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Upper South Fork of the Salmon River Ecosystem Analysis

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UPPER SOUTH FORK OF SALMON RIVER

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Executive Summary

INTRODUCTION

The purpose of the Watershed Analysis process is to provide a means by which the watershed can be understood as an ecological system. The intent is to develop and document a scientifically based understanding of the processes and interactions occurring in a watershed. This document focuses on specific values and uses within the Upper South Fork Salmon River watershed.

The Upper South Fork Salmon River Watershed occupies approximately 119,000 acres (188 mi.^{2}) in the Klamath Mountains Section. The watershed contains the headwaters of the South Fork Salmon River, a tributary to the Salmon River. The landscape can be described as rugged and mountainous with elevations ranging from 2,300-8,900 feet. The majority of the land is within the Klamath National Forest. Approximately 2,200 acres are privately owned. This document looks at the human uses/values, physical, and biological elements of the Upper South Fork Salmon River Watershed.

HUMAN USES/VALUES

Human uses in this watershed include: mining era settlements, mining, grazing, timber harvest, and the development of roads and trails.

Gold was discovered in 1850 near Forks of Salmon and soon after the towns of Cecilville, Summerville, and Petersburg sprang up. Timber harvesting occurred within the area to provide lumber for buildings, flumes, sluicing devices, and a heat source for the numerous dwellings.

Historic mining activities substantially altered the landscape. Historic operations consisted of placer and large scale hydraulic mining. The hydraulic mining began along the South Fork Salmon River in the early 1880s and totaled approximately 500 acres; the majority occurring between Rush Creek and Gibson Gulch. Estimates indicate about 15.8 million cubic yards of sediment were discharged into Salmon River (North Fork, South Fork, Mainstem) between 1870 and 1950 as a result of gold mining activities; primarily hydraulic mining. This amount of sediment probably exceeds the sum of natural sediment delivered from 1944-1993 (de la Fuente and Haessig 1992). Hydraulic mining significantly altered the main river channels and changed the vegetation in the channel area. This influenced the way in which the river responded to the floods of the 1960s and 1970s. The affects of these activities persist today.

Since 1950, commercial timber harvest influenced the character of the landscape. Timber harvest during the mid-1950s was mainly fire salvage and road right-of-way. During the 1960s the period of green timber sales began. Timber harvest throughout the 1970s and 1980s was accomplished using several methods; clearcutting was the dominant harvest prescription. By 1975, extensive harvest occurred in Ray's Gulch, China Creek, Blindhorse Creek, St. Claire Creek, Crawford Creek, Taylor Creek, Shadow Creek, and Trail Creek drainages. By 1994 additional harvest occurred in Cecil Creek, Ray's Gulch, Specimen Gulch, Crawford Creek, Shadow Creek, Sixmile Creek, and Taylor Creek drainages.

Twenty-one percent (5,000 acres) of the Riparian Reserve area has been affected by humans. The greatest single activity, timber harvest, has occurred over 3,600 acres. Timber harvest of recent vintage, however, rarely extended into the riparian zone. Two other activities, roading and hydraulic mining, have also altered the riparian area over the long-term.

All, or portions of four grazing allotments are present within the watershed: Big Flat Allotment (100%), South Russian Allotment (40%), Garden Gulch Allotment (100%), and Carter Meadows Allotment (70%).

By 1944, one percent of the watershed had been disturbed by hydraulic mines, roads, fire, or harvest. By 1988, nine percent of the watershed had been disturbed (includes South Fork and Sixmile fires of 1955). The potential for high intensity wildfire in the future is highest in upper Taylor, Craw-

ford, and Shadow Creeks. When fires occur, accelerated surface erosion will be the greatest at Taylor Creek. The potential for accelerated slump and earthflow activity will be greatest in upper Crawford and Shadow Creek watersheds.

There are nine water transmissions under special-use permits. Water is transmitted for private use by both pipe and ditch. There are approximately ten miles of ditch within the watershed. The following creeks are used for water sources: Cecil Creek, Crawford Creek, Ketchum Gulch, Rush Creek, Taylor Creek, Long Gulch, Henry's Gulch, and East Fork Salmon River.

The water diversions are generally small and have little affect on streamflows. The Rush Creek diversion, however, diverts a significant portion of the flow from the stream during low flows; it is not known if this affects downstream needs.

Trailhead use surveys indicate that approximately 75% of the total Trinity Alps Wilderness use (within the Forest) originates at trailheads in the Upper South Fork area. Roughly 80% of the stock use originates at five trailheads, with Harry Hull and Carter Meadows trailheads receiving highest levels of use. Approximately 50% of the hiker use originates in the Upper South Fork area with 23% of that use originating at Big Flat.

Developed recreational use of the area includes four campgrounds (East Fork, Shadow Creek, Trail Creek, and Big Flat). The latter two receives the most use in the watershed. Carter Meadows Horse Camp site also receives high use. Dispersed recreational use of the area includes hunting, fishing, swimming, photography, tubing, and snowplay.

Water quality of wilderness lakes within the watershed is a concern. Because soils are shallow, there are limited areas to bury fecal waste. High levels of coliform bacteria have been detected in the Caribou Lakes area.

Current use of the watershed by Native Americans is not well known. There are no known spiritual sites within the watershed, however, historical cultural sites are located near the river corridor. Known plant species of special interest are those used as basketry materials including, but not limited to, deerbrush, California hazel, beargrass, and various willow, fern, and iris species. Acorn bearing white oaks are of particular significance in this area. A diversity of species and habitat conditions were, and continue to be, important to the local Native American way of life.

PHYSICAL ENVIRONMENT

The physical environment is composed of several rock and geomorphic terrane types. Only a few, however, make up the majority of the watershed and how it reacts to and affects different processes.

Mica and horneblende schists occupy 53% (63,000 acres (ac)) of the analysis area; found primarily in Sixmile, Shadow, and Crawford Creek drainages. Most landslide deposits are found within this rock type. Granitic rock makes up 25% (30,000 ac) of the watershed. The largest bodies are found in the Taylor Creek, Caribou Lake, and China Creek areas. Meta sediments occupy about ten percent (11,500 ac) of the watershed.

The Mountain Slope terrane occupies 70% (83,500 ac) of the watershed. Debris sliding of shallow colluvial deposits is the most common landslide process, however debris slides on steep slopes (>65%) in weathered areas, and where vegetation or soil has been disturbed, is also common. Some of the largest recent landslides have occurred in this terrane. The Inner Gorge geomorphic terrane occupies 15% (18,000 ac) of the watershed. A dense network of inner gorges is apparent at elevations between 2,200 feet and 4,000 feet (ft) and is particularly noticeable in Blindhorse Creek watershed. Inner gorge density is very low above 4,000 ft. Glacial and Stream Terrace deposits occupy nine percent (11,000 ac) of the watershed.

There are 500 miles of streams within the watershed; 290 miles intermittent and 210 miles perennial. Eighty-nine miles of the perennial streams are fish bearing and 121 miles are non-fish bearing. Several high mountain lakes are within the watershed.

Approximately 90% of the watershed's precipitation occurs from October through May. Summer thunderstorms are not frequent but can be locally intense. The distribution of precipitation over time strongly influences landslide and surface erosion processes. The average annual precipitation varies from 45 inches to 55 inches (Baldwin and de la Fuente 1986).

Landsliding is the largest scale erosion process in the Salmon River watershed and is the primary mechanism for delivery of gravel, boulders, and logs to the river system.

Certain geomorphic terranes in the Upper South Fork have produced a large proportion of the landslide derived sediment which entered the stream system this century. The inner gorge yielded landslide derived sediment at a higher rate than any other terrane. Debris slides in landslide and glacial deposit terrane are important in French and St. Claire Creeks where such terranes produced many landslides in 1965 and 1975. New debris landslides have developed in the 1987 fire area of St. Claire Creek. Most of the landslide derived sediment originated on undisturbed lands from 1944-1988.

Various disturbance types have affected landslide production rate. Roaded lands in Upper South Fork produced more landslides than undisturbed lands from 1964-1975, harvested land produced less landslide sediment per acre than undisturbed lands.

Roads occupy approximately 1,095 acres in the watershed. One hundred seventy-eight acres were built after 1975 and have not experienced a landslide producing climatic event.

Road culverts sizing and the road fill over the culverts are potential sediment sources in the Upper South Fork. Of the 57 culverts, 11 were adequately sized to pass a calculated 100 year flood, ten were adequate to pass a 25 year event, and seven can pass a ten year event. The remaining 14 were designed for less than a ten year flood event. Of particular concern are the 39N23 and 39N56 roads which each have three undersized culverts. Several fill failures have occurred on road 37N07 in the Ray's Gulch area.

If climatic patterns of the last 100 years continue, episodic and chronic sedimentation will increase slightly in magnitude and frequency, primarily as a result of the destabilizing effects of existing roads. Severe climatic events, such as those associated with the 1964 flood, may cause severe disturbance to the East Fork, South Fork, and primary tributaries. Low order tributaries in recently burned watersheds, and watersheds with the highest road densities are most likely to experience channel disturbances.

The largest flood of record for the Salmon River occurred in 1964. The 1955 flood was second largest, followed by the 1971 and 1974 floods. Historic accounts describe floods in 1861-1862, and 1889-1890 (McGlashar and Briggs 1939). Landsliding associated with floods from 1964-1975 account for 58% (510,000 yd^3) of the total landslide volume estimated over the past 80 years (de la Fuente and Haessig 1993). The floods of 1955 and 1964 caused extensive main channel scouring. The 1964 flood impacts dwarf those of any other in this century. A total of 97 miles have been scoured (17% of the total riparian length). Some reaches have been scoured multiple times since 1944. Concentrations of disturbed channels can be seen in St. Claire Creek, the headwaters of the South Fork Salmon, and Little South Fork. The majority of disturbed channels are natural features related to natural sensitivity and local runoff patterns. Main channels are still in a state of vegetative recovery.

BIOLOGICAL ENVIRONMENT

The predominant vegetation in the watershed is structurally diverse and compositionally variable, is classified as coniferous "matrix", and covers 53% (63,200 ac) of the watershed. True fir stands compose ten percent of the matrix and begin around 5,000 feet in elevation. Mixed conifer stands compose 74% of the matrix and occur generally below 5,000 feet. Largely as a result of fire suppression, these stands tend to be dense and multi-layered. Plantations younger than 20 years occupy one percent (1,400 ac) of the watershed where plantations older than 20 years occupy two percent (2,200 ac). Non-commercial forest occupies six percent (7,100 ac) of the watershed.

A review of the 1935 Eddy Gulch Lookout photos and 1944 aerial photos compared with recent photos of the same areas, indicates general vegetation patterns have not differed substantially over the past several decades. However, there has been a change in composition and density.

Within the Upper South Fork Watershed there has been an increase in the amount of shade tolerant species (white fir) and a decrease in shade intolerant species (pines). The density of vegetation has also increased dramatically over the past several decades. These two situations have set up a scenario that will create fires of high intensity and large size.

As a result of the above conditions and drought, disease and insects are a concern. Common disease/insect complexes in the Upper South Fork are dwarf mistletoe/ bark beetle, and root disease/ bark beetle. Blister rust is widespread where both susceptible hosts (sugar and western white pines) occur. Dwarf mistletoe is widely distributed across the watershed. The fir engraver beetle has caused significant mortality in Taylor and Sixmile Creek areas.

There are three primary vegetative conditions within the watershed that are currently affected by a high degree of insect infestation. The transition zone between the mixed conifer and true fir forest types is subject to insect epidemics. Over the past several decades vegetation biomass in this zone increased dramatically. Vegetative biomass now exceeds site capabilities and the area is very susceptible to high levels of insect attack and mortality. This is especially true in the white and red fir that have invaded the mixed conifer forest type. Over the past several decades areas of low site capability have experienced increases in the amount of hardwood and brush concentrations. This increase in biomass has put the scattered overstory of Douglas-fir and ponderosa pine at risk to increased mortality from insect attack. The high elevation true fir stands are also experiencing high insect mortality. These three vegetative conditions serve as a catalyst for transferring insect and disease problems to adjacent watersheds. High levels of mortality will continue over the next several years. The Taylor Creek drainage, and portions of Shadow and Crawford Creek drainages are of particular concern.

Fire has shaped the vegetative composition of the Klamath National Forest for thousands of years. Fire is the dominant factor, after soil parent material, and precipitation events, that created stands and controlled stocking stand density. Fire frequencies averaging 20 years have been documented in the eastern Siskiyou Mountains (Atzet et al 1988).

The fire regime has changed considerably since European contact. As a result of an active fire suppression policy since 1910, and fire suppression prior to 1910 by white settlers/miners, the fuel condition and potential for large high intensity fire may be outside the historic range of variability.

Between 1946 and 1988, 421 fires were started in the watershed. Lightening strikes have been the primary source of identified fire starts (358). Human starts (63) make up the remainder.

Since 1950, three large fires have occurred within the watershed; South Fork Fire (1955) burned over 2,000 acres, Sixmile Fire (1955) burned 6,421 acres, and in 1987, the St. Claire Fire burned 7,166 acres.

There are two fuel related situations within the watershed that cause concern. Forest residue is currently accumulating 60% faster than it is decomposing, converting those areas currently rated as a Fuel Model 8 (very little understory vegetation and lighter amounts of dead fuel on the ground) to Fuel Model 10 (large amounts of dead and down material). Approximately 56,600 acres are classified as Fuel Model 8, and 40,300 acres are classified as Fuel Model 10. Fires in Fuel Model 10 are characterized as surface fires that have the potential to become crown fires. Approximately 40,600 acres in the Upper South Fork area are classified as a high fire hazard. The largest most contiguous areas of high hazard are located northeast of I Am Up Ridge, in the Taylor Creek and Garden Gulch drainages, and in the area north of the Cecilville Road from Grouse Point east to Sixmile Creek.

Future fires in the Upper South Fork watershed could be expected to resemble those experienced in 1977 and 1987. Total acreage burned per decade is projected to stay the same, or increase. The risk of large, stand replacing fires will continue until elements within the existing fire regime are made more consistent with historical range of variability. That consistency can only be achieved through large scale fuel reduction.

BIOLOGICAL

Terrestrial wildlife include those animals that utilize older seral stage vegetation as their principal habitat (furbearers, Northern spotted owl (NSO), and Northern goshawk), animals that utilize a wide variety of habitat for their requirements (blacktail deer, Roosevelt elk, peregrine falcon), and animals closely tied to the riparian zone (tailed frog and western pond turtle).

Approximately 52,000 acres of suitable nesting/ roosting/foraging NSO habitat occurs within the watershed. The owl territories are well linked by adequate dispersal habitat. Four of 22 quarter-

townships within the watershed do not provide 50% dispersal habitat. Two of the quarter-townships are within wilderness, natural conditions being the reason for reduced dispersal habitat. The remaining two are located in French and St. Claire Creeks (44%); Ray's Gulch and China Gulch (49%). The latter three drainages have been harvested in the past. Both quarter-townships are close to providing 50% dispersal habitat, however it is believed that dispersal in these areas may not be as much of an issue as the percentages may indicate.

There are two Late Successional Reserves (LSRs) wholly or partially within the watershed. One occupies the Taylor Creek watershed, and the small drainages entering the Carter Meadows area; Fish Creek; and Trail and Long Gulches (Taylor Creek LSR). The other LSR occupies the drainages flowing south into the South Fork and East Fork South Fork including Sixmile, Shadow, and Crawford Creek drainages (Sixmile Creek LSR). There are approximately 30,700 acres of LSR in the watershed. Roughly 14,500 acres are currently considered to be suitable habitat for spotted owls and other late seral forest associated species.

Disease, insects, and drought are interrelated factors that affect the quantity and quality of habitat, especially older seral stages. In South Taylor Creek drainage, large groups (five to ten acres each) of even-sized white fir are dying. creating holes in the habitat blocks. A tremendous fire hazard is being created, however these areas are providing excellent foraging habitat. As this loss of habitat continues, it threatens the viability of the LSR. If fuel treatments are prescribed, they need to be balanced with other LSR objectives.

There have been numerous sightings of fishers and five sightings of marten within the watershed. Both travel through the watershed very readily. Drainages which may have significant dispersal barriers include: Cecil Creek, portions of Little South Fork, lower sections of Rush and Big Bend Creeks, lower Crawford Creek, and portions of China Creek. Except China Creek, all situations are a result of natural circumstances; China Creek was clearcut in the 1980s.

A resident and migratory deer herd utilize the watershed. Overall population is assumed to be large. Fifty elk were re-introduced into the watershed in the early 1990s. The elk are found primarily in this watershed and are affecting the riparian zones in certain areas (Ray's Gulch). Ground cover is removed through trampling and grazing from the elk spending lengthy periods of time in riparian areas.

Good quality thermal and hiding cover for deer and elk is found throughout the watershed. Optimal cover is in short supply. Much of the foraging habitat for deer and elk is in moderate to poor condition because natural brushfields are in poor condition; primarily comprised of even-sized, decadent plants providing low amounts of forage, and having poor nutrition and palatability. Hardwood regeneration and young stands are not evident in the watershed.

Northern goshawk is a year-round resident of the watershed, however stands which are well suited for goshawk nesting are generally scarce. There are six interim goshawk management areas located in the Upper South Fork Watershed. Three occur within the matrix (as defined in the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the NSO) and the others are located within the LSRs.

The peregrine falcon utilizes the South Fork Salmon and East Fork South Fork. Two eyries are known to exist within the Upper South Fork Watershed.

Tailed frogs have been found in Taylor Creek, South Taylor Creek, and Trail Gulch.

Designated USDA-Forest Service "sensitive" fish species in the Upper South Fork Salmon River include spring chinook salmon and summer steelhead trout. Two species have been petitioned for listing under the Endangered Species Act, coho salmon and steelhead trout.

The South Fork Salmon River is an important refugium for the last remaining wild-run spring chinook salmon in the Klamath River Basin. During low flow years, a partial barrier exits near Matthews Creek. This barrier segregates the spring run fish above from the mix of fall and spring fish downstream. The Upper South Fork Salmon River is the last stronghold for spring chinook within the Salmon River system, providing important holding and spawning habitat.

Habitat parameters currently below regional optimum condition include: shade, embeddedness, coarse woody material recruitment and population, water temperature, and primary pools per 300 meters. There is a significant lack of shade (<10%) along the mainstem, however the tributaries are in fair-good condition. Water temperature reached lethal levels during July 1994 resulting in adult spring chinook dying off as well as juvenile salmon and steelhead, and Pacific giant salamander. The tributaries have greater embeddedness values than the mainstem, with few exceptions. There are also few exceptions where primary pool frequency is met, however the majority of fish bearing stream miles are not at regional optimum levels for primary pools per 300 meters.

Shade will continue to be a limiting factor. Stream temperature may never be within the optimum range because of the amount of streamside bedrock, river aspect, and riparian vegetation site potential. The likelihood of reaching optimum stream shade is unknown.

Coarse woody material recruitment and population will continue to be restrictive until the riparian vegetation gets to a point it can start contributing to the river system.

DESIRED CONDITION/MANAGEMENT OPPORTUNITIES

Desired condition and management opportunities are displayed in Tables 24 through 29 in *Chapter 6* of this document. The tables are broken into six general groupings: Vegetation Health, Terrestrial Wildlife Species, Aquatic Ecosystem Health, Human Uses/Values, Additional Planning Needs, and Additional Information Needs.

Desired conditions are stated in general terms. Aquatic ecosystem health and terrestrial wildlife species desired conditions are mainly addressed through habitat needs. Much of the habitat needs are vegetative or land management/road related. Desired condition was then compared to the existing condition. This process identified where management opportunities can occur.

Many management opportunities identified involve reducing vegetative stocking densities, fuel loadings, reducing erosion from roads and landslides, improving riparian vegetation conditions, improving hardwood stands, and improving/ enhancing recreational opportunities. Also included are additional planning needs such as RNA reports, Wild and Scenic River Plans, and a transportation plan. Research needs were identified as well. Examples of information gaps include habitat requirements for species of concern, linking upslope processes with the aquatic environment, determining site potential for various aquatic habitat parameters, and a cultural overview of the watershed.

The management opportunities are general in nature, the specific "how to" will be developed during the interdisciplinary National Environmental Policy Act (NEPA) process.

To provide a preliminary prioritization of work, an **"emphasis rating"** was developed. Less tangible factors such as management emphasis, partnerships, available funding, etc. will need to be considered during project planning. Criteria for rating the opportunities include:

1- Are there consequences, in terms of resource damage, of not doing an opportunity? Are there resources at risk if this opportunity does not occur?

2- Is the opportunity an immediate need? Does the opportunity provide a linkage towards achieving the desired condition? (How far will it get us toward the desired condition?)

3- Are there amenity or commodity resources that benefit from doing the opportunity?

4- Does the opportunity have implications for other resources outside of this watershed?

The implementation of these management opportunities should either maintain the desired condition or move the watershed toward the desired condition.

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UPPER SOUTH FORK *Of The Salmon River* ECOSYSTEM ANALYSIS

INTRODUCTION

The Upper South Fork of Salmon River occupies about 119,000 acres (188 square miles) in the south central portion of Siskiyou County, California (see Figures 1 and 2). It is part of the Klamath Mountains Physiographic Province, and forms the headwaters of the South Fork of the Salmon River, a tributary to the Klamath River. The watershed includes all of the area which drains to the South Fork Salmon River to the mouth of Plummer Creek. To the south and southeast the Upper South Fork boundary is the watershed divide with the Trinity River. To the northeast, the boundary is the watershed divide with the Scott River and to the north, the North Fork Salmon River. The west boundary is the watershed divide with Plummer Creek and other drainages which flow into the South Fork Salmon River downstream of Plummer Creek. The watershed is rugged and mountainous with elevations ranging from 2,300 feet at the mouth of Plummer Creek to 8,920 feet at Caesar Peak. Most of the streams in this watershed flow through narrow canyons with steep walls and inner gorges. Exceptions occur in the headwaters of the East Fork (Carter Meadow, Long Gulch, Trail Gulch) and the South Fork where valley bottoms are wide and gentle.

The approximate center of the watershed is located on the Upper South Fork of Salmon River near the Petersburg Guard Station; legal description T37N,R11W, Section 3 of the Mt. Diablo Meridian. The town of Cecilville is the current hub of the community and is located within the watershed, about 42 air miles from Yreka.

The majority of the land is within the Klamath National Forest (KNF) and is under National Forest administration. Approximately 2,196 acres are privately owned in small parcels scattered through the watershed. The Trinity Alps Wilderness encompasses 48,312 acres of the National Forest Land in the southern most portion of the watershed.

OVERVIEW OF WATERSHED ANALYSIS

The purpose of the watershed analysis process used on the Upper South Fork of Salmon River Watershed is to provide a means by which the watershed can be understood as an ecological system. In April, 1993, President Clinton commissioned an interagency scientific team to develop a set of alternatives for the management of forested lands within the range of the Northern spotted owl. The effort resulted in a report titled *Forest Ecosystem Management: An Ecological, Economic, and Social Assessment* by the Forest Ecosystem Management Assessment Team (FEMAT). A total of ten options were developed; all but one requires federal agencies to conduct Watershed Analysis on key watersheds before beginning any major ground or vegetation disturbing activities. The *Record of Decision* (ROD) of the *Final Supplement Environmental Impact Statement* (FSEIS) adopted Alternative 9. The ROD modified Alternative 9 and amplified it in an attachment to the ROD entitled *Standards and Guidelines for Management of Habitat for Late Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl.*

The intent of watershed analysis is to develop and document scientifically based understanding of the processes and interactions occurring in a watershed. This analysis focuses on specific issues, values, and uses within the watershed and is essential for making sound management decisions.

The Salmon River is a key watershed on the KNF. As a result of its size, it has been divided into five landscapes: Upper South Fork, Lower South Fork, Upper North Fork, Lower North Fork, and Mainstem Salmon. The Upper South Fork Salmon was determined to be the Forest's pilot watershed analysis project for 1994.

Currently there is a strong desire to manage federal lands as ecosystems. Watershed Analysis is a technically rigorous procedure with the purpose of developing and documenting understanding of the ecological structures, functions, processes, and interactions occurring within a watershed.

Some of these aspects include beneficial uses, vegetative patterns and distribution, flow phenomena such as vegetation corridors, streams, and riparian corridors, wind, fire, wildlife migration routes, dispersal habitat, terrestrial vertebra distribution, locally significant habitats, human use patterns throughout the ecosystem, cumulative effects, and hydrology. The number and detail of these aspects considered will depend upon the issues pertaining to a given watershed.

The results of Watershed Analysis will include a description of the resource needs, capabilities, opportunities, the range of natural variability, spatially explicit information that will facilitate environmental and cumulative effects analyses for NEPA, and the processes and functions operating within the watershed. Watershed analysis will identify potentially disjunct approaches and conflicting objectives within watersheds. The information from watershed analysis will be used in developing monitoring strategies and objectives. The participation of adjacent landowners, private citizens, interested groups, industry, various government agencies, and others in the watershed analyses will be promoted.

The strategies used will be in harmony with existing policies, direction, Draft Forest Plan Standards and Guidelines, and land allocations. This process is a means of implementing current direction.

Not only is the process a vehicle for implementation of Forest planning direction, it also is a means of ensuring the ecological health and sustainability of the resources within the Upper South Fork Salmon River Watershed. It links the National Forest Management Act (NFMA) and the National Environment Policy Act (NEPA); providing a method for defining the desired condition of the watershed and identifying opportunities to achieve and perpetuate the desired watershed character.

ORGANIZATION

There are six chapters in this analysis; not counting the Executive Summary and Introduction:

1- Physical Setting, Disturbances, and Range of Variability
2- Watershed Elements
3- Flows and Linkages
4- Processes, Interactions, and Trends
5- Management Direction and Desired Condition
6- Management Opportunities

The Introduction provides an overview of the watershed, the Watershed Analysis process, and a summary of the resource values in the area.

Chapter 1 provides the framework for defining ecosystem sustainability. This is done by **identifying natural disturbances** and **past patterns to characterize the range of variability.**

The second and third chapters are designed to describe the **existing condition** in terms of **composition**, **structure**, and **function**. The **watershed elements** are the physical, vegetative, and human features of the watershed. The **flows** describes the movement of people, organisms, nutrients, energy, and their **linkages** to other watersheds.

Chapter 4 provides an understanding of the watershed complexity by describing the **processes** and **interactions** which are important and relevant in the watershed. **Trends** then describe the existing conditions and their relationships with past and expected future conditions.

The **desired condition** is refined in *Chapter 5* by integrating the Draft LMP's goals and objectives, and existing **direction** with the unique features of the watershed, and the historical range of variability defined in the first chapter.

Chapter 6 describes **opportunities** necessary to move towards or maintain the desired condition, as well as resource uses that will not inhibit attainment of the desired condition. This step provides the purpose and need for implementation of individual projects designed to achieve desired condition. A crosswalk between this report and the Federal Guide is contained in Appendix A (Crosswalk Between Watershed Analysis Guide and This Analysis).

Klamath Basin Vicinity

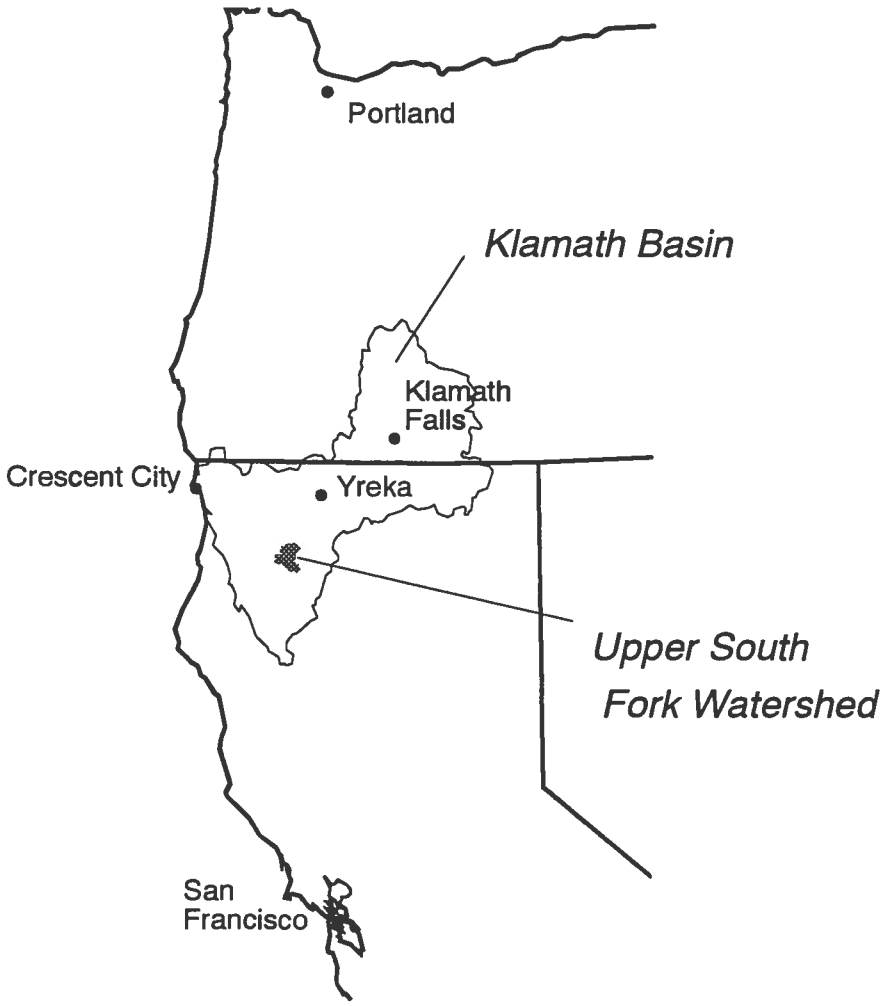


Figure 1

Upper South Fork Watershed

Klamath National Forest

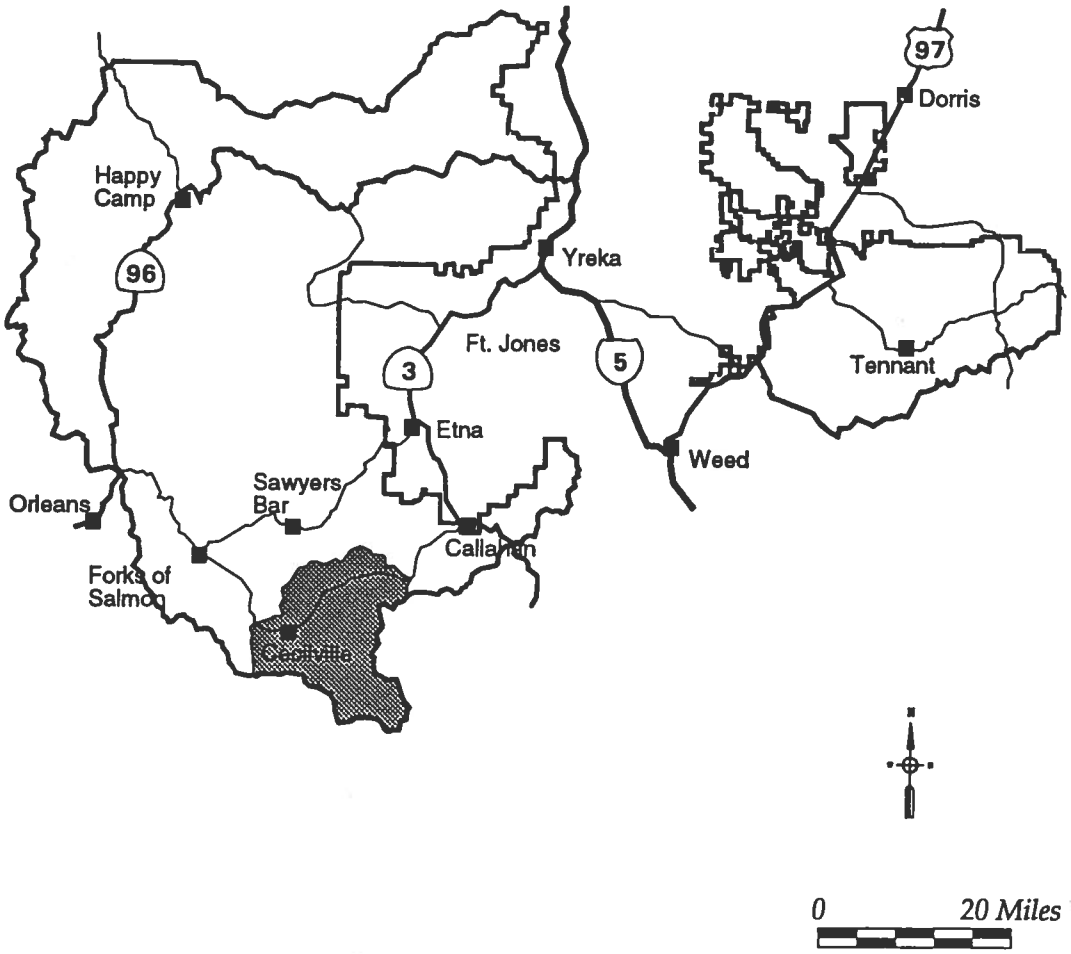


Figure 2

SCALE OF ANALYSIS

This general assessment of the watershed condition serves to define the purpose and need for proposed actions and identify ecosystem dynamics (composition, structure, and function) at a large scale. As more detailed analysis is necessary for NEPA sufficiency, the analyses will then focus on site specific issues and their potential effects.

For analysis purposes, the Upper South Fork watershed is divided into subwatersheds; ranging in size from 10,106 acres to 26,576 acres.

National Hierarchical Framework

The USDA Forest Service has proposed a national hierarchical framework of ecological units (USDA 1993) used to classify land based on combinations of physical and vegetative factors. Use of the national framework allows the Forest Service to maintain data consistency throughout the lands it manages across the United States. The boundaries are used to describe areas of similar geology, soils, vegetation, and fauna. The Upper South Fork watershed falls entirely within the Klamath Mountains Section of this hierarchy.

RESOURCE ISSUES AND KEY QUESTIONS

Resource values and issues important within the watershed (refer to Appendix B - Issues) are in two categories: ecosystem health, and socio-economic health. Issues were identified through interagency and public scoping. Key questions to be answered by the analyses focus on each issue.

Ecosystem Health

1. Physical Processes and Functions - Maintenance of a healthy ecosystem requires an understanding of the climatic, geologic, hydrologic, and fire processes under which it evolved, and maintenance of basic functions.

   Key Questions - What physical processes and interactions in Upper South Fork significantly influence ecosystem health? Which processes have been, or can be, modified by human activities to a point where they are outside their historic ranges? What opportunities are there to restore such processes back to their historic ranges?

2. Health of the Aquatic Ecosystem - Riparian and aquatic areas contain unique environments and communities of plants and animals essential to the health of the aquatic as well as the terrestrial ecosystem. In recognition of this fact, the President's Plan identifies Riparian Reserves as a basic element of the Aquatic conservation strategy. Spring chinook salmon, summer steelhead, and Western pond turtle, (all Forest Service sensitive species) and other aquatic animals depend on the Upper South Fork. Coho and winter and summer steelhead (petitioned for Federal Threatened and Endangered species protection) are found in the watershed.

   Key Question - What is the current health of the aquatic ecosystem in terms of its plant communities, and its ability to provide high quality habitat for aquatic animals? What processes or interactions threaten functional habitat viability? What management opportunities can be used to maintain or improve the aquatic ecosystem?

3. Health of the Terrestrial Ecosystem - The terrestrial ecosystem contains environments linked to the aquatic ecosystem. The ability of the forest to provide wildlife habitat, clean water, forest products, recreation opportunities, and other needs is an important value in the Upper South Fork watershed. The watershed provides habitat for the peregrine falcon <endangered>, the Northern spotted owl, <threatened>, and fisher, marten, and goshawk (all Forest Service sensitive species). The area also provides habitat for other many other species including Rooseveltelk.

   Key Question - What is the current condition of the terrestrial ecosystem in Upper South Fork? What is the current status of habitat for the endangered, threatened, and sensitive terrestrial species, as well as species of interest? What processes or interactions threaten the health of the terrestrial ecosystem or its functional habitat viability? What management opportunities would improve wildlife habitat or otherwise help maintain its health into the future?

Socio-Economic Health

1. Human Uses - The Upper South Fork area provides for a variety of human uses, including hiking, camping, and fishing, as well as other contemporary Native American uses. It also provides local employment and natural resources to the economy through logging, mining, livestock grazing and other forest related activities such as firewood and mush-

room gathering. Residents on private land within the watershed depend on the adjacent forest land for access, water, and other resources. The watershed contains special management areas such as wilderness, Wild and Scenic Rivers, Research Natural Areas, and Special Interest Areas. Scenery is of very high quality.

Key Question - What are the current desires and needs of people in the watershed? How can these be provided for while balancing human desires which conflict with each other, with the needs of the ecosystem, and within the bounds of laws, regulations, and management direction? What processes and interactions conflict with human uses of the watershed? What opportunities are there to mitigate conflicts?

Chapter 1 - Physical Setting, Disturbances, Range of Variability

This chapter discusses the geologic and climate history; important disturbance processes, and range of variability for some key processes and features of the watershed.

PHYSICAL SETTING - *Geologic History*

EVOLUTION OF THE WATERSHED

The watershed we view in the Upper South Fork of the Salmon River was shaped by geologic and climatic events which occurred over the past 570 million years during the Paleozoic (245-570 million years), Mesozoic (66-245 million years) and Cenozoic (0-66 million years) Eras. During the Paleozoic and Mesozoic Eras, the major rock units were formed and most were transported into their present locations. During the Cenozoic Era, the modern landforms were created. A brief outline of the geologic history and paleoclimate of the watershed follows.

The Paleozoic and Mesozoic Eras

During the Paleozoic and Mesozoic Eras, a series of ocean basins existed off the west coast of the North American Continent. A variety of sedimentary rocks (chert, sandstone, shale, and limestone) were deposited in these basins. Simultaneously, volcanic activity on the sea floor produced thick deposits of basaltic lava and tuff (volcanic ash) which were interbedded with the sediments.

The sediments and volcanic rocks which formed in the ocean basins were periodically subducted beneath the North American Continent. As the rocks were carried deep into the earth, they were subjected to heat and pressure. As a result, the rocks were metamorphosed, and in some cases they melted, forming large bodies of molten granitic rock or magma which rose up into the overlying rock. Further plate motions then forced the resulting metamorphic and granitic rock back toward the surface. Under certain conditions, peridotite from deep in the earth's mantle was also forced to the surface. Peridotite is a rock which is rich in iron and magnesium, and is often altered to serpentinite by metamorphism.

About 220 million years ago, a submarine volcanic sea mount formed in the area now occupied by French and St. Claire Creeks and a coral reef developed in the shallow water above it. Later, the sea mount subsided, and layers of fine siliceous sediment was deposited on top of the reef. These sediments were then converted to marble and chert.

Three distinct rock belts were formed in Upper South Fork (refer to Appendix C - Geologic Belts, Terranes, and Rock Units); the Eastern Klamath Belt, the Central Metamorphic Belt, and the Western Paleozoic and Triassic Belt, (Irwin 1960). These belts are in turn subdivided into geologic terranes, or fault-bounded units of rock with a similar history, age, and mineral assemblage (see Figure 3 - Geologic Rock Types Map located at the end of this chapter).

The **Eastern Klamath Belt** occupies a small area in the vicinity of Cecilville, and consists of metamorphosed sediments such as siltstone and chert, and partially serpentinized peridotite. The **Central Metamorphic Belt** occurs in the southern part of the Upper South Fork and consists primarily of mica and hornblende schist (amphibolite). The **Western Paleozoic and Triassic Belt** occupies more area than the other two belts, and occurs primarily in the northern and western portions of the watershed. It consists of metamorphosed volcanic rocks, chert, shale, and limestone. A large proportion of this belt is occupied by schist of the Stuart Fork Terrane. (Many geologists believe that the Stuart Fork Terrane is not part of the Western Paleozoic and Triassic Belt, but rather, a distinct belt unto itself).

The patterns of rock (see Figure 3) played an important role in topographic and landform development, soil formation, vegetation, and ecological processes in Upper South Fork.

Events of the Cenozoic Era

Throughout the Cenozoic Era (0 to 66 million years ago), terrestrial or continental conditions existed in the Klamath Mountains. Several periods of uplift and erosion occurred during the Cenozoic Era, (Aalto 1992) and the landscape had low relief and gently flowing streams. It is likely that during this time the Salmon and Klamath River systems developed their general patterns of westerly flow (Aalto 1992). Climatic conditions early in the Era (Paleocene and Eocene Epochs 40-65 million years ago) were warm and humid, allowing tropical rain forests to reach as far north as 50 degrees north latitude (Frakes and Syktus 1992). This combination of a gentle landscape and tropical conditions allowed deep weathering of bedrock to occur.

Events near the end of the Cenozoic Era, during the Pleistocene Epoch or "Ice Age" beginning about two million years ago, created modern landforms. During this time, there were several advances and retreats of the glaciers, and simultaneously, the area was uplifted several thousand feet (Hershey 1903). Glacially carved U-shaped valleys were formed in the headwaters of the South Fork, and portions of the East Fork such as the valleys of Long Gulch and Trail Gulch. Glaciers deposited thick layers of rock and soil (moraines) on valley walls and floors (see Figure 4 - Geomorphic Terranes Map contained in the map packet). As the landscape was rapidly uplifted, steep-walled canyons formed in the non-glaciated areas, and downstream of glaciated valleys, with remnants of old river terraces stranded on valley walls. Slumps and earthflows formed in the western part of the watershed (see Figure 4) occur primarily on schists of the Stuart Fork and Central Metamorphic Terranes (67%) and Metasediments of the North Fork Terrane (17%).

Most of the deep soils formed earlier in the Cenozoic Era were eroded away and young, granular soils developed on the steep mountain slopes.

Karst-forming processes were active in the limestone of French and St. Claire Creek watersheds before the onset of the Ice Age. Initially, groundwater percolating through the rock dissolved passages in the limestone. Then, during the rapid uplift which occurred during the Ice Age, French Creek and St. Claire Creeks cut deeply through the bedrock, draining the passageways. The rapid downcutting process also formed the prominent limestone bluffs near the mouth of French Creek, both north and south of the South Fork Salmon River. Fossils from Coffee Creek, a few miles south of the watershed reveal that mammoths inhabited the glacially carved valleys during the Pleistocene Epoch (Hershey 1903).

Following the Ice Age the climate grew dryer and warmer (Holocene Epoch), and new vegetative communities entered the area. Conifers and brush invaded the glacial valleys, and fire likely began to play a major role in the ecology. Plants and animals influenced the soil forming process, and retarded erosion of the soil on mountain slopes.

For purposes of this analysis, the watershed was subdivided into units of land with similar geomorphic history and landslide potential. These "geomorphic terranes" (see Figure 4) are described later in *Chapter 2 - Elements.*

CLIMATE: Historic and Present

The progression of climate at a scale of thousands of years is relevant to this assessment because landscape features that originated in response to past climatic conditions continue to influence present landscape behavior. Lacking local interpretation of paleoclimate, the work of others in nearby comparable regions is used. Adam and West (1983) and Adam (1988) have described the transition from the last glacial advance that occurred 10,000 to 15,000 years ago. Their interpretation of pollen stratigraphy at Clear Lake (Lake County, California) suggests that climatic warming and substantial drying occurred during the transition. Cool, wet periods of the transition and more recent wetter periods are believed to have contributed to the activity of presently dormant, large earthflow-slump landslides found in much of the Klamath Mountains (Baldwin and de la Fuente 1987).

In the Upper South Fork of the Salmon River, as well as in the remainder of the central Klamath Mountains, the coastal climatic influence is moderated by mountains to the west. Summers are warm and dry, winters are cool and wet. Summer high temperatures are about 90 degrees Fahrenheit, low temperatures are about 55 degrees. Winter high temperatures are about 40 to 55 degrees while raining, cooler under clear skies. The annual precipitation during the period of record (1904 to present) at Orleans, California (at the mouth of the Salmon River) ranges from 26 to 84 inches. The average annual precipitation is about 50 inches.

Approximately 90% of the precipitation occurs from October through May from north Pacific cyclonic storms. The remainder occurs during summer thunderstorms. Winter precipitation occurs mainly as snow above 4,000 feet elevation, and mainly as rain below that elevation. Fluctuation of the snow level occasionally results in rain falling on snow, causing rapid snow melt. Precipitation within the Upper South Fork Salmon River watershed varies from 60-70 inches at the uppermost headwaters to the South Fork, to 30-40 inches along the South Fork at French Creek. Intense, localized summer showers occur frequently, and have been associated with soil erosion and debris torrents.

FISHERIES: Historical Setting

At one time, the Klamath River contained large numbers of salmon. This is assumed true for the Salmon River as well since it is one of the largest tributaries to the Klamath River. Stocks/species of salmonids that existed at the time of cannery development in 1912 included the spring and fall run chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), and steelhead trout (*O. mykiss*). The spring run salmon migration used to be very pronounced prior to the canneries impact. The spring salmon could be caught in the smaller snow-fed tributaries in the Salmon River headwaters during the month of June (Snyder 1931). By the time Snyder had written his report in 1931, the Klamath River spring chinook population seemed to have almost entirely disappeared. During the period of placer mining, large numbers of salmon were speared or otherwise captured on or near their spawning beds. Snyder (1931) comments that if credence is given to the reports of old miners, this then appeared to be the first and perhaps major cause of early depletion.

Three fish canneries were located and operating at the mouth of the Klamath River in 1912. This portion of the river was heavily fished. No limits were designated. The stocks/species of salmonids that were commercially fished included both runs of chinook salmon and coho salmon. Coho or silver salmon occurred in large numbers within the Klamath River, however the extent of coho entering the Salmon River is unknown. Although no commercial fishing existed for steelhead trout, an incidental catch was taken since migration times coincided with the salmon.

Suggestions during the early 1930s to explain the decline of the spring run chinook included mining operations, over-fishing both in the river and sea, irrigation, and the building of Copco Dam. The dam did not affect those fish endemic to the Salmon River because of its location higher up in the Klamath River Basin. Snyder (1931) reported that the depletion of the Klamath River salmon (spring and fall chinook, and coho) was progressing at an alarming rate.

Little, if anything, is known about fish habitat conditions prior to the onset of mining operations in the Upper South Fork watershed. The habitat was in good enough condition to support the salmon and steelhead populations claimed to have existed by miners and R.D. Hume in Snyder's (1931) report. The extent of mining damage on riparian vegetation and stream channel is unknown, however can probably be considered extensive since the stream bottom was moved across the valley as the river terraces and stream bottom were mined for gold. The maximum water temperature measured in the South Fork Salmon River in 1934 was 78.5°F. During this time period the streams were lower than they had been during the previous decade (Taft and Shapovalov 1935) and hydraulic mining was still occurring on the Salmon River. At the time data were collected by Taft and Shapovalov (1935), mining pollution in the Salmon River was considered moderate, although at times it appeared "very bad".

Within the analysis area were several historical water diversions and dams which blocked fish migration (Taft and Shapovalov 1935, Handley and Coots 1953). Stream diversions and dams located downstream from the analysis area affected the distribution of fish within the Upper South Fork. An eleven foot high, permanent log dam, the Bennet-Smith Dam, was located approximately four to five miles above the Forks of Salmon. A fish ladder was constructed, however in 1934 it was in need of repair (Taft and Shapovalov 1935). The dam was described as a serious migration barrier to salmon and steelhead by California Department of Fish and Game because of its size, age, and the fish ladder finally built for it never worked properly (Handley and Coots 1953). Consequently, salmon and steelhead were blocked from the Upper South Fork Salmon River for approximately 50 years or more. The dam was destroyed by flood during the last week of October, 1950. The diversion associated with that dam had no screen. Taft and Shapovalov (1935) found diversions with no

screens caused a significant loss of juvenile salmon and steelhead.

Natural barriers to anadromous fish migration existed downstream from the analysis area, before 1984. Bloomer Falls, a result of a 1964 landslide, located on the mainstem Salmon River formed a partial migration barrier during low flow conditions and was modified by dynamite numerous times between 1965 - 1983. Two partial barriers on the South Fork Salmon River were also modified by explosives in 1984. The partial barriers were located at the falls at Methodist Roughs and the falls upstream from Matthews Creek, both downstream from the analysis area (Olson and Dix 1993).

Artificial propagation of fish began within the Klamath River Basin in 1896 on the Trinity River. Salmon eggs were brought in from a tributary of the Sacramento River, raised to fry and released in the Upper Klamath River. Salmon eggs from the Sacramento River were also taken in 1907, 1911, 1913, and later. A small hatchery established at the mouth of the Klamath River in the 1890s obtained eggs from the Rogue River near Grants Pass, Oregon. After Copco Dam was established, a hatchery was developed at Fall Creek (Snyder 1931). What effects these historic hatcheries and resulting fish had on the Salmon River fish is unknown. With the construction of Iron Gate Dam, a hatchery was built to mitigate the habitat blocked above the dam. Releases of Irongate hatchery adult and juvenile fish within the Upper South Fork analysis area are listed in Table 1 - Off Hatchery Distributions of Iron Gate Hatchery Produced Fish. In 1983 a small hatchery was established on the Upper South Fork, just below Petersburg, by the Pacific Coast Federation of Fisherman's Association. By 1986, the hatchery was no longer operating and was removed in 1991. Since 1991, no fish plants have occurred in the Salmon River because of increasing concern over genetic pollution of the wild fish (stocks) and competition for food and space between hatchery and wild stocks. It is assumed that the remaining coho salmon found in the Salmon River are of hatchery origin.

From Petersburg downstream, extensive instream habitat restoration activities by the USFS and the California Department of Fish and Game have occurred since 1982. Boulder structures (weirs, deflectors, and groups), complex log cover structures, and underwater log ledges have been constructed. Riparian vegetation restoration has occurred on many bars and terraces. All efforts have been met with a certain level of success.

Table 1 - Off-Hatchery Distributions of Iron Gate Hatchery Produced Fish (CDFG 1991)

Date of Release	Species	Age/ Size	Number	Release Site
12/15/75	Chinook	7/lb.	18,900	S.Fk. Siamon, 5 mi. upstream from Long Gl.
6/9-15/83	Chinook	114/lb.	56,000	S.Fk. Salmon
11/12/70	Coho	Surplus Adults	90	E.Fk. of S.Fk. Salmon
5/11/71	Steelhead	Finger-lings	166,425	S.Fk. Salmon
5/11/71	Steelhead	Finger-lings	79,750	E.Fk. of S.Fk. Salmon
Un-known	Steelhead	Surplus Adults	130	Salmon River (unknown location)
1/21/82	Steelhead	Surplus Adults	100	St. Claire Ck.

DISTURBANCE PROCESSES

Landscapes are constantly changing and disturbance processes are important agents of change. A disturbance can be defined as "any relatively discrete event in time that disrupts ecosystems, community, or population structure and changes resources, substrate availability, or the physical environment" (White and Picket 1985). Disturbances occur along a gradient, from minor to major; they can be natural, human induced, or both. The effects from disturbances can be short lived or long lasting. Some disturbances, such as fire, occur on a repeated basis and their regime can be characterized in terms of frequency, intensity, and effects to vegetative structure and patterns.

Fire, flooding, and associated landsliding were identified as playing an important role in shaping the present character of the watershed.

FIRE

Historical Fire Return Intervals

Fire has shaped the vegetative composition of the Klamath National Forest for thousands of years as evidenced by the mosaic of vegetation stand age and stand composition across the watershed. Fire is the dominant factor, after soil parent material and precipitation events, that created stands and controlled stocking and stand density. Prior to fire

suppression, forest stand development was strongly influenced by the frequency and severity of fire events (see Figure 5 - Historic Fires By Intensity Class located at the end of this chapter). Infrequent, high severity fires, resulted in the establishment of stands. Once stands became reestablished, lower severity fires maintained woody material and understories at low levels until portions of the stands began to deteriorate and more fuel was once again available for hot, stand reestablishing fires. (Perkins, personal communication).

Mean fire intervals vary in response to site and environmental factors that affect ignition source, fuel accumulation, fuel moisture, and burning conditions. Thus, dry sites burn more often than relatively wet sites. Fire frequencies averaging 20 years have been documented in the eastern Siskiyou Mountains (Atzet et al 1988). Agee (1991) has documented a similar fire return interval in the eastern Siskiyous for the period occurring between 1740 and 1860. A study of fire history and forest structure of red fir forests at Swain Mountain, Northeastern California, showed fire free intervals, stratified by historical periods, to vary from 7.9 years to to 21.4 years (Taylor 1993). In the Thompson Ridge area near Happy Camp, Skinner and Taylor estimated historic fire return intervals for the area at 15 to 25 years. A closer look at data collected from the eastern portion of Thompson Ridge resulted in a conservative estimate of 23 years for the average return interval (Skinner, personal communication). Wills (1991) documented mean fire return intervals of 12 to 17 years for the period of 1740 to 1987 in Douglas-fir/hardwood stands in the Hotelling Ridge area of the Salmon River.

Summary of Recorded Fire Events

Since 1950, three large fires have occurred within the watershed. The South Fork Fire of 1955 burned over 2,000 acres; that same year the Sixmile Fire consumed 6,421 acres and in 1987, the Saint Claire Fire involved 7,166 acres. From 1911-1988, about 15% of the Upper South Fork was involved in fire (including some areas of re-burn). This is considerably lower than the Salmon River watershed as a whole which experienced about 55% of the area burned during the same time period (de la Fuente and Haessig 1993). Fire exclusion may be resulting in a trend towards larger fires of higher severity. The role of fire in the watershed is discussed further in *Chapters 3* and *4*.

FLOODING AND LANDSLIDING

The distribution of precipitation over time strongly influences landslide and surface erosion processes. Precipitation records from Orleans, California, on the Klamath River approximately ten miles from Somes Bar, date back to 1904. Data on annual precipitation and cumulative departure from average annual precipitation show that during dry periods, the annual precipitation is about 45 inches; for wet periods, the average is 55 inches (Baldwin and de la Fuente 1986). The Orleans record, and other records from Northern California (Coghlan 1984), indicate that the period from 1870 to 1910 was a wet time; the period 1911 - 1937 dry; the period 1938-1975 wet; and 1976 to the present dry. Fritts and Gordon (1980) examined high quality precipitation records in California and interpreted tree rings to extend the precipitation record back 360 years. The period since 1890 has been one of precipitation surplus with respect to the long term average. A dry period extended from 1760 to 1820.

The only available precipitation records from within the watershed are from Cecilville, California, and cover the 1950s and 1970s.

Table 2 - Watershed Disturbances (1860-1994) displays the timing of important disturbance mechanisms in the Upper South Fork. Entries of "Yes", "No" and "Unknown (Unk)" indicate whether a given disturbance occurred within a given time interval. These temporal relationships may help identify cause-effect relationships. For example, the timing of vegetative disturbances (fire or harvest) relative to flood episodes has important implications when trying to determine if disturbances influenced landslide rates.

Table 2 - Watershed Disturbances (1860-1994)

DISTURBANCE TYPE	WET 1860-1910	DRY 1911-1937	WET 1938-1975	DRY 1976-1994
Floods	Yes	No	Yes	No
Summer Storms	Unk	Unk	Unk	Yes
Hydraulic Mining	Yes	Yes	No	No
Roads and Harvest	No	No	Yes	Yes
Fire	Unk	Unk	Yes	Yes
Landslide Episodes	Unk	No	Yes	No
Chronic Erosion	Unk	Unk	Yes	Yes

Streamflow information for the Salmon River near Somes Bar dates back to 1912. This information provides useful insight into the relative magnitude of peak flows which have occurred that apply to the watershed. The largest flood of record occurred in 1964 and had a peak discharge of about 100,000 cubic feet per second (cfs). The 1955 flood peak discharge was 64,000 cfs, the 1971 flood about 55,000 cfs, and the 1974 flood about 54,000 cfs. Peaks in excess of 40,000 cfs also occurred in the winter of 1952-53 and 1969-70. Two year recurrence flood (flows which are exceeded every other year on average) is about 18,000 cfs. The contribution of the Upper South Fork area to these flood flows is assumed to be about one-fourth the total based on proportional watershed size. Therefore a two year flood for the South Fork Salmon River at Plummer Creek is about 4,500 cfs. Historic accounts describe floods in 1861-1862, and 1889-1890 (McGlashan and Briggs 1939). Based on limited information for the older floods, it appears that the 1861 flood was the largest, followed by 1964, and 1890 (Coghlan 1984). Landsliding episodes accompanied many of these floods. Landslides associated with floods from 1964-1975 account for 58% (509,132 yd^3) of the total landslide volume estimated over the past 80 years (de la Fuente and Haessig 1993).

Widespread channel modification occurred in association with floods in the 1960s and 1970s. A survey (de la Fuente and Haessig 1993) of air photos from 1944, 1955, 1964, 1965, 1975, and 1988 provided information on flood effects of 1955, 1964, and events occurring between 1965 to 1975.

In 1944, most tributaries to the Upper South Fork Salmon River supported dense riparian stands, conifers, and hardwoods. Recent landslides were rare. Large hydraulic mines were evident along main tributaries, and especially the Upper South Fork near Petersburg. Recently disturbed channels occupied 33 miles, primarily in the headwaters of the South Fork and Little South Fork. The South Fork upstream from Big Flat appears recently disturbed. Landslide derived sediment evident from 1944 photos is an estimated total of 287,716 yd^3. A 37,000 cfs flow was recorded at Somes Bar in 1927.

From 1955 photos, riparian areas remain little changed from 1944. About ten miles of recently disturbed channels are visible, concentrated in Cecil and St. Claire Creek watersheds. Landslide-derived sediment since 1944 is estimated at 44,727 yd^3.

The flood of 1955 disrupted riparian vegetation on several tributary streams and caused localized aggradation and scour visible on summer 1964 photos. Some of these effects may have been caused by high flows some time between 1955 and 1964. This is unlikely, however, since the maximum peak flow recorded for that period was only about 25,000 cfs. Landsliding during that period (1955 - 1964) was relatively small (30,296 yds^3). Concentrated channel disturbance was evident in the St. Claire and Little South Fork watersheds, and the main South Fork by Petersburg. The total length of newly scoured channels on 1964 air photos is 13 miles.

The December 1964 flood caused channel migration, aggradation, scour, and widespread loss of riparian vegetation along the main stem of the South Fork upstream from Petersburg, from Plummer Creek to the junction of the East and South Forks, and much of the East Fork, nearly up to Carter Meadows. Most low-gradient floodplains were stripped of riparian vegetation, and covered with fresh sediment. High gradient reaches experienced both scour and aggradation. Damage to fish habitat from deposition of sediment and destruction of riparian vegetation is apparent on aerial photographs. In 1965, entire stream reaches several miles in length are stripped of riparian vegetation (i.e., Taylor and St. Claire Creeks). Fresh sediment deposits appear in low gradient reaches of these streams. A considerable amount of landsliding and scoured channels are evident in the recently burned area of the South Fork and Sixmile Fires. 69 miles of recently disturbed channel is evident from air photos, and an estimated 200,320 cubic yards of landslide sediment were delivered from 1964-1965.

Storm events between 1965-1975 caused disturbance similar to that of 1964, but it was much less severe and more localized. Disturbance was concentrated in the St. Claire Watershed, and at the South Fork of the Salmon above Rush Creek where a large debris slide entered the river from a tributary on the north side of the River. An estimated total of 308,812 cubic yards of sediment has been delivered to the channel system, and 15 miles of channel appear recently disturbed.

Between 1975-1988, no major floods occurred, allowing riparian vegetative recovery. New landslides are limited in extent and size. Areas scoured in 1964 have thick alder borders but barren floodplains persist. Landslide volume totaled less than 5,000 cubic yards, and recently disturbed channels one mile in length were observed.

Between 1988-1994 a few new landslides occurred in the vicinity of Blindhorse Creek, Rays Gulch, and in St. Claire Creek.

HUMAN INFLUENCES AND IMPACTS

Disturbances associated with human occupancy in this watershed include: Native American influences, mining era settlements, mining, grazing, development of roads and trails, and timber harvest.

Native American Influences

The watershed has been influenced by humans for hundreds or thousands of years. Large populations of Native Americans in the Klamath region were widespread. Local tribes included the Konomihu, Shasta, and Karuk (Wills 1991). The Karuk occupied the middle course of the Klamath River and up the Salmon River just east of Somes Bar. Towards the end of the 1800s, they occupied areas further up the Salmon River in the area of Wooley Creek. The Shasta tribe lived east of the watershed in the Scott Valley area. The Konomihu was the principle tribe in the watershed. Their ethnographic territory was centered around Forks of the Salmon River. The Konomihu dwelt in semi-permanent villages along the river during the winter and shifted to upland camps in the summer. They relied heavily on a combination of fish, large and small game, and various plant resources including acorns and berries (Winthrop and Winthrop 1991). Information available indicates that Native Americans actively manipulated the landscape around them, although to what degree is not known. Fire was an important tool frequently used to promote new shoots of willow, alder, and hazel for basket making materials. Fire also killed insects which would otherwise weaken the shoots. It was used in lower elevation sites to create areas for tobacco cultivation. The Karuk used fire to encourage growth of huckleberry, hazel bushes, tan oak, wild potatoes, and wild flowers. Burning was probably during the early Fall "when everything was dry" (Lewis 1993).

Settlements During the Mining Era

Gold was discovered in 1850 near Forks of Salmon and soon after the towns of Cecilville, Summerville, and Petersburg sprang up.

Cecilville was located on both sides of the South Fork of Salmon River near Cecil Creek. The town had a hotel, store, warehouse, livery and feed barn, saloon, and post office, and was second in importance only to Petersburg as a trading center for the mines along the South Fork.

Summerville was located between the mouth of Rush Creek and Board Tree Gulch. Summerville had a store, a saloon, and several dwellings. This flat was mined between 1860 and 1907, then the area was abandoned (Stumpf 1979).

Petersburg was the largest of several mining camps and trading posts in the area. Petersburg reached its heyday during the 1860s and early 1870s. At that time the town included: "a boarding house or hotel...stores, saloons, meat shop, blacksmith shop, dwellings, barns and corrals as well as vegetable gardens, and the long Frink and Crumbeugh ditch from South Fork used for mining purposes and to power the Ritner sawmill in town" (Ball 1957). There was a post office at Petersburg, at least by 1869 until 1876, and a sizeable Chinese settlement at the north end of town (Ball 1957). Pack trains regularly passed through this area to bring in the goods and equipment for the miners.

Petersburg began to dwindle in the late 1870s and by the 1890s "a few log cabins dotted the dry flat where Petersburg had stood" (Ball 1957). After the turn of the century, the Salmon River Mining Company obtained rights to the Petersburg flats and other gravel bars along the South Fork of the Salmon. The company operated until 1909 (Quinn 1986).

The watershed was altered in other ways during the historic mining era. Extensive timber harvesting occurred within the area to provide lumber for buildings, flumes and sluicing devices ("long toms"), as well as a source of heat for the numerous dwellings. All of the buildings in Petersburg, except for a few log cabins were made of lumber sawed in the area. Fire suppression was practiced by the area's inhabitants. According to one account, "There were forest fires at that time (early 1900s) that were closely watched and all gathered to help if danger threatened" (Steele 1968). Sever-

al homesteads were established further up the South Fork of the Salmon River, including the Lakeview Ranch and Abram's Cabin near Big Flat. The Deacon Lee Trail was established in the 1860s and served as the main supply route to Black Bear Mine. All machinery and supplies for the 32-stamp mill were hauled along the trail. It entered the watershed between Jackson and Trail Creek and followed the ridge between the East Fork of the South Fork and the North Fork of the Salmon River. It continued west between Eddy's Gulch and Callahan Gulch to Black Bear Creek Summit and down Black Bear Creek to the mill site. Several camps were established along the route.

Mining: Historic and Recent Past

Data from the Bureau of Mines indicates a total of 92 claims have occurred in the watershed, from historic to recent past. Figure 6 - Historic Mining Activities Map (located at the end of this chapter) shows the location of those claims. The majority of sites referenced were placer operations, although several were underground and surface mines which occurred in upland areas.

Historic mining activities substantially altered the watershed. Placer mining operations typically progressed in the following manner: Placer deposits were first worked at their surface. Then material just below the surface was mined via "ground sluicing". During ground sluicing operations, river bed deposits were mined by constructing wing dams to divert the portions of the river to be worked. Ground sluicing also required the construction of ditches and channels. River gravel and cobble was piled into series of large mounds alongside the river channel once it was worked through.

Large scale hydraulic mining operations began along the South Fork of the Salmon in the early 1880s. Hydraulic mining consisted of using a high pressure water cannon to direct a powerful stream of water at uplands. This resulted in the washing away of huge sections of ground and cobble. In fact, the Salmon river Mining Company sluiced away much of what was left of the Petersburg site.

Estimates indicate that about 15.8 million cubic yards of sediment were discharged into the Salmon River (including the North Fork) between 1870 and 1950 as a result of gold mining activities, primarily hydraulic mining. Hydraulic mining significantly altered the main river channels and changed the vegetation in the channel area (due in part to removal of soil down to bedrock). This undoubtedly influenced the way in which the river responded to the floods of the 1960s and 1970s. Many of the effects of these activities still persist today. For instance, some mines left residual vertical banks up to 60 feet in height and piles of cobbles and boulders remain along stream channels (de la Fuente and Haessig 1993)

Grazing: Historic and Recent Past

There are currently all or portions of four grazing allotments within the boundary of the watershed. They are: Big Flat, Carter Meadows, Garden Gulch, and South Russian Creek. The operations of each allotment are summarized in the following:

Big Flat Allotment: Early use, before 1905 included heavy sheep grazing which resulted in poor range condition. From 1915 until 1950 there were horses and cattle on the range. The number of cattle were as high as 200 head in a July - December grazing season in 1915. Numbers were reduced through the years to a low in 1920 when 20 head of cattle were permitted. During this period the grazing season was reduced to its current length of July 1 to October 15. In 1979 the number was increased to 25 cow/calf pair as is permitted today. This allotment has a 1982 allotment management plan. The range condition is good to fair and on an upward trend.

Carter Meadows Allotment: In the late 1800s until 1924 the Carter Meadows area was used as a stop over for horses and mules on the route from Callahan to Cecilville. The present allotment consists of three historic allotments that were combined in 1944. The Carter Meadows portion including Carter Meadows, Long Gulch, Trail Gulch and Fish Creek and the Taylor Creek portion of the Rush Creek section are in the Upper South Fork Watershed. In 1909 there were 125 head of cattle in the Carter Meadows portion, excluding Fish Creek which was part of the South Russian Allotment at that time. In 1925 sheep were run in Rush Creek, Taylor Creek, and Fish Creek. In 1935 the grazing season was cut one month to July 1 to October 31. In 1945 the season was reduced an additional month to 7/16-10/15 as it is today. In 1956 the Rush Creek unit was added to the allotment in anticipation of higher recreation use in Carter Meadows. The current allotment management plan was signed in 1969. The condition of the allotment is fair.

Garden Gulch Allotment: The original allotment included two sections covering 5585 acres. The current allotment is 1655 acres and includes primary grazing land and adjacent private meadows with the animals moving between private and federal land throughout the grazing season. The permit is for 27 horses for a season from March 1 to November 30. From before 1905 until 1924 sheep, horses and cattle grazed the allotment. Records show that from 1928 through 1947 40 head of horses and cattle grazed 90 days beginning around July 1st in the Cecil Lake section of the allotment. Use in the Garden Gulch section varied between 60 and 10 head of cattle. Use since 1961 has been 13 cattle from April 1 to October 15. Use reduction was due to loss of grazing capacity resulting from fire control by the Forest. This allotment is managed under a 1991 allotment management plan. Present condition on the allotment is good to fair.

South Russian Creek Allotment: The allotment is a portion of a larger historic allotment which contained the French Creek unit. The original allotment ran 75-150 head for a six month season. In 1920 the season was shortened to four months. For a period of time Fish Creek was part of the allotment and 150-185 head of cattle were run on the allotment. In 1946 the French Creek portion was closed to grazing and the Sixmile-Trail Creek unit from another allotment was added. 50 head were run on the South Russian unit and 75 in the Sixmile-Trail Creek unit. From 1947-1952 non-use was taken on the allotment and the permit was transferred. At this time 118 head were permitted on the allotment. In 1956 the Jackson Creek unit was added to the allotment and in the meantime the Fish Creek unit was dropped. Today 40 cow/calf pair are permitted on the allotment. Only the South Russian and the Sixmile-Trail Creek units are in the Upper South Fork Watershed. Condition on the allotment is mostly poor because these are naturally poor sites for vegetative growth. The allotment management plan was signed in 1967.

Development of Roads and Trails

The development of a transportation system in the watershed began many decades ago. Several historically used foot trails were later developed into roads. Historical road use is outlined below so that we can understand the local significance. The following information excerpted from *Poor, But Not So Poor; The Depression Era in Western Siskiyou County* (1988). "In Cecilville as late as the thirties, walking served as the main transportation for many in the area, with horses and mules providing the main alternative...People who did have cars, the rich relative, would offer to transport others, packing the car with people for outings...Trucks replaced horses on the mail stage route between Etna and Forks of Salmon as early as 1915...Roads were being extended into the back country. According to Ruth Markon, the road between Forks of Salmon and Happy Camp was completed in 1922 or 1923. This was a great advantage, since it allowed people to drive into Yreka when the road over Etna Mountain was blocked by snow, as it often was between November and June. The Cecilville area remained isolated longest. This dirt road with turnouts, which led from Sawyers Bar over Black Bear Hill to Cecilville, was built in 1927. It wasn't until the 1940s that Cecilville was connected by road with the Forks of Salmon, and not until the 1950s with Callahan. Even by the 1930s, many back country roads were essentially the same rutted wagon routes that had served for decades."

Most of the area's road systems were constructed to access burned areas for timber harvest beginning in the 1950s. Roads to access 1955 burn areas were constructed by 1957.

Examination of aerial photos from 1944, 1964, 1975, and 1994 show the progression of road building within the watershed (de la Fuente and Haessig 1994). In 1944, some roading had occurred in the northwestern and central portions of the watershed. A road existed from Petersburg to Cecilville and an additional road extends from Cecilville, north up Crawford Creek along the boundary of the watershed to Eddy Gulch lookout.

In 1964, a road along the East Fork of the South Fork Salmon River is complete; the road to Eddy Gulch lookout extends further along the watershed boundary and links with the main East Fork road at Sixmile Creek. A road up Taylor Creek is also present and an extensive road network is present in Cecil Creek. In the southwest portion of the watershed, a road accessing a private parcel near Josephine lake is in place.

By 1975, additional road building has occurred in the Rays Gulch, China Creek, Blindhorse Creek, St. Claire Creek, Crawford Creek, Taylor Creek, Shadow Creek, and Trail Creek drainages.

In 1994, further road building has occurred in Cecil Creek, Rays Gulch, Specimen Gulch, Crawford Creek, Shadow Creek, Sixmile Creek, and Taylor Creek drainages (refer to Figure 7 - Roading and Harvest History Map located at the end of this chapter).

Timber Harvest

Historic timber harvesting occurred in association with mining activities prior to the turn of the century and was extensive adjacent to townsites. Stands of trees were harvested for flume material, cabins, and fuel wood for steam boilers. Miles of wooden flumes were constructed to transport water to run hydraulic monitors for placer mining. These flumes varied in size, but used an average of 50,000 board feet of dimensional lumber per mile.

Commercial timber harvest has influenced the character of the watershed since 1950. Timber harvest during the mid 1950s was mainly fire salvage and road right-of-way. During the early 1960s, the nation's demand for lumber greatly increased, and the period of green timber sales within the watershed began. Timber harvest throughout the 70s and 80s was accomplished using several methods, including helicopter. Clearcutting was the dominant harvest prescription.

Approximately 3,600 acres of tree plantation are presently found in the watershed. Harvest information is available on approximately 2,800 acres within the watershed. Of those 2,800 acres, at least 1,700 (61%) were harvested using a clear cut (either stand or patch cut) prescription. Prior to 1980, only about 560 acres had been clearcut. The sizes of individual units ranges from two to 30 acres.

Other harvest prescriptions include (acres approximate): sanitation salvage (280 acres), overstory removal (270 acres) individual tree selection (130 acres), shelterwood seed cut (60 acres), and seed tree cut (40 acres). Individual unit sizes tend to be larger than those under clearcut prescriptions.

Most of the stands were replanted with mixed conifer species, although some single species reforestation has occurred using ponderosa pine, Douglas-fir, true fir species, and Jeffrey pine.

Harvest practices resulted in fragmentation of older seral stage forest and creation of clusters of even age vegetation in the watershed. Examination of aerial photos from 1964, 1975, and 1994 show the progression of harvesting within the watershed (de la Fuente and Haessig 1994). In 1964, harvest units occur in the northwest portion of the watershed in the area of 1955 burn (Sixmile Creek, Shadow Creek, and Cecil Creek drainages). By 1975, extensive harvest has occurred in the Rays Gulch, China Creek, Blindhorse Creek, St. Claire Creek, Crawford Creek, Taylor Creek, Shadow Creek, and Trail Creek drainages. In 1994 additional harvest has occurred in Cecil Creek, Rays Gulch, Specimen Gulch, Crawford Creek, Shadow Creek, Sixmile Creek, and Taylor Creek drainages.

SUMMARY

A key point to be addressed in this Chapter is characterization of the disturbances which have affected the riparian environment. This discussion pertains to the Riparian Reserves which in some instances, encompass upland areas. (The Riparian Reserves are discussed in more detail in *Chapter 5*.) Hence this assessment may over-estimate the frequency of disturbance impacts to the riparian zone. Table 3 - Acres of Fire Impact, Human Activities, and Flood Disturbance to Riparian Reserves by Subwatershed follows:

Table 3 - Acres of Fire Impact, Human Activities, and Flood Disturbance to Riparian Reserves by Subwatershed

Subwatershed	Riparian Reserve Acres*	Fire Impact Acres				Landslide**
1/		A	B	C (%)	D**	
1-SFH	5,207	76	76	673 (13)	-	29
2-PET	4,825	0	38	116 (2)	-	6
3-EFH	4,015	0	1,133	1,237 (31)	274	3
4-LEF	2,177	0	0	183 (8)	-	3
5-TAY	2,268	0	123	137 (6)	-	-
6-CEC	5,298	1,357	1,357	1,464 (28)	384	18
TOTAL	23,790	1,433	2,727	3,810 (16)	658 (3%)	59 (.25%)

Key to above:
1/ SFH=South Fork Headwaters, PET=Petersburgh, EFH=East Fork Headwaters, LEF=Lower East Fork, TAY=Taylor, CEC=Cecilville
Fire Impacts:
A- Recorded fire within the past 25 years (all intensities) 1969 - Present
B- Recorded fire within the past 50 years (all intensities) 1944 - Present
C- Recorded fire within the past 100 years (all intensities) 1917 - Present
D- Stand replacing fire in the Riparian Reserve.

* Unstable lands are not included.
** Landslide and stand replacing fire totals are estimated for the past 60-100 year period; 1944 was the earliest photo-year available for analysis. Landslide activity calculated for tributaries, not main channels; see text.

Subwatershed	Riparian Reserve Acres*	Human Activities**					
		1	2	3	4	5	6 (%)***
1-SFH	5,207	6	29	-	246	1,333	281(5)
2-Pet	4,825	52	198	574	64	850	888(18)
3-EFH	4,015	45	3	632	94	2,187	774(19)
4-LEF	2,177	37	48	525	132	-	742(34)
5-Tay	2,268	45	1	502	80	663	628(28)
6-Cec	5,298	82	35	1,380	145	-	1,642(31)
TOTAL	23,790	267	314	3,613	761	5,033	4,955(21)

Key to above:
Human Activities (acres within the Riparian Reserves)
1- Road construction
2- Mining (extensive hydraulic mining only)
3- Timber harvest
4- Private land, etc.
5- Grazing
6- Total of above minus grazing.

* Unstable lands are not included.
** Acres within Riparian Reserves.
*** Totals are for columns 1-4 (grazing is not included)
(% of total subbasin Riparian Reserve is also illustrated)

	Total Riparian Miles	Scoured Channels (%)	Scoured Channels (Multiple)*
1-SFH	110.59	39.29 (36)	51.9
2-Pet	105.14	13.39 (13)	21.74
3-EFH	83.04	16.71 (20)	16.74
4-LEF	47.91	3.2 (7)	3.21
5-Tay	51.92	8.66 (17)	8.66
6-Cec	120.03	15.25 (13)	16.07
TOTAL	518.61	96.50 (17)	118.32

* Total scouring during past 60-70 years. Some channels scoured multiple times. All lengths are in miles.

Since the early 1900s, about 16% (3,810 acres) of the Riparian Reserve has been burned by fire of varying intensity; 658 acres (three percent of the Riparian Reserves) have experienced stand replacing fires. Fires recorded earlier in the century had either recovered significantly by the time of the 1944 photos, or the fires had burned less intense than the fires of the 50s and 80s. Significant stand replacing fire occurred in only two subwatersheds, East Fork Headwaters (EFH) and Cecilville (Cec).

Fifty-nine acres (.25%) within tributary Riparian Reserves were impacted by natural landslides during the 60-70 year period. There is a high correlation between landsliding on the main channels and historic hydraulic mining/ditch building.

Twenty-one percent (4,955 acres) of the Riparian Reserve area has been affected by humans. The greatest single activity (timber harvest) has occurred over 3,613 Riparian Reserve acres. Timber harvest, especially of recent vintage, rarely extended into the riparian zone. Roading and hydraulic mining are significant and long lasting alterations of the riparian area. The acres reported under "Grazing" represent acres of Riparian Reserves included within an allotment. Grazing impacts are not included in the disturbance totals because grazing affects vary from year to year depending on annual range condition.

Scoured channels result from high water events, or high water events coupled with debris torrents. In 1944, the main channels (S. Fork and E. Fork of the South Fork) were extensively vegetated and most scoured channels were short lengths in headwater tributaries. Two extensive reaches in the Upper S. Fork and Rush Creek were scoured prior to 1944. The floods of 1955 and 1964 caused extensive main channel scouring. The 1964 flood

impacts dwarf those of any other in this century. Main channels are still in a state of vegetative recovery. A total of 96.50 miles have been scoured (17% of the total riparian length). Some of these reaches have been scoured multiple times since 1944. The S. Fork headwaters (SFH) and the Petersburg (Pet) sub-watersheds show the greatest frequency of multiple scouring.

RANGE OF VARIABILITY

This section describes what the historic range of variability may have been for certain environmental indicators within the watershed. Environmental indicators are structures, components, or processes of the ecosystem which change over time and can be measured or monitored. Ecosystem sustainability can best be achieved if management is done to attain effects which are within the range of variability for key environmental indicators. The temporal context for this discussion is pre-European settlement, being to describe the range of conditions which may have existed prior to widespread environmental modification.

The range of variability combines the best available information and best professional judgement to form a description.

