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Main Salmon

Ecosystem Analysis

Acknowledgements

MAIN SALMON ECOSYSTEM ANALYSIS

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US Bureau of Reclamation
US Fish & Wildlife Service
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Summary

INTRODUCTION

The Main Salmon Ecosystem Analysis report documents the efforts of the Klamath National Forest, and others, to assess and describe biological and social resources information for a portion of the Salmon River watershed. The report provides an integrated understanding of the processes and functions operating within the analysis area.

In accordance with the *Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (ROD)*, ecosystem analysis (a.k.a. watershed analysis) is required in Key Watersheds, in roadless areas of Non-Key Watersheds, and Riparian Reserves prior to the implementation of activities which may affect these areas. In 1993, the Klamath National Forest began conducting "landscape analysis" across the forest as part of its ecosystem approach to management. A merging of the two processes has occurred, resulting in an analysis which equally emphasizes human/social, terrestrial, and aquatic resources.

The analysis included five steps: 1) a summary of important historical events, 2) a description of important watershed features, 3) assessment of processes and functions, 4) incorporation of draft Forest planning direction and desired condition, and 5) identification of management opportunities.

THE ANALYSIS AREA

The Main Salmon analysis area occupies about 69,400 acres of mostly National Forest Land (it includes 500 acres of private land) in the southwestern portion of Siskiyou County. It occurs within the western portion of the Klamath planning and analysis province and Klamath hydrologic basin (see Figure 1 - Klamath Basin Vicinity Map located at the end of this section). The analysis area is part of the Salmon River Key Watershed, designated for the protection of anadromous salmon and steelhead runs.

A primary feature within the analysis area is a 20-mile long stretch of the Salmon River, which runs from Forks of the Salmon to the Klamath River. The topography is very steep with mountains rising to high elevations on both sides of the low elevation river canyon. Elevation ranges from 500 feet to 7,000 feet above sea level. The physical elements of rock, soil, and geomorphic terranes play a major role in the terrestrial and aquatic ecosystems. The majority of the area is represented by four primary vegetative series, including Douglas-fir, tanoak, white fir, and red fir. Large fires have affected a significant portion of the analysis area over the last 25 years.

The analysis area supports important biological and human resources. The watershed contains at-risk fish stocks, including spring and fall run chinook salmon; fall, winter and summer run steelhead, and coho salmon. Summer and winter run steelhead have been proposed for listing as threatened under the Federal Endangered Species Act (ESA). The other anadromous fish stocks have been petitioned for listing. The area is occupied by peregrine falcons, Northern spotted owls, and wintering bald eagles, all of which are listed as Threatened or Endangered under the ESA. The area is of tremendous importance to the Karuk American Indian Tribe, due to its historical and contemporary significance. The area offers popular recreation opportunities, particularly, river rafting and kayaking. Lastly, the area provides commodity resources, including timber and special forest products.

KEY FEATURES AND INDICATORS

Key features and indicators were identified for the analysis area. Features and indicators are physical and biological components or social values associated with the area. They were grouped as either Human/Social, Terrestrial, or Aquatic. Over 60 questions related to these key features and indicators were developed, from several sources, and became the focus of the analysis.

As the analysis progressed, several features and indicators emerged as being most important for the Main Salmon analysis area:

- American Indian Uses and Spiritual Values
- Past, Current, and Future Fire Regime
- Distribution of Late Seral Vegetation
- Fish Habitat as Affected By the Sediment Regime

The following summarizes some of the main points of the analysis, related to the features and indicators listed above.

American Indian Uses and Spiritual Values
The Karuk American Indian Tribe believes that the Main Salmon watershed is one of the most culturally significant watersheds within the Klamath National Forest.

Many places within the watershed have been and continue to be important ceremonial sites for the Karuk Tribe.

Future trends are assumed to see increases in American Indian uses within the watershed. As relationships develop from the government to government agreements between the Karuk American Indian Tribe and the Klamath National Forest, it is anticipated that the tribe will be more involved in the management activities of the Forest as it relates to this watershed.

Past, Current, and Future Fire Regime
The past fire regime (i.e., mid-1800s) was one of frequent (1-25 year) intervals, having predominantly low and moderate intensity fires.

Through fire suppression, there has been a shift in the fire regime to one of less frequent (25-100 years), but generally more intense fires.

Current vegetative patterns have been influenced by fire suppression.

An assessment of fire behavior potential for the watershed reveals that 57% of the area is in a high fire behavior potential. This condition presents a risk of not meeting many of the desired conditions within the watershed.

Distribution of Late Seral Forest Habitat
An assessment of the distribution of mature and late seral forested habitats within the analysis area show that the largest and most contiguous stands occur within Somes, Monte, Duncan, and Butler Creeks.

Approximately 40% of the 3,800 acres of mapped Late-Successional Reserve (LSR) within the analysis area are forested by mature and late seral forest. The LSRs are capable of sustaining a greater proportion of mature and late seral forest.

Fish habitat and Sediment Regime
The quality of fish and riparian species habitat in Crapo Creek and an upper reach of Nordheimer Creek, has been degraded by large inputs of sediment, partly as a result of past fires and management activities. Forty percent of geomorphic terrane within the analysis area is composed of inner gorge, granitic mountain slope, and debris basin. These geomorphic types have the potential to produce large levels of sediment when disturbed.

Landsliding is currently the primary sediment producing process in the Salmon River watershed.

Based on sediment yield modeling, Crapo Creek and Tom Payne Creek have not recovered from past disturbances. Merrill Creek is considered to be recovered.

MANAGEMENT OPPORTUNITIES
The final step in the analysis process is the development of management opportunities. These opportunities are the result of comparing existing condition with desired condition, as described in the *Draft Klamath National Forest Land and Resources Management Plan*. Information regarding existing condition is drawn directly from the analysis. Forty-six management opportunities were developed for the Main Salmon Analysis Area. The following opportunities developed in response to the main points discussed above, received the highest emphasis rating by the analysis team (see Figure 2 - "Red Flag" Opportunities Map located at the end of this section).

--Work with the Karuk Tribe to define an area for ceremonial burning on Offield Mountain. Develop strategies to reduce fire intensity and to contain fire within the defined area.

--Assess stand and fuels conditions. As per Forest direction, develop and implement fuels and vegetation management plans to reduce the likelihood of stand replacing fire. Specific areas highlighted for this opportunity include the Off Fire area and portions of Nordheimer Creek which were burned by the Hog Fire.

--Continue the fire prevention program along the Salmon River corridor. Areas identified on the Risk/ Fire Behavior Potential Map as being in a Very High Likelihood of being lost to a wildfire need to be treated and reduced to a lower fire likelihood.

--In areas most prone to large levels of sediment production, maintain vegetative condition and fuel levels that will lessen the effects of high intensity fires. Stabilize roads and/or landings on Yellow Jacket Ridge. Avoid short term disturbance to landslide on 11N21D road. The intent is to improve habitat conditions for anadromous fish and riparian associated species.

--Stabilize landslides along the Monte Creek and Horn Creek Gap Roads. Survey and explore any other slide areas for stabilization. Conduct geologic investigations of Crapo Creek and Horn Creek road systems.

Other management opportunities developed from this analysis include, but are not limited to: promote the development of late seral forest habitats within LSRs, control stocking in dense stands, develop a sustainable timber program, develop and improve facilities along the Salmon River corridor, and develop a fire management plan for the wilderness.

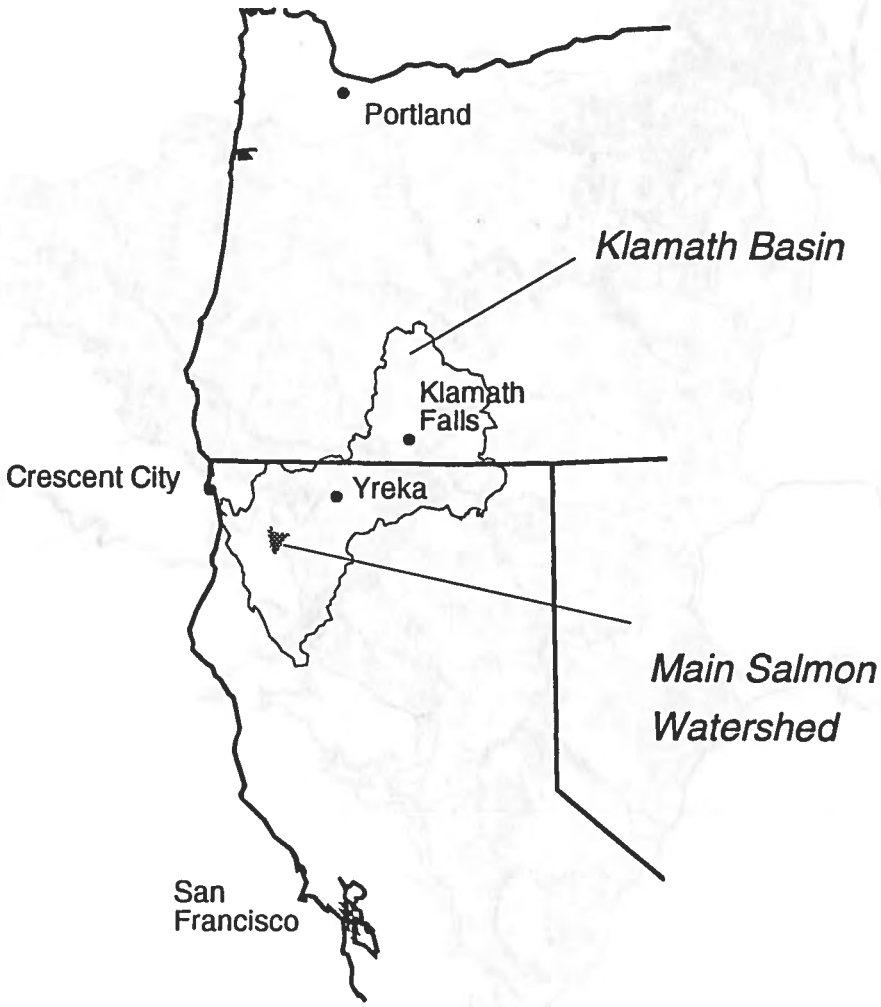
NEXT STEPS

Ecosystem analysis is an iterative process. As additional information is collected, it will be used to update the analysis report. Several management opportunities highlighted the need for additional information.

This analysis will be used to support future project planning and implementation. It will provide the basis for the Purpose and Need for future site specific projects. It will also provide resource information against which to gauge the potential effects of proposed projects.

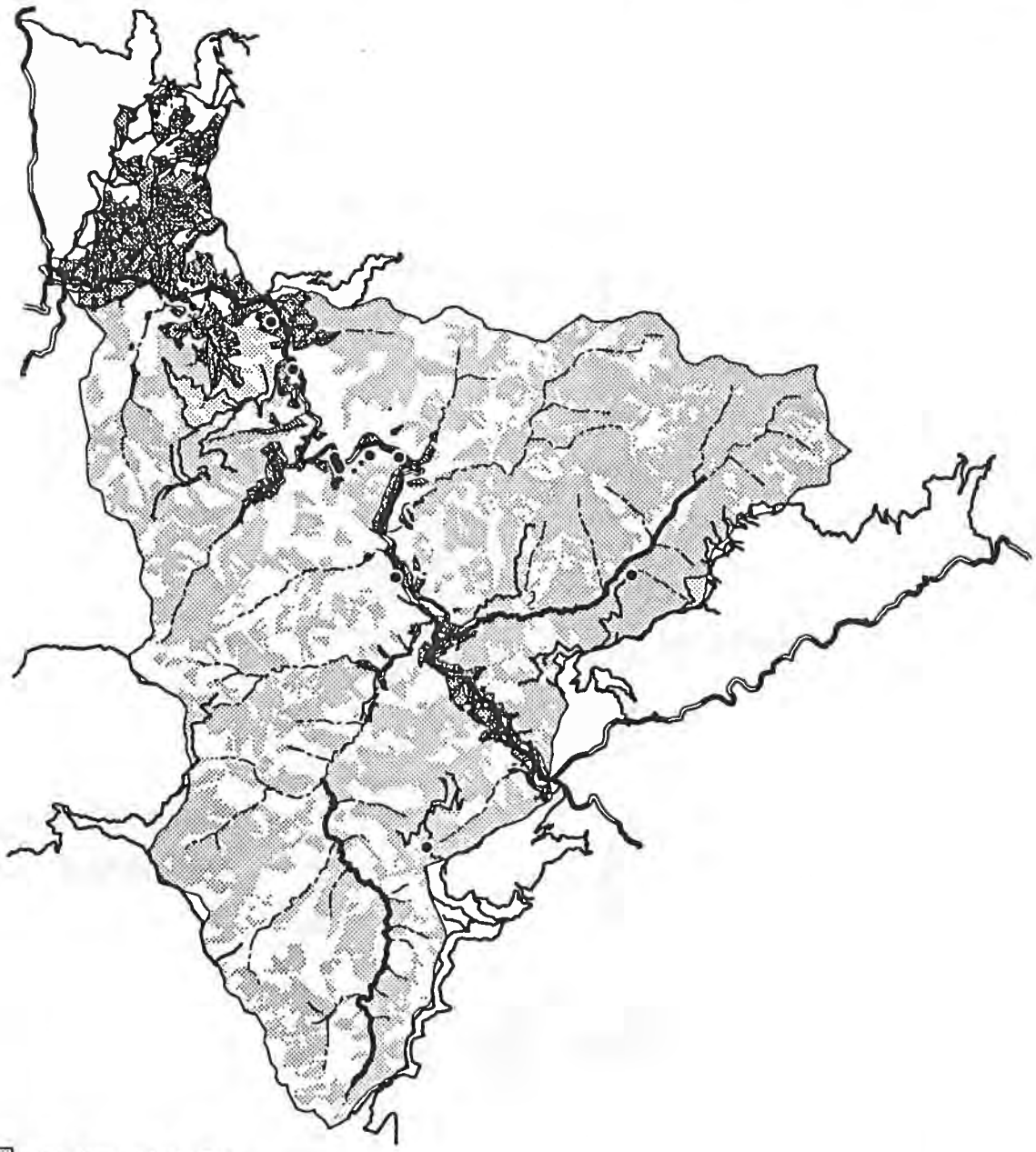
Figure 1 - Klamath Vicinity Basin Map

Klamath Basin Vicinity



· Figure 2 - Red Flag Opportunities Map

Main Salmon Watershed
"Red Flag" Opportunities



Reduce High Fire Behavior Potential (#15)

Reduce Number of Starts In High Fire Risk/Fire Behavior Potential Areas (#16)

Reduce Sediment Inputs to Streams (#32)

Stabilize Active Landslides (#33)

0 3 Miles

5/31/95 - x

Introduction

DESCRIPTION

The Main Salmon analysis area occupies about 69,400 acres in the southwestern portion of Siskiyou County, California. It occurs within the western portions of the Klamath planning and analysis province and Klamath hydrologic basin (see Figure 3 - Main Salmon Watershed vicinity map located at the end of this section). The Main Salmon forms the lower reaches of the Salmon River, a tributary to the Klamath River. The analysis area includes all of the drainages of the Salmon River exclusive of the North Fork, South Fork, and Wooley Creek. The North and South Fork Salmon River join to form the Salmon River at Forks of the Salmon on the east boundary of the analysis area. Wooley Creek joins the Salmon River from the north about five river-miles upstream of the junction of the Salmon and Klamath Rivers. The west boundary is the watershed divide between the Salmon River and other Klamath River tributaries, the north boundary the divide with Wooley Creek, and the northeast boundary the divide with the North Fork Salmon River. The southeast boundary is the divide with the South Fork Salmon River and the south boundary is the divide with the Trinity River.

The analysis area is rugged and mountainous with the Salmon River canyon running west and north through the center of the area and high mountains on both sides of the river. The elevation along the river ranges from about 500 feet at the mouth to 1,200 feet at the Forks. The highest elevations are 6,900 feet at Chimney Rock on the north boundary and 7,000 feet at Salmon Mountain on the south boundary. Most of the streams in this landscape flow through narrow canyons with steep walls and inner gorges.

Forks of Salmon is located at the eastern portion of the analysis area. It serves as a hub of a community for the central portion of the Salmon River area. Oak Bottom Administrative Site is located within the analysis area on the western portion and provides housing for Ukonom Ranger District employees. The small community of Somes Bar is located at the very north eastern portion of the analysis area. Orleans, the largest town adjacent to the analysis area, lies approximately four miles to the west, along the Klamath River.

A majority of the land is within the Klamath National Forest and is under National Forest administration. Approximately 490 acres of privately owned small parcels are scattered throughout the watershed. Designated wilderness makes up about 8,000 acres of the analysis area, occurring within the Trinity Alps Wilderness in the southwestern portion of the watershed, and within the Marble Mountain Wilderness in the northeastern portion.

The analysis area supports many important biological and human resources. Main Salmon is within the Salmon River watershed, a key watershed as identified by Johnson et al (1991). The watershed contains spring and fall run chinook salmon, fall, winter and summer run steelhead, and coho salmon; all have been petitioned for listing under the Federal Endangered Species Act (ESA). The Klamath Mountain Province Evolutionarily Significant Unit of Steelhead, both summer run and winter run, have been proposed for threatened status. The area is occupied by peregrine falcons, Northern spotted owls, and during the winter, bald eagles; all are listed as Threatened or Endangered under ESA. From a recreation standpoint, Salmon River draws rafters and kayakers nationwide. From an historical and contemporary perspective, the area is of great importance to the Karuk Tribe.

WATERSHED ANALYSIS OVERVIEW

Watershed analysis is required in Key Watersheds, for roadless areas in non-Key Watersheds, and Riparian Reserves. Watershed analysis is ecosystem analysis at the watershed scale; it is both an analysis and information gathering process. The purpose of watershed analysis is to provide a means by which the watershed can be understood as an ecological system and to develop and document an understanding of the processes and interactions occurring in a watershed. This analysis focuses on specific features, indicators, and uses within the watershed. They are assessed in terms of biological, physical, and social importance.

Some of these aspects may include beneficial uses, vegetative patterns and distribution, wind, fire, important wildlife species, migration routes, dispersal habitat, human use patterns, the importance of vegetative corridors streams, and riparian corridors. The analysis also includes an identification of management opportunities which will provide background for the development of management decisions in the future.

The analysis process is also used as a vehicle for implementation of Forest planning direction. It is an intermediate analysis between land management planning and project planning. It is purely an analysis step and does not involve National Environmental Policy Act (NEPA) decisions. It provides a means of refining the desired condition of the watershed, given the Goals and Objectives, Management Areas, and Standards and Guidelines from the *Draft Forest Land and Resource Management Plan (LMP)*, current policy, and other applicable State and Federal regulations.

The proposed *LMP* has been updated to reflect direction contained in the *Record of Decision (ROD)* for the *Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl*. There are ten different Management Areas contained within the analysis area. In order of descending proportion, they are Interim Riparian Reserve, Partial Retention, General Forest, Wilderness, Late-Successional Reserve, Recreational River, Retention, Threatened/ Endangered/ Sensitive Species, Scenic River, and Special Management (RNA, SIA, Cultural) Areas. In addition, approximately 19,700 acres are currently administratively withdrawn from timber harvest because they are harsh sites or contain isolated timber stands.

PROCESS AND DOCUMENT ORGANIZATION

The analysis was conducted by a core Forest analysis team and an expanded team of District resource specialists. During the entire analysis phase, public participation and Federal Agency involvement was encouraged; members of the Karuk Tribe were consulted regarding portions of the analysis. General notices were sent regarding public meetings (one at Orleans, two at Forks of Salmon), a newsletter was mailed midway through the process, and draft chapters were circulated to representatives from other Federal Agencies, including Environmental Protection Agency, National Marine Fisheries Service, and United States Fish and Wildlife Service (USFWS). Comments on the draft document were received from USFWS, reviewed by the analysis team and incorporated as deemed appropriate. Two public close-out meetings were held in April; one at Orleans, the other at Forks of Salmon.

There are five chapters in this analysis:

1-Historical Summary
2-Existing Watershed Features
3-Watershed Processes and Functions
4-Management Direction
5-Management Opportunities

Chapter 1 summarizes the **historical aspect** of the watershed. It is a general discussion of human settlement and the associated affects to the watershed up to the current time. It also discusses natural events that have had impacts to the watershed over time. Topics that are discussed include, but are not limited to historical American Indian use, other historical human uses, major floods and fires, and past management activities.

Chapter 2 describes the **existing watershed features**. The description highlights the important existing **biological, physical**, and **human** features of the watershed. Discussions pertain to what the important features are and where they are located.

Chapter 3 identifies the **important functions** and **processes** within the watershed. Descriptions include **past, present**, and **future trends** for the identified human/social, terrestrial, and aquatic functions and processes. It describes the interactions between the various functions and processes and identifies linkages to other watersheds.

Chapter 4 refines the **goals** and **objectives** of the **Draft LMP.** Management direction from the proposed plan is applied at the watershed level, and is further refined based on what is known about the watershed as a result of the analysis. A refined desired condition is described for each of the management areas within the watershed.

Chapter 5 describes **management opportunities** necessary to achieve or maintain the desired condition. The difference between existing condition and desired condition equals the opportunities. The opportunities link directly to the information about the existing condition of the watershed

which is uncovered through the analysis. They highlight the "red flags"; the resources or conditions which need attention. Opportunities are expressed in general terms; they identify **what needs to be done** and **why**, but **not how**. This chapter ultimately provides the **purpose and need** for implementation of individual projects designed to achieve desired condition.

In addition to the five chapters, a *Summary* is provided to highlight the main findings of the analysis, followed by the *Introduction* and then *Key Features, Indicators, and Questions*. Appendices A through M are included in support of information and findings contained within the analysis and are as follows:

A-Attachment to Key Features and Indicators
B-List of Analysis Area Maps
C-Survey and Manage Species
D-Transportatoin System Interactions
E-Special Forest Products
F-Risk/Fire Behavior Potential Analysis
G-Northern Spotted Owl & Marbled Murrelet Habitat Description
H-Spotted Owl Habitat Assessment
I-Fish Habitat Data
J-LMP Feedback
K-Visual Quality Improvement Opportunities
L-Fuels Treatment & Fire Opportunities
M-Monitoring

RELATIONSHIP TO OTHER ANALYSES AND PLANNING

As stated previously, this level of analysis occurs between land management plan and project level analyses. More detailed analysis is necessary for NEPA sufficiency, therefore individual project analyses will focus on site specific issues and their potential environmental effects.

NATIONAL HIERARCHICAL FRAMEWORK

The USDA Forest Service has instituted a National Hierarchical Framework of ecological units. This framework is used to classify land based on combinations of physical and vegetative factors. Use of the national framework allows the Forest Service to maintain 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 analysis area falls entirely within the Klamath Mountains Section of this hierarchy.

KEY FEATURES, INDICATORS, QUESTIONS

The following is a summary of the key features, indicators, and questions identified for the Main Salmon Watershed. Three categories have been identified; Human/Social Dimensions, Terrestrial Ecosystem Health, and Aquatic Ecosystem Health. Key features and indicators were identified by the ecosystem analysis team and through interagency and public scoping. Key questions focus on each feature and/or indicator. A complete list of key features, indicators, and questions follow this section.

Important human/social features and indicators identified include American Indian uses and values, recreation, commodity oriented uses, and private landowner uses. Key questions developed pertain to past, current, and expected future trends of human use, the relationship between various human uses and terrestrial/aquatic features and processes, and social values related to the watershed.

Terrestrial features and indicators identified for the analysis area include climate, rock and soil types, fire regime, vegetative composition, roadless areas, and terrestrial wildlife species. Aquatic features and indicators identified for the analysis area include climate, rock/geomorphic/soil types, sediment regime, instream characteristics, channel components, instream habitat characteristics, riparian habitat characteristics, fire regime, fish and riparian associated species, unique riparian habitats, and transportation system. Key questions were identified regarding past, present, and probable future condition of terrestrial and aquatic features, indicators, and processes. Several questions pertain to the relationship between various features and processes.

