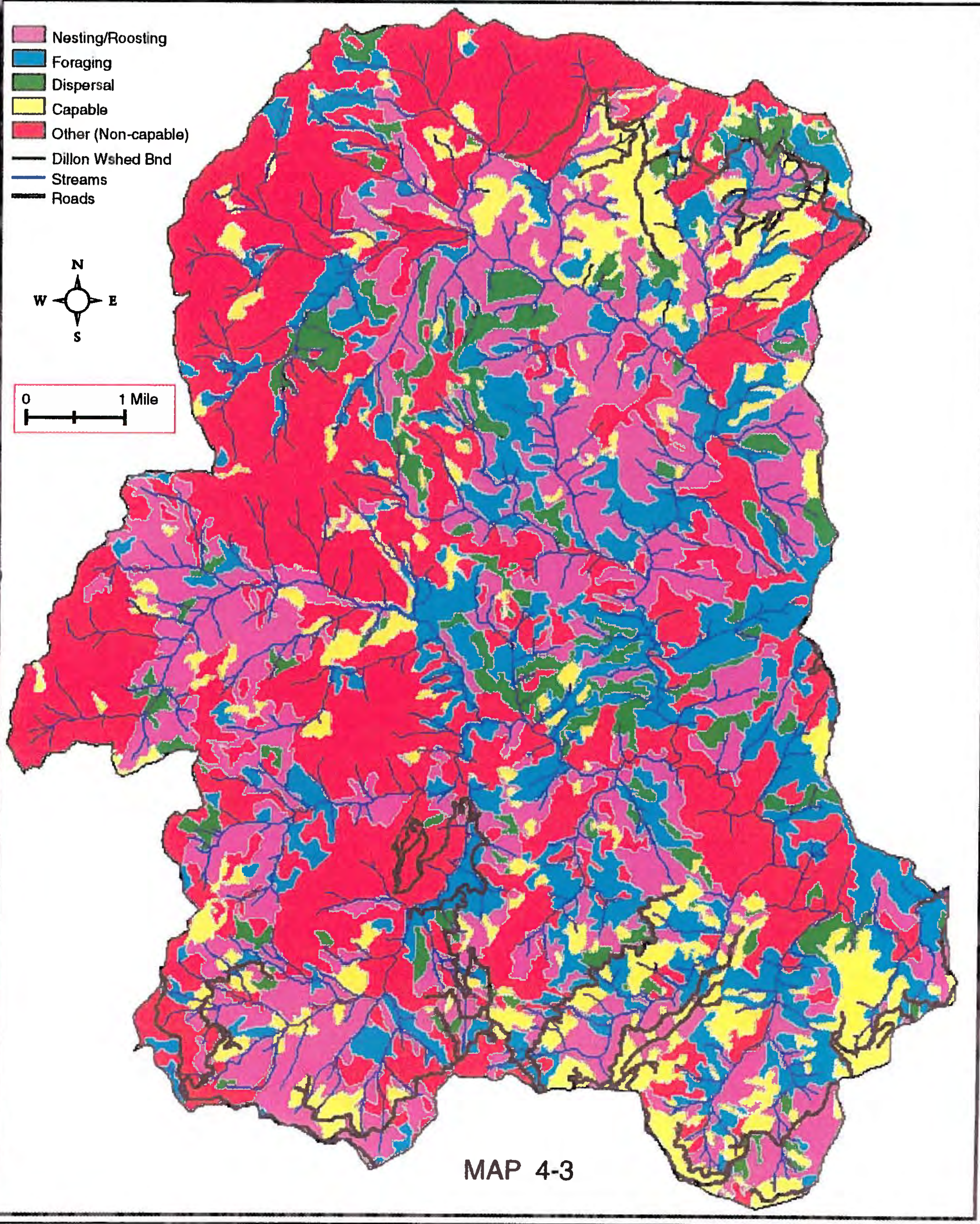
Effects to owl habitat are easier to quantify. Map 4-2 illustrates the pre-fire owl habitat condition of the Dillon watershed. Map 4-3 illustrates the changes in the distribution of spotted owl habitat throughout the Dillon drainage as a result of the wildfire. The following terms were used to describe owl habitat: nesting/roosting, foraging, dispersal, and capable. These habitats were identified based on tree density, horizontal and vertical diversity, decadence, and canopy closure. Nesting and roosting habitat could not be identified separately using the Dillon vegetation data base and have been identified as one habitat condition for purposes of this analysis.

Dillon Prefire Spotted Owl Habitat



MAP 4-2

Dillon Existing Condition Spotted Owl Habitat



Quality changes to habitats are difficult to assess, particularly in cases where low intensity fire burned through a stand of suitable nesting habitat for spotted owls and the stand remains nesting habitat in the post-fire condition. It is not possible to assess whether that stand is "better" or "worse" as a result of the wildfire. It is also difficult to determine the long-term effects to the stand or the landscape. Short-term effects may be adverse or neutral as a result of the fire, whereas the long-term effects are that the function and processes of the area are maintained. Quantitative analyses would have to be conducted at large scales to determine these effects.

Table 4-6 describes the number of acres in the prefire condition, then illustrates how those acres changed as a result of the wildfire. The table then illustrates the existing condition, or the post-fire acres, within each habitat type.

TABLE 4-6 - EFFECTS OF THE DILLON WILDFIRE ON SPOTTED OWL HABITAT WITHIN THE DILLON WATERSHED

	Acres of Each Habitat Type			
	Nesting/ Roosting	Foraging	Capable	Dispersal
Pre-fire Condition	12651	8623	3371	3478
Burned but no change in habitat	***6831***	***4993***	***2185***	***1977***
Converted to foraging due to fire	6	N/A	N/A	49
Converted to capable due to fire	988	836	N/A	408
Existing Condition	11656	7838	5608	3021

The effects of high intensity fire can be seen in the number of nesting/roosting and foraging acres converted to capable habitat. Nearly 2,000 acres were converted within the entire drainage. Nearly 12,000 acres of nesting/roosting and foraging habitat were burned in low fire intensities. These acres remained the same from the pre-fire condition to the existing condition. Determining the effects of low intensity fire to the quality of the habitat are difficult to identify, as described above. Approximately 988 acres of nesting/roosting habitat were converted to capable habitat as a result of the fire. Some acres of dispersal habitat were converted to foraging habitat because the fire opened up the previously dense stands to allow better foraging opportunities.

PEOPLE/WILDLIFE

Human interaction with wildlife is variable, ranging from hunting pursuits to bird watching to the enjoyment of seeing animals in their native habitat to forest management. Some interactions within the Dillon watershed may be limited since the drainage is remote and large portions are inaccessible to the casual wildlife viewer. Human interactions continue to influence wildlife populations today as they have in the past.

The most prevalent interaction in the Happy Camp area is hunting. Deer are hunted during the fall for approximately two months prior to the onset of winter weather. Deer populations are expected to increase in Dillon as a result of the 1994 fire and there is an expectation that hunting will increase in this drainage within the next five years. Hunting is an important recreation for the local community, as well as for people who hunt here from surrounding communities and from other regions of the state.

Elk, grizzly bear, and wolf were extirpated from the drainage and the region as a result of overhunting, habitat destruction and modification, habitat encroachment by humans, and human population increases. Elk are being re-introduced on the Klamath National Forest. It is unlikely that grizzly bear and wolf will be re-introduced.

The pileated woodpecker is an important symbol in the culture of the American Indians. It is likely the woodpecker will benefit in the long-term from the fire, as snags begin to decay and break down, providing nesting cavities and forage opportunities throughout the drainage.

Roads disturb wildlife and can affect habitat use in areas adjacent to the roads. Elk, deer, and bear are sensitive to open road use. Within the Dillon watershed, open road density increased greatly between 1950 and 1992, but is presently decreasing due to road closures (see *Opportunity* section). The present trend of reducing open road density will result in increased habitat effectiveness for many wildlife species (Christensen et. al. 1993).

CURRENT AND TRADITIONAL USES BY AMERICAN INDIANS

The native people of North America speak of their relationship to the earth in terms of family. The earth is the source of their lives. They see their role on this earth, not as rulers of creation, but as beings entrusted with a very special mission: to maintain the natural balance, to be keepers of the earth (Bruchac and Caduto 1991).

American Indian disclosure about specific use in the region has been limited in part by the very private nature of religious observance. Geographic and cultural alienation due to Euro-American settlement and conflicts have influenced and displaced land uses and lifestyles. Today, some individuals adhere more closely than others to traditional ways. Many have strong concerns over changes that might affect lands their families traditionally used.

The Federal government has unique legal and political obligations under statutes to protect important traditional use areas of American Indians. In an effort to more effectively facilitate, identify, and enhance traditional use, the Klamath and Six Rivers National Forests have developed government-to-government agreements and diplomacy to help resolve important ancestral and contemporary issues. Ongoing consultation is very important to restoring trust, and identifying current use and values.

Western locales in the assessment area are nationally and regionally important to American Indian Religious Freedom entities. In the late 1970's, controversy surfaced over construction of the Gasquet Orleans Road which was designed to travel through an area southwest of Elk Valley. Six miles of the proposed road alignment south of Elk Valley was not completed because of the areas important religious use. Recently that uncompleted six mile segment was included in the Siskiyou Wilderness.

SACRED USE

The Dillon watershed encompasses sacred lands that are widely esteemed and revered by the Karuk, Yurok, Tolowa, and Hupa. The sacred landscape is significant in regulating and shaping Yurok, Karuk, Tolawa, and recently Hupa Indian Religions. Religious use and training continues to be an important legacy. The creation of landscape features embody and reflect the significance of primeval times and world view. Today, as in the past, religion is synthesized through belief, place, and observance.

Siskiyou Crest locations maintain extraordinary position and character for Northwestern California Indian Cultures. The area today is identified as an indispensable place where natural phenomena occurs, and where landscape features, creatures, beings, or people, may be endowed with power. It is where tribal practitioners receive power to heal, where priests pray and seek the rejuvenation of the world, and where traditional quests are experienced through fasting, dancing, singing, and seeking personal reflection.

Along rivers, at specific places and times each year, World Renewal Observances are held to stabilize and preserve the earth, and to prevent future disaster and disease. Important preparatory medicine is made in watershed high country areas in association with World Renewal by religious leaders. (Krober and Gifford 1949). Observances in the high country also help insure abundance of future plant and animal harvests.

ELK VALLEY (ISHYUUX TISHRAAM) (HELKAU In Draft LMP)

The position of Elk Valley is strategic since cirques, peaks, and distant views of other sacred mountains have spiritual associations. The aesthetic beauty of the district is held sacred. Lakes have sacred symbolic purpose. Extreme privacy and solitude is essential for spiritual quests and rituals. The serene location, audio and contributing scenic qualities are essential to use, traditional concepts, and mental perceptions. Unobstructed views, sights and sounds in foregrounds, and far off mountains over vast stretches are all inclusive and critical to the religious identity of the area. The continued sacred integrity of the Elk Valley area rests on preservation of wilderness-like conditions, protection of archaeological resources, solitude, and continued free access. Certain kinds of activities near religious use areas may disrupt the sacred integrity of the area. Close tribal consultation is vital to identify possible management conflicts in order to protect the viability of cultural use.

TRADITIONAL USE AND PROCUREMENT

American Indians have developed ways of living that enable them to blend into the land (Bruchac 1991). Sacred and ceremonial, religious uses and subsistence gathering are all interrelated into overall cultural identity. Some of the important traditional gathering resources include; salmon, acorns, game, Port-orford-cedar, Pacific yew, sugar pine, tanoak, pepperwood, madrone, mock orange, willow, beargrass, herbs, ferns, woodpecker, fisher, and mushrooms. The following is a summary of some of the ways tribal members interact with the plants and animals of the watershed.

Manzanita is an important ceremonial wood. Herbs and certain plants like angelica, wild tobacco, and wild ginger are gathered by medicine people, dance leaders, and healing and spiritual doctors. Combinations of plants (formulas), are valued for many traditional uses. Angelica, sometimes found in higher elevations is extensively used in association with an array of ethnic practices. Indian Tobacco is widely used for ceremonial purposes.

In addition to subsistence needs, ethnic foods are gathered and their consumption during ceremonial events is very important. Acorns are favored as the mainstay food but huckleberries, mushrooms, herbs and other forest foods are also consumed.

Native arts continue to be important. Wood carvers and basket weavers depend on local materials, many of which are gathered in the Dillon watershed. Regionally, other tribes are infringing on Karuk ancestral gathering areas. Most coastal gatherers have to travel longer distances to obtain materials (Hefner 1984). Willow, hazel, ceanothus, beargrass, maidenhair and woodwardia fern, spruce, pine root, and Iris grass are basketry materials gathered seasonally. Wood carvers usually work with: yew, cedar, arrowwood, or mock orange. Basketweavers have expressed concerns about amounts and quality of traditional materials available for harvest. Development has reduced the quantity and amounts of basketry construction materials regionally. Exclusion of fire has reduced the quality of some basket materials. Beargrass and hazel need to be burned regularly to have good quality.

Land use, Federal and State regulatory laws, and land development has inhibited some traditions once freely practiced. Consultation, efforts and agreements with agencies help facilitate and more effectively resolve important contemporary use issues. The Six Rivers and Klamath National Forests are working with local tribes to develop a mushroom management strategy to reduce the impacts of commercial mushroom use on local tribes. The Forests are also working more closely with local basket weaver organizations to improve the quality of gathering sites.

Areas where medicine doctors visit to validate their power, where individuals are trained in religion, and where people make "high medicine" to enhance their life and world have been moderately disturbed by the last 100 years of management activities. Most of the effects have been caused by surface disturbance to sites by the public. Recreation development is not encouraged around sacred areas in order to protect the privacy of observers.

During the 1994 fires, American Indians helped monitor suppression efforts in order to preserve the integrity of important use areas during the fire event and fireline rehabilitation. Tribal monitors proved invaluable in identification and protection of cultural sites. In the Elk Valley District, fireline construction impacted cultural settings. Extensive fireline restoration to return those areas to near natural conditions was undertaken with tribal assistance. Careful fireline restoration was necessary to discourage recreation use and meet scenic integrity.

Suppression of natural fire events in the watershed is also a concern. The recent 1994 wildfire in Dillon watershed raised concerns about suppression efforts over the past 100 years. Many American Indians encourage careful Federal management of prescribed fire to improve forest environments although there is some apprehension about the level of unnatural build up of forest fuels and how prescribed fire may be carried off successfully.

The local tribes are concerned over road access. Roading in sacred areas intrudes on important natural settings. Interruptions by other forest users can be very disruptive to ceremonial activities. Access to the watershed for cultural activities is also desired. Permanent and seasonal road closures could make traditional gathering and ceremonial areas difficult to reach, especially for the elders.

Inadvertent or deliberate degradation to Indian graves and ceremonial areas continues to be a growing problem on National Forest lands. The agency in cooperation with local tribes attempts to monitor surface disturbances in sensitive areas; however, visitors sometimes purposefully vandalize sites or impact sites unknowingly. Religious sites in the watershed have continued to be disturbed by public use since 1900. Practitioners have been reluctant to reveal locations of cultural sites because it historically increased awareness and risk of disrupting sites. Public disclosure of archaeological resources is avoided by tribal and federal agencies.

HUMAN USES AND VALUES

INTRODUCTION

People are a significant part of forest ecosystems. People live, work, and play, as well as derive material and non-material goods and services from the forests. Their attitudes, behavior and knowledge affect ecosystems in direct and indirect ways. Forest management systems that alter the structure and processes of the biological component ultimately alter human systems; while the decisions and actions people make lead to alterations in the forest ecosystems (FEMAT 1994).

Dillon watershed is influenced less by humans than many of the other watersheds on the Happy Camp or Ukonom Ranger Districts. Access to the watershed is limited due to the remoteness as well as the steep, mountainous terrain. Habitation information is incomplete. The earliest seasonal inhabitants would have been the Karuk Indians. By the mid 1800's miners, including a significant Chinese population, lived in the surrounding area but limited evidence exists of habitation within the drainage. Mining employees at the Siskon Mine were seasonal inhabitants during the 1950s through the early 1960s. There are currently no residences in the Dillon watershed.

Human relationships with the Dillon watershed are primarily oriented to spiritual, recreational, and commodity driven uses and values. Dillon is highly valued as a refuge for fish and wildlife. With a minimum number of human disturbances, the watershed serves as an area where natural settings and solitude are abundant.