VEGETATIVE PATTERNS AND STRUCTURE

Disturbance processes change structural characteristics, species composition, stand condition, and patch size and shape. For instance, a disturbance can totally disrupt the seral stage progression and return communities to an early successional state or maintain the community by repeated, low intensity disturbances, such as frequent low intensity fires. Numerous factors associated with a particular disturbance affect the resulting change. These factors include the type, duration, intensity, frequency and timing of the disturbance, as well as the operational environment following the disturbance.

As described previously, the pre-suppression fire regime was one of frequent, low, and moderate intensity fires.

Fire Severity and Effects

Fire severity varies by forest cover type, from infrequent high severity fires that regenerate stands to frequent low severity fires that kill seedlings and saplings, maintaining open understories. Effects of low and high fire severity regimes are most predictable. When low severity fire return intervals are reduced to 50 years or less in dry/warm climates, mixed-conifer/hardwood stands tend to develop as follows: Douglas-fir and pine are thinned, white fir is removed, and associated hardwoods are top killed. Several recurrences of fire will create a stand with several age classes of Douglas-fir and/or pine. An age class of Douglas-fir, pine, white fir, and hardwoods which represent the regeneration after the last disturbance (USDI 1993) will also be present. Low severity fires tend to thin from below, first taking smaller trees and/or those less resistant to fire.

Moderate severity fire regimes are the most complex because of the mix of fire severities. Forests that experience moderate severity fires are patchy and composed of multiple age classes. Fire regimes in red fir forests are dominated by low and moderate severity fires. Fire scar data collected at Swain Mountain are consistent with this characterization (Taylor 1993). Large post-fire cohorts did not develop after most fires suggesting that regeneration was in small patches. The distribution of younger red fir age-classes was clumped, most likely the result of low severity fires; while older red fir were less intensely clumped, the result of thinning by competition and/or fire. Wills (1991) described stand structures resulting from fires of variable severity in the Salmon River area. Some stands were even-aged, following intense disturbances, while others were multi-structural following moderate or low severity fires.

Past Fire Conditions

Localized fire history for the area combined with research findings in adjacent areas suggest a pattern of vegetative arrangement for this watershed. Wills (1991) hypothesized that the pre-settlement watershed was probably exceptionally patchy, containing complex mosaic of age, size, and structure. Stand conditions were likely more open on upper slopes (above 4,000 feet), particularly on steep terrain and southerly aspects. Stands dominated by ponderosa pine probably occupied drier sites and occurred as open stands with scattered large trees, little structural diversity within the tree component, but with a wider array of herbaceous and shrubby vegetation in the understory. Conversely, stand conditions in the lower portions of the slope (below 4,000 feet) and on north aspect would have been less open, with more structural

diversity, particularly on productive sites (often associated with dormant landslides).

A review of 1935 Eddy Gulch Lookout photos and 1944 aerial photos compared with recent photos from the same areas, indicates that general vegetative patterns have not differed substantially over the past several decades. Areas which were predominately open, are vegetated by shrubs or grasses today, although some openings are now smaller due to tree encroachment. Most areas which were dominated by forest stands remain forested. This persistence in general pattern is probably due to geomorphic and edaphic conditions which affect site productivity and vegetative potential. Skinner noted that in portions of the Dillon, Clear and Swillup Creek watersheds near Happy Camp, estimated area occupied by openings decreased from 25.8% in 1944 to 15.6% in 1985.

The following descriptions of past vegetation stand structure and composition were hypothesized based upon what was learned from historical fire regime information:

VEGETATION CHARACTERISTICS

Mixed conifer - Historic stands were probably different in terms of structure, species composition, and pattern. Stands were more open than they are today, with fewer existing as dense and multistoried. The relatively denser stands within the watershed were most likely on north-facing slopes in riparian areas, and areas of deep, productive soils. More open stands occurred on south-facing slopes. White fir occurred less as a component of mixed conifer stands and was confined to upper elevations (above 4,500 feet). Douglas-fir was codominant primarily at lower elevations and on northerly aspects. Pine was a significant component throughout mixed conifer stands. Black and white oak were probably more prevalent. The overall watershed pattern was likely a patchy mosaic of stands.

True fir - Single aged stands were more common within true fir stands, particularly the younger aged stands, although thinning effects in older aged stands probably resulted in a multi-modal distribution.

Montane Shrub - The occurrence of shrub communities was determined by site capability and probably has not changed significantly since European settlement. Under historic fire regimes, these communities were maintained in a more vigorous condition than what exists today. Post fire response of most brush species in the watershed is either vigorous root/crown sprouting or germination of stored seedbanks.

Grass/forbs - These communities are maintained, in part, by disturbance. Prior to European settlement, lightning fires, elk grazing, and aboriginal burning provided disturbance necessary to minimize encroachment of shrubs or trees. Livestock grazing may perform a disturbance function that prevents encroachment upon these communities.

Introduction of livestock and associated practices has altered meadow communities. Differences in forage habits of cattle and elk include different species preferences and foraging patterns. Introduction of non-native grass species was probably a result of livestock grazing.

Non-commercial Forest - Live Oak stands--There were probably more pure stands of live oak with less encroachment of conifer species under historic fire regimes. Stands were sparsely stocked with minimal understory.

White Oak Stand - White oak stands were probably less dense, with patches of various ages present. With frequent fire return intervals, some stands would have been recently rejuvenated with sprouts while other stands would have consisted of small to large mast producing trees.

Knobcone Pine - Knobcone was probably more scattered throughout the watershed under historic fire regimes. Younger, more thrifty stands were more common than what persists today.

Hardwood Stands - Larger pure stands of black oak and pacific madrone may have occurred within the watershed with fire reducing the encroachment of conifers.

Riparian Tree and Shrub - Lower severity fires would topkill most shrubs and deciduous trees. They may have resulted in weakening trees, making them more susceptible to windthrow. Light ground fires probably triggered secondary succession only in lower canopy layers. Occasionally, small patches may have burned more intensely, killing vegetation through the upper canopy.

Riparian vegetation varied in response to flooding. Flooding may have resulted in widespread loss and modification of riparian vegetation.

SOIL PRODUCTIVITY

Soil productivity fluctuates in response to changes in the soil-forming and soil-erosion processes. Prior to the entry of Europeans into the Upper South Fork, the principal factors influencing soil productivity were climate, and fire.

The climate immediately prior to the entry of Europeans was probably very similar to that of the past 150 years (Adam 1988). Differences were probably well within the range of fluctuations which occurred during the past 10,000 years.

The fire regime has changed considerably since European contact. Due to the combined effects of the elimination of aboriginal burning, and an active fire suppression policy since 1910 the fuel condition and potential for large high intensity fire may be outside the historic range of variability. The potential for soil erosion and landsliding is also outside the historic range of variability.

Large excavations did not exist in the watershed prior to the 1850s. Such excavations, as from roads and mining, cause accelerated surface erosion and landsliding, which at the site level, is outside the historic range of variability . Soil productivity on road surfaces, some road cuts and fills, and some mining excavations is most likely outside the historic range of variability. The removal of soil down to bedrock by hydraulic mining in the Petersburg and Summerville areas created a situation where some of the mined sites are incapable of growing any vegetation except that adapted to growing on rock outcrops.

Sediment Regime- The sediment regime is influenced by climate, tectonic uplift, natural sensitivity to erosion, and disturbances to the soil/rock mantle and vegetation. Important aspects of the sediment regime include sediment volume, character, timing and routing.

Two assumptions are necessary in order to address the variability of the sediment regime before and after European contact. One is that the climate was similar in the period before and after European contact and other is that seismicity was similar.

Studies of landslide occurrence and channel disturbance (de la Fuente and Haessig 1993) in the Upper South Fork revealed:

1- During this century, most of the landslide derived sediment which entered the stream system was association with flood events in the ten-year period from 1964-1974. Exceptions involve pre-1944 debris slides along the South Fork from Rush Creek to Big Flat associated with water ditches and mining.

2- Roaded lands produced landslides at a rate much higher than undisturbed lands, while areas burned at high or moderate intensity produced landslides at rates slightly higher than undisturbed lands (see *Chapter 4*).

3- The relationship between harvested land and landslide rate was varied, and in some cases, harvest land produced landslides at rates lower than undisturbed lands.

4- Roaded (including cut and fill) land occupies less than one percent of the watershed (1,096 acres), harvested areas occupy three percent (3,185 acres), and areas burned at high or moderate intensity occupy five percent (5,615 acres).

Landslide rates can be expected to exceed undisturbed rates in the watersheds where roading, harvesting, and recent high intensity fire are concentrated. This includes St. Claire, Crawford and Taylor Creeks as well as the area from Blindhorse Creek to Cecil Creek, and parts of Shadow and Trail Creeks. Surface erosion continues to be a chronic problem where hydraulic mines exposed erodible granitic bedrock.

Figure 8 - Landslides and Scoured Channels All Years Map (located at the end of this chapter) shows disturbed channels where streamside vegetation was removed by channel scour debris flows or aggradation. Concentrations of disturbed channels can be seen in St. Claire Creek, the headwaters of the South Fork, and the Little South Fork. There is no significant correlation between the scoured channels and recent human disturbances. The majority of disturbed channels are natural features, related to natural sensitivity, and local runoff patterns.

The main stem of the South Fork and East Forks were affected by hydraulic mining. Sediment intro-

duced into the channel during that time probably exceeded the sum of natural sediment delivered from 1944-1994 (de la Fuente and Haessig 1993). Mining-related sediment was introduced into the river in a way which was different from natural sediment-producing events. Since the mines operated continually through the winter, the rivers were probably turbid throughout the wet season rather than in association with periodic storms as had been the case. Hydraulic mining created a unique condition. The effects of this sediment delivery on aquatic species is unknown. The effects of the large floods from 1955-1975 make it difficult to determine long-term effects of mining on the streams.

RIPARIAN CONDITION

Riparian vegetation naturally ranges in structure from an advanced, lush seral stage to a disturbed site void of any vegetation. Therefore, the natural range of variation (ROV) for vegetative structure for a riparian stand, stream reach or an entire tributary, is meaningful when viewed from a watershed perspective.

In assessing the vegetative range of variation within the riparian zone, several assumptions are made. Initially, the nature and intensity of the disturbance regime as well as site capability influence the riparian structure. Secondly, the density, health, and size of the overwood in the riparian zone dictates the nature and density of the understory vegetation. (The understory vegetation also exerts influences on the overwood, but for the purposes of this discussion it is considered secondary). Thirdly, the presence or absence of the large wood within the riparian zone is largely determined by the intensity of major disturbance events. Major disturbance is caused by stand replacing fire, landsliding, and peak precipitation and flow events, often associated with debris torrents. Lastly, major disturbances, in addition to impacting large wood presence, will also significantly determine other components and attributes within the riparian zone such as canopy closure, vegetative connectivity, and bank stability. The extent, condition and location of each of these parameters are key questions identified during the scoping process.

For the purposes of the ROV discussion, the riparian zone, and the Riparian Reserves, are divided into two areas. The two areas are the upslope riparian and the peak flow influence zone. Both areas are influenced by ground water and are transition zones between the aquatic and terrestrial ecosystems. Characteristic riparian vegetation may be present or absent in either area. The distinguishing factor is that the peak flow influence zone is able to be flooded and potentially scoured of vegetation. This flooding impact may indirectly influence the upslope riparian area by increased soil creep and landsliding. Fire, of any intensity, is able to influence both zones, but it is one of the primary forms of disturbance in the upslope area. Upslope maximal disturbance rates, for stand replacing fire and landsliding does not appear to be high at three and one-half percent of total Riparian Reserve for the past 50 - 60 years. This would imply that in the upslope riparian area most stands would presently contain large wood quantities as their respective site conditions allow. Very few sites would be maximally disturbed (i.e., no large wood). A small number of sites would be in varying stages of recovery from maximally disturbed to almost fully restored.

Low intensity fire and the effects of its suppression on riparian vegetation is discussed in Chapter 4 under Riparian General Trends. In general, however, removal of low intensity fire has probably diminished understory disturbance and helped maintain overstocking and possibly decadence in the overwood. It is likely that suppressed, low intensity fire has greatly increased the chances for stand replacing fire in the analysis area. Health and density of a particular riparian stand can be best assessed on site by a silviculturist or botanist. Though stand replacing fire may not have had major impact on the riparian zones, it appears to have significant potential to do so in the future.

Channel scouring has occurred in 17% of the total riparian length in the analysis area in the past 50 - 60 year time period. This rate appears much higher than what is indicated by the 1944 photos for the first half of the century.

Upslope management activities have increased over the last 50 years. Their contribution to increasing the delivery efficiency of upslope precipitation to channels is unassessed. The potential for roads and harvest units, as in other management activities, to increase this hydraulic efficiency, certainly exists.

The impact of increased scouring rates on riparian vegetation was discussed previously. It does appear that significant flood events, such as in 1964,

have the ability to influence stand age and hence structure within the potential scour zone.

In summary, rates from major disturbance in the upslope riparian area appear low (or not unnaturally high). The amount of large wood within the upslope portion of the Riparian Reserve is thought to approach site potential conditions over much of the analysis area. It should be noted however that 21% of the riparian reserve, much of it in the upslope riparian area, has been impacted primarily by road building, harvesting, and private land utilization. Loss of vegetation as a result of scouring, appears high. To determine whether scour rates are beyond the natural range of vegetation for this process will require more research. It appears, however, that these rates have increased in the last 50 years. The qualities of shade, connectivity, bank stability and large wood presence would be negatively impacted within the potential scour zone.

Upper South Fork Watershed

Watershed Elements (Rock Types)

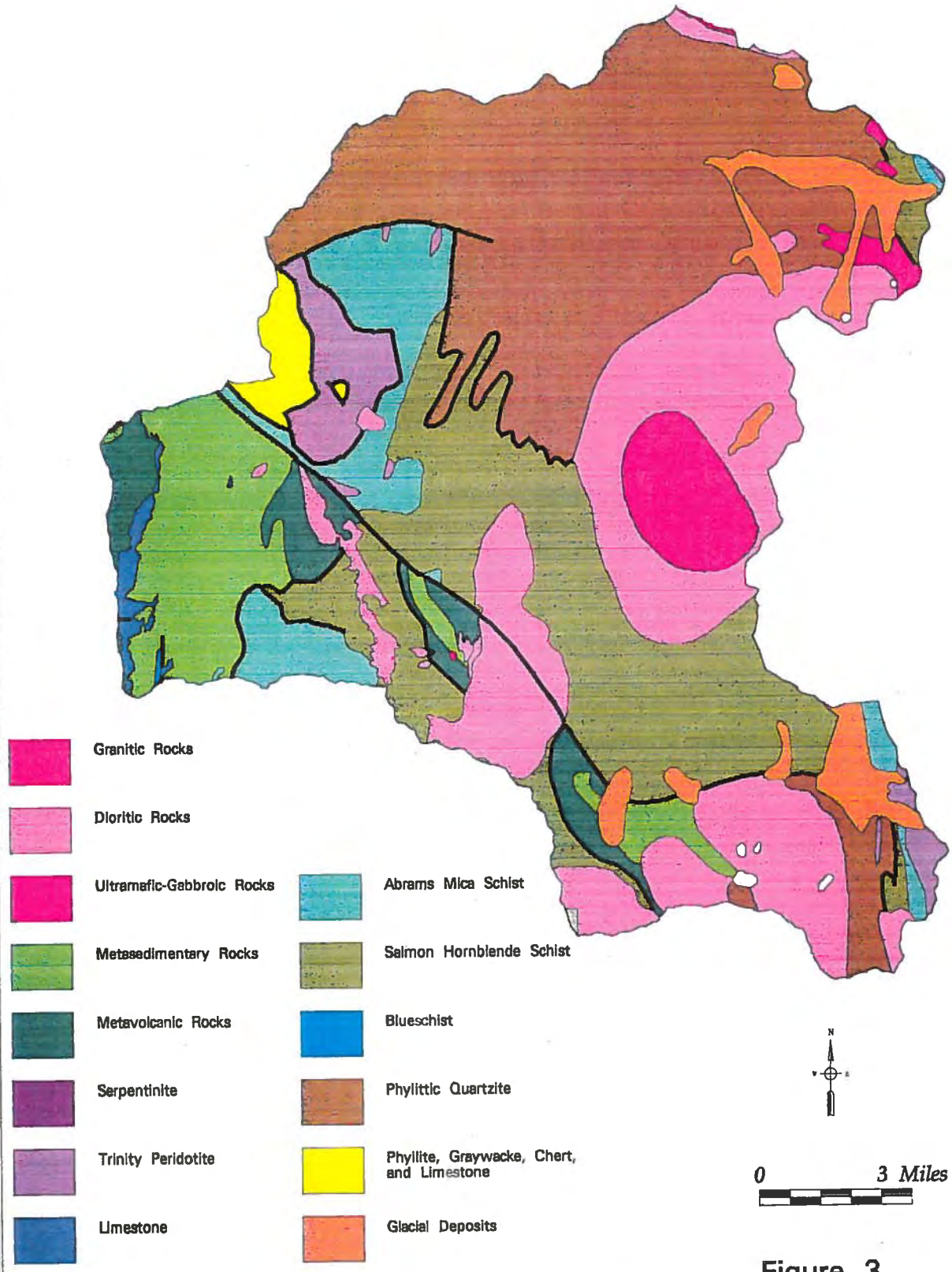
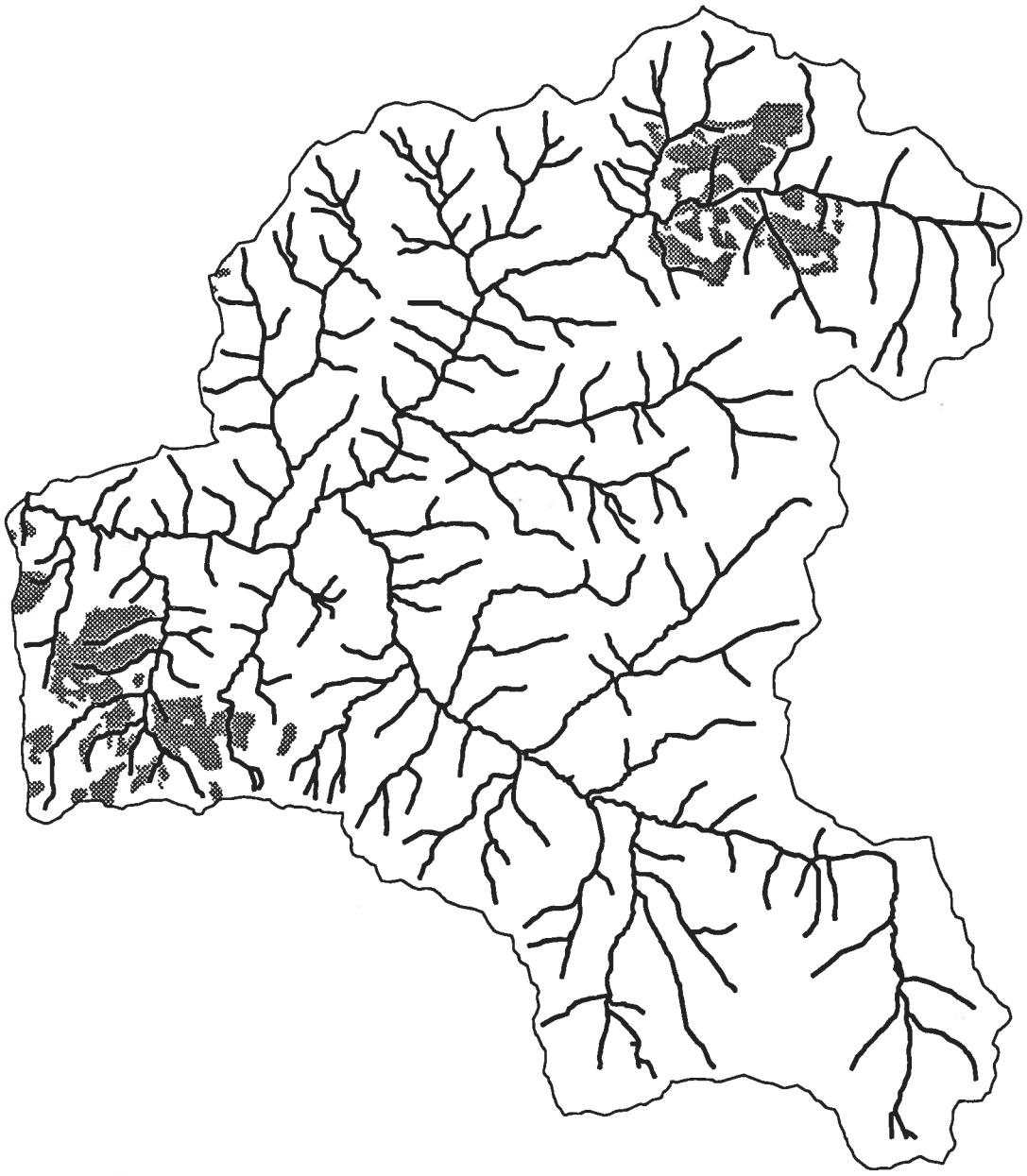


Figure 3

Upper South Fork Watershed

Historic Large Fires



High & Moderate Intensities

River/Stream

0 3 Miles

Figure 5

Upper South Fork Watershed
Historic Mining Activities

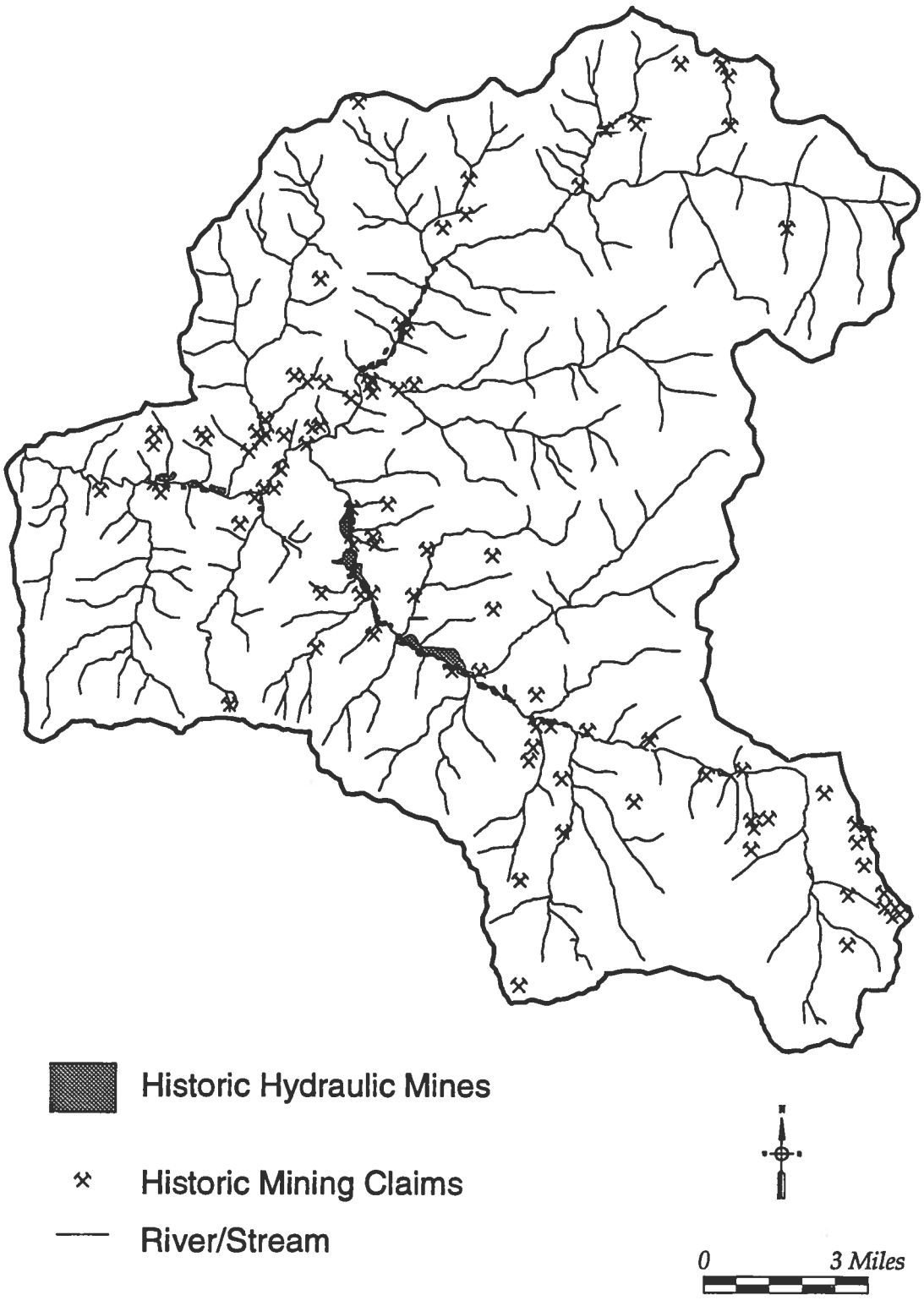
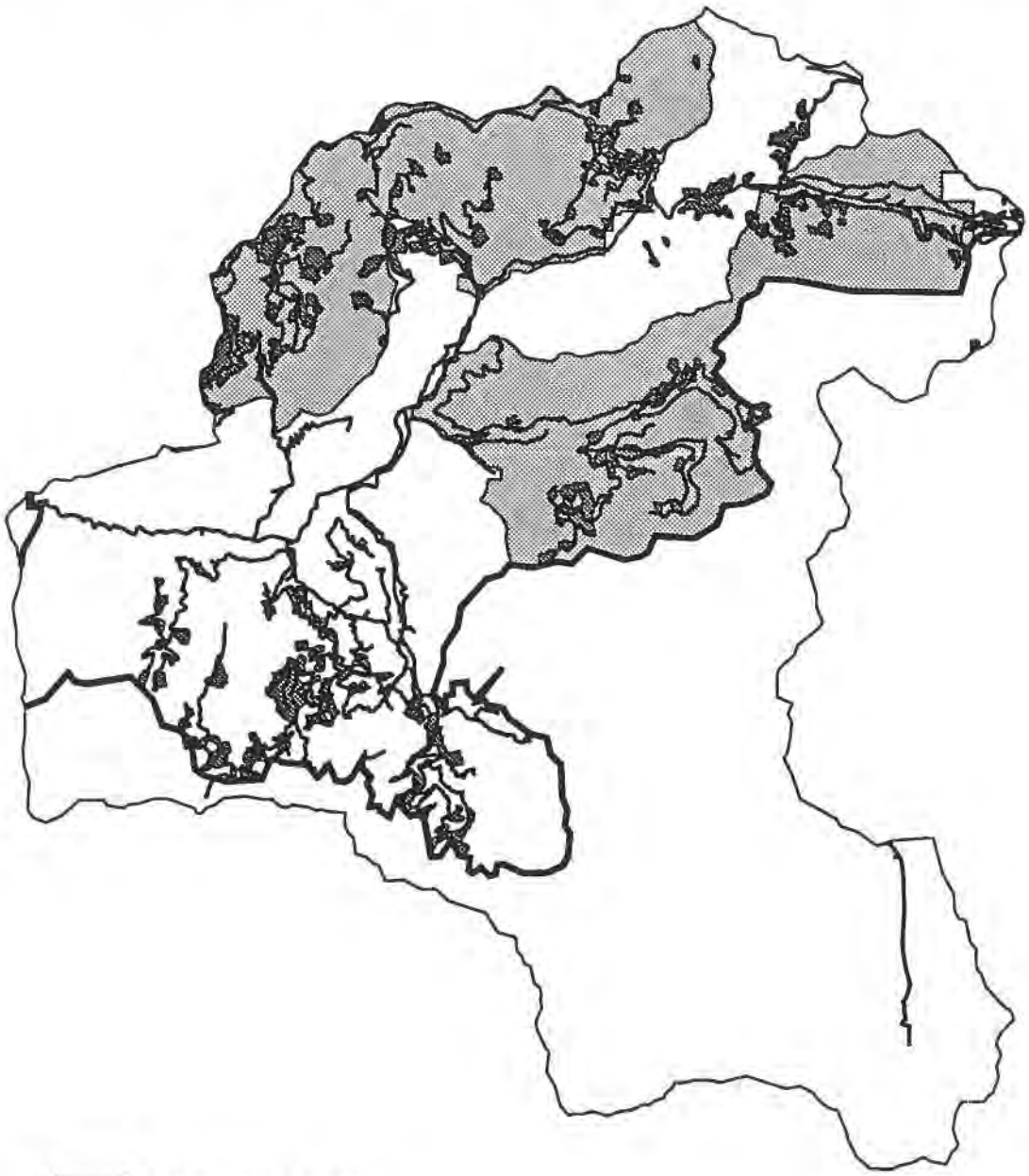


Figure 6

Upper South Fork Watershed
Roads & Harvest Units



Harvest Units

Late Successional Reserve

Highway/Road

Wilderness Boundary

0 3 Miles

Figure 7

Upper South Fork Watershed

Landslides & Scoured Channels (All Years)

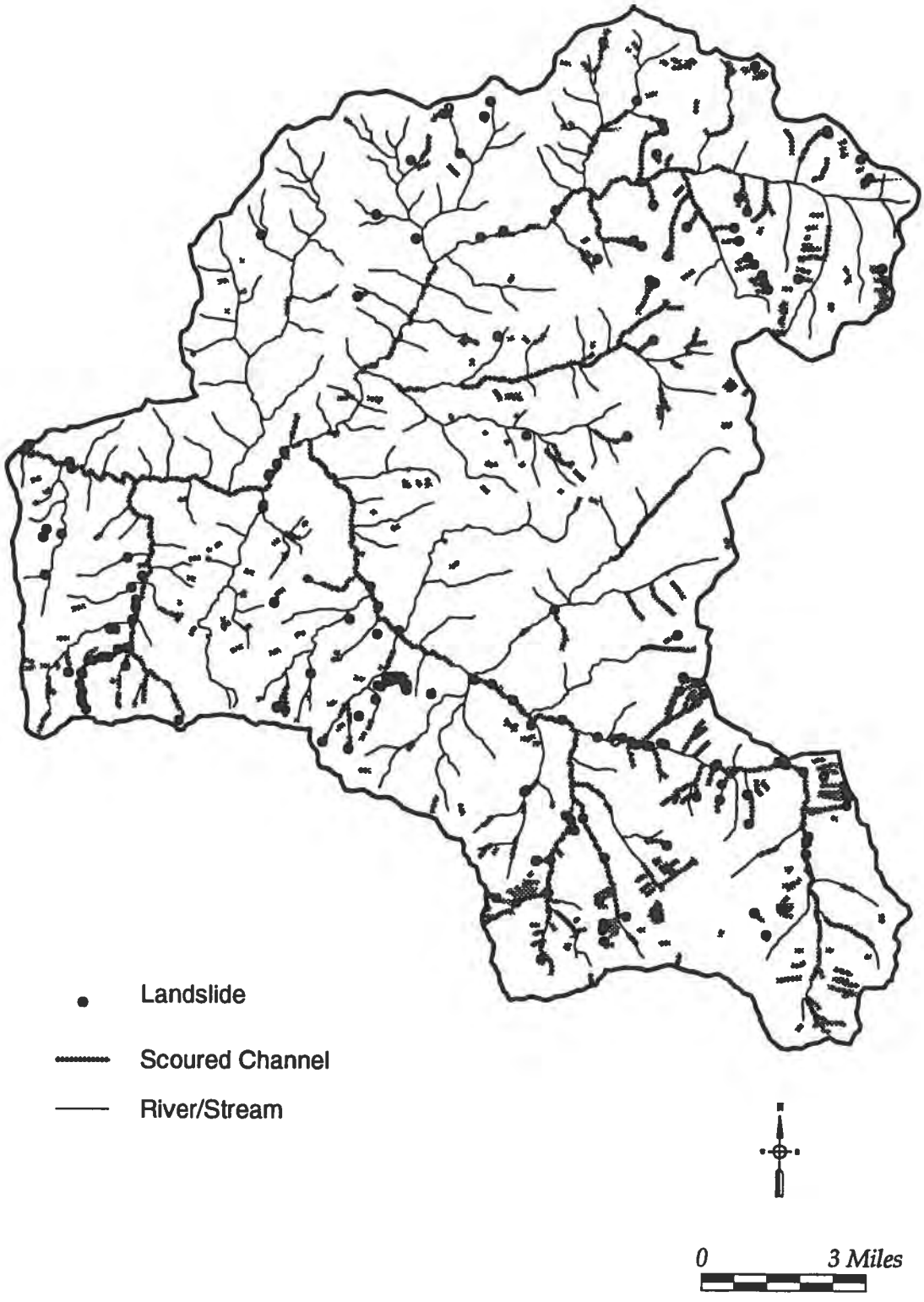
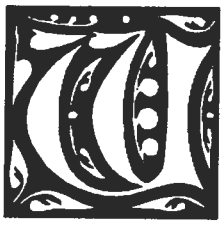


Figure 8

Chapter 2
Watershed Elements



ATERSHED ELEMENTS

Chapter 1 identified the disturbance factors that shaped or influenced the watershed. It also displayed the historic range of disturbance variability.

This chapter describes the elements found in the Upper South Fork Salmon River Watershed (Figure 9 - Watershed Elements Biological Map, contained in the map packet, and Figure 10 - Watershed Elements Human Map, located at the end of this chapter). Elements are basic physical components of the watershed (i.e., geology, soils, water, vegetation, roads and trails, campgrounds, etc.) which provide the "structure" for the ecosystem to operate in, on, or through. The relationship between structure and function is key to understanding watersheds as ecological systems. Identification of watershed elements and their arrangement is fundamental to the analysis.

Chapter 3 will discuss ecological phenomena dependent on elements identified here.

Elements are described in the context of presence, location, arrangement, and purpose.

PHYSICAL ELEMENTS

GEOLOGY

The basic physical elements, rock, soil, and geomorphic terranes play a major role in ecosystem function. The major rock types are displayed on Figure 3 - Watershed Elements Geologic Rock Types Map in map units from Wagner and Saucedo (1987). Appendix C - Geologic Belts, Terranes, and Rock Units provides further unit information including terrane affiliation, age, and area occupied. The rock type map units were divided into seven categories which define certain slope stability and soil erosion characteristics.

ROCK TYPES

Granitic Rock - Granitic rock (including granodiorite, diorite, and gabbro) occupies 25% (29,953 acres) of the Upper South Fork. The largest bodies are in the Taylor Creek area (Deadman Peak Pluton), Caribou Lakes area (Caribou Pluton) and the China Creek area (China Creek Pluton). Granitic rock can form resistant outcrops and bluffs with thin soils, or soft, or highly erodible rock overlain by thick sandy soil. Deeply weathered granitic rock, (i.e., lower Blindhorse drainage, is prone to rapid surface erosion and shallow landsliding.

Peridotite - Peridotite occupies three percent (3,808 acres) of the Upper South Fork, primarily in the Crawford Creek watershed, and forms magnesium rich soil which inhibits the growth of many plants, while favoring some species such as incense cedar, ponderosa pine, and buckbrush (ceanothus intergerimus). Typically vegetation is relatively very sparse. This rock has been partially altered to serpentine, and is likely to contain asbestos.

Metasediments - The metasediments (mostly chert and argillite as well as minor siltstone and sandstone) occupy about ten percent of the area (11,512 acres). Chert is formed mostly of silica (SiO_2), and typically forms subdued outcrops. Most outcrops are highly fractured and break into angular fragments from less than an inch to several inches in diameter. These fragments persist in the soil mantle and form areas of steep gravely soil and talus. The argillite has a similar surface expression but is locally platy.

Marble - Marble occupies less than one percent of the area (859 acres) around the French and St. Claire watersheds. Marble ($CaCO_3$) is soluble in the dilute acids which form as water passes through the soil organic matter. Solution cavities develop in the subsurface, forming caves. As caves evolve over time and are exposed to the surface, they form unique ecosystems which support a variety of plants and animals (arthropods, amphibians, reptiles, bats, and other mammals). The soils which develop on limestone typically

support distinct vegetative communities. The marble of French and St. Claire Creeks form prominent bluffs.

Schists - Mica and hornblende schists of the Stuart Fork Terrane and Central Metamorphic Terrane occupy about 53% (63,021 acres) of the area, and form fine-grained soils. They may form prominent bluffs or subdued topography depending on the weathering state. The schists of the Stuart Fork Terrane are found primarily in the Sixmile, Shadow, and Crawford Creek Drainages and supports a broad range of vegetative types. Most of the landslide deposits are contained in this rock type.

Metamorphosed Volcanic Rocks - The metavolcanic rocks of the North Fork Terrane occupy four percent of the watershed (4,486 acres) in the French Creek and St. Claire Creek watersheds. It consists of metamorphosed lavas and breccias, and exhibits rock outcrops, talus deposits, and sparse vegetation.

Glacial Deposits - Glacial deposits cover four percent of the watershed (5,317 acres).

GEOMORPHIC TERRANES

Geomorphic terranes are lands with similar geomorphic histories and similar landslide potential under modern conditions. Within the Upper South Fork, they were defined by rock type, slope gradient, landform, and slope material. The following geomorphic terranes were developed (see Figure 4-Watershed Elements Geomorphic Terranes Map).

Inner Gorge Terrane - The inner gorge terrane is the steep (>65%) landform adjacent to drainage ways. It is usually marked by a slope break which separates it from gentler slopes above. This terrane occupies 15% of the watershed (18,339 acres). As the gentle landscape of the ancestral Klamath and Salmon Rivers was uplifted, a dense stream network was incised through the weathered rock underlying the old valley floors. A dense network of inner gorges is apparent at elevations between 2,200 and 4,000 feet in the Upper South Fork Salmon River basin. This dense network is particularly noticeable where the China Creek Pluton is exposed in the valley of the Upper South Fork of the Salmon (Blindhorse Creek Watershed). Inner gorge density is very low above 4,000 feet in slump and earthflow deposits, and in areas underlain by peridotite.

Landslide Deposit Terrane - Landslide deposit terrane occupies four percent of the watershed (4,901 acres). Factors facilitating the formation of these deposits included: landscape steepening due to river incision, seismic activity, river undercutting, humid climate, and occasional structurally weak bedrock. Slump-earthflow deposits are most common in areas underlain by rock of the Stuart Fork, North Fork, and Central Metamorphic Terranes which occur in Crawford, Sixmile, and Shadow, St. Claire, and French Creek watersheds. Slump and earthflow deposits are uncommon in areas underlain by granitic rock. Landslide activity continues within these old landslide deposits in the form of localized slumps and earthflows, usually less than ten acres in size. Debris sliding is common where the deposits have been undercut by streams. Slump-earthflow deposits in the Upper South Fork have contributed a small proportion of the historic landslide sediment volume (de la Fuente and Haessig 1993).

Glacial and Stream Terrace Deposit Terrane - This terrane occupies nine percent of the watershed (10,953 acres). These two distinct deposits were combined here since they have similar physical properties and landslide potential. The glacial deposits shown on Figure 3 are from Wagner and Saucedo, while those on the Geomorphic Terrane Map (Figure 4) are from the Klamath National Forest geology database. The glacial deposits were formed by glacial erosion generally confined to elevations above 4,000 feet. The largest deposits occur in the headwaters of the South Fork, East Fork, Sixmile Creek, and Cecil Creek. River terraces are usually situated from 100-500 feet above streams and rivers. Gold was concentrated in these deposits and many are weathered to a deep red color, particularly when exposed in hydraulic mine cuts. They are concentrated along lower portions of the South Fork and the East Fork. Both glacial moraines and stream terraces are unconsolidated, and prone to landsliding when they occur on steep slopes (e.g., valley walls or adjacent to streams).

Mountain Slope Terrane - This terrane occupies 70% of the watershed (83,463 acres). Rapid uplift created steep mountain side slopes with thin soils except near ridge crests where older residual soils have escaped erosion. Debris sliding of shallow colluvial deposits is the most common landslide process, resulting in landslides less than an acre in size. However, some of the largest recent land-

slides occur in this terrane. One of the best examples is the large debris avalanche which occurred in 1974 in an un-named stream on the South flank of Packers Peak (about a mile east of Rush Creek). Such landslides involve bedrock as well as colluvium, and are usually associated with structural weaknesses in the rock. Below 4,000 feet in elevation, the Mountain Slope Terrane which is underlain by granitic bedrock is often deeply weathered. Debris slides are common on steep slopes (>65%) in weathered areas, and where vegetation or soil has been disturbed.

Debris Basin Terrane - This terrane occupies one percent of the watershed (1,266 acres) and consists of steep fan-shaped basins which occupy headwaters of many tributary streams. They are described as fan-shaped, because many small drainages which begin near the ridge crest converge at a common point near the bottom of the basin, similar to the folds in a fan. These basins were formed by debris slide processes as the mountains were being uplifted. They are concentrated in the steepest parts of watershed, where soils are very shallow, and are usually less than 200 acres in size. Due to the steepness of this terrane, debris slides which occur can disturb streams for a considerable distance downslope.

SOILS

For analysis purposes, the Upper South Fork Watershed is divided into six subwatersheds (see Figure 11 - Stream Order and Subwatersheds Map located at the end of this chapter). Areas above 5,000 feet elevation consistently develop a deeper snowpack, and north and northeast facing slopes above 7,000 feet tend to retain snowpack late in the spring. Refer to the following table which displays subwatersheds of the Upper South Fork Salmon Watershed).

Table 4 - Subwatersheds

Subwater-shed	Acreage	% Above 5,000'	% Below 5,000'	Acres of N&NE Slopes Above 7,000'
SF Salmon Headwaters	26,528	72	28	2,100
Pet.Reach SF Salmon	23,709	31	69	117
EFSF Headwaters	21,326	76	24	433
Lower EFSF	10,106	21	79	0
Taylor Creek	11,709	52	48	72
Cec.Reach SF Salmon	25,462	13	87	0
TOTAL	118,840	46	54	2,722

Some of the older soils in the watershed survive as remnants on ridge crests and erosional surfaces. Rapid Pleistocene uplift removed most of these soils and developed younger soils on steep slopes. Soils developed on metamorphic rock are typically shallow to deep, gravely loams (deeper in areas where past landsliding has formed thick surface deposits). Those developed on granitic rock are shallow to moderately deep, gravelly, coarse sandy loams, along with some deep gravelly loams. Clay loams are found in areas where old erosional surfaces have been preserved. Soils on ultramafic rock are shallow to moderately deep clay loams to gravelly loams, with local deep gravelly loams.

An attribute derived from soil map units is Erosion Hazard Rating (EHR) (relative ranking of soil erodibility without vegetative ground cover). Low EHR soils are generally rocky on flat slopes and very high EHR soils are typically granitic on steep slopes. The amount of each EHR soil group in each subwatershed is displayed in Table 5.

Table 5 - Distribution of Soil EHRs by Subwatersheds

Subwater-shed	% Low EHR	% Moderate EHR	% High EHR	% Very High EHR
SF Salmon Headwaters	0	18	50	32
Pet.Reach SF Salmon	2	3	67	28
EFSF Headwaters	0	28	62	10
Lower EFSF	3	7	90	0
Taylor Creek	1	3	80	16
Cec.Reach SF Salmon	1	9	89	1

Soil erosion potential is related to detachability. Soil detachability is the relative ease that soil is displaced by rain drop impact and splash. Coarse

sandy loam soils are easily detached while those with higher clay content have lower detachability.

STREAMS

For this analysis, draws which show annual scour and are not perennial are called intermittent, and draws which do not show annual scour are called ephemeral. The accumulation of organic litter is used to decide if a draw is intermittent or ephemeral. If a channel is covered with a layer of decomposing duff or living vegetation, annual scour is assumed not to occur. If channel is covered by recent litter fall, annual scour is assumed to occur.

A sample of the watershed's streams have been field-checked to determine the upper elevation limit of annual scour. The remaining stream identification used from the Digital Elevation Model (DEM) stream identification program which best fit the field data. The DEM streams were transferred to USGS 7 1/2 minute quadrangle maps before being digitized. According to the digital information, there are 503.2 miles of streams in the watershed (290.6 mi. intermittent and 212.6 mi. perennial).

The streams were also identified by stream order. Headwater perennial streams are first order; when two first order streams are combined, they form a second order stream; when two second order streams combine, they form a third order stream, and so forth. The South Fork Salmon River downstream from the East Fork South Fork is a fifth order stream. Portions of the East Fork South Fork and the South Fork above the East Fork are fourth order. There are 7.0 miles of fifth order streams in the watershed, 13.8 miles of fourth order streams, 19.3 miles of third order streams, and the rest first or second order, or intermittent (see Figure 11).

Larger streams in the watershed have been subdivided into smaller stream reaches to display channel and fisheries habitat information. The channels are described as one of three types: bedrock, alluvial, or transitional. Bedrock channels are dominated by bedrock and are relatively resistant to channel changes caused by flooding and debris scouring. Alluvial channels have very little exposed bedrock, generally large flood plains, and are susceptible to changes caused by floods. Transitional channels have characteristics of both other channel types.

Table 6 contains a brief summary of the characteristics of the stream reaches used for this analysis.

Table 6 - Stream Channel Condition Summary

Stream Reach	Channel Description	(Mode) % Embed.	Primary Pools per 1,000'	(Mode) % Fines	(Mode) % Shade
SF SALMON RIVER*					
Upstream of Big Flat-	Alluvial	Unk**	Unk	Unk	Unk
Big Flat to Little SF-	Bedrock	Unk	Unk	Unk	Unk
Little SF to Blindhorse-	Trans.	>20	2.0	<10	<10
Blindhorse to Black Gulch-	Trans.	<10	2.1	<10	<10
Black Gulch to EFSF-	Alluvial	10-20	1.6	<10	<10
EFSF to Cecil Creek-	Trans.	<10	1.5	<10	<10
Cecil Ck. to St. Claire-	Alluvial	<10	2.0	<10	<10
St. Claire to Plummer-	Bedrock	<10	2.1	<10	<10
EFSF*					
Upstream of Sbmile-	Alluvial	<10	Unk		
Sbmile to Shadow-	Trans.	<10	Unk		
Shadow to Taylor Creek-	Trans.	<10	3.1	<20	<20
Taylor Creek to mouth-	Trans.	10-20	1.8	<20	<20
TAYLOR CK*	Trans.	>20	Unk	–	–
RUSH CK***	Trans.	10-20	Unk	–	–
CECIL CK		>20	5.5	<10	40-50
CRAWFORD CREEK	–	>20	0.9	<10	70-80
ST. CLAIRE CREEK	–	>20	5.1	<10	40-50

* Surveyed the summer of 1994; data not analyzed
** Unk = Unknown
*** Not Surveyed

BIOLOGICAL ELEMENTS

Biological elements are described in terms of matrix and patches. The matrix refers to a vegetative type which is dominant and most influential in affecting watershed processes and functions. In this watershed, the matrix exists in the form of mid to late successional true fir and mixed conifer forest (see Figure 9). Patch refers to other elements within the watershed, vegetative or non vegetative, which are relatively homogeneous internally but different from what surrounds them (either the matrix or other patches). Patches, which are generally smaller than matrix elements, occur throughout

the watershed, particularly at the higher elevations along the watershed boundary.

MATRIX

The matrix represents the predominant vegetation. Forty-four percent (52,300 acres) of the watershed is composed of a coniferous matrix. The matrix itself is structurally and compositionally variable due to diverse biological and physical conditions. The matrix is composed of true fir and mixed conifer stands. Average tree diameter within stands ranges from 11.0 to 25 inches dbh in the "small" size class, to over 25 inches dbh in the "medium/large" size class. Stands with open canopies are more common within the true fir stands, particularly along the edges of meadows. Within mixed conifer stands, encroachment of white fir and Douglas-fir results in most stands having canopy closures of at least 40%. The typing label, size and canopy closure given in parentheses represents averages associated with vegetative typing.

TRUE FIR

True fir stands compose 10% of the matrix and begin at around 5,000 feet in elevation (depending on aspect). White fir (*Abies concolor*) and Shasta red fir (*Abies magnifica var. shastensis*) predominate other species found within true fir stands (mountain hemlock (*Tsuga mertensiana*) and western white pine (*Pinus monticola*). Incense-cedar (*Calocedrus decurrens*), Ponderosa pine (*Pinus ponderosa*) and sugar pine (*Pinus lambertiana*) are often associated at the lower elevations. These other species tend to be locally abundant on the edges rather than within the heart of the forest stands. The true fir stands vary from old, slow-growing stands to young, vigorously growing stands. Few of them are multi-storied, except in patches where gaps have occurred in the stands and allowed new trees to become established. The dense stands accumulate large amounts of duff. Cytospora and mistletoe are prevalent in dense, older stands.

Stands are lumped by canopy closure (closed canopy >40% closure) and size (small - 6 to 25 inches in diameter, medium and large - greater than 25 inches in diameter).

Closed, Small (2G, 3G; 6-25" dbh, ≥40% canopy closure) - The structure of these stands is highly variable. They tend to be more vigorous at younger ages and lower densities in this class. They occur as isolated stands, rather than patches within larger diameter stands. At this stage in stand development, the understory begins to fade. The majority of the down woody material is less than three inches dbh.

Closed, Medium and Large (4G; ≥25" dbh and ≥40% canopy closure) - This type usually contains little ground vegetation. Heavy fuel accumulations are common, as are cytospora and mistletoe. Some pockets of regeneration or brush occur within openings created by overstory tree mortality. Snags are common within these stands. Dominant tree ages range from 140-300 years. At higher elevations, the stands tend to occur as long, narrow stringers as a result of past wildfires. Large contiguous patches are most common at lower elevations.

MIXED CONIFER

Mixed conifer stands compose 90% of the matrix, occur below 5,000 feet, and are composed of Douglas-fir (*Pseudotsuga menziesii)*, Ponderosa pine, sugar pine, Incense-cedar, and white fir. Sugar pine (*Pinus lambertiana*) is concentrated in a band from 3,500-4,500 feet. Douglas-fir/ ponderosa pine (*Pinus ponderosa*) associates occur at lower elevations. The hardwood associates are canyon live oak (*Quercus chrysolepis*) on poor sites, and black oak (*Quercus kelloggii*) and pacific madrone (*Arbutus menziesii*) on productive sites. Largely as a result of fire suppression, these stand tend to be dense and multi-layered. Understories composed of Pacific yew, live oak, madrone, black oak, white oak, and/or chinquapin are usually found in the lower elevation ranges(below 4500 feet),in or along riparian areas, sheltered canopies, or where site productivity is higher.

Some pure stands of conifers do occur but are usually smaller than 50 acres. Stand locations are dependent on aspect, elevation, and site productivity:

- Knobcone Pine --South aspect in areas with frequent fire intervals
- Douglas-fir --lower elevations and northerly aspects
- Ponderosa pine --lower elevations and southerly aspects
- Gray pine --lower elevations and southerly aspects on serpentine soils.

Closed, Small (2G, 3G; 6-25" dbh, ≥40% canopy closure) - The stand structure is highly variable;

more vigorous at younger ages and lower densities in this class. They occur as isolated stands, as well as patches within larger diameter stands. At this stage in stand development, the understory begins to fade. The majority of the down woody material is less than three inches dbh.

Closed, Medium and Large (4G; ≥25" dbh and ≥40% canopy closure) - This type usually contains little ground vegetation but heavy fuel accumulations are common, as are cytospora and mistletoe. Some pockets of regeneration or brush occur in openings created by overstory tree mortality. Snags are common within these stands. Dominant tree ages range from 140-300 years. At higher elevations, the stands tend to occur as long, narrow stringers as a result of past wildfires. Large contiguous patches are more common at lower elevations.

PATCHES

Scattered (Open) Tree Stands

These are stands of conifers (true fir, Douglas-fir, or mixed conifer) that have a low percentage of canopy closure. Hardwoods are generally not present or do not contribute to canopy closure. Grass, forb and/or brush understories are present.

- Scattered, Small Size - (3P; 11-25" dbh, 10-39% canopy closure, 31,200 acres, 26% of the watershed). These open stands tend to be associated with meadow complexes, rocky or otherwise poor soils, are generally vigorous, and contain low levels of fuels accumulation.
- Scattered, Medium and Large Size - (4P; ≥25" dbh, 10-39% canopy closure, 17,200 acres, 15% of the watershed). These even-aged stands sometimes occur adjacent to or within meadows and result from poor or rocky soils, dry aspects, and poor water availability.

Plantations

Defined in two groups:

- 0-20 Years Old - 1,400 acres (1% of the watershed) - These mixed species stands range from 5-40 acres in size. Trees have crowns full to the ground and range in height from 1 to 30 feet. A grass/forb component exists between trees, with scattered young shrubs, and hardwood sprouts. Scattered snags and hardwoods remain from previous stands.
- >20 Years Old - 2,200 acres (2% of the watershed) - These stands are dominated by Douglas-fir or ponderosa pine. White fir and Incense-cedar, along with deerbrush and snowbrush have been naturally established.

Hardwood Stands

Approximately 1,000 acres of hardwood stands (black oak and/or madrone) are found in the watershed.

Non-Commercial Forest

A total of 7,100 acres (6% of the watershed) of non-commercial forest (canyon live oak, white oak, gray pine, and a small amount of knobcone pine) exists within the watershed.

Canyon live oak stands occur mainly on rocky, south-facing, steep slopes at lower elevations, and include scattered conifers. The understory typically consists of grasses/forbs and occasional pockets of deerbrush which is associated with pockets of soil lower on the slopes. The pure live oak stands vary from sparse to very dense and the size of the live oaks varies from a large mast producing tree form to dense small diameter shrubby stems.

Montane Shrub Communities

A total of 7,100 acres (6% of the watershed) of montane shrub community is present in the watershed. The community usually dominated by brush and scattered conifers, but species may vary along an elevational gradient and may integrate with each other. Position along the elevational gradient varies by aspect. High elevation species may be found lower on north aspect slopes.

The occurrence of *Prunus* and manzanita is quite variable along the elevation and aspect gradients, often interspersed with one another. There are a number of other shrub species in association, such as gooseberry and huckleberry oak.

Curl-leaf mountain mahogany tends to occur at the highest elevations (e.g., on ridge tops) in a decadent condition, and includes some scattered conifers. Plants are typically old, large, and decadent, however, some regeneration does occur along the edge of pine stands and on rocky slopes. *Prunus* occurs on open areas and on sites with little soil development. Pinemat manzanita usually forms a dense mat along the ground or sprawls over rocks, generally at higher elevations. Green leaf manzanita is widespread and where this species associates with *A. patula* intermediate forms occasionally occur where the plants are

procumbent to erect. *Ceanothus* species usually occur in areas of deeper soils. Snowbrush occurs at higher elevation and is slow growing and mature plants are often deeply rooted. Deerbrush occurs at the lowest end of the elevational gradient.

Riparian Areas

A riparian area is the transition between the aquatic and the adjacent terrestrial ecosystem. It is characterized by distinctive soils, vegetative communities, and associated animal life. It occurs near perennial and intermittent streams, wetlands, seeps, bogs, springs, wet meadows, ponds and lakes. The ecosystem exists because water supplied exceeds that available to uplands and is sufficient for the growth of water-loving vegetation.

The watershed contains 89 miles of fish bearing streams, 123 miles of perennial, non-fish bearing streams, 291 miles of intermittent streams and several high mountain lakes and meadows. Riparian areas form an extensive and dynamic network of connectivity and habitat throughout the watershed and link the lowest and highest portions of the landscape. The extent and composition of the riparian zone is dictated by adjacent slopes, geology, elevation, stream gradient and other physical parameters. Hence the width and composition of the zone varies with progression up or downstream. Tree forms dominate the riparian vegetative types at the lower and mid-elevations. Changes in species composition reflect changes in site parameters and elevation. At upper elevations, tree forms often yield to riparian shrub and meadow (grass/forb) complexes.

RIPARIAN VEGETATIVE COMPLEXES

Riparian Tree Complex --This patch type is approximated by stream locations below 5,500 ft. in elevation. At the lower and mid elevations (<4,500 feet) and on harsh sites, hardwood species dominate. On more productive sites, extending upward in elevation to the upland meadows, conifer species dominate, but often in conjunction with varying amounts of hardwoods. Changes in species composition reflect changes in the site parameters and elevation. Riparian associations are complex and vary with conditions.

Riparian Shrub Complex --A total of 800 (<1% of the watershed) acres were identified as "riparian brush" and occurs in the upper elevation riparian areas.

Riparian shrub communities are extremely diverse, but typically are dominated by *Alnus sinnuate, Alnus tenuifolia, Cornus stolonifera*, with *Salix* as a secondary associate. The herbaceous component is also a very diverse assemblage of plants in the riparian area containing a large number of community types and individual species including some rare plant species. Salmon Mts. Wake Robin (*Trillium ovatum ssp. oettingeri*) is most often associated with this type.

Vegetative species within this type tends to be correlated with the amount of oxygen in the soil, which is dependent upon factors such as slope or gravel content. On a gradient from aerobic to anaerobic conditions, species occurrence is as follows:

- White alder (*Alnus rhombifolia*)/forb - association - Found on slopes or soils with high rock and gravel content.
- Tall willow (*Salix* spp.)/forb - association - (Tolerates anaerobic conditions to a degree), multiple species of *Salix*, have niches depending on level of water.
- Wet sedge (*Carex* spp.) - association - (Almost total anaerobic conditions). This community can be encroached upon by willow due to its ability to tolerate anaerobic conditions during part of the year.

Riparian reserves are designed to protect riparian-related processes. The reserve widths are increased as water progresses from intermittent channels to perennial flows to fish-bearing streams. Generally the width increases from the height of one site tree to a length of two site trees. All areas containing riparian vegetation, floodplains, inner gorges and unstable areas are included, therefore riparian reserves may encompass an area larger than the actual riparian area. The condition of riparian areas varies considerably, some have been impacted by past management activities and natural disturbances and others display almost pristine conditions (see Figure 12 - Riparian Vegetative Condition and Disturbance Regimes Map contained in the map packet). Impacts vary but disturbances may decrease riparian widths, alter species composition and age structure, and in some cases, totally remove vegetation. Many small order stream channels exhibit a high degree of shading in the riparian zone (70-80%), (see Figure 13 - Stream Shade Conditions Map contained in the map packet).

Low productivity sites are also prevalent in the watershed, impacting every dimension of riparian structure; species composition, average stem size and density.

Table 7 depicts current conditions of key riparian parameters. Refer to Appendix D - Riparian Shading Assumptions for a list of assumptions made in the development of these tables and categories.

Table 7 - Riparian Vegetation (Acres and % by Vegetation Type and Crown Closure)

Sub-basin	Interim Res.Ac.	Riparian Vegetation Acres (Percentages Within Parentheses)				
		1	2	3	4	5
SFH	5,207	1,238 (24)	247 (5)	2,840 (55)	532 (10)	351 (7)
PET	4,825	1,844 (38)	822 (17)	1,576 (33)	514 (11)	79 (2)
EFH	4,015	932 (23)	378 (10)	2,359 (59)	300 (8)	0 (0)
LEF	2,177	839 (39)	110 (5)	981 (45)	201 (9)	47 (2)
TAY	2,268	1,015 (45)	181 (8)	944 (42)	114 (5)	15 (1)
CEC	9,298	2,704 (51)	541 (10)	1,687 (32)	365 (7)	11 (0.2)
Total	23,790	8,572 (36)	2,279 (10)	10,387 (44)	2,026 (9)	503 (2)

Key to above:
1- Conifer dominated sites with conifer basal area >150 sq. ft., (usually over 200 sq. ft.), conifers >24" dbh, total crown closures 80% and greater.
2- Stands are currently densely stocked with conifers but small in size.
3- Hardwood dominated sites with less than 150 sq. ft. of conifer basal area; usually less than 100 sq. ft. Crown closure is variable, may be high if hardwood concentration is high. These are generally low sites, but exceptions may exist if wildfire (etc.) has reduced the conifer base and either time or silvicultural manipulation is necessary to recover this component. This information is available but it is not included. Generally, total fire disturbance on low site in any subwatershed is between 5-10%. Stand replacing fire will be much less.
4- Conifer component is generally small in size (<20" dbh) and stocking density is in the moderate range (40-70% in conifer crown closure). Each stand needs to be evaluated more critically at the project level, to determine if stand will fall into category 1, 2, or 3.
5- Other areas (generally labeled on map). Includes bare areas, knobcone pine stands, water, etc.

Sub-basin	Interim Res.Ac.	Stream Shading Mileages (Percentages Within Parentheses)			
		A	B	C	D
SFH	105	7.2(7)	36.4 (35)	39.6 (38)	21.4 (21)
PET	104	2.3(2)	19.5(19)	45.2(43)	37.2(36)
EFH	81	3.2(4)	21.1(26)	40.9(51)	15.3(19)
LEF	47	0.9(2)	4.4(9)	24.9(53)	17.3(37)
TAY	50	0.9(2)	6.6(13)	19.4(39)	22.6(46)
CEC	117	2.0(2)	16.9(14)	42.8(37)	55.3(47)
TOTAL	504	18(3)	105(21)	213(42)	169(34)

Key to above:
A- Scoured channels or floodplains - No shade.
B- <40% total crown closure.
C- 40-70% total crown closure.
D- 70+% in total crown closure.

Hardwood dominated sites account for 44% of the total riparian reserve area. Conifer dominated stands with 150-250 sq. ft. of conifer basal area occur over 36% of the riparian reserve area. Approximately 25% of the total riparian length has 40% or less canopy closure in stands adjacent to channels. One third (34%) of the watershed has canopy closure exceeding 70% in stands adjacent to channels, while 42% of the riparian length falls into the nebulous category of 40-70% canopy closure.

GRASS/FORBS

There are 1,270 acres (1% of the watershed) of this "Meadow Community" in the watershed. These areas were historically used for homesites and pastures in lower elevations where they support annual and perennial dryland grasses and forbs. In the higher elevations these areas are most likely wet or dry meadows. Within each meadow are several natural and commonly occurring complexes of plants. The following types are common wet, moist, and dry site community types in the Upper South Fork Watershed (going from wet to dry along a soil moisture gradient): wet sedge, wet sedge seral (with a mixture of grasses invading the community due to disturbance), Oatgrass/Clover, Kentucky Bluegrass/Yarrow/Cinquefoil, and Dry Sedge/ Needlegrass.

WATER

About 280 acres of water are found in the watershed (<1% of watershed). The majority of lakes occur in the Trinity Alps Wilderness, and range in size from less than one acre to over 100 acres. Most water bodies are small, shallow lakes, less than five acres in size. Water quality is probably excellent, although little information has been collected from these lakes.

Water also exists in the form of streams within the watershed. More information on pattern of water flow, water quality, etc. will be discussed in *Flows and Linkages* section of this document.

BARREN AREAS

Within the watershed, 2,700 acres (2% of the area) are barren. Barren areas include ridges, talus slopes, rock outcrops, and other areas which have less than ten percent vegetative cover. Parent material is usually in association with granite, limestone, or serpentine, which influences vegetative species composition. These "barren" areas are often areas of high species diversity, including both shrubs and herbaceous vegetation.

HUMAN ELEMENTS

Human elements are those distinct human-caused activities, facilities, or structures that create an altered patch to the vegetation or landforms. These elements are point-specific such as mining or landfill activities, campgrounds, or linear or corridors such as roads or trails.

MINING

Historic hydraulic mine sites, which created altered patches in the watershed, are still evident. These mine sites comprise 500 acres in the Upper South Fork watershed. These areas are identified as human-created barren areas. The topsoil and subsoil were hydraulically mined and washed downstream, leaving behind mounds of cobble sized material and exposed bedrock with little soil and very poor conditions for growing vegetation.

The majority of the hydraulic mined areas are along the South Fork Salmon between Rush Creek and Gibson Gulch. Smaller mined areas are present along the South Fork Salmon near Cecilville, the South Fork Salmon between Big Flat and Rush Creek, and the East Fork South Fork between Shadow Creek and Taylor Creek.

LANDFILL

The removal of vegetation and subsequent backfilling of the dump, create an altered patch in the vegetation. There was one landfill operating under a special-use permit within the watershed. Siskiyou County operated the landfill until 1994 when it was closed due to noncompliance with Federal landfill regulations. The landfill is located within the Crawford Creek subwatershed near Station Gulch.

ROADS

Roads were identified as being corridors which facilitate the movement of humans to, from and within the watershed. The Upper South Fork Salmon River Watershed contains approximately 221.2 miles of road. There are 30.5 miles under Siskiyou County jurisdiction, 7.3 miles under private jurisdiction, and 183.4 miles (including temporary roads) under Forest Service jurisdiction.

County roads provide primary access to the watershed, and most were constructed near main stream courses. These roads are maintained throughout the year for user comfort and safety. Road construction standard for most of the miles was double lane, ditched, either asphalt or chip seal surface and fair alignment, resulting in larger cut and fill slopes.

Private roads provide access to residences and are maintained by those individuals. These roads were generally constructed as low standard, native surface roads.

Forest Service system roads within the watershed were constructed for the administration of National Forest lands. Public use has been allowed by the Secretary of Agriculture on most roads. Travel access management strategies are used within the watershed to minimize resource-use conflicts. These conflicts may include special wildlife considerations, erosion related water quality concerns, or public safety. Historically, most of the roads are managed to provide year-round access.

The following table displays miles of road by management activity.

Table 8 - Travel Access Management Mileages

MANAGEMENT ACTIVITY	MILES
Year-round Closure	9.4
Seasonal Closure	83.5
Open	128.3

Temporary roads are those roads on National Forest land which were constructed to provide access for a single use, such as, access to a residence, mining claim, water source, disposal site, harvest unit, etc.

Majority of the Forest System roads were constructed prior to 1980 under timber sale contracts with the use of purchaser credits. Other than timber, the roads also provide for other Forest use and management activities, such as recreation, mining, law enforcement, and fire prevention and suppression.

These roads often traversed steep side slopes (50%) within granitic and serpentine soils. Side casting (i.e., excavate and side cast without compaction) was the normal technique used during construction. The earlier dated roads were generally constructed 14-16 feet wide, in sloped or crowned, unsurfaced, with turnouts, ditched, and with drainage structures. The later dated roads were generally constructed to 14 feet wide, out sloped, unsurfaced, and with minimum drainage structures.

Table 9 displays road miles by road template and surface type (see Figure 14 - Road Template and Surface Type Map).

Table 9 - Road Miles by Design Classification

ROAD TEMPLATE	SURFACE TYPE	MILES
Crown	Chip Seal	4.5
Crown	Pavement	22.1
Inslope	Native	23.9
Inslope	Pit Run	27.1
Inslope	Pavement	0.1
Outslope	Chip Seal	1.6
Outslope	Native	121.3
Outslope	Pit Run	20.6
TOTAL	-	221.2

In order to reach the desired road location that met management objectives, grades often ranged between 6% and 14% with occasional short pitches exceeding 14%.

Forest system roads are categorized into three functional classifications, they include; arterial, collector, and local. Forest system roads within the watershed are either classified as collector or local roads. The main County road which travels through the watershed is considered an arterial. Table 10 - Function Classification Mileage shows the mileages by classification and jurisdiction.

Table 10 - Functional Classification Mileage

CLASSIFICATION	MILES	JURISDICTION
Arterial	22.5	County
Collector	71.2	County & FS
Local	127.5	FS & Private

Forest Service road maintenance is grouped into five maintenance levels (see Figure 15 - Road Maintenance Levels and Closures Map contained in the map packet). Most roads within the watershed are maintained to Level 2 or Level 3 standard. Level 2 roads are those roads maintained for high clearance vehicle use, while Level 3 roads are maintained for passenger car traffic. Level 1 roads are those roads closed to vehicular travel on a permanent or seasonal basis. Maintenance levels higher than 3 are assigned to roads that have paved or well graveled surfaces and fair alignment.

Road maintenance is accomplished in several ways. It is done through timber sale contract requirements, Forest Service crews, and service contract. The amount of maintenance accomplished each year within the watershed is declining because of reduced maintenance budgets as a result of inflation, and reduced timber sale contracts.

The following table displays miles of road by maintenance level (see Figure 15).

Table 11- Maintenance Level Mileages

LEVEL	MILES
1 (Closed)	7.8
2 (High Clearance)	147.5
3 (Passenger Car)	36.1
4 (Other)	3.8
5 (Other)	26.2

Many of the roads within the watershed have stabilized over the years, both cut slopes, and fill slopes may be vegetated. Erosion is limited to the road surface and is generally considered minor. Often erosion is triggered by intense seasonal thunderstorms, however severe erosion problems associated with roads may be chronic, and generally can be traced to one or several causes (e.g., geometric design of the road, road grades, surface type, soil

type, road location, steepness of terrain, inadequate drainage structures, road location, lack of maintenance, or vehicle use during wet weather conditions). For a detailed listing of existing road status, refer to Appendix E - Existing Road Status.

TRAILS AND TRAILHEADS

Trails were identified as being corridors which facilitate the movement of humans to, from and within the watershed. Trailheads are simply the terminus of the trail(i.e., start or finish). Access to and from the wildernesses is provided by a 180 mile trails network.

TRAILS

Trails can be broken into three basic types:

Primary trails provide access to a destination (such as Wilderness). There are 68 miles of primary trails in the watershed (e.g., Deacon Lee, Caribou Basin, and Pacific Crest Trails.

Secondary trails provide non-destination access. There are 64 miles of secondary trails.

Inactive Reserves are trails which are not currently being maintained. There are 48 miles of inactive reserve trails.

TRAILHEADS

Two types of trailheads exist within the watershed: 1) developed (with a toilet and picnic tables such as Big Flat); and 2) those having only a trailhead sign board and possibly a visitor register (Deacon Lee, Carter Meadows (PCT), Long Gulch, Trail Gulch, Harry Hull, China Springs, South Fork, and Fish Lake Trailheads).

CAMPGROUNDS

Campgrounds also create altered patches in the vegetation. There are five campgrounds within the watershed: Trail Creek, Shadow Creek, Big Flat, East Fork, and Carter Meadows group equestrian campsite.

Upper South Fork Watershed

Watershed Elements (Human)

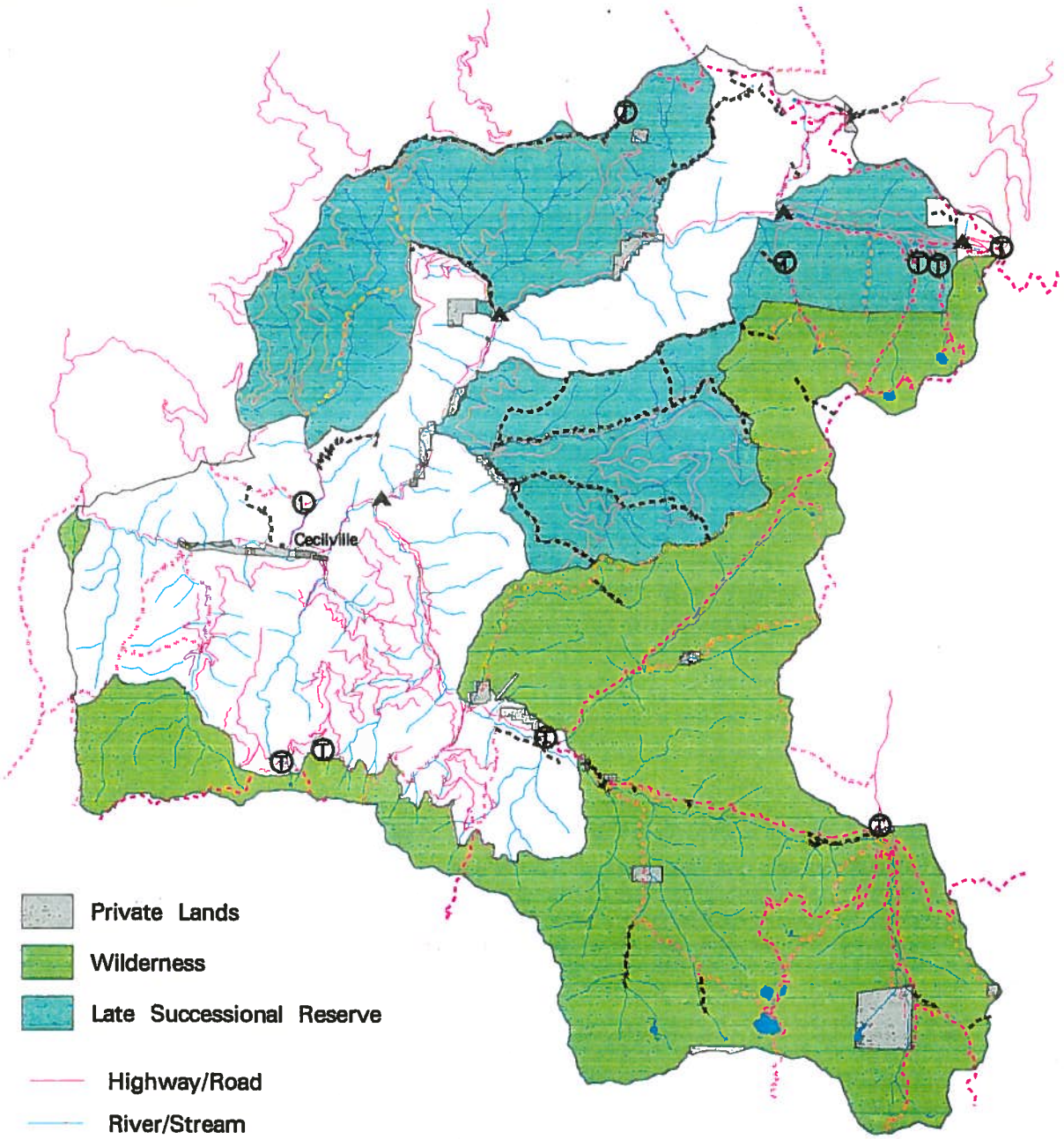


Figure 10

Upper South Fork Watershed
Stream Order & Subwatersheds

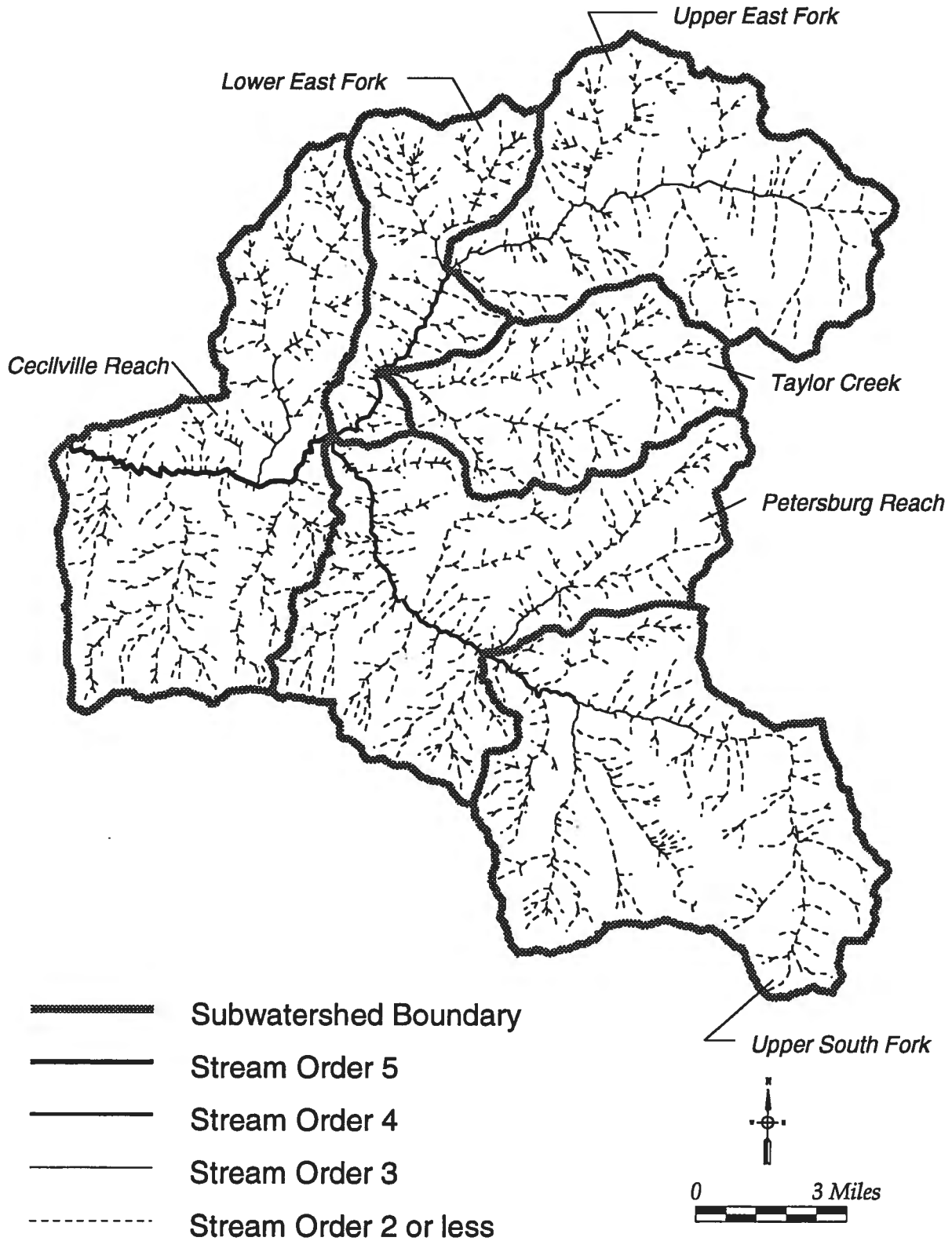


Figure 11

Chapter 3
Flows and Linkages

This chapter will deal with ecological phenomena that move across and interact within a watershed, or otherwise operate at a watershed level. These phenomena "flows", are correlated to some of the primary issues. A flow can be a group of wide-ranging mammals, or natural disturbance processes such as landsliding or wildfire. Many flows are not confined to the watershed and function or operate at a larger scale. Locations, elements, or physical structures that facilitate movement of phenomena between watersheds are "linkages".

Eight key flows are described in this section: (See Figure 16 - Biological Flows Map, and Figure 17 - Human Flows Map, located at the end of this chapter.)

- Water
- Sediment Production
- Fish
- Fire
- Diseases and Insects
- Terrestrial Species
- Livestock
- Humans

Flows were highlighted in this section if; a) they were likely to be critical for this watershed in the future, and b) they were likely to be affected by human activities or affect human activities.

WATER

CLIMATE

Approximately 90% of the watershed's precipitation occurs from October through May. Summer thunderstorms are not frequent but can be locally intense. Continuous rainfall records are from Orleans, but there are some rainfall records from Cecilville. The period of record for the Orleans station dates from 1904. The mean annual precipitation is 50.2 inches (ranging from 85.31 inches in 1983 to 22.43 in 1924). The Cecilville station has records from 1951 to 1979, adequate to establish a relationship between Cecilville and Orleans. Cecilville is consistently dryer than Orleans (average of 75% of the Orleans yearly percipitation). Generally Cecilville is the driest part of the watershed. Precipitation increases with elevation (see Figure 18 - Precipitation, Elevations, and Aspect Map located at the end of this chapter).