INFORMATION AND DATA SOURCES

Data and information used in this analysis have come from several different sources. The set of Klamath National Forest Planning Map Layers was the source for the following GIS layers which were used during the process: **Watershed Layer** with analysis area and sub-watersheds delineated, **Geologic Layer** with rock types and geomorphic terranes, **Digital Elevation** data,**Precipitation Layer, Ecological Unit Inventory Layer** which included soils, potential natural vegetation, and existing vegetation, **Fire Layer**, which included past fire perimeters, starts, and intensity, **Stream Layer** with watercourses delineated to approximate the

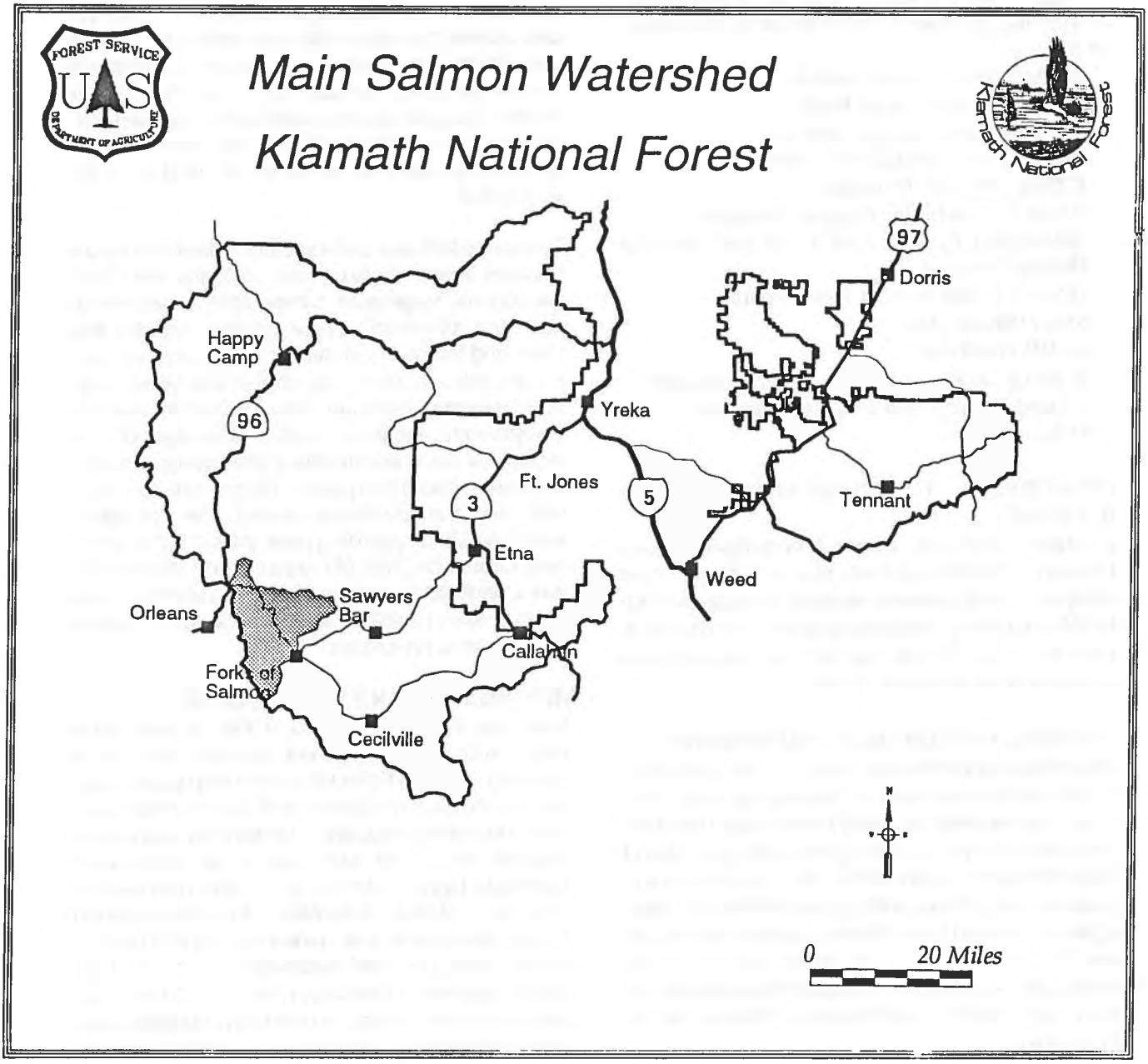
extent of annual scour, **Land Allocations** from the *Draft LMP*, and **Roads Layer**. From these data layers information such as fire hazard, soil erosion hazard, and interim riparian reserve boundaries were derived.

Additional (non-GIS) sources of information were incorporated into the analysis. Stream surveys and fisheries habitat typing data was available for some streams within the analysis area. Other information was obtained from Forest planning documents, aerial photo interpretation, county museum records, published reports and papers, and through personal communications.

AN ITERATIVE PROCESS

Watershed analysis will be an on-going process. The initial analysis report will serve as a foundation onto which new information will be added in the future. In addition, the analysis process will continue to be refined as new methods and strategies are developed and applied.

Figure 3 - Main Salmon Watershed



Key Features and Indicators

The following key features and indicators were developed by the watershed analysis team for the Main Salmon Watershed. Sources for these indicators and features include published studies, environmental assessments, public meetings, and personal knowledge of the watershed team and Local Interagency Team. The key features and indicators are identified in three categories, **Human/ Social Dimensions, Terrestrial Ecosystem,** and **Aquatic Ecosystem.**

A brief narrative will highlight important considerations for each category; the primary emphasis will be to focus the analysis on the most important aspects of each one. Key features and indicators for each category will be listed. Refer to Appendix A - Attachment to Key Features and Indicators for further information.

Key questions will be identified for each key feature and indicator within each category. Some key questions will deal with descriptions of existing conditions, while others include data manipulation and analysis. Notations following each key question describe where in the report the response to the question is located.

HUMAN/SOCIAL DIMENSIONS

Important considerations that need to be addressed within the analysis for this category include:

- A historical perspective of human settlement or changes of human-use patterns within the watershed
- The identification of important physical, emotional, mental, spiritual, social, cultural, and economic well-being of people and communities
- A discussion of human demands from the watershed, both consumptive and non-consumptive
- A discussion of human values and perceptions for the watershed
- A discussion of human interactions within the watershed

Important features and indicators needing to be addressed are:

- American Indian
  - Traditional Uses
  - Current Uses
  - Spiritual Values
- Recreational (dispersed and developed)
  - Camping
  - Wilderness Access
  - Hiking
  - River Use
  - Woodcutting
  - Fishing
  - Hunting
  - Gold Panning
  - Mushroom Gathering
  - Sightseeing
  - Special Forest Products
  - Transportation System (roads and trails)
- Commodity Oriented
  - Timber Harvesting
  - Grazing
  - Mining/Dredging
  - Whitewater Rafting Guides
  - Watershed Restoration
  - Jobs
  - Law Enforcement
  - Current Transportation System
  - Special Forest Products
- Private Landowners
  - Current Transportation System
  - Water Use
  - Communities/Residences
  - Utility Corridors
  - Law Enforcement

Key questions are:

1- What is the traditional and current American Indian cultural significance of the landscape?

Chapter 2, Human Elements; Chapter 3, Human and Social Dimensions, American Indian Considerations.

2- What are the most important traditional and current natural resource uses by American Indians within the landscape and how can those resources be sustained or enhanced?

Chapter 3, Human and Social Dimensions, American Indian Considerations; Chapter 5.

3- How do current land management practices affect traditional uses and values?

Chapter 3, Human and Social Dimensions, American Indian Considerations.

4- What may be learned from aboriginal land management practices and how can the landscape benefit from such practices?

Chapter 3, Human and Social Dimensions, American Indian Considerations.

5- What are the historical human uses within the watershed?

Chapter 1, American Indian Uses through Transportation and Timber Harvest; Chapter 3, Human and Social Dimensions.

6- What is the current management direction for human uses within the watershed?

Chapter 4.

7- What is the current recreation use and what is its relationship to other resources?

Chapter 2, Human Elements.

8- What are the expected trends for recreation within the analysis area?

Chapter 3, Human and Social Dimensions, Recreation Uses.

9- What are the viewsheds and their associated sensitivity?

Chapter 5, Management Area 15.

10- What are the Wild and Scenic River values for the landscape and what are the outstanding and remarkable values associated with their designation?

Chapter 5, Management Areas 12 and 13.

11- What is condition of the the current transportation system and what is its relationship with human uses?

Chapter 2, Human Elements; Chapter 3, Human and Social Dimensions, Commodity Oriented Uses.

12- What is the economic relationship between the local economy and the watershed?

Chapter 3, Human and Social Dimensions, Recreation Uses through Commodity and Private Land Owners Uses/Values.

13- What are the commodity outputs that can be provided from the watershed?

Chapter 3, Human and Social Dimensions, Commodity Uses; Chapter 5.

14- Where are current domestic water intakes?

Chapter 3, Human and Social Dimensions, Private Land Owners Uses/Values; Aquatic Ecosystem, Human Uses.

15- Where did historic hydraulic mining occur? Where are the active mining/dredging claims within the watershed?

Chapter 2, Human Elements; Chapter 3, Human and Social Dimensions, Commodity Uses.

16- What special forest products are available within the analysis area and what is the predicted trend in use and demand for these products?

Chapter 3, Human and Social Dimensions, Recreation Uses and Commodity Uses.

17- What is the importance of unroaded areas (in particular Released Roadless areas) to human uses?

Chapter 3, Human and Social Dimensions.

18- What benefiting function do the residents within the watershed provide?

Chapter 3, Human and Social Dimensions, Private Land Owners Uses/Values.

19-What is the direction of the Klamath National Forest regarding the use of herbicides and how might it affect management decisions within this analysis area?

Chapter 4, Forest Wide Direction.

TERRESTRIAL ECOSYSTEM

Important considerations that need to be addressed within the analysis for this category include:

- A discussion of important vegetative characteristics and patterns
- The existing resiliency to disturbances, both natural and human-caused (fire, landslide, etc.)
- A discussion of the biological and physical processes and functions that are present or are important for sustaining terrestrial plant and animal

species within the watershed; just as important are those processes and functions and current conditions that allow for movement in and out of the analysis watershed.

Important features and indicators that need to be addressed for the Main Salmon watershed analysis.

- Climate
- Current Rock and Soil Types
- Past, Current, and Future Fire Regime
- Past, Current, and Future Vegetative Composition, Structures and Patterns
- Terrestrial Wildlife Species:
  - T, E, & S Species
  - Management Indicator Species (MIS) important in watershed
  - Older Seral Stage Forest Associated Species
- RARE II and Released Roadless Areas
  - Transportation System

Key questions are:

1- Where are the current rock and geomorphic types located within the watershed?
Chapter 2, Geologic Elements.

2- What are the current soil types within the watershed?
Chapter 2, Geologic Elements.

3- What is the general condition of the seral stages found within the watershed?
Chapter 2, Vegetation.

4- Are there some problem areas in terms of insect and disease epidemics within the watershed?
Chapter 3, Terrestrial Ecosystem, Insects and Diseases.

5- What is the historic fire occurrence and the timing of historic events?
Chapter 1, Fires; Chapter 3, Terrestrial Ecosystem , Fire Regime.

6- What has been the effect of suppression on fuel types and patterns, fire occurrence, fire intensity, fire sizes, and fire timing.
Chapter 3, Terrestrial Ecosystem, Fire Regime.

7- What is the current geomorphic terrane and vegetative pattern within the Main Salmon watershed and how does it relate to the featured wildlife species (T, E, & S; MIS, late seral forest associates)? Aspects to discuss include the use and relative importance of various vegetative communities, seral stages, and management areas, and possible barriers to movement or dispersal.
Chapter 2, Geologic Elements; Chapter 3, Terrestrial Ecosystem, Geomorphic Influences and, Wildlife Species and Habitat

8- Where do important flora and fauna species currently exist within the watershed? What areas have been inventoried and to what level?
Chapter 2, Wildlife and Existing Vegetation

9- What is the affect of the current fire regime on the habitats of featured species? How does this compare with the affects of a historical fire regime and what are the implications with regards to maintenance of habitats in the future?
Chapter 3, Terrestrial Ecosystem, Wildlife Species and Habitats

10- How do past and present human uses affect components of the terrestrial ecosystem?
Chapter 2, Terrestrial Ecosystem, Human Uses

11- What kind of habitat attributes provide habitat for the featured wildlife species?
Chapter 3, Terrestrial Ecosystem, Wildlife Species and Habitats

12- What is the importance of unroaded areas to terrestrial features and indicators?
Chapter 3, Terrestrial Ecosystem, Wildlife Species and Habitats

13- What and where are opportunities to enhance or maintain certain habitat elements?
Chapter 5

Additionally, the U.S. Fish and Wildlife Service requested specific questions pertaining to T & E species and amphibians be addressed in the analysis. Those questions are found in Appendix A - Attachment to Key Features and Indicators.

AQUATIC ECOSYSTEM

Important considerations that need to be addressed within the analysis for this category include:

- A discussion of biological and physical processes and functions that are important to sustaining aquatic species and a resilient aquatic ecosystem (instream, riparian, and upslope).

- Vegetative characteristics that are important to the riparian reserve function within the watershed.
- A discussion of disturbance factors that may be important in terms of sustaining aquatic species and a resilient aquatic ecosystem.

Important features and indicators that need to be addressed for the Main Salmon Watershed Analysis.

CLIMATE REGIME

- Rock, Geomorphic, and Soil Types

Includes assessment of disturbance classes within each terrane type (fire, harvest, road, undisturbed)

- Sediment Regime
  - Surface Erosion
  - Landsliding
  - Channel Erosion
- Instream Characteristics
  - Stream Power Index
- Channel Components
  - Channel Width and Depth
  - Streamflow Velocity
  - Riparian Vegetation
  - Channel Morphology
  - Substrate Composition
  - Stream Flow Regime (peak and low)
- Instream Habitat Characteristics (for spawning and rearing)
  - Water Temperature
  - Water Chemistry
  - Pool Frequency
  - Substrate Composition
  - Coarse Woody Material (CWM)
  - Stream Flow Regime
- Riparian Habitat Characteristics:
  - Past, Current, and Future Vegetative Structures and Patterns
  - Stream Shading
  - Woody Debris Characteristics
- Past, Present, and Future Fire Regime
- Fisheries
  - Salmonid Species (including non-anadromous forms)
  - Sturgeon, shad, lamprey and other species
- Riparian associated species:
  - Western Pond Turtle
  - Riparian Associated Species Identified in President's Plan FSEIS
- Unique Riparian Habitats
  - Lakes and Sag Ponds
- Transportation System

Key questions are:

1- What is the past and current climate regime?
Chapter 1, Recent Climate and Flooding; Chapter 3, Terrestrial Ecosystem, Climate; Aquatic Ecosystem, Climate

2- What and where are the current rock types located within the watershed?
Chapter 2, Geologic Elements

3- What and where are the current soil types within the watershed?
Chapter 2, Geologic Elements

4- What are the past, current, and predicted future sediment rates related to roads, harvest, and natural events?
Chapter 3, Aquatic Ecosystem, Sediment

5- What is the current fire regimes effect on sediment and stream flow as compared to the historical fire regime?
Chapter 3, Aquatic Ecosystem, Upslope Processes

6- What are the stream substrates and how are they affected by sediment routing?
Chapter 3, Aquatic Ecosystem, Sediment

7- What is the character, timing, and distribution of peak and low flows in the watershed?
Chapter 3, Aquatic Ecosystem, Stream Flow

8- What is the historical recovery rate following large floods events?
Chapter 3, Aquatic Ecosystem, Riparian Vegetation

9- What are the effects of the upper Salmon River on the main Salmon River?
Chapter 3, Aquatic Ecosystem, Stream Flow

10- What is the current riparian vegetative pattern and condition for the Main Salmon watershed?
Chapter 2, Vegetation; Chapter 3, Aquatic Ecosystem, Riparian Vegetation

11- What and where are the featured aquatic and riparian organisms within the watershed? What areas have been inventoried and to what level?

Chapter 2, Fish and Riparian Associated Species; Chapter 3, Aquatic Ecosystem, Aquatic and Riparian Dependent Species Habitat

12- What are the current instream and riparian habitat conditions within the watershed and how does this relate to use by the featured fish and riparian associated species?

Chapter 3, Aquatic Ecosystem, Riparian Vegetation

13- Are there any unique riparian habitat features; i.e., sag ponds, dry lakes?

Chapter 2

14- What is the affect of the current fire regime on the habitats of the featured species? How does this compare the affects of a historical fire regime and what are the implications with regards to the maintenance of habitats in the future?

Chapter 3, Aquatic Ecosystem, Upslope Processes

15- What are the potential instream and riparian habitat conditions within the watershed, given the characteristics of the substrates and the historical and current disturbance factors? What are the desired habitat conditions and attributes for the featured fish and riparian associated species and how do they compare with potential conditions?

Chapter 3, Aquatic Ecosystem, Aquatic and Riparian Dependent Species Habitat

16- What factors are related to maintaining the highest quality habitat?

Chapter 3, Aquatic Ecosystem, Aquatic and Riparian Dependent Species Habitat

17- How do past and present human uses affect components of the aquatic ecosystem?

Chapter 3, Aquatic Ecosystem, Human Uses

18- What criteria should be considered in delineating the widths of Riparian Reserves?

Chapter 4, Management Area 10

19- What can be done to enhance or maintain certain habitat elements?

Chapter 5

20- What conditions are needed within this subbasin to maintain habitat for at-risk stocks of salmon so that they may be available to adjacent subbasins?

Chapter 3, Aquatic Elements, Aquatic and Riparian Dependent Species Habitat

21- Given the current condition of the subwatershed (i.e., Main Salmon) and the reasonably foreseeable events, will this area continue to provide for at-risk stocks of salmon within this subbasin and for adjacent sub-basins?

Chapter 3, Aquatic Ecosystem, Aquatic and Riparian Dependent Species Habitat

CHAPTER 1
Historical Summary

INTRODUCTION

This chapter discusses the geologic, climatic, biologic, and human history of the area; the intent is to highlight important events and transitions which occurred in the analysis area that effect current and future conditions, not give a comprehensive history of the area.

GEOLOGIC HISTORY

The Klamath Mountains Geologic Province is comprised of four rock belts made up of Mezozoic and Paleozoic rocks that form an eastward dipping structure. These belts are youngest in the west and become progressively older toward the east, ranging in age from 150 to 400 million years. These belts, from west-to-east are, the Western Jurassic belt, the Western Triassic and Paleozoic belt, the Central Metamorphic belt, and the Eastern Klamath belt. Each belt is a complex collection of collapsed back-arc and fore-arc-basins and island arcs attached to the North American Continent during a subduction event that drove the material below the continental rocks.

The material making up the island-arc complexes, carried by crustal movement, were sediments such as limestone, shale, mudstone, and chert. The subduction process caused the descending rock to melt, forming large bodies of granite. The motion of crustal plates that thrust each belt over one another brought peridotite, a rock rich in iron and magnesium, from deep within the mantle of the earth to the surface. Motion from the thrust faulting increased temperatures and pressures, metamorphosing the peridotite into talc-rich serpentine. The edges of each plate are separated from one another by serpentenite. This array of geologic processes also allowed fluids from the mantle to rise toward the surface along fractures in the overlying rock. These fluids often carried gold and other precious metals, depositing them in rocks near the surface. These processes, ongoing throughout the mid-to-late Paleozoic Era, were complete by the end of the Mesozoic Era, about 70 million years before the present.

During the early Cenozoic Era, the Main Salmon area emerged from the sea to a tropical climate. Over the next 68 million years the climate fluctuated, but in general grew cooler and drier. During this time the area experienced several periods of uplift resulting in the formation of oversteepened mountains drained by rapidly flowing rivers and streams. Extended periods of erosion reduced these mountains to a more subdued topography. This subdued landscape, in conjunction with the warm, drier climate facilitated weathering of the bedrock, forming lateritic soils such as those found today in the Amazon basin.

Recent studies indicate that by the middle of the Eocene Epoch (about 50 million years ago) the ancestral Klamath River had established its westward flow across the Klamath Mountains to the Pacific Ocean. It is likely that the Salmon River developed its direction of flow at the same time.

Events of the Pleistocene and Holocene Epochs, beginning about two million years ago, had a pronounced effect on the landscape within the Mainstem area of the Salmon River. The subdued terrain existing at that time was uplifted about 3,000 feet, forming the modern mountain range. During this uplift, streams and rivers cut deeply into the gentle terrain underlain by bedrock made soft by previous weathering, with inner gorge topography forming at the bottom of the stream and river valleys. Slump and earthflow landslides developed in the western portion of the analysis area. The landslide formation was facilitated by the humid conditions, deeply weathered and sheared bedrock, oversteepening of hill slopes, and periodic earthquakes from continued crustal movement on the coast. Sediment generated from these landslides typically had a high silt and clay content. Periodic influxes of sediment were introduced to the stream system and temporarily deposited in streams throughout the area, causing the streams to become choked with sediment. Subsequent flooding moved the sediment through the system to the Pacific Ocean. Evidence of the downcutting and rapid uplift may be observed on

the valley walls where ancient river terraces have been preserved. These terraces occur up to 600 feet above the present river level.

Slump and earthflow landslides developed in the western portion of the Main Salmon area. This landslide formation was facilitated by the humid conditions, deeply weathered and sheared bedrock, oversteepening of hill slopes and associated downcutting of streams brought about the rapid uplift rates, and periodic earthquakes from continued crustal motion on the coast. Though generally inactive under present climatic conditions, these landslides often exhibit local active areas.

During the Pleistocene Epoch, the climate fluctuated wildly, relative to the previous 68 million years. The colder temperatures resulted in several glacial episodes, while the intervals between the glaciations experienced a climate similar to todays. At higher elevations near the headwaters of tributaries to the Mainstem of the Salmon River, the bedrock was scoured and soil redeposited by the glaciers. This scouring produced the geomorphic features of cirques, U-shaped valleys, and morraines found in the headwaters of Nordheimer, Butler, Somes, Crapo, and Morehouse Creeks.

RECENT CLIMATE AND FLOODING

The average precipitation at Orleans, California, the nearest long-term rain gage to the analysis area, is about 50 inches for the period of record from 1904 to the present.

The precipitation records indicate various dry and wet periods. The time period from 1911 to 1937 was much drier than the long-term average with an average precipitation of 43 inches. From 1938 to 1975 the average precipitation was 54 inches. After 1975, very dry periods have been interspersed with very wet periods lasting a few years with a prolonged dry period from 1985 to the present.

Floods have been a major influence on the condition of streams and rivers in the Salmon River area. Large floods are documented for parts of the Klamath River in 1861, 1864, and 1875. It is likely that the same events affected the Salmon River area. Early explorers documented floods in the 1700s.

Study of the stream flow data from the mouth of the Salmon River ranging from 1912 to the present indicates that major floods occurred in 1953, 1955, 1964, 1970, 1971, 1972, and 1974, with the largest peak flow coming during the 1964 event. In the 1964 flood the daily mean flow reached 100 thousand CFS while the second largest recorded flood in 1955 was about 64 thousand CFS. The rest of the large floods ranged between 40 thousand and 55 thousand CFS.

The floods of 1955, 1964, and 1970 to 1974 are associated with landslide episodes on the Klamath National Forest. Studies of the 1944 air photos show only minor disruptions of the hillslopes and riparian vegetation. Air photos from 1955 (taken prior to the winter flood) show little change. The effects of the 1955 flood are shown on the 1964 air photo flight, flown the summer before the Christmas floods of 1964. The photos show considerable disturbance along the Mainstem, particularly from Nordheimer Creek to the mouth. The mainstem of the Salmon River was dammed by landslide debris from the Murderers Bar Landslide, about five miles up from the mouth of the Salmon River. Approximately 11.6 million cubic yards of earth failed in this event.

An air photo flight showing the aftermath of the 1964 flood shows extensive disruption of riparian vegetation along Nordheimer, Crapo, Butler, and Monte Creeks, as well as the entire reach of the Mainstem of the Salmon River. The river was dammed by the Bloomer Landslide, a bedrock failure, just below Nordheimer Creek. Over two million cubic yards of earth were involved in this river blockage. Private photographs show a massive log and debris dam behind the bridge over Butler Creek, triggering the bridge failure. Monte Creek showed widespread channel scour along its entire length. Monte Creek was again heavily impacted by the storm and runoff events of the early 1970s.