COMMODITY VALUES

Dillon is not as economically significant to the community as the more accessable watersheds, such as Indian Creek and Elk Creek watersheds. Saw logs have been the main product associated with the watershed. Other products include mushrooms and firewood, but again the use is limited due to access. The local community has been dependent on these District resources to draw new residents, provide income for a tax base, and earn adequate livings. The present condition of limited employment makes resource related employment extremely important to the community. Information from the 1990 population census for the Klamath River area, including Happy Camp, indicates that the most important industries employing people are the manufacturing of durable goods (mostly lumber and wood products), agriculture and natural resources (mostly government), and the retail businesses. The median family income was $27,039 and thirteen percent of all persons live below the poverty level. Unemployment generally runs two to six percent above the state average, common for rural areas lacking economic diversification. Unemployment shows seasonal fluctuations due to the intermittent nature of natural resource based work. Unemployment in the Happy Camp area has been as high as 18% during some winter months.

Stand tending and road maintenance activities may have the highest potential for future economic benefit to the community, over the long term. Fire suppression may also prove to be an activity that will be economically beneficial to residents over time.

Various forest products have been historically important to the Karuk Tribe. The Karuks historically relied on ample supplies of salmon, acorns and mushrooms for subsistence. Beargrass and hazel were the most commonly used basketmaking resources. In Dillon Creek watershed, sugar pines have been used for generations for extracting pitch. These resources continue to be highly valued by tribal members.

TIMBER

Timber has been removed from the Dillon watershed (see Map 3-11) over the past thirty or more years but economical access is limited. Sawlogs have been the most commonly removed timber resource, but the potential for pole and hardwood harvesting may become a reality in the near future. The current hauling costs continue to outweigh the value of these products.

The salvaging of dead timber is a present economic opportunity within the Dillon watershed. The 1994 fires left approximately twenty million board feet of dead timber which is economically feasible for removal in the matrix area of the watershed (see *Chapter V*). Some factors that must be considered in evaluating whether salvaging will be possible include the following: after mortality, smaller trees lose value more quickly than larger ones due to rapid deterioration; trees that are concentrated in a limited area are more economical to remove than those that are scattered; yarding costs are also lower with systems that depend upon road access rather than helicopter logging; and, lower yarding costs enhance the benefits of timber harvest as well as provide additional revenue for recovery project implementation within the watershed.

Firewood gathering has also been a limited activity in the watershed but as supplies dwindle in currently popular places, the pressure may increase for gathering in this area.

SPECIAL PRODUCTS

Some commercial interest in morel mushroom picking has been expressed but mushrooms have not been found in sufficient numbers for commercial use. The 1994 fire area was closed during the fall picking season for Matsutake mushrooms to allow the area to recover from the disturbance. Other than the gathering by Tribal members mentioned earlier, a limited amount of of beargrass, boughs, sundew, and burls is gathered by local and regional residents.

Trends

Forest products are becoming more scarce, as time goes on. It is likely as demands increase, the Dillon watershed may receive more attention and pressure from those who wish to obtain a variety of goods and services. People may find the need to travel further to obtain firewood, as well as develop additional interests for other forest products.

RECREATIONAL VALUES

The recreation experience in the Dillon watershed seems to suit a limited type and number of forest users. Due to the ruggedness of the terrain and limited road access, the recreational opportunities appeal to the hearty and able. It is believed that many of the users seek solitude in their experience in Dillon. The present recreational use in the watershed has very little influence on ecosystem conditions, both because of the small numbers of users and the type of use. The riparian areas in the watershed are generally difficult to access, giving these areas protection from foot travel and limiting accessibility to recreate in the creeks. The activities most users choose are hiking and backpacking, dispersed camping, hunting, and fishing. Both hunting and fishing opportunities draw very few recreationists to Dillon at the present time. Fishing activity is relatively low due to decreased populations, strict size limitations, and the extremely limited access to the creek. Most hunting in the area is done within one-half mile of a drivable road. Given the limited road system in Dillon, hunting pressure has been traditionally low. The use may increase within the next few years as deer habitat improves following the 1994 fires.

Trends

Recreational trends are likely to stay relatively stable, with no abrupt changes in numbers of users. As the general population increases, use may increase slowly over time. Although the Klamath National Forest has seen some increase in recreation use, this increase has not occurred as quickly as many managers had predicted. The anticipated inclusion of Dillon Creek and the North Fork of Dillon Creek into the Wild and Scenic River system may attract additional users.

The possibility exists that the changes caused by the 1994 wildfires may cause a decrease in recreationists for the next few years. This is based on the thought that hikers may not desire to recreate in burned over areas and that some trails will be in rather rough condition, discouraging use.

SOCIAL AND SPIRITUAL VALUES

The Dillon watershed is socially and spiritually valued for its unique characteristics at the local, regional, and national scale in terms of ethnic use, refugia, recreation, and commodities. The range of social expectations are anticipated to become more difficult to achieve as more demands are placed on National Forest lands. The context of social and spiritual values are based on landscape characteristics and anticipated public expectations of what National Forests are expected to provide to all users. In the Dillon watershed, the following are of particular value at various scales:

- Highland areas perpetuate religious use by American Indians. The significance of American Indian religious freedom highly specific to the watershed, is relative to the local, regional, and national scales.

- At all geographic scales, special interest groups have high expectations for the wild character of Dillon in terms of refugia, and sustaining fish and wildlife values. These expectations include values of the Wilderness Act and the Wild and Scenic River Act, on the national scale.

- Dillon provides dispersed camping and hiking opportunities, attracting visitors in search of privacy and solitude.

- Regionally, social values and lifestyles are oriented to rural living and resource dependent occupations. Residents depend directly and indirectly on resource revenues from National Forest land.

- Rugged and steep terrain has physically limited human development and use. Roadless areas within the interior of the watershed have left many areas without human disturbance for many years.

Trends

Regionally, Dillon watershed has a somewhat unique identity. Within the context of the Klamath Basin, the role of the Dillon watershed is not only one of a high quality fish and wildlife refuge, it is also highly valued by human beings for their social and/or spiritual well being. With only five to six percent of the watershed developed, it is one of a limited number of pristine watersheds in the region. The fact that so much of the area is exempt from human disturbance and provides such unique solitude, adds to its value. Another value held by many is somewhat difficult to describe, yet worthy of mention. The area holds significant value to people who may never visit or explore the watershed but feel strongly that undisturbed areas such as Dillon watershed have significant worth by simply "being there", to provide habitat for the numerous species of wildlife and plant life and to allow an area to develop and change with limited human input. All of these human values are likely to gain strength and importance as undisturbed areas dwindle and as the number of users on National Forest lands increase over time.

Chapter V

Current Management Direction

MANAGEMENT DIRECTION

INTRODUCTION

This chapter briefly describes the management direction (goals, desired conditions, standards and guidelines) provided by the Draft Forest Plan, as modified by the ROD, and how that direction applies to the Dillon watershed. The information from the Draft Forest Plan provides guidance for management of the watershed. The Draft Plan statements included in this chapter are only a summary of the most pertinent management direction that applies to this watershed analysis. The Draft Plan must be referenced for the complete description of management direction.

Forest-wide direction refers to general management direction that is applicable to all Forest lands and is not associated with any specific management area. Specific direction applies to the particular land classifications that are geographically locatable and have particular management objectives.

The specific management areas that apply to the Dillon watershed are listed below in Table 5-1 along with their acreages. The acreages are derived from a hierarchical data sort of the LMP database with the most restrictive management area taking precedence. For example, Riparian Reserves within Wilderness are counted as Wilderness acres, rather than as Riparian Reserve acres. Map 5-1 displays these management areas in the same format.

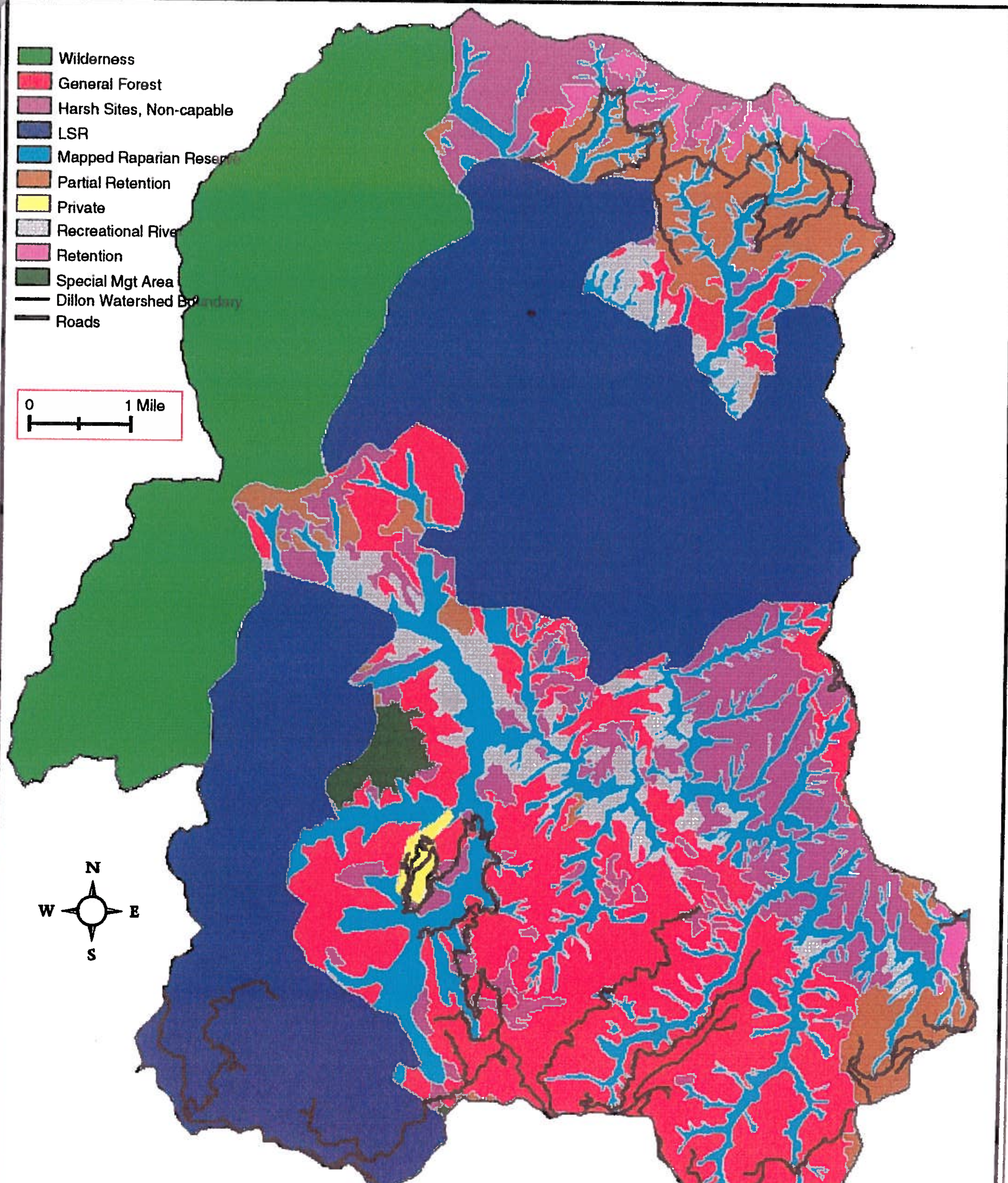
Table 5-1 - MANAGEMENT AREA SUMMARY

ROD ALLOCATION	DRAFT LMP MANAGEMENT AREA	ACRES WITHIN WATERSHED	PERCENT OF WATERSHED
PRIVATE PROPERTY	PRIVATE PROPERTY	146	<1
CONGRESSIONALLY RESERVED	WILDERNESS	8,049	17
ADMINISTRATIVELY WITHDRAWN	SPECIAL MANAGEMENT AREAS	329	<1
	HARSH SITES	4,859	10
SUBTOTAL	—	5,188	11
RIPARIAN RESERVE	MAPPED RIPARIAN RESERVE	5,424	12
LSR	LSR	15,022	32
RECREATIONAL RIVER	MAPPED RECREATIONAL RIVER	1,237	3
MATRIX	RETENTION	543	1
	PARTIAL RETENTION	2,682	6
	GENERAL FOREST	8,575	18
SUBTOTAL	—	11,800	25
TOTAL	—	46,866	100

ROD DIRECTION

Aquatic Conservation Strategy - This strategy was developed to restore and maintain the ecological health of watersheds, and aquatic ecosystems contained within them, on all public lands. The strategy was adopted as part of Alternative 9, the selected alternative of the President's Plan. This conservation strategy employs several tactics to approach the goal of maintaining the "natural" disturbance regime. Following are specific objectives identified in the Aquatic Conservation Strategy.

Dillon Draft LMP Management Areas



MAP 5-1

1) Maintain and restore the distribution, diversity, and complexity of watershed and landscape scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

2) Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian dependent species.

3) Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

4) Maintain and restore the water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

5) Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include timing, volume, rate and character of sediment input, storage and transport.

6) Maintain and restore instream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high and low flows must be protected.

7) Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

8) Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of course woody debris sufficient to sustain physical complexity and stability.

9) Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.

The components of the Conservation Strategy are Riparian Reserves, Key Watersheds, watershed analysis, and watershed restoration. These components are designed to operate together to maintain and restore the productivity and resiliency of riparian and aquatic ecosystems.

Key Watersheds - Key watersheds are not designated areas or matrix, but overlay all land allocations. A system of Key Watersheds that are identified in the President's Plan, are to serve as a refugia for maintaining and recovering habitat for at-risk stocks of anadromous salmonids and resident fish species. The Dillon Creek analysis area is a Tier 1 Key Watershed. The purpose of the Dillon Creek Key Watershed is to provide high quality habitat for spring-run steelhead and other at-risk anadromous salmonids.

Roads In Key Watersheds - The ROD specifies that in Key Watersheds no new roads will be constructed in Released Roadless areas which continue to qualify as roadless. Roadless is defined by the guidelines used to originally designate the areas under the second Forest Service Roadless Area Review and Evaluation (RARE II). The ROD also specifies that the amount of roads outside of roadless areas should be reduced in Key Watersheds through decommissioning. At a minimum, there will be no net increase in the amount of roads.

The Dillon analysis area contains 28,700 acres of Released Roadless lands which are currently identified as roadless in the Draft Forest Plan. This figure will decrease by some small percentage once the roadless areas maps are updated to exclude areas that no longer qualify as roadless. Approximately 58% of the Released Roadless lands are in the matrix (including areas shown on Map 5-1 as within matrix, but that are designated as Riparian Reserves, cultural sites, Recreational River, Retention, Partial Retention, and harsh site), 42% are within LSR, and less than 1% are within private property. Timber harvest is an expected management activity in the matrix. While the Key Watersheds/Released Roadless direction does not prohibit timber harvest, without new roads some matrix lands will remain difficult to access.

FOREST-WIDE DIRECTION

There are numerous goals, desired conditions, and standards and guidelines from the Draft LMP which apply to more than one management area. These are referred to as Forest-wide direction although many do not apply to the entire Forest or even to the entire analysis area. The Forest-wide direction which is important to managing this analysis area is summarized here.

Water Resources - The goal of water resource management is to meet the goals of the Aquatic Conservation Strategy and Clean Water Act, promote slope stability, and provide instream flows of sufficient quality water to support existing or desired habitats for fish and riparian dependant species. The immediate stream environment is within the Riparian Reserves, but disturbances outside of the Riparian Reserves affects the aquatic and riparian habitat.

Biological Diversity - The goal is to maintain the structure, composition, and function of forest and aquatic ecosystems within the range of natural variability and implement management actions in a manner that complements ecological processes and promotes long-term sustainability. Conditions that promote the introduction and spread of disease, increase the risk of insect attack or promote unacceptable fire risk should be avoided. Manage for a distribution and abundance of plant and animal populations that contribute to healthy, viable populations of all existing native and desirable non-native species.

A renewable supply of large down logs is critical for maintaining populations of fungi, arthropods, bryophytes and various other organisms that use this habitat structure. Until standards are developed to meet the needs of species, manage to provide a renewable supply of large down logs well distributed across the matrix landscape. Five to twenty pieces of course woody debris (CWD) in various states of decay will be maintained per acre.

Fire and Fuels Management - The goal is to restore fire to its natural role in the ecosystem. Wildland and prescribed fires will be managed to reduce unacceptable fuel buildups, which will in turn reduce the intensity of future wildfires. Use of prescribed fire, either by itself or in conjunction with other fuels reduction methods, is considered the appropriate method in all management areas. Prescribed natural fire is appropriate in Wilderness and Late-Successional Reserves. Action will be taken to suppress wildfires that do not meet management objectives.