Typically the precipitation falls as snow above 5,000 feet elevation and as either rain or snow below 5,000 feet. Rain on snow events, which can cause more runoff than either rain or snowmelt alone, are frequent below 5,000 feet but can occur above 5,000 feet. The larger floods are generally attributed to rain on snow events although not all rain on snow results in heavy runoff. Snow persists into late summer typically on north and north-east aspect slopes above 7,000 feet in elevation. In some years patches of snow persist until the following winter.

STREAM FLOW

Stream flows are highest in winter and spring and lowest in late summer or early fall. Largest peak flows occur between November and March. Winter flows are only slightly greater than summer flows when precipitation is dominated by snow across the watershed. Intense warm storms occur in the winter with rain above 5,000 feet. These storms result in high runoff especially when rain falls on snow. High stream flows are not sustained for a long period of time following these storms. Spring and early summer streamflow is more dependent on snowmelt when high flows are sustained for long periods.

Streamflow resulting from summer thunderstorms can be high in smaller streams, but has a relatively small impact on flows of larger streams.

A long-term record of Salmon River stream flow (near Somes Bar) dates back to 1912 and a short record on the South Fork Salmon (near Forks of Salmon) from 1959 to 1965 is available. The average flow for the period of record in the Salmon River is 1,774 cubic feet per second (cfs) (1,285,000 acre-feet per year). The yearly flow av-

erages range from 3,750 cfs in 1974, to 339 in 1977. A two year flood flow (flows which are exceeded every other year on average) is 18,000 cfs, and base flows average about 150 cfs. Summer base flow in 1992 (an exceptionally dry year) was 93 cfs, and in 1993 (the wettest year since 1986) was 204 cfs.

Contribution of Upper South Fork Watershed to Salmon River flows are about one-fourth the total (based on watershed size and precipitation patterns). Therefore a two year flood for the South Fork Salmon River Watershed is about 4,500 cfs and average base flow is about 38 cfs.

South Fork of the Salmon River streamflow is about twice the flow of the East Fork in early summer, even though the watersheds are roughly the same size and have similar topography and precipitation. The persistent snow fields of the South Fork are greater than the East Fork. The flow difference decreases late in the summer and mid-winter flows are about equal.

STREAM TEMPERATURE

Two recording water temperature gages, one in each fork, are located in the Upper South Fork Watershed. The maximum temperature of the East Fork South Fork and the Upper South Fork equal in 1992 (24.2°C).

Summertime temperatures are likely 3 or 4 degrees cooler in the headwater streams than at the temperature gages, and about 1 degree warmer where the South Fork Salmon exits the analysis area.

WATER QUALITY

Turbidity is not regularly monitored in the watershed, however observed turbidity of the Upper South Fork streams is generally low and clarity very good (visibility sometimes exceeds). Clarity is reduced during and following storms intense enough to erode hillsides and stream banks adding sediment to the stream. During very intense storms and high stream flows, clarity is greatly reduced. The streams clear up within a few days following storms as the silt and clay are flushed and the larger particles settle out.

Chemical and biological water pollution can adversely affect water quality. Possible sources of water pollution can include dumps, old mines, spills, and inadequate sanitation.

Several old dumps located in the Upper South Fork Watershed, but none have known water quality concerns at this time. Station Creek Landfill was permitted between 1967 and 1994 by Siskiyou County. The County will monitor groundwater at this site. At two other old dumps (one at Petersburg and another at Limestone Creek) no water testing is planned.

The dominate form of mining activity in the Upper South Fork was placer, although there are a few abandoned lode mines. Lode mines pose a greater risk of contaminating water. The Salmon River mine, near Siphon Lake on the north edge of the watershed, was tested and harmful levels of contaminants were absent.

Three notable chemical spills (diesel fuel spills associated with mining, equipment accidents on the roads, and at administrative sites) have occurred in the watershed over the last ten years.

High levels of coliform bacteria have been detected in the Caribou Lakes area but not in other parts of the watershed. However, some level of natural pathogens are certainly present in all of the surface waters in the area.

This "flow" links with all downstream landscapes through the South Fork of the Salmon River, eventually with the North Fork of the Salmon River to form the Salmon River. The Salmon River is linked to the Klamath River and Pacific Ocean.

SEDIMENTATION

Sedimentation is characterized as one of two types, episodic or chronic. Episodic sedimentation occurs infrequently when the bulk of the sediment delivered during rare climatic events producing peak stream flow and large landslides. Large influxes of sediment are delivered to the stream system during these times, where it is temporarily stored, and eventually is moved through the system by subsequent, smaller peak flows. Landslides associated with these episodic events occur only in response to intense winter storms. Debris slides occur after antecedent precipitation conditions are met; slumps and earthflows occur after extended periods of high precipitation over several years.

The inner gorge terrane, slump-earthflow terrane, and the granitic mountain slope terrane produce most landslide sediment.

Chronic sedimentation coincides with frequent intense rains, rapid snowmelt, or rain on snow events. These events may occur several times a year. The sediment source is surface erosion with some contribution from small landslides and channel erosion. The amount of stream sedimentation which occurs is dependent on the intensity of the runoff event. Chronic sedimentation can occur during any time of the year, especially during the wetter months. It may also occur in heavy thunderstorm events.

Soils with a high erosion hazard rating are more susceptible to erosion. Soils formed from granitic rock types are most prone to high surface erosion rates. Actual erosion is dependent on soil cover (anything which protects the soil surface from eroding (e.g., living vegetation, vegetative litter and duff, rocks, or asphalt). Factors that need to be considered for chronic sedimentation in the Upper South Fork Watershed include: vegetative cover, roads (current design standard), past timber harvest (especially clearcut units close to riparian areas), prescribed fire and wildfire, and precipitation.

Sediment from large landslides is assumed to always reach stream channels, sediment from surface erosion and small landslide is frequently filtered or deposited before reaching a stream channel. The amount of sediment reaching a stream is dependent on the location of the sediment source, particle size, filtering mechanisms between the source and a stream, and intensity of runoff carrying sediment to a stream.

Sediment which reaches the stream system from upslope or is generated from channel scour can either be redeposited in the channel or on the flood plain downstream, or flushed from the stream system.

FISH

ANADROMOUS FISH

There are approximately 89 miles of anadromous and/or non-anadromous fish bearing streams in the watershed. The anadromous fish community includes fall and spring chinook salmon (*Oncorhyncus tshawytscha*), summer and winter steelhead (*O. mykiss*), coho salmon (*O. kisutch*), and Pacific Lamprey (*Lampetra tridentata*). The non-anadromous portion of the community includes Pacific brook lamprey (*Lampetra pacifica*), speckled dace (*Rhinichthys osculus*), Klamath small scale sucker (*Catostomus rimiculus*), marbled sculpin (*Cottus klamathensis polyporus*), rainbow trout (*O. mykiss*), and crayfish.

Anadromous fish have been observed in: Upper South Fork Salmon River, East Fork of the South Fork Salmon River, Saint Claire Creek (Ck.), Cecil Ck., Crawford Ck., Blindhorse Ck., South Taylor Ck., Long Gulch (Gl.), Blacks Gl., and Blue Gl. Summer steelhead and spring chinook salmon are USDA Forest Service designated sensitive species, and coho salmon and steelhead were recently petitioned for listing under the Endangered Species Act. The anadromous fish populations rely on aforementioned streams for one or more lifestages (migration, spawning, incubation, rearing, and holding). Adult spring chinook salmon are found in the system between July and October, adult fall chinook are found in the system from mid-October through early December, adult coho are found in the system from mid-December through January, adult summer steelhead are found July through May, adult winter steelhead are found November through May, and Pacific Lamprey are present April through June. Anadromous young are found within the system year-round, steelhead remain in the system up to three years and lamprey young (ammocete) remain in the system up to seven years before outmigrating to the ocean.

Reaches of Upper South Fork Salmon, East Fork of South Fork Salmon, Saint Claire Ck., Sixmile Ck., Trail Ck., Shadow Ck., Taylor Ck., Garden Gulch, Rays Gulch, Black Gulch, Rush Ck., and Little South Fork Ck., provide habitat for non-anadromous fish community. The distribution of the resident fishes in these creeks is unclear.

The habitat requirements for the different lifestages of salmonids and resident trout vary by season. Habitat attributes affecting all lifestages include: adequate flow levels, shading, water temperature, water quality (dissolved oxygen, turbidity, etc.), coarse woody debris, hiding cover, pool size and depth, and substrate condition. Habitat characteristics that favor the historical composition of all fish populations favor both the anadromous and resident species.

FIRE

Between 1946 and 1988, 421 fires were started in the watershed. High fire risk period coincides (May 15 through September 15) with greatest thunderstorm activity. Salmon River diurnal wind patterns can exacerbate fire behavior.

Lightening strikes have been the primary source of identified fire starts (358) in the watershed. The highest concentration of strikes is elevations above 4,000 feet (291), however, ignitions above 6,000 feet pose less risk than at the lower elevations and high elevation fires average less than one acre. Larger fires in the watershed occur in the 4,000 to 6,000 foot elevation range in various fuel types.

Human-caused starts (approximately 63) have generally been associated with dispersed recreation activities and/or mining operations. Forty-six percent of all human-caused fires were located below 4,000 foot elevation and 54% above. Most human-caused fires above the 4,000 foot elevation were recreation related (see Figure 19 - Fire Occurrence and Risk Zones Map contained in the map packet).

Fire spread can threaten adjacent watersheds and fire can spread into the Upper South Fork Watershed from adjacent watersheds.

There are two fuels related situations within the watershed that cause concern (see Figure 20 - Fuels Models Map contained in the map packet). Approximately 56,600 acres are classified as Fuel Model 8 and 40,300 acres are classified as Fuel Model 10 within the watershed (the larger the Fuel Model number, the greater the fuel load).

Fires in Fuel Model 10 are characterized as surface fires that have potential to become crown fires. Dead and down fuels contain high quantities of three inch or larger limb wood. This model also has high concentrations of live understory vegetation, creating a fuel ladder that promotes crown fires.

Taylor Ck./Garden Gulch areas are currently dominated by Fuel Models 8 and 10. Fuel Model 10 stands contain large amounts of dead and down material resulting from insect killed trees. Fuel Model 8 stands are currently transitioning to a Fuel Model 10 as insects attack and kill trees within these stands. The primary difference between Fuel Model 8 and 10 is the amount of dead and down and live understory vegetation present. Fuel Model 8 contains very little understory vegetation and lighter amounts of dead fuel on the ground.

Slope, fuel Model types, and 90th percentile weather information were utilized to derive fire hazard classes (Figure 21 - Projected Fire Hazard Classes Map contained in the Map Packet). The fire hazard map is a projected indication of resistance to control based on estimated flame length and rate of spread.

About 40,600 acres in the Upper South Fork area are classified as high fire hazard. The largest, most contiguous areas of high hazard are located northeast of I Am Up Ridge, in the Taylor Creek and Garden Gulch drainages and in the area north of the Cecilville Road from Grouse Point, east to Sixmile Creek.

DISEASE/INSECTS

BLISTER RUST

Blister rust (*Cronartium ribicola*) reached this watershed in the 1930s and it is widespread where both susceptible hosts (sugar pine and western white pine) occur. A second (alternate) host (e.g., gooseberry and currant) must be involved for the disease to complete its life cycle. The windborne rust moves from a perennial infection on sugar pine to annually cause infections on leaves of the deciduous currants and gooseberries. The rust usually intensifies on these plants during the spring and early summer. Years of heavy infection are strongly correlated with cool, moist conditions or the presence of fog during August through September. Infections are often found on the ridgetops where fog concentrates or lower on the slopes near stream bottoms, where conditions are moist.

DWARF MISTLETOES

Dwarf mistletoes (*Arceuthobium douglasii*, *A.campylodum*, *A.abietinum* f. sp. *concoloris*) are widely distributed across the watershed and are considered to be a serious disease agent. Upper South Fork Watershed dwarf mistletoes are found in Douglas-fir, ponderosa pine, and white fir. Seed dispersal takes place from midsummer to late fall. Horizontal spread is directly correlated to the height of the mistletoe in the tree. Physical evi-

dence of mistletoe includes aerial shoots, swelling of infected branches, and "witches brooms".

WESTERN PINE BEETLE
Ponderosa pine is the primary host for the western pine beetle (*Dentroctonus brevicomis*). The entire tree bole, up to an eight inch top, is attacked. Trees less than eight inches dbh are seldom attacked. This insect produces one to three broods per year from late spring to winter. Attacks are common in the summer and fall, and insects overwinter in the fall-killed trees. This insect can move into or from adjacent watersheds easily.

PINE ENGRAVER BEETLE
This bark beetle (*Ips paraconfuscus*) attacks small-sized pines, but will also attack tops of larger trees. The insects breed in green boughs. Two or three simultaneous generations are common and attacks begin in May and continue through September. The beetle overwinters in either the duff or litter on the forest floor or under the bark.

FIR ENGRAVER BEETLE
These engravers (*Scolytus ventralis*) attack tops, patches, and entire boles of true fir species concentrated in the upper elevations of the watershed. Mortality has been significant in Taylor and Sixmile Creek area. Fir engraver beetles are often associated with flatheaded borers. These insects breed in slash. Attacks are most common during July and August. Beetles often emit pheremones during successful attacks, attracting other beetles and cause group killings of true fir. For a detailed description of the important diseases and insects found in the watershed, refer to Appendix F - Diseases and Insects.

TERRESTRIAL SPECIES

Flows of terrestrial wildlife include: a) animals that use older seral stage vegetation as their principal habitat for foraging, reproducing, hiding, cover, and movement requirements (furbearers, such as marten and fisher, Northern spotted owl, and Northern goshawk), b) animals that utilize a wide variety of habitats for their requirements, generally cover a wide home range, and use very different habitats from season to season (e.g., blacktailed deer, Roosevelt elk, and peregrine falcon), and c) animals tied closely to riparian zones and the special habitats these areas offer. Dozens of terrestrial species depend on riparian habitats for some part of their life cycle, and many utilize these areas almost exclusively. Some, such as herpetofauna, are highly localized in their distribution; movement among individuals or between populations is very slow (e.g., tailed frogs, and pond turtles).

Numerous individual species could have been chosen to represent these three groups. Individual wildlife species have varying human values. The rationale used for choosing the wildlife species to analyze is as follows: a) Most species are either Federally listed as Threatened or Endangered, Forest Service designated Sensitive, or recognized as a species of concern, b) location information is available about the species regionally and/or in the watershed, c) the species is observable, recognizable, and seen within the watershed, d) the species is important economically, socially or aesthetically, e) the species is a "generalist", which could represent many other species and habitats, or f) the species is strongly associated with habitat types which are of agency and public concern. Each analyzed species met several criteria.

Habitat conditions for additional wildlife species are addressed in Appendix G - LSR Assessment.

GROUP 1:
Older Seral Stage Dependent Species
FURBEARERS - Fishers are dependent on multi-storied, mature and "old growth" conifer forests, with moderate to dense canopy closure and a high number of large snags and down logs. A high to moderate quality territory consists of 6000 to 9800 acres, 50 to 80 percent of which is made up of stands of large conifers with dense canopies. There have been numerous sightings of fisher within the watershed.

Martens are dependent on multi-storied mature and old-growth mixed conifer (especially white fir/ red fir) forests with moderate to dense canopy closure (60-100%). Generally, they occupy the higher elevations of the watershed, however they have been found at low elevations (even along the Salmon River). They are most abundant in forested areas adjacent to meadows or riparian corridors. Martens use travelways comprised of closed canopy forests to move between foraging areas. Home ranges in moderate to high quality habitat range from 1,400 to 1,900 acres in size. There have been at least five sightings of marten within the watershed. Marten and fisher travel through the

watershed unimpeded by physical or vegetative barriers.

NORTHERN SPOTTED OWL - The northern spotted owl, a Federally listed threatened species, resides year-round in the watershed. Habitats selected by northern spotted owls exhibit moderate to high canopy closure (greater than 60%), a multi-layered, multi-species canopy dominated by large overstory trees, and a high incidence of large trees with cavities, broken tops and other signs of decadence. These attributes are usually found in mature and "old growth" forests. Younger forest stands may provide the necessary structure and conditions especially if they contain remnant large trees, or if they contain medium sized conifers that occur as co-dominants with hardwoods. Owls often nest in the same grove year after year, and even the same tree is used if conditions remain consistent. Adults sometimes range one to one and one-half miles from the nest or roosting grove. Young are known to disperse over wide areas.

There are currently 20 known owl activity centers (17 pairs and three territory singles) within the Upper South Fork Watershed. Thirteen are located within the designated Late Successional Reserves (LSR). These owl territories are well linked by adequate dispersal habitat through the LSR, Wilderness, Riparian Reserves, and general forest. There are some limitations to dispersal within the watershed.

Linkages between this watershed and adjacent watersheds are available. Habitat is available for dispersal to the south into the Trinity Alps Wilderness through St. Claire, Black Gulch, China and Blindhorse Creeks. Rock and brush probably prevent dispersal along much of the remaining Trinity/Salmon divide. Dispersal to the north is possible through the LSR, which occupies the northern portion of the watershed. Habitat and known owl home ranges are generally not present to the west.

NORTHERN GOSHAWK - Goshawks, a Forest Service designated sensitive species, are year-round residents of the watershed, breeding from late spring to mid-summer. They typically nest in mature to "old growth" coniferous forest stands with open understory, and moderate to high canopy closure. Their nests are usually within one mile of water. The breeding season starts in late March or April and young are fledged in July.

Salmon River goshawks do not appear to have a high degree of nest fidelity. Nest groves are sometimes used in consecutive years (not for more than two or three years), but rarely is the same nest tree used. Nests are generally on north or east facing slopes. They may defend their nest grove and young. Goshawks often hunt along an edge between two habitat types.

There are six interim goshawk management areas identified in the watershed.

GROUP 2:
Wide Home Range Species

BLACKTAILED DEER - A resident deer herd and a migratory herd utilize the watershed. The migratory herd summers in the Wilderness portion of the Upper South Fork and East Fork, but migrates in the fall through the Trinity Alps. Overall populations size is not known but assumed to be large.

Summer range of the resident herd includes most of the watershed, but the higher elevation meadows, brushfields and riparian stringers are most important. Winter range of the resident herd is concentrated along Salmon River and warmer south facing slopes. The watershed portion north of the South Fork (Crawford and Shadow Creeks, Dry Gulch, and the south facing slopes along the river) are particularly important.

There are no specific fawning areas known within the watershed. However, deer usually use moist areas with good cover and succulent forage nearby. Small springs, alder bogs, and other riparian habitats are used. Although fawns have been observed almost anywhere in the watershed, some of the better fawning areas are: Upper Cecil Creek, Ray's Gulch, lower Shadow Creek, Upper Taylor Creek, Upper Sixmile, and the Carter Meadows area.

Deer move freely through the watershed because hiding cover is available. Large openings may be avoided during daylight hours, then crossed at night. Travelways include ridgetops and drainage bottoms. Migratory routes for deer leaving the watershed are from the Upper East Fork area, across the top of Rush Creek drainage, down the major ridges to the river, across and up the ridges in the Blindhorse, Ray's, and Cecil drainages, and out of the watershed.

PEREGRINE FALCON - Peregrine falcons, an endangered species, nest primarily on large cliffs, usually near water. Peregrines, year-round residents of the Klamath River basin, arrive at nest cliffs in February and the young fledge in early summer. Where they spend the winter is unknown. Peregrines cover wide areas, over several habitat types, while foraging. Perches, in prominent locations (high rocks, cliffs, snags) are important to peregrines as observation posts in foraging, territorial defense, and reproduction behavior.

Within this watershed, they use a variety of habitat types in good condition in the main South Fork or East Fork. They aerially hunt over the watershed, taking birds which enter their space.

Two eyries are known within the watershed, one along the South Fork, and the other in the East Fork of the South Fork above Shadow Creek.

ROOSEVELT ELK - Elk were reintroduced into the watershed in 1990 with 25 animals; an additional 25 were added in 1992. Elk once inhabited the Salmon River drainage, but are now primarily limited to this watershed.

Elk use the Upper South Fork year-round. Most of time they route through area within about five miles of the Petersburg fire station and stay together in one main herd. Small groups are moving out of the watershed to the northwest.

Preferred habitats are brushy plantations, meadows, hardwood- brush, wetlands, and riparian areas.

During the calving season cows primarily utilize wetlands and riparian areas.

Currently between 40 and 60 elk may be found in the watershed.

GROUP 3:
Riparian Dependent Species
TAILED FROG - This primitive frog occurs strictly in and along cold, fast-flowing perennial streams. They are the only North American frog highly specialized for life in cold, clear mountain streams. Use occurs in small headwater streams to small rivers the size of the Upper South Fork.

Adult frogs are terrestrial, hiding by day and foraging adjacent to streams at night. Tailed frogs have been found in Taylor and South Taylor Creeks, however, population levels are unknown. No other areas in the watershed were surveyed, but frogs were located in other drainages of the Salmon River.

Tailed frog movement is likely quite slow through the watershed, since individuals probably live within a few hundred yards of where they were hatched. Recolonization would be slow; especially in small headwater streams where no population exists upstream.

WESTERN POND TURTLE - This turtle is a species of concern, a Forest Service sensitive species. Turtles are found in permanent and intermittent waters (streams, lakes, ponds, rivers, and vernal pools).

Western pond turtles have been located in the Upper South Fork of Salmon River and may inhabit the main stem of the South Fork, East Fork, and they have been observed at riparian ponds near Petersburg.

LIVESTOCK

All or portions of four grazing allotments are present in the watershed. The permittees, number of cattle or horses, and season of use are listed by allotment in Table 12.

Table 12 - Allotments Within Watershed

ALLOTMENT NAME	PERMIT-TEE	# OF CATLE*	SEASON OF USE	APPROX. % IN WATER-SHED
Big Flat	Ethel Pettis	25	7/1-10/15	100
South Russian	Carl Hammond	4	7/16-10/15	10
Garden Gulch	William Marcy	27 Horses	3/1-11/30	100
Carter Meadows	Carl Hammond	125	7/16-10/15	70

* # of cattle includes cow/calf combinations.

The cattle using the Upper South Fork Watershed allotments enter from two locations, Cecilville Summit and Big Flat. The cattle are driven to specific meadows as outlined in the annual operating plans. The cattle remain in these meadows until moved by the permittee to another meadow. When

permittees move cattle it is usually along system trails, but sometimes cross-country and often on utilization trails maintained by the permittee. Cattle moving on their own often follow these utilization trails between feed areas within landscape basins. Horses using the Garden Gulch allotment graze on Forest Service land as they move between private lands belonging to the permittee. Horses move cross country and along the roads at their own will until the permittee either catches them for use or confines them to a fenced corral or pasture.

HUMANS

PRIVATE LAND AND PRIVATE USE

The community of Cecilville has a limited economic base, consisting largely of retirement income. Many residents are independently employed, some to supplement retirement earnings, others as sole source of income. Local employment includes work in the woods, mining and small ranching operations.

The town site consists of a Community Hall and a single proprietor operating the restaurant, bar, grocery store and gas station; along with a trailer park and rental cabins (Snipes Resort).

A single large parcel adjacent to Cecilville has been subdivided, and homes are being built. The possibility of further expansion of the community exists as additional lots are purchased. The proposed Wild and Scenic River boundaries have been designed so as to not hamper the expansion of the town.

A large placer mining operation is located on private property adjacent to town.

There are two large parcels of single ownership private property within the watershed. The largest is the parcel being subdivided, and the second is Josephine Ranch in the Trinity Alps Wilderness. The remaining private property is scattered throughout the watershed in parcels ≥40 acres in size.

The ranches in the watershed fall into three general categories. First are those operated by semi-retired year-round residents, who supplement their income with small scale ranching operations. The second are those with have absentee owners, and a caretaker running a small scale ranching operation. The third are resort ranches, with wilderness recreation and commercial outfitter guide business associations (Mountain Meadows Resort and Josephine Creek Lodge).

The ranches exist on previous homestead sites and consist of a mixture of pasture and timbered lands.

The movement of people in and out of the watershed is mostly confined to the roads and trails. The private property along the main river corridor is usually accessible all year with the other lands having seasonal access which is based on snow fall.

The Salmon River District has records of nine water transmissions under special use permits. There are two known transmissions that do not have special use permits, and a single known transmission that exists on private land. Water transmitted for private use is by both pipe and ditch. Within the watershed there are approximately 10 miles of ditch. Water transmissions have the following creeks as their source; Cecil Creek, Crawford Creek, Ketchum Gulch, Rush Creek, Taylor Creek, Long Gulch, Henry's Gulch, Garden Gulch, and East Fork Salmon River.

RECREATION

Both developed and dispersed recreational use occur in the Upper South Fork.

Developed Recreation

The developed recreation is primarily confined to campgrounds located within the watershed. Most people using developed sites participate in dispersed recreational opportunities during their visit. Most developed site users are residents of Siskiyou County.

The campgrounds in this watershed are generally used during the summer months. Most use occurs between Memorial Day and the end of fall hunting season. Trail Creek Campground has potable water and trash service, but campers at the other campgrounds are requested to pack out their trash.

Campgrounds are not extensively used, and Trail Creek and Big Flat receive the most use. The Carter Meadows Horse Camp Group Campsite receives high use and use is increasing every year. East Fork and Shadow Creek Campground

receive approximately six percent use during the season. A new campground is currently being developed at the upper end of Carter Meadows.

Dispersed Recreation
Three types of dispersed recreational opportunities draw people into the watershed have; Wilderness, river use, and general recreational use.

WILDERNESS - A portion of the Trinity Alps Wilderness (46,861 acres) is located within the watershed. A considerable amount of wilderness use is by people from urban areas and from out of state. Grizzly Lake is accessed by a difficult route which is not used by regular commercial outfitters. Caribou Lake Basin is accessed by a moderately difficult route that is not used by regular commercial outfitters.

The Russian Lakes Basin is accessed within the watershed by an easy route that is utilized by two regular commercial outfitters.

A trail network provides access to and from the wilderness. Trail use is divided into Administrative, Recreational, and/or Commercial. Use generally occurs from May 25 to October 27. The highest proportion of access into the Trinity Alps wilderness from the watershed occurs at the Big Flat Trailhead (27%). Carter Meadows, Long Gulch, Harry Hull, and China Springs trailheads receive moderate use (8-11%), and the remainder of the trailheads receive low use (3-4%).

The Deacon Lee Trailhead receives 25% of the access use for the Russian Wilderness.

Most of the stock use from this watershed for the Trinity Alps Wilderness occurs at the Harry Hull Trailhead.

RIVER USE - The South Fork Salmon River (Forks of the Salmon to the Cecilville bridge) is a "Recreational" component of the National Wild and Scenic Rivers System. The primary special use (kayaking) occurs in spring when water flows are adequate. The launch point for these river trips is usually St. Claire Creek.

GENERAL RECREATION USE - General recreation use includes such things as hunting, fishing, swimming, photography, biking, and sightseeing. This use occurs throughout the watershed, mostly from spring through fall. Winter use consists of cross country skiing, tubing and associated snow play. There is currently very little snowmobile use in this area.

Commodities
Recreation, lumber and wood products manufacturing, agriculture, mining, and government play a major role in local economy.

Forest based activities include timber harvest, timber stand improvement, and reforestation which have occurred within the watershed since the 1950s.

The flow of forest products is dependent upon stands of medium to large conifer trees (which provide merchantable timber) and an adequate transportation system.

Biomass and special forest products (mushrooms, boughs, medicinal plants, etc.) are becoming important as commodities being produced from the watershed.

Mining occurred on both private and National Forest land. It has generally been confined to the major stream channels. As of October 1, 1993, 202 mining claims are on file with Bureau of Land Management (BLM) within the Upper South Fork Salmon Watershed. These claims are held by 47 claimants (individual, partnership, or company) and each claim consists of approximately 20 acres. Fifty-five claims do not have current operating plans filed with the USFS, nor have they had any activity in the past few years. Table 13 - Mining Claims Within Watershed, displays the number and type of claims that have filed current operating plans.

Table 13 - Mining Claims Within Watershed

	DREDGE	LOAD	PLACER	TOTALS
CLAIMS	25	51	51	127
CLAIMANTS	11	2	7	20
ACREAGE	560	1,020	1,020	2,600

Five of the mining claims listed in the BLM records lie within the Trinity Alps Wilderness but they do not have current operating plans filed with the USFS.

Fourteen claims within the watershed are considered active (eight placer mines and six suction dredge mines). There is one active placer claim on private land near Cecilville.

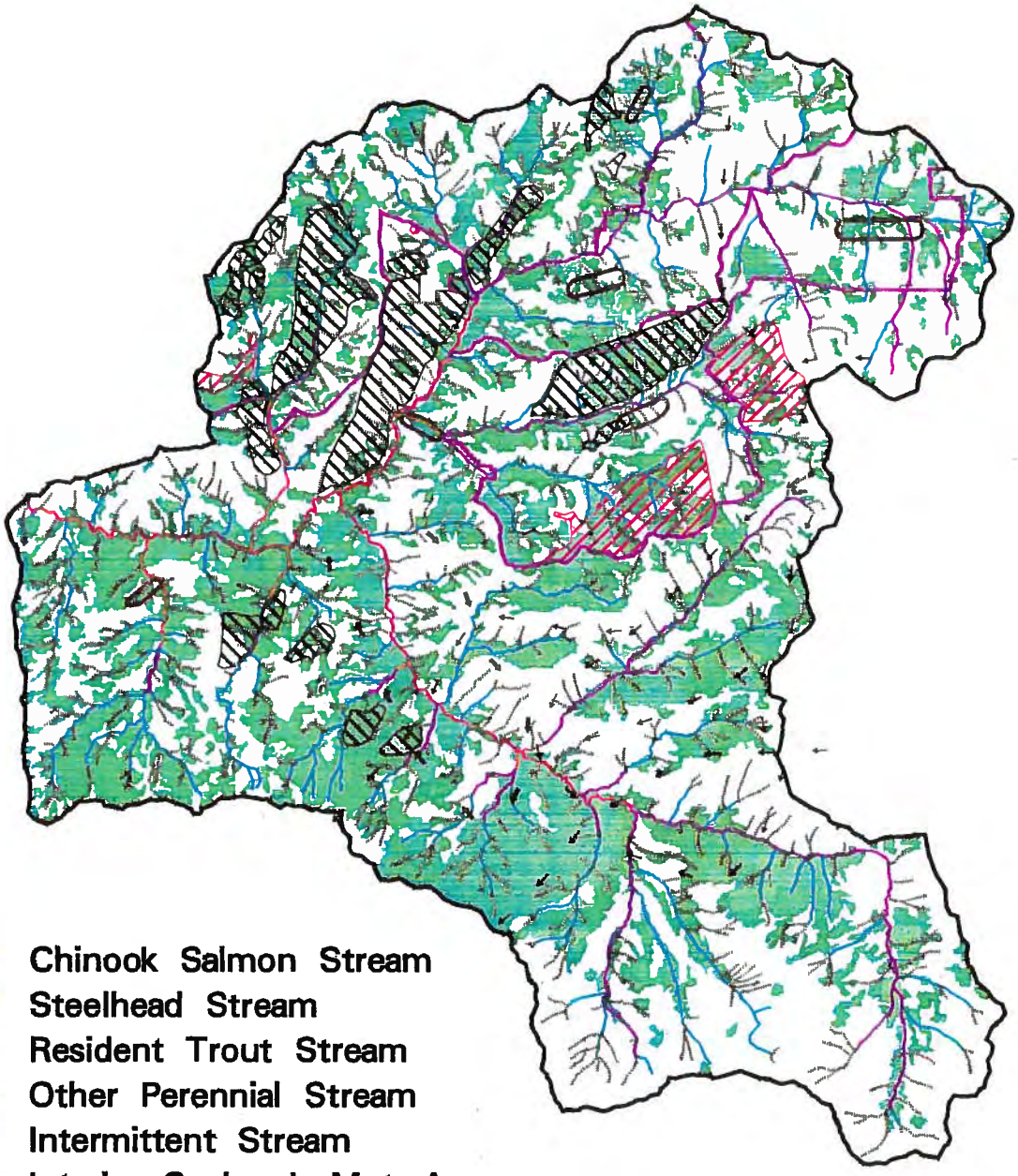
The local community depends on commodity based jobs that are provided within the Salmon River Watershed. Local businesses depend upon this employment for generating income at their establishments. The local economy has suffered recently due to the drop in jobs associated with commodity products.

Native Americans

Current use of the watershed by Native Americans is not well known. There are no known spiritual sites found within the watershed, however, there are some historical cultural sites generally located near the river corridor. There are no known focal points for subsistence gathering within the watershed. Dispersed subsistence gathering may be done for items such as deer, salmon, steelhead and trout, acorns, hazel nuts and hazel sticks, ferns, mushrooms, roots and bulbs, pine nuts, wild plums,and medicinal plants where those items occur (refer to Appendix H - Plant Species Traditionally Collected by Native Americans).

Upper South Fork Watershed

Biological Flows



Chinook Salmon Stream
Steelhead Stream
Resident Trout Stream
Other Perennial Stream
Intermittent Stream
Interim Goshawk Mgt. Area
Deer Migration Routes
Elk Use Patterns
LSR Boundary

Older Seral Stages
Moderate Insect/Disease Mortality
High Insect/Disease Mortality

N

0 3 *Miles*

Figure 16

Upper South Fork Watershed

Human Flows

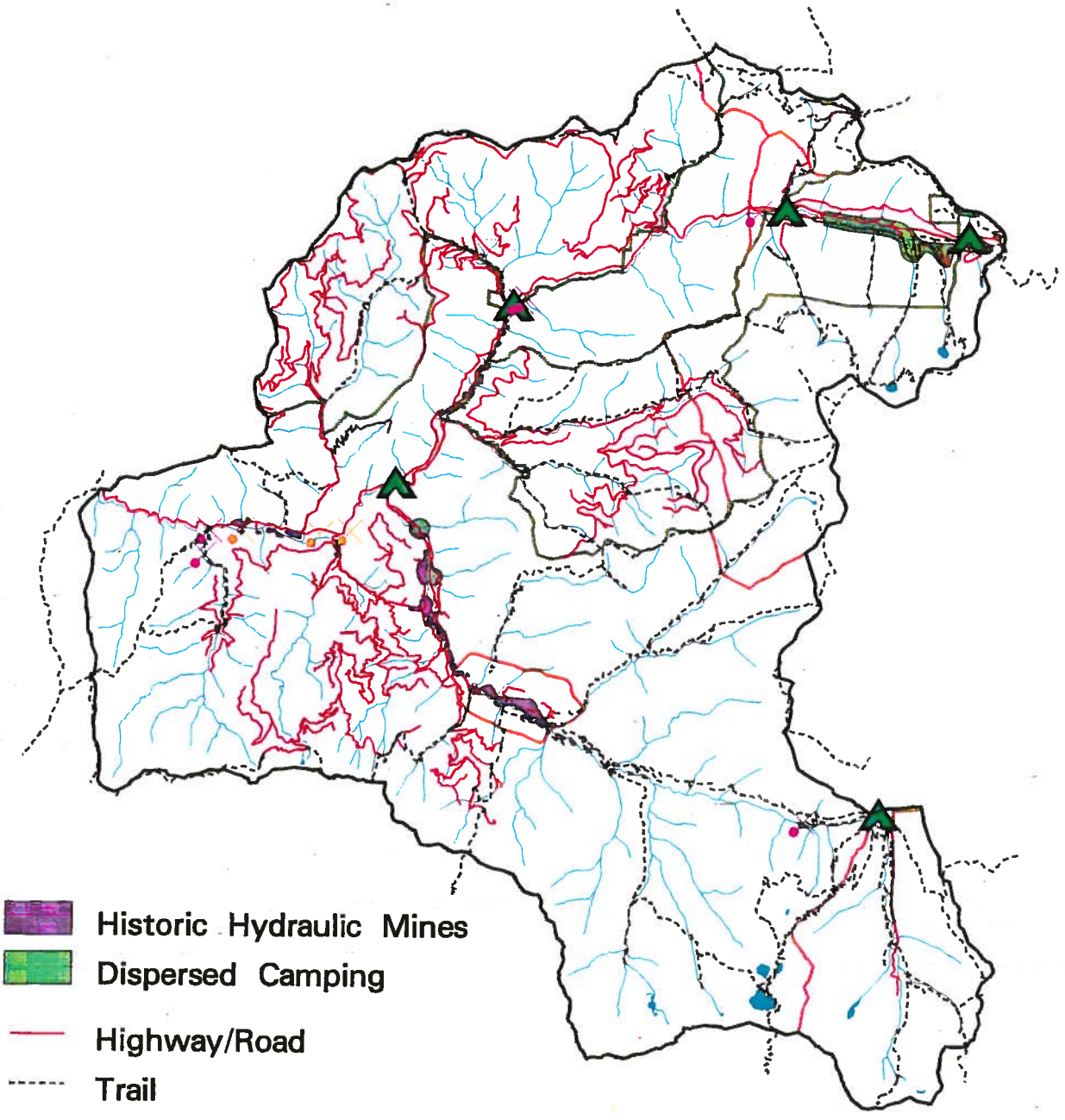
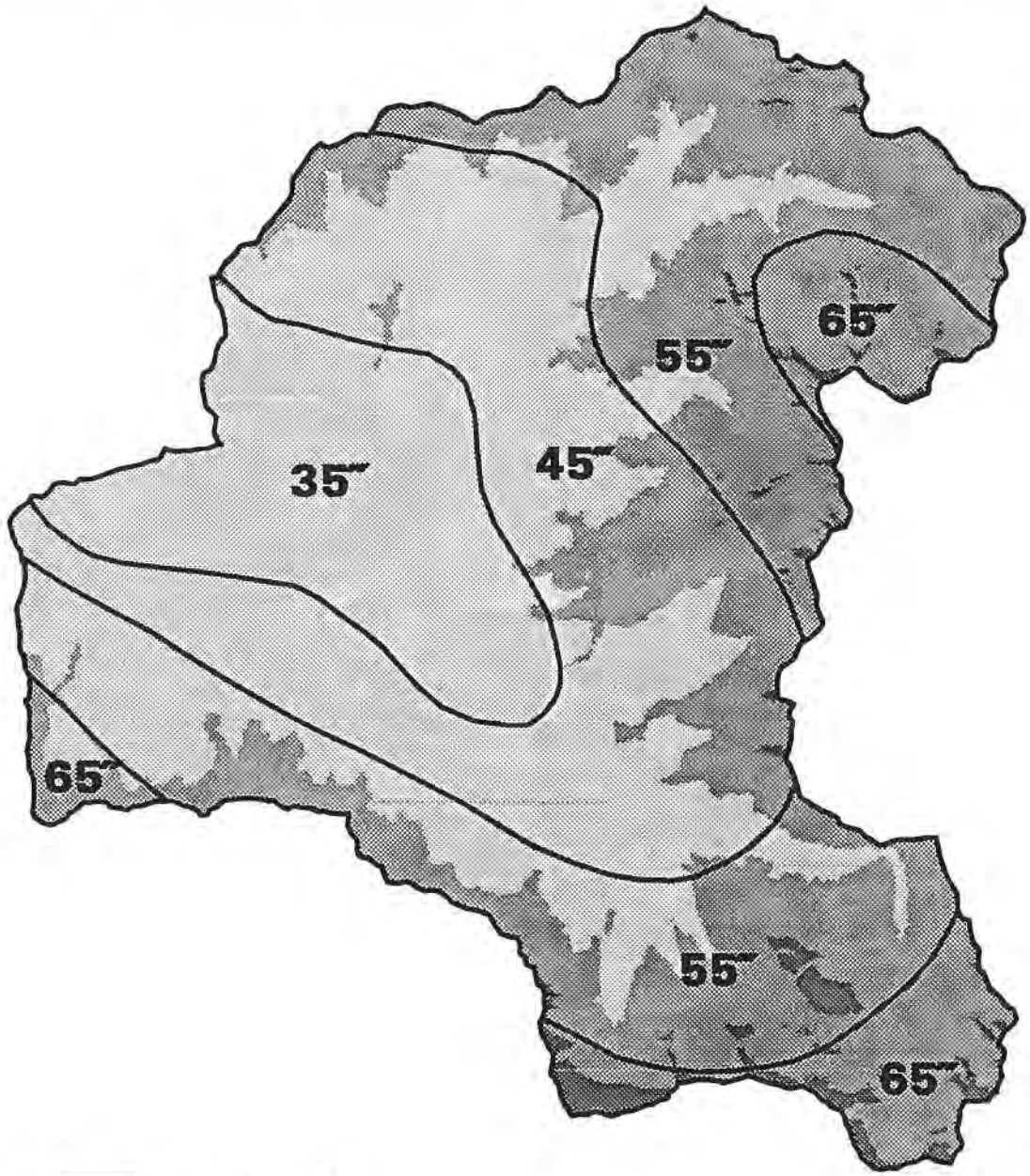


Figure 17

Upper South Fork Watershed
Precipitation, Elevations & Aspect



0 – 5000 Ft.

Above 5000 Ft.

N & NE Slopes Above 7000 Ft.

Isohyetal Lines

0 3 Miles

Figure 18

Chapter 4 - Processes, Interactions, and Trends

INTRODUCTION

This chapter provides an understanding of physical and biological processes, functions, and interactions which operate in the Upper South Fork of Salmon River, and their influence on the ecosystem.

The five categories of important processes and functions are: 1) Geologic, 2) Climatic and Hydrologic, 3) Fire, 4) Biologic, and 5) Processes Related to Human Activities.

GEOLOGIC PROCESSES

Key geologic processes in the Upper South Fork relevant to identified issues include soil formation processes, mountain uplift, erosion, sedimentation, and karst-forming processes.

The Upper South Fork is a steep area where soil is being formed from rock by mechanical and chemical weathering. The landscape is experiencing uplift, is subjected to periodic seismic shaking, and it is being rapidly eroded. Solution of bedrock by slightly acid groundwater is occurring in areas underlain by limestone.

The erosion process mobilizes soil, rock, and organic material on hillslopes, and delivers this material to stream channels. When this material reaches a stream channel, it is referred to as sediment, and the delivery process is sedimentation. Sediment includes both fine (sand size and smaller) and coarse material. Fine sediment causes turbidity in the water and is usually carried through the system during high flows. Some sediment is stored in the stream channel, but eventually, it is carried out of the watershed to the ocean. The complete process of erosion, storage, remobilization and transport to the sea is referred to as sediment regime. Modification of the sediment regime can change the timing, distribution, and magnitude of sediment production, and soil productivity.

Landsliding is largest scale erosion processes in the Salmon River Watershed and the primary mechanism for delivery of gravel, boulders, and logs to the river system.

Soil formation processes interact with vegetation and animal communities and influence their distribution. Soil processes and properties influence the rate at which water flows through the subsurface (permeability) and also the chemistry of the groundwater, which influences the cave-forming process. Mountain uplift in the Upper South Fork has created a landscape with 7,000 feet of relief and a maximum elevation of nearly 9,000 feet. Elevation strongly influences plant and animal species distribution. Erosion affects soil productivity on hillslopes, and substrate composition in streams. Sedimentation affects channel conditions, fish passage, and water quality. Erosion and sedimentation can remove riparian vegetation communities, by scour or deposition. Karst forming processes affect subsurface hydrology by influencing the rate at which water travels through a slope, as well as the temperature and chemical composition of the water. They also create unique wildlife habitats such as caves and bluffs.

Interactions between climate, soil formation, rapid uplift, erosion, and sedimentation at Upper South Fork determine the character of the streams which occupy the basin. These streams are rapidly flowing, with clean water and coarse substrate. These characteristics are favorable to salmonids.

Some geologic processes are directly affected by climate, hydrology, biologic activity, fire, and human disturbance.

Climate strongly influences rock weathering rates, soil formation, and the character and rate of erosion. Fire is a natural process which influences erosion and landslide rates. High intensity fire can kill vegetation, temporarily eliminating ground cover and root reinforcement in the soil, and remove

organic obstructions which temporarily store soil and rock on a slope. Intense fire often creates a water repellant layer in the soil which leads to rapid runoff and surface erosion. It also facilitates the mechanical breakdown of rock fragments due to rapid heating and cooling. Low intensity fire kills only low vegetation and removes some ground cover. Ash leachate affects groundwater chemistry. Biologic processes (e.g., plant roots expand fractures in the rock) facilitate mechanical weathering. Organic material decay changes groundwater chemistry, facilitating chemical rock weathering and formation of soil. Large logs influence channel erosion processes. Plant roots retard landslide activity, and plants provide ground cover to reduce surface erosion. Burrowing mammals, insects and worms create increase soil permeability, and contribute organic material which affects groundwater chemistry and its ability to dissolve limestone. Human alterations of the soil vegetation can have large effects on soil processes, erosion and sedimentation.

GEOLOGIC ISSUES

Four geologic issues were identified for Upper South Fork (refer to Appendix B - Issues): Geologic Setting and Unique Geologic Feature Issue, Soil Productivity Issue, Sediment Regime Issue, and Aquatic System Integrity Issue.

Unique geologic features in the watershed include the Limestone Bluffs (karst) at French and St. Claire Creek, Coffee Creek Stream Capture, and the Caesar Peak ice fields.

Interactions important to the karst at French and St. Claire Creeks include: water chemistry, surface erosion, uplift and stream incision, subsurface erosion and sedimentation where intercepted streams flow through caves. Earthflows on the northwest margin of the karst in French Creek have interacted with karst processes and created some unique landforms such as caves in landslide deposits. The portion of the landscape which drains into the karst system has a direct influence on the processes which operate there. This area is referred to as the "hydrologic influence zone", and its boundaries are determined by topographic, rock type, and structural features in the rock as well as the soil mantle. This term is used because it is not simply a topographic watershed divide. For example, the karst is exposed on the west flank of the ridge separating St. Claire Creek from Plummer Creek. Precipitation falling on the karst in the Plummer watershed travels through the karst and into the St. Claire watershed. Therefore, the hydrologic influence zone for this karst includes part of the Plummer drainage. Disturbances within the hydrologic influence zone affect the karst forming processes for considerable distances downstream. Thus, maintenance of hydrologic function in the karst requires that processes and functions within the influence zone not be significantly modified. As a result, the concept of Riparian Reserves applies to much of the hydrologic influence zone. Seismic activity provides a triggering mechanism for collapse of overhanging rock.

Streams capture on the South Fork occurred in response to historic glacial processes. A combination of a low drainage divide between the Upper South Fork and Coffee Creek, glacial erosion, and deposition of a moraine dam diverted the flow of Coffee Creek into the South Fork.

Persistence of the ice fields at Caesar Peak are influenced by elevation, aspect (topographic shading), precipitation rates, and summer temperatures.

Trends for unique geologic features include:

Limestone Bluffs - Karst processes are not likely to change other than in response to changes in climate or seismic activity. Modifications of the soil mantle or vegetative cover within the hydrologic influence zone affect karst processes. With the exception of the county road along the South Fork, there are no roads within the karst. However, the entire karst area south of the Salmon River burned in the fires of 1987. Most of the burn was of low intensity (about 90%), with patches of high and moderate intensity on west facing slopes in upper French Creek, and on east facing slopes in upper St. Claire Creek.

Coffee Creek Stream Capture Area - This feature formed at a time when glacial processes operated in the area. Due to the depth of the gorge which has been cut in the valley floor near Big Flat campground, it is not likely to shift its course back to Coffee Creek.

Caesar's Peak Ice Field - The persistence of the ice field is linked directly to climate. The size of the ice field is likely to increase and decrease in response to climate.

The **soil productivity** is dependent on the amount of water and nutrients plants are able to draw from the soil during the growing season. Available water capacity is dependent on soil texture and depth, nutrient supply depends on available top soil nutrients.

Soil texture is related to parent material and extent of rock weathering. Different rocks weather at different rates and to different products (e.g., granitic rocks generally form sandier soils) Soils in the Upper South Fork are relatively young and coarse, however, exceptions occur on ridgecrests and elevated stream deposits which have been stable for a long time and deep, fine textured soils have developed.

Any activity which removes the topsoil (e.g., landslides, hydraulic mining, road cuts, channel scour, and surface erosion) or causes compaction, decreases soil productivity. Actions which add fine material and nutrients to soil or decrease compaction improve productivity.

The possibility of high intensity wildfire with associated increased erosion poses a great threat to future soil productivity. Areas of highest risk for future wildfire are shown on Figure 22 - Projected Potential Wildfire Effects Map contained in the map packet. On-going site improvement projects in the Upper South Fork, located primarily in riparian areas and old hydraulic mined areas, will improve soil productivity.

The **sediment regime** is extremely important in the Upper South Fork due to linkage with anadromous fish habitat. Episodic sedimentation is a result of climatic events (the storms of 1964 and early 1970s) which trigger landslides and debris torrents. During these events, the combination of flood flows in streams and large sediment loads results in channel form and substrate composition change. The sediment delivered by landslides during floods is transported for considerable distances. Chronic Sedimentation occurs virtually every year in response to average climatic events. Surface erosion is the primary process. Chronic sedimentation can enter streamcourses during low flows, and persist in the stream. Sediment routing is movement of sediment through the stream system.

Between 1904-1988 landslides delivered sediment to the stream system at a rate of about 21.7 cubic yards per acre of land in the watershed (de la Fuente and Haessig 1993). Estimated sedimentation associated with surface erosion was 3.1 cubic yards per acre over the same time period. The Upper South Fork landslide rate (7.3 cubic yards per acre) was considerably lower than that for the Salmon River. Historic fires covered a smaller proportion of the Upper South Fork than the Salmon River as a whole (15% versus 55%) during that time period. Surface erosion in the Upper South Fork likely plays a larger role in the sediment regime than it does in the Salmon River as a whole. Surface erosion, particularly of granitic areas in the South Fork and Taylor Creek, plays an important role in channel conditions and substrate composition.

Episodic sedimentation (landsliding) is controlled by infrequent climatic events involving high levels of precipitation or snow melt. The occurrence of landslides is influenced by soil composition, vegetation, subsurface hydrology, mass distribution, slope gradient, seismic activity, and geomorphic setting. Disturbances in the watershed which modify the vegetation, soil structure, distribution of soil mass on the slope, hydrology of the slope can accelerate episodic sedimentation.

Certain geomorphic terranes in the Upper South Fork have produced a large proportion of the landslide derived sediment which entered the stream system during this century (see Table 14 - Total Landslide Sediment Volume and Yield Per Acre by Geomorphic Terrane, 1944-1988). The inner gorge yielded landslide derived sediment at a higher rate than any of the other terranes (28.7 cu/yds/acre). The relatively high yield of glacial terrane is a result of landslides in glacial deposits stranded on steep valley walls. Debris slides in landslide and glacial deposit terrane are important in French and St. Claire Creeks where such terranes produced many landslides in 1965 and 1975. New debris landslides have developed in the 1987 fire area of St. Claire Creek. The high yield (7.7 cu/yds/acre) of steep metamorphic mountain slope terrane is mostly from one large landslide which contributed about 83% of the total volume. This landslide occurred upstream of Rush Creek in 1974. Debris slides and snow avalanches on the steep walls of glaciated valleys (Long Gulch and Little South Fork) deposited debris on the floors of these valleys.

Table 14 - Total Landslide Sediment Volume and Yield Per Acre by Geomorphic Terrane, 1944-1988

Geomorphic Terrane	Landslide Volume	Total Area	Yield Yd^3/Acre
Slump-Earthflow	3,044	4,901	0.6
Mt. Slope Steep Gr.	17,099	6,942	2.5
Mt. Slope Gentle Gr.	5,168	14,850	0.3
Mt. Slope Steep Metam.	188,356	24,358	7.7
Mt. Slope Gentle Metam.	65,377	37,313	1.8
Inner Gorge	525,420	18,339	28.7
Debris Basin	1,728	1,266	1.4
Glacial/Terrace Deposit	65,180	10,953	6.0
Basin Average	**871,371**	**118,922**	**7.3**

Most of the landslide derived sediment originated on undisturbed lands from 1944-1988 as shown below in Table 15 - Total Landslide Derived Sediment From 1944-1988 by Disturbance Class.

Table 15 - Total Landslide Derived Sediment from 1944-1988 by Disturbance Class

Disturbance Class	Landslide Volume (Cu.Yds.)	Percent of Total
Fire	20,877	2
Harvest	4,359	1
Mines	69,200	8
Undisturbed	716,357	82
Roads	60,152	7

Various disturbance types have affected landslide production rate during two air photo intervals (1964-1965, and 1965-1975) as displayed in Table 16 - Landslide Production Rate by Disturbance Class. Roaded lands in Upper South Fork produced significantly more landslides than undisturbed lands in 1964-1965, and 1965-1975 respectively. Harvested lands produced no identified landslides from 1964-1965 (591 acres had been harvested at that time) and from 1965-1975, harvested land produced less landslide sediment per acre than undisturbed lands (when 4,359 acres had been harvested).

Table 16 - Landslide Production Rate by Disturbance Class

Photo Interval	Disturbance Class	Area (Acres)	Landslide Volume	Landslide Rate Yd^3/Ac.
1964-1965	Fire	3,121	20,877	6.7
	Undist.	114,133	164,023	1.4
	Road	609	15,421	25.3
	Harvest	591	0	0
	Mines	468	0	0
1965-1975	Fire	3,180	0	0
	Undist.	112,510	277,603	2.5
	Road	916	26,851	29.3
	Harvest	2,315	4,359	1.9
	Mine	468	0	0

From 1964-1965 (1964 flood), areas subjected to high or moderate intensity wildfire produced landslides which yielded 6.7 cubic yards per acre; unburned lands produced 1.4 cubic yards per acre.

Roading and timber harvest had a much larger effect on landslide production in the Salmon River as a whole compared to the Upper South Fork.

Landslides strongly influence vegetative patterns. Shallow debris slides on bedrock removes all vegetation and a vegetative patch is created which may persist over decades or centuries. This type of landslide occurs frequently along the South Fork between Big Flat and Rush Creek. Such slides often expose springs and create local riparian areas. At higher elevations these springs are inhabited by mountain beaver who burrow into the spring and influence its flow characteristics. When debris slides occur in thick soil or colluvium deposits, such as slump deposits or glacial moraines, a new patch in the vegetation is created, but may revegetate over a 10-30 year period. When slumps and earthflows move smaller vegetation often survives.

Landslides and associated debris torrents usually remove all vegetation in the stream channel area and transport large logs through the channel system to higher order stream segments. Soil is stripped from steeper reaches and deposition occurs where a floodplain flanks the stream. This process initiates the succession of plant communities, and the stream side areas acquire an even aged vegetative cover which may vary from deciduous vegetation to conifers. A large debris and rock avalanche (about five acres) occurred on Packers Peak in 1974 (see *Chapter 1*) and delivered about 157,000 cubic yards of rock and soil to the South Fork. Only about 15 moderate sized conifers were included with the debris. Since the

landslide, alders have become established along the stream course. The return of alders in 20 years re-established shade which keeps water cool on this steep south aspect slope.

Roads affect landslides by changing slope hydrology, mass distribution, and slope gradient. Road fills placed of steep draws in granitic terrane are prone to saturation and catastrophic failure.

Road culverts at stream crossings are important sediment sources in the Upper South Fork. The most common type of stream crossing in this watershed is culverts at stream level with road fill over the culvert. During an extreme runoff event, the capacity of a culvert can be exceeded by the amount of water and debris flowing down the stream. When this happens, the fill can saturate and fail catastrophically, or water can overtop the road with the potential of washing out the fill over the culvert, or travel down the road, damaging other sites. Depending on the size of the fill, this can be a very large and destructive amount of sediment released to the stream. When a debris torrent plugs a culvert, the upstream basin often servers as a sediment trap, trapping all the coarse material and large logs. Thus large wood is prevented from traveling through the system.

The culverts in the Upper South Fork were evaluated for their ability to pass floods. Of the 57 stream crossings with culverts in the Upper South Fork watershed, 11 are adequate to pass a calculated 100 year flood, ten are adequate to pass a 25 year flood, and seven can handle a ten year flood. The remainder (14) are designed for less than ten year floods. This means that about 29 culverts will be overtopped at least ten times over a 100 year period. Of particular concern are the 39N23 and 39N56 roads which each have three very undersized culverts (refer to Appendix K - Transportation System Interactions). Several fill failures in granitic terrane occurred on Road 37N07 in the Ray's Gulch area. Also, large culverts were blocked on the County road below Carter Meadow due to landslide initiated debris torrents upslope.

Chronic sedimentation enters the streams through surface erosion and the small-scale landsliding which occurs between major landslide events. Chronic erosion is dependent on soil erodibility (indicated by the Erosion Hazard Rating (EHR)), runoff intensity resulting from rainfall and snowmelt, slope steepness and length, and soil cover. Stream sedimentation is the amount of eroded material which actually reaches the stream system. The interactions of all of these factors are complex and estimating chronic sedimentation is difficult.

In undisturbed well vegetated conditions, the soil cover is high and erosion rates are low regardless of the EHR. On poor sites with less vegetation, soil cover is less and the potential for erosion is higher. Erosion rates are very low on undisturbed sites but increase with disturbance.

Flooding typically results in unvegetated landslide scars and bare stream banks and floodplains from channel scour and deposition. Disturbed areas can cause increased chronic stream sedimentation long after the event which created them. The amount of increased chronic sedimentation from these areas can only be estimated through a site-specific evaluation. For the history of channel scour see Figures 23-28 - Landslides and Scoured Channels (for various time periods) located at the end of this chapter.

Wildfire and prescribed fire may increase erosion by removing soil cover and decreasing infiltration. The amount of increased erosion is dependent on the fire intensity. A high intensity fire greatly increases erosion, a low intensity fire has a much less effect. Wildfires burn at varying intensities so have varying effects. Prescribed fires also have varying effects. A hot broadcast burn can have a similar effect to a high intensity wildfire while underburns are typically low intensity with little effect on erosion.

Surface erosion rates were measured on several sites in the Salmon River with erosion troughs following the 1987 wildfires; none of these sites are within the Upper South Fork Watershed. Erosion rates were as high as 26 tons per acre on very high EHR granitic soils following a very intense wildfire which caused water repellency. Erosion rates around ten tons per acre are common on very high EHR soils following fire which removes most of the organic cover. On high EHR metasediment soils, as much as eleven tons per acre eroded following intense wildfire. Erosion from low intensity fire areas (some organic cover and living vegetation) is elevated but much less than high intensity fire areas.

Surface erosion rates following a fire depend on the types of storms and the amount of recovery. The years immediately following the 1987 fires were not noteworthy for any severe storms. By the third year following the 1987 wildfire sediment measured in the erosion troughs dropped to less than one ton per acre. However the fourth year following the fire sediment trapped in the troughs increased to about two tons per acre following an intense thunderstorm. In subsequent years, erosion to the troughs dropped to levels almost too small to measure.

Roads alter soil cover, decrease infiltration of water, and change the downslope movement of water by routing water down the road surface or roadside ditch. Three potential erosion surfaces are created when a road is constructed: the cut slope, the fill slope, and the road surface. Erosion from the cut and fill slopes depends on the size, inherent erodibility, and vegetative recovery of the exposed areas. The size of the cut and fill varies greatly with the sideslope on which the road is built.

Road surface erosion depends on surface type, usage during wet weather, road gradient, and road drainage. Improving road surfaces through paving or rocking greatly decreases the road surface erosion. Improving the road drainage through reshaping, most commonly outsloping a previously insloped road, decreases erosion.

Chronic erosion from roads is difficult to measure but generally great compared to undisturbed slopes. Megehan (1972) measured surface erosion rates from areas disturbed by road construction 220 times the undisturbed areas, with undisturbed rates about 0.07 tons per square mile per day (about 0.04 tons/acre/year). However, road erosion is highly variable. Reid (1984) measured 130 times as much sediment from a heavily used gravel surface road as an abandoned road. Other variables also increase the complexity of estimating road erosion.

Trails act similar to roads except on a much smaller scale. There is usually little or no cut and fill slopes associated with trails. Any sedimentation concerns with trails are usually associated with the trail collecting water and acting as an ephemeral stream channel. No major trail erosion problems are known to exist in the Upper South Fork watershed.

The harvesting of timber has occurred in the watershed since the 1800s (associated with mining activity). Since 1955, timber harvest has occurred for the purpose of selling logs to sawmills. Harvesting methods include tractors, cable systems, and helicopters. Tractor logging generally causes the most ground disturbance and the greatest erosion potential, helicopter logging causes very little ground disturbance, and cable logging is somewhere in between.

Associated with timber harvest is the construction of roads and log landings and prescribed fire used to reduce harvest related fuels. Tractor slash piling is another technique used to reduce timber harvest fuels and can contribute to increased erosion. Timber harvest results in little increased erosion if adequate ground cover is left and skid trails properly drained. Recovery from harvesting operations occurs within a few years for harvest units. In the Upper South Fork watershed, past timber harvest operations are old and not considered to contribute to increased erosion over undisturbed areas.

Grazing can contribute to hillslope erosion if areas are overgrazed or trampled excessively. Generally in the Upper South Fork watershed increased erosion from grazing is not a concern due to little overgrazing and only small trampled. In the Siphon Lake area some areas are almost devoid of vegetation and show high rates of erosion and stream sedimentation.

Historic mining operations, especially the old hydraulic mining, removed large acreages of topsoil and washed many thousands of tons of soil into the streams. These areas still display low soil productivity and sparse vegetation and soil cover. Although these areas are slowly becoming vegetated, accelerated erosion still occurs, especially in the mined granite near Summerville.

Mining techniques used presently in the Upper South Fork are placer mining on the stream terraces and suction dredging in the stream channels. Water is still used to wash gold from sediment at placer mining sites but sediment settling ponds are used to reduce the sediment which enters streams. Suction dredging does not contribute sediment to the streams but stirs up channel sediment and causes increased turbidity downstream of the dredging operation.

The delivery and transport of sediment is highly variable. For example, several debris basins were constructed to catch sediment following the 1987 wildfires in the Salmon River. The debris basin on Olsen Creek, a granitic watershed tributary to the North Fork Salmon River, trapped over 16,000 cubic yards of sediment, mostly sand, in six years following 1987 (USFS Memo 1989). The Olsen Creek watershed is mostly very high EHR granitic soil and about 85% of the drainage was burned at high intensity during the 1987 wildfires. The first year following the fire, the equivalent of nine cubic yards per acre (one cubic yard is roughly equivalent to one ton) was trapped in the debris basin. The next year, about five cubic yards per acre was trapped. The soils in Olsen Creek are similar to those in Blindhorse Creek and Taylor Creek area so similar results are expected if a high intensity fire burns in those areas.

Debris basins were located in other, non-granitic watersheds which had a large amount of high intensity burning in the 1987 fires. These captured very little sediment and observations during storms following the fires suggest that Olsen Creek had a much higher sediment load. Apparently burned granitic soils erode at higher rates than non-granitic soils and granitic watersheds transport more sediment following a fire.

Sediment which enters any stream reach either passes through or is deposited (in the channel or on the flood plain). The fine sediments, silts, and clays generally pass through the streams in the Upper South Fork. Sand is deposited in varying quantities in pools and mixed with larger substrate. The stream bottoms in the Upper South Fork are dominated by gravels, cobbles and boulders which generally reach the streams during large floods and move slowly through the system.

The stream channels are formed during flows large enough to move substrate. If sediment entering a stream reach exceeds the capacity of the stream to move the sediment, aggradation occurs which results in pool filling and channel widening. If sediment is less than what can be transported, channels become more incised and pools deeper. Generally stream power exceeds sediment influx in the Upper South Fork streams. However, large sediment input from upstream landslides or erosion from large amounts of disturbance can cause aggradation, especially in alluvial stream reaches. Subsequent flows with less sediment gradually degrade the deposited sediment.

TRENDS IN STREAM SEDIMENTATION

Trends in Episodic and Chronic Sedimentation and Sediment Routing

If climatic patterns of the past 100 years persist, episodic and chronic sedimentation will increase slightly in magnitude and frequency, primarily due to the destabilizing effects of existing roads. Currently, roads occupy about 1,095 acres in the watershed, and of this, about 178 acres were built after 1975, and have not experienced landslide producing climatic events. In 1944, about one percent of the watershed was disturbed by hydraulic mines, roads, fire, or harvest. In 1988, about nine percent of the watershed was disturbed. If the South Fork and Sixmile Fires of 1955 are considered recovered, the figure would be six percent. Future disturbances of the soil and vegetation related to human activity will most likely occur within the 60% of the watershed which is outside wilderness and Research Natural Area boundaries. The potential for high intensity wildfire in the future is highest in Upper Taylor Creek, Crawford, and Shadow Creeks (see Figure 22). When such fires occur, accelerated surface erosion will be greatest at Taylor Creek. The potential for accelerated slump and earthflow activity will be greatest in upper Crawford and Shadow Creek watersheds. Areas where future landsliding will likely be accelerated by disturbances to the vegetation and soil mantle are displayed in Figure 29 - Trends In Sediment Production Map, located at the end of this chapter.

Trends in channel erosion and sediment routing are likely to be very similar to those of the the past 80 years, assuming similar climatic conditions. Thus, severe climatic events such as those associated with the 1964 flood will cause severe disturbance to the East Fork, South Fork, and primary tributaries. In addition, low order tributaries in recently burned watersheds like St. Claire Creek, and watersheds with highest road densities are most likely to experience channel disturbances.

The integrity of the Aquatic System is a function of gradient, debris slide history, and peak flow history, as well as disturbance history. Important interactions and trends are discussed under the sediment regime issue and the stream flow issue.

CLIMATIC AND HYDROLOGIC PROCESSES

The most important climatic processes at Upper South Fork include precipitation, temperature, humidity, and wind directions and intensities. Wind intensity is important due to the ability of strong winds to blow down timber stands. Together these factors produce the local climate with its typically cool wet winters and hot dry summers.

Climate strongly influences the soil forming process and determines the types of vegetation and animal communities which can grow on the watershed. It directly affects fire ignition rates, fire intensities, and biologic processes. Climate determines precipitation patterns which in turn affect groundwater and surface water characteristics.

The movement of water through the landscape affects hillslope erosion in the Upper South Fork. Landslides and surface erosion occur as a result of adding water to the slope. Long, wet climatic episodes can initiate slumps and earthflows, while intense rains or rain on snow typically initiate debris slides and avalanches. About 58% of the total landslide derived sediment delivered to the Upper South Fork from 1904-1988 was associated with the wet period and floods from 1964-1975, 33% was delivered prior to 1944. Much of the pre-1944 volume was associated with mining ditches and hydraulic mining along the South Fork from Rush Creek to Big Flat Campground (de la Fuente and Haessig 1993).

Local climate by mountain fronts such as the Trinity Alps influence the amount, type, and distribution of precipitation. The movement of groundwater through the subsurface is influenced by the soil permeability, and fracture and void space in the bedrock. Unweathered bedrock sheds water rapidly and watersheds in which solid outcrops predominate often do not have stream flow late in the season. Thick soil, colluvium, landslide deposits, or glacial moraines can store large volumes of water and release it during the summer. Such reservoirs likely exist at Carter Meadows and above Big Flat.

Vegetation patterns influence snow accumulation and melt rate which in turn affect peak flows in spring. Peak flows are influenced by drainage patterns, soil and rock permeability, groundwater storage, and rain falling on a snow pack.

Erosional processes influence stream flow characteristics by delivering sediment to channels which is temporarily stored as substrate. During peak flows, landslide debris and logs are added to the water, producing debris flows and torrents. These flows are capable of carrying large boulders due to the high density of the moving debris. The logs transported by the debris flows and torrents become part of the substrate, and can form dams which periodically burst, allowing surges of water and debris to pass through the channel. They also provide valuable diversity to fish habitat.

Vegetation plays a large role in the hydrologic cycle, particularly on the hillslope. This includes transpiration of water.

The chemistry of the water passing through the slope is determined by the nature of the parent rock, the vegetative cover, the soil composition, including organic content, and the availability of ash leachate.

Important climatic and hydrologic issues are: Climatic/Atmospheric/Hydrologic Setting, the Stream Flow Regime, Floodplain Inundation, and Water Quality.

The climatic setting at Upper South Fork was discussed in *Chapter 1* and in the previous section of this chapter.

Peaks and low flows in the streams are important because they affect riparian habitat conditions, fish habitat and temperature.

Stream flow is dependent on climate and weather patterns. However, stream flow is affected by physical and biological characteristics of the watershed. Streams with larger watersheds generally carry more water. Shallow soils on steep slopes yield quicker runoff and retain less ground water than deep soils.

The site occupancy of large trees on upslope areas influences stream flow both peak flow and summer low flow. Trees use more total water than smaller vegetation such as grass and brush be-

cause of the deeper root systems. Trees capture rain and snow in the canopy allowing for evaporation before rain can soak into the soil or snow can accumulate on the ground. The result is greater peak flows and greater low flows following disturbances which kill or remove many trees from a watershed if the amount of precipitation remains the same. In the Upper South Fork watershed this interaction takes place primarily on the better sites which are currently occupied by true fir, mixed conifer, or plantations. The other vegetation types with less potential for large tree stocking have less flow changes resulting from disturbance.

Fire suppression over the past 50 years has likely increased the vegetative biomass and increased the rate of evapotranspiration. This results in lower total discharge in the river.

Instream diversions have a major influence on stream flow, especially during periods of low flow. The diversions in the Upper South Fork, are generally small and do not significantly effect the stream flows. However some diversions, such as the diversion out of Rush Creek, divert a significant portion of the flow from the stream during low flows but it is not known if this effects downstream needs.

Roads influence stream flows by decreasing infiltration on the road surface and increasing direct storm runoff and in some cases increasing the drainage density. This contributes to increased peak flows and decreased summer low flows. However, if the road density is low as is typical in the Upper South Fork area, the change is not readily detectable.

Stream temperature is related to water temperature at its source (springs, melting snow, etc.) and the amount of heating or cooling which occurs up to the location the temperature is measured. The heating and cooling is dependent on direct solar radiation as influenced by stream shade, both vegetative and topographic, air temperature, and the travel time from stream sources to the temperature measuring location. The travel time is dependent on distance from sources, stream gradient, and stream flow.

Weather patterns and stream flows are the primary factors which influence stream temperatures over any one year. Hot or cold air temperatures influence stream temperatures. Higher relative stream flows decrease the travel time of the water which decreases the amount of heating or cooling. Solar insolation (exposure to direct sunlight) is the factor most significantly influencing heating and cooling of water.

Shading from riparian vegetation has an impact on stream temperature although it is difficult to determine exact shading effects because of the complicated interactions with the stream flow and weather pattern factors. Increased shading helps moderate warm summertime stream temperatures. Evergreen vegetation along streams helps moderate wintertime low temperatures to keep streams from freezing. Anchor ice formation is not a common problem in the watershed, but does occur in the Petersburg area where the channel is exposed.

The riparian shade was estimated for all streams in the Upper South Fork Watershed. Riparian shade has been decreased through fire, channel scour, and influences of man such as hydraulic mining, road construction, and clearing for various purposes. Riparian shade increases through the regrowth of vegetation either through natural succession or assisted by man.

Stream chemistry can be adversely affected by human activities, through improper disposal of bodily wastes and chemical spills. The designated campgrounds in the Upper South Fork area provide adequate waste disposal and do not cause water quality problems. Dispersed camping areas without sanitary facilities can pose a threat if concentrations of people are high and individuals do not practice sanitary habits. The heavily used lakes in the Caribou Basin are a concern. Many people recreate in this area and the soils are shallow with few places to bury waste. Detectable levels of fecal coliform have been found in Caribou Lake.

Chemicals spills occur in association with vehicle use, mining or other equipment use in and near streams, and during fire fighting operations. Tanker trucks leaking fuel or oil can spill into streams at tanker fills if these areas are not properly designed. Firefighting chemicals from slurry drops and ground operations can pollute streams if care is not taken to keep the chemicals from the streams.

Stream flows today are likely lower than in pre-fire suppression times due to the increased density of large trees. A further increase in vegetation density is not likely in the future but a decrease in vegetation resulting from natural or man-caused disturbance could result in increased streamflow.

Given similar climate and streamflow conditions, summertime stream temperatures are likely warmer than before mining operations which started over 100 years ago. This is due to the riparian impacts of the mining and channel scour of past floods. Summer stream temperatures are likely to be cooler in the future as a result of increasing riparian shade if channels are not repeatedly scoured.

FIRE PROCESSES

Season of ignition, fire behavior, fire intensity, flame length, and burning duration are important in determining interactions that may occur with various elements and other resource processes and functions.

Fire ignition mechanisms include lightning and human activity. The burning process is influenced by fuel accumulation, topography, air and fuel moisture, and temperature and wind patterns.

Fuel loadings have been on the increase since fire suppression policies and practices were initiated. Forest residue is currently accumulating approximately 60% faster than it is decomposing. Periodic fire was a way to balance the accretion and decomposition of forest residue. Periodic fire reduced stocking levels within stands and ladder fuels which are main contributors to crown fires and live fuel loading.

Fire shapes the character of the landscape. Variations in fire characteristics have direct and indirect influences on every function and process that occurs in the watershed.

The effects fire has on other processes is determined by fire intensity and behavior. The variation of vegetative characteristics found within the Upper South Fork watershed cause fire intensity and behavior to respond variably.

Fire intensity determines the effects on processes and elements that are currently found or functioning within the watershed.

High intensity fires interact as follows:
- New seral classes of vegetation are produced. In many cases large areas of homogeneous early seral stage vegetation is encouraged.
- Wildlife species that favor dense canopies will be displaced and wildlife species more acclimated to early seral vegetation will be favored.
- High intensity fire affects surface erosion by removing ground cover, eliminating woody obstructions on hill slopes, and accelerate surface erosion during rain storms. The removal of woody obstructions releases rock and soil allowing it to move downslope by a dry ravel process. This dry ravel process is very important in steep granitic lands such as in parts of the China Creek and Deadman Peak Plutons, and also in steep areas in which soils are gravely such as in parts of French and St. Claire Creeks which are underlain by chert bedrock. Dry ravel can deliver material directly into streams and make it available for transport during subsequent high flows. Any of these interactions will cause sediment to be deposited in different locations or completely leave the watershed.
- The loss of most of the vegetation results in reduced root support in the soil mantle, and eliminates evapotranspiration, both of which increase landslide potential.
- High intensity fires influence atmospheric conditions by creating convection currents which generate strong winds. Such winds influence fire behavior and intensity. Similarly, they can cool the atmosphere by generating smoke which blocks the suns rays and produces shade. This effect can be local, as in the case of an individual column of smoke, or widespread and persistent as when a large fire produces smoke which is trapped beneath an atmospheric inversion.
- Fire affects the soil-forming process by facilitating the mechanical disintegration of rock, altering groundwater chemistry by providing ash leachates, and removing organic material.

Low intensity fires interact as follows:
- Low intensity fire would allow for the maintenance of most of the existing vegetative patterns.
- Duff layers will not be as greatly impacted and crown cover from overstory vegetation will still exist. Low intensity fire will allow for much less movement of sediment from the site.

- Wildlife species currently using these habitats will continue their use. Forest vegetation will be more diverse, possibly allowing for greater wildlife diversity.
- Root support and evapotranspiration will be maintained as most of the existing vegetation will remain on the site. Low intensity fire will not significantly increase landslide potential.
- Low intensity fires do not generally have any impact to atmospheric conditions. They will create smoke which may block the suns rays and produce shade.

There are many biological and physical attributes that contribute to different intensities and kinds of interactions that may occur between fire and the existing watershed elements. Geologic processes influence fire by creating the steep landscape. A combination of rock type, soil, and climate determine the vegetative patterns and species which grow in the landscape, and the fire regime. Climate determines atmospheric, relative humidity, fuel moisture, wind, and temperature, all of which influence fire processes. Yearly climatic regimes, slope, topography, time of year, and aspect all have significant influences on how vegetation and fire will interact with each other.

Fire can dramatically effect social issues. While large, intense fires can have dramatic negative effects on the resources, they can have short-term positive effects on the local economy. As seen in 1977, 1987, and now in 1994, large fires bring a lot of money into the local economy. They provide numerous jobs and varieties of businesses flourish. For a detailed description of fire interactions, refer to Appendix I - Fire Interactions With Watershed Elements.

Fire has many different interactions within the ecosystem. It has always been and always will be an important agent of change within the watershed. Fire ignition most commonly occurs as a result of lightning or human activity.

Fire suppression efforts within the Upper South Fork watershed have caused changes in the vegetative characteristics. Suppression efforts have interrupted the natural process of fuel reduction, nutrient cycling, successional changes in vegetation, and the spatial arrangement of vegetation. Over the past several decades fuel concentrations have increased dramatically. The species composition and stand structures of the vegetation have also changed. Within the Upper South Fork watershed there has been an increase in the amount of shade tolerant species (white fir) and a decrease in the shade intolerant species (pines). The density of the vegetation has also increased dramatically over the past several decades. All of these situations have set up a scenario that will create fires of high intensity and large size.

Densely stocked forest vegetation stands, either natural or artificially regenerated, are very susceptible to creating intense, large fires. Dense even-aged natural pole stands and plantations are examples of vegetation structures that are capable of producing high intensity fires.

Older seral stage stands that have not experienced a fire occurrence for several decades are good candidates for initiating and spreading high intensity fires. These stands contain high amounts dead and live fuel, multi-layered vegetation, deep duff layers, and canopy closure (Fuel Model 10).

Areas of high mortality, especially associated with insects and disease, can initiate or allow for the spread of an intense fire.

Dense stands of decadent brush and hardwoods are very susceptible to a high intensity fire. Stands that contain high levels of grass and forbs have the characteristics to create intense fast moving fires.

Large areas of homogeneous vegetation within the watershed are most susceptible large crowning type fires. Areas that contain a variety of seral vegetation and structural components will cause fire behavior to change and allow better control.

Vegetative characteristics that are more open, contain very little understory vegetation or ground fuel, have less decadence present, and contain shallower duff depths generally create less intense fires. These conditions would generally be found in early, mid, and late seral stage type vegetation (Fuel Model 8). Less dense stands of hardwoods and vigorous, younger stands of brush also lower fire intensity

Riparian zones generally contain higher moisture levels and cooler temperatures and which minimize the effects of a high intensity fire. This is typical on the lower slopes in the watershed. The higher up the slope a riparian area is in the watershed, the less the fire is influenced by the in-

creased humidity and lower temperatures. Riparian areas located up slope in the watershed that contain a multi-layer vegetation, large amounts of down material, and a homogeneous closed canopy are very susceptible to high intensity fire and can be responsible for transporting fire out of the watershed.

Combinations of overstocked, even-aged stands, high fuel loads (dead and live), and the establishment of ladder fuels has created a situation which results in large stand replacing events. The entire Upper South Fork Watershed is at high risk. High fire risk/hazard areas were identified on south aspects with a slope factor of 60% or greater (see Figure 21 - Projected Fire Hazard Classes Map contained in the map packet).