FISHERIES

The salmon population in the Salmon River area were sufficient to supply the primary subsistence food and be the basis for the economy of the indigenous people prior to 1850. After 1850 and the discovery of gold in the area, salmon populations were subject to the additional impacts of miners and mining operations. Near the turn of the century salmon canneries opened at the mouth of the Klamath River and no limits were designated. Three canneries were in operation by 1912 but all closed soon afterwards.

Stocks/species of salmonids that existed at the time of the cannery development included the

spring and fall run chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), and steelhead trout (*O. mykiss*). The stocks/species of salmonids that were commercially fished include both runs of chinook and coho salmon with an incidental catch of steelhead trout. Both runs of chinook salmon and steelhead trout were plentiful in the Salmon River with the spring run of chinook salmon very pronounced. Coho or silver salmon occurred in large numbers within the Klamath River, however the extent of coho entering the Salmon River is not known. By 1931 the Klamath River spring chinook population seemed to have almost entirely disappeared and the depletion of other salmon runs was progressing at an alarming rate (Snyder 1931).

Other fish species which have inhabited the Salmon River include green sturgeon, occasionally seen in the river in spring and early summer, and American shad. Sturgeon are native but shad were introduced into the Sacramento River system from the Atlantic coast in the late 1800s and subsequently spread to the Klamath River system. Both species are seen only in the Salmon River within the analysis area.

Little, if anything, is known about fish habitat conditions prior to the onset of mining operations in the Salmon River. 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.

Within the Salmon River sub-basin there were several historical water diversions and dams which blocked fish migration (Taft and Shapovalov 1935, Handley and Coots 1953). An eleven foot high permanent log dam, the Bennet-Smith Dam, was located approximately four to five miles above the Forks on the South Fork Salmon. The dam was described as a serious migration barrier to salmon and steelhead by California Department of Fish and Game and was destroyed by flood during the last week of October, 1950. The diversion associated with that dam had no screen and may have caused a significant loss of juvenile salmon and steelhead. Bloomer Falls, created by the Bloomer Slide in the 1964 flood, was a partial migration barrier during low flow conditions and was modified by dynamite numerous times between 1965 and 1983.

Artificial propagation of fish began within the Klamath River Basin in 1896. Eggs from the Sacramento River basin were raised to fry and released in the Klamath Basin several times in the early 1900s. A small hatchery was also established at the mouth of the Klamath River in the 1890s with eggs from the Rogue River in Oregon. A hatchery was established below Iron Gate Dam following construction of the dam in 1960. Chinook, steelhead, and some coho from the Iron Gate hatchery have been released into the Salmon River subbasin several times in the 1970s and 1980s. In 1983 a small hatchery was established on the South Fork Salmon 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. Also, riparian vegetation restoration has occurred on many bars and terraces. The efforts have been met with a variable level of success.

FIRES

Lightning fires influenced vegetative patterns within the analysis area long before human habitation of the area. It is believed that American Indians have been in the area for several thousand years. Documentation of their use of fire in the watershed indicates that they frequently ignited fires. Frequent burning provided optimum conditions for hunting and gathering, for visibility, access, and safety.

Prior to the establishment of the Forest Reserves, wildfire suppression efforts focused on protecting farms and towns in the county. An 1880 Forestry report indicated there were fires every year; generally attributed to human ignitions. Fires burned for months or until fall rains extinguished them. It was noted that fires sometimes ran for distances up to ten miles and occasionally three or four fires at a

time could be seen after August 1. Little attention was paid to them unless farms were endangered.

Fire suppression efforts on forest lands began once the Klamath Forest Reserve was established in 1905. Early records (R. W. Bower 1978) indicate that around 1910 the Forest Service experienced problems with human-caused fires. This was attributed to cultural burning, forage improvement, carelessness, and people hoping to get employment in fire suppression.

The Main Salmon area was specifically noted as having a higher human-caused ignition rate. This was during a period when the Forest Service began regulating land use practices such as grazing and timber harvest. Records indicate that locals were angry, as forest lands had always been used without restriction. The increase in human-caused fires was seen as retaliation for curtailing their use of public land. An effective fire suppression program was not established in this area until about 1920.

Fire history data for the analysis area from 1922 to 1993 shows 265 fire starts. From 1930 to 1945 only five fires were greater than ten acres totaling just over 900 acres. Between 1946 and 1972 there were no fires greater than ten acres. Since 1973 three fires have had a significant effect on the landscape; the Off Fire burned about 9,000 acres in the Merrill Creek area near the mouth of the Salmon River in 1973, the Hog Fire in 1977 burned over 39,000 acres (57%) of the analysis area on both sides of the river in the Crapo Creek and Nordheimer Creek areas and outside the analysis area along the North and South Forks of the Salmon River, and the Yellow Fire in 1987 burned over 23,000 acres (33%) of the analysis area again in the Crapo Creek area and along the North Fork Salmon River outside the analysis area (see Figure 4 - Fire History Map located in the Map Packet at the end of this document).

WILDLIFE

Wildlife species believed to have occurred in the analysis area in greater numbers than today include the beaver, porcupine, bald eagle, osprey, peregrine falcon, and possibly wolverine. Historical accounts and paleontological records indicate the presence of grizzly bear and timber wolves into this century. These species were extirpated by bounty hunting and habitat loss. Bounty hunting and trapping early in the 20th century probably reduced the numbers of mountain lion, bobcat, coyote, fisher, marten, and black bear, but these species are no longer rare. Beavers were essentially trapped out in the last century, but are now found in limited numbers along the mainstem of the Salmon River.

Meat and market hunting from 1850 to 1905 wiped out the Roosevelt elk and greatly reduced deer numbers. Miners shot deer year-round for meat and hides and altered deer range by logging, burning, grazing, and clearing. Some of these changes ultimately benefited the deer, but the immediate effect of settlement was a marked decrease in deer numbers. Elk were reintroduced in the vicinity in the late 1980s and deer numbers have recovered well in the recent past although possibly not as high as they were during the last century. Placer mining, pesticide contamination and over-fishing reduced numbers of bald eagles, osprey, and peregrine falcons, but these species are currently recovering.

AMERICAN INDIAN USES

American Indians have lived in the Klamath and Salmon River corridors for several thousand years. Nearly all the terraces next to the Salmon River experienced some level of human habitation through time. Thoroughfares have historically followed winding river sides or steep cross country routes.

The Karuk Tribe utilized most settings west of the Nordheimer drainage. A smaller band called the Konomihu Tribe once inhabited eastern settings. Territorial definition by these two groups shifted and changed somewhat through time. The New River Shasta, Wintu, and Hupa Tribes may have frequented higher elevations along the southern boundary to trade with the Karuk and Konomihu.

The local hunter-gatherer societies relied on an "acorn-salmon" economy. Acorns gathered from tanoaks along with other forest foods were effectively processed and stored. Salmon were very important to cultural life ways; deer and small game were also important. Villages were located near the most important food source areas near rivers. Gathering occurred within recognized tribal territories, further defined by village or family owned areas. Residence often shifted to upland camps in the summer and fall where a variety of plant and animal resources were gathered.

Particular land configurations were in essence "religious sanctuaries". Within the Main Salmon analysis area are significant settings associated with the manifestation and origin of cultural beliefs. These same settings continue to be extremely important in regulating traditional use today.

MINING AND SETTLEMENT

In the early 1800s the region was explored by Jedediah Smith and the Hudson Bay Company's traders. Major Pierson B. Reading found gold in the area in 1849. News of the discovery of gold triggered a substantial immigration to the region in the summer of 1850. In the 1850s there were very active mining camps at the Forks of the Salmon, Bestville, and Sawyers Bar (Gudde 1975). Information on the local miner populations from 1850 to 1880 is sketchy but is estimated between 600 and 1,200. Chinese accounted for a large portion of the miners from 1860 to 1880. By the 1920s mining declined significantly and rural life was reduced to a core of established families. Mining activity increased slightly during the depression years and continues to contribute to the local economy to a limited degree.

Mining included placer-hydraulic and hardrock practices. Most of the activity centered around or near the Salmon River corridor and in the Nordheimer drainage. Hydraulic mining created heavy disturbance near the Forks of the Salmon and Nordheimer and Crapo drainages; mines were also near Merrill Creek, Oak Bottom, and Butler Flat.

The Forks of the Salmon and Somes Bar are small communities in the analysis area. Old Somes Bar was once located one mile east of the mouth of the Salmon River and had a small store, hotel-residence, and post office. The community eventually relocated west to the Klamath River where Somes Bar is currently located. In 1860 Forks of the Salmon was a small thriving community with two stores, post office, a hotel, and residences.

GRAZING

Livestock use in the area is know to have occurred since 1886 when local Salmon River packers utilized forage in the area for their pack strings. Cattle grazing began in 1888, prior to establishment of the National Forest. In 1893 the first recorded use was by Jenner and Roberts who ran cattle in the higher elevation meadows including Crapo Meadows, Morehouse Meadows, and other small meadows on the north side of the analysis area.

The Forest Service issued permits for 375 head in 1905 in the Little North Fork Allotment area, which includes the Crapo Meadows area. The allotment covered a larger area than that which is in the analysis area. There was no restricted season-of-use until 1925; prior to this time the season-of-use was dictated by weather conditions and available livestock feed in the valley ranches. The season was set in 1925 from July 1 through October 31. This was later modified to July 15 through October 15. Early records indicate that the unrestricted season contributed to range resource damage. Actual animal use has been permitted for 250 cows and calves since the 1950s. In 1982 the Little North Fork Allotment was modified to include a large area that had burned in the Hog Fire of 1977. Livestock numbers remained at 250 pairs, however the increased area was intended to achieve better livestock distribution and forage utilization inside the wilderness by distributing part of the herd into the transitory forage within the burn. Additional areas in the Crapo Creek drainage and on the south side of Yellowjacket Ridge, outside of the analysis area, have been utilized following the 1987 fires which produced additional livestock forage opportunities.

PUBLIC LAND MANAGEMENT

The Forest Reserve (later the Forest Service), established the Klamath National Forest in 1905 through the provisions of the *Organic Act of 1897*. Early management emphasized fire suppression, trail work, and road improvement to rural communities. Starting in the 1960s, timber harvest became an increasingly important activity on National Forest lands within the analysis area. Land management was to be in compliance with the *Multiple-Use/sustained Yield Act of 1960* and the *National Forest Management Act (NFMA) of 1976*. *NFMA* established a process for managing National Forests including developing Forest Plans. In 1994 the *Record of Decision for the Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl* was signed. This decision established Late-Successional Reserves and Riparian Reserves and is incorporated into the *Draft Forest Land and Resource Management Plan* for the Klamath National Forest, near completion.

Other acts of Congress also influenced management within the analysis area. The *Wilderness Act of 1964* created the Marble Mountain Wilderness,

partially within the analysis area. In 1977 the Forest Service started a second Roadless Area Review and Evaluation (RARE II) to determine other areas which meet the criteria for wilderness. In 1984 the *California Wilderness Act* was passed which designated some of the RARE II lands as wilderness, including additions to the Trinity Alps and the Marble Mountains within the analysis area, and officially released the remaining RARE II lands to multiple use management. However, management such as timber harvest within the released RARE II lands remains controversial due to the continued roadless nature of many of the areas.

The Salmon River within the analysis area was designated by the Secretary of the Interior as a component of the National Wild and Scenic Rivers system in 1981. The river was designated because of its anadromous fisheries values and has scenic and recreational segments. Currently the Wild and Scenic River boundary is one-quarter mile on each side of the river but the boundary will be refined to become more manageable though about the same size with the completion of the *LMP*.

TRANSPORTATION AND TIMBER HARVEST

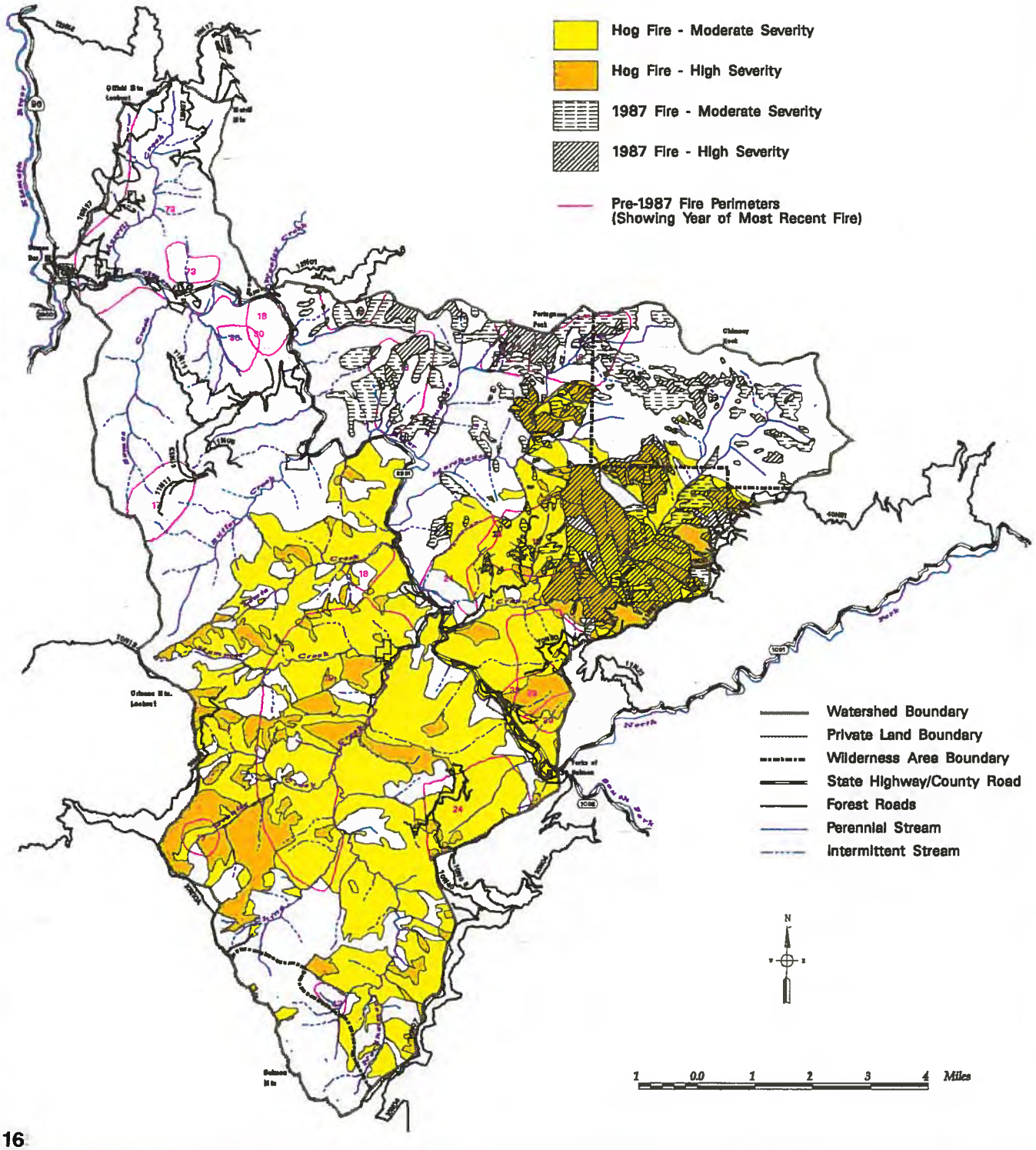
Foot, mule, or horse was the normal method of travel over early historic trails with some rough wagon roads. More substantial road development did not take place until the Works Progress Administration projects were underway in the 1930s.

The area's main access road adjacent to the Salmon River was established in the early 1920s; reconstruction in the early 1980s included widening and surfacing. The majority of the other roads were constructed from the early '60s to the early '80s, typically previous to green timber sales, or to access fire salvage timber. The road system in the Merrill Creek area was built to its present form in response to the Off Fire. The Yellow Jacket Ridge road system and roads into the Nordheimer drainage were built following the Hog Fire. The Monte Creek and Steinacher Creek road systems were built in the early '60s to early '70s to access areas for timber harvest.

Prior to the early 1960s timber harvest was done only on a small scale within the analysis area; on private lands and in conjunction with mining operations. In the 1960s timber harvest on a larger scale started along the Monte Creek road system. However, most timber harvest in the analysis area was done following large fires; the Off Fire Salvage in the mid-'70s, Hog Fire Salvage in Crapo and Nordheimer Creeks in the late '70s and early '80s, and Yellow Fire Salvage in the late 1980s.

Figure 4 Historic Large Fires

Main Salmon Watershed Fire History



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CHAPTER 2

Existing Watershed Features

INTRODUCTION

This chapter describes the elements found in the Main Salmon watershed (see Figure 5 - Main Salmon Watershed Base Map contained in the Map Packet at the end of this document). Elements are basic physical components of the watershed; geology, soils, streams, vegetation, roads and trails, campgrounds, communities, etc., which provide the structure for processes to work within, on, and through the ecosystem. Identification of watershed elements and their arrangement is fundamental to the analysis.

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

GEOLOGIC ELEMENTS

The basic physical elements; rock, geomorphic terranes, and soil, play a major role in function. The major rock types found in the watershed are described in the following narrative; see Figure 6 - Geomorphic Terranes Map located in the Map Packet at the end of this document for location of rock types.

ROCK TYPES

Rocks of the Western Jurassic plate are represented by schists and meta-sediments of the Galice formation (Jg). They comprise about 800 acres, or one percent of the analysis area.

The mildly metamorphosed assemblage of the Rattlesnake Creek Terrane include an ophiolitic melange of serpentenite, gabbro, volcanically derived sediments, and limestone (sch). The minor amounts of the Rattlesnake Creek Terrane underlie about 300 acres, or one-half a percent.

The Western Triassic and Paleozoic plate is made up of rocks of the Rattlesnake Creek Terrane that have been thrust faulted over rocks of the Hayfork Terrane, both terranes being members of the same plate. These rocks are volcanic and oceanic sediments that have been intruded by granites, diorites, and gabbros of the English Peak, and Wooley Creek Batholiths and the Orleans Mountain, the Salmon Mountain, and Forks of Salmon Plutons (Mzg, Mzgbb, Mzd). These granitic rocks underlie about 19,400 acres, or 28% of the Main Salmon area.

The rocks of the Hayfork Terrane made up of meta-andesite, argillite, and chert-argillite breccia, make up the preponderance of the analysis area, underlying about 47,600 acres, or 69% (ms, MzPz, mvs, mv).

Minor amounts of peridotite separate the Western Jurrassic plate from the Western Triassic and Paleozoic plate. These ultra-basic rocks define the fault trace of the Orleans Thrust Fault (um).

GEOMORPHIC TERRANES

A geomorphic terrane is a land type that shares a common set of physical characteristics such as slope gradient, soil type, bedrock type and structure, geomorphic history, and degree of dissection. Due to these similarities, slope hydrology and slope processes are relatively uniform within a geomorphic terrane type. Landslide production within any given type is expected to be similar.

The seven basic geomorphic terranes are: Granitic Mountain Slopes, Non-Granitic Mountain Slopes, Debris Basins, Inner Gorge, Slump/ Earthflow Deposits, Active Slides, and Glacial, Terrace, and Fan Deposits. These seven basic types have been subdivided by rock type, slope gradient, and geomorphic setting into twelve specific geomorphic terrane types, see Figure 6 for location of the specific terranes.

The following is a description of the seven basic geomorphic terranes:

Granitic Mountain Slope - This geomorphic terrane includes types #4 and #5 (approximately 7,700 and 5,000 acres respectively), and occupies about 18% of the analysis area. In areas of high elevation it generally supports a thin soil cover with glacially-exposed rock outcrops common. Topog-

raphy at elevations from 1,000 to 4,000 feet is severely dissected and exhibits a dense network of incised topographic draws with a spacing of 150 to 200 feet. The incised draws typically originate in steep (60-90%) spoon-shaped swales which are revegetated debris slide scars.

At low to mid-elevations (800 to 4,000 feet) most of the terrane exhibits a dense drainage pattern and bedrock is exposed to depths of ten to 30 feet. It is likely that the deep weathering in this elevation zone occurred in association with broad valley floors which existed during the Pleistocene. These valley floors were removed by subsequent erosion, leaving only remnants on present valley walls. Soils in these weathered areas are rich in sand, but poor in coarse gravels, cobbles, silt, and clay; they lack cohesive strength.

Non-Granitic Mountain Slopes - This terrane includes types #6 and #8 (approximately 24,100 and 8,300 acres respectively), and makes up about 47% of the analysis area. This terrane typically produces shallow debris slides, small to moderate in size, on steep slopes. In a few areas, such as the Bloomer Slide in 1964, it produces massive, structurally controlled landslides.

Debris Basins - This corresponds to terrane #12. Debris basins, or headwalls make up about one percent (approximately 400 acres) of the analysis area. Debris basins are amphitheater-shaped, steep basins usually situated at the heads of first order tributary channels. They typically have a thin soil mantle, with rock outcrops common. Slope gradients are typically much greater than 65%. Channels within the basin frequently exhibit a fan-shaped pattern, with the channels coalescing near the bottom of the basin.

Inner Gorge - This terrane includes types #9, #10, and #11 (about 1,300, 3,700, and 9,300 acres respectively), and occupies about 21% of the analysis area. They consist of steep (> 65%) canyon walls along rivers and streams in mountain areas. The upslope boundary is usually marked by a prominent slope break separating the inner gorge from the gentler slopes above. This terrane was formed by the rapid downcutting of streams and rivers in response to the relative uplift during the Holocene Epoch; the last 10,000 years.

Slump/Earthflow Deposits - This includes terrane #2 and #3 (approximately 400 and 4,800 acres respectively), making up about eight percent of the analysis area, and account for a large portion of the natural and management related landslides. Slump and earthflow deposits are irregular and hummocky features, with a more gentle topography than the surrounding unfailed mountain slopes. This geomorphic terrane was formed by rotational, translational, landsliding that occurred in thick residual soils tens to hundreds of thousands of years ago. The deposits consist of soil and rock debris, often with a high clay content. The toe zones, terrane #2, are usually steep (60 to 80%), and overlap with inner gorge terranes.

Active Landslides - Terrane #13 makes up about one percent (about 700 acres) of the analysis area. Typically, this terrane is comprised of areas on a hillslope that show evidence of recent or on-going movement. Typically these indicators are raw, fresh scarps, leaning trees as a response to soil creep or pulse-like movement, and springs or other evidence of a higher than normal groundwater table.

Glacial, Terrace, and Fan Deposits - Terrane #1 occupies about five percent (about 3,500 acres) of the analysis area, and consists of unconsolidated quaternary deposits including a wide variety of soil and earth materials. The alluvial deposits are typically cobbly and sandy, whereas some of the older glacial deposits and terraces may be clay-rich. This variation in particle size results in a variety of slope failure mechanisms. Glacial deposits make up the majority of the terrane, but valley alluvium, fan deposits, and stream terraces are also present.

SOILS

A description of various soil families by basic geomorphic terranes follow:

Granitic Mountain Slope - Soils in this terrane are dominated by Gilligan family, deep (40-60 inches) grayish brown sandy loams. Areas of Chawanakee family, shallow (<20 inches) brown sandy loams occur mostly on south aspects.

The higher elevations are dominated by Gerle family, moderately deep (20-40 inches) very dark grayish brown gravelly sandy loams. Areas of Ledford family, shallow (<20 inches) grayish brown gravelly sandy loams are associated with rock outcrops.

Non-Granitic Mountain Slope - Soils in this terrane are dominated by Clallam family, deep (40-60 inches) grayish brown very gravelly loams and Deadwood family, shallow (<20 inches) grayish brown very gravelly loams. Associated with these soils are rock outcrop and Holland family, very deep (60+ inches) reddish brown clay loams.

The higher elevations are dominated by Jayar family, moderately deep to deep (20-60 inches) brown very gravelly loams and Woodseye family, shallow (<20 inches) dark grayish brown very gravelly loam. Rock outcrop is associated with ridges.

Debris Basins - This terrane type in granitic areas contains Chawanakee family, brown sandy loams occurring with rock outcrop or in the higher elevations, Ledford family, shallow grayish brown gravelly sandy loams occur.

In the non-granitic areas, this terrane type contains Deadwood family, shallow grayish brown very gravelly loams with rock outcrop or in the higher elevations Woodseye family, shallow dark grayish brown very gravelly loams occur.

Inner Gorge - Soils in this terrane type are similar to those found on mountain sideslopes except that more rock outcrop and steeper slopes occur.