Wildlife Management - The goal is to develop and/or maintain unique wildlife habitats on the forest, such as wetlands, meadows, rocky cliffs, etc. Snags and snag replacements will be retained and in clumps when possible. Habitat improvement activities will be coordinated with the California Department of Fish and Game (CDFG) to help meet the State's management goals for deer and other species. Emphasize the maintenance and improvement of Endangered, Threatened and Sensitive Species, Management Indicator Species (MIS), and game species habitat. Manage to provide "good" habitat conditions for these groups, if that habitat type is within the range of the natural ecosystem. Endangered Species Act consultation with the U.S. Fish and Wildlife Service is required (in the form of a Biological Assessment) for any activity authorized or carried out by the Forest Service that may affect Federally Listed wildlife species or their Critical Habitat, with the goal to provide habitat conditions and management activities that contribute to their recovery. Biological Evaluations are required for any activity authorized or carried out by the Forest Service that may impact species designated as sensitive by the Regional Forester. The evaluation will disclose impacts to the Deciding Officer; the goal will be that the activities not cause a trend towards federally listing those species.

- **Northern Spotted Owl** - Parts of two mapped Late Seral Reserves (RC350, RC304) are within the analysis area, and along with Administratively Withdrawn and Wilderness areas and Riparian Reserves, provide long-term habitat for late-successional and old-growth forest related species, including the northern spotted owl. Critical habitat as determined by the USFWS also occurs within the analysis area within LSR. These areas of Critical Habitat require consultation with the USFWS on any action which may effect the primary constituent elements of spotted owl Critical Habitat. Outside of the LSRs and Critical Habitat, 100 acres of the best habitat (unmapped LSRs) will be retained around the six known activity centers. Adequate dispersal habitat will also be maintained.

- **Marbled Murrelet** - This analysis area is all Zone 1 for the marbled murrelet. Pre-project surveys of marbled murrelet habitat are required to assess possible impacts to marbled murrelets or their Proposed Critical Habitat. If stands are found to be occupied by marbled murrelets, those stands will be protected from modifications adverse to the marbled murrelet.

Other managed wildlife and plant species occur or may occur in the analysis area. These species will be managed as directed by the LMP.

Plant and Animal Species of Special Interest - There is specific management direction for several wildlife and plant species which occur in the Dillon analysis area. These species are categorized as either Threatened, Endangered, Forest Service Sensitive, Management Indicator Species, Survey and Manage species, or game species. The goal is to maintain diverse and productive habitats as an integral part of the ecosystem.

Sensitive plant species that are managed on the Klamath National Forest and species that are listed in the ROD include *Allotropa virgata*, *Cypripedium californicum*, *Cypripedium fasciculatum*, *Cypridpedium montanum*, and *Lilium wigginsii*. These and other sensitive species are listed in *Chapter III* of this analysis along with management guidelines.

Cultural Resource Management - The Dillon analysis area is very significant to the American Indian community, particularly the Karuk, Tolowa, Yurok and Hupa tribes. The Draft LMP goal is to develop partnerships with local American Indian organizations and increase consultation with tribes. At this time, a part of the analysis area is designated a Cultural Management Area (Management Area 8) in the Draft LMP. Other sites of cultural significance and contemporary American Indian uses have been identified through surveys and information provided by tribal members.

Timber Management - One goal for the analysis area is to prepare and offer sawtimber which contributes to the Probable Sale Quantity (PSQ) for the Forest as specified in the Forest Plan. The PSQ will come predominately from the General Forest and Partial Retention management areas but some salvage or hazard tree removal may occur in other management areas if consistent with the objectives for these areas. Salvage from the 1994 wildfires is considered a high priority in General Forest and will be considered in other areas where fuel accumulations may jeopardize long-term management goals.

Community Stability - The goal is to manage for long-term, broad-scale stability of local communities. Management is to provide an even flow of renewable resources and assure availability to enhance community stability. Management should also include active cooperation and coordination with Federal, State, local agencies, governments and American Indian tribes.

Transportation Management - The management goal of the transportation system is to provide an economical, safe and environmentally sensitive access to the watershed. Maintenance and restoration of existing roads is emphasized over the construction of new roads. The Dillon area contains approximately 56 miles of roads which are concentrated in the northeast and southern portions of the drainage. A travel and access management plan will be developed and documented following completion of the watershed analysis. The travel and access management document will provide greater detail on future road management.

Visual Resource Management - Visual resources are to be managed to conserve the natural scenic character of the Forest. The emphasis is on areas that can be seen from important recreation areas, major roads and trails.

Recreation Management - The forest-wide goal is to offer a wide range of recreational attractions and opportunities that are responsive to a variety of users. The Dillon watershed offers mostly semi-primitive non-motorized opportunities. Recreation guidelines that are applicable for Dillon include consideration of traditional American Indian values and management that minimizes disturbance to species.

Minerals Management - The goal is management of mineral exploration and protection of surface resources to maintain environmental quality. Administer all locatable, leasable and saleable mineral resource activities according to the 36 CFR 228 regulations and other applicable laws and regulations. Mineral deposits known to occur in the analysis area are placer gold and platinum, surface and underground lode gold, silver, copper, manganese, graphite, and chromite. Any surface disturbing activity to extract mineral values will require a Plan of Operations consistent with environmental documentation as defined in an EA or an EIS. No suction dredging is allowed in Dillon Creek. Currently, there is no active mining activities occurring in the Dillon watershed.

Forest-wide Standards and Guidelines in the Klamath Draft and Final Land Management Plan state that instances of suspected or known contamination of surface water, ground water or soil by hazardous or toxic substances will be removed or remediated, following appropriate Federal, State and local regulations. Individuals, owners or operators that may be considered potentially responsible parties will be pursued for recovery of all costs associated with clean up (Standards and Guides 1-5).

Consistent with this Standard and Guideline, Siskon Mine is a high priority abandoned mine site for investigation, hazard assessment and clean up on the Klamath Forest. The Forest recognized the mine as having potential contamination problems in 1992 as part of the Forest-wide Abandoned Mine Discovery Program. Following Federal regulations of the Comprehensive Environmental Response, Compensation, and Liability Act or CERCLA (42 U.S.C. 9605), and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), the Klamath Forest notified the National Response Center in July, 1993 of a reportable quantity release of toxic metals to the environment from the mill tailings at Siskon Mine. Following the report of a release, several actions have been taken, consistent with the NCP. They include the following: 1) A Potentially Responsible Parties Search, 2) Notification and Information Requests to Potentially Responsible Parties, and 3) Preliminary Assessment Report of Siskon Mine (Haessig 1994).

At the present time, the Preliminary Assessment Report on Siskon Mine is under review by the Environmental Protection Agency. Further work will also be conducted to find additional Potentially Responsible Parties. The Klamath Forest is sharing information about Siskon Mine mine site with California State regulatory agencies such as the North Coast Regional Water Quality Control Board, and the California Department of Fish and Game.

MANAGEMENT AREAS

Seventeen management areas are identified in the Klamath Draft Forest Plan. Eight of the management regimes are found in Dillon. General guidelines for the eight specific management areas are described below. Each area has an integrated set of management activities and practices that can be conducted to meet the objectives for that area.

MANAGEMENT AREA 1 - RESEARCH NATURAL AREAS

A portion of the Rock Creek Butte Research Natural Area (RNA) is located within the Dillon Creek watershed. RNA's are areas that are maintained as representations of important vegetative, aquatic and geologic ecosystems of scientific interest and importance, and serve as a baseline for comparing ecological changes. The Rock Creek Butte RNA is an example of the Montane chaparral/Brewer spruce habitat type. Map 5-1 displays the RNA along the southern boundary just east of the LSR. The RNA is presently mapped as including some of the area designated as LSR; using the hierarchical approach, the RNA is actually more restrictive in terms of management goals than the LSR.

The RNA will be managed for maintenance of unmodified conditions and natural ecological processes. Impacts from human activities that would modify the value of the RNA for its natural diversity and species gene pool will be precluded.

MANAGEMENT AREA 2 - WILDERNESS (Congressionally Designated)

The Dillon watershed contains just over 8,000 acres of the Siskiyou Wilderness area. Naturally occurring ecological processes should predominate within wilderness ecosystems. The wilderness provides recreationists a primitive and semi-primitive, non-motorized recreation opportunity. Other uses and activities such as grazing must be consistent with wilderness legislation.

The desired condition of the wilderness areas is to appear natural. Ecological processes, including fire, shape the vegetative patterns and conditions. Some evidence of human influence consistent with the Wilderness Act may be present. Trails provide recreational access and are maintained to meet user needs and provide resource protection.

MANAGEMENT AREA 5 - LATE-SUCCESSIONAL RESERVES/SPECIAL HABITAT

There are two mapped Late-Successional Reserves (LSRs) within the Dillon watershed, a portion of RC350 (Dillon) and all of RC304 (Medicine Mountain/Rock Creek Butte). Together the two reserves encompass just over 15,000 acres within the watershed. The locations are shown on Map 5-1.

The management goal for LSRs is to maintain and enhance late-successional and old-growth forests in order to provide habitat for species associated with them including the northern spotted owl. The desired condition is to maintain forested stands with large overstory trees, with obvious signs of decadence, coarse woody material, and multi-layers of canopy. These conditions are more common on north slopes, at lower elevations, and in cool, moist areas. At the present time (after the 1994 wildfires), approximately 22% of the LSR acres are classified as being in an old-growth seral stage condition, 38% is late mature, 27% is early mature, 4% is pole size, and 6% is shrub. The remaining three percent of the area has been harvested and is classified as pole or shrub size.

A management assessment for the LSR's will be prepared following completion of the watershed analysis. The Dillon area is part of the California Klamath Province. This Province was identified in the ROD as one of several where the probability of a large-scale disturbance, such as fire, has increased with changes in the characteristics of the forest resulting from past fire protection. Since large disturbances can eliminate late-successional habitat, risk reduction efforts are encouraged where they are consistent with the overall objective. Risk reduction efforts should generally focus on young stands. However, activities in older stands may be appropriate if they clearly result in greater assurance of long-term maintenance of habitat, are clearly needed to reduce risks, and will not prevent the Late-Successional Reserves from playing an effective role in the objectives for which they were established.

MANAGEMENT AREA 8 - CULTURAL (Administratively Withdrawn)

The I'shyuux Tishraam area (also referred to in the Draft Forest Plan as the Helkau District cultural area) is within the Dillon watershed. The configuration and acreage that I'shyuux Tishraam encompasses is an issue that needs to be better defined. Information from Map 5-1 displays I'shyuux Tishraam as approximately 300 acres outside the wilderness. Other sources in the Draft Forest Plan list it as 700 acres and the GIS cultural map layer shows it to be close to 7,000 acres.

The management goal of this area is to provide protection of the ceremonial uses and values and to manage this area to preserve and protect traditional cultural uses. The Draft Forest Plan, as amended by the ROD, addresses the general management goals and desired condition for I'shyuux Tishraam. A Memorandum of Understanding (MOU), developed jointly between the Forest and the Karuk tribe of California is needed to address the specific Forest management activities that may effect I'shyuux Tishraam and to better define the appropriate geographic area.

MANAGEMENT AREA 10 - RIPARIAN RESERVES (Administratively Withdrawn)

The Riparian Reserve consists of lands where riparian dependent resources receive primary emphasis, and where special Standards and Guidelines apply. This includes those portions of a watershed required for maintaining hydrologic, geomorphic, and ecologic processes that directly affect standing and flowing water bodies such as lakes and ponds, wetlands, streams, stream processes, and fish habitats. Also included are the habitat needs of a variety of organisms such as mollusks, amphibians, lichens, fungi, bryophytes, vascular plants, American marten, red tree voles, bats, marbled murrelets and northern spotted owls.

Riparian Reserves include the land adjacent to all permanently flowing streams, constructed ponds and reservoirs, wetlands, lakes and natural ponds, seasonally flowing or intermittent streams, floodplains, and unstable and potentially unstable land (including earthflows).

INTERIM RIPARIAN RESERVES

The Record of Decision for the President's Forest Plan identifies Riparian Reserve widths to be applied in the interim period until Watershed Analyses are completed. These widths are as follows:

a. Fish-bearing streams - 1 site potential trees or 300 feet, whichever is greater.

b. Permanently flowing, non fish-bearing streams - 1 site potential tree or 150 feet, whichever is greater.

c. Constructed ponds and reservoirs, along with wetlands greater than one acre - 1 site potential tree or 150 feet, whichever is greater.

d. Lakes and natural ponds - 2 site potential trees or 300 feet, whichever is greater.

e. Seasonally flowing or intermittent streams - 1 site potential tree or 100 feet, whichever is greater.

f. Floodplains -

g. Wetlands less than one acre - to the outer edge of the riparian vegetation.

h. Unstable and potentially unstable land (including earthflows) - the extent of unstable and potentially unstable areas.

MANAGEMENT GOALS

Riparian Reserves are delineated and protected as a major component of the Aquatic Conservation Strategy in the President's Forest Plan. The primary goal for this land is the maintenance of a healthy, functioning ecosystem where the aquatic and terrestrial components are properly linked. Riparian Reserves are used to maintain and restore riparian structures and functions of the aquatic system, confer benefits to riparian-dependent and associated species other than fish, enhance habitat conservation for organisms that are dependent on the transition zone between upslope and riparian areas, improve travel and dispersal corridors for many terrestrial animals and plants, and provide for greater connectivity of the watershed. The Riparian Reserves will also contribute to connectivity corridors within and between the Late-Successional Reserves.

DESIRED CONDITION

The desired condition for the Riparian Reserve is the presence of healthy plant and animal communities living in an environment where physical and biological processes are maintained within a range similar to that under which these communities evolved. Vegetation will be vigorous and healthy, and in tune with the local environment. There will be a wide variety of biotic communities within the Riparian Reserve. In the case of intermittent streams on south aspects underlain by shallow soils, they will include manzanita, live oak, knobcone pine, ponderosa pine, and other drought-resistant species. Along the floodplains of major streams, they will include a multitude of species, including firs, cedars, pines, and phreatophytes such as maples, alder willow, etc. In unstable areas, the desired plant communities will also depend on local site conditions, with attention to deep-rooted species capable of providing root support to the slope, and transpiring water from deep in the soil mantle. Wildlife habitat needs will play an important role in desired plant communities in most reserves. Emphasis will be placed on native species. In meadow areas, overhanging banks with herbaceous and/or shrubby vegetation provide canopy cover. Riparian Reserves will provide shade, thermal buffering, large wood, organic matter, habitat, nutrient cycling, bank stability, and sediment filtration as appropriate to site capability.

DELINEATION OF RIPARIAN RESERVES AT THE PROJECT LEVEL

Numerous species identified in the ROD were intended to benefit from the Riparian Reserves, including mollusks, amphibians, lichens, fungi, bryophytes, vascular plants, American marten, red tree voles, bats, marbled murrelets and northern spotted owls. Information regarding the ecological requirements of most of those species is lacking. Due to lack of information, ***it is recommended as a result of this analysis that the interim Riparian Reserve widths not be increased on Dillon Creek***. More information will likely be available in the future as the Forest begins to implement surveys for late-successional and old-growth forest related species.

Maintenance of geomorphic and hydrologic function may locally require expansion of the Riparian Reserve boundaries. The need for such expansion is properly assessed at the project level.

GUIDANCE FOR FIELD DELINEATION OF RIPARIAN RESERVES

Intermittent Streams - These are defined rather simply in the ROD as: "any non-permanent flowing drainage feature having a definable channel and evidence of annual scour or deposition. This includes what are sometimes referred to as ephemeral streams, if they meet these two physical criteria." Project teams will need to field verify intermittent streams identified by this analysis.

Unstable and Potentially Unstable Lands - These lands are defined in the FSEIS as:

> Lands which are prone to mass failure under natural conditions (unroaded, unharvested), and where human activities such as road construction and timber harvest is likely to increase landslide distribution in time and space to the point where this change is likely to modify natural geomorphic processes (such as the delivery of sediment and wood to channels), which will in turn affect the aquatic ecosystem including streams, springs, seeps and wetlands, and marshes. The following types of land are included: [1] active landslides and those which exhibit sound evidence of movement in the past 400 years; [2] inner gorges; [3] those lands identified as unstable by geologic investigations using the criteria stated above (includes lands already classified by the Forest Service as unsuitable for programmed timber harvest due to irreversible soil loss, and by the BLM as nonsuitable fragile lands. Highly erodible lands (i.e. lands prone to sheet and rill erosion) are not included in this definition. (FEMAT)

The Klamath National Forest draft Land Management Plan identified active landslides, inner gorges, toe zones of slumps and earthflows, and heavily dissected granitic lands as unsuited for programmed timber harvest due to slope instability.