Catastrophic fire is the result of the right combination of atmospheric and their conditions and is a natural component of the fire regime in the watershed. Fire starts in the watershed are primarily from natural causes (lightning) making the risk factor almost static. Fuels are the only variables that can be managed to reduce the effect of future fires.

Approximately 21,800 acres are classified as having a high likelihood of stand replacing fire (see Figure 22). The largest most contiguous high-likelihood areas are northeast of I Am Up Ridge through Taylor Creek/Garden Gulch drainages and in the northern portion of Crawford Creek, west of Grouse Point. No additional acres should be allowed to reach this level of potential wildfire effects.

Future fires in the Upper South Fork watershed could be expected to resemble those experienced in 1977 and 1987. Total acreage burned per decade is projected to stay the same or increase. If fires occur in the areas where there has been an increase in fuel loadings, acreages will increase. The same is true for areas where understory vegetation has been allowed to establish a fuel ladder to the overstory vegetation. The risk of large, stand replacing fires will continue until elements within the existing fire regime are made more consistent with historical ranges of variability. That consistency can only be achieved through large scale fuel reduction.

BIOLOGIC PROCESSES

Important biologic processes and functions at Upper South Fork include:
1- Capture--resources (organisms, materials and energy) are brought into the system,
2_ Production--resources are "manufactured" within the system,
3- Cycling--resources are transported within the system,
4- Storage--resources are conserved within the system,
5- Output--resources leave the system,
6- Life Cycles--individual plant and animal species go through their unique life cycles,
7- Habitat Utilization and Modification--some organisms interact directly with their habitat, modifying it significantly, while others merely utilize the habitat,
8- Predator-Prey Relationships--predators interact with their prey,
9- Foraging--non-predators interact with their forage,
10- Disease/Host Relationships--disease organisms interact with their hosts,
11- Dispersal--movement of organisms through the watershed,
12- Migration--organisms migrate seasonally within and outside the landscape, and
13- Succession of Plant and Animal Communities--plant and animal communities go through a succession process following some environmental disturbances.

Biological processes influence soil formation through mechanical weathering of rock by plants, plants produce organic material which modifies groundwater chemistry and facilitates the chemical weathering. Plants affect the erosion rate by providing ground cover and root support. They affect the amount of soil water by intercepting precipitation in the canopy, transpiration, and influencing snow accumulation and melt rates. In turn, this affects landslide and surface erosion rates.

Vegetation moderates temperatures adjacent to streams, having a cooling effect in summer, and a warming effect in winter. A vegetated hillside is much cooler than a barren one, local microclimate

influences the types of animals which can survive there. It also creates the fuel for fires.

Insects and diseases frequently weaken hosts predisposing them to other pests. These conditions (complexes) are very common within the Upper South Fork. Common complexes in the Upper South Fork are dwarf mistletoe/bark beetle complexes and root disease/bark beetle complexes.

Insects and disease create dead and down material and recycle nutrients into the ecosystem. Insects and disease interact with vegetation by serving a function of capture, production, and output for various wildlife species.

Insects and disease can increase the potential for high intensity fires by increasing the amount of dead and down fuel. This can affect sediment production, changes in vegetative character, landslides, and atmospheric conditions.

Climatic and soil forming processes determine what plant communities can grow in a given area. Landslide and hydrologic processes in streamside areas influence plant species and their distribution. Periodic debris torrents strip soil from steeper channels, and deposit soil and rock in gentler reaches. This process removes vegetation, and exposes the site to sunlight. New vegetation becomes established, and temporarily stabilizes the new channel deposits. These processes create a unique mix of vegetation in the vicinity of stream channels. Erosion and hydrologic processes influence the condition of fish habitat, including substrate composition, pool and riffle distribution, temperature, flow, chemistry, and character of suspended sediment. The distribution of springs on dry south facing hillsides limits the distribution of amphibians and other riparian dependent species. Wind patterns in conjunction with precipitation influence the occurrence of windfall in stands of large trees.

Biological and physical elements which favor the establishment of any insects or disease are important because they allow for the occurrence of all five basic ecosystem functions for the specific insect or disease. For example, the presence of favorable biological or physical elements can allow for the capture, cycling, production, output, and storage for any particular insect or disease.

Some conditions that affect interactions between the host and an insect or disease include host vigor, stand density, and site conditions. Stand and site conditions are important in determining whether the insect or disease agent will minimize or aggravate the damage to the host. This effect is most often noticeable where unfavorable stands or site conditions aggravate the effects of the predisposing agent, resulting in increased damage and mortality.

Important biologic issues identified at Upper South Fork (refer to Appendix B) are: Riparian and Aquatic Vegetation/Riparian Reserves, Viability of Aquatic and Riparian Species, Terrestrial Vegetation and Insects and Disease, and Viability of Terrestrial Species.

The existing riparian structure dictates the ecosystem function (capture, production, cycling, storage and output) provided by riparian areas. This structure is derived from the interaction of previous riparian structure and past processes (disturbance regime, human activities) operating within the watershed.

Primary functions of the riparian ecosystem are: 1) stream temperature moderation (both winter and summer), 2) organic contribution to channels (includes organic material in a variety of sizes from leaf litter to large, down wood), 3) nutrient spiraling (includes chemical filtration of upslope events such as nitrates released by fires), 4) sediment filtration, 5) bank stability and channel delineation, and 6) provision of various habitats and corridors.

When riparian plants grow in the absence of a naturally functioning disturbance regime, unstable densities can result (especially canopy species). This predisposes the stand to insect and disease attack. As significant mortality results, the stand becomes more susceptible to fire.

Riparian vegetation plays an important role in channel stability. Roots and other riparian biomass under most flow events regulate the release of stream sediments and restrict channel meander. Under certain infrequent peak flow events and in certain stream reaches, riparian structure is removed and channel migration is enhanced.

Elk on the landscape are affecting riparian zones in certain areas (e.g., Ray's Gulch). Ground cover

is removed through trampling and grazing. The elk spend lengthy periods of time congregating in riparian areas.

Direct changes in riparian structure are caused by: 1) fires of all intensity, 2) landslides and snow avalanches, and 3) a variety of human impacts (timber harvesting, road building, grazing, mining and homesteading). The extent and nature of the human impacts can modify natural processes. Hydraulic mining has caused the greatest riparian and channel disturbance associated with human activity.

Upslope events (i.e., intense fire and road building) indirectly impact the riparian zone. Their net impact upon riparian structure occurs principally through modification of two processes: 1) the timing, frequency and intensity of water delivered to the channels, and 2) the amount of sediment delivered to the channels. Upslope disturbance may increase the frequency and size of peak flows and increase the amount of sediment delivered to the channel. In the first case, the channel capacity is increased; while in the second, the channel is widened as it becomes filled with sediment. The more intense the disturbance, the greater the modification of the two processes. The net impact of both is to remove riparian vegetation.

Human suppression of low intensity fire allows an increase in stand density and decreases summer low flows (more water is being transpired). Such conditions tend to promote mortality from disease and insects. Drought periods are critical because stressed trees are less capable of expelling insect attacks. Fuel buildup occurs as trees die and stand become more susceptible to fire. This process is occurring in many locations in the South Fork watershed (particularly in upper Taylor Creek). Intense fire occurring near riparian zones can deliver sediment.

Less than five percent of interim riparian reserves have been affected by intense fire or landsliding in the last 70 years. The potential for major impacts from stand replacing fire is significant. Overstocked stands experiencing drought-related mortality (insects, etc.) are prevalent throughout the landscape. Several stands in this condition are located on unstable granitic soils, such as upper Taylor Creek and China Creek.

All fires are suppressed on the landscape, as elsewhere. In addition to the impact of increasing rates of stand replacing fire, disturbance from low intensity fire in the riparian zone has probably been reduced. The net change would be primarily to the understory vegetation, such as the grass/forb and shrub/hardwood layers. Less age-structure variation may exist in these layers.

About 20% of the total length of interim riparian reserves have been scoured by debris torrents in the past 70 years. Significant flood events this century have occurred in the 50s, 60s and 70s. Many channels are vegetatively recovering from the 1964 flood. Past land management practices and fire may increase the intensity and frequency of lesser flow events. Increased disturbance, especially in the floodplain areas, would result in a decreased age range in affected vegetation. Less large wood close in floodplain areas would be the result.

The present policy toward fire suppression will not rapidly change. Insect and disease problems will continue to be problems as long as numerous acres of overstocked stands exist. Low intensity fires on general forest land will continue to be suppressed. Increased numbers of high intensity fires are likely. In addition to direct fire impacts on riparian vegetation, the potential for associated future large sediment additions to the channels exist. Increased channel widening and vegetation scouring would result. The widespread presence of overstocked stands on the landscape will present a fire hazard well into the future.

Fewer activities will occur in the riparian reserves. Current plantations will grow and increase in density. Road necessity and location will be closely scrutinized. Management related contributions to peak flows should be reduced in the future. Stream shading should be enhanced as restoration of riparian areas occur. The increased potential for stand replacing fire and its potential impact on the riparian/channel complex will negate natural vegetative recovery unless the dilemmas created by overstocked stands is addressed.

There are four stocks of anadromous fish within the Upper South Fork Salmon River analysis area that are semelparous (i.e., dies after spawning once). These include the spring chinook salmon, fall chinook salmon, coho salmon, and the pacific lamprey. After spawning, the nutrients from the

decomposing bodies are released back into the system. Many different levels of the nutrient spiral are involved as mammals, birds, and insects feed off the carcasses. The nutrients are also released into the water providing a nutrient base for the aquatic plants and invertebrates.

AQUATIC ENVIRONMENT

The aquatic environment is strongly affected by climatic hydrologic, geologic, biologic, and fire processes. Drought and floods both have detrimental affects on the fishery resource. Drought reduces the amount of habitat available for use of all lifestages and increases water temperature which affects the quality and quantity of habitat. However, drought flows may result in high rates of in-gravel survival of incubating eggs/alevins, offsetting negative impacts of reduced rearing area. Floods scour channels and increase the sediment input to the stream, reducing riparian vegetation and affecting spawning gravels and overwintering habitat of juvenile fish by filling in the interstitial spaces between gravel and cobble. This significantly affects survival of fish species using this environment as well as the aquatic invertebrate community, the principle food source for fishes.

Geologic and hydrologic processes influence stream sediment load, channel morphology, and channel stability. Upslope and channel stability determine how much and what kind of sediment can be supplied to the system. If delivered sediment exceeds the stream's transport capacity, it accumulates in the spawning gravels, blocking open spaces between gravel and cobble particles. This decreases water flow through the substrate affecting the survival of eggs, embryos, alevins, and aquatic invertebrates. The sediment layer may also entomb emerging fry.

Vegetative cover influences the channel and bank stability and morphology by providing reenforcement to channel banks and adding large logs as trees fall into the stream. Vegetative cover also influences year-round thermal regulation and levels of nutrient introduction through leaf and needle fall.

Fire alters the riparian vegetation and can add large logs, depending on fire intensity. A severe fire can degrade the aquatic environment by reducing overhead cover (shade) and bank stability from fire-killed trees, and adding sediment to the stream from erosion.

Designated USFS "Sensitive" species in the Upper South Fork Salmon River include: spring chinook salmon, summer steelhead trout, tailed frog, and western pond turtle. Two species have been petitioned for listing under the Endangered Species Act; coho salmon and steelhead trout.

Habitat requirements for salmonid lifestages vary by season. Some requirements include stream discharge, water temperature, water quality (dissolved oxygen, turbidity, etc.), depth, and cover (Bjornn and Reiser 1991). The five lifestages of concern in the Upper South Fork Salmon River include upstream migration, holding, spawning, incubation, and freshwater rearing. Physical requirements include stream discharge and depth, substrate and porosity, cover, and space and channel morphology. Chemical/Biological requirements include temperature and water quality, food, and the influence of humans.

Upstream migration, holding, spawning, and incubation are affected by stream discharge. Suitable water discharge is needed for upstream migration to assist adult fish in getting to their spawning grounds (jumping falls or getting over low-flow barriers). Discharge can act as a migration barrier. High quality holding habitat is necessary for adult salmonid survival, particularly for spring chinook and summer steelhead, because they oversummer in the Salmon River until spawning in the fall, winter, and spring. Two components of high quality holding habitat are adequate streamflow and deep pools (West 1991). Spawning success is dependent on amount of available spawning area which is dependent upon streamflow. If flows are too low, spawning habitat may be dry (Bjornn and Reiser 1991). If flows are excessive, less spawning area is available due to high velocity. Egg incubation is affected by stream discharge because sufficient water needs to circulate through the gravel and cobble of the redd to supply the embryos with oxygen and carry away metabolic waste products. Flow is also important to prevent de-watering of redds which can result in drying or freezing of eggs and embryos. High flows which disturb redds, crushing and dislodging eggs pose a potential hazard to to eggs, embryos, and alevins (Bjornn and Reiser 1979). Rearing is dependent on streamflow because it influences the amount of space available for rearing salmonids.

Cover is important to holding, rearing, and spawning. Cover is important to adult salmonids because

it offers protection from poaching, disturbance, predation, and provides shade. Protection allows them to occupy portions of the streams they might not otherwise use. Because of their length of residency in the Salmon River, spring chinook and summer steelhead are vulnerable to predation by otters and other wildlife as well as poaching by humans. Cover for adults takes the form of bedrock ledges, boulder accumulations, submerged coarse woody debris, overhanging vegetation, undercut banks, submerged vegetation, and turbulence (West 1991, Bjornn and Reiser 1991). Fish cover needs may vary diurnally, seasonally, by species, and by fish size (Bjornn and Reiser 1991).

Substrate and porosity are important to spawning, incubation, and rearing. Suitable size of substrate for spawning depends mainly on fish size. Redd substrate affects the survival of the embryos and alevins because it influences how much water is circulated through the redd to supply the embryos with oxygen and carry away metabolic waste products. Circulation is partly a function of the porosity of the particles in the redd, and hydraulic gradient at the redd (Bjornn and Reiser 1991). Substrate is important habitat for aquatic invertebrates that provide much of the food base for salmonids. Substrate provides habitat for salmonids during winter as well as habitat for many non-game species (sculpin).

Space and channel morphology are important spawning and rearing components. The amount of space required by salmonids for spawning depends on the size and behavior of the spawners and the quality of the spawning area (suitable substrate, water depth, and water velocity) (Bjornn and Reiser 1991). Salmon and steelhead spawn in transitional zones between pools and riffles. The carrying capacity of the freshwater environment may vary year to year if controlling habitat components vary widely at critical periods. The carrying capacity may also vary season to season and may differ for the various lifestages and species of fish. Suitable space for salmonids is a function of streamflow, channel morphology, gradient, and various forms of instream or riparian cover. Food abundance, competitors, predators, and complexity of habitat determines what part of the available space an individual fish uses.

Water temperature and water quality affect every lifestage found within the Salmon River. Water temperature has negative affects on various lifestages when either too warm or too cold. Water temperatures unsuitable can lead to disease outbreaks in migrating fish, alter timing of migration, accelerate or retard maturation, and cause death. Temperatures before and during spawning must allow the spawners to survive and deposit their fertilized eggs. Approximate temperature for successful incubation affect embryo development rate. Temperature affects the dissolved oxygen (DO) capacity of water; the warmer the water temperature, the lower the DO concentration. Temperature is an important element for rearing juveniles. Temperature influences metabolism, behavior, and mortality of fish and other organisms in their environment. At the extremes of temperature suitability, growth is reduced at low temperature as a result of all metabolic processes being slowed and at high temperatures most or all the food intake must be used for maintenance. Water temperature influences fish community dynamics by modifying behavior, possibly affecting the dominance of one species over another. Water quality parameters that are important during migration are DO and turbidity. Reduced concentrations of DO, which may result from warm water temperatures, can affect the swimming performance of migrating fish. Fish have been known to avoid streams with a high suspended sediment load or cease migration when loads are unavoidable (Bjornn and Reiser 1991).

The entire South Fork Salmon River is an important refugia for the last remaining wild-run spring chinook salmon in the Klamath River Basin. The Upper South Fork is an important holding and spawning area for these fish. During low flow years, a partial barrier exists near Matthews Creek (downstream of analysis area). This barrier segregates the spring run fish above from the mix of fall and spring fish downstream. Every July for the past five years, a spring chinook/summer steelhead census has been completed on the Salmon River. The range of these fish in the Salmon is snorkeled and fish locations and numbers documented. These censuses indicate that the Upper South Fork is the last stronghold for spring chinook within the Salmon River system (Table 17 - Spring Chinook Adult Census Distribution, 1980-1994). A large portion of this area has been affected by past hydraulic mining and floods. There is a significant lack of shade (<10%) along the mainstem, however tributaries are in fair-good condition (mode ranges from 41-80%).

The tributaries have greater embeddedness values (fines filling interstitial spaces around gravel and cobble) than the mainstem. The mode ranges from 21-40% for the tributaries and 0-10% for the mainstem with the exceptions being between Black Gulch and East Fork of the South Fork and between Little South Fork Creek and Blindhorse Creek (11-20% and 21-30% respectively). Preliminary observations (July, 1994) from Little South Fork to Josephine Creek shows a range of embeddedness from 5-55%, with an average of 26%, and two modes of 20% and 30%. The higher embeddedness from Black Gulch to the East Fork of the South Fork is likely a result of sand being introduced from the granitic rock of the China Creek Pluton in the vicinity of Blindhorse and China Creeks. From Josephine Creek to the Little South Fork, the areas of high embeddedness are probably linked to sand derived from the Caribou Mountain Pluton in the headwaters of the South Fork, and from raw, pre-1944 debris slide scars along the inner gorge. In addition, high flows in the South Fork above Big Flat Campground mobilize old channel deposits of granitic sand, and convey them down the channel.

Also observed were mining activity and large landslides. There is a lack of cover provided by Coarse Woody Debris in the Upper South Fork analysis area. Since 1990 there has been an effort to re-introduce Coarse Woody Debris into the stream channel and revegetate the riparian zones along the streams. This has been met with some success.

The current drought is having impacts on the fishery. Temperatures reached lethal levels during July, 1994 resulting in adult spring chinook dying off, as well as juvenile salmon and steelhead, and Pacific giant salamanders. The drought is also reducing the amount of holding, spawning, and rearing habitat available to aquatic species occupying the Salmon River.

Table 17 - Spring Chinook Adult Census Distribution, 1980-1994

Stream /Reach	'80	'81 1/	'82	'85	'86 1/	'87 1/	'90	'91	'92	'93	'94
S.Fork 2/ Above French	-	-	-	-	-	-	52	54	85	24	255
Frch-Matws	-	-	-	-	-	-	30	51	80	10	124
Matws-Forks	-	-	-	-	-	-	16	34	61	103	171
Total	155	173	344	438	514	443	98	139	226	137	550
N.Fork	26	5	41	10	274	168	15	19	49	62	77
Mainstem	-	-	-	-	-	-	56	22	58	89	112
%UPSF Cont.3/	-	-	-	-	-	-	31	30	26	8	34
% Bar. Up Cont.4/	-	-	-	-	-	-	48	58	50	12	51

1/ Surveys done from French Ck. to Little South Fork (Above French), Matthews Ck. Campground to French Ck. (Frch-Matws), and Forks of Salmon to Matthews Ck. Campground (Matws-Forks).

2/ Population estimates done from index reaches.

3/ Contribution of spring chinook population from the partial barrier at Matthews Ck. up to Little South Fork.

4/ Contribution of spring chinook population from French Creek up to Little South Fork.

TRENDS

Habitat parameters currently below optimum condition include shade, embeddedness (only in some areas), coarse woody debris recruitment, coarse woody debris population, and primary pools/ 300m.

Olson and Dix (1993) determined that the reach from French Creek to Cecil Creek was within the desired range for primary pools. Also within this range (2/300m) are Little South Fork to Black Gulch, East Fork of South Fork from Shadow Ck. to Taylor Ck., Cecil Ck., and St. Claire Ck. Those not meeting the desired range for their size class include Black Gl. to Cecil Ck., and Crawford Ck. No data are available for Upper South Fork Salmon from Little South Fork to Josephine Ck., East Fork of South Fork Salmon upstream from Shadow Ck., Taylor Ck., and Rush Ck. A preliminary investigation of aerial photographs from 1944-1990 indicates that pool frequency changed according to sediment input events (Table 18 - South Fork Salmon River-Number of Primary Pools Between 1944 and 1990). The reach of the South Fork examined was from East Fork of South Fork upstream to Long Gulch.

Table 18 - South Fork Salmon River-Number of Primary Pools Between 1944 and 1990

YEAR	NO. POOLS
1944	20
1955	16
1964	15
1980	22
1987	22
1990	23

Shade will continue to be problematic. Those areas that can be revegetated will take 30 or more years to affect stream temperature. Stream temperature may never be within the optimum range because of the amount of streamside bedrock and river aspect. Likelihood of reaching optimum stream shade is unknown.

Coarse woody debris (CWD) recruitment and population is below optimal levels within the Upper South Fork analysis area. Coarse woody debris recruitment will continue to be a problem for several years until the riparian vegetation gets to a point it can start contributing to the river system.

Fines and embeddedness are both sub-optimum in certain areas. This condition may be improved if the sediment sources are reduced.

Tailed frogs prefer riparian micro-habitats with high relative humidity and low air temperatures often found in association with older seral stage vegetation along the riparian zone. Adults are occasionally found underwater hiding beneath cobble during hot summer periods.

Larval frogs are aquatic and are found in the faster riffle portions of the stream, attached to the undersides of cobble. They forage on algae growing on rocks, using their sucker-like mouths to scrape off the algae. They need a healthy stream bottom with plentiful interstices between the rocks. Significantly greater densities and biomass of tailed frog larvae have been found in streams in uncut forests compared with streams in cut-over forests.

Western pond turtles use a variety of aquatic habitats. Turtles are found in permanent and intermittent waters, in streams, lakes, ponds, rivers, and vernal pools. They are often restricted to areas near the banks or in quiet backwaters where the current is relatively slow and basking sites and refugia are available. They are usually unevenly distributed along a streamcourse, frequenting the deeper pools and sunny stretches where basking and security coincide.

Turtles need and utilize a variety of refugia. In rivers, large rocks, down logs, holes and undercut banks are used. The presence of these may be a critical factor in supporting sustainable populations.

The riparian habitat adjacent to the watercourses is also important. Turtles leave the water to overwinter, usually above the high water zone. They burrow into the soil, under logs, in vegetative cover, or in the duff layer. They can move up to 250 meters from the watercourse. Females move up to 400 meters from water to lay their eggs, often returning to the same nesting areas each year.

TERRESTRIAL ENVIRONMENT

Insects and diseases act as primary or secondary agents in tree mortality. Most of the insects and diseases are host specific, however, some insects will attack several different species of trees.

There are two primary vegetative conditions within the Upper South Fork watershed that are currently affected by a higher degree of insect infestation.

The transition zone between the mixed conifer and true fir forest types is subject to insect epidemics. Over the past several decades vegetative biomass in this zone has increased dramatically. Vegetative biomass now exceeds site capabilities and the area is very susceptible to high levels of insect attack and mortality. This is especially true in the white and red fir that have invaded the mixed conifer forest type.

Over the past several decades areas of low site capability have experienced increases in the amount of hardwood and brush concentrations. This increase in biomass has put the scattered overstory of Douglas-fir and ponderosa pine at risk to increased mortality from insect attacks.

These two vegetative conditions also serve as a catalyst for transferring insect and disease problems adjacent watersheds. Unfavorable stand and site conditions within Upper South Fork watershed or within adjacent watersheds provide an easy

linkage for the movement of all the insect or disease agents.

Insect and disease problems have increased over the last several years. Numerous years of drought associated with overstocked stands have been very favorable to the establishment of insects and diseases. Insects and diseases are located throughout the watershed. The area of most concern within the Upper South Fork is Taylor Creek drainage which is experiencing high levels of mortality. Portions of Shadow Creek and Crawford Creek have areas of moderate to high mortality currently occurring.

High levels of mortality will continue over the next several years, especially within the transition zone between the mixed conifer zone and true fir zone and areas of low site capability that contain scattered conifers and dense stands of brush or hardwoods. Stand conditions which have predisposed conifers to stress will continue to increase susceptibility to insect attacks and associated mortality.

The continued presence of certain species is questionable in areas with high concentrations of mistletoe infestation. Other mistletoe resistant species will probably get established on the site and eventually eliminate the infected species from the site.

The existing dead or infected stand will eventually burn in a wildfire creating large openings and large areas of early seral stage vegetation.

The conifers located in areas of lower site capability will be replaced by brush and hardwoods. The dense stocking of brush and hardwoods resulting from fire suppression will continue to make the conifers susceptible to insect and disease attacks and eventual mortality. The high biomass will inhibit re-establishment of Douglas-fir or ponderosa pine.

The vegetation communities within the Upper South Fork watershed provide habitat for a variety of terrestrial wildlife species. Some species may use a variety of habitats, their life functions (reproduction, foraging dispersal), while others are restricted to specific types of habitat.

Northern spotted owl habitat consists of closed-canopy, mixed conifer stands of medium and large sized trees (i.e., >18" dbh) which include multiple canopy layers, snags, and down logs provide nesting, roosting, and foraging habitat for Northern spotted owl. True fir stands are less structurally diverse than mixed conifer stands, and are less used. Closed-canopy stands of small trees provide some foraging and dispersal habitat. Open conifer stands, hardwood stands, and young conifer stands may provide foraging habitat where they are included in dense, large sized stands.

The owl territories are well linked by adequate dispersal habitat. Four of 22 quarter-townships within the watershed do not provide adequate dispersal habitat. Two are within wilderness, and natural conditions have reduced dispersal habitat. The remaining two cover the French Creek, St. Claire Creek (44%); Ray's Gulch and China Gulch (49%). The latter three drainages have been harvested in the past. Both quarter-townships are close to providing 50% dispersal habitat, since harvest patterns are concentrated in certain areas. It is believed that dispersal in these areas may not be as much of an issue as the percentages might indicate.

Fisher and marten are found in California at elevations between 2,000-5,000 feet in the North Coast region (fisher) and areas above 5,000 feet (marten). Mixed conifer is the primary habitat for fisher, with some use occurring in true fir habitats, the opposite use pattern is assumed for marten.

Within forested areas, closed-canopy stands of medium and large sized trees provide habitat for denning and resting. Large standing dead and down trees, in particular (i.e., >30" dbh) provide a substrate for denning. Accumulations of coarse woody debris are important for foraging habitat, particularly for winter use by marten due to access to under-snow prey. Dense stands of smaller trees provide habitat for foraging as well as dispersal. Open coniferous and hardwood stands provide some habitat for foraging, especially where they occur as small inclusions within dense conifer stands. Grass/Forbs, montane brush and riparian brush areas also provide some habitat for foraging, particularly along edges which are adjacent to forested stands. Dense, riparian tree habitats are also used for denning, resting, foraging and dispersal.

Both fisher and marten travel through the watershed very readily. Riparian corridors are especially important for travelways. Corridors with high cano-

py closure (>60%) that are within or near older seral stands are preferred.

There are some large natural openings, a few large clearcuts and other timber harvest areas where the animals may not readily travel. Both species will forage clearcuts to some extent. The natural barriers discussed for the northern spotted owl may also represent barriers to fisher and marten. Aside from these areas streams which may have significant dispersal barriers include: upper Cecil Creek, portions of Little South Fork, lower sections of Rush and Big Bend Creeks, lower Crawford Creek, and portions of China Creek. Except China Creek all of the situations are a result of natural circumstances. China Creek has a large area that was essentially clearcut in the 1980s.

In general, goshawk nesting habitat is characterized by conifer stands which are dominated by medium to large sized trees (>21" dbh), have a closed overstory and an open understory provide nesting habitat for goshawks. Goshawks forage in a variety of habitat types and seral stages. Stands which are very dense and/or exhibit a multi-layered understory do not serve as good nesting or foraging habitat because they are difficult for goshawks to maneuver through. Stands which are well suited for nesting are generally scarce in the watershed.

Goshawks are highly mobile birds. They will cross large open areas and are not as tied to protective cover as spotted owls.

Habitat for spotted owl and other older seral stage dependent wildlife is well distributed throughout most of the landscape. The drainages west and south of the South Fork, such as St. Claire, Black Gulch, Blindhorse and Little Grizzly have large blocks of habitat. Large blocks also occur in Rush Creek and Garden Gulch, east of the South Fork in the Trinity Alps Wilderness. Except for South Taylor Creek, the East Fork has relatively less, although connectivity is still good. Areas north of the South Fork, Crawford, Shadow and Sixmile Creeks have relatively smaller blocks of habitat.

Currently, much of this habitat is available within the mature and older age classes in conifer stands. Mortality in the overstory trees is high providing high amounts of dead wood. This mortality is exacerbated by the large number of younger, smaller trees that are currently occupying much of the available site. Due to the exclusion of fire, basal area (number and size of trees) for these stands is higher than the range of variability. Drought, disease and high basal area are causing mortality to occur in the overstory "old growth". This element is a being lost over many acres in these decadent, older seral stages.

Cover for deer and elk is generally described as hiding, thermal, and optimal. Hiding cover is provided by any vegetation which visually conceals an animal; it can be provided by tall grass, dense brush, or trees. Thermal cover is used to modify the effects of weather, both in the winter and the summer. The highest quality thermal cover is provided in stands which are at least 40 feet tall and have a canopy cover greater than 70%. Optimal cover is used during extreme weather conditions and provides protection from weather as well as some foraging opportunities. The best optimal cover is provided in multi-layered stands which provide an overstory and sub-canopy, as well as shrubs and herbaceous vegetation. The best quality forage is typically provided in open (total canopy closure <60%) and early seral stage areas.

Good quality thermal and hiding cover is found throughout the watershed. Optimal cover is in short supply, because most forested stands providing cover are too dense to supply suitable foraging habitat.

Deer and elk tend to forage in shrubby plantations, meadows, shrub and tree hardwoods, and riparian areas. Much of the foraging habitat for deer and elk is in moderate to poor condition. Plantations, especially those less than 20 years of age still provide moderate capability as foraging habitat. Recently burned areas, such as the Blindhorse Timber Sale clearcuts and areas burned in 1987 wildfires provide good quality foraging. However, most of the natural brushfields are in poor condition, primarily comprised of even-sized, decadent plants. They provide low amounts of forage having poor nutrition and palatability.

Hardwood stands are composed of mostly mature and older trees. Hardwood regeneration and young stands are not evident in the watershed. In addition, many older hardwoods, especially black oak and madrone, in mixed species stands are competing poorly with adjacent conifers.

Peregrine falcons are known not only to forage over wide areas, but also to hunt primarily within a few select spots within four miles or so of nest sites. Peregrine falcons feed primarily on birds which they capture in flight. Rock doves, band-tailed pigeons, and mourning doves, when available, are preferred prey species. Each of the vegetative elements provides habitats which support a diversity of prey species, and in particular, vegetated areas adjacent to water attract a diversity of avifauna. Foraging over water is common. Human activity near the nest during breeding season can be very disruptive and cause nesting failure.

It has been postulated that 90 years of fire suppression has resulted in an increase of senescent stands over what would have occurred naturally if fires had been allowed to burn unchecked. Under a natural fire regime fuel accumulations would be low. The existing level of stand decadence is a concern because it is a high fire hazard. These stands have a high amount of fine, medium and large sized fuels (standing dead and down logs), a fire ladder (multi-canopied stand), and crown fire capabilities (closed canopy). Catastrophic fires in 1977 and 1987, near the Upper South Fork watershed converted thousands of acres of this habitat to young seral stages of grass, brush and small trees. The key to habitat maintenance is balancing habitat and reducing the chances of a stand replacing fire. Thus a more likely alternative will be implementation of management activities that result in a reduction of structural diversity of some stands in exchange for a high probability of long-term maintenance of senescent stands.

Fire is important in maintaining the quality and quantity of foraging habitat for some wide-ranging species (e.g., blacktailed deer and Roosevelt elk). Many plant species have adapted to periodic fire and need fire to regenerate successful. and before fire suppression they likely existed in a mosaic of age classes. Open stands of grass/forb and shrubs are important foraging areas. Different age and size classes provide habitats for a variety of species, as well as being used for different purposes for a single species. Dense, old brush provides hiding cover for deer, as well as key habitat for small songbirds, like rufous-sided towhees and song sparrows. Young brush is critical to deer for palatable, nutritious forage.

Through fire suppression, most of these habitat types are now in the same age classes, mature and decadent. Most of these stands occupy south facing, low elevation sites. When wildfires enter these areas they will likely be severe.

Insects, disease, and drought are interrelated factors that affect the quantity and quality of habitat, especially older seral stages. Currently, some stands have high mortality, especially in old-growth trees. The high number of stems on these sites may cause susceptibility to these factors. This is evident in several locations within the watershed (e.g., the south side of I Am Up ridge, South Taylor, and Crawford Creek). On south slopes, large pines are dying while the white fir understory is maintained. Hardwoods are favored on these sites and that has a direct effect on older seral stage dependent wildlife as the old growth portion of these stands are lost. In South Taylor drainage, large groups (5-10 acres each) of even sized white fir are dying creating holes in the habitat blocks. Currently, these dead spots provide excellent foraging habitat, but in the long-term a tremendous fire hazard is being created. As this loss of habitat continues it threatens the viability of the Late Successional Reserve.

HUMAN ACTIVITIES WHICH AFFECT THE ECOSYSTEM

Human activities which affect the ecosystem are:

- Manipulation of vegetation
- Modification of the soil mantle
- Manipulation of animal communities (grazing, planned and inadvertent introduction of exotic species)
- Passive interactions between humans and animal populations (such as the presence of humans around raptor nesting sites in the spring)

Private property is located mainly along the river corridor. The primary interaction with landscape elements are the use of road systems providing access to property and water diversion for beneficial uses.

Commodity oriented interactions also occur. Local employment includes mining, work in the woods, and local services. Hunting and firewood collection are also significant subsistence uses of resources by local residents.

Three businesses in the landscape are associated with recreational use opportunities. The Snipes Resort, which consists of the local restaurant, gas station, and grocery store relies on a combination of local community, recreational visitors, and contractors working on federal lands.

Federal land-use decisions may affect this community to a larger degree than many similar size communities elsewhere in the state. This is due in large part to the remoteness of the community and the fact that most of the area is under federal jurisdiction.

Barren areas provide visual contrast and enhance scenic quality. They provide vista points and potential habitat for unique wildflowers which attract people. The distribution of use within the wilderness is highly dependent on scenic attractions. A study of wilderness use characteristics (Schuyler 1991) indicated that the portion of the Trinity Alps which is characterized by a more typical alpine setting, i.e., high mountain lakes and high meadows receives a majority of the recreational use.

Water oriented recreation developed campgrounds are located along various stream segments. Receives highest concentration of localized use outside of wilderness. Types of use include fishing, recreational dredging, swimming, and limited kayaking.

Meadows are extremely desirable and used for dispersed activities, such as hiking, hunting, and other personal interests. Grazing and commercial outfitters use these areas, which are valuable for forage production, aesthetics and recreational experience. The quality of aesthetics is subject to erosion from trails, cattle, and pack stock.

Carter Meadows is a high use dispersed recreation site which pose potential resource impacts to the meadow community (and riparian areas) as a result of unmanaged use. This area also attracts people during the winter. It is a high elevation meadow area which provides Siskiyou country residents the local opportunities for cross country skiing and Christmas tree collection as winter recreational activities.

Deer hunting is the primary recreation activity in montane shrub communities.

Riparian areas are desirable sites for dispersed recreation. Trails are often within riparian areas. Trails commonly originate in this patch type and connect to wilderness dispersed recreation opportunities. Heavier recreation use occurs when this vegetative condition occurs along wilderness trailheads, portage access and campgrounds.

Road systems provide access to dispersed camp sites, developed campgrounds and wilderness trail heads. Roads also provide opportunities for people sightseeing on "Sunday drives" or mountain bike rides. There is an increase in overall road system use during hunting season in the fall.

The primary trail systems in this landscape occur within the Trinity Alps wilderness. The Deacon Lee trail provides access into the Russian wilderness in the North Fork Salmon Watershed.

Trailhead use surveys indicate that approximately 75% of the total Trinity Alps use originates at trailheads in the Upper South Fork area. Roughly 80% of the stock use originates at five trailheads, with Harry Hull and Carter Meadows trailheads receive highest levels of use. Around 50% of the hiker use originates in the Upper South Fork area. The largest proportion originates at Big Flat, with 23% of the hiker use recorded.

According to a Trinity Alps wilderness use study (Schuyler 1991) the more heavily forested and lakeless portions of the wilderness experience infrequent use. Since the majority of recreation use occurs along the river or in the wilderness, it is not likely that recreation use is high within the conifer forests outside of wilderness. What does occur would generally be associated with roaded access and proximity to riparian areas used as dispersed recreation sites.

Suction dredging (4 inches and smaller) is generally confined to the main channels of the East Fork and South Fork of the Salmon River.

Mining operations along the East Fork and South Fork of the Salmon occur within, and adjacent to the river channel, and are limited in scope. Average size of operations that have been approved, or submitted for approval, is approximately five acres.

Another commercial venture occurring within this zone is collection of decorative rock for landscape

purposes. The type of rock is generally one to two feet in diameter, with soft edges, such as river cobble.

Meadows produce forage and are key components of grazing allotments. Collection of native grass seed is another commercial use that is increasing.

A variety of tree products are utilized in the watershed.

The type of use depends upon the compositional and structural characteristics of the stand and proximity to road systems. With the exception of sawlog harvest, use is generally confined to within 300 feet of the system roads.

Young plantations provide little in the way of actual products. Service contracts for stand management provide employment opportunities. Older plantations may provide biomass as a by-product of stand management. Actual use would depend on accessibility and market prices. These stands may also produce Douglas-fir poles harvested by the public (generally averaging 10' length and 4" diameter).

Collection of cedar boughs and cedar fence posts may occur throughout the landscape, since cedar is a minor component of both the true fir and mixed conifer communities.

Douglas-fir pole collection and biomass harvest would most likely occur in well stocked small diameter mixed conifer stands.

Firewood cutting occurs along all road systems where wood cutting is permitted. The local community is heavily reliant on firewood collection in this area. Use by people from adjacent communities has increased in the recent past as personal firewood use collection has become more restrictive in other areas of the Forest.

Sawlog production can occur in stands with average diameter >8" dbh.

Much of the commodity use is associated with road access.

Traditionally Native Americans interacted with all landscape elements. The people were governed by the yearly cycle of the seasons, moving to and between areas where seasonal changes produced abundance. They fished, gathered seeds and berries and hunted from spring to early snowfall. Their use of plants and animals was extensive, yet these people had a stability within their environment. They considered themselves and all creation around them members of the same world.

The use of wild plants for food, clothing and adornment, technology and especially curing purposes has been part of the Karuk culture since UHKAHY, the Great Spirit, imparted the information to the first medicine person. Successive generations acquired this knowledge from their progenitors

Today Native American people continue cultural practices passed down through the centuries.

As a result of ecosystem classification surveys within the Upper South Fork a list of plants that have been traditionally utilized by Native Americans was compiled. The identification of ecological types are taken to encompass the total variability of a selected geographic area or target vegetation type.
The various plant species used are numerous. There are more than 150 species identified in Plants and the People, The Ethnobotany of the Karuk Tribe (Hendryx and Davis 1991). A large number of those species listed are within the Upper South Fork area and are listed in Appendix H.

Known species of special interest are those used as basketry materials including, but not limited to, deerbrush, California hazel and bear grass, as well as a variety of willow, fern and iris species. These are only a few of the better known basketry materials that occur within this area.

Acorns and manzanita were a primary source of subsistence. Acorn gathering still occurs today. Acorn bearing white oaks are of particular significance in this area, since tanoak does not occur. A variety of herbs and teas are made from plants found mainly in riparian areas (communication from Quartz Valley Reservation).

All of the conifer species present, with the exception of red fir, were described as utilized in one manner or another. Of particular note is the use of gray pine seeds as decorative material for ceremonial dress. The northern most range of this species occurs within the analysis area.

In addition the use of the plants themselves, the habitat conditions they provide are of cultural significance. Various wildlife species are important as a food source or for their spiritual significance. These include, but are not limited to deer, bear, pileated woodpecker, flicker, blue jay, quail, hawks, eagles, fish (including the various salmon species), steelhead, eel (Pacific lamprey), freshwater clams, and Pacific giant salamander.

The previous information characterizes a portion of what is known about cultural interactions within this watershed. What it does indicate is that a diversity of species and habitat conditions were, and continue to be important to the local Native American way of life. Opportunities exist to identify areas which can provide an abundance of certain species of significance and work in cooperation with local people to manage for the continued use of these areas.

Barren areas are a useful management tool to control livestock distribution, because they often serve as a barrier to cattle movement.

Water is important for livestock, but not a limiting factor. Location of water sources can tend to concentrate use (affect patterns of use). Water use tends to be concentrated along streams rather than lakes. Cattle's impacts to stream water quality are highly variable.

Meadow communities make up the majority of vegetation community types utilized by livestock in the watershed and are preferred browse areas; most controversial with human recreation interface. Meadows are dependent upon grazing as a disturbance which maintains the existing community types. Grazing within mesic meadow communities can reduce alder and willow encroachment.

Idaho fescue is one of the best forage grasses and can withstand heavy grazing and trampling. Kentucky bluegrass provides an abundance of nutritious forage which is highly palatable to cattle and is resistant to heavy utilization. Oatgrass is fairly palatable. Clovers have high foraging value, especially for young milking animals. Bentgrass provides good forage. Sedge species are both increasers and decreasers with grazing.

Forage utilization studies focus on the meadow communities to maintain appropriate livestock distribution and prevent overgrazing.

There is minimal interaction within **montane shrub communities**. Certain species more desired, such as deerbrush and some species of prunus. If adequate palatable forage exists in meadows, livestock will not forage in the montane shrub community. Some grazing of herbaceous vegetation in the understory of these shrub communities may occur.

Within the **riparian shrub complex** cattle utilize alder and willow for shade. If willows are being grazed, it may indicate meadows are at, or above utilization resulting in possible conflicts with wildlife. Willow flycatchers nest low in willows which can be disturbed when cattle graze. There is concern for fawning areas, because repeated grazing of willows can create an armoring effect, making them less penetrable and unusable for hiding cover. Grazing of herbaceous vegetation opens up willow stands with cattle trails.

Within the **riparian tree complex** there may be local areas of concentrated use due proximity to available water and shade near forage areas. There is minimal foraging of this plant community due to low availability of herbaceous vegetation in the understory.

Use of **plantations** would be influenced by species composition and plantation age. A variety herbaceous and shrub vegetation would be present, as well as newly established conifers and hardwoods. The species present would be the same as those represented in the meadow and montane shrub communities. Forage preference would be similar. Young plantations would receive highest use, with higher proportions of grass species. As plantations age, the shrub and tree component become more dominant and forage palatability reduce.

Roads and trails are important for access and distribution, also for permittee and administrative use. Cattle will utilize roads and trails as travel corridors.

The Fish Creek, Long Gulch, and Trail Creek Trails are important for livestock management in the Carter Meadows Allotment. Rush Creek and Taylor Creek Trails are also used.

The Sixmile Trail and road below the Pacific Crest Trail are important links for the South Russians Allotment.

Forest Highway 93 from Callahan and Cecilville are important access routes for both allotments.

All trails in the Big Flat Allotment are important for livestock management. The Coffee Creek Road provides access to the allotment.

The Garden Gulch Allotment is accessed by the Petersburg road.

Upper South Fork Watershed

Landslides & Scoured Channels: Pre–1944

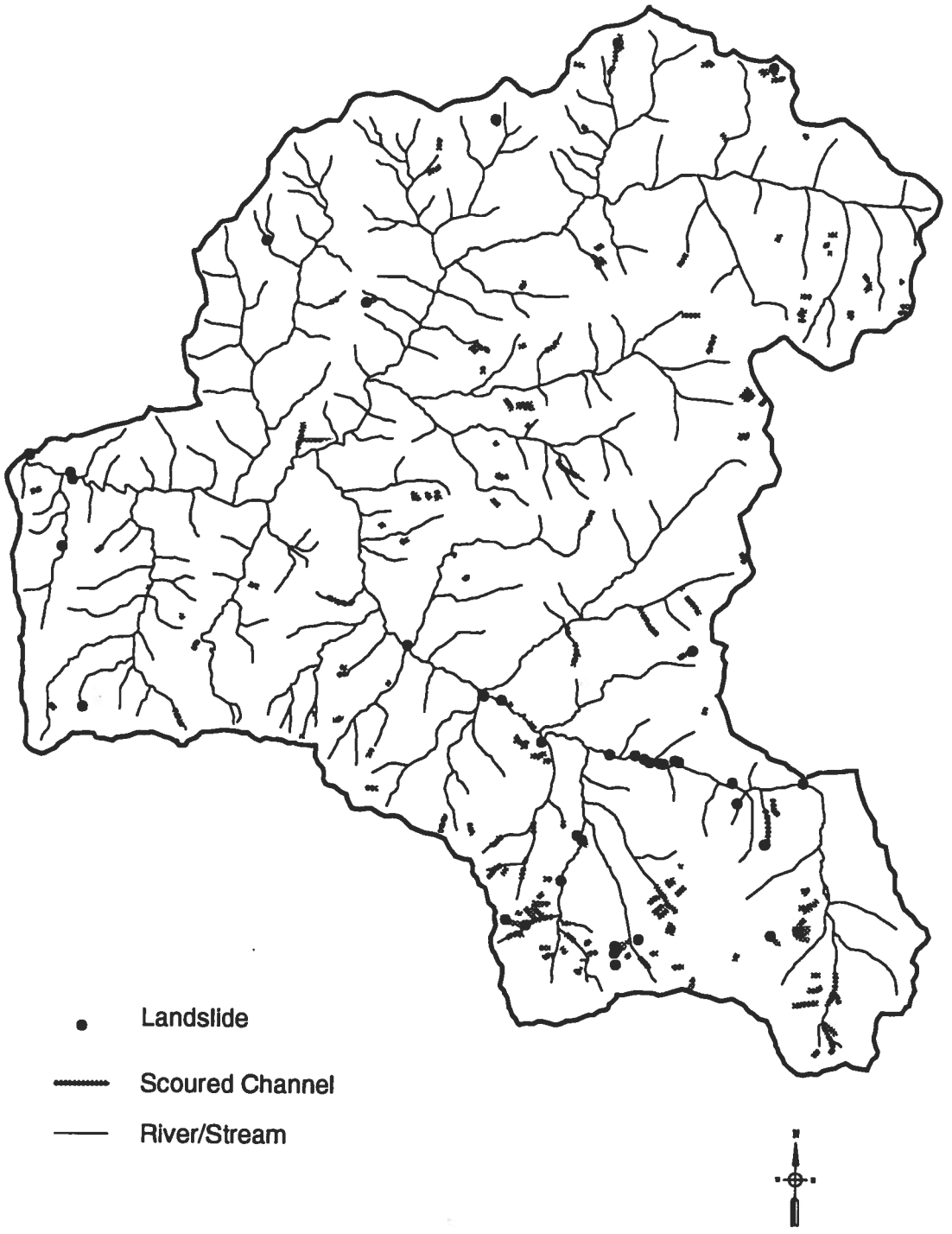


Figure 23

Upper South Fork Watershed

Landslides & Scoured Channels: 1944–55

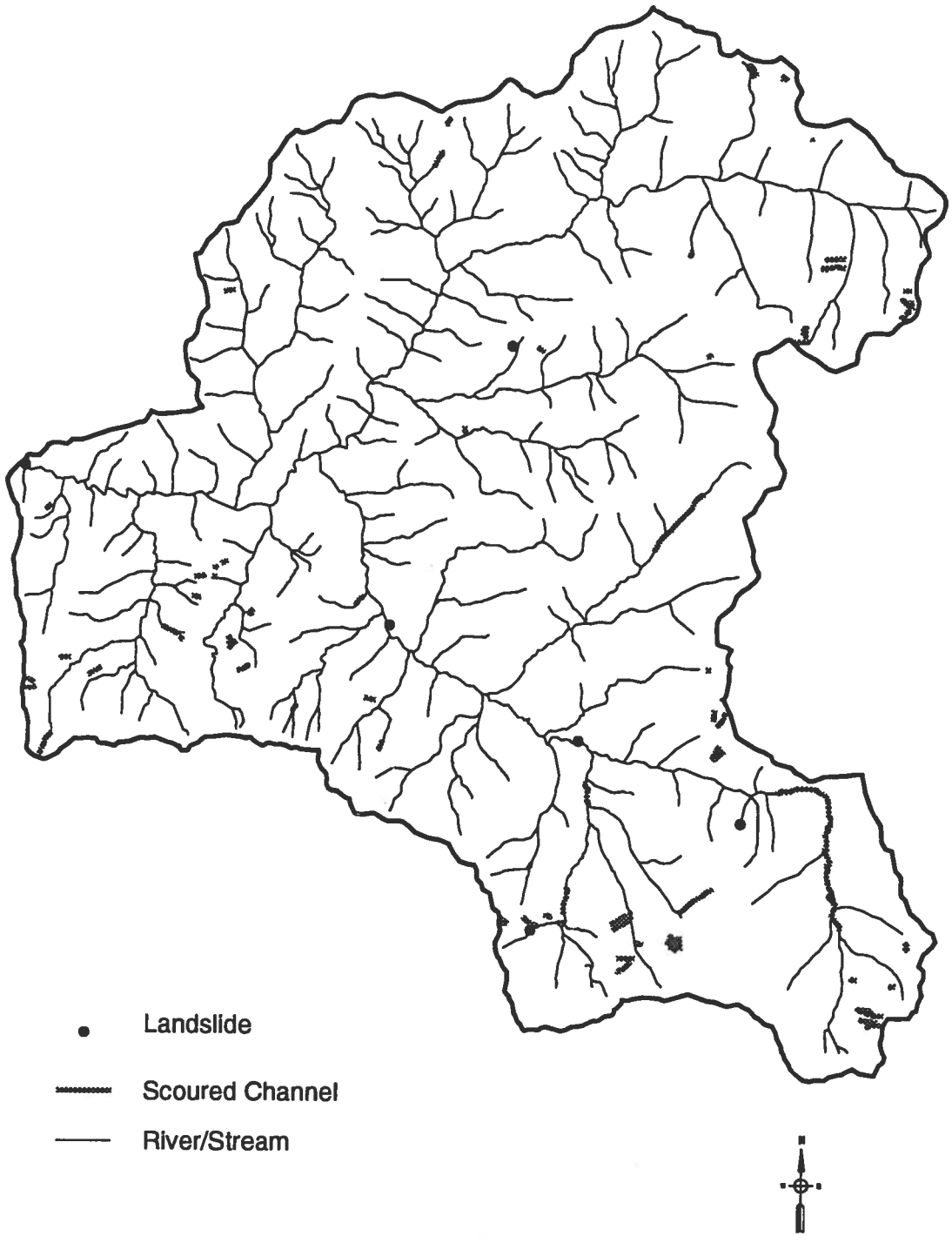


Figure 24

Upper South Fork Watershed

Landslides & Scoured Channels: 1955–64

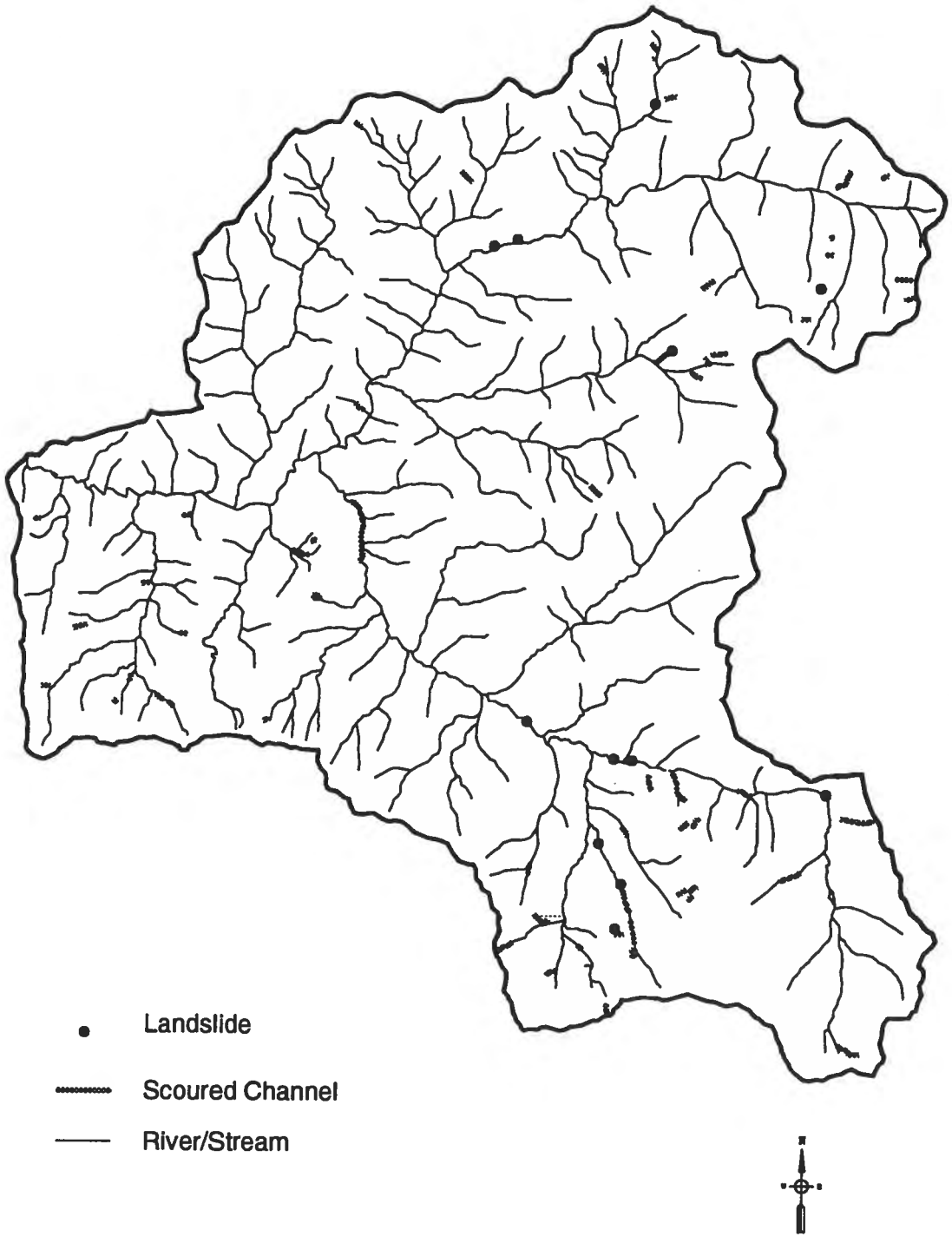


Figure 25

Upper South Fork Watershed

Landslides & Scoured Channels: 1964–65

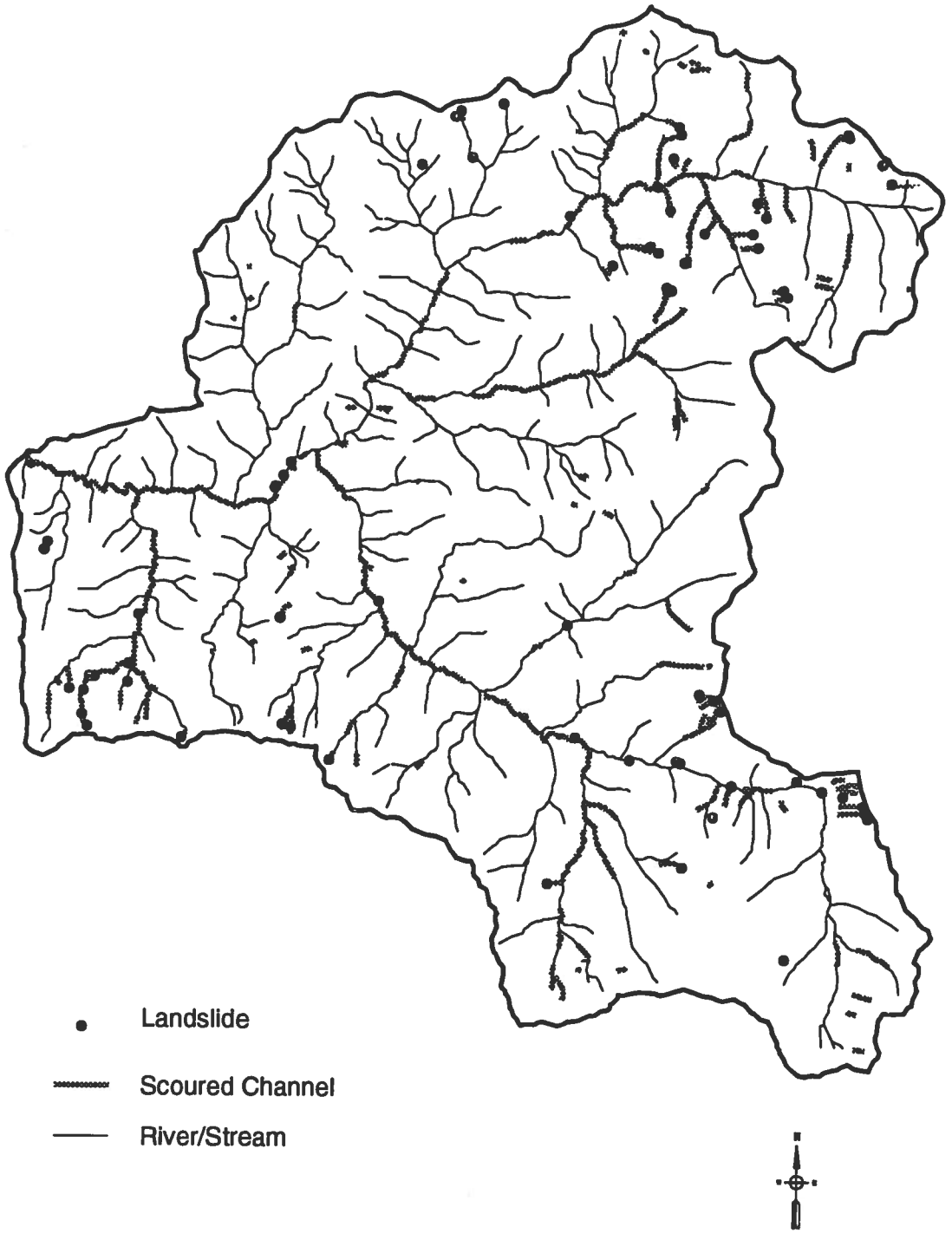


Figure 26

Upper South Fork Watershed

Landslides & Scoured Channels: 1965–75

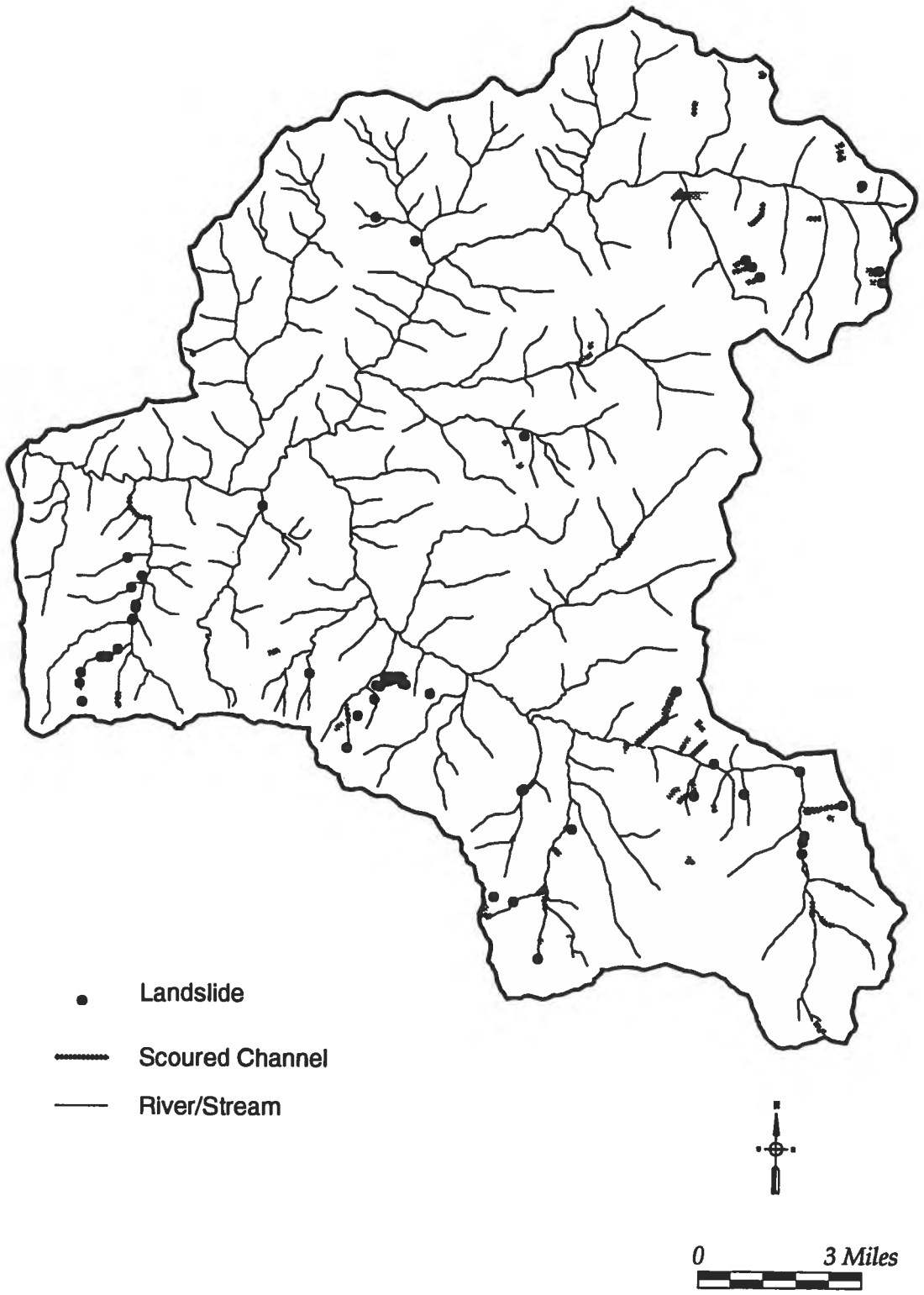


Figure 27

Upper South Fork Watershed

Landslides & Scoured Channels: 1975–88

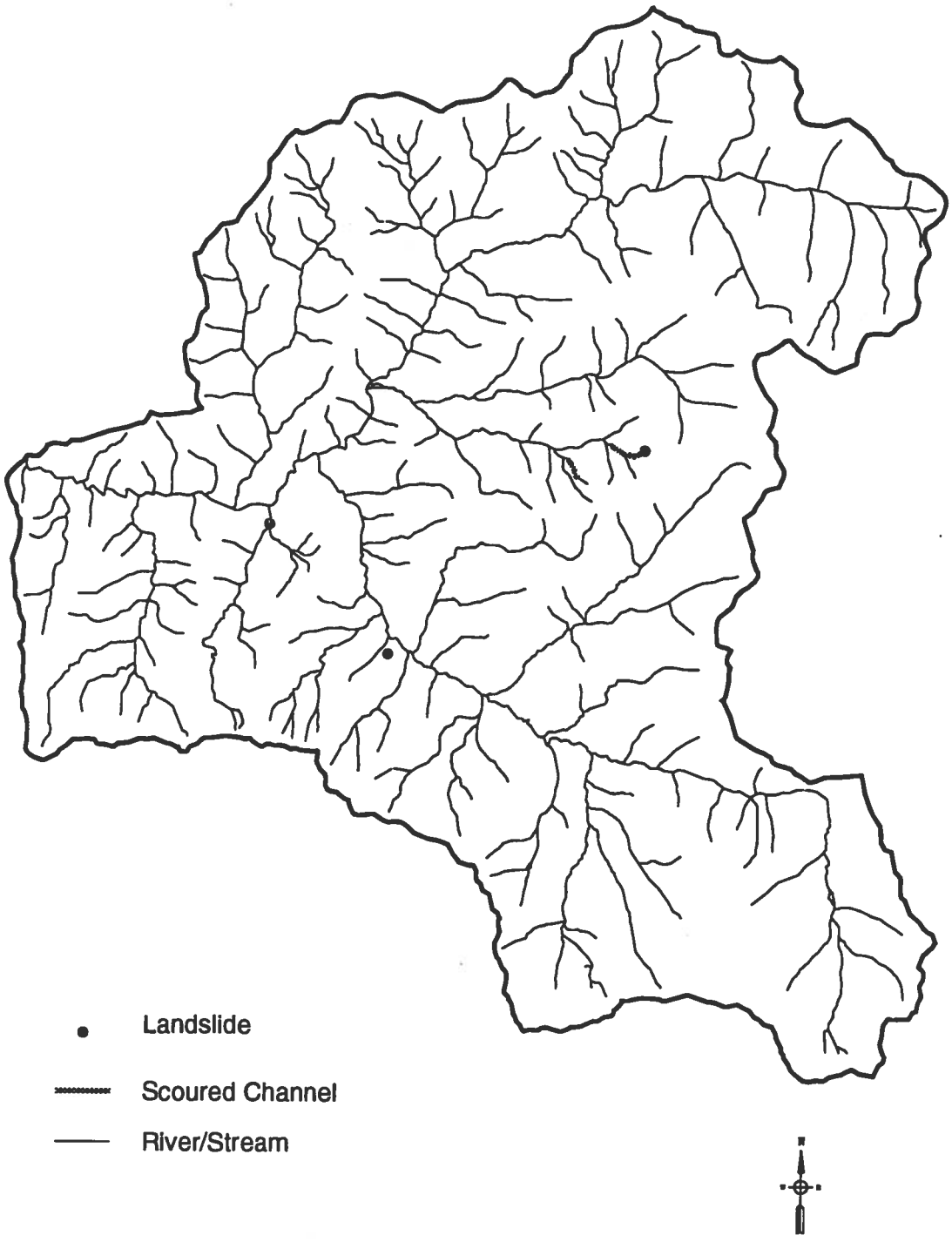
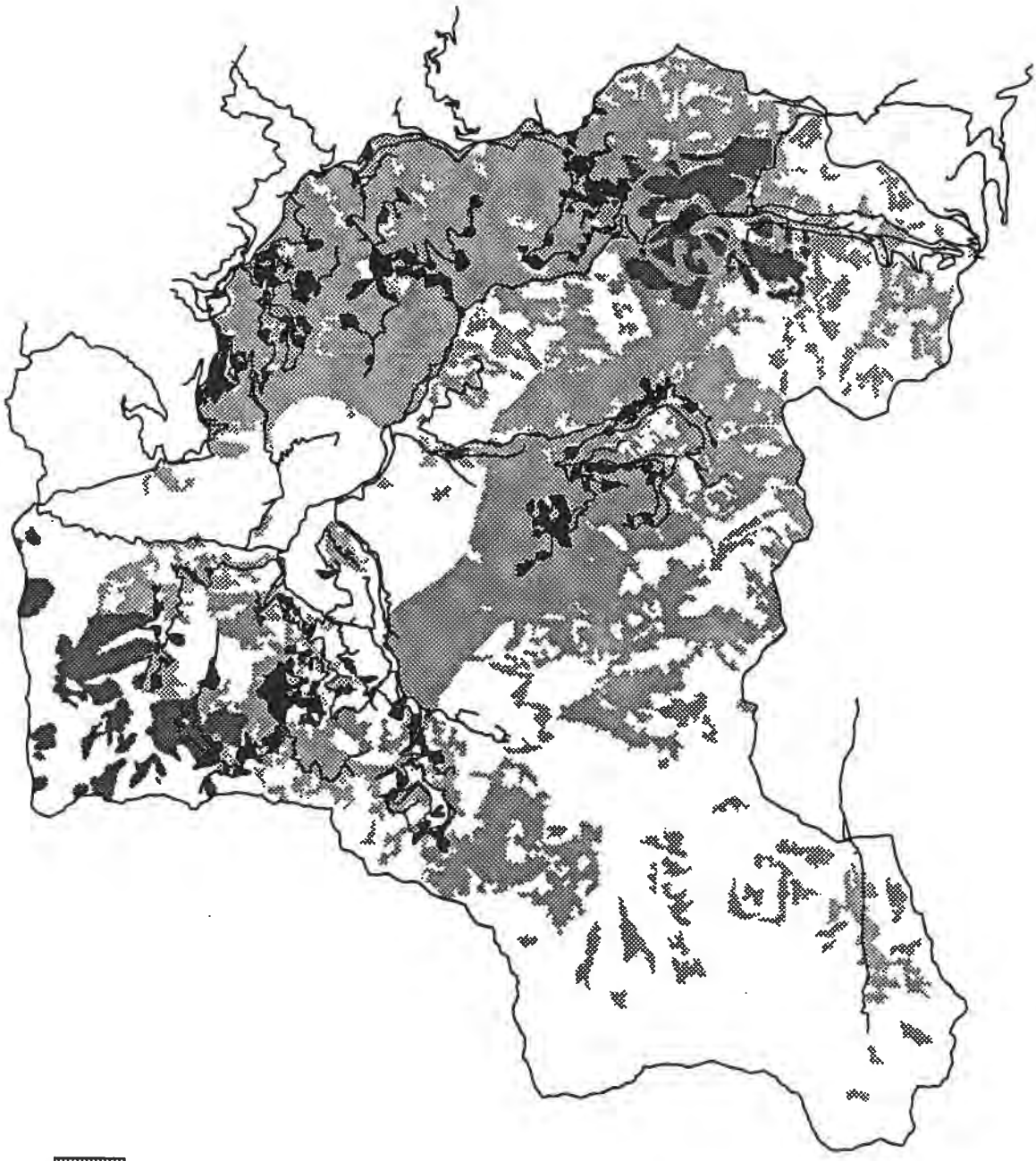


Figure 28

Upper South Fork Watershed
Trends in Sediment Production



Areas of Fuel Accumulation

Historic Fires
(High & Moderate Intensity)

Plantations

Highway/Road

0 3 Miles

Figure 29

Chapter 5 - Management Direction and Desired Condition

The land within the Upper South Fork watershed falls into one of two primary ownerships, private lands and Federal lands managed by the Klamath National Forest. All lands are subject to Federal and State laws but the National System Forest land is also subject to planning direction in the Klamath Forest Plan. Because the vast majority of the land within the Upper South Fork Watershed is under Forest Service management, the planning direction will be discussed in detail.

The Klamath Draft LMP has 17 separate management areas, 11 of which are applicable to the Upper South Fork, (see Figure 30 - LMP Preferred Alternative Map contained in the map packet).

This chapter briefly describes management direction provided by the Forest Plan and how that direction applies to Upper South Fork. The Forest Plan contains a longer discussion of management guidance that need not be duplicated here. Management area and private land acreage by subwatershed is provided in Table 19 - Management Area By Subwatershed. Additional guidance is provided for project level cumulative watershed effects (CWE) assessments and monitoring.

Table 19 - Management Area Acreage By Subwatershed

Management Area	Subwatershed Acreages					
	SFH	PET	EFH	TAY	LEF	CEC
RNA	--	--	--	--	--	1/
Wilderness	25,323	13,375	3,800	1,915	--	3,777
Wild Rivers	126	55	14	--	--	--
Special Habitat	--	456	8,541	4,272	6,647	8,284
SIAs	--	--	--	--	--	1,148
Riparian Reserves	--	1,248	693	921	275	1,547
Retention VQO	252	1,106	1,508	--	--	118
Scenic Rivers	--	--	--	--	--	280
Rec. Rivers	--	1,589	917	27	966	907
Partial Retention	--	4,626	4,690	1,434	1,623	5,654
General Forest	--	1,039	676	3,002	310	3,510
Private Lands	827	213	487	138	285	237
TOTAL	26,528	23,709	21,328	11,709	10,106	25,462

1/ Roughly 400 acres included in Wilderness Management Area acreage for CEC

FOREST-WIDE DIRECTION

There are numerous standards and guidelines from the LMP which apply Forest-Wide. Those which have the most potential to affect landscape pattern within Upper South Fork Salmon are:

BIOLOGICAL ENVIRONMENT, NORTHERN GOSHAWK

Under the Draft Forest LMP, six goshawk management areas were identified in the watershed; three occur within the matrix, three within LSRs. Based on historical information, the goshawk management areas in St. Claire, Sixmile, and the lower portion of Taylor drainages are occupied by nesting birds.

Desired Condition

Land Management Planning direction states that primary nest zones will be managed within a 0.5 mile radius of the nest site or cluster of nest sites. Within 60% (300 acres) of that zone, management activities will be conducted to retain the existing characteristics of the occupied stands. Throughout the remaining primary nest zone, the desired condition will be to provide a forest mosaic, dominated by large trees with overstory canopy clo-

sures of 40-60%, and open understories with occasional small openings. A foraging habitat zone, to be designated at a one mile radius centered on the primary nest zone, will be managed to maintain a mix of mid-mature/late (60%) and young (40%) seral conditions. Desired conditions also include open understories, large coarse woody material and small openings. The Sixmile goshawk area occurs within a designated LSR, and thus the achievement of this desired condition represents a conflict. There are opportunities to achieve them within the St. Claire and lower Taylor areas. Opportunities to achieve these conditions are discussed in *Chapter 6*.

MA-1 RESEARCH NATURAL AREAS

The proposed Limestone Bluffs Research Natural Area (RNA) is the only RNA, proposed or designated, within the Upper South Fork area. It is roughly 400 acres and is located in the French and St. Claire Creek drainages along the west boundary of the watershed. This is a geologic RNA proposed for the karst terrane and associated unique ecosystems.

The final RNA boundaries have not been mapped yet, but will be defined when the Establishment Record for the RNA is completed. Although currently listed as 400 acres, the actual area of the RNA may be larger as the limestone outcrops occupy 850 acres and the hydrologic influence zone, which is an integral part of the karst system, occupies 3,070 acres.

Management Goals

Manage RNAs for the "maintenance of unmodified conditions and natural ecological processes" *(FSM 4063.3)*.

Preclude impacts from human activities that would modify the value of the RNA. This is to maintain the area's value as a significant contribution to the Forest's biological and physical diversity and also as a gene pool for plant and animal species. In order to preserve the hydrologic function of the karst, the boundaries of the RNA must include as a minimum, the area of limestone outcrop and the hydrologic influence zone as identified on Figure 31 - Limestone Bluff Research Natural Area Map located at the end of this chapter. Field studies will refine this boundary in the future.

Desired Condition

RNAs will exist as examples of functioning ecological communities. Ecological processes would influence the biological and physical elements within each area. The exception would be in circumstances where management actions would further the management goals of the RNA, such as prescribed fire. Non-manipulative research, monitoring and educational activities will be ongoing within RNAs. Knowledge and information gained from RNA studies would be incorporated into Forest management. There will be minimal signs of human activities.

MA-2 WILDERNESS

The Upper South Fork Salmon River Watershed includes 48,044 acres of the Trinity Alps Wilderness. This constitutes approximately 40% of the analysis area. The wilderness bounds the south, southeast, and southwest portions of the watershed. Elevation ranges from 2,800 to 8,920 feet. Popular trails which access the wilderness originate at Big Flat, Harry Hull, and Carter Meadows Trailheads. The high elevation lakes in the Caribou Basin and headwaters of the East Fork South Fork are popular destination points within the watershed. Several trails access the wilderness in adjacent watersheds.

Vehicle access is restricted in wilderness areas, however there are private lands within wilderness in Upper South Fork which are accessed by vehicles. A road leads from Big Flat through the wilderness to private land near Josephine Lake and a motorcycle trail accesses the Glacierview Ranch from the Summerville Trailhead.

Management Goals

Manage for wilderness characteristics, natural conditions and ecological processes. Provide recreationists a primitive and semi-primitive nonmotorized recreation opportunity. Manage for high air quality. Utilize forage resources consistent with the *1984 Wilderness Act*. Manage for habitat that will contribute to the recovery of the Northern spotted owl, given the ecological processes within the Klamath Province.

Desired Future Condition

The wilderness will look natural, with human disturbances substantially unnoticeable. No evidence of human degradation can be seen in the attributes for which the wilderness was designated. Some evidence of human influence allowed by

the *Wilderness Act* may be present due to the existence of valid mining claims and livestock grazing operations.

Ecological processes, including fire, have shaped the vegetative patterns and condition. The desired condition is to enable these same ecological processes to continue in the future.

The trail system throughout the wilderness will provide recreational access. Some trails will keep a primitive condition, receiving light use and requiring a high degree of skill and challenge to negotiate. Other trails will accommodate light to moderate levels of use and will be easily negotiated.

MA-3 WILD RIVERS

The South Fork Salmon River from Blindhorse Creek upstream to the headwaters is recommended for inclusion into the Wild and Scenic Rivers system as a Wild River. The Wild classification applies to those rivers that are free-flowing, free of impoundments and generally inaccessible except by trail. This portion of the South Fork Salmon is dominantly within the Trinity Alps Wilderness except for the lower portion including about 200 acres of area along the river. This stretch is recommended because of its outstandingly remarkable cultural, fisheries, geological, and scenic values.

Management Goals

Protect the Wild river qualities in a free-flowing condition. Protect and enhance the outstandingly remarkable values for which the stream would be designated. Manage recreational activities to assure that the character and quality of recreational use will not cause adverse impacts to the resource values of the river areas.

Desired Future Condition

The river area shall appear essentially primitive, with little or no evidence of human activity although evidence of ecological processes may be evident.

MA-5 SPECIAL HABITATS

Late-Successional Reserve

There are two LSRs wholly or partially contained within the watershed. One occupies the Taylor Creek watershed, and the small drainages entering the Carter Meadows area, Fish Creek, and Trail and Long Gulches (Taylor Creek LSR). The other LSR occupies the drainages flowing south into the South Fork and East Fork of the South Fork Salmon including Sixmile, Shadow, and Crawford Creek drainages (Eddy Gulch LSR). In addition there are three known activity centers of roughly 100 acres in size (one is located partially in the wilderness), to which this management guidance applies (refer to Table 20 - Northern Spotted Owl Activity Centers by Management Area). They are located in Blindhorse, China and Black Gulch drainages. There are approximately 30,700 acres of LSR in the watershed. Roughly 14,500 acres are currently considered suitable habitat for spotted owls and other late seral forest associated species. Additional areas may be included as species (specific endemic species identified by the SAT) are identified as provided for in the survey and management standards and guidelines.