Slump/Earthflow Deposits - In the granitic rock type areas, Holland family, very deep reddish brown clay loams and Goldridge family, very deep reddish brown clay loams occur.

In the non-granitic rock type areas, Clallam family, very deep brown gravelly loams and Goldridge family, very deep reddish brown clay loams occur.

Glacial - This terrane type is dominated by Nanny family, very deep dark brown very gravelly sandy loams formed in glacial till. Some areas have very cobbly and stony soils.

Terrace/Alluvial Fans - This terrane type contains Clallam family, very deep brown gravelly sandy loams. Some areas have very cobbly and stony soils.

STREAMS

There are approximately 360 miles of stream within the watershed. Streams have been identified by stream order. Headwater perennial streams are first order; when two first order streams are combined, they form a second order stream; and so forth. The Salmon River is a sixth order stream and is about 20 miles long. There are no fifth order streams in the watershed. The lower four and one-half miles of Nordheimer Creek is the only fourth order stream. There are approximately 17 miles of third order streams. These include portions of Nordheimer Creek, Granite Creek, Crapo Creek, and Morehouse Creek. The remaining streams are either first or second order perennial or intermittent streams.

The Salmon River has been divided into three separate reaches based on stream character. The reaches are the upper Salmon, five miles from Forks of Salmon to Bloomer Falls, middle Salmon, nine miles from Bloomer Falls to Wooley Creek, and lower Salmon, five miles from Wooley Creek to the mouth. The upper and lower reaches of the Salmon River have a stream gradient of about one-half percent, are generally unconfined by bedrock banks, and are dominated by cobble sized substrate. The middle reach has a stream gradient of about one percent, is bedrock confined, and has a stream bed composed mostly of boulders and bedrock. The lower one mile or so of Nordheimer Creek has a gradient of about one and one-half percent in a bedrock confined channel. Nearly all other streams in the watershed have slopes of three percent or greater and contain a variety of substrates.

VEGETATION

PLANT SERIES

Vegetation communities in the analysis area are diverse in terms of species composition and structural features. The vegetation within the coniferous forest is structurally and compositionally variable.

The majority of the area is represented by four primary vegetation series. Series are assemblages of plants that reflect the climatic, soil, and physiographic features of an area. The name of a series is based on a climatic climax species that has indicator value or dominates or has potential to dominate the principal vegetation layer. The dominant series found within the watershed include; tanoak, Douglas-fir, white fir, and red fir. The vegetation within these series have been grouped into four categories; shrub/forb/sapling, pole, mid-mature, and late-mature/old-growth.

The tanoak series is primarily found at elevations below 3,500 feet and on relatively moist, productive soils. Although tanoak is the indicator species used to define the series, the dominant tree species is Douglas-fir. These forests are best envisioned as having a conifer overstory dominated by Douglas-fir, commonly along with sugar pine and occasionally ponderosa pine. Conifers generally grow to great girth and height. Conifer productivity in the range of 6,000 to 9,000 cubic feet per acre are typical.

The canopy understory is diverse, both structurally and compositionally. Tanoak is most common in this understory, but other hardwood species such as madrone, live oak, black oak and chinquapin are also present. Because tanoak is such a shade tolerant species with a great propensity for acorn production, the vegetation of the understory tree layer and shrub layers are often exclusively occupied by tanoak. However, where there is sufficient light and moisture there is often a rich shrub and herb layer. Some important shrubs and herbs found in this series include hazel, iris, five-finger and chain ferns, mock orange, huckleberry, Oregon-grape, *pipsisiwa*, and wild celery.

Within the analysis area, approximately one-half of the tanoak stands were identified as belonging to the tanoak/live oak sub-series. On the available soil moisture gradient these stands would fall at the low end, and thus, be of considerable lower potential productivity. Approximately 16% of the tanoak stands were typed as a member of a highly productive vegetation type. The mean age of late seral stands is 263 years.

The Douglas-fir series is the most common series in the analysis area, accounting for approximately 38% of the identified potential natural vegetation area. It occurs primarily in the upper and middle one-third slope positions between 2,000 and 4,000 feet elevation. It is associated with drier environments with greater extremes of summer high temperatures and winter low temperatures.

The Douglas-fir/live oak sub-series encompasses the vast majority of the forest stands in the Douglas-fir series within the Main Salmon area. This is a reflection of the amount of relatively shallow soils with high rock and gravel content. Conifer productivity in this sub-series generally ranges from 3,000 to 7,500 cubic feet per acre, which equates from very low to moderate.

Many of the shrubs and herbs associated with the tanoak series are also found within this series. However, some of the species associated with the coastal influence found within the tanoak series, such as salal, huckleberry and rhododendron, are rare or absent within the Douglas-fir series. Hardwood species are not as abundant here as in the tanoak series; however, madrone, live oak, black oak and white oak are common. Tanoak may be present, usually in shrub form, but never dominates the hardwood layer. Sites occupied with black oak are some of the more productive sites within the series. Some of the rarer communities are identified by the presence of California bay and incense-cedar, both of which are most often associated with ultramafic soils within this assessment area. The mean age of late seral stands is 248 years.

The white fir series is third in relative abundance within the area. It is predominately found between 3,600 and 5,100 feet elevation. At the lower end of the elevational gradient, white fir may only occupy 20% of the overstory with Douglas-fir being the dominant species. With increased elevation the Douglas-fir will be replaced with white fir and occasional red fir. Sugar pine, ponderosa pine, and incense-cedar are also common components of the conifer overstory.

Most noticeable within this series is the reduction in hardwood cover. Giant chinquapin and dogwood are the hardwood species most commonly encountered. Black oak may be found at the lower end of the elevational gradient on southerly aspects. Overall vascular plant species diversity tends to be high in the white fir series, second only to the Port-Orford-cedar series (Jimerson and Creasy 1991). The more mesic sites often support a diverse and abundant herb layer, including such species as Prince's pine, vanilla leaf, queens cup, anemone, trail plant, and wintergreen species. Fungal diversity is high in this series also (Steiger 1994).

The red fir series represents approximately seven percent of the potential natural vegetation stands mapped in this area. It is found at the highest elevations in the assessment area, from 4,500 to 6,600 feet. Most soils fall into the frigid temperature regime which greatly affects the distribution of the tree species. At lower elevations, white fir is often co-dominant. At the higher elevations or in cold pockets, mountain hemlock is a common asso-

ciate. Sugar pine and ponderosa pine decrease in dominance, whereas western white pine and lodgepole pine increase. Incense-cedar and Brewer's spruce are also found in this series. Cubic volumes can be very high in this series, often in excess of 9,000 cubic feet per acre.

As with the white fir series, shrub and herb diversity can be very high depending upon available moisture and light. Stand age frequency also shifts toward younger-aged stands as found in the white fir series. Mean stand age for late seral stands is 233 years (Jimerson 1994).

The remainder of the assessment area is made up of mixed conifer, live oak, mountain hemlock, Klamath enriched mixed conifer and montane chaparral series. These represent a minor portion within the watershed, but are very significant in terms of contributing to biodiversity. Many rare or endemic plants are located in these uncommon series.

EXISTING VEGETATION

The existing vegetation has been broken down into several seral stages. Seral stage categories used in this analysis include; grass/shrub/forb harvested, grass/shrub/forb natural, pole/early mature natural/harvested, mid-mature, late-mature/old-growth. These seral stages are broken out by conifer or hardwood dominated and riparian vegetation. See Figure 7 - Vegetative Condition Map located in the Map Packet at the end of this document for existing vegetative conditions within the watershed. (Numerous maps depicting vegetative condition of the analysis area were generated; for a complete listing, refer to Appendix B - List of Analysis Area Maps). A brief narrative for each seral stage follows:

HARDWOOD DOMINATED STANDS

Grass/Forb/Shrub - There are currently 9,400 acres in this seral stage (14% of the watershed area). Much of this seral stage contains hardwood seedlings and saplings, young shrub, and a grass/forb component. Conifer seedling are scattered throughout most of the stands. Many of these stands are located on poorer sites (Forest Service Site Class, FSCC 6-7). Many of the stands were created by the wildfires that have occurred over the past two decades. Some of the stands contain large amounts of down fuel.

Pole/Early-Mature - There are currently 7,600 acres in this seral stage (11%). Stands are dominated by hardwoods and brush. Some of the stands are pure tanoak, generally on the better sites. These stands tend to be relatively dense. Canyon live oak and brush are more prevalent on the lower sites. These stands tend to be more open. Fuel loadings in most of these stands is currently light.

Mid-Mature - There are currently 10,650 acres in this seral stage (15%). There are some stands on better sites that contain tanoak as the dominant species. Some black oak and madrone are mixed in. Some conifer species, primarily Douglas-fir are becoming established in these stands. Fuel loadings are increasing. Canyon live oak stands make up the majority of this acreage. These stands are still relatively open, mixed with brush, grass, and scattered conifers. Fuel loadings are still relatively light.

Late-Mature/Old-Growth - There are currently 2,900 acres in this seral stage (four percent). The tanoak portions are seeing an increase in conifers. In many cases the conifers have overtopped the hardwoods. Stands are generally very dense with multiple layers. Fuel loadings, both dead and live, are very high. The canyon live oak stands contain large open grown hardwoods and scattered conifers. Some of the conifers are showing signs of decadence. Brush and grass are still present due to the open nature of the stands. Fuel loadings have increased, especially large down material.

CONIFER DOMINATED STANDS

Grass/Forb/Shrub - There are currently 5,900 acres in this seral stage (nine percent of the watershed area). Much of this seral stage contains a mixture of conifer seedlings and saplings, young hardwoods, grass, and shrub species. Conifers contain a mixture of species, but are generally dominated by Douglas-fir and ponderosa pine. Lesser amounts of sugar pine, incense-cedar, white fir, and red fir are also present. Hardwood species are generally tanoak, black oak, madrone, and lesser amounts of canyon live oak. Common brush species are deer brush, manzanita, and snowbrush. Much of this seral stage was created by the wildfires from the past two decades.

Pole/Early-Mature - There are currently 3,300 acres in this seral stage (five percent). Most of these stands are single layered stands. Stand conditions vary throughout the watershed, but many of them are very heavily stocked. Scattered hard-

woods are present in most of the stands. Brush and grass/forbs are usually shaded out of the denser stands. Species composition is mixed conifer, weighted heavily towards Douglas-fir. Higher elevations are dominated by true fir species. Stagnation of some of the denser stands is beginning to occur.

Mid-Mature - There are currently 15,100 acres in this seral stage (22%). Most of these stands are in the beginning phases of becoming a multi-layered stand. The overstory is generally mixed conifer, dominated by Douglas-fir. Areas of regeneration, primarily Douglas-fir and white fir are becoming established in the stands. Many of the stands are densely stocked, with increased competition for moisture and nutrients. Hardwoods, black oak and madrone, are beginning to disappear from the stands. Tanoak is still prevalent due to its shade tolerance. Fuel loadings, both live and dead, are increasing in the stands.

Late-Mature/Old-Growth - There are currently 14,200 acres in this seral stage (21%). These areas contain a mixture of species. Douglas-fir is the dominant species in the low to mid elevations. Red and white fir dominating at the higher elevations. This seral stage is becoming very multi-layered. Douglas-fir and white fir regeneration has become established under many of the stands. Many of the hardwood species, except tanoak, have disappeared from the stands; decadence is increasing. Fuel loadings, both live and dead, are at very high levels in many of the stands. Shade intolerant conifer species are not reestablishing themselves in these stands.

PLANT SPECIES OF SPECIAL INTEREST

Within the diverse vegetative series exist smaller habitats in such areas or niches as springs, rock outcrops, talus, scree, and within stand layers. These communities contain fungi, lichens, mosses, vascular plants that are relatively rare throughout the watershed. These rarer elements of plant and fungi diversity are addressed through three categories of management. No Federally listed threatened or endangered plants are known to exist in the analysis area.

The first management category is Sensitive; the second is California Native Plant Society list (CNPS) and the third category is the proposed Forest LMP Table 4-3 (derived from the *President's Plan* Survey and Manage List). Each of these lists have different standards and guidelines for level of inventories and management which will be discussed later in *Chapter 4*.

Sensitive plants are determined by the US Forest Service to manage species that are relatively rare in occurrence or facing endangerment so as to conserve genetic diversity and prevent a T&E listing under the *Endangered Species Act*. In addition to the sensitive status designated by the Forest Service, the California Native Plant Society maintains an inventory of rare and endangered plants in California. The CNPS coding addresses rarity, endangerment and distribution elements of plant conservation. Use of the CNPS database and inventory assists the forest in maintaining biological diversity.

Queries were made of the CNPS database and the Forest's sensitive plant database to determine occurrence of TES species in the assessment area.

Sensitive plants consist of the following species:
- Marble Mountain catchfly (*Silene marmorensis*)
- Howell's *tauschia* (*Tauschia howellii*)
- Salmon Mountain wake-robin (*Trillium ovatum ssp. oettingeri*)
- Siskiyou *lewisis* (*Lewisia cotyledon var. howellii* and *var. heckneri*)

Marble Mtn. catchfly is endemic to the Klamath province. Its limited distribution accounts for its rarity. It is on List 1B of the CNPS inventory which are plants considered rare or endangered in California. The term rare applies here and connotes a plant that is "not presently threatened with extinction, but is in such small numbers throughout its range that it may become endangered if its present environment worsens." It is found most commonly in the tanoak or Douglas-fir series of forest communities, from 500 to 2,700 feet elevation. In the assessment area, this *silene* is relatively common along current and historical trails. Some observers believe that pack stock may have contributed to the dispersal of the species. The species prefers a more open tree canopy and seems to respond favorably to low levels of disturbance. Besides its' association with trails, it has been observed growing in numerous locations along the Salmon River highway.

Howell's tauchia is a member of the carrot family that grows in dry open slopes with gravelly or rocky surface and mostly found above 6,000 feet

elevation. It is also on List 1B of the CNPS inventory. In the assessment area it is known only from one location, at the very headwaters of Crapo Creek. Its habitat niche is more restrictive than the Marble Mtn. catchfly, but it is found in areas outside California. Even though there are only five known locations in California, it is not considered endangered by the CNPS. However, due to the rarity of occurrence, all populations should be protected.

Salmon Mountains wake-robin is another Klamath Mtn. endemic found in the assessment area. It is generally found on northerly aspects between 4,000 and 6,500 feet. It is most commonly associated with moist, shady riparian areas. It is sensitive to ground disturbance, but because of its habitat it is generally not at risk from management activities.

Siskiyou *lewisis* (*Lewisia cotyledon var. howellii* and *var. hecknerii*) are found in the area. The variety *howellii* appears to be most prevalent, but the taxonomy can be confusing. They occur on rock outcrops so they tend to be fairly well protected from habitat destruction; although, roads and rock pit operations are potential threats. They are most common on the watershed divide between the Salmon River and the Klamath and Trinity Rivers. Populations have also been noted at low elevations in the Salmon River corridor.

The check of the CNPS inventory and former USFS sensitive plant listings reveals other species that are now on a watch list; i.e., populations are noted and mapped so they can be monitored over time.

Two closely related orchids, mountain lady-slipper (*Cypripedium montanum*) and clustered lady-slipper (*C. fasciculatum*) are mapped as one population each in the watershed area. These orchids are associated with undisturbed late seral forests. The clustered lady-slipper has been located in only dense canopy in mesic conditions. Whereas the mountain lady-slipper has been located in both more open stands with harsher site conditions and dense, mesic cover on moist sites. Little is known about the reproductive success of these species and they are being monitored on several National Forests, including the Klamath. These species are also among the survey and manage list (C-3) of the *President's Plan*.

Along with the *cypripedium* orchids mentioned above, *Allotropa virgata* or candystick, also occurs in the area. This is a mycotrophic plant; i.e., it is dependent upon a fungus for part of its physiological needs. Some botanists believe that it is highly associated with tanoak mushrooms. It appears to be more common in the tanoak series and is found in a variety of seral stages from early-mature to old-growth. There is one known location in the assessment area.

Exotic plants, also known as noxious weeds, occur within the analysis area. The term "noxious weed" has legal status and is designated by the California Department of Food and Agriculture to protect agriculture values. Control measures are related to transportability or dispersal and may allow for eradication, including herbicide use, biological agents and/or quarantine. Yellow starthistle (*Centaurea solstitialis*) was introduced after the 1987 fires within the watershed and now has the potential to occupy large areas in the analysis area. A limited amount of a biological control agent (a weevil) for yellow starthistle was introduced into the watershed, but the effect is unknown. Klamath weed (*Hypericum perforatum*) and Dyer's woad (*Isatis tinctoria*) are other noxious weeds in the watershed. Klamath weed is largely controlled through a host-specific beetle that eats the seed heads and leaves. Dyer's woad has no biological control at present and is rapidly extending its range. It is a primary invader of disturbed sites such as roadsides and riparian gravel bars. Exotic, or alien species are non-native species without California legal status, but potentially adverse to the integrity of native plant communities. Some of the more common exotics include scotch broom, blackberry, dock weed, Dutch white clover, sweet clover, orchard grass, and mullein species. No exotic tree species are known to exist in the wildland ecosystems of the area. These exotics can often be aggressive and pernicious, thus affecting the establishment and functioning of native plant communities.

Appendix C - Plant Species to be Protected, is a list of species from the proposed LMP Table 4-3 to be protected through survey and management standards and guidelines, "known" to occur on the Klamath National Forest. Most of the fungi were located in the Haypress Research Natural Area (RNA) and Meadow Inventory near the watershed. This appendix also includes a complete list of species to be inventoried that have the "potential" to

occur in the watershed. These species are identified in the *FSEIS* for the *President's Plan* as being closely associated with old-growth forests and late successional forests within the range of the Northern spotted owl.

RIPARIAN VEGETATION

See Figure 7 - Vegetative Condition Map that highlights the vegetation within the riparian reserves.

Grass/Shrub/Forb - Twenty percent, or 3,100 acres of the riparian reserves are in this seral stage. Much of this was created from the 1977 and 1987 fires.

Early-Mature/Pole (< than 70% crown closure) - This seral stage accounts for ten percent, or 1,600 acres of the riparian reserve area.

Early-Mature/Pole (> 70% crown closure) - Seven percent, or 1,100 acres of the Riparian Reserves are in this condition.

Mid-Mature/Late-Mature/Old-Growth (< 70% crown closure) - This seral stage makes up 23%, or 3,700 acres of the riparian reserve.

Mid-Mature/Late-Mature/Old-Growth (> 70% crown closure) - This seral stage accounts for 40%, or 6,400 acres of the riparian reserve area.

WILDLIFE

The following is a list of wildlife species, known or suspected to exist within the analysis area which will be addressed in this analysis. The list is split into five categories of wildlife species.

Category A - Federally Listed Species --Bald eagle, American peregrine falcon, marbled murrelet, and Northern spotted owl.

Category B - Regional Forester's Sensitive Species --Northern goshawk, Pacific fisher **(*)**, American marten **(*)**, great grey owl (additional sensitive species are listed in the Fish and Riparian Associated Species section).

Category C - Candidates For Federal Listing --Pacific western big-eared bat, Del Norte salamander (additional candidate species are listed under the Fish and Riparian Associated Species section).

Category D (*) - Other Species Associated With Late-Successional Forest (LSF) Habitats --Clouded salamander, fringed myotis, hoary bat, long-eared myotis, long-legged myotis, silver-haired bat (additional LSF-associated species are listed under the Fish and Riparian Associated Species section).

(*) footnote item - These are among the species identified in the *FSEIS* for the *President's Plan* as being closely associated with old-growth and late-successional forests within the range of the Northern spotted owl. They received additional analysis between the draft and final *SEIS* and were specifically considered when additional standards and guidelines were added to the selected alternative.

Category E - Klamath National Forest Management Indicator Species (MIS):

--Snag Associates - Downy woodpecker, hairy woodpecker, red-breasted sapsucker, white-headed woodpecker, pileated woodpecker, Vaux's swift.

--Hardwood Associates - acorn woodpecker, Western grey squirrel.

--Harvest Species - black bear, black-tailed deer, Roosevelt elk.

(Additional MIS species are listed under the Fish and Riparian Associated Species section.)

SPECIES OCCURRENCE

Bald eagle - There are currently no known bald eagle (*Haliaeetus leucocephalus*) nests or communal winter roosts within the analysis area. Sightings of bald eagles within the analysis area during the winter are not uncommon.

Peregrine falcon - Surveys and monitoring have established that there is one currently active and one historically active American peregrine falcon (*Falco peregrinus anatum*) eyrie (cliff nests) currently being used within the analysis area. These sites are monitored for occupancy and reproduction each year. It is possible that additional eyries exist within the analysis area, since all potential eyries have not been recently surveyed.

Marbled murrelet - Surveys for marbled murrelet (*Brachyramphus marmoratus*) have not been conducted within the watershed. The analysis area is bisected by the Marbled Murrelet Zone 2 boundary.

Northern spotted owl - There are currently four known Northern spotted owl (*Strix occidentalis*) activity centers within the analysis area. These sites are referred to as Somes Creek; KL-4045, Duncan Creek; KL-4044, Butler Creek; KL-0261, and Monte Creek; KL-304.

Northern goshawk (*Accipiter gentilis*) - Incidental sightings of goshawk have occurred in several drainages within the analysis area, including repeated sightings in Somes Creek. Although recent protocol surveys have failed to identify nest sites, occupancy in Somes Creek is still considered probable.

Northwestern pond turtle (*Clemmys marmorata*) - Western pond turtles have been sighted frequently in backwater pools along the lower three miles of the Salmon River. It is likely that surveys of perennial ponds and backwater pools within the analysis area will detect additional Northwestern pond turtles.

Great gray owl (*Strix nebulosa*) - There is one unconfirmed report of a great gray owl from Crapo Meadows. Confirmed sightings have occurred elsewhere on the Forest, including the Marble Mountain Wilderness.

The other species to be addressed within this analysis are known or suspected to occur within the analysis area based upon incidental sightings or the inclusion of suitable habitat as described in habitat suitability models and published literature.

FISH/RIPARIAN ASSOCIATED SPECIES

The following are important fish and riparian associated species found within the analysis area which will be addressed:

FISH

Chinook salmon, coho salmon, steelhead trout, Pacific lamprey, green sturgeon, and American shad.

Summer steelhead and spring chinook salmon are Regional Forester designated Sensitive Species. Spring and fall run chinook salmon, fall, winter and summer run steelhead, and coho salmon have all been petitioned for listing under the Federal Endangered Species Act (ESA). The Klamath Mountain Province Evolutionarily Significant Unit of Steelhead, both summer run and winter run, have been proposed for threatened status (see Figure 8 - Fish Species Range Map (1 of 4) through Figure 11 - Fish Species Range Map (4 of 4), all located at the end of this chapter).

RIPARIAN ASSOCIATED SPECIES

Regional Forester's Sensitive Species - Northwestern pond turtle, and willow flycatcher.

Candidates for Federal Listing - tailed frog (*), Northern red-legged frog.

LSF-Associated Species (*) - black salamander, Southern torrent salamander, and common merganser.

Klamath National Forest MIS - American dipper, Northern watershrew, long-tailed vole.

(*) footnote item - These are among the species identified in the *FSEIS* for the *President's Plan* as being closely associated with old-growth and late-successional forests within the range of the Northern spotted owl. They received additional analysis between the draft and final *SEIS* and were specifically considered when additional standards and guidelines were added to the selected alternative.

HUMAN ELEMENTS

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

COMMUNITIES

There are three small communities located within or adjacent to the watershed area.

Somes Bar, population 225, is located on the western edge of the watershed. It is located near the junction of Highway 96 and the Salmon River Road. There is an elementary school and small store located in the community. A few residents still live on the Somes Bar Work Center site.

The community of **Forks of Salmon**, population 150, is located on the eastern edge of the watershed. It is located at the junction of the North Fork Salmon River Road and the South Fork Salmon River Road. It also has an elementary school, small store, post office, and several residences.

Oak Bottom is a residence community that is located within the watershed area. It houses approximately 40 individuals, mostly who are Forest Service employees for the Ukonom Ranger District.

Within the watershed boundary there are several scattered residences, primarily located along the river corridor; some of these residences have associated small businesses.

AMERICAN INDIAN

Contemporary use within and adjacent to the watershed area continues to be important to American Indians by linking them to their past and heritage.

Landscape features and elements of the landscape are all inherent and important to current use and ceremonial activity. Offield Mountain and areas within the confluence of the Salmon and Klamath Rivers hold extreme importance as do specific ridge alignments which have high significance and are used by Karuk after death.