Future Projects will need to verify the existing mapping of the following unstable and potentially unstable lands.

- Inner gorge.

- Slumps and Earthflows - Many of toe zones of slumps and earthflows were not mapped on the geomorphic data layer, and projects should refine this mapping. Slump and earthflow deposits are typically very sensitive to disturbance, each feature needs to be carefully evaluated.

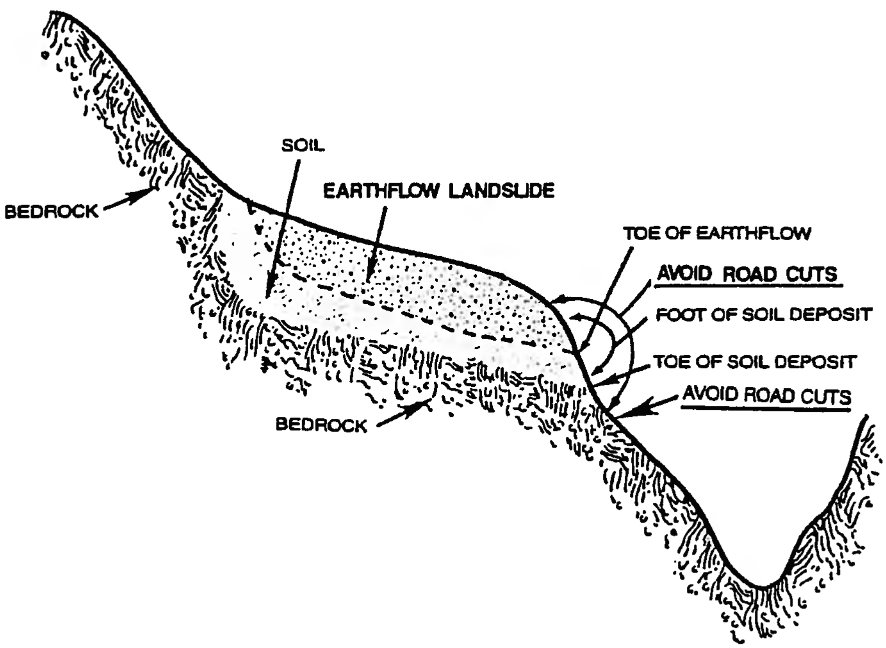
- Toe zone of dormant slumps and earthflows - (See Figure 5-1) Many of the significant, existing landslides on the west side of the Klamath National Forest occur in this situation. The pattern is one of the strongest indicators of landslide potential that we have.

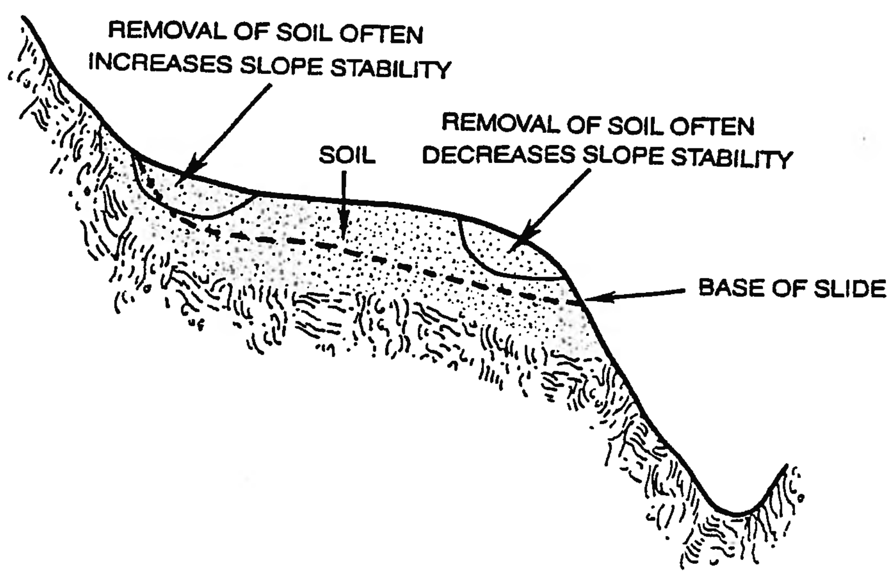
- Highly Dissected Granitic Lands

- Other Unstable Lands - swales at the heads of low order drainages are potentially unstable. These lands have not been mapped, and will need to be identified by the project. In addition, there are many other combinations of slope, soil type, rock structure and groundwater conditions which are potentially unstable, and they can only be identified at the site level by qualified personnel.

Qualifications of Personnel Doing Field Delineations - Personnel delineating intermittent streams, unstable lands, and hydrologic influence zones must be skilled in the appropriate earth and biological science disciplines.

FIGURE 5-1 COMMON INDICATORS OF LANDSLIDE POTENTIAL





GUIDANCE TO PROJECT TEAMS IN DELINEATING AND MANAGING RIPARIAN RESERVES

The following guidelines are offered to assist project level teams in dealing with the Riparian Reserve.

1) Riparian Reserve widths applied on Dillon Creek will be equal to or greater than the interim widths identified in the ROD. No reductions in width are recommended until sufficient information is acquired on habitat needs of identified species.

2) In delineating individual Riparian Reserves, teams should stratify them by primary function. For example, the inner gorge functions as a source of sediment, wood, shade, and habitat for certain species. These are the attributes which should dictate the actual widths delineated in the field. Delineations should be guided by the inherent physical and biological attributes of the site.

3) Project teams must utilize new wildlife/vegetation data as it comes available to adjust Riparian Reserves as needed.

4) Project teams should field verify existing mapping of unstable areas and intermittent streams, evaluate other lands for inclusion in the Riparian Reserve, and update the data base. Monitoring will then allow tracking of changes in the area and distribution of the Riparian Reserve.

5) Active management of the Riparian Reserves will require development of vegetation management prescriptions which meet the needs of geomorphic function as well as plant and animal habitat. It is essential that an interdisciplinary team develop these prescriptions due to the fact that desirable conditions for some values may conflict with those for others.

MANAGEMENT AREA 11 - RETENTION (Matrix)

The Retention Management Area represents approximately 540 acres, or one percent of the analysis area. These areas are in the foreground of high visual sensitivity roads or trails.

Management goals are to maintain the areas in a natural or natural-appearing condition where human activities are subordinate to the characteristic landscape. Manage so that human activities are not evident to the casual forest visitor. Areas will have a programmed, sustained harvest of wood products in areas that are capable, available, and suitable for timber management. Stand health and resilience will be maintained and enhanced where practical. When projects are implemented, the Retention visual quality objectives should be met immediately upon completion of the project where possible, or at a maximum within three years after project completion. Where the existing visual conditions do not meet the desired visual goal of Retention, areas should be rehabilitated over time.

MANAGEMENT AREA 13 - Recreational Rivers (Matrix)

Two segments of Dillon Creek and the North Fork of Dillon Creek are assessed in the Draft Forest Plan as being potentially eligible for inclusion into the National Wild and Scenic Rivers (WSR) System. Segment 1 (12.6 miles) includes the source of Dillon Creek in the Siskiyou Wilderness to about one mile above its confluence with the Klamath River. Segment 2 is the one mile section from Segment 1 to the confluence with the Klamath River. The North Fork of Dillon segment (ten miles) includes the area from its source in the Siskiyou Wilderness to its confluence with Dillon Creek.

To be eligible, a river must be free-flowing and, with its adjacent land area, possess one or more outstandingly remarkable values. All three segments possess values for fisheries, vegetation, and water quality. In addition, Segments 1 and 2 have cultural/historic values, and Segment 1 and the North Fork have scenery values. All segments are recommended for designation as Recreational in the Draft Forest Plan.

Specific management measures will be documented later in a River Management Plan. For recommended rivers the plan must be completed within three years after designation by Congress. Until the management plan is completed, general guidelines for Recreational Rivers apply. Rivers will be preserved in a free-flowing condition. Rivers will be managed so that the outstandingly remarkable values for which they would be designated will be protected and enhanced, while providing for public recreation and resource uses that do not degrade those values.

MANAGEMENT AREA 15 - PARTIAL RETENTION (Matrix)

The Partial Retention Management Area represents 2,682 acres, or six percent of the analysis area. These acres are generally located within the foreground of roads and trails with moderate visual sensitivity or the middleground of travel ways with high visual sensitivity.

The Management Goals are to provide an attractive, forested setting where management activities remain visually subordinate to the characteristic landscape. Manage a programmed, sustained harvest of wood products in areas capable, available, suitable, and appropriate for timber management.

The Desired Condition for this area is to meet the Partial Retention Visual Quality Objective, which will show evidence of management activities (form, line, color, texture) but will remain visually subordinate to the characteristic landscape.

MANAGEMENT AREA 17 - GENERAL FOREST (Matrix)

General Forest Management Area varies in size and locations within the watershed. The majority of the area is concentrated in the southwestern portion of the watershed generally in the Mill, Cedar, Coffee Can, and Copper Creek areas. Approximately 8,570 acres of the Dillon Watershed is within the General Forest Management Area.

The management goal for General Forest Area is to provide a programmed, non-declining flow of timber products, sustainable through time. These levels may vary from year to year, based on ecological processes. Conifer stocking levels are to be maintained at levels commensurate with the capability of the site to produce wood fiber. Minimum and recommended conifer stocking levels for regeneration depend on the site quality and run from 125 to 225 respectively for Douglas-fir, 150 to 200 for mixed conifer types, 200 to 300 for red and white fir types, and 75 to 200 for Ponderosa and jeffrey pine.

Young regenerated stands are managed to maximize growth potential. Management activities such as thinning will be done to maintain stand vigor and resilience to disturbances such as wildfire, insects, and disease and to emulate ecological processes and watershed patterns where possible. Within harvest units, maintain the structure, composition, and ecological function of the area. Provide snags and hardwood habitat to help maintain viable populations of wildlife species that require these structural functions.

Stocking levels are generally regulated by thinnings or logging. As discussed in *Chapter IV*, reintroduction of fire into the watershed ecology is also used to maintain or attain desired stocking levels and fuel loadings.

The Draft Forest Plan proposes management for a forest condition that is a mosaic of healthy forest stands. The oldest stands should be between 80 and 120 years old. However, all areas should maintain some structural components of older stands. Fifteen percent of the area of each regeneration cutting unit will be retained in its pre-harvest condition. Approximately 70% of the 15% is to be retained in groups and the remainder retained as dispersed trees. Presently (post 1994 wildfires), 11% of the General Forest area is in an old-growth seral stage condition, 35% is late mature, 28% is early mature, 3% is classified as pole size, and 14% as shrub. The remaining 9% has been harvested and is classified as pole or shrub.

General Forest land has the potential to contribute to more than just the primary goals of timber production. By having an array of management tools available, vegetation can be manipulated to accommodate a variety of multi-resource objectives in both the short-term and long-term time frames.

Large sections of the General Forest Management Area are located within Released Roadless Areas. The desired condition of these areas as incorporated by the ROD is to have no new road construction in roadless areas within Key Watersheds. Since much of the area still meets the criteria of roadless, helicopter logging is the primary yarding method for harvesting timber. Some areas may be currently infeasible due to distance to existing roads.

HARSH SITES (Administratively Withdrawn)

The Harsh Sites were originally identified for a variety of reasons. Many of these areas are of very low site quality and would be difficult to regenerate or would produce low yields (cannot produce twenty cubic feet of wood fiber per acre per year) after harvest.

Harsh Sites are an Administratively Withdrawn land allocation in the President's Plan and have no scheduled timber harvest. Management direction is to treat harsh sites as inclusions of the Management Areas in which they are located. For instance, if a harsh site falls within an area this is a Partial Retention area, it will have no scheduled timber harvest and the standards and guidelines that apply to Partial Retention will also apply in the harsh site. Management direction allows salvage, fuel reduction and other activities under the guidance for visual quality objectives.

The mapping of these areas for the Draft LMP is coarse. The intent is that identification of these areas will be refined on a site specific basis.

Chapter VI

Management Opportunities

OPPORTUNITIES

INTRODUCTION

The management direction for the various Draft LMP land classifications, in the context of President's Plan guidlelines, is somewhat generalized to cover a broad range of situations and conditions. Since there is information available that is specific to the Dillon Creek watershed, we have adapted the goals and objectives of the Aquatic Conservation Strategy and the Draft LMP to the conditions actually found in Dillon Creek for the various land classifications. By identifying where existing conditions are not on an ecological trajectory to meet the stated desired conditions, a number of opportunities were identified which will move various components of the watershed towards the desired conditions within the regulatory framework that now exists.

The following chart shows a summary of existing and desired conditions which have identified opportunities associated with them. This is a synthesis of conditions and opportunities that were identified in IDT meeetings while conducting analysis. The IDT worked together to develop this summary. It is sorted by Draft LMP land classification, and is followed by some opportunities that are not specific to individual management areas.

DRAFT LMP MANAGEMENT AREA - WILDERNESS

Existing Condition	Desired Condition	Opportunity
No application of prescribed fire, no wilderness fire management plan.	The role of fire as a viable, functioning process in the wilderness ecosystem.	Develop wilderness fire management plan.
Low level of use, lack of development, and primitive nature.	Continued low level of use and primitive nature especially in the vicinity of Elk Valley (Ishyuux Tishraam).	Avoid measures that might attract increased recreational use in areas of religious significance.
Roadless area adjacent to Wilderness.	Management activities conform to roadless area status.	Explore possibility of updating the land classification.
Pitcher plant bogs adjacent to trail in Willis Hole area are being disturbed by foot traffic as people avoid using deteriorated log-type corduroy across a bog portion.	Discourage foot traffic near pitcher plants. Sustain pitcher plant populations adjacent to trail.	Renew corduroy or construct boardwalk where Kelsey trail crosses bog.
1994 fire has had some detrimental effects on wilderness trails.	Passable trails.	Trail maintenance appropriate for basic facilities.
Headwaters of the west fork of Clear Creek trail in poor condition-tributary to Kelsey trail.	Improve condition to help route recreational use away from more sensitive areas in Dillon.	Improve west fork of Clear Creek Trail.

DRAFT LMP MANAGEMENT AREA - LATE-SUCCESSIONAL RESERVES

Existing Condition	Desired Condition	Opportunity
No LSR Management Plan/Assessment	LSR Management Plan to include any additional lands proposed for LSR and a fire management plan specific to LSR's.	Write LSR Management Plan/ Assessment.
Matrix lands North of Main Stem Dillon and South of North Fork between two LSRs is not accessible and cannot be accessed under President's Plan constraints.	Manage these lands commensurate with appropriate land classification, remove land from consideration for contribution to PSQ if status as matrix lands is found to be inappropriate.	Remove these acres from PSQ land base pending conditions permitting management.
Portion of matrix lands northwest of Medicine Mtn. are in a highly sensitive cultural area.	Land classification status and objectives are met, and PSQ is adjusted to reflect any updated status.	Explore expansion of Elk Valley (Ishyuux Tishraam) or re-examine Draft LMP land classification.
1994 fires in high and moderate burn intensity areas have created excessive fuel loadings in LSR, which threatens objectives of LSR.	Sustainable late-successional characteristics.	Conduct fire recovery activities to treat fuels and restore vegetation.
Increased stocking density and high fuel accumulations due to unusually long fire-free intervals both inside and outside 1994 fire threaten objectives of LSR.	Sustainable late-successional characteristics.	Apply prescribed fire and silvicultural treatments to LSR to reduce fuels and stocking density.

DRAFT LMP MANAGEMENT AREA - CULTURAL

Existing Condition	Desired Condition	Opportunity
Different versions of mapped locations.	One map of Elk Valley (Ishyuux Tishraam)	Resolve mapping discrepancies.
Recreation facilities exist in vicinity of Elk Valley (Ishyuux Tishraam).	Limited recreational use in vicinity of Elk Valley (Ishyuux Tishraam).	Avoid measures that might attract increased use.
Elk Valley (Ishyuux Tishraam) management plan needs updating.	Have comprehensive plan to manage Elk Valley (Ishyuux Tishraam) with full tribal participation.	Develop a Elk Valley (Ishyuux Tishraam) Plan.
Poor beargrass and other basketry material growth due to lack of fire.	Good source of basketry materials.	Apply silvicultural treatments to improve growth of basketry materials.
Strong desire within American Indian community for high levels of pileated woodpeckers within Dillon watershed.	Maintain habitat to have sustainable populations of pileated woodpeckers, which have particular cultural significance in Medicine Mt. area.	Retain snags of number, size, and type favored by pileated woodpeckers. Conduct study on how watershed is functioning as woodpecker habitat. Gain better understanding of cultural significance.
Ethnographic information incomplete.	Better understanding of cultural uses and values. Identification of dispersed sites.	Study area to locate and protect specific sites, cultural uses and values.
Traditional management has not been practiced since the exclusion of fire.	Culturally sensitive areas managed to meet tribal objectives.	Manage traditional areas in partnership with Tribes.