Table 20 - Northern Spotted Owl Activity Centers By Management Area

Management Area	Pairs	Territory Singles	Total
Designated LSRs:			
Eddy Gulch	6	0	6
Taylor Creek	7	0	7
Wilderness:	0.5*	1	1.5*
Matrix: 100 Acre Activity Centers	3.5*	0	3.5*
TOTAL	17	1	18

* Partially within wilderness/partially within matrix

MANAGEMENT GOALS

As stated in the *President's Plan Record of Decision* (4/94): The objective of the LSRs is "to protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth related species including the northern spotted owl. These reserves are designed to maintain a functional, interacting, late-successional and old-growth forest ecosystem."

Provide habitat conditions and management activities that contribute to the recovery of Federally listed T&E species found on the Forest. Emphasize recovery of each species by managing for quality habitat consistent with ecological processes.

Standards and guidelines in the *ROD* encourage the use of silvicultural practices to accelerate development of overstocked young plantations into stands with late-successional and old-growth for-

est characteristics, and to reduce risk to LSRs from severe impacts resulting from large-scale disturbances and unacceptable loss of habitat.

The ROD *Standards and Guides* refer to the compatibility of recreation within LSRs. It states "dispersed recreational uses, including hunting and fishing, generally are consistent with the objective of LSRs". Then it states adjustment measures should be used if recreation practices retard or prevent attainment of objectives. There are two developed campgrounds within LSRs, Shadow Creek and Trail Creek. By Klamath National Forest standards, there is high recreational use in the Carter Meadows area and associated trailheads, also within the LSR. Use includes backpacking, horse packing, camping, hunting, fishing and general sightseeing. In the winter, cross country skiing is popular here. Currently, the levels and types of use are compatible with LSR objectives. Disturbance by vehicular, human, or horse traffic is probably not a factor in this area, as it has developed and been in place over a long period of time.

However, one concern for the area is the increased fire risk associated with human use. Careful planning, public awareness, and education is necessary to keep this risk to a minimum. Some on-site fuel treatment adjacent to high use areas may be necessary. LSR objectives for snags and down woody material need to be balanced with fire hazard and risk reductions.

The ROD contains Standard and Guides (S&Gs) covering a variety of resource activities that commonly occur on public lands. Proposed projects within LSRs need to follow the S&Gs, and management objectives for allocated lands need to be met. Any Environmental Assessment that considers actions within LSRs need to incorporate the S&Gs and management objectives.

Desired Condition

The desired condition is to develop and maintain structure, composition, and ecological processes that are essential for the development and maintenance of late-successional and old-growth forest ecosystems, where site conditions allow. Major structural attributes include live old-growth trees, standing dead trees, fallen trees or logs on the forest floor, and logs in streams. Additional important elements typically include multiple canopy layers, smaller understory trees, canopy gaps, and patchy understory. These conditions begin between 80 and 140 years depending on site conditions, species composition, and site history.

In the California Klamath Province, the more structurally complex late seral stage conditions occur on north and east slopes at higher elevations. It is desirable to maintain the good sites in moderate to dense stands (60-100% canopy closure) of the tree species best suited to the site conditions. Decadence should be present, or even obvious in the stand, snags and large woody material would be common, although in varying concentrations throughout the stand. The exact amounts of material would vary from site to site, generally in the range of three to seven snags per acre. Deformed, broken, and diseased trees would be common enough to provide numerous nesting and roosting substrate opportunities for wildlife.

South and west slopes, particularly at lower elevations often have a high amount of hardwoods in the stand, or stands of pure hardwoods or shrubs intermingled with conifer stands. It is beneficial to have a canopy closure of 40-60% in these stands; a large amount contributed by mature hardwoods. Openings in the canopy are more frequent than in better sites. Snags and large woody debris is less prevalent, especially large concentrations of this material. Snags populations of two to four per acre is more desirable. The stands are more open, with less multiple stories present.

Process that create the current late-successional and old-growth ecosystems include: tree growth and maturation, death and decay of large trees, low to moderate intensity disturbances (e.g., fire, wind insects and disease) that create canopy openings and gaps in various strata of vegetation, establishment of trees beneath the maturing overstory trees either in gaps or under the canopy, and closing of canopy gaps by lateral growth or growth of understory trees. These processes result in forests moving through different stages of late-successional and old-growth conditions that may span several hundred years.

In the California Klamath Province, prior to fire suppression, fire was more frequent, less intense, and an integral part of the internal dynamics of a typical stand. The reintroduction of prescribed and natural fire to the LSRs will help encourage the processes and attributes that define late-successional and old-growth ecosystems.

It is expected, and even desirable to have low to moderate intensity fires burn in LSRs. Low intensity fires reduce fine fuels and ladder fuels, create a seedbed for a diversity of herbaceous plants, and keep the understory open enough for spotted owl movements. Moderate intensity fires are desirable if they create small openings in the canopy of one to five acres in size. This allows for regeneration of forest stands to begin and creates snag patches and concentrations of down woody material which are important prey base habitats. Burn openings are most desirable if they occupy a small percentage (5-10%) of stands providing habitat.

Introduction of a fire cycle similar to that which occurred in pre-suppression times, will reduce the risk of catastrophic, stand-replacing fires. Large stand replacing, high intensity fires are not desirable within LSRs. If they do occur, limiting the size of burn to 200 acres or less is highly desirable. Management tools, such as underburning, salvage logging, and other fuel reduction methods should be used to reduce the possibility of this kind of fire occurring. Geographic features such as slope, aspect, and elevation, as well as fuel types need to be examined and priorities for an active fuel reduction program established. It is preferable to treat large blocks (i.e., 100-200 acres) of vegetation and then leave large blocks untreated.

Fuel treatments needs to be balanced with other LSR objectives; a fire management plan may need to be developed. Furthermore, lands adjacent to LSRs, with high fire hazards and risks should be examined for possible prevention of catastrophic fires. Areas downslope or downwind of prevailing wind patterns should be examined.

The transportation system within LSRs should be complete enough to provide administrative access to each drainage and major subdrainage, but not dense enough to inhibit the attainment of management objectives. Dense road systems (>2 mile/sq.mi.) fragment habitat, disrupt wildlife species movement, and provide access for wildlife harassment. In addition, dense road systems can damage watershed and fisheries values. However, some road system is needed in the watershed to maintain management options and allow management practices to occur. Roads provide access for fire suppression, prescribed burning, silvicultural practices, and salvage logging. In summary, the desired condition for transportation systems is to strike a balance between the various management objectives for LSRs; options for management need to be maintained, but habitat and wildlife need to be protected.

Watershed Elements

Many of the elements within the Upper South Fork Watershed (non-commercial forest, montane brush, grass/forbs, water, barren areas, and scattered small, medium/large sized conifers) are primarily a result of the inherent diversity within the watershed (soils, geology, etc). On many sites, they are not likely to change much in terms of acres gained or lost. The desired condition for those elements expected to, or have the potential to undergo substantial change in terms of composition and total acres gained or lost is discussed.

PLANTATIONS --The assumption is made that these patch types are capable of supporting mature and late-successional forest, therefore, the desired condition is to manage them as such. Residual snags, hardwoods, and down logs from the previous stand would be desired components to maintain within these plantations. Ten to fifteen hardwoods per acre should be carried through the life of the stand. In the interim, the stands should be healthy and fast growing with stocking levels and fuel accumulations that reduce the likelihood of loss to catastrophic fire.

MONTANE BRUSH --Within the Taylor Creek LSR, some of the acres currently vegetated by montane brush are a result of fires which occurred in 1955. Approximately one-half of these acres occur on productive sites and have the potential of supporting mature and late-successional forest. Soils within the Eddy Gulch LSR are more shallow and rocky. Within this LSR, no site currently vegetated by montane brush has the potential to support mature and late-successional forest.

TRUE FIR/DOUGLAS-FIR AND MIXED CONIFER, OPEN STANDS --Within the Taylor Creek LSR, some of the acres currently vegetated by open coniferous stands are a result of fires which occurred in 1955. About one-half of these stands occur on productive sites with potential for supporting closed canopied stands of mature and late-successional forest. Soils within the Eddy Gulch LSR are more shallow and rocky. Approximately one-half of the open true fir stands and one-tenth of the open Douglas-fir/mixed conifer stands have the potential of supporting closed

canopy stands of mature and late-successional forest.

TRUE FIR/DOUGLAS-FIR AND MIXED CONIFER, CLOSED/SMALL --Desired condition for these stands is to maintain them and allow them to develop into large sized stands where site capability allows. Snags, hardwoods, down logs, and vegetative layering would be desired components within these stands. The most structurally diverse stands will occur primarily on north and east slopes. Fuel accumulations will be lowest on south slopes and at lower elevations.

TRUE FIR/DOUGLAS-FIR AND MIXED CONIFER, CLOSED, MEDIUM/LARGE --Desired condition is to maintain and perpetuate stands with low levels of fine fuels and moderate levels of large down logs, decadent live trees, and snags. Moderate and large sized hardwoods would be present where ecological capabilities allow. Periodic concentrations of large down material and snags should be present, particularly on north and east-facing slopes, with fuel accumulations lowest on south slopes. Multi-layered canopies are desired, but disruptions in the continuity is important to minimize ladder fuels. Gaps in the forest canopy would be present, with regeneration occurring.

The following table (Table 21 - Vegetative Composition Within Mapped LSRs) does not include the 100-acre know spotted owl activity centers:

Table 21 - Vegetative Conditions Within Mapped LSRs

LSR Element	Existing Acres
EDDY GULCH	
True Fir, 3P	255
True Fir, 3G	318
True Fir, 4P	109
True Fir, 4G	209
DF/Mixed Conifer, Dense	6,478
Plantations, 0-20 Yrs.	757
Plantations, >20 Yrs.	426
Plantations, Age Unknown	182
Commercial Hardwoods	47
Non-Commercial Hardwoods	1,099
Montane Brush	403
Grass/Forbs	39
Barren Areas	37
Urban Development	18
Riparian Brush	1
DF/Mixed Conifer, Open	4,615
TOTAL	**14,993**
Existing Dense Mature & Late-Successional Forest: 7,004 ac. (47%)	
Desired Dense Mature & Late-Successional Forest: 7,000-9,000 ac. (47-60%)	
TAYLOR	
True Fir, 3P	382
True Fir, 3G	110
True Fir, 4P	137
True Fir, 4G	231
DF/Mixed Conifer, Dense	6,903
Plantations, 0-20 Yrs.	383
Plantations, >20 Yrs.	380
Plantations, Age Unknown	145
Non-Commercial Hardwoods	765
Montane Brush	1,488
Grass/Forbs	126
Water	30
Barren Areas	51
Riparian Brush	64
DF/Mixed Conifer, Open	4,237
TOTAL	**15,433**
Existing Dense Mature & Late-Successional Forest: 7,244 ac. (47%)	
Desired Dense Mature & Late-Successional Forest: 7,200-11,100 ac. (47-72%)	

LATE SERAL FOREST HABITAT AND OTHER LAND ALLOCATIONS

In addition to LSRs, the established Trinity Alps Wilderness provides a considerable amount of mature and older seral stage vegetation suitable as spotted owl and other dependent species habitat. The upper drainages of St. Clair Creek, Blindhorse Creek, Rush Creek, and Garden Gulch offer large patches of habitat. There are 11,000 acres of habitat in the wilderness. The amount and condition of this habitat has developed through time by natural biological processes which occur on these Congressionally designated lands. Because of wilderness management policies, opportunities are limited for maintaining, enhancing, or developing suitable spotted owl habitat.

Critical Habitat

In January 1992, the Fish and Wildlife Service designated critical habitat for the northern spotted owl. The Fish and Wildlife Service may review and revise its critical habitat designation for the northern spotted owl, based upon the provisions of the land allocations and associated standards and guidelines as a result of the Record of Decision for amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl. "In the interim, the combination of, and standards and guidelines for, Late-successional Reserves, Riparian Reserves, and matrix, should allow for critical to habitat to perform the biological function for which it was designated. Any site-specific considerations of critical habitat in the matrix are considered minimal and will be evaluated through watershed analysis and be addressed in area-specific plans, as appropriate", *(USDA and USDI, 1994)*.

Two critical habitat units (CHUs) lie entirely within the watershed (CA27, CA28) and a portion of a third occurs along the northwest boundary of the watershed (CA25). These CHUs occur within the Northern Interior Coast Range Subprovince as described by USDI in the draft "*Description of Critical Habitat for the Northern Spotted Owl in California*". The subprovince was noted as important due its high density of owls.

At the time critical habitat was designated, the Forest was managing for Habitat Conservation Areas (HCAs). The designation of CA25 extended beyond the then HCA boundary in order to aid in supporting a target number of owl pairs identified by the Interagency Scientific Committee (ISC). Within the watershed, approximately 2,130 acres of critical habitat extends beyond the now LSR boundary to the matrix. Currently, one territory single occurs within that portion of critical habitat. As directed by the ROD, 100 acres of the best spotted owl habitat will be retained around that known activity center. The designation of CA25 also intended to extend protected owl habitat to the southwest, helping to connect other CHUs across the Salmon-Trinity Alps Wilderness. The table below (Table 22 - Elements By Management Areas Within CHUs) displays the acres by watershed element that occur within the matrix:

Table 22 - Elements By Management Areas Within CHUs

MANAGEMENT AREA *	WATERSHED ELEMENT **	ACRES
02	1	38
	2	110
	3	68
	4	33
	6	0
	8	0
	11	13
	12	3
	14	1
	17	7
		274
03	2	140
	4	164
	9	0
	10	53
		357
07	2	314
	4	150
	6	1
	7	25
	10	50
	11	1
		543
08	2	10
	4	53
	6	2
	10	259
	11	59
		383
101	1	610
	2	9,386
	3	493
	4	5,546
	6	1,219
	7	638
	8	175
	9	47
	10	1,123
	11	783
	12	97
101 Cont.	13	30
	14	55
	17	49
		20,253
11	2	121
	4	72
	11	0
		194
12	2	5
	3	1
	4	1
	7	1
	8	0
		9
13	2	491
	3	1
	4	286
	6	3
	9	0
	10	12
	11	5
		800
15	2	419
	4	432
	6	65
	7	193
	8	1
	10	17
	11	1
		1,127
TOTAL		23,940

*** KNF FINAL EIS - MANAGEMENT AREA CODES:**
01 = Private Lands
02 = Congressionally Designated (Wilderness, BVNG)
101 = Late-Successional Reserve
Administratively Withdrawn -
03 = Eagle, Falcon, Sensitive Plant
04 = Special Management (RNA, SIA, Cultural Areas)
05 = Backcountry
06 = Wild River
07 = Mapped Riparian Reserve
102 = Winter Range
08 = Harsh Sites, Non-Capable
Matrix -
09 = Managed Wildlife Habitat
10 = Scenic River
103 = Forage
12 = Retention

11 = Recreational River
13 = Partial Retention
15 = General Forest
** ELEMENTS:
Matrix -
1 = Dense True Fir (3G & 4G)
2 = Dense DF/Mixed Conifer (3G & 4G)
Patch -
3 = Sparse True Fir (3P & 4P)
4 = Sparse DF/Mixed Conifer (3P & 4P)
6 = Plantations, 0-20 yrs.
7 = Plantations, > 20 yrs.
8 = Plantations, age unkown
9 = Commercial Hardwoods
10 = Non-Commercial Forest
11 = Montane Brush
12 = Grass/Forbs
13 = Water
14 = Barren Areas / Corridor
17 = Riparian Shrub

NORTHERN SPOTTED OWL RECOVERY PLAN GOALS

The goal of the *Final Draft Recovery Plan for the Northern Spotted Owl* (USDI, 1992) is to delist the owl throughout its range. The major threat to the subspecies, identified by the USDI, were that suitable habitat was unprotected and decreasing throughout its range. For delisting to occur, it must be demonstrated that adequate habitat suitable for spotted owls exists and will continue to exist to allow the species to survive without the protection of the *Endangered Species Act*. In addition, evidence must be available that owl populations are stable or increasing and are unlikely to become threatened again in the foreseeable future.

The same strategic and biological principles used for the development of the Draft Recovery Plan were also used in the development of the alternatives in the SEIS, including *Option 9* (USDA Forest Service and USDI Bureau of Land Management 1994). The following are biological principles from the Draft Recovery Plan which are most applicable in the context of watershed analysis: Emphasis should be placed on management for clusters (or local population centers) of owls in large habitat blocks rather than for individual pairs, and Habitat conditions and spacing between local populations must provide for survival and movement of Northern spotted owls.

As discussed previously, this watershed includes approximately 30,400 acres (over 25%) of designated LSR which are intended to provide for multiple pairs of spotted owls (Table 20). Spacing between the two LSRs (less than one mile in some areas) is adequate to allow for movement of dispersing juvenile and adult Northern spotted owls.

PEREGRINE FALCON MANAGEMENT AREA

Two peregrine management areas are located within the watershed. Each management areas approximates a one-half mile radius area around the eyrie. This area is also referred to as the nest protection area. Some overlap occurs with Riparian Reserves and LSRs; however it is considered to be minimal and no conflicts in management direction are apparent at this time.

Management Goals

Management goals are to protect these sites in accordance with the US Fish and Wildlife's approved Recovery Plan in order to contribute towards the recovery of the species. Recovery Plan objectives include to protect and enhance essential breeding habitat, prevent direct human interference and habitat disturbance at nest sites, and to maintain suitable food supplies near nest sties. Forest direction includes the additional designation of a primary protection zone around this management area. The intent is to increase reproductive success by restricting noise disturbance activities to periods outside breeding season.

Desired Condition

The desired condition is to maintain nest protection areas which are free of disturbance that would interfere with the breeding cycle of peregrine falcons. Also, to maintain the integrity of the area by avoiding large scale changes in the vegetative composition.

PATCHES - Several patch types are included within this management area including non-commercial forest, montane brush, and scattered open stands. These patch types provide for a diversity of habitat, and thus, a variety of prey species. It is desirable to maintain these areas in a healthy condition to maintain foraging opportunities.

WATERSHED MATRIX - Maintenance of the existing matrix would be desirable to avoid large scale changes to the area around the eyrie. Activities or processes which may affect the sub-canopy structure of the stand would be compatible with this management area. Maintenance or enhancement of vegetative conditions which would provide opportunities for foraging, such as providing for large

snags which provide above-the-forest canopy or maintenance of existing openings, would be desirable.

The following table (Table 23- Existing Conditon Acreages for Peregrine Falcon Management Area) displays existing acres by element:

Table 23 - Existing Condition Acreages for Peregrine Falcon Management Area

AREA Element	Existing Acres
WESTERN	
DF/Mixed Conifer,Dense	43
Commercial Hardwoods	39
Non-Commercial Forest	162
Montane Brush	34
DF/Mixed Conifer, Open	115
TOTAL	393
NORTHERN	
DF/Mixed Conifer, Dense	170
Commercial Hardwoods	1
Non-Commercial Forest	53
DF/Mixed Conifer, Open	170
TOTAL	394

MA-7 SPECIAL INTEREST AREAS

Two geologic Special Interest Areas (SIAs) and part of one botanical SIA are located within the Upper South Fork. These are Caesar Peak Snow Field and Coffee Creek Stream Capture geologic areas, and the Gray Pine botanical area. All of these are partly or completely within the Trinity Alps Wilderness and do not have a separate land allocation at this time. The Caesar Peak Snowfield is the remnant of a small glacier, and is one of the southernmost examples of such a feature. It is situated on the south flank of Caesar Peak. The Coffee Creek Stream Capture is an example of a stream capture, where the South Fork of the Salmon River captured the headwaters of ancestral Coffee Creek. It is located in the vicinity of the Big Flat Campground. The Gray Pine botanical area features *Pinus sabiniana* at the northern end of its range.

Management Goals

Manage for ecological processes and unique features for which the area was designated. Promote public use, education, interpretation, and enjoyment of the special interest values of the area when such activities do not harm values for which the area was designated.

Develop partnerships with local or regional groups to foster public education and enjoyment of these special resources and research opportunities where possible.

Desired Condition

These SIAs are within the wilderness. Few signs of management activities will be present, fostering a primitive or semi-primitive recreational experience. Educational or interpretive information on the ecological or scenic values may be provided in recreational areas outside of wilderness. This could promote public awareness of the unique features present within the wilderness, while maintaining wilderness standards at the sites.

Watershed Elements

The vegetative elements along the Coffee Creek Stream Capture are subject to natural ecological processes. Refer to the wilderness discussion of watershed elements for description.

The condition of Caesar's Peak Snowfield is subject to climatic variables. In years of average (or better) snowfall, the snowfield will persist throughout the year. Whereas in drought years the snowfield may not be present in late summer. For comparison the snowfield did not persist during the drought year of 1992. The following year (1993) received a slightly above average snow pack and the snowfield persisted throughout the year.

MA-10 RIPARIAN RESERVES

The Riparian Reserve consists of lands where riparian dependent resources receive primary emphasis, and where special Standards and Guidelines apply (see Figure 32 - Option 9 Reserves Map contained in the map packet). They include portions of a watershed required for maintaining hydrologic, geomorphic, and ecologic processes directly affecting standing and flowing water bodies (e.g., lakes and ponds, wetlands, streams, stream processes, and fish habitats). Also included are habitat needs of a variety of animals (e.g., 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:

- Fish-bearing streams--Riparian Reserves consists of the stream and the area on each side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100 year floodplain, or to the outer edges of riparian vegetation, or to a distance equal to the height of two site-potential trees, or 300 feet slope distance (600 feet total, including both sides of the stream channel), whichever is greatest.
- Permanently flowing/Nonfish-bearing streams--Riparian Reserves consist of the stream and the area on each side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100 year floodplain, or to the outer edges of riparian vegetation, or to a distance equal to the height of one site-potential tree, or 150 feet slope distance (300 feet total, including both sides of the stream channel), whichever is greatest.
- Constructed ponds and reservoirs, and wetlands greater than one acre--Riparian Reserves consist of the body of water or wetland and: the area to the outer edges of the riparian vegetation, or to the extent of seasonally saturated soil, or the extent of unstable and potentially unstable areas, or to a distance equal to the height of one site-potential tree, or 150 feet slope distance from the edge of the wetland greater than one acre or the maximum pool elevation of constructed ponds and reservoirs, whichever is greatest.
- Lakes and natural ponds--Riparian Reserves consist of the body of water and: the area to the outer edges of the riparian vegetation, or to the extent of seasonally saturated soil, or to the extent of unstable and potentially unstable areas, or to a distance equal to the height of two site-potential trees, or 300 feet slope distance, whichever is greatest.
- Seasonally flowing or intermittent streams, wetlands less than one acre, and unstable and potentially unstable areas--This category applies to features with high variability in size and site-specific characteristics. At a minimum, the Riparian Reserves must include: 1) the extent of unstable and potentially unstable areas (including earthflows), 2) the stream channel and extend to the top of the inner gorge, 3) the stream channel or wetland and the area from the edges of the stream channel or wetland to the outer edges of the riparian vegetation, and 4) extension from the edges of the stream channel to a distance equal to the height of one site-potential tree, or 100 feet slope distance, whichever is greatest.

A map of interim Riparian Reserves was developed for this analysis. It utilized existing geologic mapping of unstable areas and a digital elevation model to identify intermittent streams. This map and associated electronic data file is intended for display purposes, and to get preliminary information on the area occupied by the Riparian Reserve. It is not intended for site specific use.

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 serve as connectivity corridors among 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, there will be a great 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, pines, and phreatophytes such as maples, alder, willow, etc. In unstable areas, the desired plant communities will 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, but in some situations, non-native species may be desirable. 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. Riparian Reserves will also provide organic matter, ash, sediment, and nutrients to allow karst processes to operate without significant disruption.

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 these species is lacking. Due to this lack of information, **it is recommended that the Interim Riparian Reserve widths not be reduced at Upper South Fork as a result of this analysis.** More information may 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 refinement of the Riparian Reserve boundaries. The need for such revision 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 nonpermanent 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 follows:

> "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, and 3) lands identified as unstable by geologic investigations using the criteria stated above (includes lands classified by 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."

The Klamath National Forest Draft Land Management Plan identified active landslides, inner gorges, toe zones of slumps and earthflows, and severely dissected granitic lands as unsuited for programmed timber harvest due to slope instability. Of these, active landslides, inner gorges, and toe zones have been mapped and are in GIS. The severely dissected granitic lands are not mapped.

Future Projects will need to verify the existing mapping of unstable and potentially unstable lands as follows:

- Inner gorge- Field work conducted after development of the geomorphic data layer in the GIS revealed that many of the inner gorges on first and second order streams were mapped considerably wider than they were in the field, so this should be taken into account at project level. Refined mapping of inner gorges is available for the area around Blindhorse to Cecil Creek.
- Slumps and Earthflows- Many toe zones of slumps and earthflows were not mapped on the geomorphic data layer; projects should refine this mapping. Slump and earthflow deposits are typically very sensitive to disturbance, and each feature needs to be carefully evaluated to determine if it should be included in the Riparian Reserve.
- Severely Dissected Granitic Lands- The granitic lands in the vicinity of Blindhorse Creek at elevations below 4,000 feet meet the description of the severely dissected granitic lands (as defined in the Draft Land Management Plan), and as such should be included with the Riparian Reserve following field delineation of actual boundaries.

• Other Unstable Lands- In the Upper South Fork Watershed, the steep (>60%) swales at the heads of low order drainages in some of the granitic lands, such as in the Taylor creek watershed are potentially unstable. These lands have not been mapped, and will need to be identified by the project. They are generally isolated patches of less than an acre in area. Swales such as these also occur in lands underlain by different rock types. 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.

Hydrologic Influence Zone --The hydrologic influence zone (see Figure 30) is the area adjacent to the karst at Limestone Bluff Research Natural Area. It includes the karst plus those lands which are linked to it hydrologically (*Chapter 4 - Processes, Interactions, and Trends*). As part of this analysis, a preliminary map of this zone was developed. The map is based on detailed field mapping in some areas and air photo interpretation in others. Much of this zone comprises part of the Riparian Reserve in that disturbances which occur there have a direct effect on stream and other geomorphic (karst) processes downslope. Field refinement of this boundary should include additional detailed mapping of the karst surface exposure, field cross sections, and continued mapping of the cave resources. Subsurface data need to be linked accurately to surface data. This information can be used to delineate Riparian Reserves in-the-field, and these in turn be used in delineating the final RNA boundaries.

Determination of Potential Tree Height --Potential tree height should be determined at the site level. Guidelines are currently being developed in Region 5 and 6.

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.

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. For a summary of biological information, refer to Appendix J - Biological Considerations for Riparian Reserve Widths.

1- Riparian Reserve widths applied at Upper South Fork will be equal to or greater than the interim widths identified in the ROD.
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 intended to benefit from the reserves. 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, independent of planned management activities. For example, boundaries for the Riparian Reserve will not be shifted across the landscape as different management activities are planned for the area.
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 or withdrawal from 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. Also, it is often necessary to balance long-term goals against short-term risks. This is particularly true of the reduction of fuel loads which provide long-term benefits in reducing fire risk, but may incur short-term risk of accelerated surface erosion due to loss of vegetative cover.

MA-11 RETENTION VISUAL QUALITY AREAS

The watershed includes 3,000 acres (three percent of the watershed) of lands which are to be managed to meet the Retention Visual Quality Objective (VQO). These lands include the foreground views of roads, a river, and trails with a high visual sensitivity.

Management Goals

Provide a level of attractive, forested (where capable) scenery by maintaining the areas in natural or

natural appearing condition. Manage human activities so they are subordinate to the characteristic landscape. Also manage human activities so they are not evident to the casual forest visitor.

Desired Future Condition
The signs of management activities will not be apparent. Foreground views from the Cecilville-Callahan Road, the Pacific Crest Trail, both the Trail and Long Gulch Trails, and to recreationists on the recommended wild segment (outside of wilderness) of the South Fork Salmon River, will provide a natural or natural appearing forest (where capable). Management activities should mimic natural patterns, thereby retaining the naturally established watershed character.

Vegetative or ground-disturbing management activities that have been implemented will repeat form, line, color, and texture that represent characteristics of the watershed. Changes in their qualities of size, amount, intensity, direction, pattern, etc. would not be evident to the average Forest visitor.

Visual assessments are to be based on what can be seen, or the "seen areas" as observed from the above roads, rivers, and trails.

Other Management Areas which would be managed to meet Retention VQOs while managing for other resource values include Research Natural Areas, and Wild River segments.

MA-12 SCENIC RIVERS
The portion of the South Fork Salmon River from about St. Claire Creek to the downstream limit of the analysis area is a designated Scenic River for approximately 280 acres. This is the only stream in the Upper South Fork watershed designated or proposed for Scenic status. The outstandingly remarkable value for which it is designated is fisheries values.

Management Goals
Preserve the Scenic River qualities in a free-flowing condition and protect the outstandingly remarkable value for which the river was designated. Provide recreational use that will not cause adverse impacts to the outstandingly remarkable values of the river areas.

Desired Future Condition
The river area should appear largely primitive and shoreline largely undeveloped although some discernible developments may be present. The river environment should present an overall natural character.

MA-13 RECREATIONAL RIVERS
Portions of the South Fork Salmon and East Fork South Fork are designated or proposed to be included in the Wild and Scenic Rivers system as Recreational Rivers. This includes about 4,400 acres within the Upper South Fork Watershed. The outstandingly remarkable values involved include fisheries, cultural, wildlife, and water quality.

Management Goals
Preserve the Recreational Rivers in a free-flowing condition. Protect the river and its immediate environment for the benefit and enjoyment of present and future generations. Protect and enhance the outstandingly remarkable values for which the river was designated, while providing for public recreation and resource uses that do not adversely impact or degrade those values. Manage recreation activities to assure that the character and quality of recreation use will not cause adverse impacts on the resource values for which the river is designated or recommended.

Desired Future Condition
The river area may be developed for the full range of agricultural and forestry practices, may show evidence of past and ongoing timber harvest and may include some residential, commercial, or similar development. The waterway should remain generally natural and riverine in appearance.

MA-15 PARTIAL RETENTION VISUAL QUALITY AREAS
The Partial Retention VQO land allocation is the area not within one of the previously mentioned land allocations but has some visual sensitivity. These areas are primarily in the middle distances (one-half to three miles) from selected roads and trails.

Management Goals
Provide an attractive watershed where management activities remain visually subordinate to the natural character of the watershed. Manage for a programmed, sustained harvest of wood products in areas capable, available, suitable, and appropriate for timber management.

Desired Future Condition
Partial Retention VQO areas will show evidence of management activities but will be visually subordinate to the characteristic watershed. Views from visually important roads and trails will provide a nearly natural looking watershed.

MA-17 GENERAL FOREST
This management area varies in size and locations within the watershed. The majority of the areas are located within the southwest portion of the watershed generally the Cecil Creek and St. Claire area. Overall three levels of General Forests exist within the watershed, they consist of 625 acres of General Forest with no scheduled timber harvest, 525 acres of General Forest with a limited schedule of timber harvest and 4,308 acres of General Forest which are lands where timber management is a high priority.

Management Goals
Provide a programmed, non-declining flow of timber products, sustainable through time. Maintain conifer stocking levels and high growth rates commensurate with the capability of the site to produce wood fiber. Intensively manage young regenerated stands to maximize growth potential.

Manage activities to maintain stand vigor and resilience to disturbances such as wildfire, insects and disease. Emulate ecological processes and stand and watershed patterns where possible.

Within harvest units, maintain the structure, composition and ecological function of the area. Provide for snags and hardwood habitat to help maintain viable populations of wildlife species that require these structural components.

Reintroduction of fire into the watershed to attain pre-fire suppression stocking levels and fuel loadings.

Utilize the adjacent vegetation patterns of a mosaic of serial stages and stocking levels. By utilizing vegetative patterns and past disturbance occurrences VQOs of Modification and Maximum Modification will be met or exceeded.

Gradual changes of stand structure would be desirable in the I Am Up Ridge area.

The need for new access routes is minimal and an upgrade of design features of existing roads for less maintenance is desirable.

General Forest land has the potential to attain 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.

Desired Future Condition
These areas will be a mosaic of vigorously growing forest stands made up of a variety of vegetative species. The composition of individual stands will vary considerably depending upon the forest type and seral stage development. Although openings with hardwoods, shrubs, grasses and forbs will be apparent, forest stands will consist primarily of conifers.

Stand structure will be variable. Generally, the forest will look younger than the surrounding areas, but will blend with the surrounding landscape. Stand sizes will vary with topography and watershed pattern of the surrounding area. Clearcutting will be infrequent. Regeneration openings will generally retain clumps of green trees (15-20% of the stand) and individually scattered green trees (two to five per acre of average stand diameter). Forests plantations will become available for regeneration between 80-120 years or will adjust to be consistent with Option 9. Commercial thinning will be used frequently to maintain healthy, vigorously growing trees. Fuelwood and other forest products would be available.

Watershed Elements
The general watershed element descriptions are consistent with management emphasis in this area. The vegetation in this management area consists of a variety of structural classes in the conifer matrix.

With emphasis on maximizing growth potential, there would be a higher proportion of younger stands and less evidence of decadence than elsewhere in the watershed. The riparian reserve network would contribute to the diversity found within this management area.

The Taylor Creek area Late-Succession Reserve is the critical element from which Gould Gulch cre-

ates connectivity from the Taylor Creek to the late-succession area in Sixmile Creek.

Description --These are capable, available, and suitable lands where no other constraining land allocation occurs. This will be consistent with FEMAT Report and Option 9 allocations.

General Forest is broken into three regulations classes:

- Regulation Class 1 is timber emphasis. These timber emphasis lands are characterized by relatively high timber yields using the full range of silvicultural practices to obtain these yields within the standards and guidelines designed to provide for multiple uses. Rotation ages on intensive timber lands occur near culmination of mean and annual increment occurs at a point where net merchantable growth is at its maximum.
- Regulation Class 2 is moderate timber yields. These lands which co-empathize timber management and other resources related equally are characterized by moderate yields (70 to 80% of the biological potential) and by longer rotations. Such reductions are due to limitations on silvicultural practices of to an emphasis on other resource objectives.
- Regulation Class 3 is minimal timber yields. These lands emphasize non-timber resources and timber yields are characterized as minimal (20% of biological potential). All prescriptions are available, but longer rotations and reduced rates of regeneration harvest restrict timber yields.

Management Goals --The objective of this Management Area is to provide a regulated, non-declining flow of timber products, sustainable through time. Conifer stocking levels would be commensurate with the capability of the site, ranging from 75 - 200 trees/acre.

Manage stands to maximize growth potential. Manage activities to maintain stand health and resilience to wildfire, insect, disease or other natural processes. Emphasize salvage and restoration from catastrophic events. Reforest capable, but currently non-stocked lands. Develop a transportation system to transport Forest commodities efficiently to available markets.

Desired Future Condition --These areas will be a mosaic of vigorously growing forest stands made up of a variety of vegetative species. Stand structure will vary over time from bare ground to forest plantations, and to mature, well stocked conifer stands. Generally, the forest will look younger than the surrounding area, but stand size and structure will be quite variable over time. Forest plantations will become available for regeneration between 80 - 120 years or will adjust to be consistent with Option 9. Clearcutting will be infrequent. Regeneration with residuals and uneven-aged stand structure will be more common. Retain clumps of green trees (15% - 20%/unit) and individually scattered trees (two to five trees/acre of average stand diameter). Commercial thinning will be used frequently to maintain healthy, vigorously growing trees.

General Forest - What Does It Look Like Now And In The Future? --Overall, less then seven percent of the Upper South Fork Watershed is within the General Forest Management Area.

Watershed Elements Unaffected --Certain watershed elements will maintain the same amount and distribution regardless of being managed to meet General Forest Management Objectives. These elements include:

Hardwoods - Commercial and non-commercial hardwoods represent less then one percent within this management area. The amount and distribution is not expected to change based on General Forest Management objectives. Hardwoods are not available for conifer conversion opportunities.

Grass/Forb - Grass/forbs represent less than one percent of this management area. This element will not change in patch size although there may be more in the understory as a result of management activities such as regeneration or intermediate treatments, brush conversion to conifers, or underburning.

Barren - This element is also very limited within this management area (less than one percent) and will not change in size or arrangement.

Montane Brush - This element is also very limited within this management area (less than one percent). Although brush species will be more prevalent in understories in regenerated areas, acres classified as this type will change little.

Matrix Components Affected --The following components of the matrix are likely to change in size, condition, and/or arrangement within this management area.

Conifer Seedlings/Saplings (Existing = 4%, DFC= 15-20%) - Conversion of capable lands and regenerating some of the existing stands within this management area (concentrating with the medium-sized conifers) can contribute to this desired condition. Based of the Klamath NF's plantation inventory and assuming an average Site Class 3 for mixed conifer, existing plantations will reach an average DBH of 13" at 60 years. Stand growth has been projected to culminate at 100 years without commercial thinning or 120 years with commercial thinning. This correlates to the desired range for rotation length (80-120 years) for this management area. Young plantations are desirable to maintain growth, productivity and structural diversity over time. Less regeneration would occur in the northwest and eastern portions, while the southwest portion would provide the greatest regeneration opportunities. Often fewer trees/per acre will be planted to: a) promote the growth of larger trees in a shorter period of time, b) avoid precommercial thinning costs, and c) reduce excessive fuel loadings. Recommended stocking levels are 150-200 trees/acre for the mixed conifer forest type and 75-150 trees/acre within the ponderosa pine forest type. Plantations have been identified by the district as an important investment, representing a unique vegetative component. Plantations provide future opportunities for wildlife habitat and vegetative diversity over time.

Pole-Sized Conifers (Existing = 16%, DFC= 15-20%) - The amount of desired seedlings/saplings would become the desired amount of pole-sized stands over time. This meets General Forest objectives for the same reasons described above. These areas will be a mosaic of vigorously growing stands made up of a variety of vegetative species. The existing older plantations range between 30-40 years and closely resemble the size class of pole-sized conifers. In areas with high fire risk, a high degree of contrast or edge is desirable. Fuel treatment is desirable where needed to reduce potential loss of this resource.

Forested, Small Sawtimber Conifers (Existing = 35%, DFC= 35-40%) - The major management opportunity within this type is commercial thinnings which would aim to maintain stocking at optimal levels for tree growth in order to achieve General Forest objectives. Harvest operations should be prioritized to treat stands where the greatest increase in conifer growth and yield can be obtained or where the presence of disease and insect problems jeopardize meeting resource objectives.

Forested, Medium/Large-Sized Conifers (Existing = 36%, DFC= 20-25%) - This type provides the greatest opportunity for management activities to meet General Forest objectives. A significant portion of this type would be converted to younger conifer stands in order to approach a more regulated forest condition. General Forest objectives specify that commercial thinning will be used frequently to maintain healthy, vigorously growing stands. Tree mortality due to drought and insect attack has reduced the future available seed source in certain portions of the watershed. Protecting and maintaining the remaining existing seed source is critical to future resource opportunities. Additionally, General Forest management direction specifies that salvage and reforestation efforts are a priority. Minimize the loss of timber value where possible.

HARSH SITES

These are areas originally part of General Forest but not considered for full timber yield due to economic considerations in the Klamath Draft LMP. Many of these areas are harsh sites with low yields and difficult regenerability while others have better site conditions but are not economically accessible depending on economic conditions. The "Harsh Site" areas became a separate land allocation with the planning done for the FSEIS and are considered Administratively Withdrawn through the President's Plan.

The "Harsh Site" areas were not withdrawn from the Matrix for a specific purpose so there is not management goals and desired conditions attached to these areas. Also, the boundaries of these areas are very rough due to the coarse level of mapping and need to be more refined at the site level. Because the areas are administratively withdrawn, programed timber harvest is not appropriate. However salvage, fuel reduction, and other activities are not excluded.

GUIDANCE FOR PROJECT LEVEL CWE ASSESSMENTS

Assessing and controlling cumulative watershed effects is an important aspect of land use planning at several scales. Prediction of cumulative effects is required by NEPA, but equally important, it is key to prudent watershed management. CWE considered here are off-site effects. The definition of cu-

mulative off-site watershed effects is "All effects on beneficial uses of water that occur away from the locations of actual land use which are transmitted through the fluvial system. Effects can be either beneficial or adverse and result from the synergistic or additive effects of multiple management activities within a watershed." (*FSH 2509.22*). Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. (*40 CFR 1508.7*).

The Guide for Pilot Watershed Analysis cites the need to address effects that accumulate over time and to assess the "wide variety of land uses, impact mechanisms, and impacts likely to occur in a watershed". This analysis of the Upper South Fork provides the basis for evaluation of CWE in the future, during project planning.

There are two parts to the following discussion:
- A summary of the disturbance mechanisms and process interactions at work in the Upper South Fork, and their relationship to various Cumulative Watershed Effects.
- Recommendations for developing project-level CWE assessments at the Upper South Fork.

Types of CWE and Disturbance Factors In the Watershed

Several kinds of effects which can accumulate are addressed in *Chapter 4 - Processes, Interactions, and Trends*. These are soil productivity , sedimentation, base and peak streamflows, water quality, fuel loading, coarse woody material, riparian conditions, and anadromous fish habitat quality. Disturbance factors working in the watershed to initiate cumulative effects are hydraulic mining, timber harvest, roads, and fire. The disturbance regimes were detailed in *Chapter 1*.

The following summarizes the current and anticipated CWE problems based on past and present disturbance, processes and trends at Upper South Fork.

Soil Productivity - The possibility of high intensity wildfire with associated increased erosion poses the greatest threat to future soil productivity. Ongoing site improvement projects in the Upper South Fork, located primarily in riparian areas and old hydraulic mined areas, will improve soil productivity.

Sedimentation - If climatic patterns of the past 50 years are repeated in the next 50 years, episodic sedimentation will increase slightly in magnitude and frequency. In 1944, about one percent of the watershed was disturbed by mining, roads, fire, or harvest. In 1988, about nine percent of the watershed was disturbed (six percent if the Trail Creek Fires of 1955 are considered recovered). Since 40% of the watershed is wilderness, future human activities will occur mostly in the non-wilderness.

Substrate embeddedness is an indicator of sediment regime. The Upper South Fork tributaries have greater embeddedness values (fines filling interstitial spaces around gravel and cobble) than the mainstem. The mode ranges from 21-40% for the tributaries and 0-10% for the mainstem with the exceptions being between Black Gulch and East Fork of the South Fork and between Little South Fork Creek and Blindhorse Creek, 11-20% and 21-30% respectively. Tentative observations from data collected July 1994 from Little South Fork to Josephine Creek shows a range of embeddedness from 5-55%, with and average of 26%, and two modes of 20% and 30%. Direction from the Draft Land Management Plan has criteria of less than 20% embeddedness.

Base and Peak Streamflows - Stream flows are very much dependent on future climate. Assuming the same climate, the stream flows today are likely lower than in pre-fire suppression times due to the increased density of large trees which exists today. A further increase in vegetation density is not likely in the future but a decrease in vegetation resulting from natural or man-caused disturbance could result in increased total discharge. Changes in stream diversions are not anticipated.

No significant peak flows have occurred since the early 70s. Several new roads and harvest units have since been added to the watershed. The potential for increased rates of delivery of upslope precipitation to channels exist. Current plantations will grow and increase in density. Road necessity and location will be closely scrutinized. Management related contributions to peak flows should be reduced in the future. However, this situation may be dwarfed by the increased potential for stand replacing fire and its potential impact on the riparian/channel complex.

Man's contribution through management impacts to peak flow timing and intensity of the larger

floods (1955, 1964, early 1970s) is not known. Under such large events, the contribution may have been minimal. Man's contribution may be more pronounced under lesser flow phenomena. The last significant flood event was in 1974. Management impacts have increased since then. Additional roads and harvest areas have been added to the watershed.

The site occupancy of large trees on the upslope areas influences stream flow at both peak flows and summer low flow. Trees use more total water than smaller vegetation such as grass and brush because of the deeper root systems. Also, trees capture rain and snow in the canopy allowing for evaporation before rain can soak into the soil or snow can accumulate on the ground. The result is greater peak flows and low flows following disturbances which kill or remove many trees from a watershed if the amount of precipitation remains the same.

Currently we are in a drought which is having impacts on the fishery. Temperatures reached lethal levels during July, 1994 resulting in adult spring chinook dying off. It is also reducing the amount of holding, spawning, and rearing habitat available to the various fish species occupying the Salmon River.

Water Quality (Temperature) - Like streamflows, water temperatures are dependent on climate. Given similar climate and streamflow conditions, summertime stream temperatures are likely to be warmer than before mining operations which started over 100 years ago. This is due to the riparian impacts of the mining and channel scour of past floods. Summer stream temperatures are likely to be cooler in the future due to a gradual increasing of riparian shade if channels are not repeatedly scoured. No attempt is made in this analysis to quantify future changes in stream temperatures.

Water Quality (Physical and Chemical) - These parameters were not analyzed at this time, due to paucity of data. It is likely that turbidity trends will generally follow sediment trends, based on data from Crapo and Knownothing watersheds, and elsewhere in Northern California.

Fuel Loading - Fuel loadings have been on the increase since fire suppression policies and practices were initiated. It is estimated that forest residue is currently building approximately 60% faster than it is decomposing. Periodic fire was the way to strike a balance between the accretion and decomposition of forest residue. The periodic fire also reduced stocking levels within the stands and the ladder fuels which are main contributors to crown fires and live fuel loading.

The entire Upper South Fork Watershed is at high risk for large, stand-replacing fires. Future fires in the Upper South Fork watershed could be expected to resemble those experienced in 1977 and 1987. When fire gaming the existing situation, the total acres burned per decade are projected to stay the same or increase. If fires occur in the areas where there has been an increase in fuel loadings then acreages will increase. The same is true for areas where understory vegetation has been allowed to establish a fuel ladder to the overstory vegetation. Given the existing condition of the watershed, the risk of large, stand replacing fires, will continue until elements within the existing fire regime are made more consistent with historical ranges of variability. This can only be done through large scale fuel reduction.

Coarse Woody Material - Currently there is a lack of aquatic habitat cover provided by CWM in the Upper South Fork analysis area. Since 1990 there has been an effort to re-introduce CWM into the stream channel and revegetate the riparian zones along the streams for long range CWM supply. Increased disturbance in the floodplain areas, as from channel scour, would result in a decreased age range in affected vegetation. Less large wood over time close to the stream would be the result.

Riparian Conditions - A large portion of the Upper South Fork has been affected by past hydraulic mining and floods. From habitat inventories conducted in the recent past, there is a significant lack of shade (<10%) along the mainstem. The tributaries, however, are in fair-good condition, with the mode ranging from 41-80%. Channel scouring rates approach 20% of total riparian length for the past 50-60 year period in the analysis area. Significant flood events this century have occurred in the 50s, 60s and 70s. Riparian vegetation along the main river and the larger tributaries is still recovering from the effects of the 1964 and 1973/1974 floods. Man's contribution, if any, to the timing and intensity of these major peak flows is unassessed. It is very possible that management impacts have increased the intensity and frequency of lesser flow events.

Current modification of the riparian reserves from stand replacing fire and landsliding for the past 50-70 years within the analysis area is minor. The potential, however, for major impacts from stand replacing fire appears significant due to overstocked stands experiencing drought-related mortality. Suppression of low intensity fire means that disturbance in the riparian zone has probably been reduced. This would mainly affect the understory vegetation. It is suspected that less age-structure variation may exist in these layers presently. In addition a lack of low intensity fire has probably reduced the number of weakened trees for windthrow that might have otherwise been available for CWM. In addition to direct fire impacts on riparian vegetation, the potential for future large sediment additions to the channels exist. Increased channel widening and vegetation scouring would result.

The potential for major disturbance to riparian vegetation and the associated channels is significant. Disturbance could result either from stand replacing fire or from of flow-related impacts. This is based on the potential for increased peak flows if additional roads are built. The potential for large contributions of sediment to channels will also remain high for a number of years. Increased sediment can decrease channel depths and increase channel widths, thereby affecting riparian vegetation. Risk for increased sediment from stand replacing fire will remain high. A severe fire intensity can degrade the aquatic environment by reducing overhead cover (shade) and bank stability from fire-killed trees, and adding sediment to the stream from erosion. On the other hand, a low intensity fire in the riparian area can make coarse wood available for aquatic habitat.

Anadramous Fish Habitat Quality - The focus of this discussion, as in Interactions section (*Chapter 4*), is on habitat requirements of anadromous fish. The entire South Fork Salmon River is an extremely important refuge for the last remaining wild-run spring chinook salmon in the Klamath River Basin. A spring chinook/summer steelhead census has been completed on the Salmon River annually for the last five years. These censuses show the Upper South Fork to be the last stronghold for spring chinook within the Salmon River system.

GUIDANCE FOR PROJECT LEVEL CWE ANALYSES

The Guide for Pilot Watershed Analysis cites the *Washington State Forest Practice Act Board Manual* (Washington Forest Practice Board 1992) as an example of state-of-the-art cumulative effects analysis, based on watershed analysis.

The Washington State Timber-Fish-Wildlife Agreement recommended an iterative approach with the following components: 1) risk assessment to identify existing problems and predict future ones, 2) goal-setting based on local conditions and resource sensitivities, 3) monitoring and evaluation to determine if goals are being met, 4) adaptation of management and assessment tools based on feedback from monitoring, and 5) re-evaluation of goals as new information becomes available.

The above strategy summarizes how management direction, watershed analysis, project level analysis and monitoring are linked. Goal-setting has been done in the *President's Plan*, and the *Klamath Forest Plan* objectives. A watershed analysis enables land managers to refine these goals to reflect local conditions. Monitoring, which is an integral part of this approach, is recommended in Appendix M - Monitoring of this document. That chapter also lists relevant monitoring which is part of the *Klamath Forest Plan*. The Upper South Fork Watershed analysis is an important step toward assessment of risks and re-evaluation of goals. Future project-level and watershed assessments will be able to recommend adaptation of management, based on iterations of analysis and monitoring/evaluation.

The basic process for analyzing CWE associated with a project can be seen as a 6 step process:

1- Identify the issues
2- Describe current conditions, including sensitivity of the watershed and subwatersheds, and the disturbance history
3- Identify the physical and biological processes and their parameters which are potentially affected
4- Identify the beneficial uses in the subwatershed
5- Describe the potential effects
6- Monitor to validate predictions and assumptions

Scale

A screening process should be used which takes into account the results of the watershed analysis, the nature of the proposed project, and the

scoped issues, to determine the appropriate level of detail.

The watershed analysis will indicate the sensitivity of the beneficial uses and of the land itself. The intensity of the proposed disturbance will indicate the likelihood for CWE, and thus the intensity of analysis needed. This could range from a cursory assessment, as for helicopter logging of dead trees, to a more in-depth assessment for ground-disturbing activities in a sensitive watershed.

Small incremental changes or changes over a small area can have potential CWE, depending on the sensitivity of the next larger system, at least for a given watershed function. For this reason, we need to understand the bigger picture, to know what is potentially affected. In the Upper South Fork watershed, for example, a project in Taylor Creek would likely analyze CWE in that tributary watershed. But that analysis would need to be in the context of what was occurring in the East Fork or the Upper South Fork.

In addition to looking at the next larger scale, one should also consider the next smaller scale. For example, a project in Taylor Creek might not have CWE which are significant for this stream. However, it may be largely concentrated in a subwatershed of Taylor Creek which is particularly sensitive to disturbance of that type.

Assessment Areas
Appropriate assessment areas will be determined based on the parameter or process being analyzed. Stratifying the area may help to streamline the analysis. One approach would be to stratify stream segments by morphology and/or size. The Upper South Fork Watershed Analysis divided channels into stream order, and also by basic morphology. These may be useful at the project level, as well as some other stratification based on physical characteristics which reflect mechanisms or sensitivity to processes. For the upslope areas, and eventually the riparian areas, the EUI may provide a useful way to stratify the watershed into response units.

Critical reaches, identified according to biological, political or geomorphic sensitivity, may be useful for delineating analysis areas (i.e., all land which drains to a certain critical reach). This reach could be one of exceptionally high quality habitat. Critical reaches could be identified for the various cumulative effects being analyzed. For example, low gradient, shallow critical reach for sediment aggradation may not be sensitive to peakflow increases.

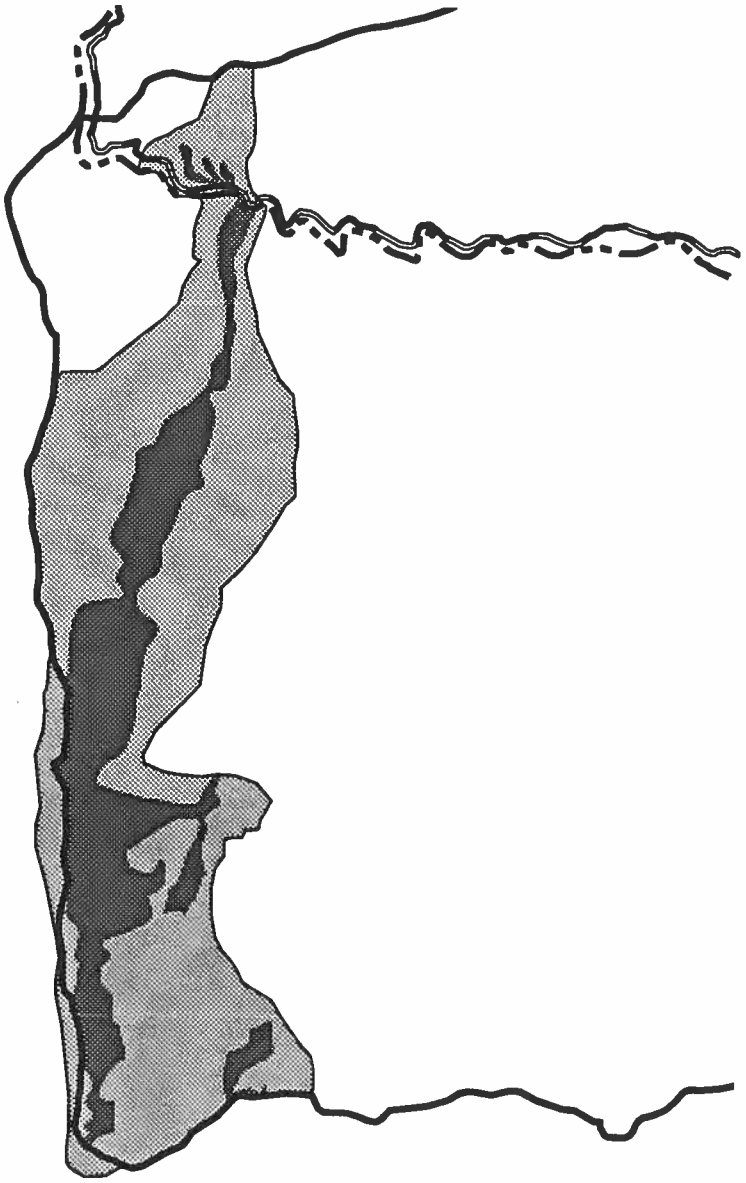
Types of Disturbance
NEPA language mandates that we consider all disturbances for human activities in a watershed. Natural disturbances become a consideration in that they affect the processes at work and may worsen the vulnerability to human-caused disturbance.

Monitoring and Evaluation
The assumptions which went into the project level CWE analysis, and the watershed analysis it is based on, need to be tested. In addition, the disturbance level and response of the watershed and beneficial uses need to be monitored.

Critical reaches or index reaches of a stream are logical locations to examine either physical or biological processes of concern.

Upper South Fork Watershed

Limestone Bluff Research Natural Area



Limestone Outcrops

Hydrologic Influence Zone

Upper South Fork Watershed Boundary

South Fork Salmon River

County Road

0 1 Miles

Figure 31

Chapter 6
Management Opportunities

Comparison between existing and desired conditions yields how close the watershed is to the desired condition. Opportunities are then developed which either maintain the desired condition, or move the watershed toward the desired condition.

Opportunities are broken into four general resource groupings: Vegetation Health, Terrestrial Wildlife Species, Aquatic Ecosystem Health, and Human Uses/Values. Opportunities are mentioned by the resource group which would be most benefited by the activity. However, activities may benefit several resources and these benefitting resources are identified.

Other opportunities identified in the analysis are Additional Planning and Inventory Needs, and Additional Information and Research Needs. Some of the additional planning is required by law, such as the Wild and Scenic Rivers Plans, others are subject to funding and prioritization. Inventory, and additional information and research needs may be required before other opportunities can be implemented. These are also implemented as funding allows.

It is important to note that all opportunities are general in nature, the specific "how to" will be developed later during the project implementation phase. It will then be evaluated on a site-specific basis following the procedures of the *National Environmental Policy Act.*

To provide a preliminary screen for establishing work priorities during the implementation phase, an "emphasis rating" was developed. Other less tangible factors such as management emphasis, partnerships, available funding, etc. would need to considered during project implementation. Criteria for rating opportunities are:

1- Are there consequences, in terms of resource damage, of not doing an opportunity? Are there resources at risk if this opportunity does not occur?
2- Is the opportunity an immediate need? Does the opportunity provide a linkage towards achieving the desired condition? (How far will it get you towards the desired condition?)
3- Are there amenity or commodity resources that benefit from doing the opportunity?
4- Does the opportunity have implications for other resources outside of this watershed?

A general description of the watershed's existing condition, desired condition, management opportunities, benefitting resources, and emphasis ratings are described narratively in the following tables, (Tables 24-29) and general ground locations are displayed in Figure 33 - Management Opportunities Map (1 of 2) and Figure 34 - Management Opportunities Map (2 of 2) which are contained in the map packet.

Table 24 - Vegetation Health Management Opportunities

EXISTING CONDITION	DESIRED CONDITION	MGMT. OPPORTUNITY	BENEFITTING RESOURCES	Emphasis Rating
1- A combination of overstocking, long-term drought, insects, and diseases have contributed to increasing tree mortality. Moisture stress brought on by overstocking and drought has reduced tree vigor, thereby predisposing trees to attack by insects/diseases	1- Stands are healthy and resilient to wildfire, insects and diseases	1- Reduce stocking levels to improve forest stand health and vigor, reduce ladder fuels and future ground fuel accumulations	1- Timber, Vegetative Resources, Pest Management, Fuels Management, Wildlife, Watershed Values *	1.H 2.H 3.H 4.H Avg.H
2- High stocking densities of true fir now exceed site capabilities and are susceptible to high levels of insect attack and mortality	2- Shade tolerant species are resilient to fire and insects	2- Reduce stocking densities of true fir species that have invaded the mixed conifer forest types	2- Timber, Fuels Management, Wildlife, Vegetative Resources, Pest Management	1.H 2.M 3.H 4.M Avg.MH
3- Accumulation of both natural and human-caused fuels now exist at levels which increase potential for stand replacing fire events.	3- Stands are resistant to stand replacing fire events	3- Reduce fuel loading of both natural and human created slash to reduce potential of stand replacing fire events	3- Fuels Management, Wildlife, Watershed Values, Timber, Vegetative Resources	1.H 2.H 3.H 4.M Avg.H
4- Older plantations are dominated by single species making them less resilient to insects and fire, and provides lower quality habitat for wildlife	4- Mosaic of vigorously growing forest stands made up of a variety of vegetative species	4- Manage plantations for species diversity and desired stand characteristics	4- Timber, Wildlife, Vegetative Resources, Visual Quality, Fuels Management	1.M 2.M 3.M 4.L Avg.M

* Watershed Values includes the following individual resources: Hydrology, Soils, Fisheries, and Geology

Table 25 - Terrestrial Wildlife Species Management Opportunities

EXISTING CONDITION	DESIRED CONDITION	MGMT.OPPORTUNITY	BENEFITTING RESOURCES	Emphasis Rating
5- Late successional areas provide habitat for dependent wildlife but have a high fuel hazard, high concentrations of down fuels and large amounts of ladder fuels	5- Late successional areas that provide habitat for dependent wildlife and have a limited fire hazard. Large down fuels and ladder fuels are in amounts appropriate to a moderate fuel hazard	5- Maintain and improve late successional habitat and dispersal habitat for late successional wildlife species	5- Wildlife, Watershed Values *	1.H 2.H 3.H 4.H Avg.H
6- Conifers and shrubs are encroaching into some meadows reducing vegetative diversity and meadow habitat for wildlife	6- Meadows provide openings, high quality riparian habitat and forage for grazing animals	6- Reduce and eliminate shrub and conifer encroachment, and reduce meadow erosion	6- Wildlife, Watershed Values, Human Uses/Values **	1.M 2.H 3.M 4.L Avg.M

EXISTING CONDITION	DESIRED CONDITION	MGMT.OPPORTUNITY	BENEFITTING RESOURCES	Emphasis Rating
7- Hardwoods are dying out of mixed forest stands as competition with conifers increases, conifers are invading formerly pure stands of hardwoods thereby creating a loss of food source and structural diversity for wildlife	7- Mature, mast-producing hardwoods within mixed conifer stands. Pure stands of hardwoods in varying seral stages are present through time	7- Maintain pure hardwood stands and older hardwoods within mixed conifer stands	7- Human Uses/Values, Hardwood-Dependent Wildlife	1.M 2.H 3.M 4.M Avg.M
8- Lack of willow and alder component in some riparian areas - particularly smaller stream systems, these systems have <15% deciduous component along their length	8- Small stream systems having a deciduous component (willow and alder) on approximately 15% greater of their length	8- Planting of deciduous riparian species on those smaller streams that have <15% of their length in deciduous cover.	8- Riparian Associated Wildlife, Watershed Values	1.L 2.L 3.M 4.M Avg.M

* Watershed Values includes the following individual resources: Hydrology, Soils, Fisheries, and Geology

** Human Uses/Values includes recreational use, Native American use, private land use, and commodity use

Table 26 - Aquatic Ecosystem Health Management Opportunities

EXISTING CONDITION	DESIRED CONDITION	MGMT.OPPORTUNITY	BENEFITTING RESOURCES	Emphasis Rating
9- Landslides comprise the most important source of sediment delivered to streams, those within the inner gorge produce most of the volume	9- Eliminate or reduction of management related landslides which deliver sediment.	9- Reduce the volume of sediment delivered to streams by landslides, with emphasis on management related landslides	9- Watershed Values *, Wildlife	1.H, 2.H, 3.M, 4.M, Avg.MH
10- Road fills are sometimes prone to failure (some culverts will not pass 100 year flows, particularly if such flows are accompanied by organic or rock debris), a preliminary inventory of problem culverts exists (refer to Appendix K - Transportation System Interactions)	10- Repair of existing culverts where the risk of failure is high and the adverse effects to aquatic resources is significant	10- Stabilize existing roads and landings including, but not exclusive to fixing culverts that do not meet storm flow criteria	10- Watershed Values, Human Uses/Values **	1.H, 2.H, 3.M, 4.M, Avg.MH
11- Road surface erosion depends on soil type, usage during wet weather, road gradient, and road drainage; there are 28 miles of insloped, native surfaced roads	11- Road prisms do not contribute significant sediment to streams	11- Reduce surface erosion from roads and other sites	11- Watersheds, Riparian Associated Wildlife	1.H, 2.H, 3.M, 4.M, Avg.MH

EXISTING CONDITION	DESIRED CONDITION	MGMT.OPPORTUNITY	BENEFITTING RESOURCES	Emphasis Rating
12a- Plantations in riparian reserves, are younger seral stages lacking larger wood component, 12b- High intensity fires have occurred historically in some areas within riparian reserves - Trail Cr., Sixmile, E. Fork of South Fork. These fires have created a younger seral stage simplified stand structure, 12c- Historical hydraulic mining areas (Petersburg, etc.) have simplified channel structure, lack of soil, and riparian vegetation, 12d- Grazing and trampling by livestock can contribute to exposed streambanks. Some browsing on streamside vegetation (need to field assess), and 12e- Some scoured channels have a lack of riparian vegetation (determine cause - landslide, peak flow, etc.)	12a- through 12e-The riparian vegetation is diverse and dense enough that it stabilizes the streambanks and adjacent hillslopes, providing an area that catches sediment and contributes large wood and organic material to riparian reserves; the riparian vegetation also provides shade, a multi-layered canopy, and diverse species where it's site potential exists	12a- through 12e-Improve riparian vegetative conditions and aquatic habitat complexity with emphasis on channel stability and future large wood recruitment	12a- through 12e- Watershed Values, Wildlife	1.M 2.M 3.M 4.H Avg.M
13- Riparian values and processes in a variety of land ownerships are negatively impacted throughout the watershed	13- Riparian areas on all lands throughout the watershed are healthy, stable, and provide habitat for diverse species	13- Help provide environmental education to communities of watershed processes and derived benefits	13- Wildlife, Watershed Values	1.M 2.M 3.M 4.H Avg.M
14- Historic mining operations still display low soil productivity, sparse vegetation, and soil cover, especially the mined granite area near Summerville	14- Revegetation of mined areas in which sites support vegetation equal to the site potential, where significant erosion is occurring, enhancement of site potential to provide additional vegetative cover	14- Restore mining sites to minimize sediment production.	14- Wildlife, Watershed Values	1.-M, 2.-M, 3.-M, 4.-M, Avg.-M,

* Watershed Values includes the following individual resources: Hydrology, Soils, Fisheries, and Geology

** Human Uses/Values includes recreational use, Native American use, private land use, and commodity use

Table 27 - Human Uses/Values Management Opportunities

EXISTING CONDITION	DESIRED CONDITION	MGMT.OPPORTUNITY	BENEFITTING RESOURCES	Emphasis Rating
15- Present facilities are substandard; do not meet sanitation and accessibility standards	15- Recreation sites and facilities meet public expectations, they are safe, sanitary, and accessible to all people.	15- Improve visitor enjoyment of developed campgrounds by managing for current accessibility, safety, and sanitation standards	15- Watershed Values *, Human Uses/Values **	1.L 2.H 3.M 4.L Avg.M

EXISTING CONDITION	DESIRED CONDITION	MGMT.OPPORTUNITY	BENEFITTING RESOURCES	Emphasis Rating
16- Increased use of dispersed recreation sites along the river corridor is creating resource damage	16- Provide a broad range of recreational opportunities, that meet recreational use, and is compatible with the Aquatic Conservation Strategy goals and objectives	16- Improve quality of dispersed recreation sites	16- Human Uses/Values	1.M 2.M 3.M 4.L Avg.M
17- Currently there is a lack of looped mountain bike routes within the watershed; some members of the public have requested looped routes	17- A range of recreation opportunities within primitive, semi-primitive non-motorized and motorized as well as roaded natural areas	17- Develop mountain bike routes	17- Human Uses/Values	1.L 2.M 3.M 4.L Avg.M
18- Two geologic SIAs (Coffee Creek Stream Capture, Caesar Peak Snow Field) and one botanical SIA (Gray Pine), contain unique values which offer educational interpretation opportunities	18- Coffee Creek, Caesar Peak, and Gray Pine are recommended in LMP for designation by the RF, emphasize recreation experiences where education and interpretation of unique natural resource values exist in SIAs	18- Provide interpretive information of special interest areas	18- All resources	1.L 2.L 3.M 4.L Avg.L
19- Previous activities have created visual impacts that vary from not noticeable, to very noticeable; in some areas these impacts are not consistent with desired Visual Quality Objectives	19- Develop management strategies for areas of concentrated use to rehabilitate landscapes that do not currently meet the desired VQOs, prioritize rehabilitation efforts based on criteria found in LMP	19- Rehabilitate visual quality of disturbed areas (refer to Appendix L - Visual Quality Improvement Opportunities)	19- Human Uses/Values	1.M 2.M 3.M 4.L Avg.M
20- Several trails and trail segments pose resource or safety concerns, or do not meet appropriate design standards - Specific trail segments: **Trail Gulch/ Fish Lake Trail** --Does not meet resource needs, **Trail Creek/Siphon Lake Trail** --Does not meet resource needs, **Harry Hull Trailhead** --Does not meet resource needs, **Trail Creek Trailhead/Pacific Crest Trail** --Construct new trail to meet hiker/equestrian standards, and **Trail Creek Campground/Fish Lake Trailhead** --Construct new trail	20- All trails meet recreation management objectives, user needs, ensure user safety, and provide resource protection	20- Construct, maintain, relocate, or reconstruct trails and trail segments to meet design standards, resource, and/or safety concerns	20- Human Uses, Wilderness, Watershed Values	1.L 2.M 3.M 4.L Avg.M

EXISTING CONDITION	DESIRED CONDITION	MGMT.OPPORTUNITY	BENEFITTING RESOURCES	Emphasis Rating
21- Range data is limited and inaccurate in many locations	21- Rangelands are healthy ecosystems with a diverse forage base	21- Determine present ecological status on allotments within the watershed and develop community typing to determine current conditions and appropriate actions to improve conditions where appropriate	21- Human Use, Watershed Values, Wildlife	1.H 2.M 3.H 4.M Avg.MH
22- Less than optimum permittee involvement in allotment administration monitoring program	22- Range stewardship is a result of partnership between agency and permittees	22- Work towards active/joint stewardship between agency and permittees	22- Human Use, Watershed Values, Wildlife	1.H 2.M 3.H 4.M Avg.MH
23- Locally uneven livestock distribution exceeds standards	23- Rangelands are healthy ecosystems and grazing practices meet current standards	23- Conduct monitoring, inventory and analysis to establish site specific standards	23- Human Use, Watershed Values, Wildlife	1.H 2.M 3.H 4.M Avg.MH
24- Currently there are limited opportunities for employment in the wood fiber business than has been historically; there is a great demand for jobs in this field	24- Job opportunities related to wood fiber production	24- Provide a programmed, non-declining flow of timber products	24- Human Uses/Values, Wildlife	1.M 2.H 3.H 4.M Avg.MH

* Watershed Values includes the following individual resources: Hydrology, Soils, Fisheries, and Geology

** Human Uses/Values includes recreational use, Native American use, private land use, and commodity use

Table 28 - Additional Planning and Inventory Needs Management Opportunities

EXISTING CONDITION	DESIRED CONDITION	MGMT.OPPORTUNITY	BENEFITTING RESOURCES	Emphasis Rating
25- Limestone Bluffs is an area which contains unique geologic values, the karst topography found there has created numerous limestone caves	25- Limestone Bluffs RNA is recommended in the LMP for designation by the Regional Forester	25- Develop an establishment report for the Limestone Bluffs RNA	25- Geology, Human Uses **, Wildlife, Botany	1.L 2.L 3.M 4.L Avg.L
26- Fuels in stands within wilderness have increased to levels which increase potential of stand replacing fire events	26- Fire events within the wilderness could occur without causing unnatural consequences	26- Establish prescribed fire plans for planned and unplanned fire ignitions that will reduce unnatural fuel loads and create an environment for fire events to function as a natural process	26- Wilderness, Fire, Watershed Values *, Wildlife, Human Uses/Values	1.H 2.H 3.H 4.H Avg.H

EXISTING CONDITION	DESIRED CONDITION	MGMT.OPPORTUNITY	BENEFITTING RESOURCES	Emphasis Rating
27- Portions of the South Fork Salmon River (Cecilville Bridge downstream beyond watershed boundary) were designated in 1981, a river management plan has not been completed	27- A river management plan is in place within three full fiscal years after final approval of the LMP and provides current guidance for monitoring and and enhancing outstandingly remarkable values	27- Develop a Wild & Scenic Rivers Management Plan for designated components of the National Wild & Scenic River System	27- Fisheries, Human Uses/ Values	1.L 2.M 3.M 4.L Avg.M
28- Some roads and road segments do not meet objectives. Currently there is a partially completed transportation plan	28- Provide an economic, safe, and environmentally sensitive transportation system that meets resource use needs. A transportation plan is in place	28- Complete and implement a transportation plan for the area. Identify areas which can be managed to correct resource problems and meet objectives	28- All resources	1.M 2.M 3.H 4.M Avg.M
29- Allotment plans and associated analyses are outdated and need revision	29- Allotment plans and range project decisions are current and provide guidance for integrated sound management of rangeland resources	29- Develop ecologically based management plans, base on current data which meet current standards	29- Human Use, Watershed Values, Wildlife	1.M 2.H 3.H 4.M Avg.MH

* Watershed Values includes the following individual resources: Hydrology, Soils, Fisheries, and Geology

** Human Uses/Values includes recreational use, Native American use, private land use, and commodity use

Table 29 - Additional Information and Research Needs Management Opportunities

EXISTING CONDITION	DESIRED CONDITION	MGMT.OPPORTUNITY	BENEFITTING RESOURCES	Emphasis Rating
30- Little information is available regarding the presence and habitat needs of many wildlife species, including sensitive, species of concern, and other rare species	30- Enough knowledge to properly manage high quality habitat for sensitive, species of concern, and other rare species is based on current data and research information on species habitat needs and interactions	30- Develop a data base on many species using research, administrative studies, and established survey methods, species to emphasize include, but are not limited to: willow flycatcher, shasta salamander, western pond turtle, riparian-associated amphibians, especially black salamander, southern torrent salamander, tailed frog, bats (fringed myotis, Hoary bat, long-eared myotis, long-legged myotis, pallid bat, silver-haired bat) fisher, marten	30- Wildlife	1.L 2.M 3.M 4.L Avg.M
31- There is little information on the linkage between upslope processes and fish habitat.	31- Linkage is established between upslope processes and fish habitat to help determine the most effective restoration activities.	31- To establish what linkage exists between upslope processes and fish habitat.	31- Fisheries, Hydrology, Geology, Engineering	1.M 2.H 3.H 4.M Avg.MH

EXISTING CONDITION	DESIRED CONDITION	MGMT.OPPORTUNITY	BENEFITTING RESOURCES	Emphasis Rating
32- There is little information on the routing of sediment through the Upper South Fork Salmon River	32- Sediment routing within the Upper South Fork Salmon River, and its implications on the aquatic habitat are well understood	32- Determine the processes which affect the way sediment is routed through the aquatic system and determine its affect on the aquatic habitat and organisms (initiate research with the U.S. Geological Survey (they have expressed interest in Upper South Fork)	32- Fisheries, Hydrology, Geology	1.M 2.H 3.H 4.M Avg.MH
33- There is no current information on the site potential of those streams that do not meet desired condition for shade, CWM recruitment, and CWM population (aquatic and terrestrial)	33- Site potential is determined for those areas which don't meet currently established criteria (shade, CWM, etc.)	33- Determine the site potential for those areas that are below desired condition for shade, CWM recruitment, and CWM population (aquatic and terrestrial).	33- Fisheries, Wildlife	1.M 2.H 3.H 4.M Avg.MH
34- Very little is known about the use patterns and life styles of Native Americans within the watershed thereby limiting our ability to assess the effects of activities on their culture	34- A better understanding of the indigenous peoples past and present life-styles	34- A cultural overview specific to the Upper South Fork area	34- All resources	1.M 2.H 3.H 4.L Avg.MH
35- Considerable information on cave resources in the French Creek/St. Claire area has been developed by the Klamath Mountains Conservation Task Force and the Klamath National Forest, Federal law requires the USFS to develop a list of potentially significant caves by December, 1994	35- Create a cave resource data system which is accessible to cave researchers and government agencies	35- Develop a cave resource data management system which meets the intent of the Cave Law of 1988 and the Research Natural Area designation recommended inthe LMP	34- All resources	1.M 2.M 3.M 4.M Avg.M

PPENDICES

APPENDIX A

CROSSWALK BETWEEN WATERSHED ANALYSIS GUIDE AND THIS ANALYSIS

This note describes how the *Watershed Analysis Guidebook* was applied on the Pilot Watershed Analysis conducted on the Upper South Fork of the Salmon River. Steps in the guidebook are linked to chapters in the final report for Upper South Fork.

STEP 1: Identify Issues, Describe Desired Conditions, and Formulate Key Questions

This step was the first item completed by the analysis team. Issues were identified through meetings with the Local Interagency Interdisciplinary Team (LIIT) and the public. Key questions were then developed to address these issues. A river basin assessment was not available at this time to assist in issue identification. Though we attempted to develop desired conditions in this phase, we were not fully successful, and decided that this should occur later in the process.

Documentation-
1- Issues and Key Questions- A complete list of issues and key questions in contained in Appendix B of this analysis. A brief summary is included in the *Introduction*.
2- Desired Conditions- These are contained in *Chapter 5 - Management Direction and Desired Condition*, and are linked directly to desired conditions identified in the draft Forest LMP.

STEP 2: Identify Key Processes, Functions, and Conditions

Key processes, functions and conditions were developed and refined throughout the analysis. Comment and review was solicited from the LIIT and the public at meetings and through individual contact.

Documentation
1- List of Key Characteristics by Issue- This information is presented in *Chapter 4 - Processes, Interactions, and Trends*, and also in Appendix B.
2- List of Key Processes and Functions by Issue- This information is presented in *Chapter 4*, and also in Appendix B.
3- List of Key Impact Mechanisms- This information is presented in *Chapter 4*, and also in Appendix B.
4- List of Analyses to Assess Impacts- A description of the analyses conducted, along with rationale, is contained in *Chapter 4*, and in the form of process papers by discipline (Appendices). Some of the modules used in the analysis were the landslide, debris flow, and sediment yield.

STEP 3: Stratify the Watershed

The watershed was stratified in a number of different ways in order to facilitate the analysis. The following strata were developed:

a. Geomorphic Stratification- The watershed was stratified into geomorphic terranes, lands with similar landslide potential, in order to assess landslide and sediment production.
b. Erosion Hazard Stratification- The landscape was stratified into units of land with similar surface erosion potential.
c. Riparian Reserve Stratification- A preliminary map of interim riparian reserves was developed from a digital elevation model.
d. Fire Hazard Stratification- A fire model was used to stratify the landscape into areas of similar existing fuel conditions, potential for fire ignitions, and potential for high intensity fires.
e. Stream and Watershed Stratification- Streams were stratified by channel type (confined, unconfined etc.), and by stream order. Watersheds were stratified into units of similar area and habitat elements.

Documentation
1- Maps- Maps of strata are displayed in *Chapter 2 - Watershed Elements* and *Chapter 3 - Flows and Linkages*, and in appropriate process papers in the Appendices.
2- Rationale for Stratification- contained in *Chapters 2* and *3*.

STEP 4: Assemble Analytic Information

Assembly of analytic information began prior to any formal team meetings, and continued throughout the process.

Documentation
1- Maps and Computer Printouts- Copies in the Supervisor's Office and on Ranger Districts. Electronic files in GIS.
2- Locations of Data Which Could not be Copied- None.
3- Index Maps of Air Photos- In Supervisor's Office, central file.
4- Index of Relevant Information About Watershed- In process records, Supervisor's Office.
5- Index Maps, Locations of Air Photos, Phone Numbers Etc.- In process records, Supervisor's Office.
6- Minimum Information Needs- The analysis team felt that sufficient information was available to proceed with Watershed Analysis. Researchers from Pacific Southwest Range and Experiment Station agreed with this assessment. Some new inventory data were collected as part of the analysis.
7- Acquiring Missing Information-

STEP 5: Describe Past and Current Watershed Conditions-

Past and current watershed conditions were described by utilizing existing inventories and previous studies in the watershed.