RECREATION DEVELOPMENT

See Figure 12 - Recreational Features Map located at the end of this section, for locations of recreation areas.

Campgrounds - There are two developed campgrounds and two undeveloped campgrounds within the watershed. The developed campgrounds are Oak Bottom and Nordheimer.

River Access Sites - River access sites are developed sites for access to the Salmon River. There are ten sites; Nordheimer, Bloomer Falls, Tripp, Cascade, Butler Creek, Brannon Bar, Oak Bottom, George Geary, Blue Hole, and Mouth of Salmon.

Trails - Trails are identified as being corridors which facilitate the movement of humans to, from, and within the watershed. Trails are broken into three types:

- Primary --Trials that serve as main transportation routes and traditionally receive at least a moderate amount of use are called primary. In almost all cases, they serve major attractions such as high mountain lakes; they include the Pacific Crest Trail and National Recreation Trails. They are also all-purpose trails and are maintained on an annual basis. There are approximately 19 miles of primary trails in the watershed.
- Secondary --They are trials that don't necessarily serve major attractions. Only one-third are maintained each year. In many cases they are not passable for stock. There are about 55 miles of secondary trails in the watershed.
- Inactive Reserves --These are trails which are not currently being maintained. There are approximately 40 miles of inactive reserve trails in the watershed.

Trailhead - Trailheads are the terminus of any trail. There are two types of within the watershed:

- Primary Trailheads --Trailheads with improvements such as bulletin boards, toilets, stock holding facilities, and adequate parking; there are two within the watershed.
- Secondary Trailheads --They do not have any major improvements and parking consists of basic road grading or widening; there are two within the watershed.

Roads - The watershed contains approximately 85 miles of road; about one mile is under State jurisdiction, 18 miles are under Siskiyou County jurisdiction, four miles private jurisdiction, and 62.0 miles, including temporary roads, under Forest Service jurisdiction (refer to Appendix D - Transportation System Interactions).

The county road provides primary access to the watershed and was constructed near the Salmon River. This road is maintained throughout the year and provides access to the communities. Road construction standard for most of the miles was double lane, ditched, either asphalt or chip seal surface and fair alignment.

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

Forest Service system roads within the watershed were constructed for administration of National Forest lands. Public use is allowed by the Secretary of Agriculture on most roads. Travel access management strategies are used within the analysis area to minimize resource-use conflicts.

Refer to maps of the road template, surface type and road maintenance levels and closure, located in an atlas at the Ukonom or Salmon River Ranger District, for information and location concerning travel access, design classification, functional classification, and maintenance levels.

Mining - Historic hydraulic mine sites, which created altered patches in the watershed, are still evident. Most of the activity centered around or near the Salmon River corridor and in Nordheimer drainage. Surface disturbance appears strongest near the Forks of the Salmon and near Nordheimer and Crapo drainages where tailing piles and cut banks are most evident.

There are an estimated 80 mining claims located in the analysis area. The nature of these claims range from recreational placer operations along the Salmon River to lode claims in Crapo Creek in the vicinity of the Evergreen Mine. All but ten claims are seasonal in nature.

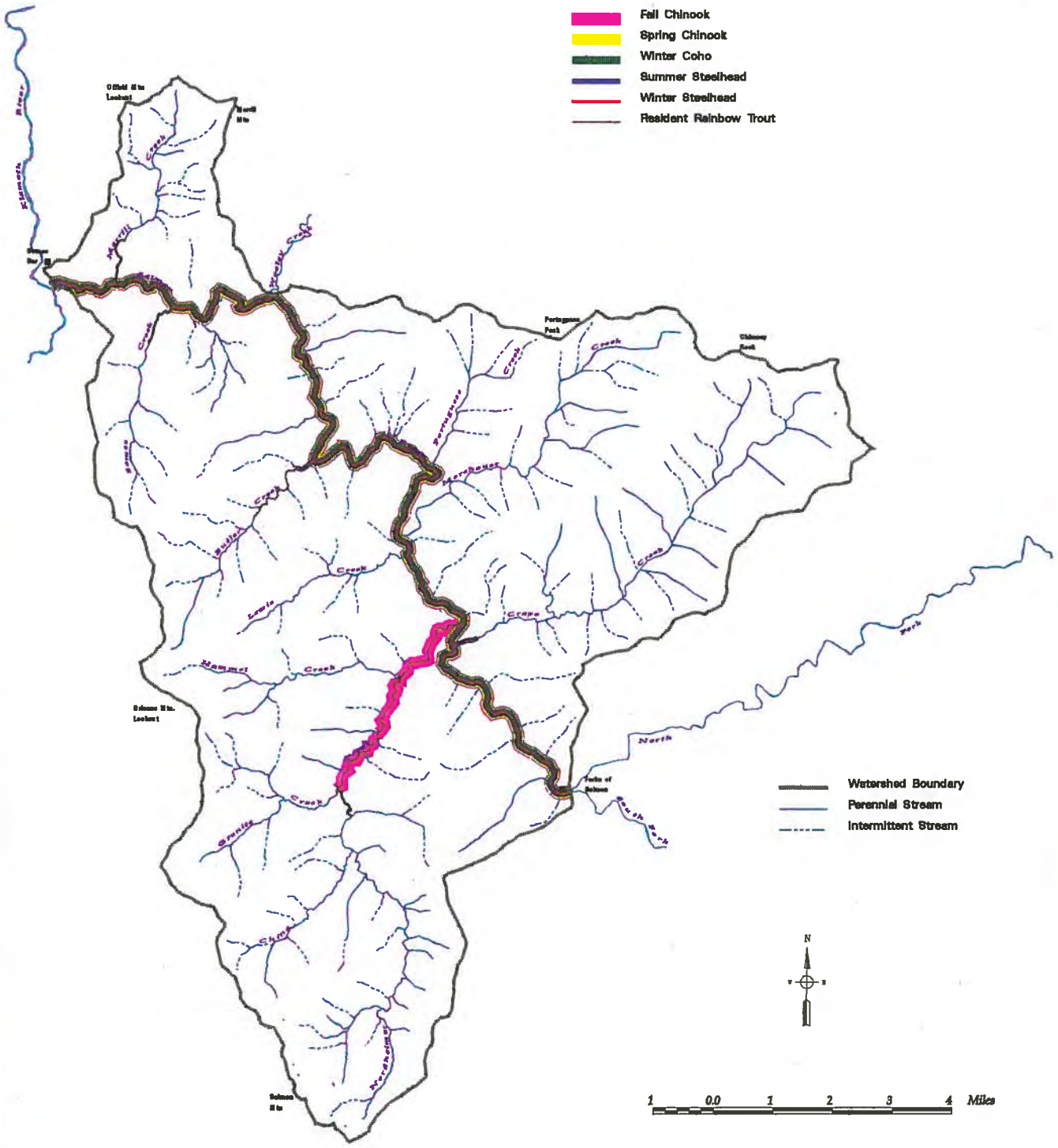
Landfill - There is one known county landfill located within the watershed. This landfill is located at Oak Bottom Administrative site and is currently closed. It is presently being tested for contamination.

Special-Uses - Special-use authorizations within the watershed include the following activities: public road right of way, easements, disposal areas, domestic water sources, in-stream gauging station, utility/parking access, and electrical /phone line installations.

Figure 8 *Fish Species Distribution (1 of 4)*

Main Salmon Watershed

Fish Species Range (1 of 4)

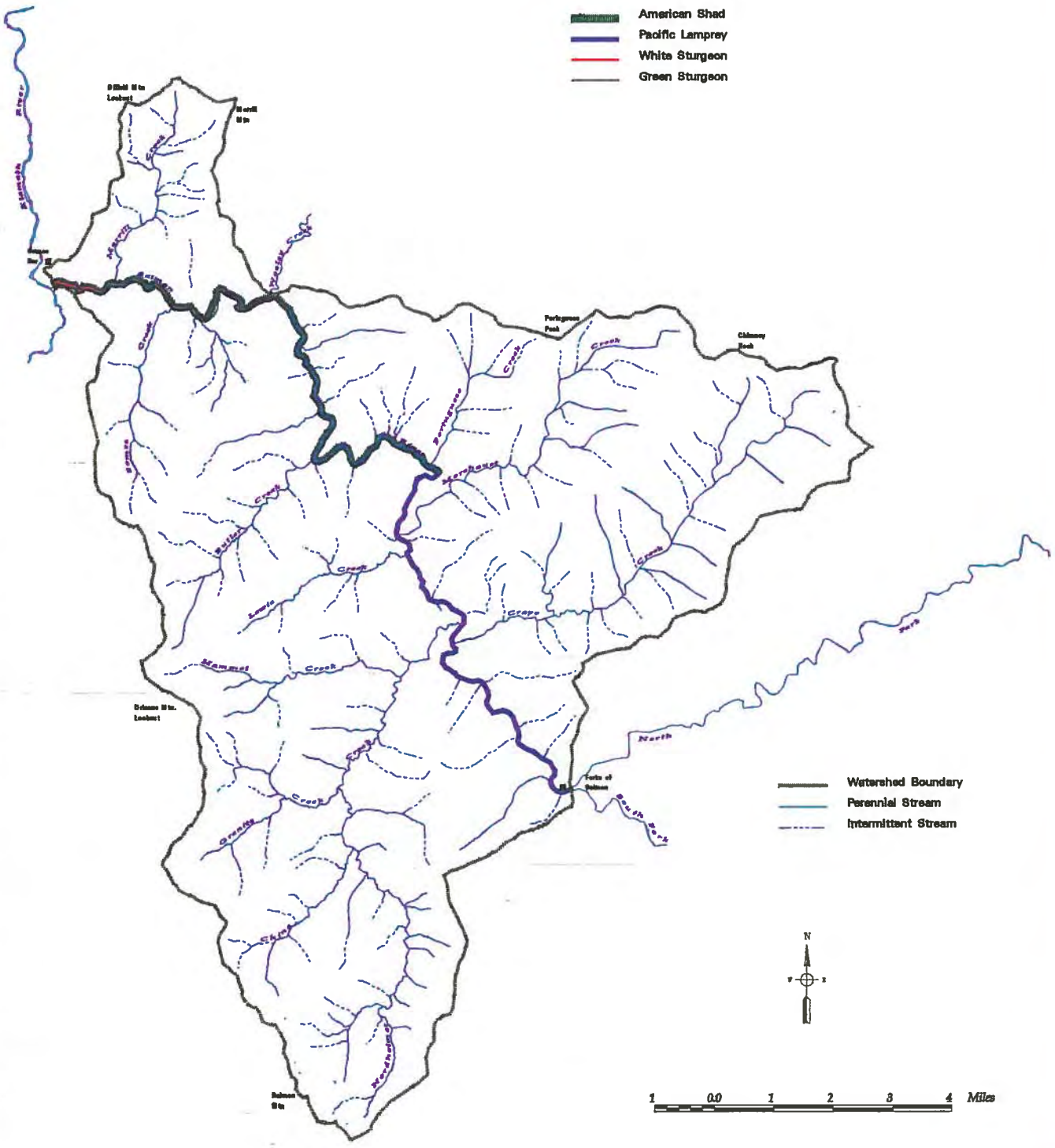


June 07, 1995

Figure 9 *Fish Species Distribution (2 of 4)*

Main Salmon Watershed

Fish Species Range (2 of 4)

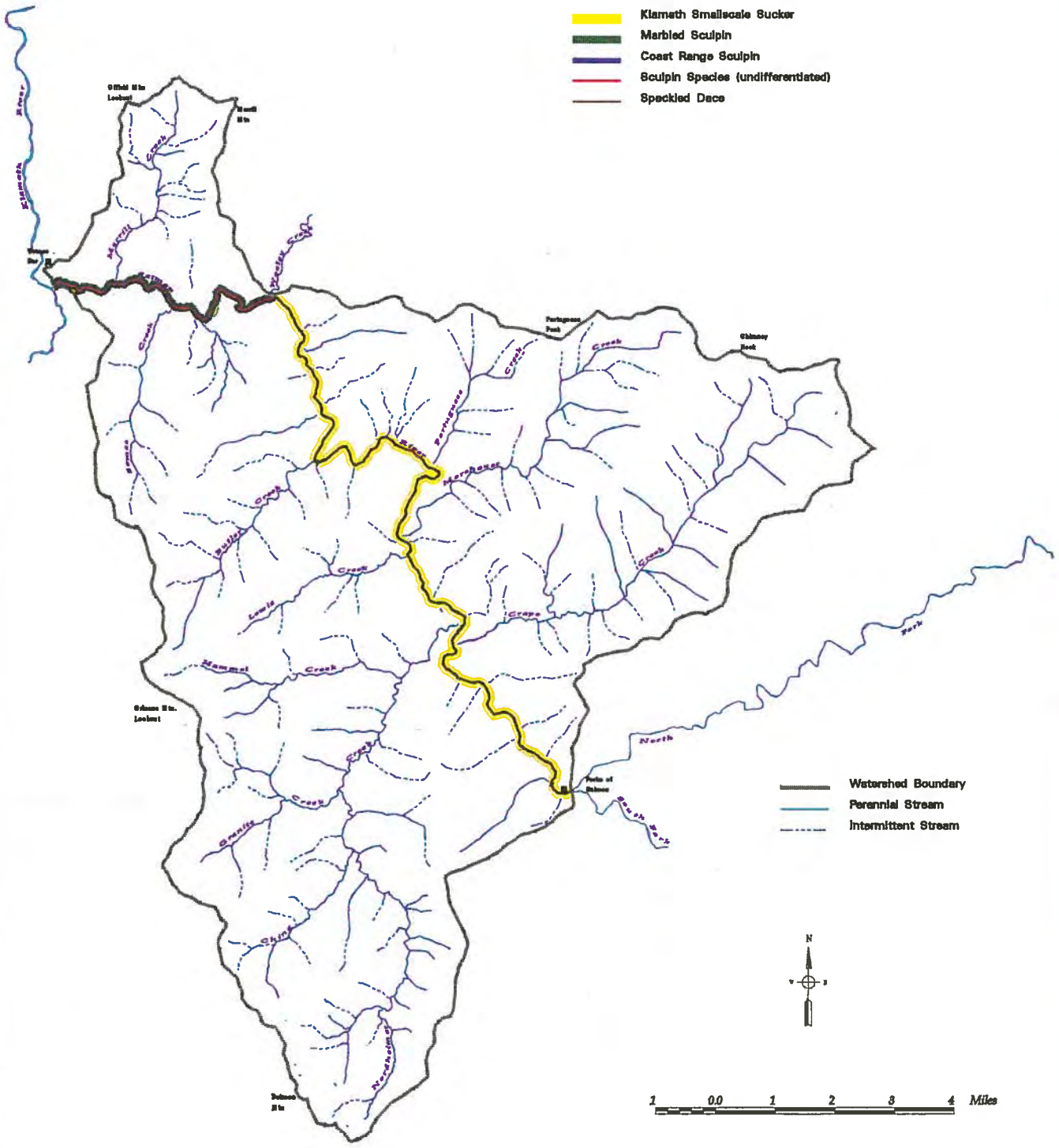


June 07, 1995

Figure 10 *Fish Species Distribution (3 of 4)*

Main Salmon Watershed

Fish Species Range (3 of 4)

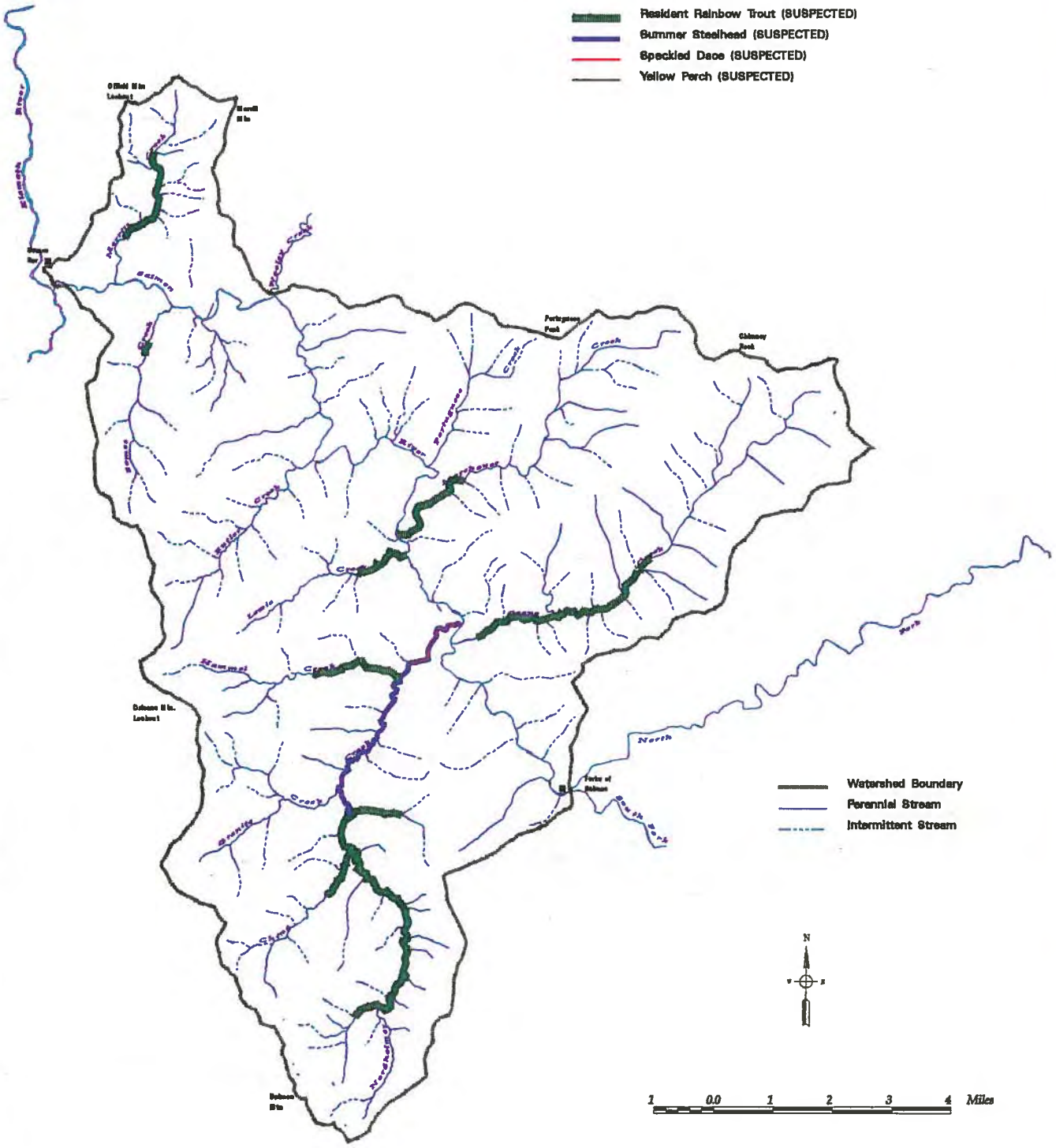


June 07, 1995

Figure // *Fish Species Distribution (4 of 4)*

Main Salmon Watershed

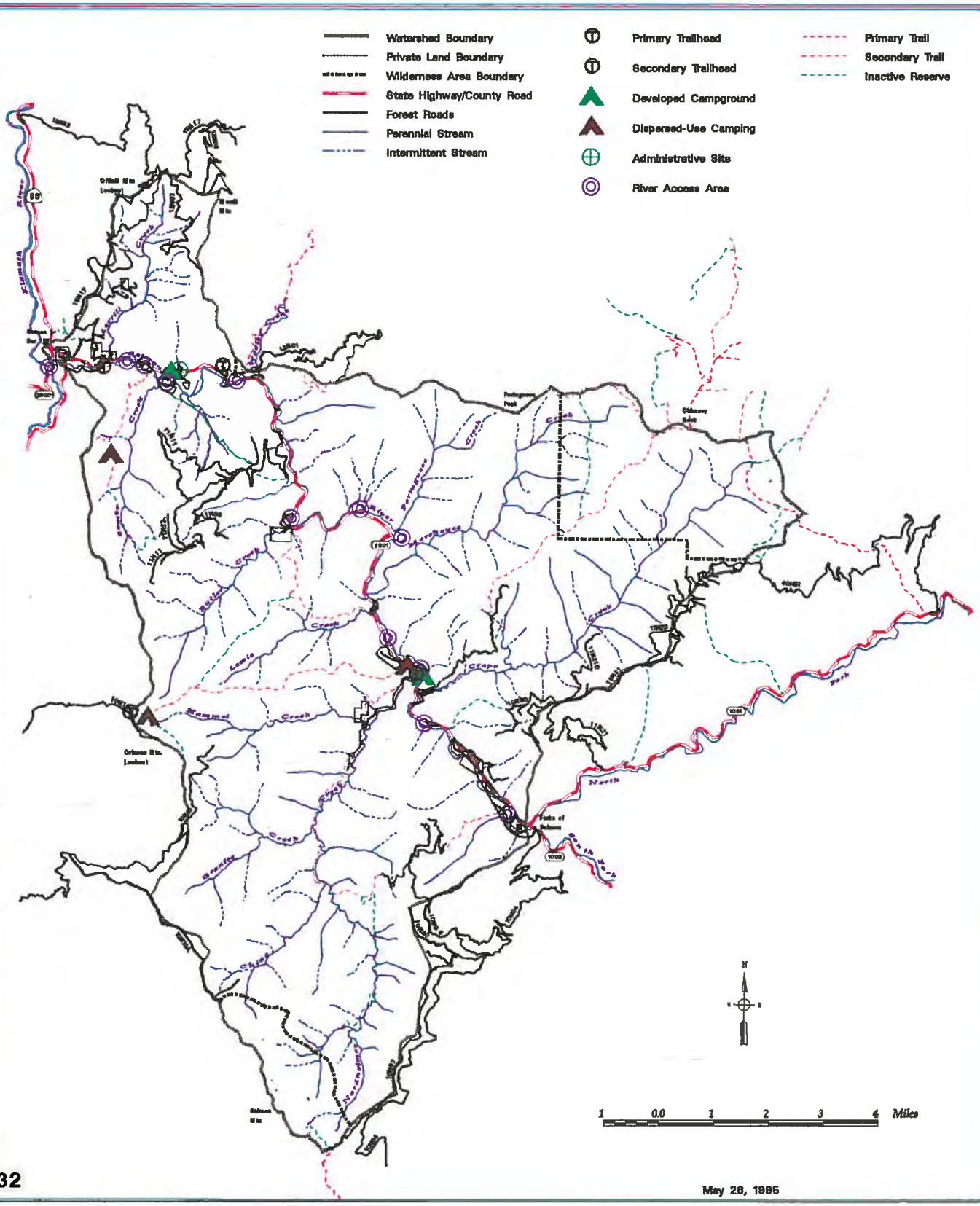
Fish Species Range (4 of 4)



June 07, 1995

Figure 12 *Recreation Features*

Main Salmon Watershed
Recreation Features



May 26, 1995

CHAPTER 3

Watershed Processes and Functions

INTRODUCTION

This chapter describes our current understanding of key processes and functions, including interactions, which are operating within the analysis area. Interactions refers to the relationships between different processes and functions. The development of vegetative conditions, the movement of sediment, and the spiritual values of the area to the Karuk Tribe are some examples of key processes and functions.

This assessment of key processes and functions is organized by the following three categories: Human and Social Dimension, Terrestrial Ecosystem, and Aquatic Ecosystem. The information under each main heading was organized in such a way to reflect the interactions between processes and functions. The following outline/diagram is to help display the flow of information contained within this chapter:

HUMAN/SOCIAL DIMENSIONS

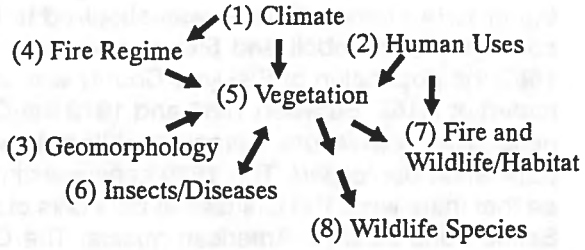
AMERICAN INDIAN
- Past
- Present
- Future Trends

RECREATION
- Past
- Present
- Future Trends

COMMODITY USES
- Past
- Present
- Future Trends

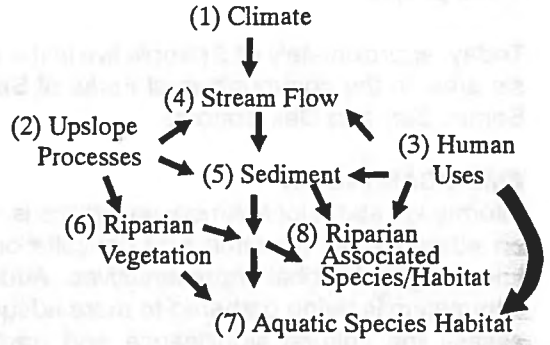
COMMUNITY AND PRIVATE LAND USES
- Past
- Present
- Future Trends

TERRESTRIAL ECOSYSTEM



(Numbers within parentheses are for order of flow within the document, but do not appear in the text.)