DRAFT LMP MANAGEMENT AREA - RESEARCH NATURAL AREA

Existing Condition	Desired Condition	Opportunity
Portion of Rock Creek Butte RNA is located within Dillon Creek.	RNA meets goals and objectives described in Draft LMP. Fuel/fire planning is integrated with adjacent management areas.	Prepare an RNA plan that encompasses the entire RNA. Make sure that fire suppression forces are aware of any special procedures or goals.
Largest portion of RNA that is located in Dillon Creek is depicted as Late Successional Reserve in the Draft LMP.	Correct land classification and status.	Update Forest Plan management status to reflect appropriate objectives for the RNA.

DRAFT LMP MANAGEMENT AREA - RIPARIAN RESERVES

Existing Condition	Desired Condition	Opportunity
Riparian Reserve mapping expanded to include modeled intermittent streams and Draft LMP unstable, unsuitable lands Increased riparian reserve acres over Draft LMP map.	Acres of matrix lands in LMP reflect expanded map of riparian reserves. Manage these lands with no PSQ.	Feed back to LMP more accurate map of riparian reserves and reduction of acres of matrix lands in watershed.
1994 fires have created excessive fuel loading in some portions of the riparian reserve putting them at risk to achieve long term objectives.	Sustainable vegetative cover meeting aquatic strategy as described in ROD the Draft LMP.	Reduce fuel loading in riparian reserves where it is identified as a high risk to adjacent overstory, does not compromise large woody debris goals, and achieves long term goals.
Increased stocking density and heavy fuel accumulations due to missed fire events inside and outside 1994 fire threaten objectives of riparian reserves.	Sustainable vegetative cover meeting aquatic strategy as described in ROD and Draft LMP.	Apply prescribed burning and silvicultural treatments to achieve Desired Conditions.
Past flood damage has left some riparian areas with sparse vegetative cover.	Sustainable vegetative cover meeting aquatic strategy as described in ROD and Draft LMP.	Revegetate riparian areas.
Mapped riparian reserves are not site specific.	Site specific determinations of riparian reserve boundaries adhere to ROD standards and guidelines.	Adhere to standards as described in the ROD to determine site specific boundaries of riparian reserves.
Dead trees will add to CWM recruitment in streams.	Snags retained where they are likely to enter stream system.	Protect snags in riparian reserves that have potential to reach streams.
Most recent information on fish habitat is pre-fire (1989-91).	Current information on fish habitat and populations.	Monitor fish habitat and populations.
POC root disease not present in Dillon.	Maintain disease-free environment.	Design all activities to minimize threat through implementation of POC plan.
High quality fish habitat.	Protect and preserve high quality fish habitat.	Design and implement all activities consistent with aquatic conservation strategy.

DRAFT LMP MANAGEMENT AREA - RETENTION

Existing Condition	Desired Condition	Opportunity
Variety of visual settings.	Management activity not evident.	Design management activities to meet Draft Draft LMP objectives.

DRAFT LMP MANAGEMENT AREA - PARTIAL RETENTION

Existing Condition	Desired Condition	Opportunity
Variety of visual settings.	Provide forested setting, human activity subordinate to character of landscape.	Design management activities to meet Draft Draft LMP objectives. Specific project to reduce sharp contrast caused by 1994 fireline construction, as viewed from river corridor.
Some settings along Kelsey Trail negatively affected by 1994 fire.	Provide forested setting with human activity subordinate to character of landscape.	Trail maintenance work to rehabilitate settings.

DRAFT LMP MANAGEMENT AREA - GENERAL FOREST

Existing Condition	Desired Condition	Opportunity
Dead, standing fire killed trees rapicly losing value.	Achieve desired stocking levels and sustainable forest conditions. Capture value of dead trees.	Salvage dead trees and reestablish stands as soon as possible.
Mature and over mature stands past culmination of mean annual increment.	Rapidly growing thrifty stands.	Conduct regeneration harvest and reforestation where appropriate.
Immature stands that are over stocked.	Immature stands at desired stocking levels with a mixture of age classes and vegetation types.	Conduct thinning and prescribed fire where appropriate.
High percentage of late seral stage conditions. Adjacent LSR management will increase amount of late seral conditions in watershed.	Maintain a diverse mix of seral stages in watershed.	Conduct harvest and regeneration to provide early seral conditions and maintain overall watershed diversity where early seral condition is a limiting habitat factor.
Fire exclusion has altered vegetative patterns, species mix and fuels conditions.	Sustainable forests, e.g. continued existence of fire evolved black oak stands. Lower tree stocking and higher proportion of grasses, brush and forbs. Maintenance of unique stands of rare species. Smaller patches.	Apply prescribed fire to reestablish natural range of fire frequency and intensity.

DRAFT LMP MANAGEMENT AREA - RECREATIONAL RIVER

Existing Condition	Desired Condition	Opportunity
Dillon and North Fork of Dillon Creek found suitable and recommended by Draft LMP to Wild and Scenic River System.	Congress acts quickly to incorporate Dillon into Wild and Scenic River System.	Conduct activities consistent with LMP recommendation.
Areas burned within 1/4 mile of Dillon Creek in 1994.	Protect outstandingly remarkable values which qualifies river for designation.	Apply silvicultural treatments including prescribed fire,salvage, and thinning to support and achieve Wild and Scenic River objectives.
Remote rugged characteristic of river and Dillon Creek.	Continued low level of use.	Avoid measures that might foster abrupt increases in use.

OPPORTUNITIES NOT RELATED TO A SPECIFIC MANAGEMENT AREAS

Existing Condition	Desired Condition	Opportunity
Many areas experienced first fire event in many years. Various vegetation components killed; fuels will accumulate in 5-10 years.	Fire maintained in the ecosystem with fuel loads that burn at low intensity.	Applying prescribed fire where appropriate over the long term.
Instability in local economy.	Increased local economic stability.	Provide economic opportunities through commodity production and activities that provide jobs.
Increasing demand for tanoak mushrooms. Little information available on interactions of fires and tanoak mushroom production.	Sustainable production and availability of tanoak mushrooms both for cultural and economic purposes.	Implement studies and testing of tanoak mushroom functions and responses.
Very little known about wildlife populations in Dillon.	More information available about wildlife populations in the watershed.	Conduct surveys for Threatened, Endangered and Sensitive species.
Optimum amount of coarse woody debris for the food web versus the risk from too-high fuel levels is probably variable across the landscape, but there is insufficient information to refine it further.	Sound information for prescriptive levels of CWD to manage for over the long term.	Develop models for various vegetation types for the dynamics of snags and related coarse woody debris/fuels relationships.
Few or no elk in Dillon, but suitable habitat is present.	Elk herd in Dillon.	Reestablish elk population in Dillon.
During 1994 fire, Elbow Springs trailhead used for fireline.	Visually attractive trailhead designed to provide for parking, overnight use and interpretative information.	Develop site plan for Elbow Springs and implement. Develop walking interpretative tour from Elbow Springs trailhead.

Existing Condition	Desired Condition	Opportunity
The Siskon Mine is an abandoned mine hazardous wast site with several contaminant sources, and mining-related erosion problems.	Restor a healthy terrestrial, riparian and aquatic system and habitat to support native flora and fauna.	Siskon Mine site evaluation, clean-up, reclamation, and monitoring, consistent with Federal and State regulations. Pursue Potentially Responsible Parties for cost-recovery and participation in clean-up activities. Reduce sedimentation from mine-related landslides.
The responsible parties/liability for the Siskon Mine hazardous wastes and other mining-related environmental problems are undetermined.	Area fully restored and recovered.	Pursue the possibility of including the responsible parties in clean-up activities, and potential cost recovery.

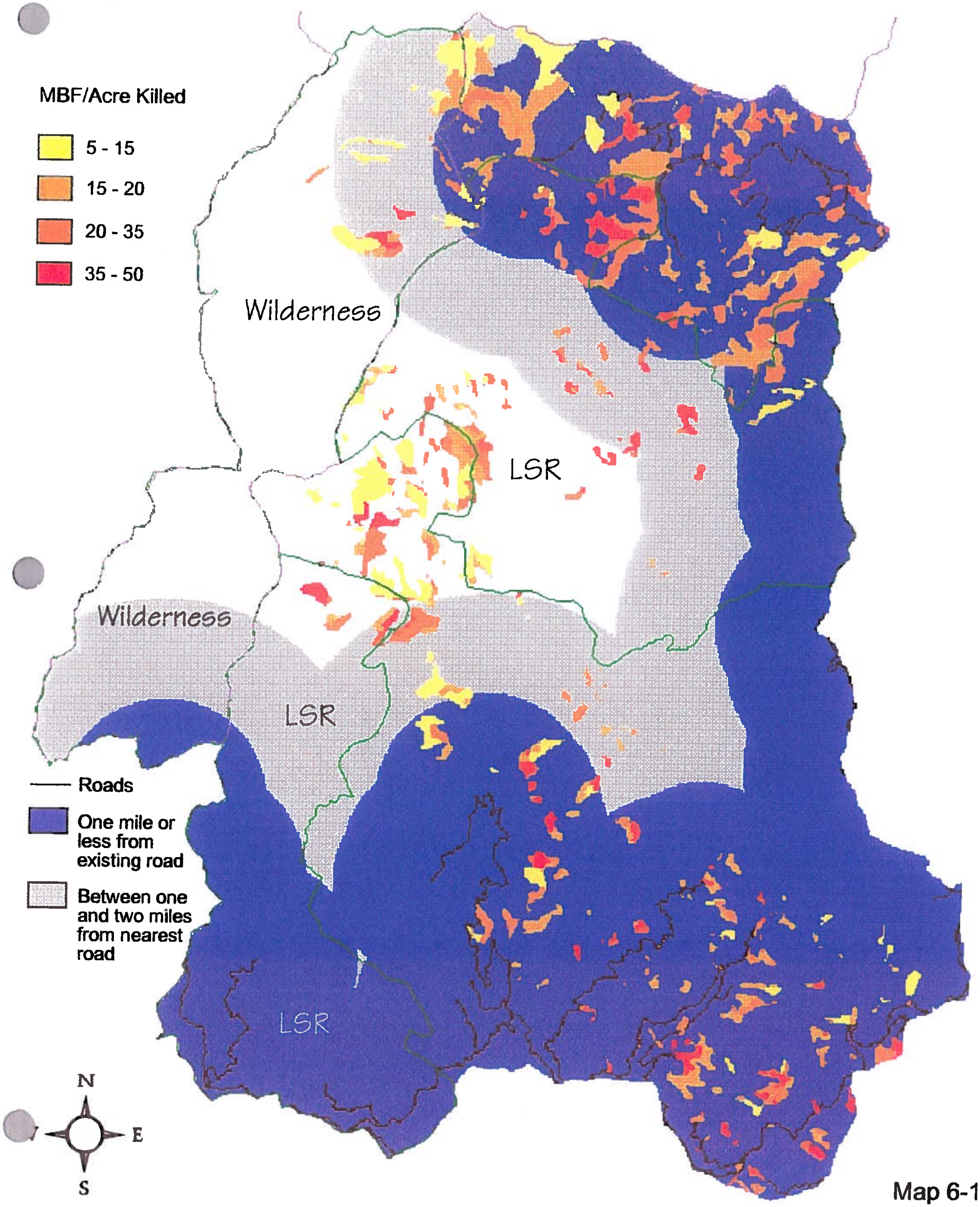
ROADS

Existing Condition	Desired Condition	Opportunity
Transportation system includes 55 miles of road concentrated in Southern and Northern ends of the watershed.	Transportation system that provides management and recreation access appropriate to each management area.	Prepare transportation management strategy (plan). Follow Draft LMP Standards and Guidelines.
Roads have elevated the sediment production potential in the Dillon Creek watershed.	Reduce sediment production potential. No net increase in road miles. No new roads in roadless areas.	Reduce surface erosion, stabilize roads, decommision selected roads, locate and design new roads (if any) to achieve objectives of aquatic conservation strategy.
Landslides damage roads and decrease utility of roads.	Reduce road damage and keep road management economical.	Stabilize existing roads, locate and design new roads (if any) with improved stability.
No comprehensive travel and access management plan.	Road management strategy which considers: 1) Identification of roads that should be maintained in present status, upgraded, downgraded, or decommissioned. 2) Open road densities as they pertain to wildlife and sedimentation. 3) Current and projected use patterns relating to timber management, administration, recreation, and private land. 4) Identification and prioritization of restoration projects on roads that pose the greatest risk to riparian and aquatic environments. 5) Reduction of existing maintenance levels to meet Forest Plan goals.	Put infrequently used roads into a self- maintaining status to reduce watershed and wildlife impacts and to reduce road maintenance costs. Close, stabilize, and revegetate any roads not identified as having long-term utility to the transportation system.
Forest Plan Released Roadless map designation conflicts with some locations of existing roads.	Released Roadless Areas depicted accurately on Forest Plan information to meet the guidelines originally used for RARE II.	Update map of roadless areas to match site specific information.

Many of the potential opportunities to achieve the objectives for the various land classifications involve fuel hazard reductions by prescribed burning, removal/salvage of material, or combinations of both. In most cases, the limited extent of the transportation system preclude ground-based entry into the severely burned areas. Map 6-1 depicts the concentrations of fire mortality and distances from the existing transportation system. Areas within a mile of system roads are depicted, as well as the band of area between one and two miles. The map is displayed only to give the reader a feel for the extent to which achieving some of the salvage portions of the opportunities may be feasible. In general, the economics of operating beyond that range with helicopter salvaging systems are very marginal.

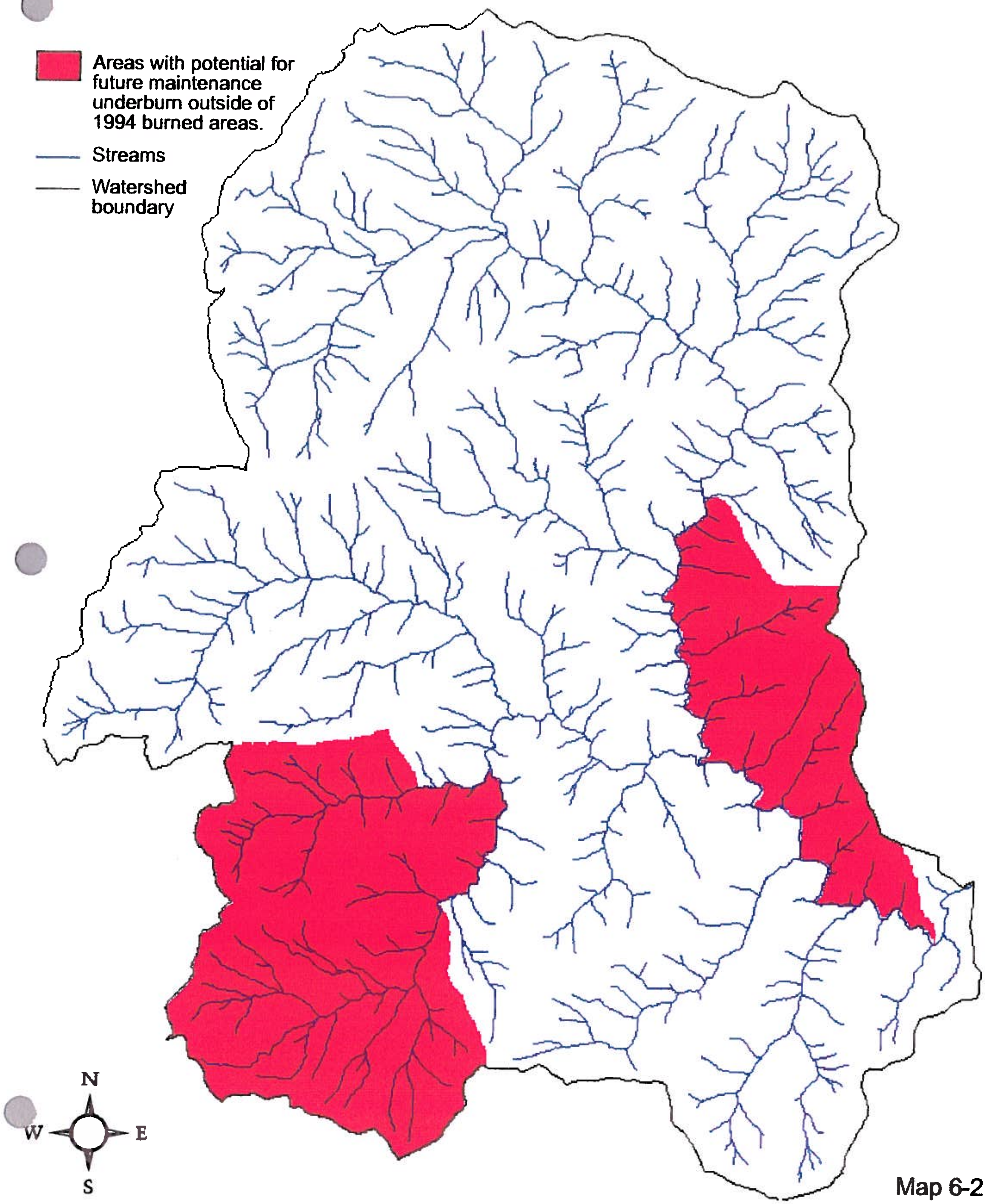
Returning some of the more inaccessible ground to a condition of lower fuel loads would likely involve multiple light prescribed fires as the fuels accumulate. This would be somewhat dependent upon revenues from salvage done in the appropriate places, as Congress-appropriated funds to perform multiple fuel treatments for large areas is severely limited. Map 6-2 depicts some areas where future prescribed fires can help in restoring the dynamics under which the system evolved, while minimizing risks to the existing forest cover. It shows areas that did not burn in 1994, as the 1994 burn area is considered in detail elsewhere.