Documentation
1- Maps of Current Conditions and Process- Maps of active landslides, fuel conditions, riparian conditions, recently disturbed channels, fish habitat condition, hydraulic mine sites, historic fires by intensity class, are dispersed through the final report and Appendices (Process Papers), with most in a map packed attached to the report.
2- Maps and Descriptions of Existing Impacts and Severity- Map locations described in #1 above, and narrative provided in *Chapter 1 - Physical Setting, Disturbances, Range of Variability, Chapter 2,* and *Chapter 4.*
3- Narrative Description of the Causes of the Impacts- See #2 above.
4- Narrative Description of the Condition of Riparian, Wetland, and other Physical and Biological Factors- See #2 above.

STEP 6: Describe Condition Trends and Predict Effects of Future Land Management

Condition trends are described for all important issues and resource values. There was no attempt made to predict future land management activities. Rather, the effects of various types of land management were described, as were various climatic scenarios.

Documentation
1- Discussion of Impact Trends and Recovery Rates- Contained in *Chapter 4* by resource issue.
2- Table and Discussion of Effects of Land Use on Watershed Processes- The effects of land use on watershed processes are discussed thoroughly in *Chapter 4.*
3- Maps Showing Areas Sensitive to Various Environmental Changes- These maps are contained in *Chapter 2* and include the Geomorphic Terrane Map (Figure 4), the Landslides and Scoured Channels All Years Map (Figure 8), and Potential Wildfire Effects Map (Figure 22). Some of these maps are in the Map Packet.
4- Discussion of Likely Effects of Foreseeable, and/or Desirable Land Use and Restoration- Effects of likely future land use were noted, but not addressed at depth. Rather, they will be addressed at the project level as part of NEPA analyses. Some restoration opportunities are described in *Chapter 6 - Management Opportunities.*
5- Describing Future Changes (effects of existing and future disturbances)- Effects of existing disturbances are described in *Chapter 4.*

STEP 7: Integrate, Interpret, and Present Findings

The parts of the Watershed Analysis Report Outline are distributed in the Final Report on the Upper South Fork as follows:

Documentation
1- Watershed Description- *Chapters 1-3.*
2- Beneficial Uses, Values and Issues- *Introduction,* and Appendix B.
3- Desired Conditions- *Chapter 5.*
4- Key Questions- *Introduction* and Appendix B.
5- Past And Current Conditions and Processes- *Chapters 1-3.*
6- Condition Trends and Effects of Future Land Use- *Chapter 4.*
7- Guidance for Future Projects-
a. Riparian Reserves- *Chapter 5.*
b. Restoration * - *Chapter 6.*
c. Transportation Planning- *Chapter 6* and Appendix K - Transportation System Interactions.
d. Monitoring * - Appendix M - Monitoring.
e. Cumulative Watershed Effects Assessments- (*Chapter 5*)

f. General Planning * - No guidance is provided for general planning.
8- Information Management * - Process Records and GIS files.
9- Monitoring Plan * - Appendix M
10- Criteria For Revision * - No guidance provided.
11- Appendices-
a. Index of Information Sources * - Process Records.
b. Data Index * - Process Records.
c. References- Literature Cited.
d. Team Members and Persons Consulted- List of Preparers
e. Maps- Throughout this analysis and in Map Packet.

* Additional work is needed.

APPENDIX B

ISSUES

The following issues were developed by the core team for the Upper South Fork of the Salmon River. Sources for these issues include published studies, environmental assessments, public meetings, and personal knowledge of Core Team and Local Interagency Interdisciplinary Team (LIIT) members. Issues are presented in two main categories, **Terrestrial and Aquatic Ecosystem Health**, and **Socio-Economic Stability**. The following format is used:

1- **Issue Statement** - This is a brief statement describing the issue.

2- **Attributes of Issue** - A statement of attributes used to track the issue through the analysis process. They are described in terms of quantifiable parameters when possible. Their primary function is to focus the analysis on the most important aspects of the issue. For example the attributes of the sediment regime issue include sediment volume, timing, and routing.

3- **Key Questions** - Key questions relevant to each issue are presented. Questions were developed by the Core Team, LIIT members, and the public, and are addressed by this analysis. Some involve descriptions of existing conditions, while others include data manipulation and analysis. At the end of each key question discussion, reference is made to various portions of the document where questions are addressed.

The issues addressed are slightly modified from those given to the LIIT members at a meeting on 3-4-94, and some have been moved within the document.

TERRESTRIAL AND AQUATIC ECOSYSTEM HEALTH

ISSUE STATEMENT --Health of the aquatic and terrestrial ecosystem is an important issue at a regional, river basin, and local watershed scale. Maintenance of a healthy ecosystem requires understanding physical and biological *processes*, *conditions*, and *functions* under which the modern plant and animal communities of the Upper South Fork developed. These processes, conditions, and functions include:

The Physical Environment -
- Geologic/Geomorphic Setting
- Soil Processes and Productivity
- Sediment Regime
- Climatic/Atmospheric/Hydrologic Setting
- Fire Regime

The Biological Environment -
- Aquatic and Riparian Vegetation
- Aquatic and Riparian Dependent Animals
- Terrestrial Vegetation
- Terrestrial Animals
- Biodiversity
- Insect and Disease
- Connectivity
- Population Viability

Thirteen separate sub-issues were identified under the category of Terrestrial and Aquatic Ecosystem Health. These are described below.

THE PHYSICAL ENVIRONMENT

Sub-Issue 1: Geologic and Geomorphic Setting - Unique Geologic Features

ISSUE STATEMENT --Deciphering the geologic/geomorphic history of the Upper South Fork Salmon River Watershed is crucial to understanding the ecosystem; how it evolved, how it functions today, and how it is influenced by human activity. This requires identifying the geologic and geomorphic processes which shaped the modern landscape, those which continue to operate today, and understanding the ways in which human activity affects these processes. In addition, some unique geo-

logic features have been identified in the watershed. They include the French/St. Claire Karst area (Proposed Limestone Bluffs Research Natural Area), the Caesar Peak Snowfields, and the stream capture in the headwaters of Upper South Fork (Coffee Creek Stream Capture).

PARAMETERS OR ATTRIBUTES TO BE ANALYZED --Attributes that will be discussed include plate tectonic processes which brought a variety of different rock types to their present locations, intrusion of granitic rock, and episodes of mountain building, glaciation, and erosion which formed the mountains and valleys. Processes affecting the unique geologic areas will be identified, and the effects of human activities evaluated.

Key Questions

1- What is the origin of the broad variety of rock types in the project area, and how does rock type influence landform, soils, and vegetation? Where are the different rock types located? See *Chapter 1 - Physical Setting, Disturbance, Range of Variability*.
2- How did modern landforms develop, and how does landform influence soil, vegetation, and sediment production? Where are these landforms located, and what proportion of the watershed do they comprise? See *Chapter 1* and *Chapter 4 - Processes, Interactions, and Trends*.
3- What are the primary geomorphic and hydrologic processes which formed and maintain the French/St. Claire Karst? How can disturbances to the soil and vegetation affect these processes? Where are the relevant hydrologic boundaries? See *Chapter 4*.
4- What climatic and geologic factors led to the formation of the Caesar Peak Snowfields, and the Salmon River Stream Capture? What clues can these features provide regarding changes in the ecosystem? See *Chapters 1* and *4*.

Sub-Issue 2: Soil Productivity

ISSUE STATEMENT --Soil productivity is one of the most important factors influencing terrestrial and aquatic plant communities, and by extension, the associated animal communities. Restoration and/or maintenance of soil conditions to assure long-term productivity of the ecosystem is extremely important.

PARAMETERS OR ATTRIBUTES TO BE ANALYZED --Current soil conditions, potential soil productivity will be discussed.

Key Questions

1- What kinds of vegetation can be established on various soil types? See *Chapter 4*.
2- Where are areas not currently at site potential? See *Chapter 2 - Watershed Elements*.
3- What is the current site productivity of the analysis area? See *Chapter 2*.
4- What are limiting factors for vegetation development on various soil types? See *Chapter 4*.
5- What can be done to enhance or maintain certain vegetative elements within the analysis area? See *Chapter 6 - Management Opportunities*.
6- What activities affect soil productivity? See *Chapter 4*.

Sub-Issue 3: Sediment Regime

ISSUE STATEMENT --The sediment regime (both erosional and sedimentation processes) in the Upper South Fork is of great importance to the productivity of the soil, water quality, and fish/aquatic habitat. Restoration and/or maintenance of the sediment regime more consistent with the historical range of variability is of great importance to ecosystem health.

PARAMETERS OR ATTRIBUTES TO BE ANALYZED --Sediment regime attributes will be discussed in terms of landsliding, surface erosion, and channel erosion. The key attributes of these processes addressed in this analysis are ***timing***, ***volume***, ***rate***, ***character***, and ***routing***.

Key Questions

1- What is the historic (past 100 years) sediment regime in the Upper South Fork, and how has it varied over time? How has it been influenced by climate and landform (geomorphic terrane)? See *Chapters 1* and *4*.
2- What trends can we expect in future sediment production, and how do they compare to historic rates? Where is sediment production likely to be higher than historic rates? See *Chapter 4* and *Chapter 5 - Management Direction and Desired Condition*.
3- What is the relative role played by landslides, surface erosion, channel erosion, and hydraulic mining in the total sediment budget? See *Chapter 3 - Flows and Linkages*.

4- How has sediment production affected fish habitat, and how is it likely to affect it in the future? See *Chapters 2* and *4*.
5- How does historic sediment production compare to the amount of debris discharged into the streams by hydraulic mining operations around the turn of the century? See *Chapters 1* and *4*.

Sub-Issue 4: Integrity of the Aquatic System

ISSUE STATEMENT --The integrity of the aquatic system is important to the plant and animal communities which utilize it, and it can be degraded by flood flows, earth moving activities, and fire. Restoration and/or maintenance of the physical integrity of the aquatic system including shorelines, banks, and bottom configurations has been identified as an important concern at the watershed scale.

PARAMETERS OF ATTRIBUTES TO BE ANALYZED --Attributes that need to be addressed during the analysis include identification of channel integrity and channel condition (Pfankuch rating).

Key Questions
1- What is the current condition? See *Chapter 2*.
2- What factors are influencing poor ratings? See *Chapter 4*.
3- Is the Pfankuch rating system the appropriate one to use? (Discussion will be in the Appendices if the analysis team feels that it is not the most appropriate one for this watershed, but nothing else exists).

Sub-Issue 5: Climatic/Atmospheric/Hydrologic Setting

ISSUE STATEMENT --Climate plays an important role in soil formation, erosion rates, vegetation, and animal communities. Thus, identification of the atmospheric/climatic regimes under which the ecosystem of the Upper South Fork has developed is of great importance in understanding how the ecosystem functions. This includes identification of historic flood, drought, storm patterns in winter and summer, and occurrence of severe lightning and wind storms. It also includes an understanding of longer-term climate change (over thousands of years).

PARAMETERS OR ATTRIBUTES TO BE ANALYZED --Attributes that will be discussed in the analysis include long-term climatic patterns, wet/dry periods, current climatic regimes, period of intense storms, and rain on snow events.

Key Questions
1- What role has climatic patterns over the past 10,000 years played in the character and function of the modern ecosystem? See *Chapter 1*.
2- What are the historical and longer-term patterns of floods and droughts (from historical records)? See *Chapter 1*.

Sub-Issue 6: Stream Flow Regimes

ISSUE STATEMENT --Peak flows are important due to effects on the aquatic environment and sediment movement/flushing, etc. Low flows are important due to their effects on fish passage, water temperature and riparian vegetation water needs. Restoration and/or maintenance of in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats including fish passage, and to retain patterns of sediment, nutrient, and wood routing is important to the aquatic ecosystem.

PARAMETERS OR ATTRIBUTES TO BE ANALYZED --Attributes that need to be analyzed are peak flows and low flows.

Key Questions
1- What is the character, timing and distribution of peak and low flows in the watershed - current situation? See *Chapter 3*.
2- Have peak flows adversely affected habitats for aquatic species and have low flows fostered high temperatures or inhibited movement? See *Chapters 3* and *4*.
3- What is the range of variability for peak flows and low flows? See *Chapter 1*.
4- What is the comparison of the current condition versus the historical record? See *Chapters 1, 3,* and *4*.

Sub-Issue 7: Floodplain Inundation

ISSUE STATEMENT --Inundation of the floodplain is important to riparian vegetation due to the accumulation of fine sediment which occurs during this inundation, and the wetting effect of these flows. Maintenance and restoration of the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands is critical to their health.

PARAMETERS OR ATTRIBUTES TO BE ANALYZED --Timing and duration of inundation are to be addressed.

Key Questions
1- Historically, what has been the timing, variability, distribution, and duration of floodplain inundation and water table elevation in meadows and wetlands? See *Chapter 1*.
2- How does the current situation compare with the historical perspective? See *Chapters 3* and *5*.

Sub-Issue 8: Water Quality

ISSUE STATEMENT --Water quality (temperature, chemistry, suspended sediment, and bacterial and viral content) is of extreme importance to a large number of fish and riparian dependent species in Upper South Fork. Many species which occur there are accustomed to clear, cold water. Restoration and/or maintenance of water quality necessary to beneficial uses and that support healthy riparian, aquatic, and wetland ecosystems is essential to the health of the aquatic ecosystem.

PARAMETERS OR ATTRIBUTES TO BE ANALYZED --
A- Maintaining suspended sediment within legal limits (less than 20% of background).

B- Keeping water temperatures within the range desired for the aquatic species.

C- Another attribute that needs to be addressed, if possible, concerns bacteria levels in association with domestic uses.

Key Questions
1- What is the existing condition of suspended sediment? See *Chapter 3*.
2- What is the current temperature regime? See *Chapter 3*.
3- How does the current condition compare to the desired condition? See *Chapters 3* and *5*.
4- What is current domestic water use? See *Chapter 3*.

Sub-Issue 9: Fire Regime

ISSUE STATEMENT --Fire is the most important natural process causing change in vegetative patterns in the Upper South Fork, and as such, it also influences erosion and sedimentation processes. The concern has been raised that the fire regime has changed considerably in the past 50 years. Restoration of a fire regime which will result in vegetative patterns and structures that are more consistent with historical ranges of variability, is desired.

PARAMETERS OR ATTRIBUTES TO BE ANALYZED --
A- The attributes needing to be addressed for air quality within the analysis will be particulates and compliance with federal and state laws and regulations.

B- Attributes that will be addressed and analyzed for fire processes, functions, and conditions will be fuel type and patterns, fire occurrence, fire intensities, fire sizes, fire timing, and fuel modeling (slope and aspect).

Key Questions
1- What is the current fire regime? See *Chapters 3* and *4*.
2- What has been the effect of suppression on the identified attributes? See *Chapters 1* and *4*.
3- What is the historic fire occurrence and the timing of historic events? See *Chapter 1*.
4- How does air quality differ from historical regimes and current suppression regimes? See *Chapters 1* and *3*.
5- What was the scope of stand replacing fires under the historical regime? See *Chapter 1*.
6- What is the current air quality condition? See *Chapter 3*.
7- How will achieving a more historic regime for fire affect particulate requirements? See *Chapter 1*.
8- What is the potential particulate emission with the current situation? See *Chapter 4*.
9- What is the current fire regimes effect on sediment and stream flow as compared to the historical fire regime? See *Chapters 1* and *4*.

THE BIOLOGICAL ENVIRONMENT

Sub-Issue 10: Riparian and Aquatic Vegetation and Riparian Reserves

ISSUE STATEMENT --Riparian areas comprise unique communities of plants and animals which form an important element of the ecosystem. The *President's Plan* identifies "Riparian Reserves" as part of the aquatic conservation strategy. Protection of these lands is essential for healthy aquatic habitat.

PARAMETERS OR ATTRIBUTES TO BE ANALYZED --Riparian function, *FEMAT* definitions, filtration, vegetative types, links to other resources.

Key Questions
1- What is the condition of riparian zones in Upper South Fork? See *Chapter 2.*
2- Which areas are high or low site potential? See *Chapter 2.*
3- What do we know about historical conditions? See *Chapter 1.*

Sub-Issue 11: Viability of Aquatic and Riparian Dependent Species

ISSUE STATEMENT --Several species of anadromous fish as well as resident fish and other riparian dependent species reside in the Upper South Fork. Viability of all these species has been identified as an important issue however, the Forest Service has jurisdiction only over habitat. Therefore, maintenance of habitats capable of producing viable populations of individuals of all life stages throughout the watershed for all anadromous and resident fish is the formal issue statement.

Restoration and protection of aquatic habitat for all anadromous and resident fish.

Maintenance and protection of habitats to ensure population stability for the tailed frog, pacific giant salamander, and the pond turtle.

Restoration and/or maintenance of spatial and temporal connectivity within and between watersheds.

PARAMETERS OR ATTRIBUTES TO BE ANALYZED –
A- Identify importance of habitat in Upper South Fork Salmon River in relation to remaining Salmon River drainage.

B- Identify where Upper South Fork Salmon River habitat does not meet criteria necessary to maintain viable fish populations and why.

C- Identify levels of coarse woody material (CWM) in terms of distribution and abundance.

D- Identify levels of primary pool frequency and distribution.

E- Attributes for amphibians that need to be addressed include vegetative structure, water flow needs, and connectivity requirements.

Key Questions
1- What are current habitat conditions and possible locations of aquatic/riparian dependant amphibian and reptile species? See *Chapters 2* and *3.*
2- How much connectivity of habitat is needed to have viable populations of fish and herptafauna? See *Chapter 5.*
3- What habitat elements need to be enhanced or maintained to have viable populations of herptafauna? See *Chapter 6.*
4- Can optimum biological objectives be met with habitat capability? See *Chapter 5.*
5- What stocks/species are endemic to the analysis area?
6- What habitat features are necessary for productivity?
7- What condition (by critical feature) is necessary for productivity?
8- What stochastic events could reduce habitat productivity?
9- What is the risk of reducing habitat productivity from stochastic events?
10- How do we reduce the risk of impacting habitat productivity through stochastic events?
11- What stocks/species should we maintain habitat productivity for?
12- Does existing habitat condition provide for viability?

Sub-Issue 12: Terrestrial Vegetation - Insects and Disease

ISSUE STATEMENT --Terrestrial vegetation occupies the bulk of the Upper South Fork, and is critical to the functioning of the ecosystem. Understanding of the nature, distribution, and processes of vegetative change are needed for ecosystem management. Insect infestations and plant disease form an important component of the ecosystem and influence vegetative patterns.

PARAMETERS OR ATTRIBUTES TO BE ANALYZED --Understanding of the composition and evolution of terrestrial vegetation as follows:
1- Matrix Vegetation: Mixed Conifer, True Fir
2- Patches
3- Corridors

Maintenance of plant disease and insect populations at levels more consistent with the historical

range of variability. Attributes to discuss in the analysis include vegetation characteristics conducive to disease and insect epidemics and identification of current problem areas: insects and diseases, conifer mortality, and implications to the current situation.

Key Questions

1- What are the terrestrial vegetative patterns in the Upper South Fork? What vegetative groupings are useful in ecosystem analysis? See *Chapter 2*.
2- Where do corridors exist, and what role do they play? See *Chapters 2* and *4*.
3- What are some the primary insects and diseases found within the watershed? See *Chapter 3*.
4- Are there some problem areas in terms of insect or disease epidemics within the watershed? See *Chapters 3* and *4*.
5- Are there some vegetative conditions that are promoting the increase of insect and disease problems? See *Chapter 4*.
6- Are there any opportunities to control the spread of some of the problem areas and bring the landscape, as a whole, into a situation more like that found historically? See *Chapters 5* and *6*.
7- What is the distribution, character, and severity of plant diseases and insect infestations in the watershed? See *Chapter 3*.
8- Where have insect infestations and plant disease occurred? Is this a "normal occurrence"? See *Chapter 4*.
9- What are the effects of dying vegetation on fire potential and overall ecosystem health? See *Chapter 4*.

Sub-Issue 13: Viability of Terrestrial Species

ISSUE STATEMENT --Viability of terrestrial species is intimately linked to habitat characteristics and connectivity in time and space between separate habitat areas. Habitat needs of terrestrial species can be addressed by focusing on groups of species which share certain needs in common. Rationale for these groups of animals described below are contained in *Chapter 3 - Flows and Linkages*. Maintenance of well-distributed, suitable habitat for fisher, marten, Northern spotted owl, black tailed deer, Roosevelt elk, Northern goshawk, and peregrine falcon is essential to maintenance of the ecosystem.

Restoration and/or maintenance of spatial and temporal connectivity within and between watersheds is also essential to the viability of terrestrial species.

PARAMETERS OR ATTRIBUTES TO BE ANALYZED --

A- Older seral stage dependent species: The analysis will focus on habitat required for reproduction, foraging, and other life cycle functions of the previously identified late seral stage species. Habitat attributes that ultimately need to be addressed include stand structure, dead and down material, snags, and canopy closure. The current condition of may of these habitat attributes cannot be assessed at the landscape level, given the existing vegetation information. The desired condition, amounts, and arrangements of these attributes can be described and will be incorporated in this document (*Chapter 5*). Lands allocated to be managed for Northern spotted owl, goshawk, fisher, and marten were included in the draft land management plan. At present, it is not known whether or not, and in what configuration these land allocations will be incorporated into the preferred alternative.

B- Species which use a variety of habitats: The analysis will focus on habitat required for reproduction, foraging, and other life cycle functions. Attributes that need to be addressed during the analysis for wide ranging species include size of openings in forested areas, distance to cover from openings, cover/forage ratio, quality of foraging areas. The ability to assess the current condition for some of these attributes at the landscape level is limited. The desired condition, amounts, and arrangement of these attributes can be described and will be incorporated in this document (*Chapter 5*).

Key Questions

1- Is it possible to maintain the habitat attributes identified for older seral dependant species, based on interactions with other flows and elements? See *Chapters 2* and *4*.
2- What is the current habitat situation for those species highlighted in the sub-issue statement? See *Chapters 2* and *4*.
3- What is the desired habitat conditions for those species highlighted? (See *Chapter 5*.
4- What are the habitat use patterns for these species? See *Chapter 3*.
5- Are there any barriers to movement or is there adequate connectivity between habitat blocks? See *Chapters 2*, *3*, and *5*.

6- What dispersal habitat is available? See *Chapters 2, 4,* and *5.*
7- Where do these species exist? See *Chapter 3.*
8- Is this the appropriate scale for addressing a range of viable population levels; i.e., defining a desired range of population levels. (If addressed, it will be in *Chapter 5.*
9- What are some of the limiting factors to maintaining the highest quality habitat? See *Chapters 1* and *4.*
10- What can be done to enhance or maintain certain habitat elements? See *Chapter 6.*

SOCIO-ECONOMIC STABILITY

ISSUE STATEMENT --Human interactions with the environment, and associated economic considerations constitute an important aspect of the ecosystem at Upper South Fork of the Salmon River. These considerations can be placed in three categories as follows:

1- **Conflicting Human Values** - Differing values by the wide range of public interests.
2- **Economic Considerations** - How the analysis relates to the local economy, and how economic stability might be affected.
3- **Effects of Human Actions** - Concerns addressing the effects of human activities on the terrestrial and aquatic ecosystems.

Sub-Issue 1: Visual Quality

ISSUE STATEMENT --Maintenance of visual quality objectives as identified in the draft Land Management Plan has been identified as an issue. This includes restoration of areas currently not meeting visual quality objectives,

Key Questions:
1- What are the viewsheds and their associated sensitivity? See *Chapter 5.*
2- What are the identified landscape character and goals? See *Chapter 5.*
3- What is the comparison of the desired visual quality objective and the current condition? See *Chapter 5.*

Sub-Issue 2: The Human Role in the Ecosystem

ISSUE STATEMENT --The role of humans in the ecosystem has been identified as an important issue. This includes prehistoric patterns of use by Native Americans, as well as their current utilization of the ecosystem. It also addresses conflicting human values on how the ecosystem should be managed, economic stability of the local community, opportunities for sound management with multiple benefits.

Provide for the diversity of human uses and values through appropriate laws, regulations, and land use allocations.

Provide community stability by combining awareness of ecological processes occurring at the landscape scale with existing laws and regulations.

Identification of opportunities to manage human uses and activities that are consistent with ecosystem function and processes.

Identification of cultural resource sites, concerns, issues, and history.

PARAMETERS OR ATTRIBUTES TO BE ANALYZED --There are many human related attributes that are addressed in the analysis. Human use, expectations, and values can be broken down into categories of recreation, private, commodity, and contemporary Native American.

A- Recreation attributes include fishing, dispersed vs. non-dispersed camping, wilderness vs. non-wilderness use, hunting, winter sports, ORV use, horse back riding, kayaking, mountain biking, etc.

B- Private attributes include transportation systems, water uses, mining, resort locations, communities, utility corridors, community expansion, etc.

C- Commodity attributes include local employment, timber harvest, grazing, biomass production, rock quarrying, mining, watershed restoration activities, road systems, jobs, etc.

D- Contemporary native American attributes include subsistence collecting, spiritual areas, prehistoric sites, etc.

E- Other attributes that need to be considered include historic sites, law enforcement, poaching, unauthorized uses, etc.

Key Questions

1- What are historical uses? See *Chapter 1.*
2- What are current uses? See *Chapter 3.*
3- Are current uses sustainable? (We weren't sure whether this could be answered in the analysis).
4- What is the current condition of current transportation system, roads and trails? See *Chapter 2.*
5- Are there areas within the current transportation system which may be aggravating physical or biological conditions, processes, and functions? See *Chapter 4.*
6- What is the desired condition for all the intermixed human uses and values? See *Chapter 5.*
7- What are the locations of Native American settlements within and outside the Watershed Analysis area? See *Chapter 5.*
8- What areas of traditional hunting and gathering practices lie within the Watershed Analysis area? What are their current conditions and how can these resources be managed for traditional uses? See *Chapters 1* and *3.*
9- Which of these areas are still being utilized by the Native Americans of the region? See *Chapter 5.*
10- What seasonally available foods and materials are available within the Watershed Analysis area? See *Chapters 2* and *3.*
11- What were the patterns of aboriginal burning in the Watershed Analysis area? What areas were burned, when and for what purposes? See *Chapter 1.*

Sub-Issue 3: Special Management Areas

ISSUE STATEMENT --There were other issues identified that concern other special management areas. These areas included wilderness, wild and scenic rivers, research natural areas, and special interest areas. All of these areas are identified as management areas within the Draft Forest Plan. They have specific goals, desired condition, and standards and guidelines that need to be adhered to. These management areas will be addressed in the Forest Plan landscape pattern and objective step.

Roadless areas was another issue that was identified during our public meetings. This issue will be highlighted after we analyze the watershed as a whole. We will overlay the roadless area over the watershed and ask if there are any critical concerns or processes that need to be highlighted. The roadless area will not have a specific management area designation. It will be treated as whatever designation is currently found in the Draft Forest Plan. Special criteria (i.e., roads) as identified in the Presidents Plan, will be displayed in the analysis.

APPENDIX C

GEOLOGIC BELTS, TERRANES, AND ROCK UNITS

MAP LABEL (ACREAGE)	ROCK TYPE	GEOLOGIC BELT	GEOLOGIC TERRANE	GEOLOGIC ERA/PERIOD	AGE IN MILLIONS OF YEARS
Qg (5,317)	Glacial moraine	-	-	Cenozoic /Quaternary	0.01-2.0
MzPz-mft-ms (8,819)	Chert and Argillite	Western Paleozoic & Triassic	North Fork	Mesozoic-Paleozoic /Permian-Triassic	210-250
MzPz-mft-mv (3,035)	Mafic Volcanic Rock	Western Paleozoic & Triassic	North Fork	Mesozoic-Paleozoic /Permian-Triassic	210-250
MzPz-ms (1,017)	Chert and Argillite	Western Paleozoic & Triassic	North Fork	Mesozoic-Paleozoic /Permian-Triassic	210-250
MzPz-mv (1,451)	Meta- Volcanic	Western Paleozoic & Triassic	North Fork	Mesozoic-Paleozoic /Permian-Triassic	210-250
MzPz-s (32,464)	Phyllitic Quartzite & Blue schist	** Western Paleozoic & Triassic	Stuart Fork	Mesozoic-Paleozoic /Permian-Triassic	220-230
bs (51)	Blue-schist	Western Paleozoic & Triassic	North Fork	Mesozoic-Paleozoic /Permian-Triassic	220-230
ls (856)	Limestone /Marble	Western Paleozoic & Triassic	North Fork	Mesozoic-Paleozoic /Permian-Triassic	210-250
Mzg (3,828)	Grano-diorite	-	-	Mesozoic /Jurassic-Cretaceous	140-150
mzd (25,329)	Diorite Tonalite	-	-	Mesozoic /Jurassic-Cretaceous	140-150
Mzgb (796)	Gabbro	-	-	Mesozoic /Jurassic-Cretaceous	140-150
Pza (8,489)	Mica & Hornblende schist	Central Metamorphic	Central Metamorphic * Abrams Mica schist	Paleozoic /Devonian	320-400
Pza (22,027)	Hornblende schist	Central Metamorphic	Central Metamorphic * Salmon Hornblende schist	Paleozoic /Devonian	320-400
SOd (1,676)	Lime Siltstone Slate & Sandstone	Eastern Klamath	Yreka	Paleozoic /Silurian-Ordovician	350-460
Op (3,806)	Peridotite (Serpentinized)	Eastern Klamath	Trinity Ultramafic Complex	Paleozoic /Ordovician	315-480

* Informal Names
** Classified as distinct belt by some authors

APPENDIX D

RIPARIAN SHADING ASSUMPTIONS

Stream shade conditions for the South Fork analysis area were estimated. All channel sections, including intermittent portions, were included. It should be noted that the following procedure only renders a coarse approximation of shade quality in the Upper South Fork. Shade characteristics were estimated either directly from aerial photos or from vegetative conditions adjacent to channels. These vegetative conditions were derived from the typing used in the development of the Klamath Draft LMP. The typing only addressed canopy closure for the conifer component. Due to the exclusion of the hardwood component, the vegetation typing would underestimate the total riparian stand shading. However, shading directly over a channel is usually less than what is indicated by the total canopy closure within the adjacent riparian stand. This is indicated by the stream shading obtained during stream habitat typing.

It is also assumed that in smaller order channels (1-3), stream shading is more accurately portrayed by the associated vegetation typing. A poorer correlation exists on larger order channels between stream shading and associated riparian stands. Data is easily available that could portray stream shading based on associated riparian stands for order 1-3, perennial streams only.

Procedures, Assumptions Employed

1- All currently scoured channels (1990 photos) were given a stream shade rating of 0%. Channel segments with 40% or less shading were also determined using 1990 aerial photo interpretation.

2- All of the mainstem South Fork was assumed to have a shade rating of <40%. The East Fork, above its junction with the mainstem South Fork was assumed to have an overall shade rating of 40-70%.

3- All stands (i.e., 3G, 4G & 5G) identified as able to currently provide large wood in suitable volumes as determined under current riparian vegetative conditions were ascribed a stream shade rating of >70%. All moderate density, larger conifer stands (4N, 5N) were also given a stream shade rating of 40-70%. These are at least moderate quality sites, with a large hardwood component contributing to stream shading. All dense but young conifer stands (1G, 2G, etc.) were placed into the 40-70% shade category. This may be an underestimation. All hardwood dominated sites, not identified as possessing under 40% shade by air photo interpretation, were placed into the 40-70% shade category. Similarly, all riparian shrub complexes, not identified as under 40% shade, were placed into the 40-70% category. This, likewise, may be an underestimation in several situations. All unique codes (BA-barren, WA-water, etc.) were given a rating code of <40%.

4- Stream shading was quantified by miles of channel meeting a certain quality of shade (0, 0-39%, 40-70%, >70%) for a given sub-watershed.

Again, as previously stated, this analysis provides only a crude portrayal of stream shade in the Upper South Fork. For example, road crossings over channels were not given a lowered shade rating, but maintained the shade rating of the stand through which they passed.

APPENDIX E
EXISTING ROAD STATUS

DEFINITION OF TERMS

PLEASE NOTE: (Source TIS & RMO Report 3/18/93)

MAINTENANCE LEVELS:
1 = Assigned to intermittent service roads during the time they are closed to vehicular traffic.
2 = Assigned to roads open for use by high clearance vehicles.
3 = Assigned to roads open and maintained for travel by a prudent driver in a standard passenger car.
4 = Assigned to roads that provide a moderate degree of user comfort and convenience at moderate speeds.
5 = Assigned to roads that provide a high degree of user comfort and convenience. Normally paved roads. Aggregate roads would be treated for dust abatement.

SURFACING:
NAT = Native Material
AGG = Aggregate Material (pit run or crushed)
PAV = Pavement
CHP = Chip Seal

TEMPLATE:
O = Outslope, assumes no ditch, or outside berm unless needed for short stretches.
I = Inslope, assumes inboard ditch, with no outside berm unless needed for short stretches.
C = Crown, assumes inboard ditch, with no outside berm unless needed for short stretches.

ROAD CLOSURES:
Y = Yearlong for the following reason(s): = Road Maintenance, Wildlife, and Sensitive Soils
N = Road Open Year-round
S = Seasonal Closure/Open (minimize resource/use conflicts such as wildlife, sensitive soils, public safety, or road maintenance, normally during winter conditions).

AVERAGE DAILY TRAFFIC (ADT):
Low (L) = 0 or 1; Moderate (M) = 5 or 10; High (H) = 15

HIGHWAY SAFETY ACT (HSA):
If road is passable by passenger car, then HSA applies (normally applies to Level 3, 4, and 5 roads).

PRIMARY USER:
P = Private land access
A = Administrative
R = Recreation use
T = Timber use
GP = General Public (public highway, open to all users)

EX. MGMT. STRATEGY:
A = Accept
E = Encourage
L = Eliminate
P = Prohibit (road closure order applies)
N/A = Not Applicable for County roads

NUMERIC LISTING OF ROADS AND THEIR STATUS IN THE UPPER SOUTH FORK

FOREST RD# (COUNTY RD#)	ROAD NAME	LENGTH	MAINT. LEVEL	LANES	SURFACING	TEMPLATE	CLOSURE	ADT	HSA	PRIMARY USER	EX MGMT STRATEGY
37N01	FIVE DOLLAR	1.7	2	S	NAT	O	N	M	N	T	A
37N02	BLUE GULCH	4.0	2	S	NAT/AGG	O	N	M	N	T	A
37N02B	BLUE GULCH	0.3	2	S	NAT/AGG	O	N	L	N	T	A
37N03	STAGE GULCH	3.2	2	S	NAT	O	N	M	N	T	A
37N03A	STAGE GULCH	0.2	2	S	NAT	O	N	L	N	T	A
37N03B	STAGE GULCH	0.4	2	S	NAT	O	N	L	N	T	A
37N04	BEARFOOT	2.5	2	S	NAT	O	N	M	N	T	A
37N05	BLACK GULCH	1.7	2	S	NAT	O	N	M	N	T	A
37N06	CECIL CR.	1.2	2	S	NAT	O	N	M	N	T	A
37N07	RAYS GULCH	6.2	3	S	AGG	I	N	H	Y	T	A
37N09	JOHNNY RAY	1.0	2	S	AGG	I	N	M	N	T	A
37N10	SUGAR RAY	1.7	2	S	AGG	I	N	M	N	T	A
37N11	BLACK RAY	3.1	2	S	NAT	O	N	M	N	T	A
37N11A	BLACK RAY	0.3	2	S	NAT	O	N	M	N	T	A
37N14	LOR-O-RAY	2.0	2	S	NAT	I	N	M	N	T	A
37N14B	LOR-O-RAY	0.4	1	S	NAT	O	Y	L	N	T	L
37N25	TAZWELL	3.3	2	S	NAT	I	N	M	N	T	A
37N26	CECIL	1.0	2	S	NAT	O	N	M	N	T	A
37N26A	CECIL	0.1	2	S	NAT	O	N	M	N	T	A
37N28 N/S	37N.,11W.,SEC5,8	1.1	2	S	NAT	O	N	L	N	T	A

NUMERIC LISTING OF ROADS AND THEIR STATUS IN THE UPPER SOUTH FORK

FOREST RD# (COUNTY RD#)	ROAD NAME	LENGTH	MAINT. LEVEL	LANES	SURFACING	TEMPLATE	CLOSURE	ADT	HSA	PRIMARY USER	EX MGMT STRATEGY
37N29 N/S	37N.,11W.,SEC5,8	0.9	2	S	NAT	O	N	L	N	T	A
38N01	PETERSBURG	3.7	2	S	NAT	O	N	M	N	A	A
38N01A N/S	38N.,11W.,SEC34	1.2	2	S	NAT	O	N	L	N	A	A
38N03	BAD SHADOW	3.7	2	S	NAT	O	S	M	N	T	A
38N04	TAYLOR CREEK	0.1	3	S	PAV	I	N	M	Y	T	E
38N04	TAYLOR CREEK	8.2	2/3	S	NAT/AGG	I	S	H	N/Y	T	E
38N04A	TAYLOR CREEK	2.0	2	S	NAT	O	N	M	N	T	A
38N06	STATION GULCH	0.2	3	S	AGG	O	N	H	Y	A	A
38N07	SNIPER	6.2	2	S	AGG	I	S	M	N	T	A
38N07A	SNIPER	1.0	2	S	AGG	I	S	M	N	T	A
38N07B	SNIPER	1.3	1	S	NAT	I	Y	L	N	T	P
38N08	POISON	4.1	2	S	NAT	O	S	M	N	T	A
38N10	TAYLOR RIDGE	1.6	2	S	AGG	O	S	M	N	T	A
38N10A	TAYLOR RIDGE	0.9	2	S	AGG	O	S	L	N	T	A
38N14	HAYPRESS MDWS	3.8	2	S	AGG	O	S	M	N	T	A
38N14A	HAYPRESS MDWS	1.9	2	S	AGG	O	S	M	N	T	A
38N16	SAINT CLAIRE	6.5	2	S	AGG	I	S	M	N	T	A
38N16A	SAINT CLAIRE	1.5	2	S	NAT	I	S	M	N	T	A
38N16D	SAINT CLAIRE	0.3	2	S	NAT	O	S	L	N	T	A
38N17	KING SOLOMON	3.1	2	S	NAT	O	S	M	Y	T	A

NUMERIC LISTING OF ROADS AND THEIR STATUS IN THE UPPER SOUTH FORK

FOREST RD# (COUNTY RD#)	ROAD NAME	LENGTH	MAINT. LEVEL	LANES	SURFACING	TEMPLATE	CLOSURE	ADT	HSA	PRIMARY USER	EX MGMT STRATEGY
38N17F	KING SOLOMON	0.2	2	S	NAT	O	S	L	N	T	A
38N19	ROCK FACE	0.3	2	S	NAT	O	S	M	N	T	A
38N19A N/S	38N.,10W.,SEC19	0.2	2	S	NAT	O	S	L	N	T	A
38N20	SOUTH TAYLOR	0.7	2	S	NAT	O	S	M	N	T	A
38N25	EAST FORK CG	0.2	3	S	CHP	O	N	H	Y	R	E
38N27	CECIL POINT	10.0	3	S	NAT/AGG	I/O	N	M	Y	T	E
38N27A N/S	38N.,11W.,SEC32	0.5	1	S	NAT	O	Y	L	N	T	P
38N40	SPECIMEN LOOP	3.4	2	S	NAT	O	S	M	N	T	A
38N40A	SPECIMEN LOOP	0.3	2	S	NAT	O	S	M	N	T	A
38N40B	SPECIMEN LOOP	0.3	1	S	NAT	O	Y	L	N	P	P
38N65	CLAIRE	1.0	2	S	NAT	O	S	M	N	T	A
39N03	CARTER MDW GROUP	0.4	3	S	AGG	O	N	H	Y	R	E
39N04	McDOWELL	3.6	3	S	NAT	O	N	H	Y	T	E
39N04A	McDOWELL	0.4	2	S	NAT	O	N	M	N	T	A
39N05	FISH LAKE	2.0	2	S	NAT	O	N	M	N	T	E
39N05A	FISH LAKE	0.6	1	S	NAT	O	Y	L	N	T	P
39N06	TRAIL CREEK	0.6	2	S	NAT	O	N	M	N	T	A
39N07	CARTER MDW FAMILY	0.9	3	S	AGG	O	N	H	Y	R	E
39N08	CARTER MDW	5.5	3	S	AGG	I	N	H	Y	T	E
39N13	HAZEL GULCH	2.1	2	S	NAT	O	S	M	N	T	A

NUMERIC LISTING OF ROADS AND THEIR STATUS IN THE UPPER SOUTH FORK

FOREST RD# (COUNTY RD#)	ROAD NAME	LENGTH	MAINT. LEVEL	LANES	SURFACING	TEMPLATE	CLOSURE	ADT	HSA	PRIMARY USER	EX MGMT STRATEGY
39N14	GRASSHOPPER	11.9	3	S	NAT	O	N	H	Y	T	E
39N14A	GRASSHOPPER	0.5	2	S	NAT	O	N	M	N	T	A
39N14B	GRASSHOPPER	0.6	2	S	NAT	O	N	M	N	T	A
39N14C	GRASSHOPPER	0.4	2	S	NAT	O	N	M	N	T	A
39N14D	GRASSHOPPER	0.8	2	S	NAT	O	N	M	N	T	A
39N20	SHADOW CREEK	7.4	2	S	NAT/AGG	O/I	S	M	Y	T	A
39N20B	SHADOW CREEK	0.2	2	S	NAT	O	S	M	N	T	A
39N20G	SHADOW CREEK	0.7	2	S	NAT	O	S	M	N	T	A
39N23	CRAWFORD CREEK	7.6	3	S	NAT	I	N	H	Y	T	E
39N23A	CRAWFORD CREEK	0.04	1	S	NAT	O	Y	L	N	T	P
39N26	GEORGE RANCH	1.9	2	S	NAT	O	N	M	N	T	A
39N38	SHADOW CR. CG.	0.3	3	S	CHP	O	N	H	Y	R	E
39N42	MIDDLE GRASSHOPPER	0.7	2	S	NAT	O	S	M	N	T	A
39N42A	MIDDLE GRASSHOPPER	0.4	2	S	NAT	O	S	M	N	T	A
39N43	LAFAYETTE CRAWFORD	0.4	2	S	NAT	O	S	M	N	T	A
39N43A	LAFAYETTE CRAWFORD	0.4	2	S	NAT	O	S	M	N	T	A
39N45	SALMON CRAWFORD	2.5	2	S	NAT	I	S	M	N	T	A
39N45A	SALMON CRAWFORD	0.5	2	S	NAT	I	S	L	N	T	A
39N46A	BLACK MURPHY	0.05	2	S	NAT	O	N	L	N	T	A
39N47	CRAWFORD RIDGE	2.6	2	S	NAT	O	S	M	N	T	A

NUMERIC LISTING OF ROADS AND THEIR STATUS IN THE UPPER SOUTH FORK

FOREST RD# (COUNTY RD#)	ROAD NAME	LENGTH	MAINT. LEVEL	LANES	SURFACING	TEMPLATE	CLOSURE	ADT	HSA	PRIMARY USER	EX MGMT STRATEGY
39N48	CARTER JACK	0.6	2	S	NAT	O	N	M	N	T	A
39N50	DARK SHADOW	2.3	1	S	NAT	O	Y	L	N	T	L
39N51	GROUSE POINT	2.3	2	S	NAT	O	S	M	N	T	A
39N51A	GROUSE POINT	0.7	2	S	NAT	O	S	M	N	T	A
39N52	TRAIL CREEK CG	0.4	3	S	NAT	I	N	H	Y	R	E
39N53	EDDY GULCH LO	0.8	3	S	NAT	O	S	H	Y	A	E
39N53A N/S	39N.,11W.,SEC15	0.2	2	S	NAT	O	S	L	N	A	A
39N56	OLD CRAWFORD	5.6	2	S	NAT	O	S	M	N	T	A
39N57	BIG FLAT	0.2	3	S	NAT	O	N	M	Y	T	E
39N57A	BIG FLAT CG	0.5	3	S	NAT	O	N	M	Y	R	E
39N58	DEACON LEE	1.6	3	S	NAT	I	N	M	Y	R	E
39N58A	DEACON LEE	0.1	2	S	NAT	O	N	L	N	T	A
39N59	INCLINE	0.1	2	S	NAT	O	N	M	N	T	A
39N69	CARTER MDW OBS	0.1	3	S	NAT	I	N	H	Y	R	A
39N73	SHADOW	3.1	2	S	NAT	O	S	M	N	T	A
39N73A	SHADOW	0.2	2	S	NAT	O	S	M	N	T	A
39N74	CRAWFORD SHADOW	0.5	2	S	NAT	O	S	M	N	T	A
39N75	WEST SHADOW	1.5	2	S	NAT	O	S	M	N	T	A
39N75A	WEST SHADOW	0.3	2	S	NAT	O	S	M	N	T	A
COX	39N.,10W.,SEC21	0.3	1	S	NAT	O	Y	L	N	P	L

NUMERIC LISTING OF ROADS AND THEIR STATUS IN THE UPPER SOUTH FORK

FOREST RD# (COUNTY RD#)	ROAD NAME	LENGTH	MAINT. LEVEL	LANES	SURFACING	TEMPLATE	CLOSURE	ADT	HSA	PRIMARY USER	EX MGMT STRATEGY
JACKSON	39N.,10W.,SEC12	1.5	1	S	NAT	O	Y	L	N	P	L
BIG FLAT	37N.,09W.,SEC18	0.1	2	S	NAT	O	N	L	N	A	A
ELKENCLOSURE	37N.,11W.,SEC7	0.1	2	S	NAT	O	S	L	N	A	A
GOULEYS	38N.,11W.,SEC13	1.0	1	S	NAT	O	Y	L	N	P	L
JOSEPHINE	37N.,09W.,SEC30	3.0	3	S	NAT	O	S	M	N	P	L
LOR-O	37N.,11W.,SEC12	0.6	2	S	NAT	O	S	M	N	P	A
PETERSBURG	38N.,11W.,SEC34	0.3	4	S	CHP	O	S	H	Y	A	E
PRIVATE	38N.,11W.,SEC30	0.1	2	S	NAT	O	N	L	N	P	L
PRIVATE	39N.,10W.,SEC16	0.5	2	S	NAT	O	N	L	N	P	L
RAMEYS	38N.,11W.,SEC14,21	1.8	2	S	NAT	O	Y	L	N	P	L
RUSH CREEK	37N.,11W.,SEC12	0.4	2	S	NAT	O	S	L	N	P	A
WATERSOURCE	37N.,11W.,SEC3	0.3	1	S	NAT	O	Y	L	N	A	P
T-1	38N.,11W.,SEC5	1.0	2	S	NAT	O	S	L	N		A
T-2	39N.,11W.,SEC27	0.2	2	S	NAT	O	N	L	N		A
T-3	39N.,11W.,SEC35	0.1	2	S	NAT	O	S	L	N		A
T-4	39N.,11W.,SEC23,26	0.2	2	S	NAT	O	S	L	N		A
T-5	39N.,11W.,SEC26	0.4	2	S	NAT	O	S	L	N		A
T-6	39N.,10W.,SEC23	0.7	1	S	NAT	O	Y	L	N		L
T-7	38N.,11W.,SEC27,28	0.3	2	S	NAT	O	N	L	N		A
T-8	37N.,11W.,SEC24	0.2	2	S	NAT	O	N	L	N		A

NUMERIC LISTING OF ROADS AND THEIR STATUS IN THE UPPER SOUTH FORK

FOREST RD# (COUNTY RD#)	ROAD NAME	LENGTH	MAINT. LEVEL	LANES	SURFACING	TEMPLATE	CLOSURE	ADT	HSA	PRIMARY USER	EX MGMT STRATEGY
T-9	37N.,11W.,SEC11	0.9	2	S	NAT	O	N	L	N		A
T-10	37N.,11W.,SEC11	0.3	2	S	NAT	O	N	L	N		A
T-11	37N.,11W.,SEC3,10	0.5	2	S	NAT	O	N	L	N		A
T-12	38N.,11W.,SEC33	0.2	2	S	NAT	O	N	L	N		A
T-13	38N.,11W.,SEC32	0.2	2	S	NAT	O	N	L	N		A
T-14	37N.,11W.,SEC5	0.2	2	S	NAT	O	N	L	N		A
T-15	38N.,11W.,SEC32	0.2	2	S	NAT	O	N	L	N		A
T-16	38N.,10W.,SEC10	0.3	2	S	NAT	O	S	L	N		A
T-17	39N.,11W.,SEC32	0.1	1	S	NAT	O	Y	L	N		L
T-18	39N.,09W.,SEC20,29	0.3	2	S	NAT	O	N	L	N		L
T-19	39N.,09W.,SEC20	1.2	2	S	NAT	O	N	L	N		A
T-20	39N.,10W.,SEC20	0.8	2	4WD	NAT	O	N	L	N		A
T-21	38N.,11W.,SEC16	2.4	2	4WD	NAT	O	N	L	N		A
T-22	38N.,11W.,SEC27	0.1	2	S	NAT	O	N	L	N		A
T-23	38N.,11W.,SEC3	0.2	2	S	NAT	O	N	L	N		A
T-24	37N.,11W.,SEC3	0.1	2	S	NAT	O	N	L	N		A
T-25	39N.,09W.,SEC19	0.3	2	S	NAT	O	N	L	N		A
T-26	39N.,09W.,SEC19	0.2	2	S	NAT	O	N	L	N		A
T-27	39N.,09W.,SEC19	0.2	2	S	NAT	O	N	L	N		A
T-28	39N.,09W.,SEC19	0.2	2	S	NAT	O	N	L	N		A

NUMERIC LISTING OF ROADS AND THEIR STATUS IN THE UPPER SOUTH FORK

FOREST RD# (COUNTY RD#)	ROAD NAME	LENGTH	MAINT. LEVEL	LANES	SURFACING	TEMPLATE	CLOSURE	ADT	HSA	PRIMARY USER	EX MGMT STRATEGY
T-29	39N.,10W.,SEC24	0.2	2	S	NAT	O	N	L	N		A
T-30	39N.,11W.,SEC36	0.4	2	S	NAT	O	N	L	N		A
T-31	39N.,11W.,SEC25	0.5	2	S	NAT	O	N	L	N		A
T-32	39N.,11W.,SEC25	0.3	2	S	NAT	O	N	L	N		A
T-33	39N.,11W.,SEC25	0.1	2	S	NAT	O	N	L	N		A
T-34	38N.,11W.,SEC28	0.7	2	S	NAT	O	N	L	N		A
T-35	38N.,11W.,SEC27	0.6	2	S	NAT	O	N	L	N		A
T-36	38N.,11W.,SEC34	0.4	2	S	NAT	O	N	L	N		A
T-37	38N.,11W.,SEC34	0.8	2	S	NAT	O	N	L	N		A
T-38	39.,10W.,SEC19	1.7	2	4WD	NAT	O	N	L	N		A
(1C02)	CECILVILLE RD	18.0	5	D	PAV/CHP	C	N	H	Y	GP	N/A
(1C02)	CECILVILLE RD	4.5	5	S	CHP	C	N	H	Y	GP	N/A
(1E002)	PETERSBURG	0.3	3	S	CHP/NAT	O	N	M	Y	GP	N/A
(1E003)	CARIBOU	3.7	5	D	CHP	C	N	H	Y	GP	N/A
(1E003)	CARIBOU	2.6	3	S	NAT/AGG	I	N	H	Y	GP	N/A
(2E001A)	EDDY GULCH	1.1	5	S	CHP	O	N	H	Y	GP	N/A

APPENDIX F

DISEASE AND INSECTS

White Pine blister rust (*Cronartium ribicola*)
White pine blister rust has been devastating to the white pines in California since the disease entered California around 1930. Sugar pine is a highly valued commercial conifer and this widespread, threatening disease is a regional concern. Blister rust can be found within the watershed in most stands that contain a host species. All stands containing one of the host species are susceptible to infections, but stands located on the lower one-third of a slope, closer to the drainage bottom, and stands on north slopes, where humidities are higher may have higher levels of infection.

Trees in the smaller size classes die more rapidly, but all size classes suffer mortality. High levels of mortality from blister rust are more likely in the smaller size classes. Plantations that do not contain rust resistant or slow rusting seedlings are also very susceptible to mortality once infection sets in.

Blister rust is caused by a specialized group of fungi known as obligate parasites, which develops only on living tissue. White pine blister rust passes through five different spore stages in its life cycle. The pines host two spore types and the alternate host, ribes, host three spore types. Symptoms of white pine blister rust include needle spots, cankers, and branch "flagging".

Several "wave years" of heavy infection have occurred within the Upper South Fork watershed. This has been documented in 1938, 1940, 1944, 1948, 1956, 1961, 1976, 1983, and 1989.

Control strategies include both genetic and cultural. Genetic controls have involved the studying and selecting of rust resistant and slow rusting trees. Regional efforts are ongoing to select for rust resistant trees. Successful genetic selection has been less than two percent on the Klamath National Forest.

Cultural controls include removing infected branches and pruning infected branches during thinning operations.

Dwarf Mistletoe (*Arceuthobium* spp.)
Dwarf mistletoes are host specific. Mistletoes of most concern within the Upper South Fork watershed include: white fir dwarf mistletoe (*A. abietinum* f. sp. *concoloris*), red fir dwarf mistletoe (*A. abietinum* f. sp. *magnificae*), western dwarf mistletoe (*A. campylopodum*), and Douglas-fir dwarf mistletoe (*A. douglasii*).

Dwarf mistletoe is widespread throughout the watershed and is not confined to specific locations. Any area that contains conifer trees is susceptible to dwarf mistletoe infections. In general, heavier infestations of dwarf mistletoe are found on low site productivity lands.

Areas of concern for dwarf mistletoe occur in situations where mistletoe is found in vegetative elements that contain open stands with abundant regeneration, plantations with scattered infected overstory trees and/or adjacent stands that contain infected trees of the same species as found in the plantation, and dense pole stands that may be heavily infected with mistletoe. Trees that get infected at a young age or size class are less likely to develop into large size.

Dwarf mistletoes are obligate parasites; they are dependant on their hosts for water, mineral, and other nutrients. The dwarf mistletoes have jointed shoots which are less than six inches long. True leaves are lacking. The fruit is oval-shaped, containing one seed per fruit. Seeds are forcibly discharged from the fruit. A period of two to five years elapses before aerial shoots are formed. Flowering occurs one to two years after the shoots appear. It takes another year before seeds mature and seed dispersal occurs.

Dwarf mistletoes are considered the most serious forest disease agents in many western states. Effects of dwarf mistletoe include: 1) reduction in growth, 2) mortality, 3) predisposition to other pests, 4) growth abnormalities, 5) reduced seed production, and 6) product degrade.

There are several control activities that have been successful in the suppression of dwarf mistletoe. Most of the control efforts have been associated with recreation sites. The method of control depends primarily upon the objective or management goals of the area. Direct suppression methods include: 1) broom pruning, 2) tree removal, 3) creation of buffer strips, and 4) branch

pruning/eradication. Indirect suppression methods include: 1) thinning, 2) favoring and planting non-host conifers and hardwoods, and 3) rotation of campground usage.

A disease that needs to considered along with dwarf mistletoe is Cytospora canker (*Cytospora abietis*). This disease is usually found in conjunction with dwarf mistletoe in true fires. Elements favorable to Cytospora infection are those that contain any true fir species. Cytospora infections have been noted throughout the high elevations of the watershed, primarily in red fir stands.

Western pine beetle (*Dentroctonus brevicomis*), Pine engraver beetles (*Ips* spp.), Fir engraver (*Scolytus ventralis*), Fir flatheaded borer (*Melanophila drummondi*)
Elements that attract all of these insect species are those that contain high levels of competition for moisture and nutrients. The most susceptible trees to attacks from these insect species are those under stress from the lack of soil moisture or the presence of debilitating agents.

One area of primary concern for large scale insect epidemics is the transition zone between the mixed conifer and true fir forest types. Over the past several decades vegetation in this zone has increased dramatically. It is now at a point where vegetative biomass exceeds site capabilities in many cases. This has made the area very susceptible to high levels of insect attack and mortality. This is especially true in the white and red fir that has invaded into the mixed conifer forest type. This zone is currently receiving large amounts of mortality from the fir engraver beetle.

The bark beetles and engravers, western pine beetle, pine engraver beetle and the fir engraver beetle, are the most destructive group of insect pests to be found associated with coniferous forests. They kill trees and breed in the dying cambium of freshly felled trees and slash. These insects can have up to three to four successful broods each year.

It can be difficult to accurately detect trees killed by bark beetles. Ground and aerial surveys are the best way to do this. The primary problem is that by the time the trees begin to fade, the bark beetles are no longer in the tree. Ground surveys are the best way to examine for currently infested trees. Boring dust, pitch tubes, and galleries under the bark are the best visible signs of a tree infested with bark beetles.

The western pine beetle generally attacks ponderosa pine. It can affect the entire bole up to an eight inch top. Pitch tubes are small.

The pine engraver beetle attacks all species of pines. They generally attack the tops of large trees and the entire bole of small trees. Standing trees contain small pitch tubes and boring dust and freshly attacked slash will have visible boring dust.

The fir engraver beetle generally attacks white fir and red fir. It can attack just the top of the tree, patches of the tree, or the entire bole. Successful attacks are usually characterized by resin flow from the entrance points. The fir engraver beetle usually have one brood each year.

There are no real economic direct control methods. There is no method developed that will save a tree once it is attacked. Some direct methods tried in the past include: fell-peel-burn, fell-deck-burn, fell-peel-spread bark, solar heat, and submerging the infested log. Pheromone treatments have also had some success in attracting the beetles to one location for treatment. Some insecticides have also been used with varying success. All of the direct approaches are expensive and limited in scope of use.

Another direct method is to harvest the infected trees. This will at least capture the wood value of the infested trees but will not always eradicate the pest populations. It is easy to miss infested trees and beetle populations can be so large that it is impossible to remove all of them from the stand and adjacent stands.

The best method of limiting catastrophic insect attacks by indirect silvicultural practices. This involves establishing vigorous, healthy trees and stands by maintaining the stocking and age at certain levels for each species and site.

Winter air temperatures of -20 degrees Fahrenheit and lower for a few days have been found to cause heavy brood mortality.

Wood borers, fir flatheaded borer, are generally considered as being secondary pests. They infest weakened and dead trees and various forest products. Detection, evaluation, and control methods

for these insects are similar to the bark beetles and engravers. Proper forest management and sanitation is the best, long term solution to preventing large scale epidemics.

The fir flatheaded borer generally attacks red fir, white fir, and Douglas-fir. It can attack the entire bole and limbs. Successful attacks are distinguished by resin flow and coarse boring dust.

APPENDIX G

LATE-SUCCESSIONAL RESERVE ASSESSMENT

TAYLOR CREEK, UPPER SOUTH FORK SALMON WATERSHED

Late-Successional Reserve Management Objectives --Late-Successional Reserves (LSR) are to be managed to protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth related species including the Northern spotted owl. These reserves are designed to maintain a functional, interacting, late-successional and old-growth forest ecosystem (USDA Forest Service and USDI Bureau of Land Management, 1994).

Additional information on the ecology and management of late-successional and old-growth related species can be found in Appendix D of the Final Draft Recovery Plan for the Northern Spotted Owl.

Late-Successional Reserve Description --LSRs have been designated based on five elements: 1) areas mapped as part of an interacting reserve system, 2) LS/OG 1 and 2 areas within MAMU zone 1, and certain owl additions, 3) sites occupied by MAMU, 4) known owl activity centers, and 5) protection buffers for specific endemic species identified by SAT.

Desired Future Condition of Late-Successional Reserves --The following information has been reproduced from parts of the *ROD*. It is not a complete text, however, it does represent information from the text that helps to describe the desired future condition of LSRs, including information on the intent of establishing the LSR network, the desired vegetative characteristics, the desired structure and composition, function, and the ecological processes that are important. The complete text can be found within the *ROD* on pages B-1 thru B-5.

General Ecological Basis --Late-successional forests are those forest seral stages that include mature and old-growth age classes. One goal of these standards and guidelines is to maintain late-successional and old-growth species habitat and ecosystems on federal lands. Another goal of forest management on federal lands is to maintain biological diversity associated with native species and ecosystems in accordance with laws and regulations. Forest ecosystems are quite variable throughout the range of the Northern spotted owl. Therefore, site-specific knowledge of ecosystems will be incorporated into watershed-level analysis and integrated into Forest and District plans, and province level planning.

- In LSRs, standards and guidelines are designed to maintain late-successional forest ecosystems and protect them from loss due to large scale fire, insect and disease epidemics, and major human impacts. The intent is to maintain natural ecosystem processes such as gap dynamics, natural regeneration, pathogenic fungal activity, insect herbivory, and low intensity fire. These S&Gs encourage the use of silvicultural practices to accelerate the development of overstocked young plantations into stands with late-successional and old-growth forest characteristics, and to reduce the risk to LSRs from severe impacts resulting from large scale disturbances and unacceptable loss of habitat. A more in depth discussion of the ecological principles behind the establishment of LSRs can be found in Appendix B2 of the *ROD,* pages B-43 thru B-50.

- The matrix (other land allocations) is an integral part of the management direction included in these S&Gs. .... however, forests in the matrix (other land allocations) function as connectivity between LSRs and provide habitat for a variety of organisms associated with both late-successional and younger forests (*ROD*, B-1).

- Late-Successional Reserves are designated to maintain and enhance late-successional forests as a network of existing old-growth forest ecosystems, although their size, distribution and management varies. These reserves represent a network of existing old-growth forests that are retained in their natural condition with natural pro-

cesses, such as fire, allowed to function to the extent possible. First, they provide a distribution, quantity, and quality of old-growth forest habitat sufficient to avoid foreclosure of future management options. Second, they provide habitat for populations of species that are associated with late-successional forests. Third, they will help ensure that late-successional species diversity will be conserved (*ROD*, B-4).

Late-Successional Reserve Characteristics --Desired late-successional and old-growth characteristics that will be created as younger stands change through successional development include: 1) multi-species and multi-layered assemblages of trees, 2) moderate to high accumulations of large logs and snags, 3) moderate to high canopy closures, 4) moderate to high numbers of trees with physical imperfections such as cavities, broken tops, and large deformed limbs, and 5) moderate to high accumulations of fungi, lichens, and bryophytes (*ROD*, B-5).

STRUCTURE AND COMPOSITION --The structure and composition of late-successional and old-growth forest ecosystems have been detailed in numerous publications. Four major structural attributes of old-growth Douglas-fir forests are: live old-growth trees, standing dead trees (snags), fallen trees or logs on the forest floor, and logs in streams. Additional important elements typically include multiple canopy layers, smaller understory trees, canopy gaps, and patchy understory. Structural characteristics of late-successional and old-growth forest vary with vegetation type, disturbance regime, and developmental stage....(*ROD*, B-2).

ECOSYSTEM FUNCTIONS --Late-successional ecosystems perform several ecological functions that appear to be lacking, or less well developed in younger natural forests and managed plantations. These functions include buffering micro-climates during seasonal climatic extremes, producing food for those consumer organisms that occupy late-successional forest, storing carbon, providing nutrient and hydrological cycling, and providing sources of arthropod predators and organisms beneficial to other ecosystems or successional stages. Old-growth ecosystems appear to have high retention of nutrients and low soil erosion potential, although differences in these functions between stand developmental stages may not be large when canopy closure has occurred. Tall, deep canopies of late-successional forests can also intercept more moisture from clouds and fog than young plantations (*ROD*, B-4).

ECOLOGICAL PROCESSES --Ecological processes include those natural changes that are essential for the development and maintenance of late-successional and old-growth forest ecosystems. Although the processes that created the current late-successional and old-growth ecosystems are not completely understood, they include: 1) tree growth and maturation, 2) death and decay of large trees, 3) low to moderate intensity disturbances (e.g., fire, wind, insects and disease) that create canopy openings or gaps in the various strata of vegetation, 4) establishment of trees beneath the maturing overstory trees either in gaps or under the canopy, and 5) closing of canopy gaps by lateral canopy growth or the growth of understory trees (*ROD*, B-2).

Several authors have described these stages, and one has expanded these descriptions to include their protracted nature of stand development in forests dominated by long-lived trees such as Douglas-fir. Following stand replacing disturbance, these stages can be described as: 1) establishment, 2) thinning, 3) maturation, 4) transition, and 5) shifting gap.

The maturation stage (3) is characterized by a slowed rate of height growth and crown expansion. Heavy limbs begin to form; gaps between crowns become larger and more stable, or expand as a result of insect and pathogen mortality. Large and fallen trees begin to accumulate, and the understory may be characterized by seedlings and saplings of shade tolerant tree species.

During the transition stage (4), the original component of overstory trees approaches its maximum height and diameter, and growth is slow. Tree crowns become more open, irregular in shape and contain heavy limbs. Broken, dead, and decaying portions of tree crowns are common. Old trees become relatively resistant to low to moderate intensity fire and, depending on on species, crown bases are high above the understory and bark is thick. During this stage, understory trees form multiple canopy layers. Coarse woody debris accumulates to relatively high levels, and low to moderate intensity disturbances from insects, disease, wind and fire create patchy openings and accumulations of standing dead trees.

The shifting gap stages begin when the last of the original component of overstory old-growth trees dies and all trees in the canopy have been established following various smaller gap type disturbances. Forests in the last two stages of development (4 and 5) actually contain all of the stand development stages in a relatively fine-grained mosaic of smaller stands. The later three stages (3, 4, and 5) embody the late-successional and old-growth conditions that are the focus of these S&Gs.

Some of the stand development processes, such as tree growth and mortality, and understory establishment, can be accelerated through silvicultural manipulations in younger stands. Other processes such as tree crown maturation, bark thickening, and tree bole decay are not readily accelerated through silvicultural prescriptions.

In the drier provinces, fire control and timber harvest have decreased the abundance of some types of old-growth, such as Ponderosa Pine, that are dependant on frequent, low intensity fires. Other types of late-successional forests that are less fire resistant or are less desirable for harvest have become more widely spread. In these areas, the potential for stand replacing fires has increased, resulting in a higher risk to the stability of current stands reserved for late-successional species.

Until more experience and knowledge about active management to produce late-successional ecosystems is gained, sustaining late-successional ecosystems in the landscape will be best accomplished through retention of existing areas of late-successional forest. Given the relatively low remaining proportion of late-successional ecosystems in the landscape at the present time, these older forests should be protected from fire and other stand-resetting disturbances.

MANAGEMENT ASSESSMENT

As stated in the *ROD*, a management assessment should be prepared for each large LSR before habitat manipulation activities are designed and implemented. The *ROD* also includes a recommended contents of an assessment. Those recommendations are included below.

This assessment addresses the Taylor Creek LSR and the portion of Eddy Gulch LSR that occurs within the watershed. The watershed analysis report is referenced where it incorporates information pertinent to this LSR assessment. The assessment for the Eddy Gulch LSR will be completed through subsequent analyses.

Assessment Contents

1- A history and inventory of the overall vegetative conditions within the reserve.

- *Chapter 2* contains a description of the vegetation within the entire watershed. Although the area contains large amounts of mature and late seral forest, it includes other vegetation types including montane shrub and hardwood communities. The existing amounts of each vegetation type that occur within the LSR are displayed in *Chapter 5*.

- *Chapter 1* describes the historic role of fire and how it influenced vegetative composition, structure, and function. Historic fire regimes were typically characterized by short fire return intervals with fires primarily of low and moderate severity. This suggests that forest were more open and less structurally complex than they are today. Large stand replacing fires were less frequent.

To the extent possible, information on the status of the current vegetative conditions should be mapped. The map should depict locations where vegetative conditions currently exist to support late-successional species including the Northern spotted owl based on the local definition of suitable habitat. Identify lands within the LSR that are not capable of supporting suitable habitat.

Figure 9 - Watershed Elements Biological Map and Figure 10 - Watershed Elements Human Map shows the distribution of all vegetation in relationship to the LSRs. The Mature and Late Seral Stage Vegetation Map (located at the back of this appendix) shows the distribution of mature and late seral stage forest within the watershed. Those areas are assumed to provide habitat for species associated with mature and late seral forest, including the Northern spotted owl.

- Site potential is quite variable within the watershed. *Chapter 2* contains a discussion of the affect of geologic types on vegetation. Soils are shallow and rocky in some portions of the landscape, particularly within the Crawford Creek and Sixmile Creek drainages, and are unable to support mature and late seral forest vegetation. *Chapter 5*

includes a discussion of the site capability and potential vegetation within LSRs.

Include a watershed scale (or larger) vegetation map in the document to provide information on the condition of the vegetation in the area surrounding the LSR. An analysis of the ability of late-successional species to distribute and interact with late-successional species across the landscape should be included.

Maps pertinent to this are discussed above.

- *Chapter 4* includes a discussion of the pattern and distribution of mature and late seral forest habitat within the watershed and its relationship to the movement of associated wildlife species.

2- A history and description of the current resource and social uses of the LSR.

- *Chapter 1* discusses some of the historical resource uses which have occurred within the watershed, including early gold mining, grazing, timber harvest and road construction. Figures 7 - Roading and Harvest History Map show the progression of timber harvest and road construction from 1944 to present. *Chapters 3* and *4* discuss the current human-related resource uses which occur within the watershed and the location of some of those uses are displayed in Figure 10.

3- A list of identified late-successional associated species known to exist within the LSR, information on their location, and any information on their current or historic population levels or reproductive success.

- The following amphibian, mammalian, and avian species were identified in the *FSEIS* as being closely associated with late-successional forests on federal lands within the range of the Northern spotted owl, based on criteria developed by FEMAT (1993). Those which are known or suspected to occur within the Upper South Fork Salmon River Watershed are noted.

Riparian	Known/Suspected Occurrence
AMPHIBIANS: Black salamander * +	USFK
Cascade torrent salamander +	
Columbia torrent salamander +	
Copes'giant salamander +	
Dunn's salamander	
Northwestern salamander *	USFK
Olympic torrent salamander	
Pacific giant salamander *	USFK
Rough-skinned newt *	USFK
Southern torrent salamander * +	USFK
Tailed frog * +	USFK
Van Dyke's salamander + (Cascades) Coastal, Oly Penin.)	
TERRESTRIAL: Clouded salamander * +	USFK
Del Norte salamander *	
Larch Mountain salamander +	
Oregon Slender salamander +	
Shasta salamander * +	USFK
Siskiyou Mountains salamander * +	
BIRDS: Bald eagle *	USFK
Barred owl *	USFK
Barrow's goldeneye	
Black-backed woodpecker * +	
Brown creeper *	USFK
Buffiehead *	USFK
Chestnut-backed chickadee *	USFK
Common merganser * +	USFK
Flammulated owl *	USFK
Golden-crowned kinglet *	USFK
Great gray owl *	USFK
Hairy woodpecker *	USFK
Hammond's willow flycatcher *	USFK
Harlequin duck	
Hermit thrush *	USFK
Hermit warbler *	USFK
Hooded merganser *	USFK
Marbled murrelet *	
Northern flicker *	USFK
Northern goshawk *	USFK
Northern pygmy-owl *	USFK
Northern spotted owl *	USFK
Pileated woodpecker *	USFK

Riparian	Known/Suspected Occurrence
Pygmy nuthatch *	USFK
Red crossbill *	USFK
Red-breasted nuthatch *	USFK
Reb-breasted sapsucker *	USFK
Three-toed woodpecker	
Varied thrush *	USFK
Vaux's swift *	USFK
Warbling vireo *	USFK
Western willow flycatcher * (Pacific slope flycatcher)	USFK
White breasted nuthatch *	USFK
White-headed woodpecker *	USFK
Williamson's sapsucker *	USFK
Wilson's warbler *	USFK
Winter wren *	USFK
Wood duck *	USFK
MAMMALS: Deer mouse *	USFK
Douglas squirrel *	USFK
Dusky-footed woodrat * (Klamath province)	USFK
Elk *	USFK
Fisher * +	USFK
Forest deer mouse	
Marten * +	USFK
Northern flying squirrel *	USFK
Red tree vole (P.longicaudus) +	
Red tree vole (P.pomo) * +	
Shrew-mole *	USFK
Southern red-backed vole	
Chipmunk complex * (Allen's, Siskiyou, Townsend's)	USFK
Pacific/fog shrew complex *	
Western red-backed vole *	USFK
BATS: Big brown bat *	USFK
California myotis *	USFK
Fringed myotis * +	USFK
Hoary bat * +	USFK
Keen's myotis +	
Little brown myotis *	USFK
Long-eared myotis * +	USFK
Long-legged myotis * +	USFK
Pallid bat * +	USFK
Silver-haired bat * +	USFK
Yuma myotis *	USFK

*** Known or suspected to occur on Klamath National Forest.**
+ This species was specifically considered when additional standards and guidelines were added to *Option 9*.

Surveys have been conducted for only a few of the above species. Survey information is available for Northern spotted owl and tailed frog and is discussed in *Chapter 3*. Some incidental sightings of fisher and marten have occurred within the watershed.

4- Information on the habitat needs of those species associated with late-successional habitats identified in #3, above. Use the latest scientific information, Wildlife Habitat Relations (WHR) analysis model, or other Habitat Capability Models to conduct an analysis on each species. Use that information as the basis from which to make biological interpretations on the current, and potential habitat conditions within the LSR. The use of other accepted models is encouraged.

Habitat analysis for late-successional associated species will be completed and attached to this document.

5- Summarize the important processes and flows within the LSR, and identify the risks associated with those processes and flows to maintaining or enhancing late-successional species habitat.

- *Chapters 3* and *4*, and Appendix F - Disease and Insects discuss the important processes and interactions that affect the potential to maintain or enhance mature and late-successional forest habitat within the watershed. Insect and disease mortality exacerbated by overstocked conditions and increased fire risk are the two most important threats to the future maintenance of habitat. The Disease and Insect Mortality Areas Map (located at the end of this appendix) shows the occurrence of the greatest concentrations of insect and disease related mortality in relation to LSRs.

6- Develop a fire management plan. Fire currently poses the greatest risk to the long term management of LSR. The fire management plan should

address the risk of large scale, stand replacement fires.

• The past, present, and predicted future role of fire within the watershed are incorporated into the watershed analysis. Chapter one describes historical fire return intervals and how they affected vegetation within the landscape. Fire occurrence, fire hazard and fuel models are discussed in *Chapter 3*. *Chapter 4* describes the potential wildfire effects within the landscape.

From 1946 to 1988, 421 fires were started in the landscape, 358 of which were human caused. Figure 19 - Fire History Map displays fire occurrence with reference to LSRs.

Fuel models are displayed in Figure 20. Two areas were highlighted as being of concern due to existing and future fuel models. The first occurs within the Eddy Gulch LSR. The majority of the fuels in the LSR are typed as Fuel Model 10. Fires which occur in Fuel Model 10 are characterized as surface fires that have potential to become crown fires. The second area of concern occurs within the Taylor Creek LSR. This area is dominated by Fuel Models 8 and 10. Areas of Fuel Model 10 are characterized as such due to the large amounts of dead and down material resulting from insect killed trees. Fuel Model 8 stands are currently in transition to Fuel Model 10 as insects continue to attack and kill trees.

Slope, fuel models, and 90th percentile weather information were used to derive fire hazard classes for the landscape. Fire hazard is a projected indication of resistance to control based on estimated flame length and rate of spread. Most of Eddy Gulch and Taylor Creek LSRs fall within a high fire hazard class (Figure 21 - Fire Hazard Classes Map).

Chapter 4 discusses the potential wildfire effects within the watershed and Figure 22- Potential Wildfire Effects Map displays the situation. Potential wildfire effects is calculated using fire hazard class and fire risk. The result is a projection of the likelihood of a stand being lost to wildfire. Approximately 21,800 acres within the watershed were classified as having a high likelihood of a stand replacing fire. The largest, most contiguous high likelihood areas are located within the Taylor Creek and Eddy Gulch LSRs.

The results of the fire analysis were used to identify areas where fuel loading should be reduced. See items 7 and 8 below.

Appendix B8 of the *FEIS*, "Fire Management Standards and Guidelines" provides additional information on the desired future condition to be achieved from fire management planning.

7- Develop a summary of the criteria for developing appropriate treatments.

• To provide a preliminary screen for establishing work priorities during the implementation phase, an "emphasis rating" was developed. Other less tangible factors such as management emphasis, partnerships, available funding, etc.,would also need to considered during project implementation. Criteria for rating the opportunities are:

1) Are there consequences, in terms of resource damage, of not doing an opportunity? Are there resources at risk if this opportunity does not occur?
2) Is the opportunity an immediate need? Does the opportunity provide a linkage towards achieving the desired condition? (How far will it get you towards the Desired Condition?)
3) Are there amenity or commodity resources that benefit from doing the opportunity?
4) Does the opportunity have implications for other resources outside of this watershed?

8- The locations of where management opportunities for habitat improvements, based on the criteria described in #7 are displayed in Figures 33 - Management Opportunities (1 of 2).

The identified management opportunities should include any management activities that would result in the movement of the current vegetative condition towards the desired future vegetative condition. A description of the desired vegetative conditions for LSRs has been provided in *Chapter 5*.

At this time, one management opportunity has been identified to maintain and improve conditions of late-successional forest within LSRs (*Chapter 6*):

Existing Condition --Late-successional habitat provides for dependent wildlife but also is a high

fuel hazard as large concentrations of down fuels and large amounts of ladder fuels are present.

Desired Condition --Late-successional habitat that provides for dependent wildlife and is a limited fire hazard; large down fuels and ladder fuels are in amounts appropriate to a moderate fuel hazard (see more detailed description of desired habitat conditions in *Chapter 5*).

Management Opportunity --Maintain and improve late-successional habitat and dispersal habitat for late-successional wildlife species.

Benefiting Resources --Wildlife, Watershed Values

Emphasis Rating (based on criteria described in #7 above) – 1 = High, 2 = High, 3 = High, 4 = High, then Average = High.

Inventory needs for numerous wildlife species, including several late-successional associate species, are identified in *Chapter 6*.

9- A proposed project implementation schedule based on restoring critical, or depleted habitat attributes, and tiered to a higher order plan such as the Land and Resource Management Plan, or the Ecosystem Assessment for the surrounding area.

- The next step following the completion of the watershed analysis will be development of priorities for project implementation, which will include consideration of the opportunities identified within LSRs.

10- Baseline data on vegetative and population characteristics proposed as monitoring and evaluation components to help evaluate if future activities are carried out as intended and have achieved the desired results.

- Key implementation monitoring things to consider include: 1) are timber harvest activities consistent with S&Gs and with REO review requirements, 2) are management activities consistent with LSR objectives, 3) have LSR assessments been completed, and 4) are management activities consistent with the LSR assessment?

- Key effectiveness monitoring things to consider include: 1) size, location, special distribution, species composition, and development of late-successional and old-growth forests, 2) retention of snags and coarse woody debris levels, 3) abundance and diversity of species associated with late-successional forest communities, 4) species presence, 5) percent of land area affected by non-desirable exotic species, 6) structure and composition, 7) ecological processes, 8) ecosystem functions, and 9) air quality.