AQUATIC ECOSYSTEM



HUMAN/SOCIAL DIMENSIONS

Humans have been an integral part of the ecosystem for thousands of years. Early use and settlements were mostly in low elevations along the Salmon River Canyon and tributary streams. Access, remote steep mountainous terrain, fires, and floods influenced the way life developed. The region's past ethnographic cultures are some of the most complex in the United States, reflecting diverse prehistoric and historic use patterns, and human adaptations (USDA Forest Service 1994).

Regionally, social attitudes tend to be commodity oriented, long time resident values, and rural lifestyle. The timber industry, mining, recreational use, government employment, and fish and game have been important. Four areas of human/social affects are American Indian Cultures, recreation by

the public, commodities, and private land influences.

In the past, the Karuk and Konomihu Indians, the Chinese, and Euro-Americans, including Portuguese descendants lived in the area. Actual miner population figures between 1850 and 1870 are fragmented. Census figures conflict with historical accounts (which generally are higher). The watershed was made part of Klamath County in 1851, but in 1874 Klamath County was absolved to become part of Humbolt and Siskiyou counties. By 1880 the population of Siskiyou County was estimated at 8,162. Between 1860 and 1870 the Chinese miner populations increased while the anglo population decreased. The 1870 census estimated that there were 100 Chinese at the Forks of the Salmon and 50 Euro-American miners. The Chinese population was highest in the 1870s but by 1900 nearly all the Chinese had returned to their homeland or relocated elsewhere. The number of American Indians who lived within the watershed boundaries before 1850 is estimated to be under 1,000 people.

Today, approximately 415 people live in the analysis area, in the communities of Forks of Salmon, Somes Bar, and Oak Bottom.

AMERICAN INDIAN

Information about local American Indians is based on ethnographic research and consultation with knowledgeable tribal representatives. Additional information is being gathered to more adequately assess the cultural significance and traditional American Indian use in the watershed. The study is currently being contracted with R. Winthrop and will be attached to this document, in the future, for references on ancestral and contemporary use in the watershed. The Karuk believe that the Main Salmon watershed is one of the most culturally significant watersheds within the Klamath National Forest.

Many Karuk descendants still live in the region, although they have no reservation land. The Karuk are the second largest tribe in California and gained formal Tribe recognition in 1979. Today they have approximately 2,500 members nation wide. The Karuk contend they are a living culture adapting and evolving, not static, who have performed traditional ceremonies and practices in the vicinity on a regular basis throughout history and have maintained continuous tribal identity and relations in a manner consistent with their cultural origins. The Karuk Tribe's Natural Resource Department is very active in environment management of ancestral homelands.

Since perceptions about reality are most particular to local Indian cultures, discussions about religious beliefs and life ways can only be broadly defined. Animals, plants, and important landscape settings are inherently essential to traditional use. The natural world continues to play an extensive role in shaping beliefs, customs, and social practices. Many continue to value and rely on important traditional resources. Some tribal members adhere more closely than others to cultural customs. Other individuals have strong concerns over land changes that affect settings their family traditionally occupied for centuries.

Successful management enhancement activities generally benefit local Indian cultures through watershed/fisheries improvement programs, cultural resource monitoring, ethno-historic research, educational programs, cooperative stewardship programs, land allocations emphasizing Indian cultural uses, and cooperative inter-agency planning.

The Konomihu, a small band who also once inhabited eastern portions of the watershed, today have no formal organization. There are currently very few local descendants in the area.

Past

Karuk history in the vicinity is great. In pre-contact times area settlements were part of the largest population cluster in Karuk domain. In former times the Karuk drew their tribal identity from an area at a place known as Katimen. Stories about immortal figures and creatures explain many local physical features.

Most activity centered around riverine settings. Travel was either by canoe, cross country, or by a network of trails in river corridors or along ridges. In addition to village life near rivers they secured important seasonal resources at locales in higher elevations. Trade was important but goods and services were mostly locally obtained. American Indians suffered traumatic cultural displacement as the result of miner confrontations. Many also died from European diseases to which they had no resistance.

Early geographers and anthropologists alluded to and described management practices by Native Californians (Blackburn and Anderson 1993). While specific historic records are unclear about the intensity of past habitat modification, the land was shaped by American Indians.

Tribal participants reviewing this analysis have emphasized the prevailing presence of thousands of years of careful environmental management by Native Californians. Their continuum of use would have been highly integrated with aquatic and terrestrial ecosystem functions. They feel even though modern land management and land change over time has reduced more readily visible land patterns invoked by local Indians, careful investigation would clearly reveal more conclusive modification.

Karuk consulted stress that elements of the landscape were carefully managed to provide food, shelter, tools, and clothing. Foraging and gathering needed resources stimulated, sustained, and increased quantities and diversity of useful plants. Pruning and burning plant habitats increased productivity. Selective removal and cultivation of resources was important. Relationships landscape configurations held, the supernatural realm, prayer, social status, and everyday life were all interrelated and interwoven in how the local American Indian environment was managed.

Tribal elders cite underburning practices as late as the 1920s locally, although federal policies prohibited it. Burning practices discouraged fir trees near acorn bearing oaks. Fire was used to enhance wildlife habitats and resources such as beargrass, hazel, or willows used for basketry. An example of indigenous management is the existence of shrub fields on the west side of Offield Mtn. The mountain was burned annually before 1900 in conjunction with important Karuk Ceremonies held at Somes Bar (Kroeber and Gifford 1949). Local effects from Indian burning was once very apparent.

Evidence taken from forest repeat photography, air photos, and personal accounts leads to the conclusion that forest settings 200 years ago were generally more open than today. Denser stands of conifers were found on north facing aspects, good soils, and in draws. South facing slopes generally supported less dense stands of conifers with more oak trees. Areas more intensely modified by American Indians generally are anticipated within deep canyons adjacent the Salmon River and secondary streams.

Current American Indian Use

The watershed has close proximity to where the most productive gathering sites for salmon and eel (lamprey) are located; Ishi Pishi Falls.

American Indians today view the Main Salmon Watershed primarily a " Cultural Landscape " with different and distinct boundaries over and above all other landscape features. The vicinity near the Klamath and Salmon Rivers is historically and presently identifiable to local American Indians as the "Center of the World". Ethnographically the area has extraordinary relation with cultural origins, having powerful character and position. Cultural practices and observances in the vicinity continue to bond American Indians with their heritage.

Currently the area is famous to the Karuk, but also to other local tribes because of the World Renewal Ceremonies held at Katamin and Amekyaram. Area events traditionally linked American Indians in ritual, dance, feasting, and gambling (Palmer 1980). Associated with ceremonial centers are ritual sites for arrow shooting, sweeping away disease, fire building, earth leveling, and dancing and praying. Some of that ceremonial activity extends several miles beyond where ceremonial activities are concentrated which include analysis areas.

The cultural legacy of the area is based on several important features. Karuk oral literature in the vicinity is significant. It is the place where many immortal beings, landscape features, and creatures originated. The ability to perform appropriate ceremonies has been important. Yearly, about three to six hundred Yurok, Tolowa, Hupa, and Karuk attend local ceremonial events.

Offield Mountain and areas near the confluence of the Salmon and Klamath Rivers hold extreme importance as do specific landscape configurations in higher elevations. Offield Mountain is associated with important Karuk ceremonial observances. The mountain is sacred and revered as a place and origin of supernatural influence. Karuk individuals have disclosed that ridge alignments in the watershed area are used by deceased relatives as a pathway for Karuk after death. Respect for deceased relatives is very strong and a considerable aspect of the Karuk culture. Areas east of Orleans Mountain are also significant. The area known as

(Anasuweihiviyak) in the headwaters of Nordheimer Creek has been an historic "medicine mountain" for Karuk doctors who traditionally validate their power at that location.

Some individuals believe that the inability to perform traditional observances in the area and interruption of ceremonial activity has destructive effects on their personal life, the Karuk Culture, and the world.

Traditional gathering resource use will need further investigation to adequately qualify use, however several areas have been identified as current gathering sites.

The Karuk Tribe and the Klamath National Forest have developed government to government agreements in order to better facilitate and more effectively work together on important ancestral and contemporary issues. As demands are placed on Federal lands, conflicts over traditional use continue. Recently there has been a renewed interest by local American Indians in traditional values, beliefs, and practices.

Traditional use once more freely practiced has been restricted by Federal and State regulations. Fish and game laws, permit requirements, land use restrictions, and laws prohibiting traditional Indian burning have impeded traditional uses today. Other activities that alter relationships between traditional use and available resources include; logging and road development, mining, pollution, commercial plant uses, increased public use, and recreation development.

Lands in the vicinity have been allocated contributing to ceremonial use. The administrative Forest Service site at Somes Bar will eventually be relocated because it is currently located in a traditional ceremonial area. The LMP land matrix designates part of the vicinity as a cultural resource management emphasis area. The Karuk contend that actual ceremonial landscape extends beyond the current LMP matrix to include areas on the west side of the Klamath River and areas in Somes Drainage.

Local American Indian religion continues to depend on and be illuminated by sacred landscapes. Interruptions affecting the integrity of use include; unnatural modification to environments near religious sites, interference during use such as noise pollution, and unwelcome contact with the public during vision quests. Surrounding sounds and sights must have the right integrity to promote a sense of sacredness. Scenery around sacred sites should appear natural.

Large scale timber harvests (clearcut methods), and road construction generally present the most adverse impact to ceremonies by increasing access and disrupting the natural solitude of sacred use. Small scale timber harvests that utilize horse logging or helicopter removal typically create less impact. Generally strong obtrusive land disturbances near known sacred use areas are avoided today. Unroaded areas (Released Roadless) hold high value because they maintain the integrity of natural environments.

Inappropriate behavior by unwelcome river-users during local observances has created conflicts. River use is being restricted and monitored during important ceremonial times. Forest activities which create unwelcome noise are avoided near ceremonial events and recreational activities around sacred use areas during ceremonial events are avoided.

Commercial and public use of tanoak mushrooms and basketry resources is effecting traditional use. The agency has been working closely with the Karuk Tribe to develop a mushroom strategy that protects traditional use. Depletions of tanoak forests that once were more abundant is another issue. Land management demands overall have moderately restricted the availability of traditional gathering resources in the watershed.

Fire suppression around oaks has reduced the quality and quantities of local acorn harvests. Indian basketry organizations support agency activities that use prescribed fire and plant pruning. In other landscapes, beargrass plant vigor has been improved by agency prescribed burning with tribal supervision. Planning is also underway to reintroduce fire on Offield Mountain so fire may once again become part of the traditional observances. Fire suppression had prevented ignitions since the early 1900s.

Seasonal and permanent road closures are an issue since road use affects public and traditional use. Increased road access is discouraged by the Karuk near sensitive ceremonial areas. Two areas have been identified within the analysis area. Road management has somewhat limited gathering ac-

tivities in the watershed area. Individuals and families often have their own areas where they historically gather. Disclosure of gathering sites is discouraged by some weavers due to the limited availability of good gathering places.

Inadvertent or deliberate degradation to graves and ceremonial sites continues to be a growing problem in the Klamath National Forest. Although the agency and the Karuk Department of Natural Resources monitor known surface disturbances in sensitive areas, visitors vandalize sites or impact sites unknowingly. In the past some American Indians have been reluctant to reveal locations of resources because it increases awareness creating a greater risk of disrupting sites. However, increased levels of Forest use have raised the potential of inadvertent disturbance through various kinds of activities, so currently American Indians are working more closely with agency officials to protect sites. Public disclosure of archaeological resources is avoided by Tribal and Federal agencies.

As more is learned about indigenous land management and tribes continue to play a significant role in Federal land management planning, there will be more opportunities for collaborative ecosystem management at the professional level. Modern land managers are now gathering more information on indigenous stewardship and what might be gleaned from the past. Further studies on aboriginal use may benefit ecosystem management through a better understanding of the behavior of natural ecosystems and how they were modified. Knowledge on Indian land management philosophy and attitudes may also prove useful. Restoring the landscape to the same condition as transformed by hunter-gathers societies will not appropriately meet diverse social demands today. There are now indications that indigenous practices such as (burning to open up the forest) enhances patterns that resemble images of more healthy forests.

Future Trends

As future demands are placed on lands there will be concern that resources may decrease. Traditional American Indian use is anticipated to continue to be substantial and not decrease. Identity with the area will remain strong. Due to the extraordinary cultural magnitude of religious use, increasing forest activity or development will be an issue. Recreation, logging, and other landscape activities will increase the potential for disrupting traditional use.

Activities that enhance resources that have disappeared or were once more plentiful will be substantial. Other issues will relate to uncontrolled poaching, predation, and public impacts to animal and plant life. The agency can contribute to favorable habitat for salmon runs by controlling activities in the vicinity drainages. Careful utilization of prescribed fire around established oaks and gathering sites, protection of archaeological sites and tanoak forests, and ample supplies of tanoak mushrooms are significant to the tribe.

Future activities that restrict use will need to be clearly defined through cooperative tribal efforts. Unwelcome intrusion by forest visitors, if not controlled will continue to have a negative effect on traditional observances. Forest policies may need to be reviewed and possibly revised in some cases to mitigate conflicts. Close tribal consultation will be essential in order to protect the viability of traditional use. Agency partnerships in the future are anticipated to benefit traditional use.

Future trends are assumed to see increases in American Indian uses within the watershed.

As Tribal members renew interest in traditional values and the population increases, there will be an increased demand for traditional use areas.

As more ethnographic research is completed and traditional use areas are better defined, it is anticipated that stewardship with the tribe will increase.

As relationships develop from the government to government agreements, it is anticipated the tribe will be more involved in the management activities of the Klamath National Forest as it relates to this watershed.

Managing specific ceremonial lands/areas to maintain the integrity of the natural environments, will require cooperative stewardships more than ever, since current management direction includes timber harvest.

Areas for anticipated timber harvest are concentrated on the westside of the watershed and this same area is significant to the Karuk Tribe's cultural integrity. This conflict of values will need to be

resolved at the next level; NEPA project implementation.

RECREATION USES

Past

Recreational uses within the analysis area has been historically light. Long distances from major population centers and difficult access to the area have all had a part in diffusing use. Several back country trails, hunting camps, logging access roads, bridges, river access roads and trails, and recreational sites are typical National Forest developments since 1905. Most of the developed recreational sites were constructed within the Salmon River corridor where recreational use is highest. Remote areas and high elevation settings have been least effected by human use.

Present

Current recreational uses include camping, fishing, hiking, hunting, mountain biking, recreational dredging, sightseeing, whitewater rafting, swimming, and woodcutting. Most use begins with river rafting in March and ends with hunting season in November. Whitewater rafting is the greatest single recreational use in the analysis area.

There are two developed campgrounds in this analysis area; Oak Bottom and Nordheimer, both used primarily by whitewater rafters. Occupancy use is estimated at 30% and 20% respectively, throughout the season (Memorial Day-Labor Day), with the peak use(40-50%) from mid-March to early July. Oak Bottom has 26 campsites, can accommodate trailers up to 30' in length and has water, toilets, and trash service. Nordheimer has a group site and no services, with a water system and two group sites proposed for future development. Both campgrounds provide good swimming, day use, and river access for boating.

Runs of fall steelhead on the Main Salmon make fishing popular from April - November. Currently there are four to five drift boat guides who commonly use the Main Salmon for commercial trips. These trips are purely based on water flows. There are two drift boat runs on this section of the river; one between Wooley Creek and Somes Bar and another between Forks of Salmon and Nordheimer. These runs are relatively short and non-consecutive, so they don't offer a full day's fishing. Because of the infrequent use, actual use data is unavailable.

There are several maintained trails in the analysis area accessing both remote, non-wilderness areas and the Marble Mountain and the Trinity Alps Wildernesses. Trail use includes hiking, some horseback riding, swimmers, recreational mining, and spiritual. Overall trail use is low (0-100 visits/year) with the exception of the river access trails which receive a high amount (300+) use.

Because of the steepness of the topography, deer hunting is generally confined to existing open roads. Hunter success is probably higher in shrub areas. Many hunters use either Oak Bottom or Nordheimer Campground as a base camp.

Mountain biking is becoming more popular in this watershed, with one outfitter providing this service to Forest visitors from outside the area. Currently the primary roads used for mountain biking are the Salmon River Road (County Road N93), the Camp Three Road (#15N17), and the Yellow Jacket Ridge Road (#11N21).

Recreational gold suction dredging or panning occurs at various locations along the Main Salmon River. Use is estimated to be moderate, with 1,000-1,200 user days per year within the 6/1-9/15 season. These uses impact recreational facilities including five river access points, sanitation facilities, and parking areas.

Sightseeing is another use of the area. The relatively undeveloped, natural-appearing scenery is valued as an attraction by both local residents and users alike. The Salmon River or the road are probably used most often for this purpose. the area was inventoried for existing visual condition levels in 1988. Existing visual condition represents an attempt to define how noticeable human activities are. Examples of human activities include road construction, timber harvest, and mining. Acreages by existing visual condition levels are displayed in Table 1 - Existing Visual Condition Level Acreages.

Table 1 - Existing Visual Condition Level Acreages

Existing Visual Condition Level	Acreage	% of Watershed
Untouched	55,900	81
Unnoticed	0	0
Minor Disturbance	3,200	5
Disturbance	5,200	7
Major Disturbance	<100	0
Drastic Disturbance	5,000	7
TOTAL	69,400	100

Rafting and kayaking on the Salmon River, which is the greatest recreational attraction of the area, offers some of the best river recreation in the region. There is a small core of local use, but most use comes from Redding, Ashland, Eureka, and Grants Pass; surveys show users from as far away as Australia.

Most of the rapids between Forks of Salmon and Somes Bar are rated as Class 4, with a couple rated Class 5. Typical daily runs are Nordheimer Flat to Butler Creek or Butler Creek to Somes Bar. Use can fluctuate from year to year depending on the water flows. An average season would begin in April and end by mid-June; an exceptional season would start in March and extend into mid-July. Local use can begin as early as January if the flow reaches 955 cubic feet per second (cfs) to 1,350 cfs.

In 1993, total use was estimated at 3,500 user days, with 3,000 commercial user days reported and 500 private party user-days estimated. Four outfitter/guides base all of their operations locally, with the remaining companies based outside the immediate area.

The river also receives heavy use by locals and campers during the summer for swimming and other water play. The river's cool water is a drawing feature, particularly during hot weather. Numbers over two hundred have been recorded during peak use on hot summer days. There are five designated river accesses with roads, although those seeking more seclusion may use several walk-in accesses.

Woodcutting use in this area is believed to be light because of the limited number of roads and availability of firewood. As with other areas on the District, woodcutters are primarily opportunistic, gathering wood along roads.

Future Trends

While traditional activities in the watershed such as scenic drives, camping, swimming and waterplay, fishing, hiking, and hunting will remain popular, whitewater rafting and mountain biking are expected to increase.

As Tribal use increases in the watershed the conflict of values will also increase. Assure that traditional American Indian values and concerns are considered and accommodated as possible in recreation management activities and operations.

As the rural lifestyle and associated natural setting prevalent to the watershed become increasingly rare, the recreational opportunities will increase in value. This includes the value of the unroaded areas within this watershed.

As recreation use increases so will the volume of traffic in this area. This will increase the need to actively coordinate with CalTrans, Siskiyou County and the Karuk Tribe to manage the road system for its recreational value and public safety.

COMMODITY USES

Past

In June of 1850 prospectors found rich deposits of gold at the Forks of the Salmon and several hundred miners quickly entered the region. By the 1860s many miners that arrived in 1850 moved on after making quick strikes. In the 1870s the Chinese were mining many river and stream settings. Lumber was needed for sluices, flumes, mine timber, and residences. Initially miners cut timber by hand but eventually small saw mills were built to meet the needs of the camps. For 70 years mining was important, changing many river and stream channel settings.

In the late 1800s, two small towns within the assessment area, the Forks of the Salmon and Somes Bar were centers of rural activity. Most miners lived outside towns on available flats in scattered gold camps in the Salmon River corridor. Winter snows influenced travel. Steep topography and lack of employment has kept the area relatively untouched by industrial, agricultural, and recreational development. Most residents gave considerable effort to non-monetary forms of subsistence such as fishing, hunting, raising a garden, and domestic animals. Mining declined sharply by the 1920s and communities were reduced to a core of established families.

It was not until 1892 that a wagon road was cut through the 50 mile stretch of wilderness from Etna to the Forks. Prior travel was mostly by foot or by horse over trails. Grazing land was limited so hay was grown locally at Brazille Flat to provide feed for pack animals. More substantial road development did not take place until the Works Progress Administration projects were underway in the 1930s. The road from the Forks of the Salmon to the Klamath River was established in 1925.

The Forest Reserve (later the Forest Service), established the Klamath National Forest in 1905. By the 1890s the need to protect publicly held over exploitation of frontier lands resulted in withdrawal of unreserved lands from public entry and settlement. The Organic Administration Act followed giving authority to the president to alter the classification of land within reserves.

Initially Klamath National Forest policy emphasized fire suppression, trail work, and road improvement to rural communities. The focus shifted toward timber management after World War II as private land was logged.

Present

Timber harvest has occurred in the analysis area since the 1960s, when many of the secondary roads were constructed. Green timber sales occurred in the '60s in Dead Mule Gulch, and Horn Creek Gap areas, and in the '70s in Duncan and Monte Creek areas. Approximately 590 acres have been harvested using clearcutting as the predominate harvest method. Plantations range in size from three to 133 acres, averaging 37 acres. In the last two decades, there have been no green tree harvest in the area because of a variety of reasons; Released Roadless areas, fires, and lack of a final LMP.

Beginning in the mid-1970s, salvage of fire killed trees occurred in Merrill Creek area as a result of the Off Fire, and in Lunch, Granite, China, and Hammel Creek areas as a result of the Hog Fire. Salvage also occurred in both 1977 and 1987 in Crapo Creek as a result of the Hog and Yellow Fires. Roadside hazard salvage occurred along the Salmon River road in the early 1990s. Plantations (as a result of salvage activities) range in size from two to 1,024 acres, averaging 74 acres.

Grazing has occurred in the area since 1886. Currently there is one allotment (Little North Fork) with a permitted use of 250 cow/pairs for a season of July 15 to October 15. The 250 pairs of cattle are split into small groups of 20-40 cow/calf pairs and distributed into separate meadows. The groups are moved as the meadow reaches allowable utilization. Following the wildfires in 1987, the permittee requested that from May-July one hundred head of the 250 pairs of cattle take advantage of the increase in early seral stage vegetation and available livestock forage. After allowing four years of plant growth for post-fire rehabilitation, the permittee was issued a permit in 1991 for 50 head from May-July to utilize the burned area. A final grazing plan, which would determine the number and grazing locations of cattle, needs to be completed.

Surface disturbance appears strongest near the Forks of the Salmon and near Nordheimer and Crapo drainages where tailing piles and cut banks are most evident. Several river setting stretches appear undisturbed including settings between Wooley and Nordheimer Creek, and narrow channels east of Nordheimer to Quail Flat. Limited historical era remains include tailings, mining remnants, homestead sites, small cemeteries, historic structures, and mining ditches.

At present there are an estimated 80 mining claims located on the Salmon River, 48 placer and 32 lode claims. The recreational placer claims have a use of two to four weeks per year during the period of July 1 to September 15. Operators either camp on-site or stay at commercial lodging facilities. They often shop at local stores in the communities of Somes Bar or Orleans.

There are two claimants with seasonal variances to operate outside the May-September time frame. One claimant (with six claims) operates until mid-October, and the other (with ten claims) year-round.