Fire mortality/Distance from existing transportation system



Map 6-1

Future maintenance underburn potential



Map 6-2

APPENDIX A

MINING SIGNIFICANCE AND HISTORY, AND PAST, PRESENT AND FUTURE ENVIRONMENTAL EFFECTS OF MINING.

Prepared by: Polly Haessig

Mining Activity and Mineral Deposits

Mineral deposits known to occur in Dillon Creek Watershed and its vicinity, include placer gold and platinum, surface and subsurface lode gold, silver, copper, manganese, graphite, and chromite. The most significant past mining exploration and production activities were placer gold operations at the Burns T, Dillon Hill, and Blue Nose mines, surface mining of gold and silver at the Siskon Mine and exploration for manganese at the High Light No. 1 Claim.

Gold dredging and hydraulic mining occurred along the Klamath River and nearby tributaries to during the late 1880's to the through the 1920's. The largest hydraulic mines were the Dillon Hill, Elliot Diggings, Nolan's Bar, Carter Mine, Blue Nose, and the Ti Bar mine. These mines are located on the Klamath River or its tributaries betwen Cottage Grove and Ti Bar. Dillon Hill Hydraulic Mine was active in the late 1890's. Hydraulic mining occurred at several locations near the mouth of Dillon Creek. Dredge tailings, ditch lines, and settling ponds are visible today. The Burns T mine was a placer mine located upstream of the Dillon Hill, on the North Fork Dillon Creek. Other placer mining occurred in Medicine and Copper Creeks in the 1920's and during the Great Depression era of the the 1930's.

Copper prospecting occurred during World War I. In 1917, following wildfires that occurred in the area, several copper claims were located in the headwaters of Dillon Creek. Manganese and chromite exploration occurred in the 1940's. This prospecting was associated with the World War II effort.

Siskon Mine History

As one of the biggest gold and silver producing mines known in Siskiyou County during the 20th century, Siskon Mine has a notable history.

Siskon Early Exploration

First entry is believed to have occurred in the early 1900's with about 1200 feet of drifts in two adits constructed. During the late 1920's or early 1930's the first tunnel (Florida Tunnel) was driven by hand at what became Siskon Mine. In the 1930's the Scott Tunnel was driven. The first 10 original claims of the Siskon Mine were located in the late 1930's. During WWII, 1945-1946, The Texas Gulf Sulphur Company explored the Siskon Mine Property in search of a source of sulphur. The company drilled 5 holes totalling 5086 feet, and drove 6 short adits. By 1950, more than 30 additional claims were located at Siskon Mine, 10 miles of road were built from Cedar Camp to the Mine, and the mine camp was built along Copper Creek.

Siskon Mine, 1950-1960

The period 1950-1960 was the height of operations at Siskon Mine. Claim owner Hugh Wright, and operators Siskon Corporation, H. B. Chessher and H. B. Chessher Jr. were the principals running the mining operations. At this time, the Siskon Mine property included one mill site and 62 unpatented lode and placer claims. All the claims were contiguous. Mine operations during this period were extensive. More than $3.7 million dollars worth of gold and silver were recovered from 400,000 tons of ore that came from 3 open pits on the top of the ridge. These pits and adjacent lands are now patented claims. At the time of operations, the price of gold was fixed at $35.00 per ounce. The price of silver was $1.29 per ounce. The ore was trucked about 2.5 miles downhill to an all-slime cyanide processing plant. There, a solution of cyanide and lime was used to dissolve the metals and the resultant slurry was then washed with water in large agitators in order to dilute the cyanide. Zinc dust was used to concentrate and amalgamate the gold and silver. The initial capacity of the plant was 100 tons per day. At the latter stages of operation, capacity was 400 tons per day. During this time period Siskon Corporation extended 5 adits several thousand feet. Gold and silver bullion produced at Siskon was sent the smelter in Tacoma, Washington, and then to the U.S. Government mint at San Francisco (Sikon Corporation Files).

During this period, 30 to 35 men and women were employed and lived at the mine, including the mess hall crew. Families would live and work at the mine during the summer months, with wives and children going home when school was in session. Most of the mine employees were from Happy Camp. The mine operated from March through November and was shut down during the winter months. The mine operated 3 shifts, 24 hours a day. The camp had electricity, bunkhouses, a rec hall and a TV. Wages for most of the employees were $2.00 an hour, with $1.25 a day deducted for room and board. The green shack at Cedar Camp was used as a survival shack for the mine. In March when there was still quite a bit of snow on the ground, the crew would snowshoe in to the shack and camp for the night. The next day they would snowshoe in to the mine camp, start up the CAT bull dozer and open up the road (Smith, 1993).

Siskon Mine, 1960 to the present

Six claims were patented on the Siskon Mine property in 1961. From 1960 to 1992, the 63 claims comprising the Siskon Mine claim group were held by a succession of mine companies and individuals. During this time, several exploration studies were undertaken to define the extent of gold and silver mineralization and potential copper reserves at depth. No active mining occurred although the possibility of cyanide heap leach operations there was considered during a surge of gold prices ($800/oz) in 1979. The current claimant has contracted out drilling, sampling, and exploratory work at the mine during the years 1988-1991. This recent exploratory work has extended the strike and depth of the ore zone. The claimant has indicated interest in developing the mine in the future, and has conducted some environmental assessment at the site. Today, only the six original patented mining claims are maintained. All the other 57 unpatented lode and placer claims have been relinquished and are presently abandoned (Siskon Corporation Files).

Current Status of Mining Activities and Relation to New Mining Regulations

The present owner of the six patented mining claims of Siskon Mine is Mr. Raymundo J. Chico of Denver, Colorado. He has held these claims since 1988. He held the other 57 contiguous lode and placer claims from 1988 to 1993. He relinquished these claims probably because of the rental fees required as part of annual assessment work.

Currently, there are no other active lode or placer claims within the Dillon Watershed. The few placer claims that appear on BLM filing indexes are located on the Klamath River. Bureau of Land Management (BLM) claim indexes indicate that even the New 49ers claims near the bridge at Sidewinder road have not kept up their annual assessment/rental fees since 1991. Many placer claims along the Klamath River and its tributaries have lapsed since the late 1980's and early 1990's. This is likely due to two factors. Suction dredging was allowed in Dillon Creek and its tributaries until 1982. Since that time, Dillon Creek has been closed by CDFG to suction dredge mining. The annual maintenance (rental) fee requirement of $100.00 per year per mining claim became effective in the 1993 assessment year. BLM mining claim indexes show an increase in mining claim case closure and abandonment beginning in 1993.

Economic Mineral Potential, Dillon Creek Watershed

Past production and exploration for copper and associated gold and silver in Siskiyou County suggest that economic to subeconomic ore deposits may still be discovered. Most all of the copper mined in California has come from deposits that were exposed at the surface. In general, the copper mined in California has been from small to medium sized deposits. Undiscovered ore bodies could exist beneath the surface in geologically favorable areas. Modern techniques of subsurface exploration along with physical and geochemical analysis could lead to discovery of new copper reserves in geologically favorable areas. Economic to subeconomic reserves of gold and silver are known to exist at Siskon Mine. Though there have been many investigations exploring the ore body present there, the geology and ore values are conflicting and poorly known. The most reasonable estimates of gold and copper potential remaining at Siskon are several hundred thousand tons of 0.05 to 0.10 oz. Au/ton, and perhaps millions of tons of low grade gold, copper and silver. The costs of mine development, rehabilitation, environmental compliance, transportation, reclamation, and other factors could limit future exploration and development of new gold, silver, and copper deposits. Particularly for copper, the small size of most copper deposits, milling costs and lack of nearby smelters, and environmental costs are for the most part, prohibitive.

Geology of the Known Ore Deposits

There is more known about the geology of the Siskon Mine ore deposit than any of the other mineral deposits in Dillon Watershed.

The Siskon Mine ore deposit can be characterized as a disseminated epithermal massive sulfide deposit. The deposit is similar in geology to those found in Clear Creek District, Grey Eagle Mine, and at the Buzzard Hill Mine. Mineralization occurs within a structurally complex zone consisting of fault-bounded blocks of rocks from both the Western Jurassic (Galice Formation) and Western Paleozoic & Triassic belts (Rattlesnake Creek Terrane) of the Klamath Mountains geological province.

Siskon Mine is underlain by a weakly metamorphosed Jurassic sedimentary rocks and mafic intrusive and volcanic rocks. The layered sequence of rocks includes slate, phyllite, schist, serpentinite, and greenstone, and strikes northerly and dips variably to the west. The sequence was intruded by hornblende diorite.

Mineralization is related to the fault contact between phyllite and greenstone (pyritic schist). Mineralization includes pyrite, chalcopyrite, barite, and sphalerite associated with quartz and possibly controlled by shear zones. Economic ore mined in the past and apparently still remaining is confined to the secondary, siliceous gossan cap rock. The red-colored, acid leached cap rock is what gives the ridge its distinctive appearance. The surface enrichment significantly improved ore grades at the top of the ridge. Numerous investigations have been made to find primary, high grade gold and copper mineralization as well as a supergene chalcocite (copper mineralization) blanket. During these investigations, additional gold and silver ore zones were located. Most geologists believe that potential ore reserves are within an order of magnitude of several thousand tons of 0.05 to 0.10 oz. Au/ton with mineralization around or in existing open pits. Unoxidized primary mineralization at depth likely will be subeconomic.

Though hypotheses about the origins of mineralization at Siskon abound, the geology is still poorly known. Some geologists have compared Siskon to concordant massive sulphide deposits like those found in the Shasta District in California. Others believe that Siskon does not fit that model, but indicate that some sort of submarine volcanic origin (Black Smoker) might be appropriate. Another hypothesis to be considered is that of a sub-aerial, structurally controlled hydrothermal replacement deposit. In this hypothesis, the mineralization could be post Nevadan and associated with faulting.

The chromite deposits commonly worked in the Klamath Mountains are lenticular to tabular bodies of podiform chromite that occur in peridotite and serpentinite. Chromite prospects found in the watershed are associated with ultramafic rocks of the Rattlesnake Creek Terrane.

Manganese deposits in the Klamath Mountains are mostly found in bedded metasedimentary deposits such as metamorphosed chert. The manganese prospect found at the High Light No. 1 claim is associated with a large bock of chert metamorphosed to quartzite.

The Klamath Mountains contain graphitic schists which have been prospected for graphite, the crystalline form of carbon. The one graphite prospect in the watershed is likely associated with slates and phyllites of the Rattlesnake Creek Terrane.

Because of gold's high specific gravity, and resistance to weathering, gold is easily concentrated in stream deposits or placers. All streams that flow through gold-bearing regions have been productive at one time or another. Placer deposits range from Recent to Tertiary in age. Recent deposits are in and adjacent to active streams. The older deposits are found in older terraces, or benches; some may be located on ridges, where the terraces have been uplifted. Though suction dredge mining is prohibited in Dillon Creek at this time, there is potential for exploration and development of placer mines along Dillon Creek and its tributaries.

Environmental Impacts Associated with Mining

Uncontrolled release of acid mine drainage is considered to be the most serious environmental impact mining can have on the environment. Acidic mine drainage from metal mines can contain dissolved heavy metals in toxic concentrations. Other environmental impacts associated with mining include: (a) seepage, leaching and runoff from open pits, ore stockpiles, tailings ponds, waste dumps, or tailings piles; (b) environmental problems associated with modern techniques of ore recovery and ore processing (cyanide heap leach), (c) mass failures of unstable ore stockpiles, mine waste, tailings or overburden piles, (d) sedimentation, stream channel and riparian damage resulting from placer mine operations; and (e) slope stability problems associated with non- maintained or poorly designed mine roads. Advanced technology and research in acid mine drainage prediction and control, new advances in mine waste treatment technology and engineering design practices are under development today to reduce these common mining impacts to the environment. Each new mining proposal today is faced with its own set of environmental challenges.

Existing Environmental Problems Associated with Mining in Dillon Watershed

Significant environmental problems are associated with the Siskon Mine, which is the largest producing gold and silver mine in the watershed. The patented portion of the mine is inactive; the rest is abandoned. Siskon Mine was identified as a hazardous waste site in 1993 after uncontained mill tailings, a slurry tank filled with mill tailings, acidic mine drainage, and more than 250 open, empty cyanide drums with cyanide residues were found on site. Other environmental problems associated with the mine include a large debris slide formed from mass failure of overburden stockpiles, and several rock slides and debris slides associated with the mine road, and tunnel portals. Acidic drainage occurs in Medicine Creek where the ore body (pyrite-bearing schist) intersects the creek. This acidic drainage is considered to be natural in occurrence, and not accelerated by mining.

Description of Environmental Problems at Siskon

Preliminary Assessment of the Siskon Mine found the following contaminant sources: mill tailings, a slurry tank filled with mill tailings, abandoned, open, empty cyanide drums with residues, and acidic mine drainage.

Mill Tailings

Metal and cyanide contamination is associated with remnant mill tailings in what is left of the mill tailings pond. The tailings are fine grained and red in color due to high iron content. There is a noticeable lack of vegetation growing on the tailings, which are found in the old tailings pond and along the stream bank of Copper Creek. As recent as March and May of 1994, sediment from the tailings was observed eroding into Copper Creek. A small spring flows from the middle of the tailings pond area and discharges directly into Copper Creek. There are young coniferous and deciduous trees growing near the springs. The estimated volume of tailings remaining in the old tails pond and in the vicinity of the mill site is about 6,900 cubic yards. About 80 cubic yards of mill tailings remain in one of the cyanide slurry tanks. A sample of mill tailings from the middle of the tailings pond contained elevated levels of arsenic, mercury, copper, zinc, molybdenum, selenium, lead, and cyanide. These metals are typical of the ore body, but became concentrated during ore processing. The levels of arsenic and copper exceed their respective total threshold limit concentrations (TTLCs), but none of the metals exceeded their soluble threshold limit concentrations (STLCs). Under California regulations, the uncontained tailings are classified as a hazardous mine waste.

Open Cyanide Drums with Residues

Approximately 250 open (tops removed), empty cyanide drums with residues, are scattered throughout lands managed by the USFS adjacent to the patented mining claims. Some of the drums appear to have been scattered by a landslide that occurred on the road where the drums had been stockpiled. Drums are scattered around the tailings pond area and in the camp area on the east side of Copper Creek. Twenty drums were wipe-sampled in 1993 and showed the presence of cyanide residues ranging from 2.5 to 200 milligrams per kilogram (mg/kg). The cyanide drums, an undesirable relict left over from past mining, may be a considered an environmental or safety hazard and will be costly to remove from lands managed by the national forest.