- Information should also be collected on: 1) land use data, 2) seral stage development and shifts of forest plant communities, 3) locations and concentrations of plant disease and infestations, 4) amount of fuel buildups, 5) air quality, 6) water quality information, and 7) riparian and stream habitat condition by stream class.

BACKGROUND INFORMATION ON LSRS FROM THE ROD

Decision Summary

Late-successional reserves are to be managed to protect and enhance old-growth forest conditions. Thinning or other silvicultural treatments inside these reserves may occur in stands up to 80 years of age if the treatments are beneficial to the creation and maintenance of late-successional forest conditions. Additional management activities are allowed to reduce risks of large scale disturbance. Salvage guidelines are intended to prevent negative effects on late-successional habitat. Non-silvicultural activities within late-successional reserves are allowed where such activities are neutral or beneficial to the creation and maintenance of late-successional habitat. Thinning or other silvicultural activities must be reviewed by the REO and RIEC.

The Role Of Silviculture

Silvicultural systems proposed for LSRs have two principle objectives: 1) development of old-growth forest characteristics including snags, logs on the forest floor, large trees, and canopy gaps that enable establishment of multiple tree layers and diverse species composition, and 2) prevention of large scale disturbances by fire, wind, insects, and diseases that would destroy or limit the ability of the reserve to sustain viable forest species populations. Small scale disturbances by these agents are natural processes and will be allowed to continue (*ROD*, B-5).

Stand Management
Stand management in LSRs should focus on stands that have been regenerated following timber harvest or stands that have been thinned. These include stands that will acquire late-successional characteristics more rapidly with treatment, or are prone to fire, insects, disease, wind or other disturbances that would jeopardize the reserve. Depending on stand conditions, treatments could include, but are not limited to: 1) thinning or managing the overstory to produce large trees; release advanced regeneration of conifers, hardwoods, or other plants; or reduce risk from fire, insects, disease, or other environmental variables, 2) under planting and limiting understory vegetation control to begin development of multi-storied stands, 3) killing trees to make snags and coarse woody debris, 4) reforestation, and 5) use of prescribed fire. Thinning prescriptions should encourage development of diverse stands with large trees and a variety of species in the overstory and understory. Prescriptions should vary within and among stands (*ROD*, B-6).

Management of Disturbance Risks
Natural disturbance is an important process within late-successional forest ecosystems, but humans have altered the disturbance regimes. Management may be required to re-introduce natural disturbance, such as fire, or to minimize socially unacceptable impacts.

Silvicultural practices aimed at reducing the risk of stand replacing fires may be appropriate. Treatments may include thinning and underburning. Density reduction in mid-level canopy layers by thinning may reduce the probability of crown fires. Underburning can be used to reduce fuel loading and vertical fuel continuity. To increase effectiveness, underburning should be implemented over large areas (*ROD*, B-7).

Assessments for Late-Successional Reserves during the Transition Period
Projects and activities within LSRs (including restoration, recreation, projects for public safety, thinning and salvage) may proceed in fiscal years 1994-1996 using initial LSR assessments done at a level of detail sufficient to assess whether the activities are consistent with the objectives of the LSR (A-7).

Response to Comments
CONCERN --Whether salvage or thinning should be allowed in reserves.

RESPONSE --Alternative 9 as proposed in the Draft *SEIS* rated third highest among the ten alternatives analyzed in terms of ecosystem quantity and quality (abundance, diversity, processes, function and connectivity). This rating was partly based on the ability to manage late-successional reserves to maintain or enhance old-growth structure, diversity and function. This type of management is especially important in the dry provinces and in young plantations, where some management can protect and enhance old-growth conditions. The Assessment Team found that "without restoration silviculture (which includes thinnings), late-successional conditions would be retarded in development" (Final *SEIS*, pp. 34-36). Silvicultural treatments are limited to those that will be beneficial to late-successional forest conditions. Salvage activities must be intended to prevent negative effects on late-successional habitat. Ecological Principles for Management of Late-Successional Forests was added to Appendix B (*ROD*, pg. 62).

COMMENT --Salvage logging is the most nebulous category in practice and agency standard and guidelines leave to much to be determined by whim. Therefore, confine all salvage logging to AMAs.

RESPONSE --To ensure that salvage in late-successional reserves is considered with the intent of the standards and guidelines, salvage is subject to review by the REO and approval by the REIC. Salvage is not required to be beneficial, but is designed to permit the recovery of timber volume in those instances where catastrophic events clearly kill more trees (resulting in more snags and down logs in the short-term and long-term) than are needed to maintain late-successional conditions. For example, if a major blow-down event leaves dead trees 15 feet deep over the landscape, a determination could be made that only a portion of those logs are needed to meet the objectives of the reserve. The rest, after consideration of the impacts of the harvest systems themselves, including any required roading, might be available for salvage. Salvage of individual dead trees within the landscape is not intended within LSRs under the salvage guidelines. Work with the REO and adaptive management schemes on a

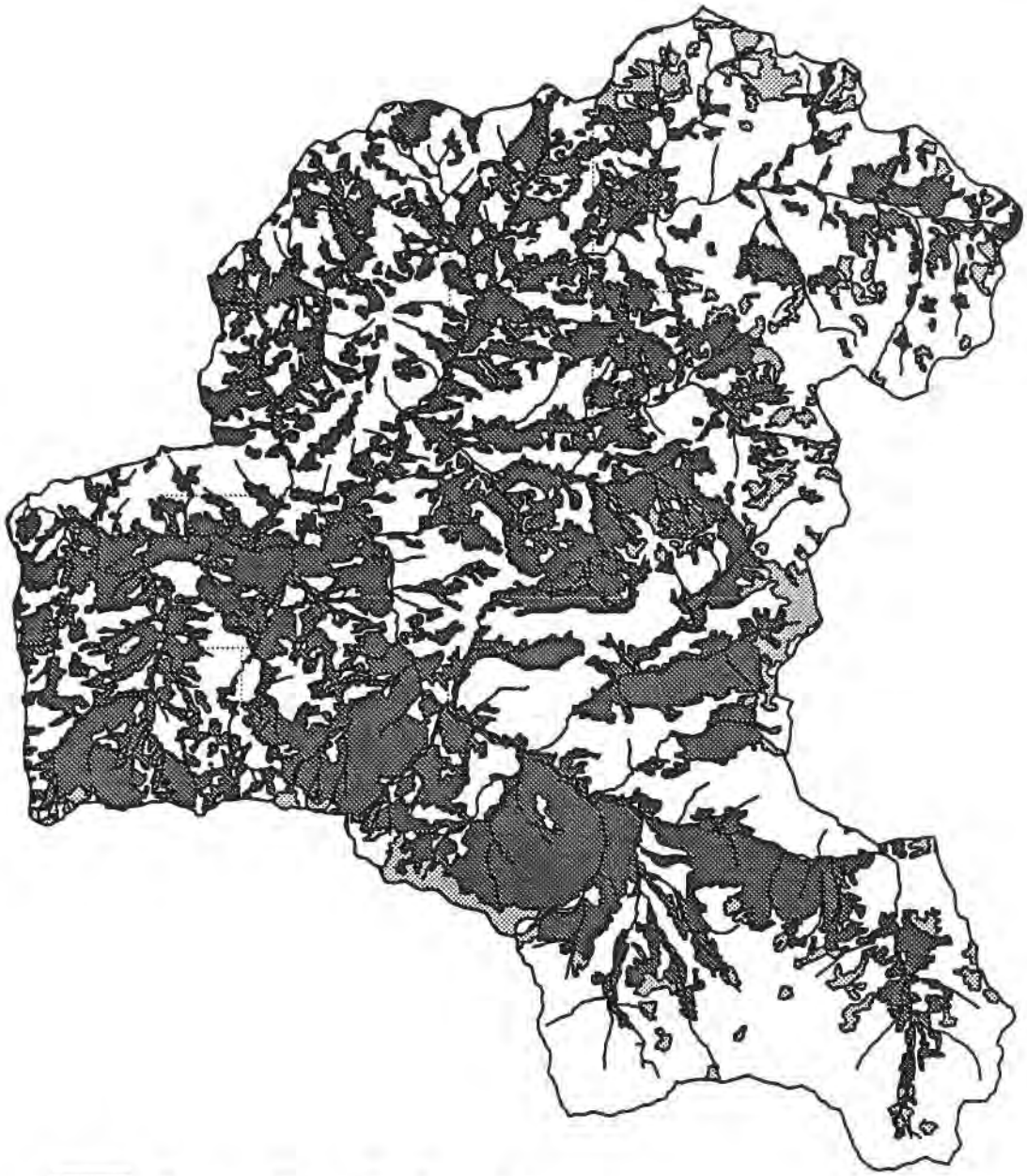
case by case basis to define where salvage is appropriate (*ROD*, pg 66).

COMMENT --LSR assessments should include a road obliteration plan for the purpose of reducing fragmentation of the forest ecosystem within these reserves.

RESPONSE --The 1992 Spotted Owl *FEIS* which this *SEIS* supplements states that "roads which are no longer needed are identified for restoring to a natural state though such methods as planting trees and shrubs, mulching, and seeding grasses, or roadbed obliteration. Roads which are not needed for ongoing or short-term projects can be proposed for closure in order to reduce conflicts with other resources or to reduce use and hence maintenance needs". Those that remain (roads), while perhaps distracting somewhat from late-successional reserve objectives, will be used for fire protection, beneficial silvicultural objectives, as well as facilitating existing and new uses neutral to late-successional reserve objectives (*ROD*, pg 68).

Upper South Fork Watershed

Mature & Late Seral Stage Vegetation



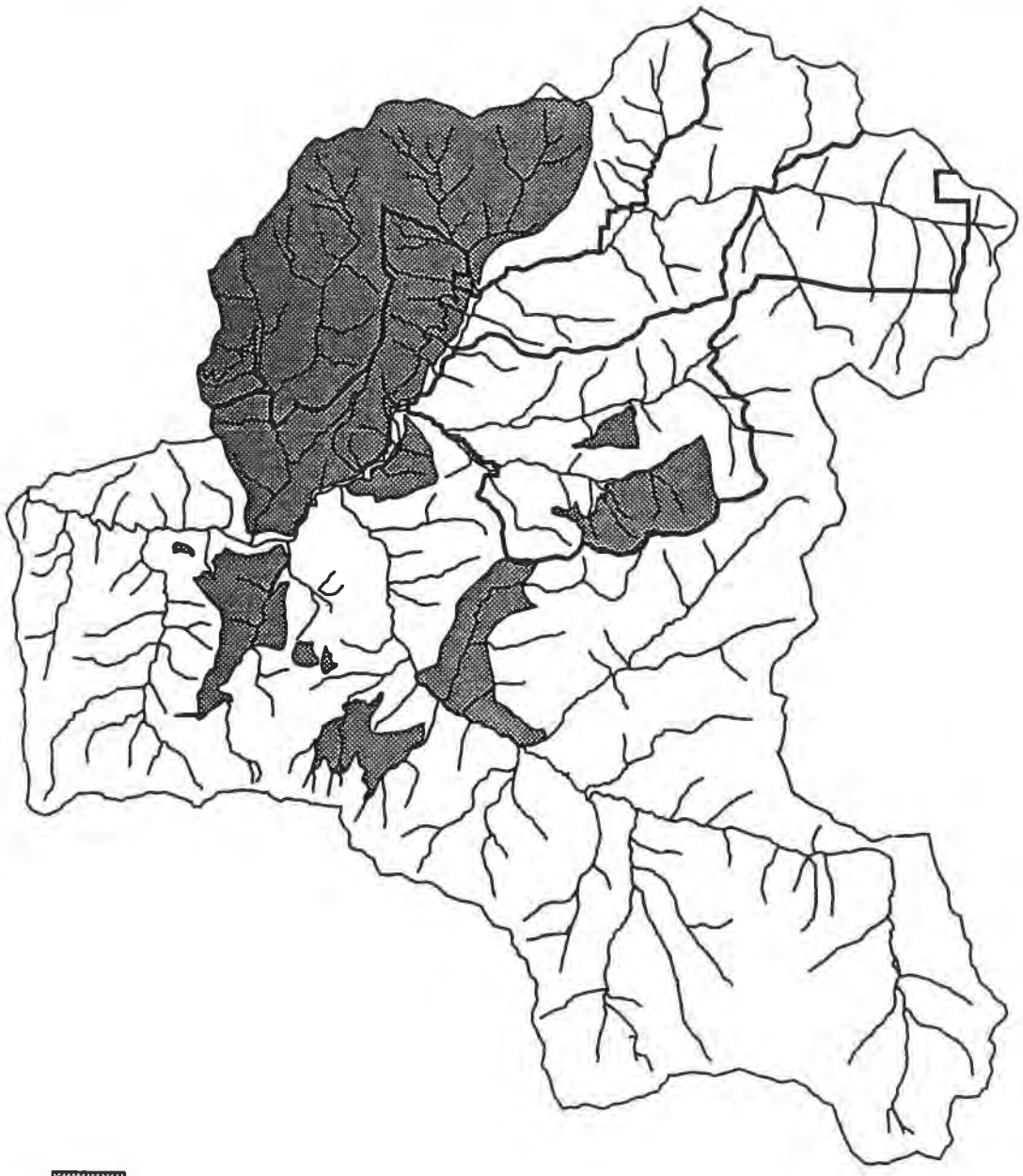
Dense True Fir Stands

Dense Douglas Fir/
Mixed Conifer Stands

River/Stream

0 3 Miles

Upper South Fork Watershed
Disease & Insect Mortality Areas



Concentrations of Disease & Insect Mortality

Late Successional Reserve Boundary

River/Stream

0 *3 Miles*

APPENDIX H

PLANT SPECIES TRADITIONALLY COLLECTED BY NATIVE AMERICANS

The following plant species have been traditionally collected by the native American community and are found within this watershed.

LATIN	COMMON
Achillea lanulosa	Mountain yarrow
Adiantum pedatum aleuticum	Five-finger fern
Agoseris sp. herbaceous longevity unknown (*aurantica*)	Dandelion
Allium bolanderi	Wild Onion
Apocynum androsaemifolium	Dogbane
Asarum caudatum	Long-tail wild ginger
Boykinia major (elata)	Mountain Boykinia
Brodiaea sp. herbaceous perennial	Brodiaea
Castilleja miniata	Indian paint brush
Chimaphila umbellata occidentalis	Prince's pine
Datisca glomerata	Wild horse radish
Darmera peltata	Indian rhubarb
Delphinium sp. kind unknown, *longevity unknown (decorum)*	Coast Larkspur
Dichelostemma ida-maia	Firecracker flower
Equisetum sp. herbaceous perennial	Rough horsetail
Eriogonum sp. kind unknown, *longevity unknown (lahfolium)*	Wild Buckwheat
Fragaria californica	Wood strawberry
Galium triflorum	Fragrant bedstraw
Iris sp. herbaceous perennial (macrosyphoa & purdyi)	Iris
Lathyrus lanswertii tracii	Nevada Pea
Lilium pardalinum	Leopard lily
Lomatium sp. kind unknown, *perennial (californicum)*	Wild celery
Lupinus sp. semiwoody herb	Perennial lupine
Monardella odoratissima	Mountain monardella
Montia perfoliata (sibireca)	Miners lettuce
Petasites palmatus	Sweet coltsfoot
Perideridia sp. herbaceous perennial (gairdneri)	Yampah
Polystichum munitum	Sword fern
Pteridium aquilinum lanuginosum	Bracken fern
Pyrola asarifolia bracteata	Wintergreen
Pyrola picta	White-vein shinleaf
Sanicula bipinnatifida	Purple sanicle
Satureja douglasii	Yerba buena
Silene campanulata	Catch Fly
Smilacina racemosa amplexicaulis	Fat solomon
Triochostema sp. herbaceous annual or biennial (lanceolatum)	Vinegar weed

LATIN	COMMON
Trifolium sp. kind unknown, *longevity unknown (pratense)*	Red clover
Veratrum californicum	Western false hellebore
Xerophyllum tenax	Bear-grass
Bromum mollis	Soft chess
Elymus glaucus	Blue wild rye
Juncus effusus exiguus (ensifolius var. montanius)	Bull rush
Amelanchier pallida	Western serviceberry
Arctostaphylos nevadensis	Pinemat manzanita
Arctostaphylos patula	Greenleaf manzanita
Berberis aquifolium	Oregon grape
Ceanothus cuneatus	Wedgeleaf ceanothus
Ceanothus integerrimus	Deerbrush
Ceanothus velutinus	Tobacco brush, snowbrush
Chrysothamnus nauseosus	Rubber rabbitbrush
Corylus cornuta californica	California hazelnut
Cornus stolonifera	American dogwood
Holodiscus discolor	Ocean spray
Paxistima myrsinites	Oregon boxwood
Philadelphus lewisii	Mock orange
Ribes roezlii	Sierra gooseberry
Rubus leucodermis	Western raspberry
Rubus parviflorus	Western thimbleberry
Salix sp. woody shrub (laevigata, hindsiana, scouleriana, coulteri)	Willow
Toxicodendron diversilobum	Poison-oak
Abies concolor	White fir
Acer macrophyllum	Bigleaf maple
Alnum rhombifolia	White alder
Arbutus menziesii	Madrone
Castanopsis chrysophylla	Giant chinquapin
Calocedrus decurrens	Incense-cedar
Pinus attenuata	Knobcone pine
Pinus lambertiana	Sugar pine
Pinus ponderosa	Ponderosa pine
Pseudotsuga mensiesii	Douglas-fir
Quercus chrysolepis	Canyon live oak
Quercus garryana	Oregon oak, garry oak
Quercus kelloggii	California black oak
Taxus brevifolia	Pacific yew
Cornus nuttallii	Pacific dogwood
Sambucus caerulea	Mountain blue elderberry

APPENDIX I

FIRE INTERACTIONS WITH WATERSHED ELEMENTS

TRUE FIR

True fir stands are very susceptible to wildfire, especially at early stages of growth. Sapling and pole-sized fir have thin bark that provides little insulation for the cambium, and shallow roots which are susceptible to soil heating.

The primary fire carrier is ground litter usually under three inches in diameter. This fuel composition produces low to moderate fire intensities resulting in high levels of mortality in smaller diameter trees. As the ground fuels dry in mid to late summer the threat of a stand replacing fire event increases.

Larger trees are more fire resistant due to the insulation factor of a thicker layer of bark. Medium to large true firs (4G; 25" and greater dbh) are susceptible to high levels of mortality during high intensity fires.

Heavy loading of dead and down fuels and increasing depth of the duff layer creates potential for stand replacing fire events. Low to moderate intensity fires tend to have low rates of spread with minimal stand damaging impact.

Occasional torching of fir regeneration and high fire intensity in heavy fuel accumulations will occur. The results will be patch openings and stringers of high levels of mortality creating the environment for younger age classes to get established.

Because of its shade tolerance, true fir is slow to self-prune lower branches. These low-growing branches provide a fuel ladder to the upper crown and creates an environment for stand replacing crown fire.

True fir stands need low intensity fire events to reduce fuel and duff accumulations and to reduce ladder fuel development. Factors which influence intensity and rate of spread include elevation, aspect, time of year, vegetation composition; structure and condition, and ground fuel accumulation and distribution.

True fir communities exist primarily above 5,000 feet elevation. High fuel moistures in early spring and early summer lessen probability of high intensity fire. As fuels and vegetation lose fuel moisture throughout the summer, risk of stand replacing fire events increase.

MIXED CONIFER

Mixed conifer community consist of many overstocked stands. The overstocking, understory development, tree mortality and increasing fuels buildup have put stands at risk.

Mixed conifer stands are very susceptible to high fire intensities, crown scorch and crown fire events. Exclusion of fire has increased fuel loading and understory ladder fuel development.

Low to moderate intensity fires reduce fuels buildup and thins out smaller less resistant shade tolerant species reducing ladder fuel component.

The primary fire carrier is ground fuels, but, during mid to late summer period as fuel moistures and burning conditions become more severe, potential for fire to be carried through the crown increases. South aspects and slopes of 60% or greater will usually exhibit active stand replacing runs to the ridge top.

Down slope backing fire exhibit lower burning intensities and usually occur at night or under inversions. Day time solar heating and decreases in relative humidities accelerates fire behavior causing torching and crown fire activity.

Stand composition and structure has changed drastically with the suppression of natural fire and Native American burning practices. Stands tend to be overstocked and fuel continuity and loading on the increase.

The most productive sites show the greatest response to fire and fire exclusion in relation to composition, structure and function. Productive sites rapidly reestablish following a fire disturbance.

PATCHES

Barren Areas - Barren areas are often areas of high species diversity, including shrubs and herbaceous vegetation. Vegetation is susceptible to fire occurrence although fire very seldom burns through barren areas due to lack of fuel continuity.

When fire does occur, it is low intensity, carried though dry fine fuels and is generally spotty. Bar-

rens provide a break in the continuity of fuels and can slow or stop a fire spread.

Water - Ability to act as natural barrier depends upon stream size, shape of the stream banks and adjacent land, and fire intensity. Ineffective as a natural barrier under high intensity fire conditions. Generally most effective in a backing fire situation where lower fire intensities can be expected. Lakes and typical surrounding vegetation also provide opportunities as a natural barrier to fire spread.

Meadows - In natural meadow communities and developed fields, the drier
community types are more susceptible to wildfire effects and a shift in species composition, especially in fall, (cured fuels). Fire in meadow communities would tend to be low intensity surface fires with a rapid rate of spread, representing a low to moderate hazard. Fire exclusion has caused an increase in alders and influences encroachment of meadows by trees.

When grass is a primary component in the vegetative structure of a site and is combined with downed and standing fuels, very high fire intensities can occur. Significant fire hazard is present within the areas of the 1987 fires that have converted or enhanced grass component. Opportunity for rapid rates of spread into other vegetative patches can greatly change fires effects within these patches.

Montane shrub communities - These communities are susceptible to high intensity fires and can be a stand replacing event. Grass and fine fuel component are usually the fire carrier, affecting rate of spread and fire intensities. Fire intensities are also greatly affected by aspect, slope, both live and dead fuel moistures, wind and vegetative condition, (live to dead ratio).

High intensity fires in this vegetation generally occur in the mid to late summer months, with increased occurrence on south facing, hot dry slopes. Low and moderate intensity fires reduce ground fuel buildup and scattered patches of vegetation within the patch, providing opportunity for new plant growth.

RIPARIAN AREAS

Riparian Shrubs - Generally vegetation has high live fuel and ground moisture creating conditions for low intensity slow moving fire, if occurring under dry summer conditions. If exposed to very high fire intensities and severe burning conditions, vegetation can be heavily damaged. Wet sedge community not as likely effected.

Riparian Trees - Lower elevation riparian areas generally resistant to fire. Mesic site. In low intensity fire can serve as a barrier. Where high intensity fire activity took place during the 1987 fires, survival was minimal.

Exclusion of low intensity fires from riparian zones has created buildup of fuels and ground litter that can create conditions of higher fire intensities and mortality levels in a fire event.

Noncommercial forest - Typically on poorer sites associated with live oak and sparse conifer stands. Grass and brush is the fire carrier in this vegetative component. Fire behavior is highly variable due to a diverse vegetation composition. Live oak stands can vary from a dense to a sparse structured stand. Continuity of the fuels and vegetation in combination with aspect, elevation, live and dead fuel moistures, slope and fire weather determine fire intensity levels and mortality. While individual live oak are easily damaged by fire, stands are generally fire tolerant at low fire intensities but can survive moderate fire events.

Scattered (open) Tree Stands - Usually very little fuels buildup with wide spacing between trees makes these stand less susceptible to fire events. The fire carriers are grass and brush types. Fire behavior would be a fast, low intensity fire. Fire effect would result in thinning of smaller trees and reduction of understory vegetation. When stand is part of a larger stand (i.e., pocket of windfall or area of high decadence and mortality) there is an increased probability of stand mortality.

PLANTATIONS

0-20 Years Old, Plantations in this age class are highly susceptible to loss in a fire event. Grass component would be the dominate fire carrier. Plantations with a mix of brush and hardwoods tend to have higher survival rate. The break in fuel continuity and mix of vegetation and associated live fuel moistures tend to lower fire intensities and rate of spread.

Precommercial thinning at a young stand age reduces fuel loading and reduces future hazard. Stand can be highly affected by adjacent stand

types. Moderate to high intensity fires burning from adjacent stand can, and usually will, increase levels of mortality within this stand structure.

20 + Years Old, Plantations that have been thinned and untreated are at a high risk of loss. The increased fuel loading provides surface fuels available to the fire and can exacerbate it's behavior. Spacing and continuity of stand creates conditions that puts the stand in high risk of loss. Fire is likely to burn through the crowns with light winds causing severe mortality within the stand.

APPENDIX J

BIOLOGICAL CONSIDERATIONS FOR RIPARIAN RESERVE WIDTHS

INTRODUCTION

Several changes were made to the preferred alternative between the Draft and Final *SEIS* (for the *President's Plan*). Among those changes was the incorporation of Riparian Reserve Scenario 1. This resulted in an increase of Riparian Reserve buffer widths for all intermittent streams outside of Tier 1 Key Watersheds. The prescribed Riparian Reserve width for intermittent streams may be adjusted in decisions following watershed analysis. As stated in the *ROD*, "Post-watershed analysis Riparian Reserve boundaries for permanently-flowing streams should approximate the boundaries prescribed in these standards and guidelines. However, post-watershed analysis Riparian Reserve boundaries for intermittent streams may be different from the existing boundaries."

Watershed analysis will "identify critical hillslope, riparian, and channel processes that must be evaluated in order to delineate Riparian Reserves that assure protection of riparian and aquatic functions." In addition to geologic and hydrologic considerations, the analysis must also take into account all species that were intended to be benefited by the prescribed Riparian Reserve widths. "Those species include fish, mollusks, amphibians, lichens, fungi, bryophytes, vascular plants, American marten, red tree voles, bats, marbled murrelets and northern spotted owls. The specific issue for spotted owls is retention of adequate habitat conditions for dispersal."

In this discussion, the species specifically intended to benefit by the prescribed Riparian Reserve widths are listed (See Appendix J2 of the *FSEIS*). Evaluation criteria, to be used at the project level if changes to the widths are considered, were developed for some of the species. Those criteria, along with a summary of supporting biological information for each of those animal species is presented.

BACKGROUND ON PRESCRIBED INTERIM RIPARIAN RESERVE WIDTHS

The *FEMAT* report includes a detailed discussion regarding riparian processes as a function of distance from stream channels. There are several riparian process related to vegetation which are important in affecting the habitat conditions for riparian associated species. They include large wood delivery, organic matter input, shade, microclimate, and water quality. Although site specific conditions vary tremendously, in general, the effectiveness of these processes increases with increased buffer widths. In some cases, that effectiveness is directly related to tree height. For example, the probability that a falling tree will enter the stream is a function of slope distance from the channel in relation to tree height. The relationship between the above listed riparian processes and the distance from stream channels or water bodies were included in the determination of the interim riparian reserve widths prescribed by *FEMAT*.

SPECIES INTENDED TO BE BENEFITED BY PRESCRIBED INTERIM RIPARIAN RESERVE WIDTHS

Based on additional species analysis which occurred between the Draft and Final *SEIS* (see Appendix J2 of the *FSEIS* on the *Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl*), the following species, which are known to or potentially occur within the Upper South Fork Salmon River watershed, were specified as benefiting from the prescribed Riparian Reserve widths:

AMPHIBIANS
Black salamander
Southern torrent salamander
Tailed frog

BIRDS
Common merganser
Northern spotted owl *
Tailed frog

BATS
Fringed myotis
Hoary bat
Long-eared myotis
Long-legged myotis
Pallid bat
Silver-haired bat

OTHER MAMMALS
Fisher
Marten

FISH

Coho salmon
Fall chinook salmon
Resident Cutthroat Trout/Rainbow Trout
Spring Chinook/Summer Steelhead Trout
Winter Steelheat Trout

MOLLUSKS
Fluminicola n. sp. 1
Fluminicola n. sp. 3

BRYOPHYTES
Antitrichia curtipendula
Douinia ovata

FUNGI **
Rare chanterelles
Polyozellus multiplex
Rare Gilled Mushrooms
Otidea leporina
Otidea onotica
Otidea smithii
Rare Cup Fungi
Helvella compressa
Helvella crassitunicata
Helvella elastica
Helvella maculata
Jelly Mushroom
Phlogoitis helvelloides
Mushroom Lichen
Phytoconis ericetorum
Moss Dwelling Mushrooms
Cyphellostereum leave
Galerina atkinsoniana
Galerina cerina
Galerina heterocystis
Galerina sphagnicola
Galerina vittaeformis
Rickenella setipes

LICHENS **
Nitrogen-fixing Lichens
Lobaria oregana
Lobaria pulmonaria
Lobaria scrobiculata
Nephroma bellum
Hephroma helveticum
Nephroma laevigatum
Nephroma parile
Nephroma resupinatum
Pannaria leucostictoides
Pannaria mediterranea
Pannaria saubinetii
Peltigeria collina
Peltigera neckeri
Peltigera pacifica
Pseudocyphellaria anomala
Pseudocyphellaria anthraspis
Pseudocyphellaria croacata
Sticta beauvoisii
Sticta fuliginosa
Sticta limbata
Riparian Lichens
Ramalina thrausta
Usnea longissima
Aquatic Lichens
Dermatocarpon luridum
Hudrothyria venosa

VASCULAR PLANTS **
Botrychium minganese

* The specific issue for Northern spotted owls in relation to Riparian Reserve widths is retention of adequate habitat conditions for dispersal.

** List is possibly incomplete at this time (8/30); will consult forest botanist.

RECOMMENDATIONS FOR RIPARIAN RESERVE WIDTHS
We recommend that the prescribed interim widths be retained. Numerous species were intended to benefit by the Riparian Reserves, although information regarding the ecological requirements of most of those species is severely lacking. More information may be available in the future as the Forest begins to implement surveys for late-successional and old-growth forest related species.

Evaluation criteria were developed for some of the species intended to be benefited by the prescribed Riparian Reserve widths. However, any

proposed changes to the prescribed Riparian Reserve widths will have to take into account all of the species that were intended to benefit by them. As evaluation criteria are developed for the remaining species, they will be added to this document.

AMPHIBIANS

Background Information

BLACK SALAMANDER - This species potentially occurs within the Upper South Fork watershed. Its habitat requirements and distribution are not well known. It is associated with moist conditions, under rocks, surface litter, and coarse woody debris. Headwater streams may be important refugia, as well as riparian habitat along intermittent streams.

SOUTHERN TORRENT SALAMANDER - This species potentially occurs within the Upper South Fork watershed. Its distribution is not well known. It occurs in or near cold, clear streams and seeps. It is sensitive to sedimentation.

TAILED FROG - This species has been located within the Upper South Fork watershed. It is associated with fast-flowing permanent streams and headwaters within forested areas, up to timberline. It is very sensitive to water temperature and water quality.

BATS

FRINGED MYOTIS - The Upper South Fork Salmon watershed is within the known range of this species. They forage at or within the forest canopy, primarily in riparian habitats. Snags and large trees appear to be important for roost and hibernation sites.

HOARY BAT - The Upper South Fork Salmon watershed is within the known range of this species. They forage on large moths that are pursued at forest edges in riparian zones and roost only in large, live trees. They are a migratory species and occur within the watershed only during the summer.

LONG-EARED MYOTIS - The Upper South Fork Salmon watershed is within the known range of this species. They glean and pursue moths and beetles at the edges of mature forests, especially within riparian zones. Small water sources, such as ponds in clearings appear to be important. Natural roost sites include snags and trees.

PALLID BAT - This species potentially occurs within the Upper South Fork Salmon watershed. They forage widely along riparian zones by pursuing arthropods low to the ground. Natural day and maternity roosts and hibernation sites include snags and broken-top trees.

SILVER-HAIRED BAT - The Upper South Fork Salmon watershed is within the known range of this species. They pursue prey over dense, mature forests near streams and ponds. Natural day and maternity roots include large snags and decadent trees. They are known to follow stream corridors when travelling from roosts to foraging sites.

OTHER MAMMALS

MARTEN - Marten are known to occur within the Upper South Fork Salmon watershed. The American marten is among the better known mammalian carnivores, but relatively little is known about their habitat relationships and population status in the Pacific Northwest. Key habitat features for marten include intact forest along riparian zones. Martens preferentially select resting sites in large diameter trees near streams. Riparian areas are important for foraging and travelling. Marten are benefited by Riparian Reserve buffer widths due to the habitat they provide in addition to LSRs.

FISHER - Fisher are known to occur within the Upper South Fork Salmon watershed. Little is known about the habitat relationships of fisher in the Pacific Northwest. They are not as closely tied to riparian areas as marten, but they are benefited by Riparian Reserved buffer widths due to the habitat they provide in addition to LSRs.

BIRDS

NORTHERN SPOTTED OWL - Northern spotted owls are known to occur within the Upper South Fork Salmon watershed. The specific issue related to Riparian Reserve widths is retention of adequate dispersal habitat.

RIPARIAN RESERVE WIDTH EVALUATION CRITERIA

Amphibians

Survey the area for the occurrence of riparian associated salamanders, using an approved protocol. If black salamander, southern torrent salamander, or tailed frog are located, then maintain the prescribed Riparian Reserve width along the entire stream reach, including the intermittent portion (to be determined in the field). If no animals

are located, then the width may may be reduced. The point to which they may be reduced will depend upon other species criteria and the objectives of the Aquatic Conservation Strategy.

Bats

The important habitat components for bats (i.e., for foraging, roosting and hibernating) should be considered in any proposal to alter Riparian Reserve widths. Those important habitat components include forested habitat adjacent to water, large snags, large decadent trees.

Other Mammals, Northern Spotted Owl

If the prescribed Riparian Reserve buffer does not provide, or does not have the potential to provide forested habitat for fisher, marten, or northern spotted owl, then the width may be reduced. The point to which they may be reduced will depend upon other species criteria and the objectives of the Aquatic Conservation Strategy.

APPENDIX K

TRANSPORTATION SYSTEM INTERACTIONS

Roads have and will play an important role within the watershed. Roads allow humans to access many areas of the watershed for many different reasons. Even though most roads were constructed for the purpose to manage the timber resource, benefit to other uses exist, such as; private landowners, permittee's, firewood collection, grazing, and access for the various recreational opportunities that exist, fire management, and other administrative use.

How roads interact with other resources depends on a number of attributes:
1- Design Criteria Used for Construction.
2- Soil types.
3- Road Gradient.
4- Drainage Structures and their Location.
6- Road Density.
7- Open Road Density.
8- Road Maintenance or (lack of), including winter maintenance.
9- Road Management for Travel and Access.
10- Road Surface Type.
11- Amount of Area Disturbed.
12- Road location (Stable Location or not).
13- Wet Weather Use both Private and Administrative.
14- Amount of Traffic.
15- Road Widths.
16- Unauthorized Use.

ATTRIBUTES AND DEFINITIONS USED FOR EACH RESOURCE

Wildlife

DISTURBANCE --Deals with disturbance in terms of proximity to active nest sites for threatened, endangered, or sensitive species. Also deals with harassment to some of the critical games species.
FRAGMENTATION --Deals with fragmentation of habitats for particular species.
ROAD DENSITY --Deals with areas of high road density. Can be closely correlated with the harassment issue and fragmentation of habitats.

Fire

CRITICAL ROADS --Roads that are critical for fire access, control points, and those that provide a fuel break situation.
IMPORTANT ROADS -- Roads that are important for fire access and those that are needed for strategic type project work (i.e., prescribed burning, fuels clean-up, etc.)

Visuals
Visuals is being analyzed as roads or portions of roads that may not currently meet the established VQO for the area. Roads addressed here are designated as needed additional field verification for actual vantage points and locations in need of visual restoration.

Watershed
CHRONIC EROSION --Identifies roads or portions of roads that have or may have some sedimentation problems.
LANDSLIDE RISK --Roads that have locations that are within inner gorges, toe zones (active and dormant landslides), and active landslides --these are the highest risk situations. Other roads with a lower risk situation, those on dormant landslides, will be highlighted as well.
STREAM FLOW CAPACITY OF CULVERTS --Will analyze current situation of culverts and their ability to carry water and sediment that may be produced from a 100 year storm event, as per the *President's Plan.*
COMPACTED AREA DENSITY --Will highlight areas that have a high density of roads. This will be analyzed for reducing the likelihood of peak flow problems. Also a concern is where landings are large and abundant, and where there are wide or parallel road systems.

Law Enforcement
LAW ENFORCEMENT PROBLEMS --Will highlight which roads or system of road currently encounter law enforcement problems.
CURRENT USE --Roads that need to have current use analyzed. It may not necessarily be an enforcement problem, but needs to be explored for whether current use needs to be encouraged or restrictions need to be implemented. The use that generally needs to be analyzed is ATV use. Other uses that have the potential to encourage or discourage use include snowmobiles, equestrian, mountain bikes, and four-wheel-drive vehicles
LAW ENFORCEMENT NEEDS --Will identify roads or road system law enforcement needs for access and personal safety.

Timber
MATRIX LANDS --Areas where access is needed for timber management opportunities.
OTHER LANDS --Areas where access may be needed to provide vegetative manipulation for other resource concerns.

Recreation
TRAILHEAD ACCESS --Roads that currently serve trailheads access into the Trinity Alps or Russian Wilderness areas.
GENERAL RECREATION USE --Roads that are heavily used for dispersed recreation (i.e., hunting, sightseeing, woodcutting, fishing, etc.).

Fisheries
STREAM PROXIMITY --Roads that are located very close to streams. This issue is very closely related to the chronic sedimentation issue for watershed.

Lands & Minerals
ACTIVE CLAIMS --Roads utilized for access to active mining claims.
PRIVATE LAND --Roads needed to access private property or have special-use easements attached to them.

Road Management
NOTES --Roads below maintenance level 3 normally do not receive brush treatment along roads.
FINAL TRANSPORTATION PLAN --A realistic look at maintenance wants vs. dollars expected needs to occur. Public input needs to be included in the decision making process.

UPPER SOUTH FORK WATERSHED ANALYSIS AREA
APPENDIX K - TRANSPORTATION SYSTEM INTERACTIONS

TRANSPORTATION AREA	DISCIPLINE	GENERAL ISSUES & CONCERNS	SPECIFIC ROAD ISSUES & CONCERNS	REMARKS & RECOMMENDATIONS FOR DESIRED CONDITION
SIXMILE	Wildlife	Disturbance	Spotted Owl Center/Deer Winter Range 39N13 Current Closure Period Nov 1 - Apr 15.	Manage Access for Spotted Owl and Deer Winter Range Managment.
		Open Road Density & Road Fragmentation	39N14D & 39N14C.	Reduce Open Road Density & Recommend Some Form of Decommission of Roads 39N14D & 39N14C.
			Goshawk on Private Sixmile Rd.	Maintain Access for Goshawk Management.
		Designated Late-Successional Reserve Area.		Manage Access to Protect and Enhance Conditions which serve Habitat for Late-Successional and Old Growth Forest Related Species.
	Fire	Fire Management Access(Key Locations for Strategic Fire Management).	Critical Roads are 39N14 & 39N58. Important Roads are 39N13 & 39N14A.	Critical & Important Roads Need to be Maintained and Accessible During Fire Management Season.
		Vegetation Encroachment on Roads(Loss of Fuel Breaks).	Any Critical or Important Roads that Serve as Fuel Breaks for Fire Management Access Needs.	Develop an Active Program to Manage Vegetation Encroachment.
	Cultural	No Issues Related to Roads.		Further Surveys Needed.
	Visuals	Road Segments that do not Meet Current Visual Objectives.	Segments of 39N13, 39N14C, 39N14D, 39N13A, 39N42 & some unnamed Spurs.	Need Additional Verification for Actual Vantage Points & Location of Visual Restoration.
	Watershed	Erosion Related Sediment.	Chronic Erosion.	Low Priority in Sixmile.
		Landslide Sedimentation.	Road Locations within Inner Gorges & Toe of Active and Dormant Landslides.	Evaluate Risk and Take Necessary Action if Needed to Minimize Risk.
		Storm Flow Capacity of Culverts (cumulative effects)	39N13, 39N14, & 39N14D have Culverts that do not meet the 100 Year Storm Flow.	Evaluate Culverts and their Ability to Handle 100 Year Storm Flow. Correct Deficiencies if Needed.
		Compacted Area Density(Peak Flow Runoff).	Landings & Excessive Road Width & Parallel Roads.	Minimize Compacted Areas to Reduce Peak Flow Runoff.

TRANSPORTATION AREA	DISCIPLINE	GENERAL ISSUES & CONCERNS	SPECIFIC ROAD ISSUES & CONCERNS	REMARKS & RECOMMENDATIONS FOR DESIRED CONDITION
SIXMILE (Continued)	Law Enforcement.	Current Uses	OHV & ATV Use on Fuel Break between 39N14A & 39N42A, and 39N14B.	Need to Determine if Current Uses should be Encouraged or Restricted. Other Uses that should be Analyzed include Snowmobile, Equestrian, Mt. Bike, and 4-Wheel Drives.
			Access to Eddy Gulch L.O. for Siskiyou Telephone, California Highway Patrol, California Dept Fish & Game, & Forest Service.	Continue to Provide Access to Manage Radio Equipment.
	Timber	Management of Plantations & Vegetation Manipulation for Other Resource Concerns.	All Roads	Maintain Roads on System for Access.
	Recreation	Trailhead & Recreation Site	Roads to Timber Camp Trailhead. Roads to Eddy Gulch L.O.(Vista Area).	Continued Seasonal Access Desired.
		General Uses,(Hunting, Sight Seeing, Woodcutting, Fishing, etc).	39N14 Major Access for Christmas Tree Cutting Areas.	Continued Seasonal Access for Christmass Tree Cutting. Analyze Transportation System to Provide Adequate Access for all Recreational Uses.
	Fisheries	Sedimentation from Roads.	Location of Roads near Streams.	Minimize Sedimentation from Roads. Identify Problem Areas, and Prioritize to Correct or Mitigate Adverse Impacts.
			Road 39N14B, Mining Access	Analyze Relationship of Road to Sixmile Creek (Riparian Reserve).
	Lands & Minerals	Trespass on Private Property.	No Easement on Cox Property Road 39N13, 39N14.	Obtain Easement.
		Access to Mining Claim.	Road 39N14B.	Provide Backhoe Access.
	Range	No Concerns in Sixmile.		
	Road Management.	Roads that are not needed for Management of the National Forest.	Any Temporary or System Roads	Analyze all Roads and Decommission those Roads no Longer Needed.
		Traffic Management for Travel and Access.	Use Restrictions to Minimize Resource-Use Conflicts on all Roads.	Identify which Roads shall be Permanently or Seasonally Closed.

TRANSPORTATION AREA	DISCIPLINE	GENERAL ISSUES & CONCERNS	SPECIFIC ROAD ISSUES & CONCERNS	REMARKS & RECOMMENDATIONS FOR DESIRED CONDITION
SIXMILE (Continued)	Road Management (Continued)	Reduce Road Maintenance.	All System Roads.	Assign Appropriate Level of Maintenance to all Roads. Identify & Correct Problems that Contribute to High Cost.
				Reduce Existing, and Non System Road Mileages
		Road Signing (all roads)		Install and Maintain Signs that Corresponds with the Forest Visitor Map, and Provides for Adequate Direction and Users Safety.
SHADOW CREEK	Wildlife.	Deer Disturbance Deer Winter Range.	Existing Road Closure(period from November 30 to May 30).	Continue Road Closure Policy
		Open Road Density & Road Fragmentation.	39N74, 39N75, 39N75A, & 37N20B. All Temp Roads.	Reduce Open Road Density, & Recommend Some Form of Decommission. Assess Temp Roads for Road Density and Fragmentation.
	Fire.	Fire Management Access(Key Locations for Strategic Fire Management).	Critical Roads are 39N20, 39N51 39N51A, 39N73, & 39N75. 39N58 Access to Eddy Gulch LO.	Critical & Important Roads Need to be Maintained and Accessible During Fire Management Season.
		Vegetation Encroachment on Roads(Loss of Fuel Breaks).	Critical and Important Roads that Serve as Fuel Breaks for Fire Management Access Needs.	Develop an Active Program to Manage Vegetation Encroachment.
	Cultural.	No Issues Related to Roads.		Further Surveys Needed.
	Visuals.	Road Segments that do not Meet Current Visual Objectives.	Segments of 38N20B, 39N22G, 39N73A and all of 39N51.	Need Additional Verification for Actual Vantage Points & Location of Visual Restoration.
	Watershed.	Landslide Risk (sedimentation).	Road Locations within Inner Gorges(Roads 39N20, 39N26, 39N73, & 39N75).	Stabilize Cutbanks, Fillslopes, Drainages & Unstable Fills to Minimize Risk if Needed.
		Storm Flow Capacity of Culverts(cumulative effects).	Five Culverts on 39N20 that do Meet 100 Year Storm Flow.	Evaluate Culverts and their Ability to Handle 100 Year Storm Flow. Correct Deficiencies if Needed.
		Compacted Area Density(Peak Flow Runoff).	Landings & Excessive Road Width & Parallel Roads.	Minimize Compacted Areas to Reduce Peak Flow Runoff.

TRANSPORTATION AREA	DISCIPLINE	GENERAL ISSUES & CONCERNS	SPECIFIC ROAD ISSUES & CONCERNS	REMARKS & RECOMMENDATIONS FOR DESIRED CONDITION
SHADOW CREEK (Continued)	Law Enforcement.	Access Needed.	39N20, 39N51, 39N51A, & 39N73.	Need for Access and Personal Safety.
	Timber.	Management of Plantations & Vegetation Manipulation for Other Resources.	High Priority on Roads 39N20 & 39N51.	Maintain All System Roads for Timber Management Activities. Temporary Roads Not Critical.
	Recreation.	Access for Hunting(Deer, Bear Grouse, etc). Other Uses Include Wood Cutting, Mushrooms, & Sight Seeing.	None	Analyze Transportation System to Provide Adequate Access for all Recreational Uses.
	Fisheries.	Sedimentation from Roads. (Location of Roads and Landings Near Streams).	39N73 (Road Location within Inner Gorge, West Fork Shadow Creek).	Minimize Sedimentation from Roads. Identify Problem Areas, and Prioritize to Correct or Mitigate Adverse Impacts.
	Lands & Minerals.	Access to Private Land.	39N26.	Continue Providing Access to Private Land. Sam George uses the Road to Access to Maintain and Operate Ditch.
	Range.	No Concerns in Shadow Creek.		
	Road Management.	Traffic Management for Travel Access.	Use Restrictions to Minimize Resource-Use Conflicts on all Roads	Identify which Roads shall be Permanently or Seasonally Closed.
		Reduce Road Maintenance.	All System and Non-System Roads	Assign Appropriate Level of Maintenance to all Roads. Identify & Correct Problems that Contribute to High Cost.
				Reduce Existing system and Non System Road Mileage.
		Road Signing(all roads).		Install & Maintain Signs that Corresponds with the Forest Visitor Map, and Provides for Adequate Direction and Users Safety.
CRAWFORD CREEK	Wildlife.	Disturbance.	38N17 & 39N45 Owl Activity Center.	Manage Access for Spotted Owl Management.

TRANSPORTATION AREA	DISCIPLINE	GENERAL ISSUES & CONCERNS	SPECIFIC ROAD ISSUES & CONCERNS	REMARKS & RECOMMENDATIONS FOR DESIRED CONDITION
CRAWFORD CREEK (Continued)	Wildlife (Continued)		Jeep Road(Dry Gulch), Deer Harassment(Winter Range).	Close or Decommission Road.
		Open Road Density & Fragmentation.	39N43, 39N43A, 39N45, & 39N43A. Existing Seasonal Closures on Roads 38N17, 39N56 including all off roads from November to April.	Reduce Open Road Density. Recommend Some Form of Decommission to Reduce Habitat Fragmentation.
	Botany	Sensitive Plants.	39N51A & Jeep Road(Dry Gulch).	Minimize Disturbance to Plants. Close or Decommission Road.
	Fire.	Fire Management Access (Key Locations for Strategic Fire Management).	Critical Roads: 38N17 and Fuel Break, 39N23, 39N56, & 39N47 to Fuel Break. Important Road: 39N45.	Critical & Important Roads Need to be Maintained and Accessible During Fire Management Season.
		Vegetation Encroachment on Roads(Loss of Fuel Breaks).	Critical and Important Roads that Serve as Fuel Breaks for Fire Management.	Develop an Active Program to Manage Vegetation Encroachment.
	Cultural.	No Issues Related to Roads.		Further Surveys Needed.
	Visuals.	Road Segments that do not Meet Current Visual Objectives.	Segments of 39N04A, 39N43, 39N43A, 39N45A, Temp1 & Temp2 from Distant View Points.	Need Additional Verification for Actual Vantage Points. Identify Problem Areas & Prioritize to Correct or Mitigate Adverse Impacts.
Crawford Creek (continued)	Watershed.	Erosion & Landslide Erosion Related Sediment.	Road Location within Un-consolidated Material in Inner Gorges on 39N23, 39N56, 39N43, 39N43A. Chronic Erosion Source. 39N45: Four(4) Crossings within Inner Gorge & Active Slide 1st Section From Junction. Temp Road off 38N17 Located within Inner Gorge.	Identify Problem Areas & Prioritize to Correct or Mitigate Adverse Impacts.
		Storm Flow Capacity of Culverts(cumulative impacts).	Three(3) Culverts on 39N23, One(1) Culvert on 39N45, & Three(3) Culverts on 39N56 That do not Meet 100 Year Storm Flow	Evaluate Culverts and their Ability to Handle 100 Year Storm Flow. Correct Deficiencies if Needed.
		Compacted Area Density(Peak Flow Runoff).	Landings & Excessive Road Width & Parallel Roads.	Minimize Compacted Area to Reduce Peak Flow Runoff.

TRANSPORTATION AREA	DISCIPLINE	GENERAL ISSUES & CONCERNS	SPECIFIC ROAD ISSUES & CONCERNS	REMARKS & RECOMMENDATIONS FOR DESIRED CONDITION
CRAWFORD CREEK (Continued)	Law Enforcement.	Poaching & Wildlife Harassment.	Area Between Crawford Creek & Shadow Creek.	Minimize Poaching & Wildlife Harassment. Possibly Restrict Road Access.
		Bear Hunting.	39N56.	Local Houndsman Association would like to see Road Remain Open for Hunting Opportunities.
		Access Needed.	Critical Roads 39N23, 39N56, 38N17, 39N14, & 39N04.	Maintain Access For Law Enforcement Activities &
			39N23, 39N04, & 39N14.	Winter Access Route to Eddy Gulch LO to Maintain Radio Equipment.
	Timber.	Management of Plantations & Vegetation Manipulation for Other Resources.	Need Access on all Roads to Manage the Timber Resource.	Maintain Access for Timber Management Activities.
		Tree Mortality High.	All Roads.	Maintain Access to Manage Tree Mortality.
	Recreation.	Dispersed Recreation (Hunting Woodcutting, Sight Seeing, Mountain Bikes, Camping, & Fishing).	Fishing Along 39N23, Crawford Creek. Camping Site at McDowell Camp.	Analyze Transportation System to Provide Adequate Access for all Recreational Uses.
	Fisheries.	Sedimentation from Roads.	39N23 & 39N56 Parallel Crawford Creek for Long Distances & Road Located within the Riparian Zone.	Look for Opportunities to shape or reconstruct road to Reduce or Mitigate Sediment.
		Water Contamination.	Toxic Waste(Surface Runoff, & Ground Water from Dump Site 38N06.	Monitor For Contamination. (Siskiyou County is Monitoring)
			Risk of Spills, 39N23 & 39N56.	Reduce Risk when Possible.
	Lands & Minerals.	Special-Use (Crawford Creek Domestic Water Source), Sediment Concerns.	Sediment From Roads.	Identify Problem Areas & Prioritize to Correct or Mitigate Impacts.
	Range.	No concerns in Crawford Cr.		
	Road Management.	Traffic Management for Travel and Access.	Use Restrictions to Minimize Resource-Use Conflicts on all Roads.	Identify which Roads shall be Permanently or Seasonally Closed.
		Reduce Road Maintenance.	All System and Non-system Roads	Assign Appropriate Level of Maintenance to all Roads. Identify & Correct Problems

TRANSPORTATION AREA	DISCIPLINE	GENERAL ISSUES & CONCERNS	SPECIFIC ROAD ISSUES & CONCERNS	REMARKS & RECOMMENDATIONS FOR DESIRED CONDITION
CRAWFORD CREEK (Continued)	Road Management (Continued)			that Contribute to High Mtce Cost. Reduce Existing system and Non System Road Mileage.
		Road Signing(all roads).		Install and Maintain Signs that Correspond with the Forest Visitor Map, and Provides for Adequate Direction and User Safety.
TAYLOR CREEK	Wildlife.	Disturbance.	Spotted Owl Activity Center Road 38N14A.	Manage Access to Minimize Disturbance.
		Open Road Density & Fragmentation.	Currently Most Roads are Closed from Nov. 1 each year to April 15. 1 each year to April. Road 38N07B is Closed Year Road.	
			38N14, 38N14A, 38N10, 38N07A, 38N10A, 38N20, and 38N79A.	Recommend Year Around Closure to Minimize Disturbance and Reduce Open Road Density.
	Fire.	Fire Management Access(Key Locations for Strategic Fire Management.	Critical Roads are 38N04, 38N07 38N10 to the junction of 38N14, and 38N03.	Critical Roads Need to be Maintained and Accessible Fire Management Season.
		Vegetation Encroachment on Roads(Loss of Fuel Breaks).	Critical Roads that Serve as Fuel Breaks for Fire Access Needs.	Develop an Active Program to Manage Vegetation Encroachment.
	Cultural.	No Issues Related to Roads.		Further Surveys Needed.
	Visuals.	Road Segments that do not Meet Current Visual Objectives.	Segments of 38N08, T16, 38N14, 38N10, 38N10A, 38N19A, and 38N07A from 38N19 to the End.	Need Additional Verification for Actual Vantage Points & Location of Visual Restoration.
	Watershed.	Erosion and Landslide Erosion Related Sediment.	Chronic Surface Erosion on Roads,38N04,38N07, 38N10, 38N14 and 38N14A.	Identify Problem Areas & Prioritize to Correct or Mitigate Adverse Impacts. Recommend Converting Inslope Roads to Outslope and Placing Aggregate.

TRANSPORTATION AREA	DISCIPLINE	GENERAL ISSUES & CONCERNS	SPECIFIC ROAD ISSUES & CONCERNS	REMARKS & RECOMMENDATIONS FOR DESIRED CONDITION
TAYLOR CREEK (Continued)	Watershed (Continued	Erosion and Landslide Erosion Related Sediment (Continued)	Road Location within Inner Gorge. 38N07: Two(2) Crossings. 38N14 and 38N14A: Several Crossings.	
		Storm Flow Capacity of Culverts(cumulative Impacts).	Four(4) Culverts on 38N14, Five(5) Culverts on 38N07, Three(3) Culverts on 38N14, & One(1) Culvert on 38N14A Do Not Meet 100 Year Storm Flow.	Evaluate Culverts an their ability to Handle 100 Year Storm Flow. Correct Deficiencies if Needed.
	Law Enforcement.	Poaching(Bear).	38N04 and 38N07.	Minimize Poaching & Wildlife Harassment. Possible Restrict Road Access.
		Access Needed.	38N04 and 38N07.	Maintain Access for Law Enforcement Activities.
	Timber.	Area is within LSR. Manage of Plantations & Vegetation Manipulation for Other Resources.	Need Access on all Roads to Manage the Timber Resource.	Maintain Access for Timber Management Activities.
		Natural Stands are Dense and Need Thinned.		
	Recreation.	Trailheads(Bark Shanty and Garden Gulch Trail Access).	38N04, 38N07, and 38N19.	Maintain Seasonal Access.
		Dispersed Campsites for Hunting and Fishing.	Several Locations.	Maintain Seasonal Access
		Other Uses Include Fire Wood Cutting and Sight Seeing.	All Open Roads.	Need to Manage Access to Meet LSR objectives.
	Fisheries.	Sedimentation from Roads & Road Location Near Streams.	38N04, 38N04A, 38N08 and Stream Crossings on 38N14.	Minimize Sedimentation. Look For Opportunities to Reduce Sediment, Such as Surfacing and Correcting Drainage Problems.
	Lands & Minerals	Access to Private Land.	Gouleys & Powers 38N04.	Provide Year Around Access to Private Residence in the Lower Reaches of Taylor Creek.
	Lands & Minerals	Special-Use.	Raymes Road.	Provide Year Around Access to Private Residence on South Side of East Fork of Salmon River.

TRANSPORTATION AREA	DISCIPLINE	GENERAL ISSUES & CONCERNS	SPECIFIC ROAD ISSUES & CONCERNS	REMARKS & RECOMMENDATIONS FOR DESIRED CONDITION
TAYLOR CREEK (Continued	Lands & Minerals (Continued)	Special-Use (Continued)	38N04, Under Ground Telephone Line, Lower End of Road.	Maintain Access and Protect.
			38N04, Water Line for Frank Power/Chuck Thompson.	Maintain Access and Protect.
	Range.	Cattle Range in Poison Creek Area.	38N04	Need Access to Monitor Cattle.
	Road Management.	Traffic Management for Travel and Access.	Use Restrictions to Minimize Resource-Use Conflicts on all Roads.	All Roads Beyond MP 4.8 on 38N04, and 38N03 are Closed Seasonally from November to April.
				Need to Re-evaluate Existing Closures. Identify Which Roads shall be Permanently or Seasonally Closed, or Decommissioned.
		Reduce Road Maintenance.	All System and Non-System Roads	Assign Appropriate Level of Maintenance to all Roads. Identify & Correct Problems that Contribute to High Cost.
		Road Signing(all roads).		Install & Maintain Signs that Correspond with the Forest Visitor Map, and Provides for Adequate Direction and User Safety.
SOUTH FORK/ RAYS GULCH	Wildlife.	Disturbance (Spotted Owl Activity Center).	Road 37N14, Also used to Access China Trailhead.	Analyze for Resource-Use Conflict.
		Open Road Density & Road Fragmentation.	37N09, 37N10, 37N07, 37N14, 37N02B AND T11.	Reduce Open Road Density. Decommission the T11 Road.
			Elk Enclosure Road.	Maintain Year Around Closure.
	Fire.	Fire Management Access(Key Locations for Strategic Fire Management).	Critical Roads are 37N07 and 37N14. Important Roads are 37N09 and 37N10(would make good anchor points for suppression).	Critical & Important Roads Need to be Maintained and Accessible During Fire Management Season.
		Vegetation Encroachment on Roads(Loss of Fuel Breaks).	Critical and Important Roads Serve as Fuel Breaks for Fire Management.	Develop and Active Program to Manage Vegetation Encroachment.

TRANSPORTATION AREA	DISCIPLINE	GENERAL ISSUES & CONCERNS	SPECIFIC ROAD ISSUES & CONCERNS	REMARKS & RECOMMENDATIONS FOR DESIRED CONDITION
SOUTH FORK/ RAYS GULCH (Continued)	Cultural.	Petersburg Cultural Site. No Other Issues Related to Roads.	38N01A.	Analyze for Possible Closure. Further Surveys Needed.
	Visuals.	Road Segments that do not Meet Current Visual Objectives.	37N09, Segment of 37N07 Near Old China Trailhead, 37N14 from 37N14B to the End, and 37N14B Existing China Trailhead	Need Additional Verification for Actual Vantage Points. Identify Problem Areas & Prioritize to Correct or Mitigate Adverse Impacts.
	Watershed.	Erosion & Landslide Erosion Related Sediment.	Slump Area at the Landing, end of 39N09.	
			County Road above Rays Gulch has Drainage Problems.	Work with County to Resolve.
			Roads in Big Flat Area has Erosion Problems.	Identify Problem Areas and Correct or Mitigate Impacts.
		Erosion & Landslide Erosion Related to Sediment.	Elk Enclosure Road.	Analyze for Possible Decommission.
			Existing OHV use in the Moonscape Area.	Analyze for Possible Closure.
			Active Slides along 37N09 & 37N10.	Reduce Risk if Needed to Minimize Sediment.
		Storm Flow Capacity of Culverts(cumulative effects)	37N02; Two(2) Culverts, 37N07; Three(3) Culverts, 37N10; One(1) Culvert, & 37N14; One(1) Culvert Do Not Meet 100 Year Storm Flow.	Evaluate Culverts that do not Meet 100 Year Storm Flow Capacity. Correct Deficiencies If Needed.
		Compacted Area Density(Peak Flow Runoff).	Landings & Excessive Road Width & Parallel Roads.	Minimize Compacted Areas to Reduce Peak Flow Runoff.
	Law Enforcement.	Search & Rescue.	37N07 & 37N14 are Key Roads for Search and Rescue.	Maintain for Access to China Gulch Trailhead.
	Timber.	Access to Manage the Timber Resource.	All Roads Needed for Vegetation Management.	Analyze To Fix Problems Rather Than Decommissioning Roads.
	Recreation.	Trailhead Access.	Road 37N07, Access to China Gulch Trailhead. County Road 1E002 Provides Access to Garden Gulch, Rays Gulch, Blindhorse, Rush Creek, and South Fork Trails. Road T10 is Used For South Fork Trail.	Maintain Roads to Trailheads at Level 3 Standards.

TRANSPORTATION AREA	DISCIPLINE	GENERAL ISSUES & CONCERNS	SPECIFIC ROAD ISSUES & CONCERNS	REMARKS & RECOMMENDATIONS FOR DESIRED CONDITION
SOUTH FORK/ RAYS GULCH (Continued)	Recreation. (Continued)	Administrative Site.	Elk Enclosure Road Uses For Administrative Site.	Maintain For Administrative Use
		Other Recreation Uses.	Hunting, Wood Cutting Most Roads. Swimming Near Red Bridge	Maintain Reasonable Access.
		Gated Road.	Decision Was Made in the Blue Ray EA to Gate Road 37N14 at Mile Post 1.2	Implementation Needed.
		ORV Use Off County Road.	ORV Use is Causing Some Erosion Problems, Primarily In The Granitic Soils Off County Road 1E002 and Elk Enclosure Road.	Analyze to Mitigate Erosion Problems and Off Road Use.
		Public Concerns at Rush Creek Trailhead (Inside Wilderness).	Public has to Access By Foot, and Private Land Owners Access By Vehicles.	Analyze Access to Reduce Conflicts,and Minimize Adverse Impacts.
		Motorized Use on Trail System Inside Wilderness.	Trail System from South Fork Trailhead.	Analyze Access Conflict Between Public and Private Land Owners.
		Big Flat Area.	To Many Roads Around Campground	Define a Campground Road System and Decommission Not Needed Roads.
	Fisheries.	Sedimentation from Roads.	Location of Roads Near Streams. 37N10, & Temp Road just Before China Gulch, 37N07 At Rays Gulch.	Identify & Prioritize to Correct or Mitigate Adverse Impacts.
			37N09 Sloughing Off into Creek. Sediment from Landing on 37N10.	Minimize Sediment Caused by Project In the Plans to Mitigate Impacts.
			Active Slides on 37N10 & 37N09.	Analyze to Correct or Reduce the Risk of Failure.
			Temp 10, Erosion Problems.	Minimize Sediment Caused by Erosion.
			37N14 has Chronic Erosion Problems at the Junction with 37N07.	Reconstruct Road to change Drainage Pattern.
			37N07. Road Surface and Ditch Drainage causing Erosion.	Reduce or Minimize Erosion from Rd. Analyze For Reconstruction to Change Road Template from Inslope with Ditch to an Outslope without Ditch. There

TRANSPORTATION AREA	DISCIPLINE	GENERAL ISSUES & CONCERNS	SPECIFIC ROAD ISSUES & CONCERNS	REMARKS & RECOMMENDATIONS FOR DESIRED CONDITION
SOUTH FORK/ RAYS GULCH (Continued)	Fisheries (Continued)	Sedimentation from roads. (Continued)		May be Sections to Reduce Road Widths.
	Lands & Minerals.	Large Mining Operations.	North Side of River Near Board Tree Gulch. There is the Potential for Large Scale Mining Operations.	Identify Potential Problems Early and Plan for Necessary Mitigation Measures Alternatives.
		Suction Dredging Along River		Identify Problems and Plan for Mitigation Measures.
		Special-Use Permits for Telephone Repeaters. (Siskiyou Telephone)	Road 37N07, 38N40 & 38N40B.	Siskiyou Telephone Needs Access to Repeaters for Operation & Maintenance.
		Private Land Access.	Several Roads Access Private Lands Off County Road 1E002.	Roads on National Forest Lands that Access Private Lands Need to be Analyzed for Erosion Problems. Provide Access to Pvt. Lands.
		Historical Ditch (Access for Ditch Maintenance).	Rush Creek Road.	Analyze Road for Erosion Problems.
	Range.	Grazing Permittees	George Ranch & Big Flat	Analyze for Impacts.
	Road Management.	Roads that are not Needed for Management of the National Forest.	Any Existing System or Non System Roads.	Analyze the Need for all Roads and Decommission those Roads No Longer Needed to Manage the National Forest.
		Traffic Management for Travel and Access.	Use Restrictions to Minimize Resource-Use Conflicts on all Roads.	Identify which Roads shall be Permanently or Seasonally Closed.
		Reduce Road Maintenance.	All System Roads.	Assign Appropriate Level of Maintenance to all Roads. Identify & Correct Problems that Contribute to High Cost.
		Road Signing (all roads)		Install and Maintain Signs that Correspond with the Forest Visitor Map, and Provides for Adequate Direction and Users Safety.
CECIL CREEK	Wildlife.	Open Road Density and/or Road Fragmentation (Wildlife Harassment).	Roads 37N03, 37N05, 37N06, 37N28, and 37N28B. A Seasonal Road Closure Exist on Road 38N16.	Reduce Open Road Density

TRANSPORTATION AREA	DISCIPLINE	GENERAL ISSUES & CONCERNS	SPECIFIC ROAD ISSUES & CONCERNS	REMARKS & RECOMMENDATIONS FOR DESIRED CONDITION
CECIL CREEK (Continued)	Wildlife. (continued).	Elk Harassment.	38N01A	Year Around Closure.
	Fire.	Fire Management Access(Key Locations for Strategic Fire Management.	Critical Roads are 37N02, 38N11 38N16, 38N27 to the Junction of 38N25, then down 37N04, and 38N40. Important Roads are 37N06 to the Main Ridge.	Critical & Important Roads Need to be Maintained and Accessible During Fire Management Season.
		Vegetation Encroachment on Roads(Loss of Fuel Breaks).	All Critical and Important Road that Serve as Fuel Breaks for Fire Management Access Needs.	Develop an Active Program to Vegetation Encroachment.
	Cultural.	Protection of Cultural Sites (Wetlands Area Between South Fork Bridge and Peterburg).	Road 38N01A, and the Non-System Roads within the Wetlands Area.	Analyze Roads for Decommission that are not Needed to Manage the National Forest. Close Road 38N01A Year Around.
	Visuals.	Road Segments that do not Meet Current Visual Objectives.	Portion of 37N01 that is within the Wilderness at Harry Hall Camp. Last 1/4 Mile of 37N03. Segments of 37N05, 37N25, 37N27 Near the Old Lookout Site, 37N28, 37N29, 38N40 on the North Side of Ridge Above South Fork, 38N40A, and 38N16 From the Beginning, to the Ridge.	Recommend Decommission and Re-vegetate for Visuals. Need Additional Verification for Actual Vantage Points & Location of Visual Restoration. Include Restoration Action Plan During Project Level Planning.
	Watershed.	Erosion Related Sediment.	Chronic Erosion on Several Stream Crossings on Road 37N11. (Fills Being Washed Out and Surface Erosion within an Area Near an Old Temp Road and the the Junction of 37N11A.	Fills were Constructed with to Small of Rock. Reconstruct with Larger Size Rock. Place Aggregate on the Road within the Area where Surface Erosion is Occurring.
			Erosion from a Segment of 38N01 that is within the Cecil Creek Drainage (between T13 and 37N02).	Analyze for Possible Decommission Segment of Road to Eliminate Sediment Production (this segment of road May not be Needed to Manage the National Forest).
			Minor Erosion on Access Road to Petersburg Water Source.	Reduce Erosion by Adding a Few More Waterbars.

TRANSPORTATION AREA	DISCIPLINE	GENERAL ISSUES & CONCERNS	SPECIFIC ROAD ISSUES & CONCERNS	REMARKS & RECOMMENDATIONS FOR DESIRED CONDITION
CECIL CREEK (Continued)	Watershed. (Continued)	Landslide Sedimentation.	Landslide Terrain in the Inner George of 37N65, and 38N16.	Evaluate Risk and Take Necessary Action if Needed to Minimize Risk of Sedimentation.
		Compacted Area Density(Peak Flow Runoff).	Road Density in Black Gulch and Blue Gulch, and Landings & Excessive Road Widths. (all roads).	Minimize Compacted Areas to Reduce Peak Flow Runoff.
		Drainage Problem.	Boggy Area on Road 37N03.	Re-shape and Surface.
		Storm Flow Capacity of Culverts(cumulative effects)	37N03; Two(2) Culvert, 37N11; One(1) Culvert, 38N16; One(1) Culvet, 38N16A; Two (2) Culverts, 38N27; Three(3) Culverts, & 38N65; One(1) Culvert; Do Not Meet 100 Year Storm Flow.	Evaluate Culverts and their Ability to Handle 100 Yr. Storm Flow. Correct Deficiencies if Needed.
	Law Enforcement.	Poaching (Deer & Bear).	High Open Road Density Creates Easy Accessibility During Winter Months.	Analyze to Reduce Open Road Density.
		Access Needed.	37N01, 37N02, 38N01, and 38N27.	The Need for Access and Personal Safety.
		Woodcutting (Debris Left in Ditches and Heads of Culverts).	All Roads.	Improve Public Awareness of the Problem.
		Marijuana Cultivation		Strive to Eliminate all Drug Operations.
	Timber.	Access Needed to Manage the Timber Resource.	All Roads Needed for Vegetation Management.	Analyze to Fix Problems Rather than Decommission Roads.
	Recreation.	Trailhead Access.	Roads 38N27, 37N01, 38N16 and 38N65.	Maintain Roads to Trailheads at Level 3 Standards.
		Dispersed Recreation (Hunting & Fishing.	Most Roads Used During Deer Hunting Season.	Provide Adequate Access for Dispersed Recreation(this does not mean every road needs to left open).
	Fisheries.	Sedimentation from Roads.	Road Surface Erosion on 38N01 from County Road to 37N02 (Cecil Creek Side).	Analyze for Possible Decommission, or Minimize Erosion, or a Combination of Both.
			Road Locations of Roads 38N27, 38N16, and 38N65 Adjacent to	Identify Sedimentation Sources, & Prioritize for Treatment

TRANSPORTATION AREA	DISCIPLINE	GENERAL ISSUES & CONCERNS	SPECIFIC ROAD ISSUES & CONCERNS	REMARKS & RECOMMENDATIONS FOR DESIRED CONDITION
CECIL CREEK (Continued)	Fisheries. (Continued)	Sedimentation from Roads. (Continued	Creeks.	Those Areas to Minimize Sedimentation.
			Old County Road Across from East Fork Campground.	Analyze for Decommission.
		Public Access,(surface erosion).	Roads Near Streams.	Reduced Public Access Will Allow Road Surfaces to Stabilize.
	Lands & Minerals.	Mining Operations (Erosion & Sedimentation).	T7 & T15.	Analyze for Road Surface Erosion Sedimentation. Need to Maintain Access for Mining Operations.
		Special-Uses.	Under Ground Telephone Cable Up 38N01 from Cecil Creek to Black Gulch (Siskiyou Telephone).	Protect Underground Cable. Provide Access to Maintain Cable Line.
			38N01 and T13 is Access Roads To Domestic Water Source in Cecil Creek.	Provide Permittee Access to Domestic Water Source.
	Range.	No Concern in Cecil Creek.		
	Road Management.	Roads That Are Not Needed For Management of the National Forest.	Any Temporary or System Road.	Analyze all Roads, and Decommission Those Roads No Longer Needed. Include Public Involvement.
		Reduce Road Maintenance.	All System Roads.	Assign Appropriate Level of Maintenance to all Roads. Identify and Correct Problems that Contribute to High Cost. Analyze for Reconstruction Roads in Granitic Soils that Contribute High Levels of Sedimentation.
		Road Signing (all roads).		Install and Maintain Sins that Correspond with the Forest Visitor Map, and Provides for Adequate Direction and User Safety.
UPPER EAST FORK	Wildlife.	Disturbance (Two Spotted Owl Centers).		Manage Access to Minimize Spotted Owl Disturbance.

TRANSPORTATION AREA	DISCIPLINE	GENERAL ISSUES & CONCERNS	SPECIFIC ROAD ISSUES & CONCERNS	REMARKS & RECOMMENDATIONS FOR DESIRED CONDITION
UPPER EAST FORK (Continued)	Wildlife. (Continued)	New Road Construction.		Carefully Analyze Any Road Construction/Reconstruction Activities.
	Fire.	Fire Management Access(Key Locations for Strategic Fire Management).	Critical Roads are 39N08, 39N48, & Road to Carter Mdws Observation Site 39N69.	Critical & Important Roads Need to be Maintained and Accessible During Fire Management Season.
			Fish Lake Road 39N05 is Considered an Important Road for Fire Management.	
	Cultural.	No Issues Related to Roads.		Further Surveys Needed.
	Visuals.	Boulders Along Road.	39N08 Between Long Gulch and Hammonds Cabin.	Opportunity to Improve Scenic Values Along Road & to Improve Road Surface Drainage.
	Watershed.	Chronic Erosion.	Oversized Ditch Along 39N08 Between Hammonds Cabin and Trail Creek Campground.	Use Boulders Along 39N08 to Fill and Stabilize Oversized Ditch.
			Culverts Along County Road 1C01 (Poor Locations).	Work with County to Reduce Erosion Associated With Drainage Structures.
			Stream Crossings on 39N50.	Minimize Erosion at Stream Crossings.
			Switch Backs on 39N06 Eroding.	Analyze for Treatment to Correct Erosion Problem.
			39N48 Surface Erosion(from the County Road through the Switch Backs.	Analyze for Treatment to Reduce Erosion.
			39N69 Carter Mdws Observation Site (Surface Erosion).	Analyze for Treatment to Reduce or Eliminate Erosion Problem.
			Temp Road Below Equestrian Camp.	Analyze for Decommission.
		Storm Flow Capacity of Culverts(cumulative impacts).	All Roads.	Evaluate Culverts and Their Ability to Handle 100 Year Storm Flow. Correct Deficiencies if Needed.
	Law Enforcement.	ORV Use in Meadow Areas and In Wilderness.		Recommend Signing and More Patrols.

TRANSPORTATION AREA	DISCIPLINE	GENERAL ISSUES & CONCERNS	SPECIFIC ROAD ISSUES & CONCERNS	REMARKS & RECOMMENDATIONS FOR DESIRED CONDITION
UPPER EAST FORK (Continued)	Law Enforcement. (Continued)	Access Needs.	39N08 and 39N05.	Maintain Access for Law Enforcement Activities.
	Timber.	Much of the Area is Designate Late-Successional Reserve.	Management of Plantations & Vegetation Manipulation for Other Resource Concerns, All Roads.	Maintain Roads on System for Access.
	Recreation.	Access to Trailhead and Recreation Sites.	39N05, 39N06, 39N08, and 39N69.	Maintain Seasonal Access to Trailheads & Recreation Sites.
		Winter Sports (Carter Mdws Area).	39N08, 39N05, and 39N48.	Used by Cross Country Skiing & Snowmobiles
		Mountain Bike Use.	39N05, 39N08, and 39N50.	Existing Seasonal Use. Opportunity to Develop Designated Routes of Use.
		Equestrian Use.	Carter Mdws Area.	Provide Access to Camp Sites.
		General Recreation Uses.	Hunting, Fishing, and Sight Seeing.	Maintain Adequate Access for all Uses.
		New Equestrian Development Site and Trail.	0.45 miles New Road Constructed 1994.	Put on Transportation System.
			Develop an Equestrian Trail on 39N05A.	Opportunity to Decommission Road and Make Equestrian Trail.
			Temp Road Below Carter Mdws Horse Camp.	Opportunity to Develop Into Hiking or Equestrian Trail.
		Erosion and Drainage Problems	Temp Roads Near Trail Gulch, Long Gulch, and Fish Gulch.	Have Been Closed to Vehicle Use and Converted to Trails. Analyze Any Erosion Problems For Treatment.
		Upgrading Road Surface.	39N08, (As Recreation Use Increases, There Will Be More of a Need to Control Dust and Provide a Better Riding Surface).	Opportunity to Improve Access Rd. as Recreation Use Increase. Consider Increasing Maintenance Level.
		ATV Use.	39N06 and Trail Creek 4WD Road.	Continue to Allow Use of ATV's to Access Ridge and Jackson Lake Area.
				Road Used for Administrative Use.

TRANSPORTATION AREA	DISCIPLINE	GENERAL ISSUES & CONCERNS	SPECIFIC ROAD ISSUES & CONCERNS	REMARKS & RECOMMENDATIONS FOR DESIRED CONDITION
UPPER EAST FORK (Continued)	Fisheries.	Same Concern As Watershed and Concern of Dispersed Sites Along East Fork Creek.	All Sites Adjacent to Creek. (Sanitary Waste)	Analyze for Treatment Problem Areas.
	Lands & Minerals.	Private Land Access.	39N48.	Provide Access to Private Lands Over Existing Roads.
		Special-Uses (Hammonds Cabin)	Access via 39N08.	Provide Access to Permittee.
	Range.	Existing Range Allotments.	39N05, 39N08, and 39N48 Needed By Permittees to Manage Livestock.	Need Roads on a Seasonal Basis To Access Allotment Area.
	Road Management.	Roads That Are Not Needed To Manage the National Forest.	Any Temporary or System Roads. (T6, T18, T19, T25, T26, T27, T28, T29 and 39N05 beyond Fish Lake Creek).	Analyze All Roads and Decommission those Roads no Longer Needed.
		Reduce Road Maintenance.	All System Roads.	Assign Appropriate Level of Maintenance to all Roads. Identify & Correct Problems that Contribute to High Cost.
		Traffic Management For Travel Access.	Use Restrictions to Minimize Resource-Use Conflicts on all Roads.	Identify which Roads Shall Be Permanently or Seasonally Closed.
		Road Signing(all roads).		Install and Maintain Signs that Corresponds with the Forest Visitor Map, and Provides for Adequate Direction, and Users Safety.
		Traffic Counting.	39N08 (Began a Traffic Counting Program in 1994 to Determine The Amount of Vehicle Use in Carter Mdws Area).	Need Program Continued on a Yearly Basis for a 5 Year Period In Order to Establish A Good Base Line.