On file with the District office is a request for prospecting operations on two claims that will entail ground disturbing activities on approximately two acres; evaluation is in progress for NEPA.

A wide array of special forest products (SFP) are found in the analysis area (see Appendix E - Special Forest Products for listings). All are of Karuk Tribal importance. While available for limited personal-use, some SFP are of commercial value, with high demand regionally and found in abun-

dance in the area. The amount of overall commercial-use of SFP is unknown, but believed to be low.

There has been limited opportunity for employment/jobs in the analysis area. Potential opportunities for local employment would probably be short-term, and might include watershed restoration, road rehabilitation, and State and/or Federal government work.

Future Trends

Local interest (both personal and commercial-use) in SFP will increase, thereby placing more demand on available supplies.

Agency expectations for timber harvest outputs will increase upon completion of the *Final LMP*. The general forest lands in the analysis area represent 20% of the total available to both the Salmon River and Ukonom Ranger Districts.

New road construction will be very minimal because of the amount (62%) of unroaded (Released Roadless) areas in the watershed.

Future employment opportunities are predicted to be limited, given social norms and current LMP direction.

Unless market conditions change drastically, mining operations will continue to be generally small scale. The number of mining operations will also be about the same.

Requests for ground disturbing mining operations are increasing.

There will continue to be a seasonal influx of people due to mineral prospecting activity.

COMMUNITY AND PRIVATE LAND VALUES/ USES

Past

The communities of Somes Bar, Oak Bottom, and Forks of the Salmon are located within or adjacent to the analysis area. An important social interaction is the controversy over how recent federal management has affected the local community culture, economy, residence, and quality of rural life. Settlement patterns and lifestyles have influenced this interaction.

Following the depletion of gold in the late 1800s, alternative sources of income were locally developed. Cash income was obtained through small locally owned logging operations and sawmills, or seasonal fire fighting and forestry work. The depression drew many men again to the area who were able to live in comparative comfort from mining activity because they were single. With World War II, many left again to support war related industries. Following the war, fewer local residents were willing to live by the local rural standards. A few retirees moved in securing private lands through the 40s and 50s.

The arrival of individuals seeking a country-alternative lifestyle in the 1970s caused a new level of population pressure on available mining claims. This resulted in access problems to scarce claims and habitable cabins. The Forest Service then began to crack down on illegal constructions. Herbicides, deforestation, and environmental concerns have been community social issues since the '70s. Enforcement of mining claim requirements has resulted in further reduction of the miner population. Area residents historically have had strong social interactions with the Federal government.

Present

Present day communities such as the Forks still draw from frontier traditions and appreciate the rural lifestyle. As people have had to leave because of land management conflicts, it has created opposition toward Federal management policy. That view is socially perpetuated by a high percentage of the local population in the Forks of the Salmon area.

Former Released Roadless or roadless areas, are one aspect of Federal land management in which people place differing values on. Former Released Roadless areas occupy 43,200 acres (62%) of the analysis area. Some individuals view these areas as providing a vital link for biodiversity and wildlife movement between the Marble Mountain and Trinity-Alps Wildernesses. Others perceive these areas as limiting opportunities for timber harvest with the current restriction on road building.

Today, private land within the analysis area totals approximately 500 acres. Lands are located primarily along the Salmon River, with one parcel located up Hammel Creek, and another up Nordheimer Creek.

There are three authorized recreational residences located on the Salmon River. The recreational residences are on term permits.

Special use authorizations on the Salmon River are associated with public road right-of-ways, easements, a public elementary school, disposal areas, domestic water sources for private landowners, an instream gauging station, utility and parking area access for private ownership, and electrical and phone line installations. The current special-use case load is not anticipated to increase in the future. Private land ownership is limited and special-use authorizations have been in use for extended periods of time in association with these private land holdings.

There is a proposal for a land exchange that will affect approximately two acres of Federal ownership within the Salmon River Corridor. The exchange will eliminate a long standing special-use permit and allow private ownership of an access route to private ownership. In return, the Forest Service would acquire seven and one-half acres of an inholding with cultural significance within the Klamath Wild & Scenic corridor.

There are several domestic water users in the area. Water generally is diverted from surface water sources, which is an acceptable practice for private landowners. However in a cooperative relationship between Forest Service, Forks of Salmon fire station, and the Forks Community School, the underground water source has insufficient supply to meet both users needs and a solution is currently being sought.

Future Trends

Local community residents will continue to be actively involved in Federal land management issues affecting their area.

Local community populations will stay about the same, because of the geographical remoteness of the area, as well as a decline in historic timber harvest levels.

The Lands Exchange Program workload is expected to remain at about the same levels.

There will continue to be a seasonal influx of people into the area as a result of mineral prospecting activities.

TERRESTRIAL ECOSYSTEM

Climate, physiographic processes, disturbance processes, and human uses all have influences on the terrestrial ecosystem. All of these processes work together to determine vegetative patterns, structures, composition, and terrestrial species habitat conditions. The following discusses these processes and their role in the terrestrial ecosystem. There are separate discussions for each process, but it must be remembered that they all influence the ecosystem together.

Climate

The annual precipitation, as measured from the period of 1904 to 1944, at the Orleans weather station is 50" with a range of 26 to 84". Approximately 90% of the precipitation occurs between October and May. Within the analysis area, summer rain events lasting a full day or more can occur. This is especially true for the western portion of the analysis area. Summer thunderstorms occur several times a year on average with locally intense rainfalls. Precipitation within the Main Salmon analysis area varies from over 80" near the headwall of Nordheimer Creek to about 40" at the Forks of Salmon. Somes Bar, near the mouth of the Salmon River, has a mean annual precipitation of about 60". For average rainfall information refer to the Annual Precipitation Map located in the Map Atlas at either the Ukonom or Salmon River Ranger District.

Winter temperatures during storms are highly dependent on the storms origin. A winter storm from the Gulf of Alaska typically brings temperatures near freezing to the lowest elevations of the analysis area. A storm from farther south in the Pacific Ocean brings warmer temperatures. Generally, above 5,000 feet elevation, precipitation is dominated by snow with large snowpacks accumulating every year. Below 2,500 feet snowpacks rarely develop. A transitional snow zone occurs between 2,500 and 5,000 feet. About 34% of the analysis area is below 2,500 feet, 53% between 2,500 and 5,000 feet, and 13% above 5,000 feet.

Within the analysis area, the summers are warm and dry with cold and wet winters. Summer temperatures typically have a large variation between night and day with high temperatures in the lower elevations about 90°F., occasionally above 100°, and low temperatures about 55°. Temperatures are generally cooler at the higher elevations. Relative humidity is usually quite low during summer

days but recovers well at night. Winds are generally light at night and in the mornings. Up-canyon breezes increase in the afternoons and are sometimes associated with thunderstorms and gusty winds. Temperature inversions are common at night and into the mornings because of the topography and light winds but generally lift by mid-morning. Thunderstorms occasionally bring lightning with very little rain.

Climate within the watershed is one factor that influences vegetative patterns. Elevational differences and location in relation to the coast influence rainfall patterns, which in turn influence the vegetative composition and patterns throughout the watershed. The analysis area is located on the eastern edge of the fog influence from the coast. This influence is responsible for some of the species that are found within the watershed.

HUMAN USES AND THE TERRESTRIAL ECOSYSTEM

Past

American Indian practices and uses have occurred within the watershed for possibly several thousand years. Important features of the ecosystem, vegetation diversity and composition, developed as a result of managing and modifying habitats. Prescribed burning practices for subsistence hunting and gathering was the most effective tool used for managing vegetation. Oak species were favored because of their mast producing capabilities. Foraging and gathering needed resources stimulated, sustained, and increased quantities and diversity of useful plants. Vegetation within settlement areas tended to be more open to allow room for structures and movement.

Timber harvesting occurred within the watershed during a period between the 1960s and 1980s. Harvesting consisted primarily of clearcutting; the effects on vegetation consisted of converting mid to late seral stands to early seral stands. Many of the earlier harvested stands are now in the pole size class.

Livestock use in the area is known to have occurred since 1886 when local Salmon River packers utilized forage in the area for their pack strings. Cattle grazing began on 1888, prior to establishment of the National Forest. Permitted grazing began in the watershed in 1935. Most of the grazing has been confined to the upper elevations within Morehouse and Crapo Creek areas. The grazing is generally done in the higher elevation meadows. Effects to the meadow systems with the past grazing is not well known, though early records do indicate the unrestricted season contributed to range resource damage. Impacted areas would generally be vegetation found within the wet and dry meadow areas.

Prior to permitted grazing, unrestricted grazing occurred within the watershed. Cattle and hogs were grazed quite extensively throughout the watershed. Some of the effects of grazing have been on the dry meadows within the area, grass dominated meadows have been converted to forb dominated meadows. Cattle and horses are points of introduction and spread of noxious and/or exotic plant species to the watershed especially at trailheads (unclean hay). Current study of grazing utilization and impacts is ongoing and inconclusive at this time.

Watershed restoration projects that have occurred during the past two decades following fires have also affected vegetative conditions. Reforestation efforts have created stands of even-age conifers that have a wide range of densities. Riparian planting efforts have also been conducted in an effort to establish some desired riparian vegetation along areas that were denuded during the fires.

Past mining had effects on vegetation. Hydraulic operations created changes to the stream/river channels and removed much of the vegetation from these areas. Many tons of rock and soil were removed along with all of the vegetation. Large tailing piles were created from these efforts. Most of the mining operations were confined to the Nordheimer Creek confluence of the Salmon River.

During the last 100 years Euro-American settlements have been established within the watershed. Most of these permanent residences are located on flats near the river. The only impact to vegetation has been the conversion of forest land to a situation more conducive to agriculture and building sites.

Past market hunting, especially for deer and elk, had a dramatic influence on population levels. Populations declined dramatically during the period of market hunting.

Several species have been extripated from the analysis area due to humans influences. Some of

these species include grizzly bears, wolves, and bald eagles.

Humans have also been responsible for introducing some exotic plant and animal species within the watershed. Known exotic plants include noxious weeds, star thistle, Klamath weed, and Dyer's woad, and some common exotics include clovers, scotch broom, blackberry, orchard grass, and mullein species. Some introduced animal species include pigs, shad, starlings, and bullfrogs.

Current

Some human activity has introduced noxious and/or exotic plant populations. For example, Dyer's woad had no known biological control and is rapidly extending its range. It is the primary invader of disturbed sites such as roadsides and riparian gravel bars. Another primary invader is star thistle which has been introduced since the 1987 fires and has the potential to occupy large areas. Some points of introduction are trailheads from unclean hay, road grading, and grazing of stock animals. These exotics can often be aggressive and pernicious, thus affecting the establishment and functionality of native plant communities.

The major human-caused influence on current vegetative conditions has to do with taking frequent low intensity fires out of the ecosystem. These impacts will be described in more detail in the fire effects on vegetation section.

American Indian burning has not been done for over 80-90 years. This, along with aggressive fire suppression, has caused forest conditions to become much denser, favored shade tolerant species (white fir), created multiple layered stands, and has favored conifer species over hardwoods. Also, some of the species that were utilized for other uses, i.e., basket making, have been impacted due to the increased shading.

No green timber harvesting has occurred during the past ten years. Salvage harvesting has occurred following the Off, Hog, and Yellow Fires. There has been no conversion from mid-late to early seral vegetation from timber harvesting for the past decade. Stands converted over the past three decades have continued to grow. Many of the older harvested stands are now in the pole size class. There is a wide range of densities in these stands.

Grazing continues today in the northeast portion of the watershed. This area is currently supporting 200-250 cow/calf pair of grazing cattle. They are generally confined to the meadow areas within the wilderness. Analyses of these areas shows utilization is within the Forest Plan Standards and Guidelines and meadow vegetation appears in satisfactory condition.

Within the analysis area, mining does not have a significant effect on the terrestrial ecosystem. It generally consists of small dredging operations along the Salmon River. Vegetation effects from past hydraulic operations is still visible today. Vegetation has been very slow to come back into many of these areas.

There has been no major increase in the amount of people moving into the area. The numbers and size of residences has remained about the same for quite some time. This has not impacted changes in vegetation composition along the river to any degree.

General Trends

Vegetation changes can be expected through harvesting for commodity production. Most of the vegetative changes due to timber harvesting will concentrated in the General Forest and Partial Retention management areas.

Grazing will continue on the meadow areas within the watershed, but no changes are expected in vegetation composition.

Controversy over land management practices will continue amongst the various interest groups. Some land management practices that may cause controversy include timber harvesting, increased recreational development, grazing, burning, fire suppression, etc. Controversy will be primarily based on personal beliefs and values for specific areas.

Recreation interest will continue to increase in the analysis area. Independent of seasonal water levels, overall river rafting on the Salmon River is expected to slowly increase. Mountain biking is also expected to slowly increase.

Geomorphic Influences

Vegetative patterns and characteristics are influenced by many variables. One of the important variables is the land type attributes that influence

vegetation. Vegetation structure, species composition, and patterns are strongly influenced by a combination of topography, soils, and terrane types. This description will be a generalization of how these attributes affect the vegetative character within the analysis area.

Shallow soils and harsh site conditions are generally associated with south, southeast, and southwest aspects on the mountain slopes. These site characteristics tend to favor shrub and live oak dominated hardwood stands because of their low waterholding capacity, fertility, and high transpiration rates. Scattered conifers are associated with these sites. The shallow soils associated with these terrane types and aspects include the Chawanakee, Ledford, Deadwood, and Woodseye families.

The Debris Basin terrane contains rock outcrops and shallow soils from these same soil families. These areas support very little vegetation due to the frequency of the debris sliding that occurs. Shrubs, forbs, and very scattered conifers or hardwoods are located on these sites.

The north, northwest, and northeast aspects on the mountain slope terranes have deeper soils, higher waterholding capacity and fertility, and lower transpiration rates, supporting denser stands of conifers. Madrone, black oak, and tanoak are the hardwood species generally associated with these sites. Associated soils include the Gilligan, Gerle, Clallam, and Jayar families.

The inner gorge terrane type contains soils similar to those found in the mountain slope terrane. Vegetation tends to be more sparse due to the steepness and rockier, shallow soils found in this terrane type. Big-leaf maple and white alder are the dominant hardwood species found in the inner gorge terrane.

Within the mountain slope and inner gorge terranes, vegetation can be greatly influenced by parent material. Granitic parent material, on north and east aspects favors tanoak, Douglas-fir, and sugar pine. Granitic soils on south and west aspects favor live oak, black oak, Douglas-fir, and some ponderosa pine. Granitic soils are deep and generally support more vegetation.

Non-granitic soils favor the same species as granitics except ponderosa pine.

The Slump/Earthflow terrane has well developed, very deep soils. This terrane type supports some of the densest and best growing conifer stands within the watershed area. Hardwoods such as black oak, madrone, and tanoak are intermixed in this terrane type. The soils found within this type include the Holland, Clallam, and Goldridge families.

The Glacial and Terrace/Alluvial fan terrane types support deep soils and have the ability to support denser vegetation. The Glacial terrane is found at high elevations while the Terrace/Alluvial fan terrane is found at low elevations.

Vegetation found in the Glacial terrane consists of red fir mixed with wet and dry meadows and rock outcrops. The Terrace/Alluvial fan terrane consists of conifers intermixed with hardwoods, such as black oak, madrone, and tanoak. These terrane types have areas that contain very cobbly and stony soils which can reduce the amount of vegetation.

Within the Main Salmon Watershed there are numerous inclusions of contrasting soils found in each of these terranes. This can create variations in vegetative composition and structure even within the same terrane and aspect. There are always exceptions to the generalizations stated above. For a more detailed look at the soil families refer to the Order 3 Soils Map located in the Map Atlas at either the Ukonom or Salmon River Ranger Districts. This, along with soil map unit descriptions will highlight areas that have an abundance of inclusions of either deep or shallow soils.

One inclusion that needs to be discussed are soils found on peridotite and serpentinite. These areas generally support very sparse vegetation. Species consist of Jeffrey pine, incense-cedar, buckbrush, and manzanita. Certain threatened and endangered plant species associated with serpentinite may be found scattered on these inclusions.

FIRE REGIME

A fire regime is a description of the role fire plays in the ecosystem. For consistency in this analysis the fire regime description is based on fire severity or the effects of fire on the dominant vegetation.

Past

The past fire regime, prior to European settlement, within the watershed falls into Agee's Fire Regime

#2 (Agee 1981a). This fire regime is described as having frequent fires (1-25 year intervals). Lightning and American Indian burning were the causes of ignition. These frequent low to moderate intensity fires had little effect on dominant trees, which had developed a thick bark that insulated them from low intensity fires. Limited overstory mortality occurred during these frequent fires, with most mortality occurring in the understory on small trees. By removing the understory trees, these frequent fires removed the ladder fuels that contributed to crown fire development. The steepness of slope contributed to stand replacing events; evidenced by vegetative patterns within the watershed.

American Indians actively managed areas within this watershed. It is believed that watershed vegetation, especially at the lower elevations, was influenced by frequent fires ignited by American Indians. Information gathered from writings by early Euro-Americans indicates that indigenous groups deliberately burned specific areas of the watershed.

Detailed evidence of indigenous use of fire remains obscure and generalizations are necessarily broad, yet there is clear evidence that nearly all California Indian Cultures managed important habitats with fire. Park like primitive forests were perpetuated by frequent surface fires set by American Indians and lightning.

Frequent burning served to prevent long-term destruction by lightning fires and favored increase of productive cover and concentration of plant and game resources. Set fires provided optimum environments for hunting and gathering strategies, for visibility, access, and safety. Karuk accounts indicate that specific plants and surfaces were burned including places where tobacco was grown, and around clusters and populations of hazel, beargrass, iris, willow, and tanoaks. Low intensity burning around tanoaks helped control insect infestations thus enhancing acorn productions. In addition, fire was set in association with ceremonial symbolism affecting site specific lands.

Euro-Americans saw benefits to frequent burning, which enabled them to graze more livestock in the years prior to the Forest Service's fire suppression policy. Burning by both American Indians and Euro-Americans continued until the early 1920s, when the Forest Service and Federal Law enforcement put emphasis on ending these practices, by prosecuting offenders and supporting a policy of suppression of all fires.

By looking at panoramic photos of the watershed taken from Orleans Mountain Lookout in 1935, and interpreting the 1944 aerial photographs, it is apparent that the past fire regime, in association with site capabilities, had dramatic effects on the vegetative composition and pattern within the watershed. Frequent fires created a diverse forest with a variety of vegetation and age classes, and a more open and less dense forest than exists today, except within the tanoak series. Following disturbances, dense stands of tanoak would persist. Vegetation patterns within the analysis area were heterogenous. Large areas of continuous old-growth conifer stands were non-existent. The vegetative pattern primarily consisted of hardwood/shrub, hardwood/shrub with scattered conifers, and patches of conifer. Stands of conifers occurred on north and east aspects on the lower one-third of those slopes, but large continuous stands were maintained only in the higher elevations of the watershed. These vegetative types were intermixed throughout the landscape.

Stand replacing fires have been a characteristic of this watershed, due to the extreme topography, hot and dry summer climate, and flammable vegetation. More often it appears that fires burned with low to moderate intensity. There were occasional runs, flare ups, and torching of patches of vegetation. These patches were probably missed by previous fires which allowed for the build-up of available fuel. The next fire that burned through these patches did so with higher intensities. The effects would be high mortality in that patch. During the following years, the dead fuel loading would increase as these stems would fall. The next fire or several fires burning through this dead material would create a seed bed for the next generation. This fire behavior is characteristic of what would be expected from frequent low to moderate intensity fires.

The watershed area south of the Salmon River was primarily dominated by hardwoods and scattered conifers intermixed with stands dominated by conifers. The hardwood stands mixed with scattered conifers were mostly found on the south and west aspects and to a lesser degree on the east aspect. These conditions can be attributed to both the fire regime and the capabilities of these sites. Live oak

in association with black oak were the dominant hardwood species on the south and west aspects. Tanoak and big-leaf maple were the dominant hardwood species on the north and east aspects. The frequent low intensity fire regime allowed for the maintenance of hardwood dominance. On occasion conifer species would be able to regenerate which created scattered conifers throughout these sites. Dense stands of conifers were a rarity within these hardwood dominated areas.

Most of the denser conifer stands were located on north facing aspects, stream bottoms, and flatter areas. On occasion some conifer stands were found on east facing aspects as well. Occasionally small stands of conifers are located on west or south facing aspects. Higher in the watershed area, shrub fields were also a dominant landscape character.

The portion of the watershed north of the Salmon River was dominated by shrub and hardwoods with fewer stands of conifers present. This was primarily due to the south facing aspect on this side of the river. The dominant hardwood species was canyon live oak. Conifer stands are almost exclusively confined to north and east aspects and drainage bottoms. The only exception is within the upper reaches of Crapo Creek on the east side and within the Morehouse Meadows and Chimney Rock areas.

The eastern side of Crapo Creek, primarily on the flat portion along the ridge, supported a continuous stand of conifers. The change in slope characteristics tended to cause fire effects to be less extreme. This created conditions that favored conifer establishment on the site. Once established, the fire regime was then able to maintain these conifers in an open even-aged condition for quite a long period of time. Some small openings of shrub and hardwoods were scattered throughout the area.

The Morehouse Meadows and Chimney Rock area are located at a high elevation with very gentle slopes. This area contained numerous meadows with patches and stringers of red and white fir. These meadow complexes were probably fairly stable due to low to moderate intensity fires. Fires, in conjunction with the high water table in the meadows, kept conifers from encroaching upon the meadow areas. This entire area was intermixed with numerous open rocky areas.

The primary conifer species within the watershed was Douglas-fir. White and red fir were the dominant species at higher elevations within the watershed. Ponderosa pine and sugar pine were found intermixed with the Douglas-fir and also on the more hardwood dominated sites.

There was a wide range of vegetative conditions resulting from fire as a disturbance factor. Occasionally, another type of disturbance, landslide, avalanche, windthrow, etc., would be the cause, but these were in the minority. Stand regeneration following a fire disturbance would usually have a few predominants left from the previous stand, but overall most of the conifers were of the same age class. Frequent fires within the conifer stands tended to keep inter-tree competition to a minimum with little to no conifer regeneration present. Grass/forbs, young shrub, and hardwood sprouts were probably the dominant understory vegetation. Multi-layered stands were mostly nonexistent. The alluvial basins within the watershed contained black oak and white oak.

Due to the steepness of the slope, stand replacing fires did occur. Some would create small gaps within existing stands while others would replace large areas. Local assessment has shown that these stand replacing event ranged from less than an acre to over 1,000 acres. Most of the openings were linear with extensive perimeters. Overall, most of the conifer stands had very little vertical diversity but high horizontal diversity.

A majority of the conifer stands were maintained in mid to late seral stage for a long time period. Stands dominated by large old trees, probably did not have the characteristics of stands that today are classified as Late-Successional Old-Growth (LSOG) due to the influences of more frequent fires on the surface fuels, understory, and stand structure. This would keep the stand in a condition that was resilient to fire, for a long period of time. Senescence in stands would influence fire behavior. Increased decadence would create higher fire intensities creating gaps and stand replacing events. These areas would then be recycled back to an earlier seral stage.

Locations favorable to maintaining stands with old-growth characteristics were mid to lower north facing aspects, flatter areas and the bottoms of slopes. Due to higher moisture and humidity levels on the north slopes and slope bottoms, fire had

less of an influence. Fire behavior was not as extreme on the flatter areas of the watershed. Flat areas under an established canopy allowed fires to burn slower and less intense than fires in exposed areas or on steeper slopes.

The high elevation red fir type within the watershed received less frequent low to moderate intensity fires. The longer time frame between fires allowed the establishment of denser longer lived stands. The duff and litter layers within these high elevation stands was compacted by heavy winter snow. Fires tended to burn at low to moderate intensities and had a low rate of spread due to higher moisture content, cooler temperature, and shading effect caused by the closed canopies. These stands were also maintained as dense stands of late-mature with basically no understory vegetation. As decadence set into these stands, they were set to convert to early seral. The increase in decadence caused the fires to become more intense with stand replacing characteristics. These stand replacing events usually took place in small patches or fingers running up slope. This created diversity in stand ages throughout the red fir zone within the watershed. This also created horizontal diversity within the red fir stands.