Acidic Drainage

Acidic mine drainage is associated with the Scott Tunnel. Field observations at Scott Tunnel on June 10, 1993 showed that the water discharging from the tunnel had a pH of 3.2 at an estimated 20 degrees C, and the flow rate was estimated at 15 gallons per minute. Limited metals and sulfate sampling and testing has been done on the Scott Tunnel discharge. Copper and zinc concentrations exceed federal ambient water quality criteria. The discharge flows overland for about 50 feet and then disappears under mine waste rock and soil. The nearest surface water body to the discharge from the Scott Tunnel is Rough Creek, which approximately 200-300 feet downslope. The impacts of the discharge on Rough Creek are unknown at this time.

Open Pits

There are three open pits on the patented mining claims. The open pits drain internally and do not impound water. They do not appear to create an acidic discharge, and thus are not considered to be a contaminant source.

Landslides and Road Failures

There are approximately 5 miles of road on patented and unpatented mining claims of the Siskon Mine claim group. The road miles were map wheeled off of a Mineral Survey Map dating from 1955. All the roads were built prior to 1950. There are approximately 1.7 miles of road on the patented claims. The mine road is the 14N31 road, a level 2 road. There are no easements associated with this road. Most of the mining-related landslide and erosion problems occur on unpatented lands managed by the forest.

Small road failures (fill failures) show up on the 1955 aerial photos. Several other debris flows in discarded waste rock material are also found downslope of tunnel portals. The largest debris slide that is still raw today, occurred adjacent to the largest pit, the Florida Pit. It appears that either a large overburden waste rock pile failed, or more simply, that overburden material was sidecast and wasted on the steep mountain slopes above Medicine Creek. Subsequent severe wet winters and flood events enlarged the debris slide, formed gullies, and scoured out a channel to Medicine Creek.

The severe rains and floods during the winter of 1955-1956 caused significant damage to roads and mine property from landslides and flooding. Other failures occurred in road fills and in waste rock dumps outside of tunnel portals. The large rock failure that forms a distinctive scar on the eastern slope of the mine failed during the 1955 flood event. The debris scoured out a channel to Copper Creek. The mine road is impassable to vehicles today due to this landslide.

The 1964 flood caused further damage to the mine road. Large gullies were formed in the debris slide near Florida Pit. Another new landslide occurred near the mill site. This landslide likely was initiated on a wide road fill where the many empty cyanide drums were stockpiled. The landslide scattered all of the drums downslope. Other cut failures occurred on the mine road near this landslide.

The 1971 aerial photos show that the landslides initiated in 1964 or earlier had not revegetated very much. The channel of Copper Creek was still raw and showed little new riparian vegetation. The 1986 and 1990 photos show considerable vegetative growth from 1964. Though the largest landslides remain unvegetated the smaller ones have partially filled in with young conifers and other shrubs. The scoured out portions of the larger debris flows have almost fully revegetated near stream courses. Willow and alder have grown in thickly along the Copper Creek stream channel.

Historical Recollections of the Environmental Conditions During the 1950's

Reports of conditions at Siskon Mine during its 1950-1960 period of operation come from recollections of a former employee and caretaker at the mine, Laren "Smitty" Smith (Smith, 1993) and from California Department of Fish and Game (CDFG) reports. Smith reported that the tailings impounded behind the dam would be 100 feet deep after 7-8 months of continuous mill operation. During the late fall when the mill closed, the caretaker would start a hole in dam, and release all of the tailings down Copper and Dillon Creek. When the slug of tailings reached the Klamath River, it turned the Klamath into a red mud.

CDFG reviewed existing and proposed operations at Siskon Mine as early as 1953. In July of 1953, a game warden fished Copper Creek just below the mine and caught 15 trout in less than one hour. CDFG expressed concerns about mine tailings laden with cyanide, lime and zinc entering Copper Creek. A field report of April, 1954 indicated that the tailings dump was nearly full and about to overflow into the creek. This may have been before the tailings dam was constructed to hold the tailings. A CDFG memo dated February 1958 documents that the tailings dump washed out in December of 1957, creating "considerable discoloration of the Klamath River". CDFG recommended running some tests such as holding trout in live cars in the stream below a sample release of the tailings. There is no record, however, of any tests being conducted. Production at the Siskon Mill ended in 1960.

Interrelationships between Siskon Mine Contaminant Sources and Resources

The most significant contaminant pathway of concern is surface water. In addition, the uncontained mill tailings and cyanide drums with residues could pose a threat to wildlife species inhabiting the area. Public safety and human health concerns are low at this site because of its remote location and lack of on-site or nearby residents. As there are no groundwater drinking wells within the watershed affected by the mine site, groundwater contamination is not a significant concern.

Copper Creek is an anadromous fishery supporting summer and winter steelhead fish populations and important fish habitat upstream and downstream from the mine and mill site area. The mill tailings and tailings pond area are entirely within the riparian reserve, annual floodplain, and 100 year floodplain of Copper Creek. The effects of erosion of mill tailings on the water quality, and aquatic life of Copper Creek are unknown at this time. No analyses of surface water, stream sediments, or macro-invertebrates, have been conducted to assess the degree of contamination or its effects.

Acidic discharge from Scott Tunnel has the potential to impact Rough Creek and Copper Creek. Further evaluation is needed of metals loading from the tunnel discharge, and water quality above and below the estimated point of entry of the discharge in to Rough Creek. The metals content of sediment in Rough Creek also requires further evaluation.

Though several sensitive plant species have potential habitat or known populations in the area, no botanical surveys have been conducted in the mine or mill site area. A Late Successional Forest Reserve is within two miles of the mine site and mill site area. Two known nesting pairs of northern spotted owls have been recorded within 2 miles of the mine site and mill. The mine is also within the habitat range of the marbled murrelet, but no surveys have been done in the area. Habitat associated with the Del Norte salamander occurs in the area but no surveys have been done to identify the presence of the salamander, or other herpetofauna. Deer and bear have been seen in the mill site and tailings area, and both deer and bear tracks have been observed in the slurry tank. The mill tailings are used as a "salt lick" by both deer and bear.

Management Direction

Forest-wide Standards and Guidelines in the Klamath Draft and Final Land Management Plan state that instances of suspected or known contamination of surface water, ground water or soil by hazardous or toxic substances will be removed or remediated, following appropriate Federal, State and local regulations. Individuals, owners or operators that may be considered potentially responsible parties will be pursued for recovery of all costs associated with clean up (S&G 1-5).

Consistent with this Standard and Guideline, Siskon Mine is a high priority abandoned mine site for investigation, hazard assessment and clean up on the Klamath Forest. The Forest recognized the mine as having potential contamination problems in 1992 as part of the Forest-wide Abandoned Mine Discovery Program. Following federal regulations of the Comprehensive Environmental Response, Compensation, and Liability Act or CERCLA (42 U.S.C. 9605), and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), the Klamath Forest notified the National Response Center in July, 1993 of a reportable quantity release of toxic metals to the environment from the mill tailings at Siskon Mine. Following the report of a release, several actions have been taken, consistent with the NCP. They include:

1. A Potentially Responsible Parties Search
2. Notification and Information Requests to Potentially Responsible Parties
3. Preliminary Assessment Report of Siskon Mine (Haessig, 1994).

At the present time, the Preliminary Assessment Report on Siskon Mine is under review by the Environmental Protection Agency. Further work is also being conducted to find additional Potentially Responsible Parties. The Klamath Forest is sharing information about Siskon Mine mine site with California State regulatory agencies such as the North Coast Regional Water Quality Control Board, and the California Department of Fish and Game.

Desired Condition and Opportunities

As an abandoned mine, Siskon Mine has significant environmental problems remaining from its active period of mining in the 1950s. These include several contaminant sources and mining-related landslides and chronic sediment sources. Of most concern, is the damage to the riparian reserve, and water quality of Copper Creek from the uncontrolled release of potentially toxic or hazardous mine tailings. Other serious contaminant sources include the old cyanide drums, and acidic drainage from the Scott Tunnel.

Several mining road-initiated landslides and debris slides from failed mine waste rock and overburden piles exist at the mine. Some of the larger debris flows remain unvegetated and are a chronic source of sediment to stream channels.

The desired future condition of Siskon Mine is to restore the mill site and other damaged areas to prevent further degradation of the riparian resource, and to promote a return of a healthy and functioning terrestrial, riparian and aquatic system that supports native flora and fauna.

Further site evaluation is planned to more fully characterize these contaminant sources, and to develop alternatives for the removal of the mill tailings and cyanide drums, and possible remediation of acidic drainage. Consistent with the National Contingency Plan, any response action at the site will involve community relations a Record of Decision, and public comment. Potentially Responsible Parties will be actively pursued to engage them in full cooperation in the clean-up response, or to recover costs incurred. Opportunities exist for road stabilization, and revegetation of the larger chronic sediment-producing landslides.

REFERENCES

Minerals Availability System (MAS) Database, Generated Nov. 1, 1993, U.S. Dept. of Interior, Bureau of Mines, Western Field Operations Center, Spokane, WA.

Minerals Resource Data System (MRDS) Database, Generated May 23, 1994, U.S. Dept. of Interior, Geological Survey, Minerals Information Office, Reno, NV.

Mining Location Maps, and List of Principal Mineral Deposits in Siskiyou County, California. On file with the Klamath National Forest Supervisors Office, Yreka, CA.

Siskon Corporation Files. On file with the Klamath National Forest Supervisors Office, Yreka, CA.

Smith, Lauren "Smitty" 1993, Mining--Siskon Mine, *In* Davies, Gilbert W. and Frank, Florice M., Stories of the Klamath National Forest, The First 50 years: 1905-1955, Graphic Press, Klamath Falls, OR. pp.374-381

Haessig, Polly A., July, 1994, Preliminary Assessment Report, Siskon Mine, Klamath National Forest. Klamath National Forest, Supervisors Office, Yreka, CA. On file in the Administrative Record for the Siskon Mine Project.

LITERATURE CITED

Agee, J.K. 1991. Fire History Along an Elevational Gradient in the Siskiyou Mountains. Oregon Northwest Science, Vol. 65, No. 4

Allison, B. and B. Woodbridge. 1993. Presentation made at the Sixty-third Annual Meeting of the Cooper Ornithological Society, Northen Goshawk Symposium April 14-15, 1993.

Amaranthus, M.P., R.M. Rice, N.R. Barr, and Ziemer. 1985. Logging and Forest Roads Related to Increased Debris Slides in Southwestern Oregon. Journal of Forestry, Vol. 83, No. 4. pp 229-233.

Amaranthus, M.P. et. al. 1990. Long-term productivity and the living soil. In: Perry, D.A.; Meurisse, R. et. al. eds. Maintaining long-term productivity of Pacific Northwest Ecosystems. Portland, OR: Timber Press: 36-52.

AOU (American Ornithological Union). 1983. Checklist of North American Birds, 6th Edition.

Austin, K. 1993. Habitat use and home range size of breeding northern goshawks in the southern Cascades. M.S. Thesis. Oregon State University.

Bent, A.C. 1938. Life histories of North American birds of prey. Dover Publication, Inc. NY, NY. 482 pp.

Bingham, B. B. and J. O. Sawyer, Jr. 1990. Distinctive Structural Features of Old-Growth Douglas-fir/ Hardwood Forests. Old-Growth Douglas-fir Forests: Wildlife Communities and Habitat Relationships, Symposium, Portland, Oregon.

Bisson, P.A., J.L. Neilsen, R.A. Palmason, and L.E. Grove. 1981. A System of Naming Habitat Types in Small Streams, with Examples of Habitat Utilization by Salmonids During Low Streamflow: Paper presented at the symposium on Acquisition and Utlilzation of Aquatic Habitat Inventory Information. October 1981, Weyerhauser Company, Western Forestry Research Center, Centralia, Washington.

Brown, E. Reade, Technical Editor, 1985. Management of Wildlife and Fish Habitat in Forests of Western Oregon and Washington, USDA Forest Service, Pacific Northwest Region, Portland, Oregon.

Bruchac, Joseph, and Michael J. Caduto. 1991. Native American Stories, Fulcrum Publishing, Golden, Colorado.

Buckley. 1976. The High Country: A Summary of New Data Relating to the Significance of Certain Properties in the Belief Systems of Northwestern California Indians.

Carter, H.R. and S.G. Sealy. 1987. Inland Records of Downy Young and Fledgling Marbled Murrelets in North America. Murrelet 68:58-63.

Christensen, Alan G., L. Jack Lyon, and James W. Unsworth. 1993. Elk Management in the Northern Region: Considerations in Forest Plan Updates or Revisions. General Technical Report INT-303. USDA-Forest Service.

Ecological Subregions of the United States. 1994. Section Descriptions, USDA Forest Service, Washington, DC.

Feldman, M. 1982. Notes on reproductive patterns and habitat use of *Accipter* hawks in Utah. Ph.D. Dissertation. Brigham Young University. Provo, Utah.

FEMAT (Forest Ecosystem Management Team: USDA, USDI, USDC, EPA). 1993. Forest Ecosystem Management: An Ecological, Economic, and Social Assessment.

Fisher, D.L. 1986. Daily activity patterns and habitat use of *Accipter* hawks in Utah. Ph.D. Dissertation. Brigham Young University. Provo, Utah.

Franklin, J.F. 1989. Ecological Characteristics of Old-growth Douglas-fir Forests. Paper in draft. Old-growth Douglas-fir Forests: Wildlife Communities and Habitat Relationships, Symposium, Portland Oregon.

Franklin, J.F., K. Cromack, Jr., W. Dennison, A. McKee, C. Maser, J. Sedell, F. Swanson, G. Juday. 1981. Ecological Characteristics of Old-Growth Douglas-fir Forests. General Technical Report. PNW-118. USDA Forest Service. PNW Forest and Range Experiment Station.

Fritts, H.G. and G.A. Gordon. 1980. Annual Precipitation for California Since 1600 Reconstructed from Western North American Tree Rings. [unpublished report] California Department of Water Resources. Agreement #B53367.

Goheen, E.M., D.F. Cobb and K. Forry. Undated. Survey of the Coquille River Falls Research Natural Area, Siskiyou National Forest. USDA, U.S. Forest Service, Forest Pest Management, Portland, Oregon. Unnumbered report. 10pps.

Gorman, O.T., and J.R. Karr. 1978. Habitat Structure and Stream Fish Communities - Ecology 59: pp. 507-515

Grier, C. C., and Logan, R. S., 1977, Old-growth *Psuedotsuga menziesii* Communities of a Western Oregon Watershed: Biomass Distribution and Production Budgets. Ecol. Monogr. 47:373-400

Hall, P. 1984. Characteristics of nesting habitat of Goshawks (*Accipter gentilis*) in northern California. M.S. Thesis. Humboldt State University, Arcata, California. 70 pp.

Hansen. 1989. Testing Port-Orford-Cedar for Resistance to Phytophthora. Plant Disease 73:791-794, paper 2493, Forest Research Laboratory. Oregon State University.

Hargis, C., C., McCarthy, and R.D. Perloff. 1992. Home Ranges and Habitats or Northern Goshawks in Eastern California. Studies in Avian Biology.

Heffner. 1984. Following the Smoke, Six Rivers National Forest.

Heizer. 1978. Handbook of North American Indians. California Volume.

Herbert, R.A. and K.G.S. Herbert. 1965. Behavior of peregrine jfalcons in the New York City Region. The Auk 82:62-94.

Holland, D.C. 1991. A synopsis of the ecology and status of the western pond turtle (*Ckemmys marmorata*) in 1991. University of Southern Louisiana. 141 pp.

Jimerson, T.M. and J.A. Fites. 1989. Preliminary Old-Growth Definitions for Northwest California. Draft. USDA, US Forest Service.

Jimerson, T.J. 1991; A Seral Stage and Successional Pathway Model for the Tanoak-Canyon Live Oak/ Evergreen Huckleberry Ecological Type on the Gasquet Ranger District, Six Rivers National Forest. PhD Dissertation, University of California, Berkeley, CA

Keane, R.E. 1987; Forest Succession in Western Montana - A Computer Model Designed for Resource Managers. USDA, US Forest Service, Intermountain Research Station, Research Note INT-376, Ogden, UT

Kroeber and Gifford. 1949. World Renewal: A Cult System of Northwest California. Anthropological Records 13:1-154.

Kucera, T.E. 1992. Guidelines for establishing and monitoring photographic bias stations. University of California - Berkeley. 5 pp.

Laven, R.D. 1982. Establishing Homogeneity in Studies of Forest Succession. Forest Ecology and Management 4:161-177

Lisle, T.E. 1981. The Recovery of Aggraded Stream Channels at Guaging Stations in Northern California and Southern Oregon. In: Davies, T., A. Pearce, Editors, Proceedings, Christchurch Symposium, Erosion and Sediment Transport in Pacific Rim Steeplands. International Association of Hydrological Sciences, Publication No. 132, P. 189-211.