APPENDIX L

VISUAL QUALITY IMPROVEMENT OPPORTUNITIES

Visual Quality Improvement Opportunities were identified in *Chapter 6 - Management Opportunities*. This paper documents the process used to develop those opportunities by first briefly outlining the process used, and then defining and describing the process steps and the information sources used.

GENERAL PROCESS USED

1- Identify existing visual condition for the watershed.
2- Identify visual quality objectives for the watershed.
3- Identify visual improvement opportunities within the watershed.

Existing Visual Condition (EVC) - EVC represents differing degrees of deviation in form, line, color, and texture caused by human activities. Examples include: road construction, timber harvest, mining, or habitat alteration. In evaluating the scenic impacts of human activities in a landscape, the magnitude, scale, and degree of deviation of design attributes-form, line, color, and texture-determine scenic condition levels. These attributes include: soils color, vegetative pattern, landform, rockform, and waterform.

Harsh deviations with discordant visual elements decrease visual condition levels, while subtle deviations do not.

In evaluating the achievement of visual condition levels, the frame of reference is the combination of attributes of the natural or natural-appearing landscape character of a national forest.

The existing visual condition levels for Upper South Fork Watershed were inventoried in 1988 as part of the land management planning process. Aerial photos of the Forest from 1985-1988 were used to determine degree of change from natural conditions. Areas mapped also included an area of influence which is larger than the actual disturbance. The EVC map, which was taken directly from the LMP data base, was reviewed and revised by input from Salmon River District personnel. The acreage totals follow:

Existing Visual Condition Levels	Acreage	% of Watershed
Untouched	80,800	68
Unnoticed	6,300	5
Minor Disturbance	3,500	3
Disturbance	16,400	14
Major Disturbance	4,100	3
Drastic Disturbance	7,700	6
TOTAL	118,800	100

Visual Quality Objectives (VQOs) - These objectives are established and adopted in the draft *Forest LMP*. Data was taken directly from the LMP data base. Definitions of the objectives are listed in this Glossary. The objectives identify acceptable levels of visual change to the landscape. The acreage totals for the Upper South Fork Watershed are displayed in the following table:

Visual Quality Objectives	Acres
NATURAL/NATURAL-APPEARING	
Preservation	49,200
Retention	8,000
Partial Retention	56,200
HUMAN-DOMINATED	
Modification	800
Maximum Modification	4,800

Visual Improvement Opportunities - Visual Improvement Opportunities are large areas which may need visual rehabilitiation to meet the assigned VQO. Further field verification will be necessary before project level work could proceed.

To identify visual management opportunities, an overlay of EVC and VQO maps was done. As there is a strong correlation between visual conditions and objectives, areas were highlighted in which there were discrepancies between the two. Listed below is a table which displays the correlation between EVC and VQOs:

Visual Quality Objectives	Existing Visual Condition
Preservation	Untouched
Retention	Unnoticed
Partial Retention	Minor Disturbance
Modification	Disturbance
Maximum Modification	Major Disturbance
No corresponding VQO	Drastic Disturbance

Existing Condition areas which did not correlate with the visual quality objectives were identified as visual improvement opportunities (see the follow-

ing table). As an example, an area with an EVC of "Disturbance" may require rehabilitation if it has an assigned VQO of Partial Retention. Also all Drastic Disturbance areas were automatically identified, as there is no matching VQO.

To further determine the degree of inconsistency between VQO and EVC, and also to assist in setting work priorities, a delta score was assigned. "Delta Score" represents the difference between VQO and EVC. For example, an area that has been Drastically Disturbed but which has a VQO of Preservation would receive a score of 5; its existing visual condition is five categories removed from its visual quality objective. As in the earlier example, an area that has some disturbances with a VQO of Partial Retention would recieve a score of 1.

Management opportunities for visual improvements would total 27,200 acres. Most of the acres are in the Partial Retention VQO areas.

VQO	Delta Score	Acres
Preservation	2	247
P	3	557
P	4	110
P	5	19
Subtotal		932
Retention	1	295
R	2	2,562
R	3	36
R	4	1
Subtotal		2,894
Partial Retention	1	12,018
PR	2	3,633
PR	3	7,310
Subtotal		22,962
Modification	1	195
M	2	123
Subtotal		317
Maximum Modification	1	98
Subtotal		98
TOTAL		27,203

APPENDIX M

MONITORING

Monitoring is an essential component of ecosystem analysis which provides information on the relative success of implementing resource management strategies identified during the analysis. Monitoring in Upper South Fork will be conducted consistent with the *ROD* as discussed on page 57 and in Attachment A. According to the *ROD*, watershed analysis monitoring and evaluation will identify indicators of environmental changes, formulate and test hypotheses about the causes of changes, and guide management of the ecosystem to achieve desired conditions.

Three basic types of monitoring (implementation, effectiveness, and validation) will be applied to meet management objectives. The monitoring plan in the KNF LMP will provide the specific monitoring questions to be addressed at the watershed scale. Additional monitoring questions may result from updates and revisions of the WA.

MONITORING SPECIFIC TO LAND ALLOCATIONS

Late-Successional Reserves

Key items to monitor:

- Timber Harvest consistent with standards and guidelines and REO review.
- Other management activities consistent with standards and guidelines (e.g., prescribed fire.)

Riparian Reserves

Key items:

- Width and integrity of Riparian Reserves (RRs).
- Management activities in RRs consistent with standards and guidelines.

Matrix

Key items:

- Number and distribution of green trees left in harvest units.
- Snags, Coarse Wood Material (CWM).
- Prescribed burning and resulting emissions.

Key Watershed

Key items:

- Presence and timing of activities, including restoration.
- Road densities.
- Interagency and public involvement.

RESOURCE MONITORING

Aquatic Ecosystems

Key items:

- Pool frequency and quality (width, depth and cover).

- Percent fine sediment.
- CWM (size and quantity).
- Water temperature.
- Width-to-depth ratio.
- Bank stability and lower bank angle.

Biological Diversity and Late-Successional Forest Ecosystems
Evaluation Questions:
- Ecosystem function, sustainability?
- Use of Rx fire to maintain natural processes?
- Habitat conditions for northern spotted owl and marbled murrelet maintained or restored?
- Habitat conditions for late successional species maintained or restored?
- Desired conditions for at-risk fish stocks maintained or restored?
- Silvicultural treatments benefit late-successional conditions?

To address these questions a variety of variables can be monitored.
Key items:
– Size, location, spatial distribution, species composition and development of late-successional and old-growth forest.
– Retention of snags and CWM.
– Abundance and diversity of late-successional and old-growth related species.
– Species presence.
– Air quality.

Soil and Aquatic Resources
- Assess compliance with BMPs.
- Determine population trends and habitat conditions for Forest Service Sensitive species and management indicator species.
- Determine effectiveness of restoration projects at achieving aquatic conservation strategy goals.

Wildlife
- Rare and declining species.
- Track trends and status over time.
- New locations.
- Determine occupancy and suitable habitat for TES species.

Range Management
- Determine vegetative ecological condition and trend.
- Determine compliance with Forest Plan standards and guidelines for forage utilization and riparian health.

CONCLUSION

Long-term systematic monitoring will be necessary to provide reference points for effectiveness and validation monitoring. Plans will be developed cooperatively with inter-agency and research participation.

APPENDIX N

RESPONSES TO QUESTIONS ON ENDANGERED SPECIES ACT CONSIDERATONS FOR WATERSHED ANALYSIS

An interagency memo (see below) on watershed analysis guidelines has requested that the following questions be answered for each watershed analysis. A response specific to the Upper South Salmon River watershed follows each question.

SOURCE: Interagency memo, dated June 13, 1994, Appendix C, page C7-12, *Endangered Species Act and Other Species Considerations*

NORTHERN SPOTTED OWL
Question - Are spotted owl activity centers located within the watershed?
Response - Yes

Question - If so, how many and in what *ROD* land allocations are they located?
Response - There are 18 owl activity centers. Two are in wilderness (#2007, and 4004). Twelve are centered within Late-Successional Reserve (LSR). These are #2008, 2009, 4010, 2011, 0257, 4026, 1028, 1032, 1033, 1012, 3023, 3291. The other four (#4006, 4004, 4003, and 4002) are in the matrix and Riparian Reserve. 4001 has one-half the home range circle in wilderness.

Question -Which of these are currently above "take" thresholds and which are below and when were the activity centers located?
Response - At the .7 mile radius level, six of the 18 territories are above the incidental take threshold of 500 acres of suitable habitat. At the home range 1.3 mile radius level, six owl pairs have more than 1,336 acres required to preclude incidental take allowance. Only five territories meet both thresholds (#4002, 2007, 2008, 2009, and 1033).

Owl #	Acres in .7 Circle	Acres in 1.3 Circle	Year Located
4004	494	1,164	1989
4001	441	1,272	1987
2007	564	1,362	1986
4006	434	1,175	1985
4003	559	559	1989
4002	636	1,796	1985
2008	503	1,587	1987
2009	505	1,629	1985
4014	284	1,273	1989
2011	143	943	1989
0257	* Not Available	-	1990
4026	355	1,274	1990
1028	248	1,148	1989
1032	441	1,287	1985
1033	532	1,548	1986
1012	415	1,407	1987
3023	290	845	1988
3291	294	720	1992

* Three-quarters of home range is within LSR.

Question - Describe the reproductive history.
Response -

Owl #	Year Pair Verified	Year Young verified
4004	1989, 90*	-
4001	1987	88,91,92
2007	1986	87,90,91
4006	1985,86,8 8	-
4003	1989,90	-
4002	1985,87,89-91	-
2008	-	1988
2009	1987, 90	85,86,91
4010	1989	-
2011	1989, 90	-
0257	-	1991
4026	1990	-
1028	1989-91	-
1032	1987, 89	85,86,88,90-92
1033	1986-89, 92	1990,91
1012	1987,89,90,92	1991
3023	1989,90	1988,91,92
3291	-	1992,94

* territorial single confirmed

Question - Has a 100 acre core area seen designation around each activity center located in matrix lands?
Response - Yes, all four matrix territores have a 100 acre core delineated.

Question - How many acres of nesting, roosting, and foraging (NRF) habitat are there in the watershed?
Response - There are 51,919 acres of suitable owl habitat including foraging habitat in the watershed.

Question - What percentage of the watershed is this?
Response - Suitable habitat is provided over 44% of the watershed.

Question - Which of these stands have been surveyed to protocol (two years) and which were not?
Response - Within about 75% of the watershed, surveys have been performed to protocol for calling routes, SOHAs, timber sales, and ecosystem management areas from 1989 to 1994. More importantly, about 90% of the suitable habitat has been surveyed. The remainder is within the Salmon-Trinity Alps Wilderness and within a released roadless area, I Am Up Ridge.

Question - What is the amount of NRF habitat in each *ROD* land allocation within the watershed?
Response - Suitable Habitat (NR) Acres by ROD allocation is as follows: LSR = 14,019, Matrix = 18,439, and Wilderness = 19,471.

Question - Does any portion of the watershed contain LSRs?
Response - Yes, a 14,992 acre portion of LSR RC345 in within the landscape and LSR RC344 is totally within the landscape, 10,159 acres.

Question - What percent of the total watershed is this?
Response - The LSR land totals 25,151 acres, or 21 % of the watershed.

Question - What are the current totals of NRF habitat and capable habitat in the LSR?

Response - 16,618 acres, or 66% of the LSRs.

Question - What is the amount of dispersal habitat (11-40 and above) in each ROD land allocation within the watershed?
Response - This figure is included within the totals given for NRF habitat within the watershed. Timber type size/density class "3G" and larger are considered to be suitable habitat. Size/density class "3N" meets dispersal standards, at least 11" and 40% cc, and some may meet suitability. For calculation purposes, 3N was included in the NRF figures. Size/density classes smaller than 3N are not considered dispersal habitat.

Question - Is distance between LSRs (those over 10,000 acres) greater than four miles?
Response -No.

Question - If so, then what is the amount of dispersal habitat on Federal lands for all 1/4 townships between the LSRs?
Response - Not applicable.

Question - What percent of the total Federal lands in these 1/4 townships is this?
Response - Not applicable.

Question - How much (% and total) of the dispersal habitat is in Riparian Reserves, Admin. Withdrawal (which provide long-term protection), Congressionally Reserved, 100 acre cores, and smaller (<10,000 acres) LSRs?
Response - Not applicable.

Question - Is this total greater than 50%?
Response - Not applicable.

Question - Describe, if present, the natural barriers to dispersal.
Response - Open hardwood and shrub stands on southfacing slopes.

Question - Is connectivity, or dispersal habitat, sufficient to allow movement?
Response - Connectivity is sufficient within the landscape and from this landscape to adjacent ones.

Question - How much critical habitat has been designated within the watershed?
Response - In the watershed, 17792 acres are within CA-25, 2884 acres are within Critical Habitat Unit CA-27, 3988 acres are within CA-28.

Question - How much of this total overlaps with LSRs?
Response - All but about 2800 acres or 11% is within an LSR.

Question - For areas that do not overlap, how much is currently NRF habitat?
Response - The suitable habitat outside of the LSR is about 850 acres.

Question - And how much is capable?
Response - There is about 420 acres of forested land that are capable to become NRF at a later time.

Question - How many activity centers are located in this non-overlap area of CHU?
Response - None

Question - How many are currently above "take"? How many below? (use acres established by FWS for .7 and 1.3 mile radius)
Response - Not applicable.

Question - What role does this non-overlap critical habitat play in this watershed in relation to the reasons for the designation of the CHU?
Response - This critical habitat will act as a dispersal habitat connector between the two CHUs. It also adds additional habitat to CA-xx and the potential for another owl home range.

BALD EAGLE

Question - Are occupied bald eagle activity areas (nesting, foraging, winter roosts, or concentration areas) located within the watershed?
Response - No. Eagles are occassionally seen within the watershed, usually during the fall and winter. These are single, scattered observations. The number of sightings has been slowly climbing over the past few years.

Question - If so, what type and how many?
Response - Not applicable.

Question - What *ROD* land allocations are they located?
Response - Not applicable.

Question - Describe reproductive history based on monitoring data.

Response - Not applicable.

Question - Has a final site-specific protection/ management assessment been developed for each site?
Response - Not applicable.

Question - Does this watershed analysis corroborate the findings of the management assessment?
Response - Not applicable.

Question - Has an assessment been made as to whether there are potential bald eagle activity areas (nesting, foraging, winter roosts, or concentration areas) located within the watershed?
Response - Nothing of detail has been done, but looking at fish population levels, there is not a fisheries large enough for a food base. Chinook salmon and steelhead trout are in the watershed, especially during the fall. These runs are greatly depleted and of short duration. There are no large natural or man-made bodies of water within the watershed, which would provide a food base. There are suitable stands for winter roosts within short distances of the larger streams.

Question - If so, what type?
Response - Not applicable.

Question - How many?
Response - Not applicable.

Question - What ROD land allocations are they located?
Response - Not applicable.

Question - Have these areas been surveyed to protocol to determine they are unoccupied?
Response - Not applicable.

Question - Describe historical bald eagle occurrence and nesting within the watershed.
Response - There is no known historic occurrence or nesting in the watershed.

Question - What is the status of the watershed as it relates to the Recovery Plan? (target territories, including beyond watershed boundaries) Does the watershed and the surrounding area meet objectives of the Recovery Plan?
Response - Yes. The watershed is in Zone 23 (California/Oregon Coast) of the Pacific States Recovery Plan. The main threats previously listed for this zone are shooting, logging, human disturbance, and loss of anadromous fish. The proposed management direction listed is to restore anadromous fish populations and increase the nesting population. This zone is rated at the 75% occupancy level according to the Calif Fish and Game update 9/7/94. In total of all the zones within the Forest, the Forest is currently below its target nesting pair levels recommended as recovery goals. The Klamath has two known nesting pairs.

Question - If not, then are there capable eagle activity areas located within the watershed?
Response - No, there are no capable activity areas since there is not an adequate fisheries food base. Even in the future with salmon recovery, the watershed may only serve as a secondary foraging and nesting area.

Question - If capable activity areas are present, what type are they?
Response - Not applicable.

Question - How many?
Response - Not applicable.

Question - What ROD land allocations are they located?
Response - Not applicable.

Question - What type of project or enhancement could develop sites into potential or occupied sites?
Response - Restoring anadromous fish runs during all seasons of the year. Development of a large resevoir in the Upper South Fork drainage. Restoration goals for the watershed will contribute to increase habitat quality for steelhead trout and salmon in the future.

Question - If present, describe significant habitat within the watershed that is not under Federal ownership.
Response - Private lands do not have significant habitat for the eagle.

AMPHIBIANS

Question - Have any amphibian inventories been done on a project or watershed level?
Response - There has been some inventory done for tailed frog by PSW Redwood Science Lab researchers. Tailed frogs were located in Taylor Creek. It suspected they occur elsewhere in the watershed.

Question - What species does the literature suggest may be present?
Response - The home range of several frogs and salamanders is within the watershed: northwestern salamander, Pacific giant salamander, southern torrent salamander, rough-skinned newt, ensatina, black salamander, western toad, tailed frog, Pacific tree frog, northern red-legged frog, foothill yellow-legged frog, and bullfrog.

Question - Are sensitive species and *ROD* Table C-3 species present or possibly occur?
Response - Yes, although no surveys have been completed, it is suspected the Shasta salamander is present in the French Creek limestone outcrops. These salamanders have been located to the east near Shasta Lake and also to the north in the Marble Mountain Wilderness. No surveys have been completed for either the Siskiyou Mountain or Del Norte salamanders, but other surveys on the Forest have located the Siskiyou Mt. salamander. These new sightings have expanded the known range of this species. It is possible that either or both of these species could occur.

Question - Have intensive or extensive inventories been conducted in adjoining drainages/subwatersheds?
Response - Yes, by researchers from PSW, Redwood Science Lab, looking for tailed frogs. They were located in other drainages within the Salmon River.

Question - If so, can those inventories be extrapolated to this watershed?
Response - Yes, this frog is within the watershed.

Question - Are endemic species known to occur in the general geographic region?
Response - No.

Question - Are exotic species known or suspected to be in the watershed? (e.g. bullfrogs)
Response - Bullfrog populations are a possibility since there are observations on the Klamath Forest, but there are no known recordings.

PEREGRINE FALCON

Question - Are any cliffs located within the watershed? (rock wall >50 feet)
Response - Yes, there are two cliff areas outside of Wilderness, many more within the Wilderness.

Question - Are any cliffs present that are historic (pre-1975) or traditional (post-1975) peregrine eyries?
Response - There are two traditional eyries in the landscape. Data is unavailable to determine whether these cliffs or others are historic.

Question - For past projects near historic cliffs, have mitigation measures for habitat been considered?
Response - Not applicable.

Question - At these historic cliffs, have surveys to protocol (Pagel 1992) been accomplished for at least two years prior to the activities?
Response - Not applicable.

Question - For traditional cliffs, have surveys/ monitoring been conducted to determine nest site occupancy and reproductive status?
Response -

SURVEY YEAR	SITE/RESULTS
1977	*LB/occupied
1978	LB/3 eyas
1979	LB/2 eyas
1980	LB/2 eyas
1981	LB/2 eyas
1982	LB/2 eyas
1983	LB/3 eyas
1984	LB/2 eyas
1985	LB/3 eyas
1986	LB/3 eyas
1987	LB/failed; *SH/2 eyas
1988	LB/2 eyas; SH/failed
1989	LB/2 eyas; SH/failed
1990	LB/4 eyas; SH/inactive
1991	LB/3 eyas; SH/failed
1992	unavailable
1993	LB/2 eyas; SH/failed
1994	LB/eggs laid-insuff. data; SH/inactive

*LB=Limestone Bluff, SH=Shadow (first located 1987)

Question - Has a draft or final site mgt plan been created?
Response - No.

Question - Is this plan based on site specific and PNW sub-population nesting ecology?
Response - Not applicable.

Question - Have the cliffs located been rated or monitored for falcon potential or presence?
Response - Not applicable.

Question - If cliffs are un-rated, have surveys been accomplished to protocol?

Response - Not applicable.

Question - Describe site habitat variables within a three mile radius of historic and traditional nest sites. (cliff parent material, distance to water/ riparian, vegetative habitat, seral stages, human activities)

Response - The Limestone Bluff eyrie is on a very large southfacing cliff is made up of weathered, fractured limestone rock. The South Fork of the Salmon is about a 100 yards away; the cliff itself may be within the riparian reserve. Habitat is a mosiac of riparian vegetation, dry live oak, brush and ponderosa pine on a south facing slope, and mixed conifer of various age classes on the north slopes. The mixed conifer stands were burned lightly to moderately during the 1987 fires. Snags for perches are common. The main county road connecting Cecilville to Forks of Salmon follows the South Fork just below the cliff system. An alterate cliff eyrie, which has been used once in the last 15 years, is on the opposite side of the river. It is of the same parent material, in underburned mixed conifer, and further away from human activity.

The Shadow Creek eyrie is on a large northfacing limestone cliff, located ten miles upstream on the East Fork of the South Fork. Habitat is similar to Limestone, although it has not been burned. Snags for perches are present. The East Fork is about 100 yards away, the cliff is probably within the riparian reserve. Human activity is present in the form of the same road system connecting Cecilville to Callahan; the cliff is on the opposite side of the river, however.

GRAY WOLF

Not applicable. Species not in the State or province.

GRIZZLY BEAR

Not applicable. Species not in the State or province.

MARBLED MURRELET (Zone 1 and 2)

Not applicable. The watershed is beyond the Zone 2 boundary.

APPENDIX O

MANAGEMENT DIRECTION AND DESIRED CONDITON QUESTIONS AND RESPONSES

The following questions were asked to help make interpretations about structural elements and landscape patterns of the Upper South Fork Watershed. The answers are a brainstormed list developed during an interdisciplinary meeting. These answers then have two uses: incorporate with the Forest Land and Resource Management Plan Standards and Guidelines into desired condition statements of the applicable management areas, and/or guide management opportunity development.

Are there some rare, unusual, critical, or unique landscape features we want to protect or enhance?

HUMANS
- None identified

PHYSICAL COMPONENTS
- Karst topography

VEGETATION
- Riparian shrub and tree complex
- High elevation meadows
- Stands of mature/older forest providing habitat around spotted owl activity centers
- Gray pine
- Sensitive plants
- Old-growth hardwoods

WILDLIFE
- Tailed frogs
- Spring chinook
- Townsend bat
- Western pond turtle
- Pacific giant salamander
- Shasta salamander
- Great grey owl

Are there patches or areas of the vegetative matrix between which connectivity should be maintained?
- Habitat connectivity along riparian corridors and key saddles
- Older/mature forest patches within and between landscape boundaries for connectivity of habitat

between Late-Successional Reserves and General Forest management areas
- Riparian vegetation along stream channels to provide shade, organic input, bank stabilization
- Isolated populations of anadromous fisheries

Is there anything missing that should be introduced or restored?
- Fire regime more consistent with the historic range of variability
- Optimal cover for elk
- Spawning and rearing habitat, coarse woody material component
- Vegetative stability on active slides
- Renewal of early seral communities over time, providing forage in low elevation deer wintering range
- Thermal vegetative cover along South Fork Salmon River (Petersburg-Forks of Salmon)
- Diversity of age classes in shrub communities and hardwood stands
- High mortality areas within Late-Successional Reserves
- Areas in need of visual restoration

To what extent, and where, do we want to emulate certain elements of natural landscape patterns or processes?
- In the upper elevations patchy open patterns resulting from natural fire processes are desired.
- Throughout the landscape fire is desired to maintain the fuel component more consistent with historic fire frequencies.
- Throughout the landscape visual quality should mimic natural patterns.
- Large patches of more open older stands
- Sediment regimes

Are there areas of the landscape where fragmentation is a concern?
- Late-successional reserves
- Riparian corridors
- Owl activity centers, goshawk management areas
- Areas with high road densities

Are there areas where gradual changes rather than sharp edges are desirable?
- Retention and partial retention management areas
- Boundary areas visible from within wilderness
- Administrative sites and developed recreation sites outside of wilderness
- Adjacent to late-successional reserves.
- Between Riparian Reserves and the matrix

Are there areas where a high degree of edge and contrast is desirable?
- Meadow edges
- Plantations
- Barrens
- To break up fuel loading within and/or adjacent to late-successional reserves

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LITERATURE CITED

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UPPER SOUTH FORK OF SALMON RIVER

ECOSYSTEM ANALYSIS

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Figure 4

Upper South Fork Watershed

Watershed Elements (Geomorphic Terranes)

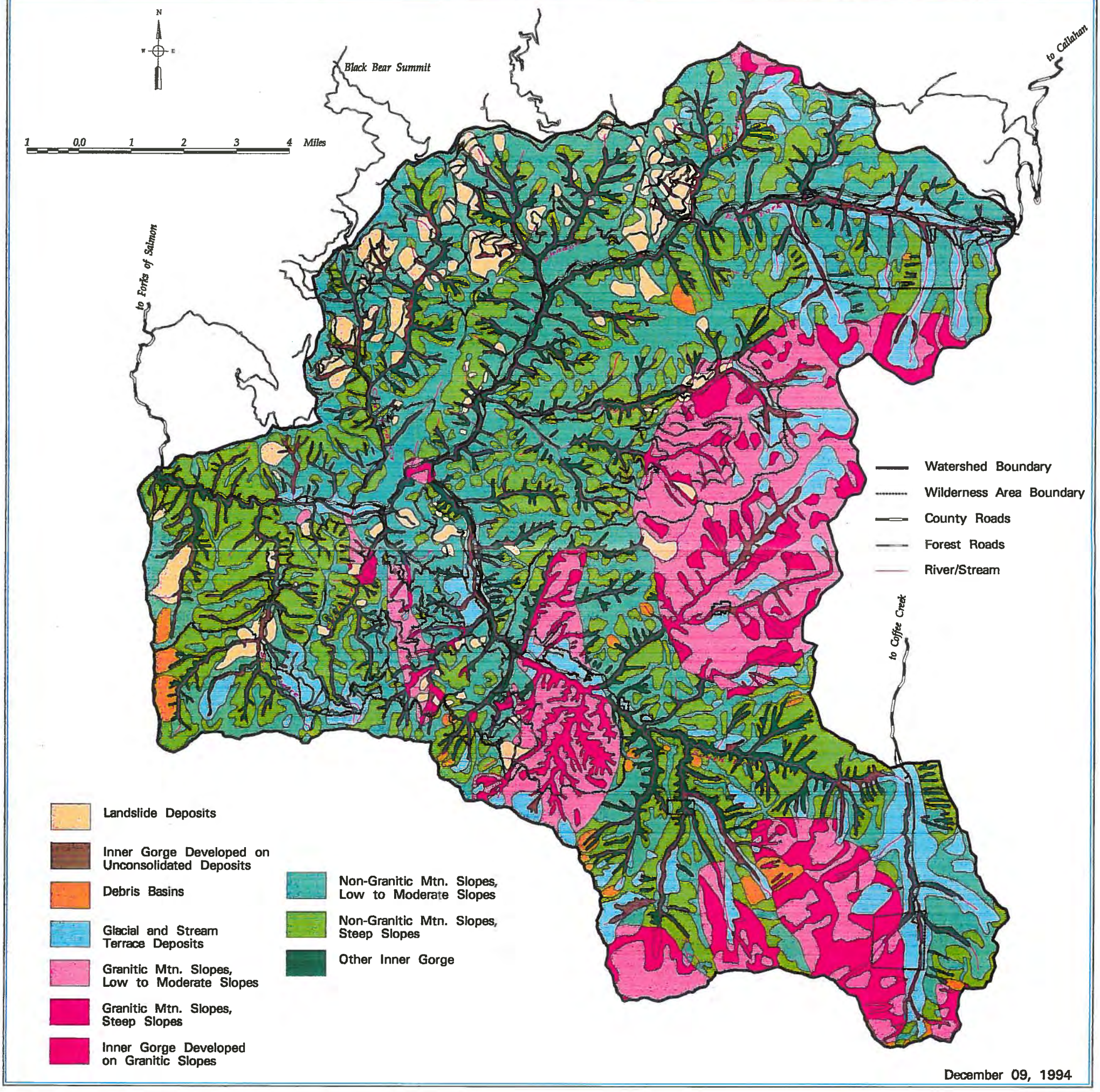

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Figure 9

Upper South Fork Watershed
Watershed Elements (Biological)

Klamath National Forest

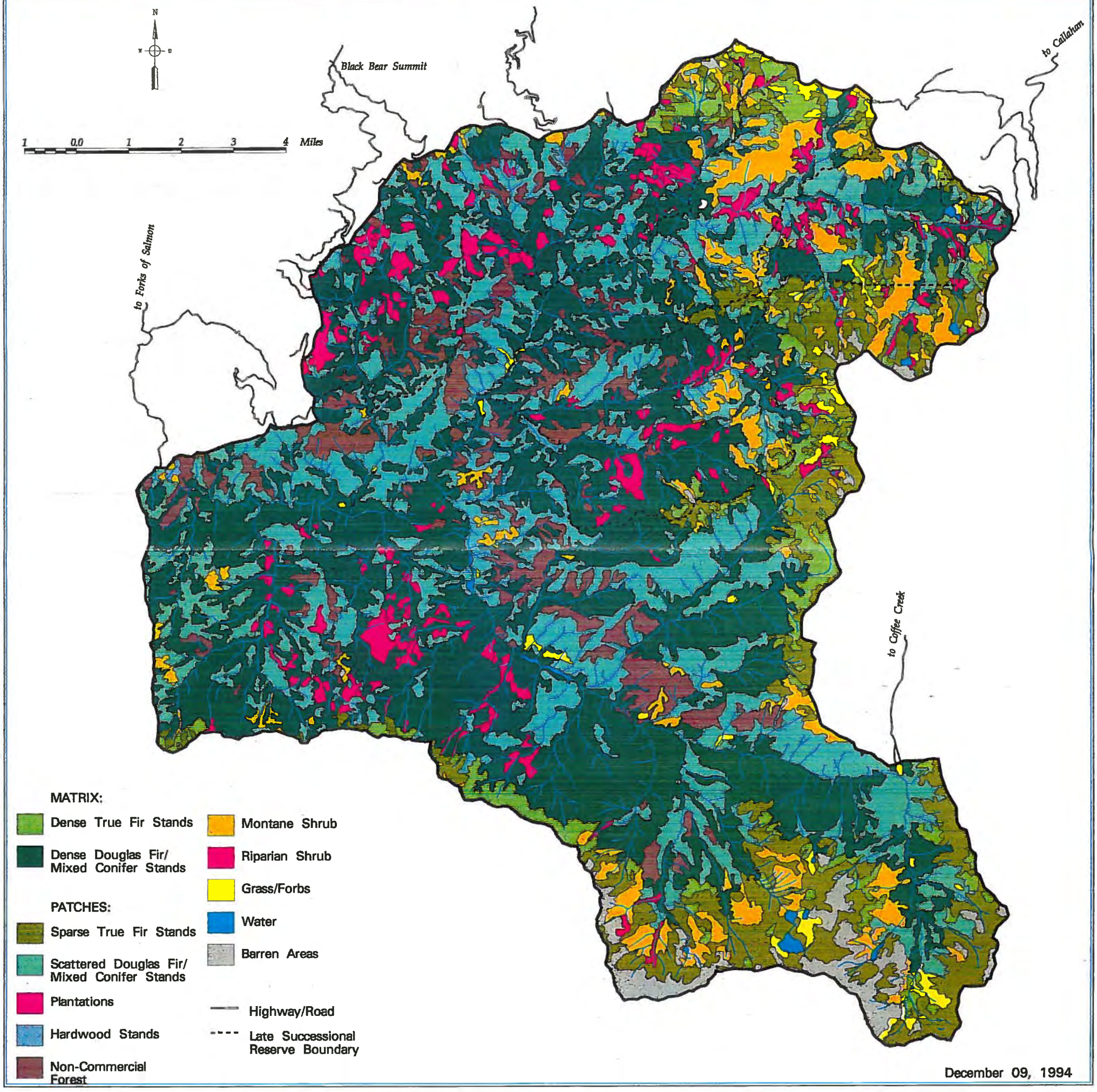

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Figure 12

Upper South Fork Watershed

Vegetative Elements Within Riparian Reserves

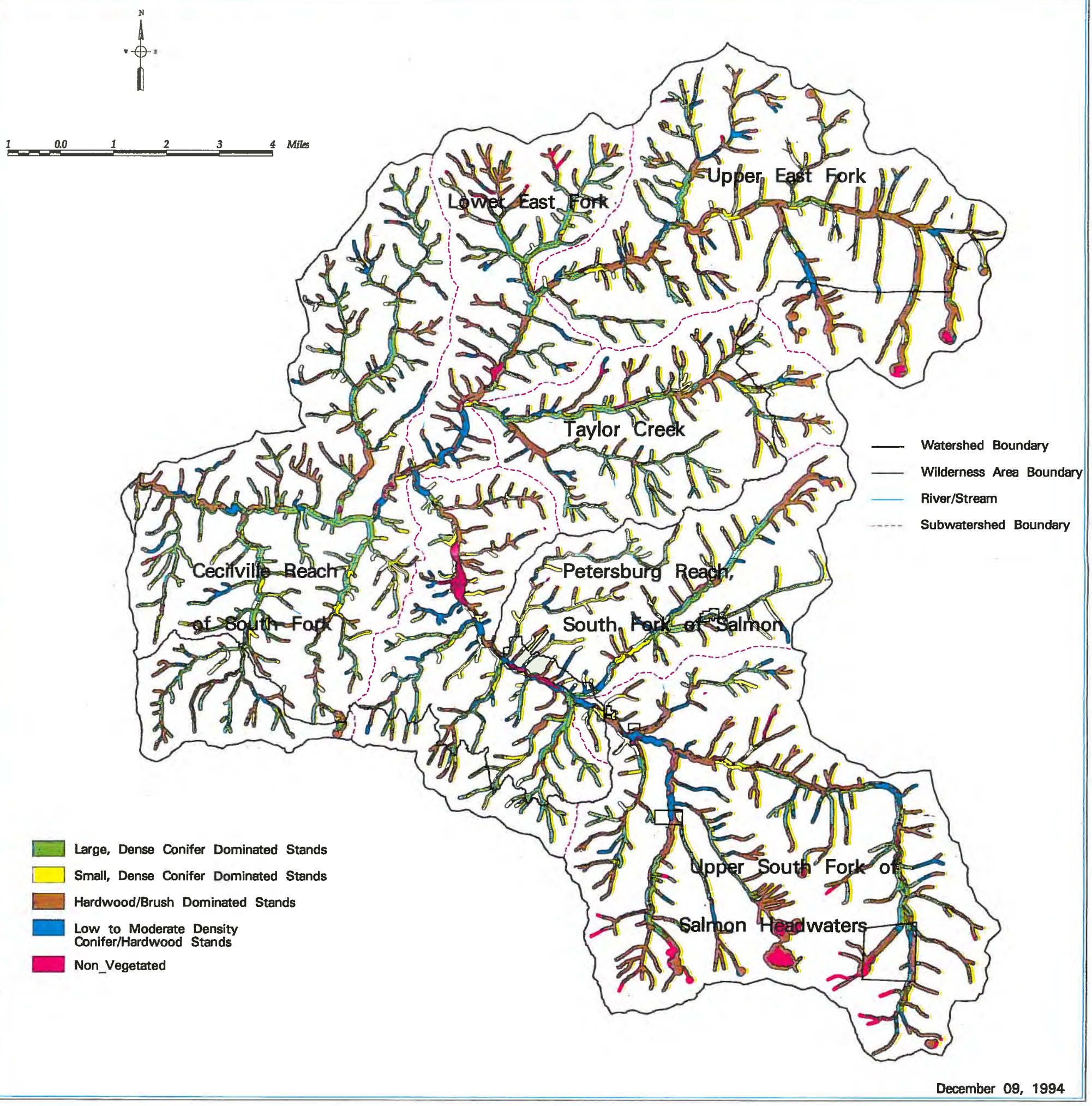

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Figure 13

Upper South Fork Watershed

Stream Shade Conditions

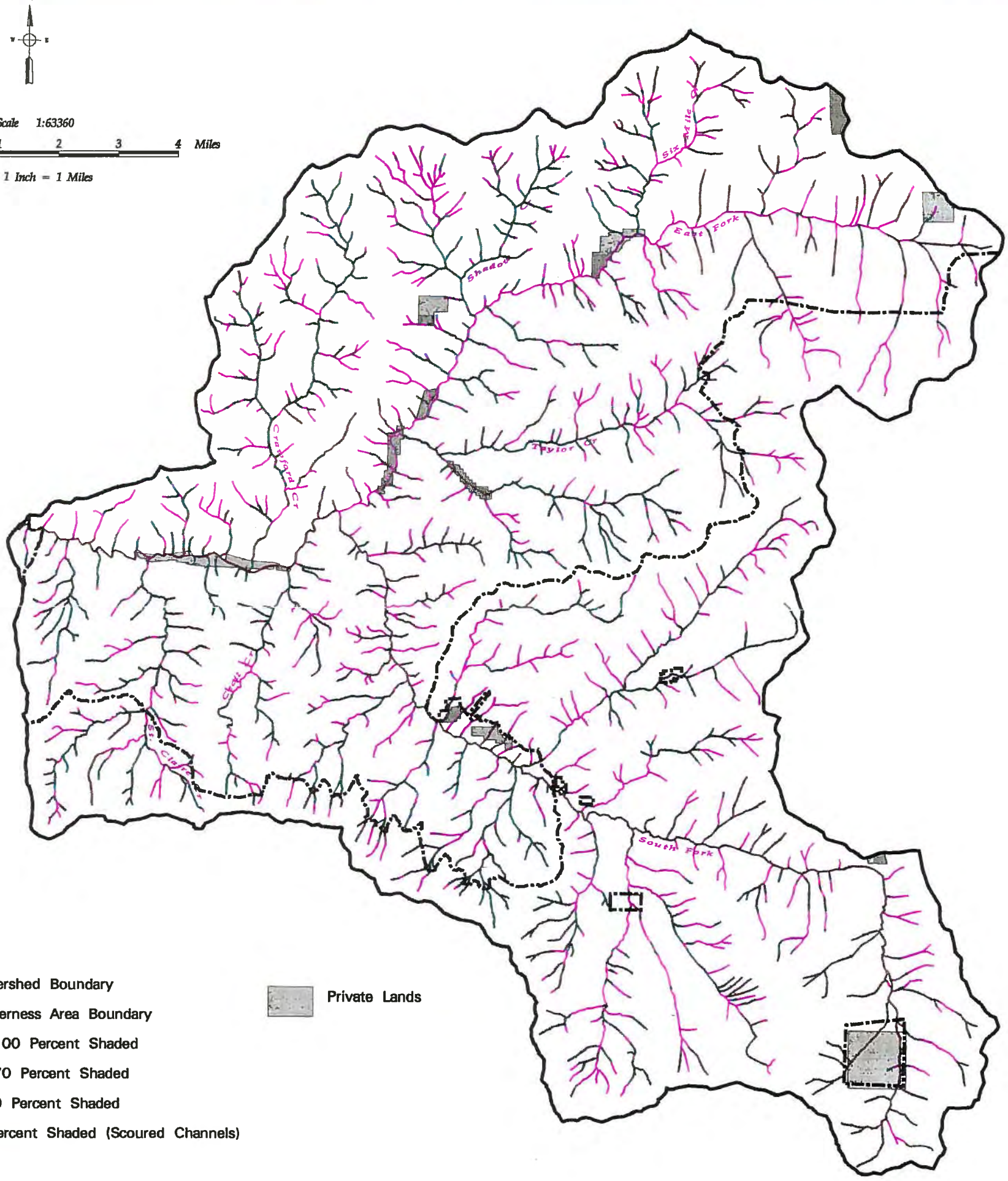
Klamath National Forest

N

Map Scale 1:63360

1 0.0 1 2 3 4 *Miles*

Scale: 1 Inch = 1 Miles



Watershed Boundary

Wilderness Area Boundary

70-100 Percent Shaded

40-70 Percent Shaded

0-40 Percent Shaded

0 Percent Shaded (Scoured Channels)

Private Lands

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Figure 14

Upper South Fork Watershed
Road Template and Surface Type

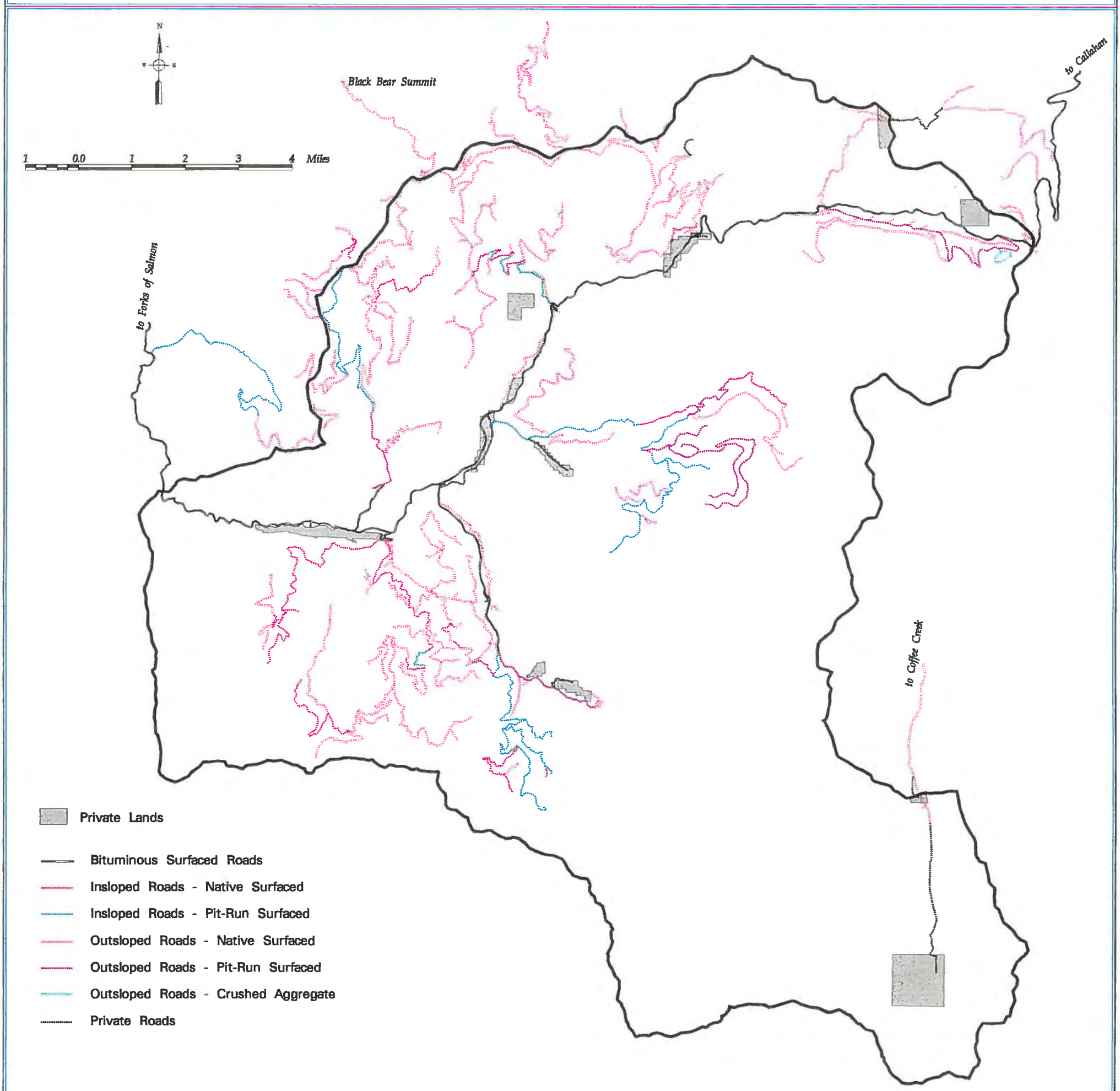

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Figure 15

Upper South Fork Watershed
Road Maintenance Levels & Closures

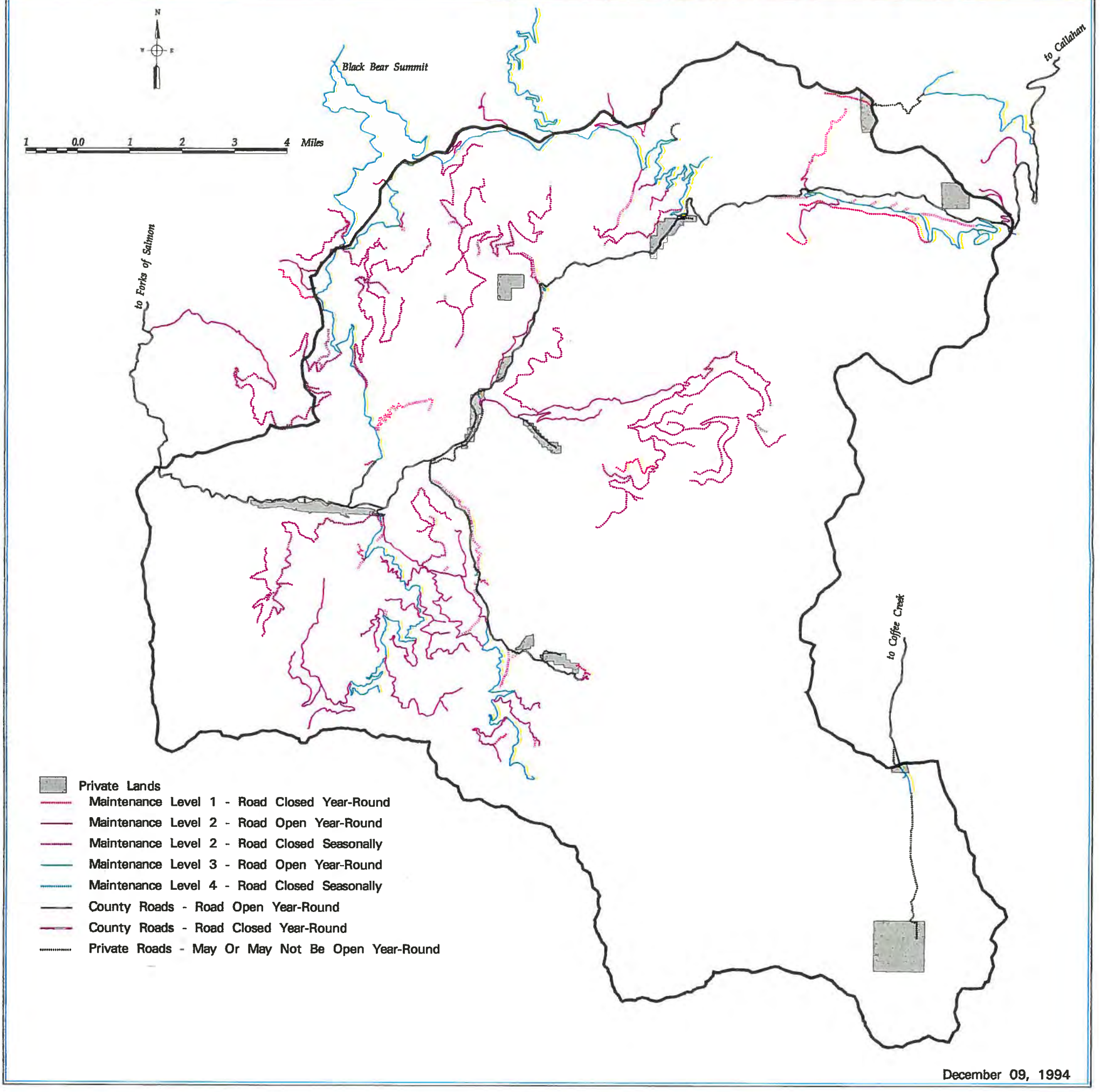

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Figure 19

Upper South Fork Watershed
Fire Occurrences & Risk Zones

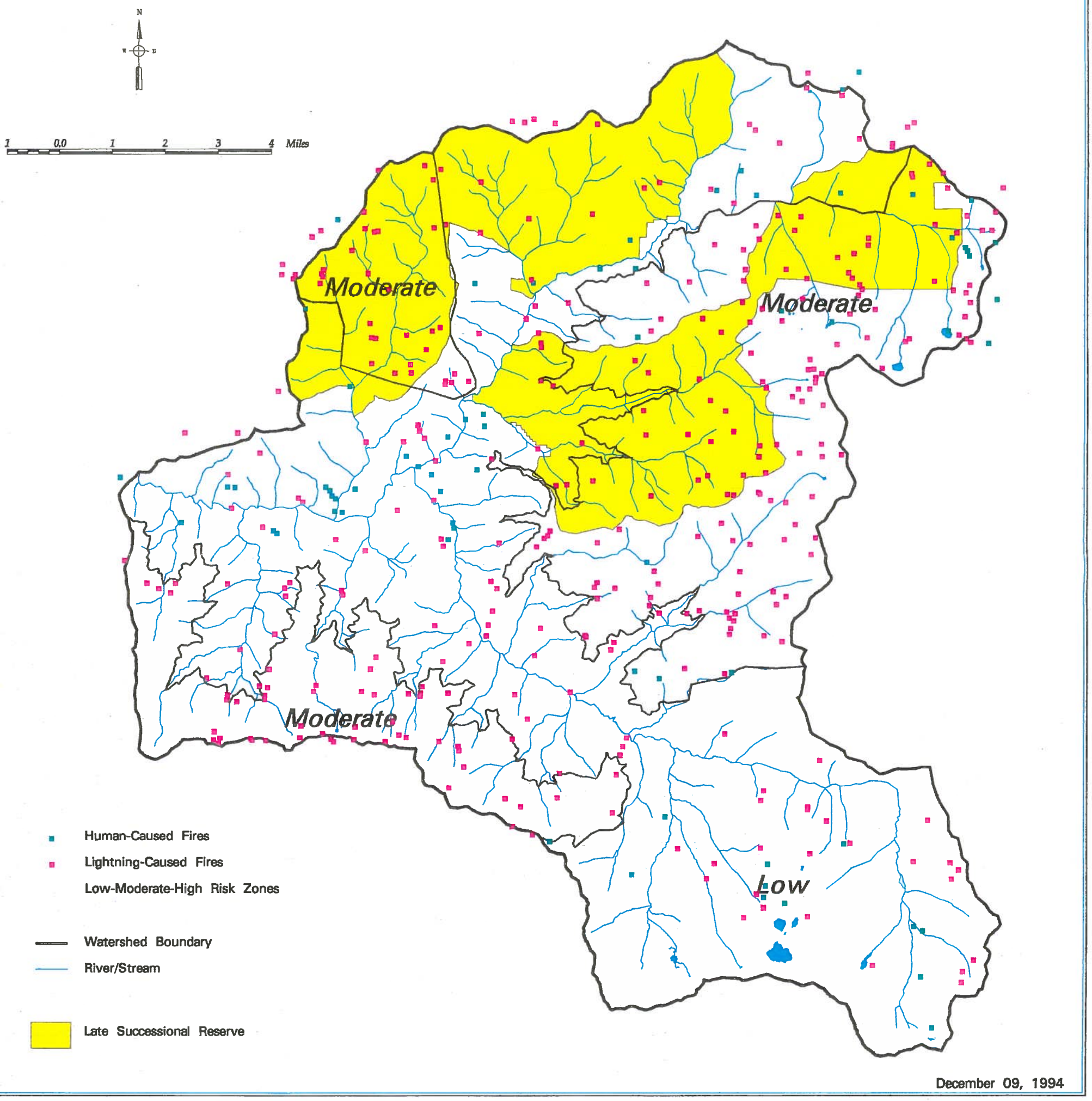

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Figure 20

Upper South Fork Watershed

Fuel Models

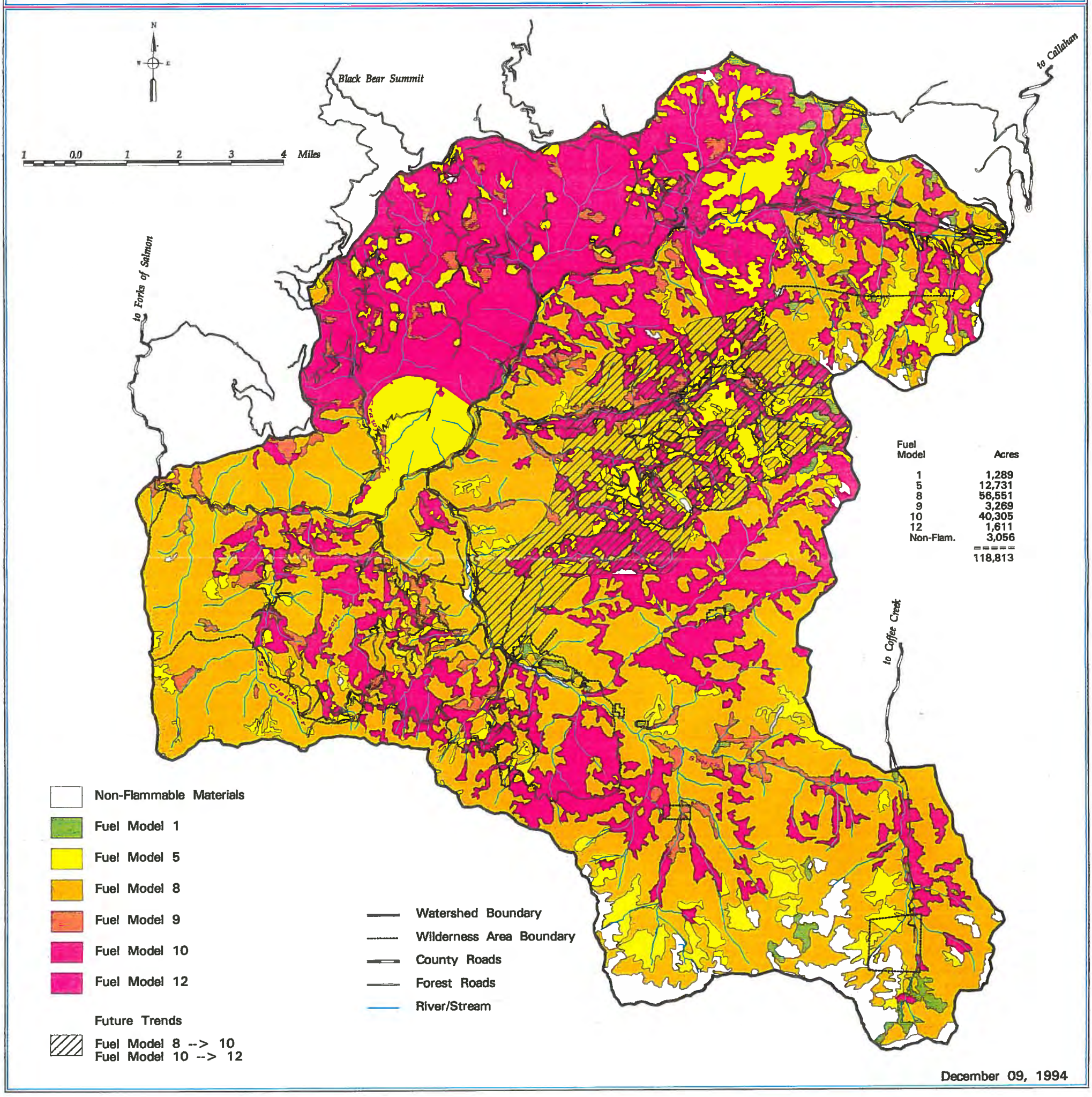

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Figure 21

Upper South Fork Watershed
Projected Fire Hazard Classes

Klamath National Forest

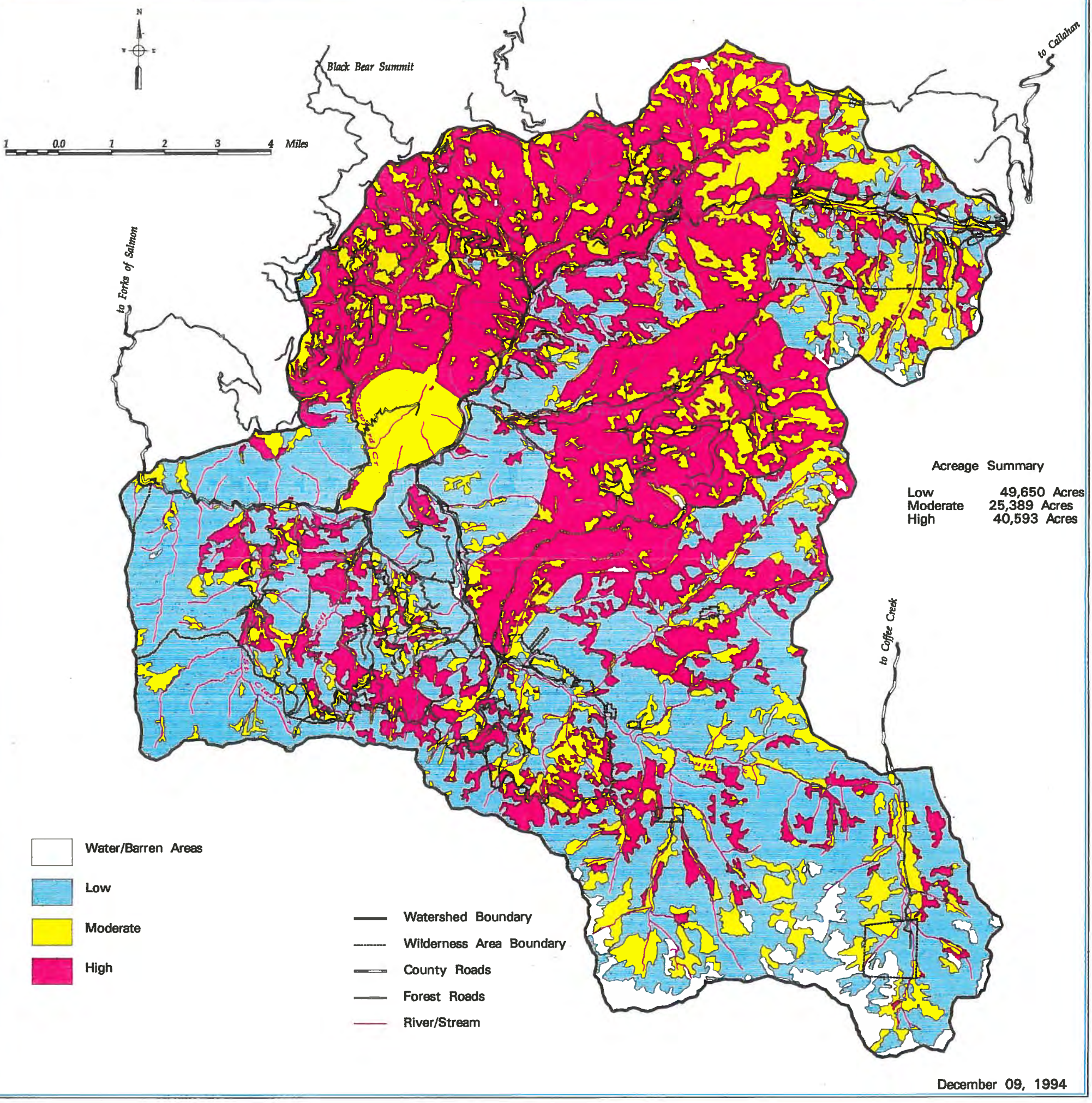

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Figure 22

Upper South Fork Watershed
Projected Potential Wildfire Effects

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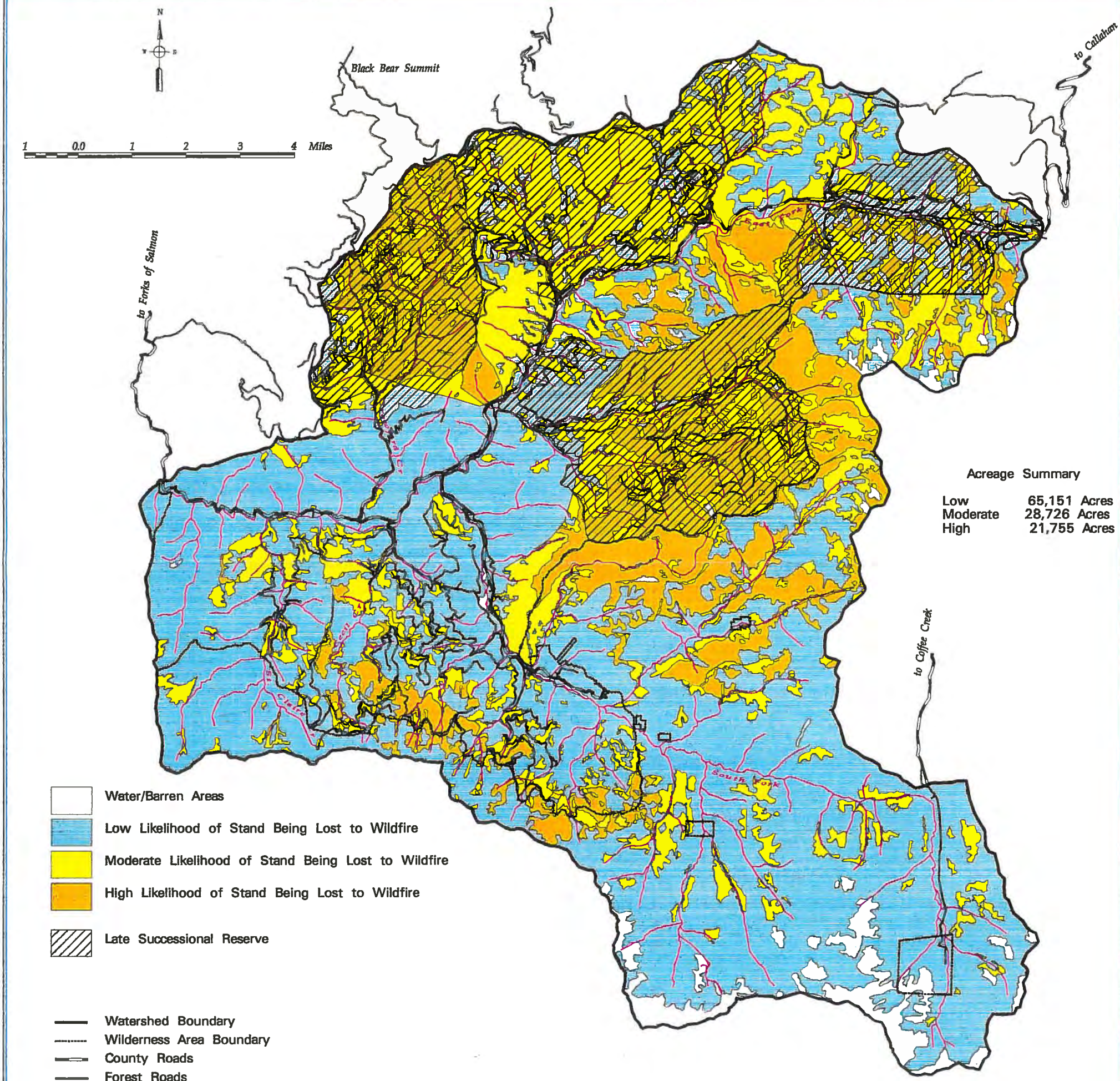
DEPARTMENT OF AGRICULTURE

Klamath National Forest



Acreage Summary

Low	65,151 Acres
Moderate	28,726 Acres
High	21,755 Acres

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Figure 30

Upper South Fork Watershed
LMP Final Preferred Alternative

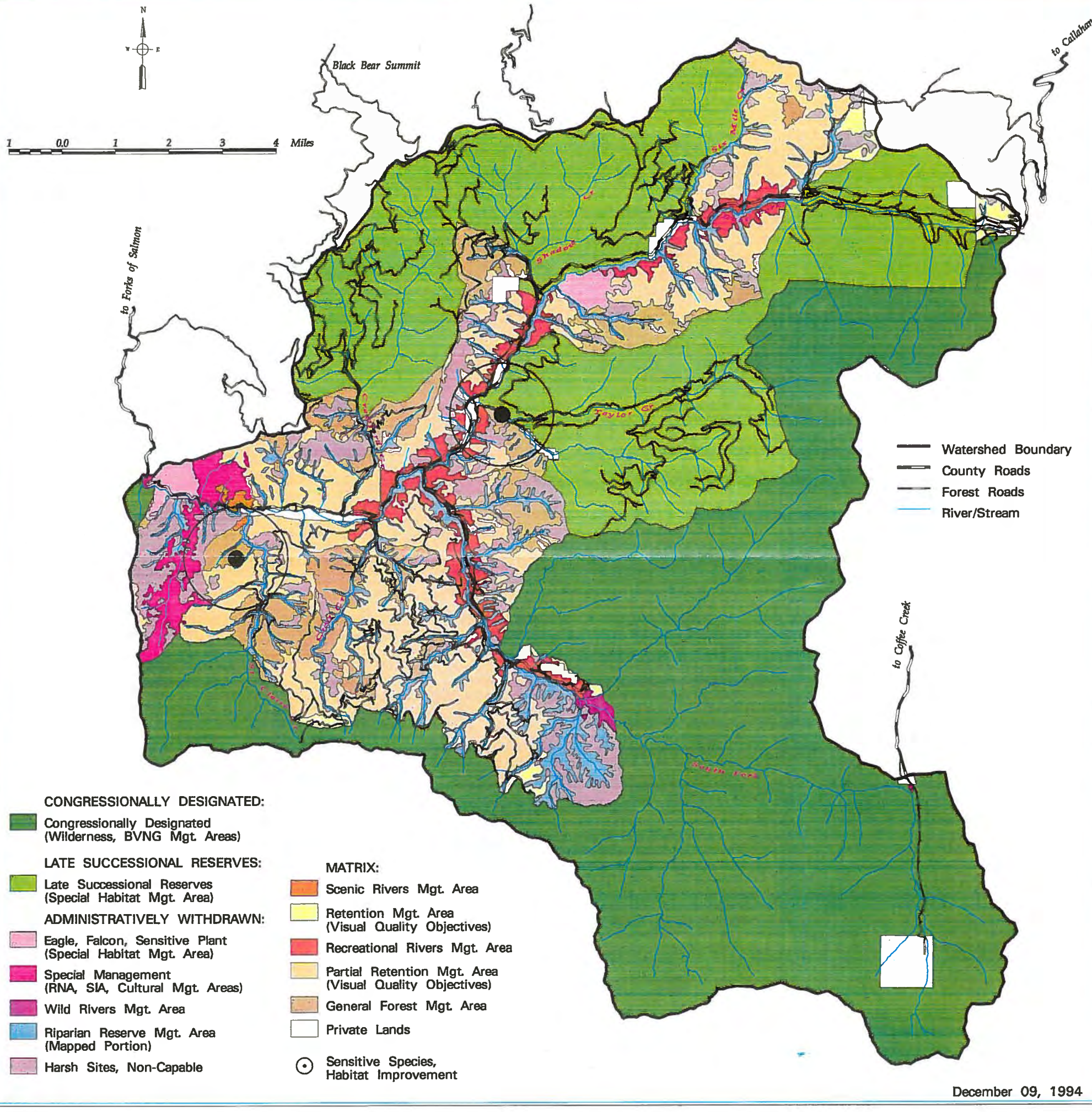

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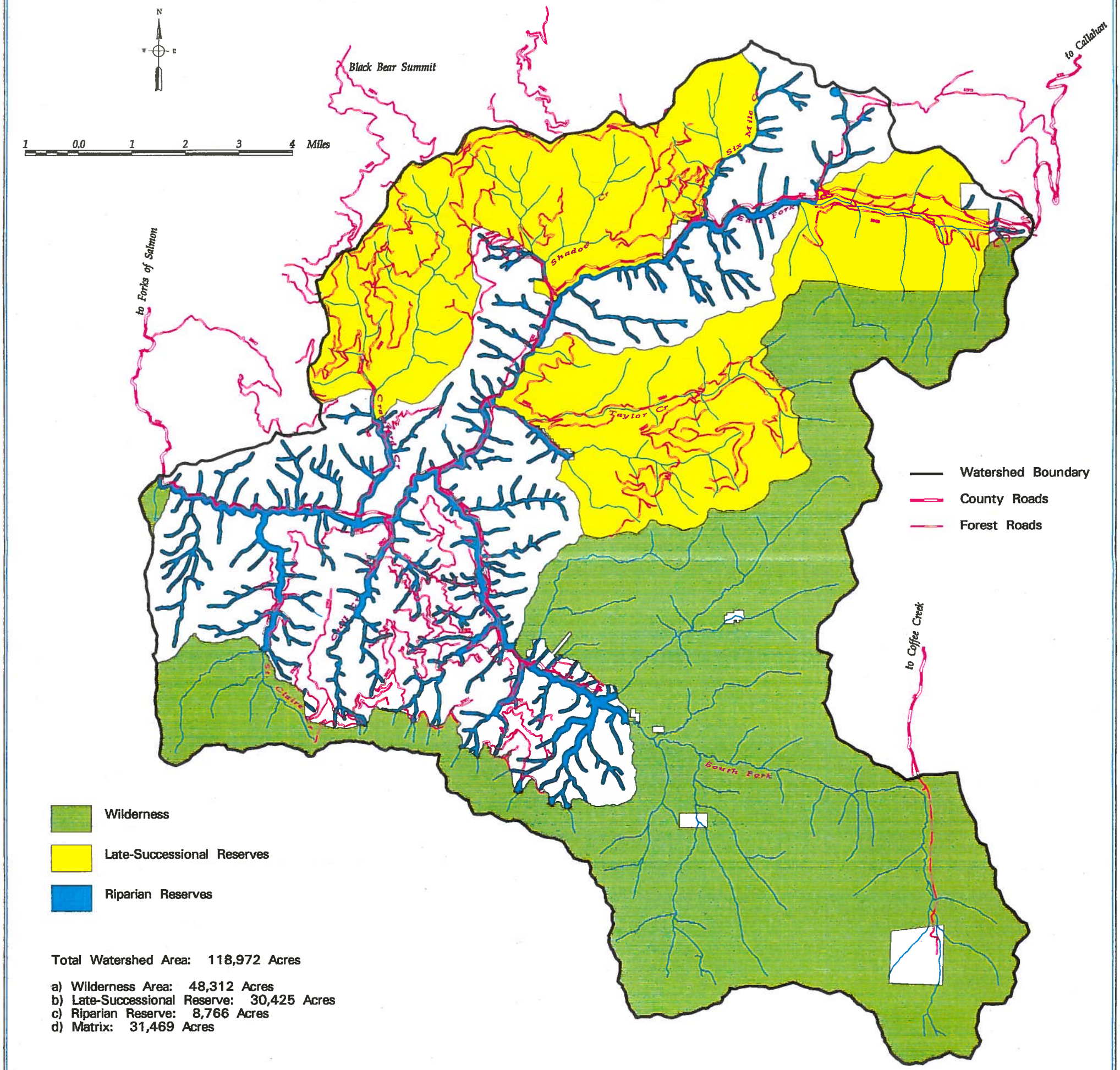
Figure 32

Upper South Fork Watershed

Option 9 Reserves



Total Watershed Area: 118,972 Acres

a) Wilderness Area: 48,312 Acres
b) Late-Successional Reserve: 30,425 Acres
c) Riparian Reserve: 8,766 Acres
d) Matrix: 31,469 Acres

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Figure 33

Upper South Fork Watershed Management Opportunities (1 of 2)

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Klamath National Forest

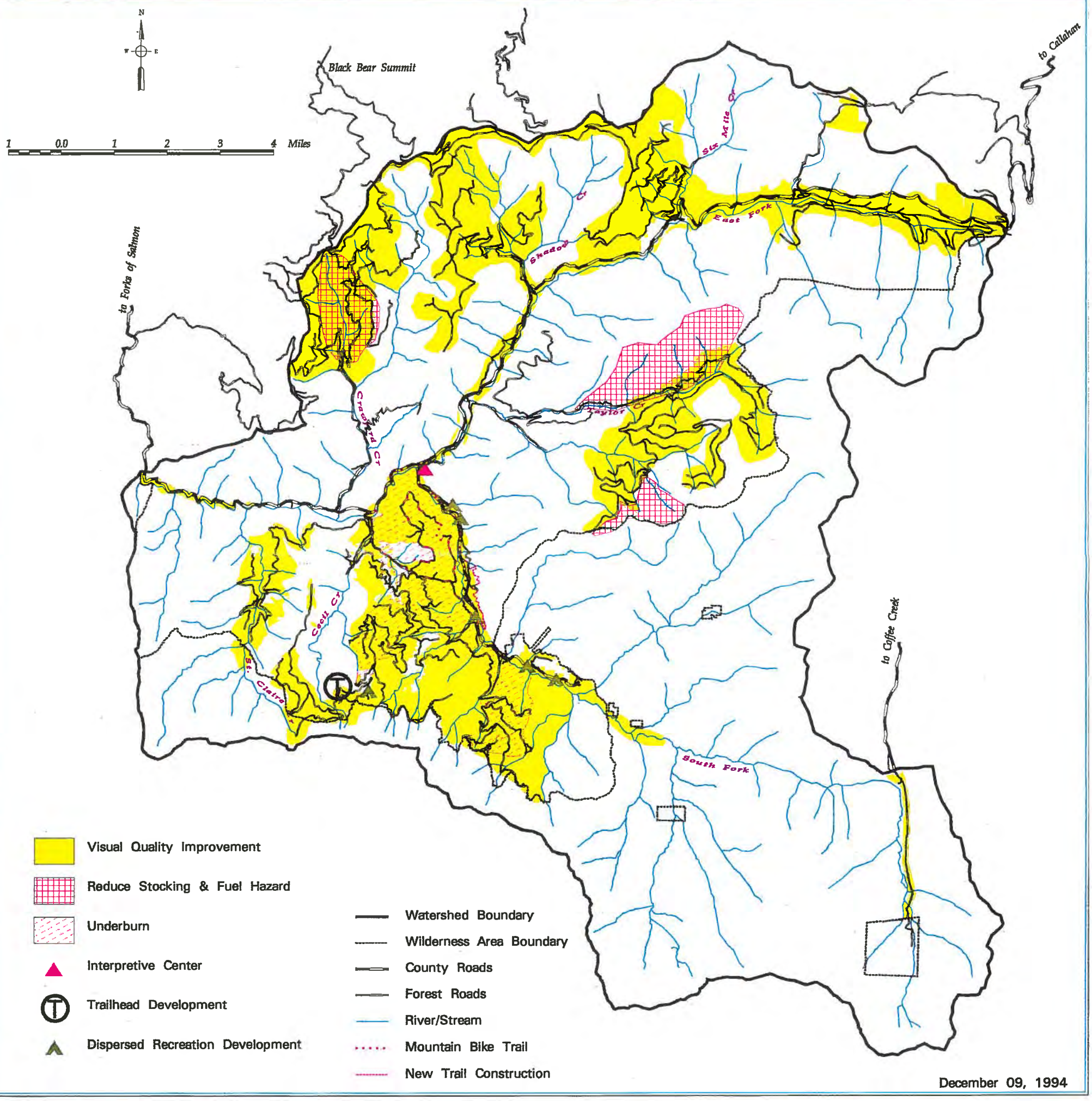

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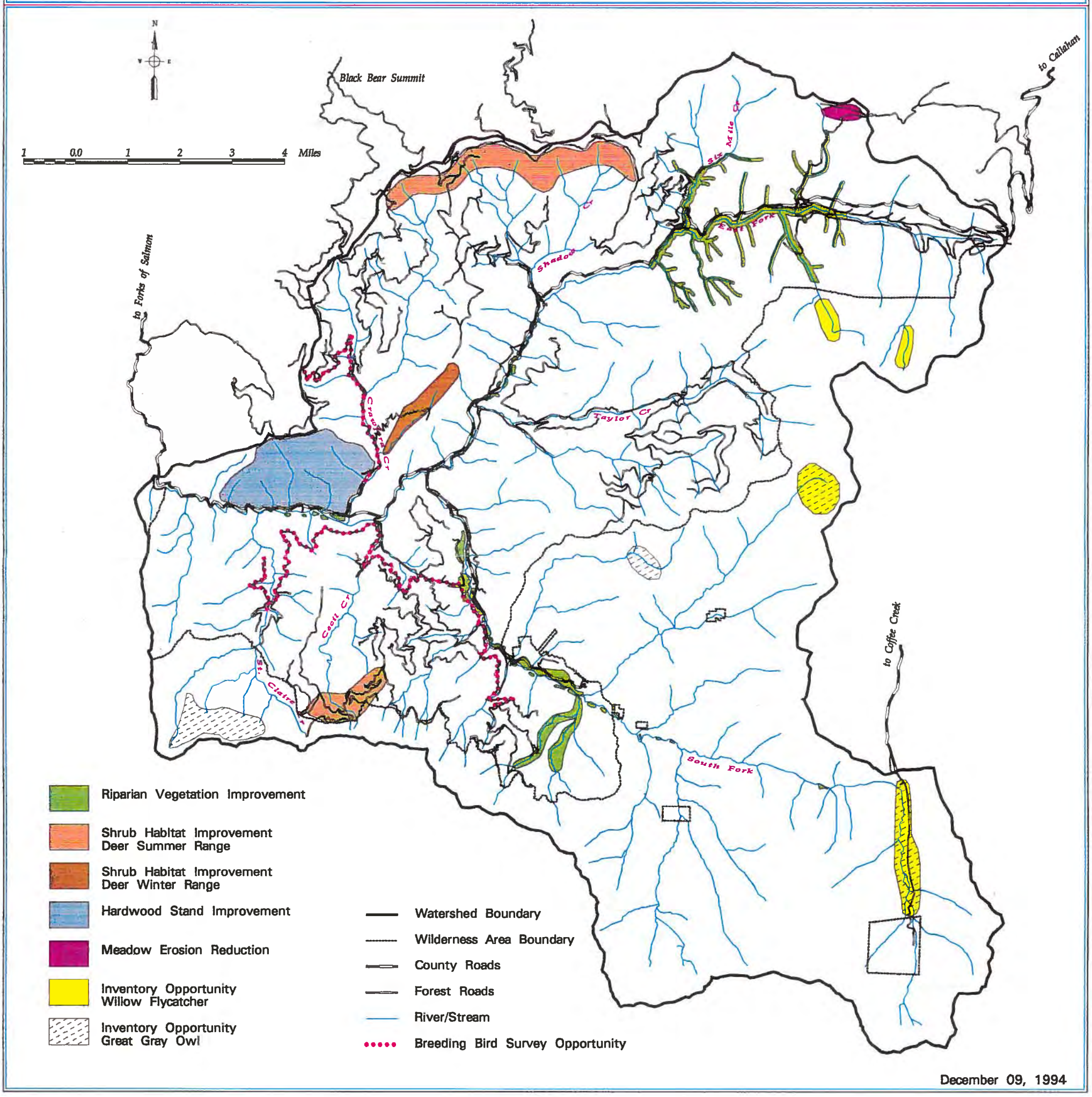
Figure 34

Upper South Fork Watershed
Management Opportunities (2 of 2)

Klamath National Forest



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