Lisle, T.E. 1987. Channel Morphology and Sediment Transport of Steepland Streams. In: Beschta, R.L., T. Blinn, G. Grant, G. Ice, and F. Swanson, Editors, Erosion and Sedimentation in the Pacific Rim. International Association by Hydrological Sciences, Publication No. 165, Washington, DC.

McClaskie, G., P. DeBenedictis, R. Erickson, and J. Morlan. 1988. Birds of Northern California, an annotated field list. 2nd edition. GOlden Gate Audubon Society, Berkeley, California.

Madej, M.A. 1987. Recent changes in Channel-Stored Sediment in Redwood Creek, California. In: Nolan H., H. Kelsey, and D. Marron, Editors, Geomorphic Processes and Aquatic Habitat in the Redwood Creek Basin, Northwestern California. US Geological Survey, Professional Paper 1454.

Martin, Robert E., David V. Sandberg, and Paul J. Zinke. 1988. Smoke from Prehistoric, Wild, and Prescribed Fires in California. Unpublished paper presented at the Air Pollution Control Association/ Environmental Administration Specialty Conference in San Francisco, California.

Maser, Chris, 1988. The Redesigned Forest. R.&E. Miles, P.O. Box 1916, San Pedro, California 90733.

Maser, Chris; J.M. Trappe; and R.A. Nussbaum. 1978. Fungal-small mammal interrelationships with emphasis on Oregon coniferous forests. Ecology 59: 799-809.

Mayer, K.E. and W.F. Laudenslayer, Jr., Editors. 1988. A Guide to Wildlife Habitats of California. U.S. Forest Service (Pacific Southwest Forest and Range Experiment Station), California Department of Fish and Game, Pacific Gas and Electric Company, U.S. Forest Service (Region 5). 5 vols.

Mills, Terry J. 1990. Cooperative Investigations on the Klamath River Main Stem. U.S. Fish and Wildlife Service. Arcata, California.

Noble, I.R., R. Slatyer 1977; Post-Fire Succession of Plants in Mediterranean Ecosystems. In: Environmental Consequences of Fire and Fuel Mgmt. in Mediterranean Ecosystems: Proceedings of the Symposium; Aug 1977, Palo Alto, CA. General Technical Report. WO-3. Washington DC USDA, US Forest Service; 1977:27-36

Paton, P.W.C., and C.J. Ralph. 1988. Geographic Distribution of the Marbled Murrelet in California at Inland Sites During the 1988 Breeding Season. Report to the Nongame Bird and Mammal Section, California Department of Fish and Game, Sacramento, California, Job II.B.2. 35 pp.

Paton, P.W.C., and C.J. Ralph, and R.A. Erickson. 1992. Use of Inland Sites in Northwestern California by Marbled Murrelets. PP. 109-116 in Carter, H.R. and M.L. Morrison (eds). Status and Conservation of the Marbled Murrelet in North America. Proceedings of the Western Foundation of Vertebrate Soology 5(1).et.

Patton, D.R. 1992. Wildlife Habitat Relationships in Forested Ecosystems. Timber Press. Portland, Oregon. 392 pp.

Sachs, D. and Sollins, P., 1986, Potential Effects of Management Practices on Long-Term Productivity of Western Hemlock Stands. Forest Ecology Management 17:25-36.

Schoonmaker, P. and A. McKee 1989; Species Composition and Diversity During Secondary Succession of Coniferous Forests in the Western Cascade Mountains of Oregon. Forest Science 34(4):960-979

Serena, M. 1982. The status and distribution for the Willow Flycatcher. Region 1, USFWS, Portland, Oregon.

Skinner, N.C. Changes in Spatial Characteristics of Forest Openings in the Klamath Mountains of Northwestern California. Landscape Ecology. 1995.

________.; A. Taylor. Personal communication

Snyder, J.O. 1931. Salmon of the Klamath River California. Fish BUlleting No. 34. Division of Fish and Game of California. 129 pp.

Sollins, P. S., Cline, T., Verhoeven, D., Sachs, D. and Spycher, G., 1987, Patterns of log decay in old-growth Douglas-fir forests. Candian Journal of Forest Research.

Spies, T. and J.F. Franklin. 1990. The Structure of Natural Young, Mature, and Old-growth Forests in Washington and Oregon. PP 91-109. Wildlife and Vegetation of Unmanaged Douglas-fir Forests. USDA Forest Service. Gen. Tech. Rep.

Steele, R. 1984; An Approach to Classifying Seral Vegetation Within Habitat Types. Northwest Science, Vol.58, No. 1, p. 29-39

Storer, T.M. 1930. Notes on the range and the life history of the Pacific fresh-water turtle, *Clemmys marmorata*. University of California Publication, Zool. 32:429-441.

Swanson, F.J.; J.F. Franklin; J.R. Sedell. 1992. Landscape Patterns, Disturbance and Management in the Pacific Northwest, USA. In: Changing Landscapes: An Ecological Perspective. Zonneveld, I.S. and R.T.T. Forman, Editors.

Swetnam, T.W. 1993. Fire History and Climate Change in Giant Sequoia Groves. Science Vol. 262 11-5-93

Theodoratus. 1978. The Cultural Resources of the Chimney Rock Section. Gasquest-Orleans Road, Six Rivers National Forest.

Thomas, J.W.; E. Forsman; J. Lint; E. Meslow; B. Noon; and J. Verner. 1990. A Conservation Strategy for the Northern Spotted Owl, Interagency Scientific Committee. Portland, Oregon.

USDA Forest Service. 1994. Klamath National Forest Land and Resource Management Plan.

USDA Forest Service and USDI Bureau of Land Management. 1994. Final Supplemental Environmental Impace Statement on Management of HAbitat for Late Successional and Old-growth Forest Related Species Within the Range of the Northern Spotted Owl.

USDA, USDI. February 1994. Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl.

USDA, USDI. 1994 FY 1994-96 Watershed Analysis Guidelines.

USDA, USDI. April 1994. Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl: Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl.

USDI, Fish and Wildlife Service. 1992. Critical Habitat for the northern spotted owl. Federal Register Volume 51, No. 10. PP 179-1838.

Whitfield, M.J. 1990. Willow Flycatcher reproductive response to brown-headed cowbird parasitism. Master's Thesis, California State University, Chico.

Whittaker, R.H. 1960. Vegetation of the Siskiyou Mountains, Oregon and California. Ecological Monographs, Vol. 29, 1960.

Wills, R.D. and J.D. Sturat. 1994. Fire History and Stand Development of Douglas-fir/Hardwood Forests in Northern California. Northwest Science, Vol. 68, No. 3, 1994.

Wyle and Heffner. 1976. A Synopsis of Supernatural Indian Properties in and Adjacent to the Eightmile-Blue Creek Planning Unit. USDA Forest Srevice,Gasquet-Orleans Road, Six Rivers National Forest.

GLOSSARY

A

Alluvial Terrane - It is found in the active, unconsolidated stream sediment in storage along broader, lower-gradient stream reaches. It is composed of silt to boulder size particles; anadromous fish spawning habitat is associated with this terrane.

C

Coarse woody material (CWM) - pieces of wood at least two feet in diameter and 50 feet in length, which enhance pool formation, increase cover complexity, and improve over winter survival.

D

Debris Flow - A relatively fast moving (feet per second) slurry-like flow of soil, rock and vegetative material most frequently in a first to third order stream channel. Also known as a mudflow.

Dispersed Recreation - Outdoor recreation in which visitors are diffused over relatively large areas. Where facilities or developments are provided, they are more for access and protection of the environment than for the comfort or convenience of the people.

E

Early Seral - This habitat generally includes the grass/forb, shrub/seedling, and pole stages as described in the Vegetation section. It often develops after a disturbance and may never reach late seral conditions, if disturbance is frequent, such as fire.

Ecosystem - The complete natural system formed by the interaction of a group or organisms and their environment.

Embeddedness - an ocular measure of fine sediment surrounding larger particles (boulders, rubble, or gravel) in riffle habitat. This embeddedness caused by fine sediment can impact fish populations by reducing the number of aquatic invertebrates.

Erosion - A general term for movement of soil particles on the surface of the land initiated by rainfall and running water. This includes surface erosion and channel erosion, as opposed to landsliding.

Escapement - Portion of an anadromous fish population that escapes the commercial and recreational fisheries and reaches the freshwater spawning grounds.

F

Fire Extent - Fire extent refers to the spatial pattern of fire effects on vegetation over the landscape. It includes the overall size of individual fires, and the size and distribution of canopy openings caused by subsequent fires following a stand replacement event. The scale of landscape dynamics influences the structure, species composition, size and distribution of patches over the landscape.

Fire Intensity - The intensity of a fire usually determines the amount of vegetation consumed or killed. The main factors in fire intensity are fuel accumulation, topography, and climatic factors including fuel moisture. The fuel that contributes to variation in fire intensities can be accumulated as a result of earlier fires or from any of several vegetation interactions, including insects, diseases, windstorms or actions of wildlife on the vegetation. Fuel accumulations are the most dynamic of the elements involved in fire intensity, as climate is often approximately the same within the landscape at any given point in time, and the topography is fixed.

Fire Regime - The kind of fire (frequency and intensity) that characterizes a specific region.

Fire Severity - Fire severity is the effect of fire on the ecosystem and how quickly it recovers to a predisturbance condition. Severity is largely dependent on the quantity, type and distribution of available fuels and the rate at which it burns. There is a tendency for fire severity to be inversely related to fire frequency in forested ecosystems. For example, low severity surface fires tend to occur in forests where frequent fires maintain fuels at low levels (Ponderosa Pine). High severity crown fires tend to occur in forests where large amounts of fuels accumulate between infrequent fires (True fir types).

Fish-Bearing Streams - Any stream containing any species of fish for any period of time.

Fuels - Fuels are the organic materials that accumulate on a site through the growth and death of plants. Fuels also include the live vegetation that could burn under the right fire weather conditions. Fuel loading is of interest to the fire manager because it is the only aspect of the fire regime that can be managed. Neither the climate, topography nor probability of natural ignition can be changed, but the amount, size and distribution of fuels can be managed, thereby reducing fire severity.

> Fire suppression has lengthened the interval between fire events in the Elk Creek watershed. This has changed the amount of fuels available to burn and increased potential fire severity. The 1987 fires burned a substantial portion of the watershed, but large areas have not burned in more than 50 years. It is not likely that these areas would burn with an historic pattern after missing several fire cycles. The areas that burned in 1987 still have relatively low fuel loadings. However, many areas have the potential for rapid increases in larger fuels. This is due to the wildfires killing a large amount of the understory vegetation that had established without prior frequent fires. These areas would also soon have unnaturally high fuel loadings and potential for more severe fires.

G

Glacial Terrane - The high elevation sites of alpine glaciers. Includes various erosional landforms and unconsolidated, weathered deposits of glacial erosion (moraines). This terrane occurs in the glacially carved valleys of north aspect and high elevation in the Siskiyou Maintains. Small lakes (tarns), alpine meadows and bogs are found in the bottoms of these valleys.

Granitic Terrane - It consists of oceanic, mafic (gabbro) and continental, silicic (granodiorite, diorite) granitic rocks. Soils are thin to thick. Slope gradients range from 45% to 85% and average about 60%. Thick, soft, cohesive and loose, granular residual soils occur in belts that are genetically related to the deep, red soils of Old Landslide terrane.

H

Historic Range of Variability - This phrase is an attempt to explain the kinds, amounts and speed of the changes that tended to occur in the forest prior to European settlement. It is a useful tool for understanding ecosystem function and processes, which is essential to predicting the behavior of altered as well as natural ecosystems (Sampson, et. al.)

Home Range - Home range is the area, usually around a home site, over which an animal normally travels in search of food, a mate and to care for young.

I

Inner Gorge Slopes - Slopes greater than 65% which occur along rivers and streams.

Intermittent Stream - A stream which normally flows two or three seasons, with flow disappearing or going subsurface during drier season(s).

Inversion - A layer in the atmosphere where the temperature increases with altitude.

L

Large Home Range - A large home range is larger than 100 acres in size. Many birds and mammals have large home ranges.

Late Seral - This habitat includes early and late mature and old-growth forest. Early mature forest was included in this habitat to be consistent with the definitions of late seral habitat in the ROD (1994).

M

Metamorphic Terrane - It consists of metamorphosed sedimentary (one third) and volcanic (two thirds) bedrock with thin (less than 3 feet) cohesive and granular soils. Slope gradients range from 60% to 85% and average about 70%.

Migratory - This includes those species that change locality seasonally for feeding or breeding. Except for elk moving up in elevation during the warm summer months most of the migratory species in this area are birds.

O

Old Growth - A forest stand with moderate to high canopy closure. Canopy to be multilayered and multispecies, dominated by large overstory trees. Stand has high incidence of large trees with broken tops and other indications of decadence. Numerous snags and heavy accumulations of logs and other woody material on the ground are also characteristics of old growth.

Old Landslide Terrane - This terrane is composed of very thick (greater than 10 feet to as much as a few hundred feet), typically fine-grained, cohesive soils. Blocks of rock in these soils are composed of mafic, ultramafic igneous rocks and, less commonly, metasedimentary and granitic rocks. Slope gradients range from 5% to 85% and average about 45%.

P

Pool - a fish habitat type which is characterized by low velocity flow. Pools must be deep enough to provide overhead cover from predators and have reduced velocities for improved food accessibility. Primary pools must be at least 3 feet deep. Spawning gravels are generally associated with the tailouts of pools. Pools are critical holding and rearing habitat.

Prescribed Fire - A fire burning within prescription resulting from management ignited or natural ignition.

R

Redd - a nest where the female fish deposits her eggs and the male fertilizes them.

Riffles - a fish habitat type which is characterized by shallow reaches of swiftly flowing turbulent water with some partially exposed stream bottom which obstructs flow. Aquatic invertebrates, which are the basic food for all fish populations, reside in riffles.

Riparian - This habitat is adjacent to and influenced by streams and wet areas. In the Dillon Creek watershed, riparian vegetation changes subtly from the streamside areas to upper slopes; the changes occurring in the understory, shrub, and ground cover vegetation. Overstory conifer and hardwood species largely remain the same from the upper slopes to the stream banks. Mapping this habitat using aerial photographs is difficult without extensive field verification. Although riparian habitat would be a subset of the Interim Riparian Reserves (see the Fish and Water Quality section), those Reserves will be used in this document to loosely describe the distribution of riparian habitat within the watershed. Interim Riparian Reserves cover approximately 15,454 acres of the watershed or 33% of the watershed. More detailed description of the riparian conditions can be found in the *Aquatic System* section (Chapter 3).

Run - a fish habitat type which is characterized by moderately shallow water with no major flow obstructions and little surface agitation. Aquatic invertebrates also reside in runs.

S

Salmonid - Member of the fish family Salmonidae; includes salmon and trout.

Self-pruning - The loss of vigor and natural shed of lower branches from the bole of a tree. This occurs particularly on shade intolerant trees growing at close spacing.

Seasonality - The time of year (seasonality) of fire events also influences ecosystem response and recovery. Each organism or community has a unique combination of responses to changes in weather, day length, fire intensity and fire duration. Consequently fire produces different biological effects as the nutrient storage status, phenology, and live fuel moisture content of plants change.

Sedimentation - The deposition of material along a stream channel.

Seral Stage - A description of the age and development of forest communities and the physical canopy characteristics present during various stages of succession. It focuses on the size of the larger vegetation and the development along a continuum that goes from grases and forbs to old growth conditions.

Serotinous - Trees that produce cones late in the season that remain on the tree without opening for one or more years. In most cases cone opening is initiated by fire.

Site Class - A measurement of the site quality which considers: soil depth, texture and profile characteristics, mineral composition, slope aspect, microclimate, and species.

Small Home Range - A small home range is less than 100 acres in size. Amphibians and reptiles usually have small home ranges.

Succession - Change in the composition of an ecosystem as the available competing organisms, especially plants, respond to and modify the environment.

T

Temperature Inversion - A reversal of normal atmospheric temperature gradient; increase of temperature of the air with increasing altitude; stable air conditions during the evening and morning hours.

Turbidity - The optical property of water as affected by suspension of material such as sediment, i.e., the muddy or cloudy state of water as measured in standard turbidity units based on light transmission through the water column.

U

Ultramafic Terrane - The bedrock of this terrane consists of peridotite and serpentinite. Serpentinite is locally intensely fractured. Slumps occur in the deep, cohesive soils that form as a result of the greater susceptibility of these rocks to chemical weathering of the bedrock.