Combining extremes of fuel, weather, and topography creates extreme fire behavior. With frequent fires occurring in the watershed in the past, fuel accumulations did not usually reach extreme conditions, although topography continually represents an extreme condition in this watershed, and average summer climate can include extreme weather conditions.

Two recent fire history studies looked at fire regimes for two vegetation types that are found in the analysis area. Wills (1991) did a fire history study on Hotelling Ridge, two miles to the east of the Main Salmon Watershed. This study revealed a pre-suppression fire return interval of 10-17 years in Douglas-fir/hardwood stands. In the Thompson Ridge area on the Happy Camp Ranger District, 35 miles north of the watershed, Taylor and Skinner (1994) have estimated presuppression fire return intervals for Douglas-fir/sugar pine to be between 15 and 25 years.

Present

Through effective fire suppression there has been a shift in the fire regime of the watershed. What was Agee's Fire Regime #2 has been converted to Fire Regime #4. In previous discussion, Fire Regime #2 was characterized as having frequent fires (1-25 year intervals). This is viewed as a low to moderate severity fire regime. Fire Regime #4 is characterized as having short return interval crown/severe surface fires (25-100 year intervals). This is a moderate to high severity fire regime. Partial stand-replacement fires are a result of the current fire regime.

The fire season for the analysis area typically lasts from June until the end of September, although fires have on rare occasions started in April and fires have burned into November. Conditions most conducive for fires exist in July, August, and September. Between 1922-1993 there have been 265 fire starts in the watershed area, 65% of these were started by lightning, 29% are attributed to human causes, and six percent are unknown. Analysis of the data also indicates that a single storm has started as many as 15 fires in the watershed. These starts occurred throughout the elevational range of the watershed, occurring mostly on ridges, but are not limited to them.

Table 2 - Human-Caused Fire Frequency and Size for 1972-1993 shows a breakdown of human-caused fires, their frequency, and acres burned.

Table 2 - Human-Caused Fire Frequency and Size for 1972-1993

CAUSE	FREQUENCY	ACRES
Debris Burning	6	3.5
Miscellaneous	1	.1
Equipment Use	7	9,200
Incendiary	6	.4
Children	3	.3
Smoking	3	.6

The area burned by wildfire in the West since the 1920s continuously declined into the 1960s. A disturbing U-shaped trend is evident in these data and similar data from Canada (Flannigan and Van Wagner 1991). A possible explanation (Agee 1993) linked with fire severity as well as fire size, is the buildup of fuel hazards that have been fostered through fire exclusion policies. Without fire acting as an agent of decomposition, litter has built up, tree density has increased, and fuel continuity, both vertically and horizontally, is greater than historical levels. Fires that occur in such fuels are more intense and more difficult to control, even as

fire control technology improves. This effect is most pronounced in fire regimes which historically burned with low to moderate severity, where increased fire area is now burned primarily by high severity fires. The more successful we are at fire control, the worse the problem becomes; a seemingly insoluble problem if we do not look beyond the short-term objectives.

Table 3 - Acres Burned by Decade shows those acres burned by wildfire within the analysis area.

Table 3 - Acres Burned By Decade

1920s	1930s	1940s	1950s
6,838	2,598	1,076	39
1960s	1970s	1980s	1990s
64	48,536	23,262	12

Note that data for the 1920s begins in 1922 and that data for the 1990s ends in 1993.

Within the watershed fire regime conditions have changed. Historically large numbers of acres were burned. Due to the lack of fire during the effective suppression era, duff layers increased in depth, accumulations of available fuels in all size classes increased, and the amount of vegetative biomass increased. Areas that had few conifers became heavily stocked. The affects of these changed conditions included increases in dead and live fuel, development of fuel ladders, and a closed canopy that was able to sustain a crown fire. In 1973 these conditions combined with steep south aspects were instrumental in the spread and intensity of an equipment use ignited fire (Off Fire) that burned 9,200 acres in the watershed. In 1977 and 1987, these conditions, combined with dry weather patterns and multiple lightning starts, over-took the capability of the initial attack suppression forces. Refer to *Chapter 1*, Figure 4 to see the perimeters of these fires, and the Fuel Models Map contained in the Map Atlas located at either the Ukonom or Salmon River Ranger District.

A fuels inventory completed for the Somes Butler area, which is most of the remaining unburned area within the watershed, found dead fuel loadings in natural stands of up to 59 tons per acre. This amount of dead fuel is typical of Fuel Model 13, the heaviest slash model. At the 90th percentile (*) weather, the ground fuels easily burn with flame lengths greater than four feet. These flame lengths will cause torching of the understory vegetation, which preheat and cause torching of the larger trees that were previously resistant to fire. Combined with steep slopes, light winds, and dry conditions, this individual torching will advance to running crownfires and large stand replacing events.

(*) Footnote Item - 90th percentile weather is a standard used when calculating fire behavior predictions. 90th percentile weather is defined as the severest historical fire weather (i.e., hot, dry, windy) occurring ten percent of the time on mid-afternoons during the fire season.

It is presumed that current vegetative structure and patterns are greatly influenced by fire suppression policies. Without fire in the landscape, species composition changed from open stands of conifers and hardwoods to stands with hardwoods and shade tolerant conifers encroaching. As more shade tolerant species (tanoak, white fir, and Douglas-fir) grew into the understory they created a multi-storied stand and increased the stocking levels. There are two exceptions to this scenario. Tanoak stands have always been dense and site limitations have kept open live oak stands from large increases in biomass. As stocking levels increase, inter-tree competition increases. Soil nutrients and moisture availability become limiting factors. The vegetation becomes stressed as sunlight, moisture, and nutrients become limited. Fire adapted and shade intolerant species such as ponderosa pine and sugar pine are not regenerating because of the increased shading and lack of fire to create openings.

The current fire regime has directly influenced the development of six primary vegetative conditions within the watershed:

Dense early/mid-mature areas (associated with Douglas-fir and white fir series): These areas contain stands of densely stocked early/mid-mature white fir and Douglas-fir. Very little natural thinning has taken place by regular disturbance. Without the presence of fire these stands have become increasingly dense, which slows growth and does not allow an increase in the proportion of medium and larger diameter conifers. The homogeneous character of this vegetation type increas-

es the risk of fire carrying through these stands, causing a stand replacing event.

Late-mature conifer stands (associated with Douglas-fir and white fir series): These are stands that have been encroached by shade tolerant species. This condition is scattered throughout the landscape in patches of various size and location . These are conditions where late-mature stands that once had little vertical diversity, due to frequent fire, now have more understory vegetation. Shade tolerant species, white fir and Douglas-fir, have grown up in the understory causing increased inter-tree competition. Stress on all trees is occurring due to the increased demand for space and available resources. The encroaching vegetation has also created a live fuel ladder that increases the risk of a crown fire and stand replacing events.

Canyon live oak with scattered conifer stands (associated with live oak and Douglas-fir series): This vegetative type is probably the most stable in the watershed. Site limitations have not allowed for large increases in vegetative biomass. Hardwoods dominate the site, but conifers are scattered throughout the stands. Fires burning in these areas are usually not of high intensity. Due to the site limitations, accumulations of ground fuels are low, allowing for the maintenance of these conditions. Any increase in vegetation would be from additional hardwood stems, shrub, and to a minor degree conifers.

Tanoak stands (associated with tanoak series): These stands are confined primarily to the western portion of the watershed. Douglas-fir associated with these stands is now in the pole to early-mature size class. Tanoak understory has increased in these stands. Tanoak is persistent, but this persistence adds development of fuel ladders within the stand. Vertical structure increases as more trees are established and persist. Fire intensity levels will be higher as live fuel accumulations increase.

Large areas of early seral vegetation (associated with all the series): Recent fire activity has created large areas of early seral vegetation that is homogeneous in character. These areas have been created in the past couple of decades. These large expanses of early seral vegetation were not as prevalent in the past fire regime. The current fire regime with its increased severity has burned large areas encompassing several drainages. These fires and subsequent salvage have left little to no conifer seed-source for miles. Artificial regeneration has become the only way to restock these areas with conifers. The areas of early seral vegetation that have only burned once in recent years, contain large amounts of dead material from the previous fire and a mixture of shrub and grass/forbs. Many areas of homogeneous vegetation also include large areas that have been replanted to conifers creating large areas with continuous fuels capable of sustaining crown fires at the 90th percentile weather. This highly flammable vegetation along with the large amount of unburned dead fuel run a high-risk of a stand replacing event. Those early seral areas that have burned twice do not have the large amounts of dead material remaining but still have the large concentrations of highly flammable grass/forbs and shrubs.

> The watershed includes approximately 6,500 acres of plantation, nine percent of the analysis area, the largest being around 1,800 acres in Crapo Creek. Most of the plantation acres in this watershed are attributed to recent stand replacing fire events.

Persistent shrub fields: Mature to over-mature shrub field areas are not as common as the other vegetation types. These are usually found on shallow soils and in higher elevations within the watershed. Primary species is greenleaf manzanita, huckleberry oak, bitter cherry, and snowbrush. Frequent fires would keep these persistent shrub fields in a vigorous healthy condition. Dead material was usually kept at low levels. The lack of fire has allowed these shrub species to become very dense and decadent. Few conifers have been able to establish themselves on these sites. As the shrub stand gets older, more material dies creating a large fuel loading. There is currently a large amount of dead material in these areas. These conditions have increased the risk of a more intense fire that could temporarily denude the site. This will have impacts to the shallow soils on these sites when a very intense fire occurs.

These changes in severity have been recognized by the analysis of the Hog Fire (1977) and the Yellow Fire (1987) areas. Severity ratings for the Hog and Yellow Fires were classified from post-fire vegetation canopy. A high severity rating was given to areas where no vegetation canopy remained. A moderate rating was given to areas where cano-

py remained but was scorched (discolored but remained attached) from radiant heat. Areas with no apparent discoloration or damage were given a low rating. The burn intensity for the Hog Fire was predominantly characterized as moderate (54%) with 20% burned at a high intensity and 26% at low intensity within the analysis area. Severity ratings for the Yellow Fire were looked at differently than the Hog Fire. The canopy could not be used as an indicator of burn intensities in much of the Yellow Fire area. This results in a severity analysis for the Yellow Fire that indicates the severity was lower than the Hog. In reality the high severity ratings for the Yellow Fire were much higher than the Hog Fire. A high severity for the Hog Fire indicated standing dead timber, a high severity for the Yellow Fire indicated scorched earth and exposed rock. For the Yellow Fire, burn intensity was characterized as 64% low, 19% high, and 17% moderate in the analysis area.

The area of the Hog Fire that reburned in the Yellow Fire showed some interesting characteristics. Much of the area that had burned at high intensities during the Hog Fire, again burned at high intensity ratings in the Yellow Fire. A primary factor of this intensity is due to the fuels component. After the Hog Fire, those areas that experienced high intensities, also experienced high stand mortality. This added tremendous amounts of dead fuel component, as the stand fell apart, allowing the Yellow Fire to burn with much higher intensities. These areas have experienced a complete stand replacement. These areas now consist of plantations (early seral vegetation, consisting of planted conifers, shrubs, and forbs). Most of the area of the Hog Fire that had burned with moderate and low intensities, reburned with low intensities in the Yellow Fire. This is probably due also to the available fuels. Since mortality of the stand did not occur, effects of the fire were mostly a reduction in ground fuels. The fuels were reduced in the Hog Fire, thus reducing the fuels available for the Yellow Fire.

The Hog Fire burned with moderate and high intensities in the Nordheimer Creek drainage. This area has not had a large fire occur since then. The stand that was present for the Hog Fire has and continues to be a high fuel loading for this area. Much of the area has come back in shrub and live oak, growing over the top of fallen material. There have been fire starts, but they have been controlled with aggressive fire suppression efforts. The most recent in 1992 burned about 2.5 acres in China Creek, a tributary of Nordheimer. This fire burned with high intensity and due to the terrain and fuel conditions was extremely difficult to control. This fire occurred early in the season and plenty of support was available, if it had occurred at a time when forces were not as available, it would have become much larger.

Future Trends

As discussed earlier, a disturbing increase in acres burned has occurred in recent decades. It appears that this trend has a direct link to increases in available fuels, due to effective fire suppression beginning in the 1920s. Although technological improvements in fire suppression continue, it appears that increases in fire behavior have overtaken these improvements.

Under most conditions, fire suppression forces are still successful in containing fires during initial attack. As more technical advances are achieved, added success in containing fires during initial attack may be realized. With added success in containing fires comes continued build-ups in the amount of available fuels. On occasion, the suppression forces will be overwhelmed with a large number of starts, either in, or near, the watershed. In the event of a fire escaping initial attack, it will burn with more intensity, due to increases in available fuels, thus increasing damage within the fire areas.

Recent fires that escaped initial attack, have been large and destructive, affecting major portions of the watershed. As time progresses, areas that have not burned become more volatile.

The cost of Fire Suppression is high. Charges for the Dillon Fire, (1994) a fire on the Klamath National Forest near this watershed were $19,470,000. Total acreage for this fire was 29,000. This equates to $670. per acre. The Specimen Fire, (1994) also a Klamath National Forest fire, on the Salmon River Ranger District in an adjoining watershed, had suppression costs of $3,289,000. and was 7,000 acres. This equates to $470. per acre. Typically, costs per acre are less on larger fires. The China Creek Fire (1992) mentioned earlier, was 2.5 acres, suppression costs were $8,500., this equates to $3,400. per acre. Although this is a high per acre cost, this fire had the potential to become much larger, incurring much more resource and suppression costs. All three of these fires were

ignited by lightning. Costs for fire suppression will continue to rise. The cost of prescribed underburning for the Klamath is running at around $250. per acre. At this time, the prescribed fire program on the Klamath is small, burning 4-5 thousand acres annually. As the size of the program increases, the cost per acre is expected to decrease.

Certain information has been summarized from Appendix F - Risk/Fire Behavior Potential Analysis and is following; for the complete analysis refer to Appendix F, also the Fuel Models and the Potential Wildfire Effects Maps contained in the Map Atlas located at either the Ukonom or Salmon River Ranger District, and Figure 13 - Fire Behavior Potential Map contained in the Map Packet at the end of this document.

FIRE RISK
The watershed as a whole, has a Moderate-Risk rating, or one fire start per 11-20 years per thousand acres can be expected.

From the Fire Start Map, (located in the Map Atlas at either Ukonom or Salmon River Ranger District) the Fire Behavior Potential Map was developed (Figure 13). The Fire Start Map indicates that the river corridors and the population centers have the highest densities of fire starts within the watershed. By separating the watershed into three risk areas, the river corridors, the north side, and the south side, three risks are identified.

- High-Risk (one fire start per 0-10 years per thousand acres) --The river corridor, from Forks of Salmon to Somes Bar and Merrill Creek have a risk of 1.06.
- Moderate-Risk (one fire every 11-20 years per thousand acres) --The north side of the watershed, north of the Salmon River has a risk of 0.5.
- Low-Risk (one fire every 20 or more years per thousand acres) --The south side of the watershed, south of the Salmon River has a risk of 0.36.

Acres Within Risk Classes: High-Risk is approximately 12,300, Moderate-Risk is 33,800, and Low-Risk is 23,300.

FIRE BEHAVIOR POTENTIAL
The following acres are associated with each Fire Behavior Class in the watershed: High is approximately 39,000 (57% of watershed), Moderate is 6,700 (10% of watershed), and Low is 23,300, (33% of watershed).

PROBABILITY OF LOSING A STAND TO WILDFIRE
The following is a summary of acres within each potential loss category for the watershed: Class 1 is approximately 21,000 (31% of watershed), Class 2 is 25,300 (37% of watershed), Class 3 is 16,200 (23% of watershed), and Class 4 is 6,400 (9% of watershed).

VEGETATION
See *Chapter 2* for a description of the present vegetation characteristics. A good comparison for vegetation changes is to compare the 1944 vegetation map with the current vegetation map (refer to the 1944 Vegetation Map contained in the Map Atlas located at either the Ukonom or Salmon River Ranger District).

The compositionally and structurally variable vegetation and the diverse and dissected terrains found in the analysis area, combined with the relatively uninhabited and undisturbed nature of the watershed has resulted in a high degree of habitat diversity, and therefore wildlife diversity.

Within the diverse vegetative series exist smaller habitats in such areas or niches as springs, rock outcrops, talus, scree, and within stand layers. One example is the *Allotropa virgata* or candystick that appears to be more common in the tanoak series and is found in a variety of seral stages from early-mature to old-growth. It is a mycotrophic plant; i.e., is dependent upon a fungus for part of its physiological requirements. Some botanists believe it to be highly associated with tanoak mushrooms; studies are needed to determine the interactions between fungi species and other forest processes.

Future Trends
The major trend for vegetation within the watershed is for an increase in biomass. The mid-mature, late-mature, and old-growth stands will see an increase in understory vegetation. Shade tolerant species will continue to become established underneath the current stands. Competition induced stress will become more prevalent as the quantity of vegetation increases. The older trees will begin to die-out and hardwoods, excluding tanoak, will be eliminated from the stands. Crown ratios will be reduced as more stems get established. Due to the vertical structure, mistletoe will be inclined to spread through the stand in all size classes. Fuel levels within these stands will become very high.

The planted areas within the current shrub seral stage will trend towards pole/early-mature. As the conifers get larger, grass/forbs, shrubs, and hardwoods will begin being eliminated from the site. Shading will be the major factor as most stands will tend to be dense. Even age conditions will be prevalent within the pole/early-mature seral stage. Eventually, dense early-mature and mid-mature stands will be prevalent; they will be less vigorous due to this density. Trees will have shorter live crowns, smaller diameters, and in some cases, become stagnated.

In areas not planted with conifers, the shrub seral stage will tend to be dominated by shrub and hardwoods. Density levels for these plant communities will increase. Shrub will become more decadent after a 20-25 year period. It will be a long time before conifers get established and once established they will be fairly scattered.

The live oak stands will not change much in biomass quantities but current vegetation will get older and more decadent. Crowns on both hardwoods and conifers will become more sparse. Some trees will start dieing, especially during drought periods. The shrub component will become more decadent. Dead fuel concentrations will continue to build in these stands.

The current trend for vegetation is showing a shift from shade intolerant to shade tolerant species. Species such as ponderosa pine and sugar pine are not being replaced within stands due to the lack of openings. Hardwoods such as black oak and madrone are suffering the same fate.

The current trend, increased vegetation biomass and changes in stand structure, raise a concern for increased risk to disturbances such as wildfire and insect and disease problems. Also, as vegetation biomass increases in the watershed as a whole, forest health problems will become more prevalent, which can have ramifications on a variety of resources.

INSECTS AND DISEASE

Past

Various insect and disease species have always been present within the watershed. Insect levels are dependent upon favorable vegetative conditions. These are conditions that allow insects to successfully complete their life cycles in the host species. Situations conducive to this are those that provide stress to host species. Increased competition for water and nutrients are inducers of stress as is increased age and decadence of individual trees. Disease establishment is also favored by stress factors. Other important attributes for establishment and spread can be the lack of disturbance for some diseases, mistletoe, and disturbance for others, root diseases. Due to past vegetative structures and patterns, insect and disease populations were present in endemic levels.

Inter-tree competition was minimal within the conifer stands and the individual stands were somewhat fragmented causing insects to be confined to small areas. Insect populations probably increased during periods of drought. Trees most susceptible to insects were overmature trees, and intermediate and suppressed trees in denser conifer stands. Scattered trees associated with hardwood/shrub areas were probably targeted by insect species during drought situations. The fire regime generally kept the vegetation in a stress free environment so insect epidemics were not common within the watershed.

Disease centers were probably confined to small areas. Root diseases do not appear to have been a major problem within the watershed. Dwarf-mistletoe was present, especially on Douglas-fir. Infections levels were probably low and spread rates slow due to frequent fires that burned through the watershed.

Present

Insects are not a major problem within the watershed. Total biomass has increased dramatically over the past 100 years, but the high rates of mortality being experienced in adjacent watersheds have not occurred in Main Salmon. One location in the true fir zone with very dense red and white fir stands has received an increase of insect activity.

There has been no confirmation of large scale population centers of root disease problems and informal visual observations have not surfaced any problems. Levels of dwarf-mistletoe infestation have been increasing since the inception of fire suppression. The level of infection on individual trees and within stands has been increasing and in some cases is causing some forest health concerns within some of the conifer stands. Douglas-fir is the dominant species being infected. Infection levels in the Douglas-fir stands are on the rise. Regeneration located within or adjacent to these

infected areas is being impacted so severely that many of the trees will never attain a large tree character. Some known areas of mistletoe problems include Duncan Creek and the headwaters of Somes and Butler Creek.

Future Trends

Mistletoe problems will continue to increase in portions of the watershed. Successful regeneration and growth of infected species will be unlikely in areas of high infestation. Mortality will become a problem, which will exacerbate insect and fire problems.

WILDLIFE SPECIES AND HABITATS

This section addresses wildlife and their habitats within the analysis area. Fire is discussed as a primary process affecting wildlife habitat. For each species, or groups of species, habitat elements are described, followed by a discussion on what past conditions may have been and what current conditions are. The current conditions address the influence of other processes and functions on wildlife habitat.

Fire and Wildlife Habitat

PAST

The past fire regime was characterized by a short return interval (1-25 years) with low to moderate intensity fires. The current regime has shifted to one of longer intervals between fires with moderate to high intensity. In general, the longer the interval between fires, the more intense the subsequent fire. Increased intensity is attributed to increases in accumulated fuels during the longer fire-free interval.

Lightning and American Indian practices provided ignition sources in the watershed prior to European settlement. Euro-Americans ignited fires in the watershed, from 1850s until the 1920s. During that period frequent fires and grazing by domestic livestock, probably accounts for the open parklike forest conditions of that time. Due to low fuel accumulations most fires burned with low to moderate intensity and crown fires were not sustained over large areas. High intensity fires occurred in short runs, based on topography and weather conditions. Due to the topography of the area these high intensity patches were usually linear, oriented up and down the slope, interspersed within areas burned at low intensity.

Patches of high intensity fire, although infrequent, produced snags and downed woody material. Small woody material retention was short due to frequent fires, but large (>30") woody material was retained for long duration (20-30 years) except in periods of drought when larger fuels dried and burned completely.

The past fire regime produced irregular patches of even-aged vegetation, ranging in size from, less than an acre, to a thousand acres, adding horizontal diversity to the watershed.

Northern aspects, cool moist canyon bottoms, and higher elevations that were cool and less exposed, tended to burn less often than more exposed sites. These sites maintained a thicker understory that provided vertical diversity to those stands, characteristics which are closely associated with spotted owl nesting and roosting habitat. Fires burning into and through these sites provided a patchy surface mosaic. Frequent fires in the adjoining patches kept fuels at low levels, and understories relatively free of small trees and other vegetation that could form fuel ladders and carry surface fires into the main canopy. This helped to protect and maintain the vegetative characteristics of these sites, by minimizing fire intensities in areas of overlap, thus minimizing fire severity in all but the most extreme conditions (i.e., severe drought).

Fire created openings provided for regeneration and growth of shade-intolerant and fire-resistant trees and other vegetation. These species include Douglas-fir, ponderosa pine, sugar pine, Oregon white oak, and black oak. They are able to regenerate successfully in the presence of frequent fires. A typical scenario may have begun with the death of a small group of trees by a locally intense fire, or another cause. The resulting concentration of fuel was reduced by one or more fires. Mineral soil was exposed, and competing vegetation (including reserves of dormant seeds stored in the duff and soil) was reduced. Given a good cone crop and favorable soil moisture and temperature, seedlings became established. Subsequent fires in the vicinity burned only lightly, if at all, through the opening because of the local lack of an overstory to provide enough litter to carry a fire of appreciable intensity through the opening, some of the young trees were large enough to survive the next fires. Fire-resistant species would have comprised a majority of the surviving trees. With reduced competition these survivors would become domi-

nants in the overstory. With frequent fires these fire-resistant dominants could be sustained in a late-mature condition for a long period (possibly several centuries) of time.

The more shade-tolerant, fire-sensitive species (white fir, red fir, incense-cedar) regenerate beneath overstory trees as well as in openings. Periodic fires, however, kept their numbers relatively low, especially in the understory. The moister sites, which generally experienced longer fire return intervals, permitted fire-sensitive species to survive.

Meadows that experience seasonal drying were a stable habitat where frequent low to moderate intensity fires maintained the meadow complexes by consuming encroaching seedlings.

PRESENT

The present moderate to high severity fire regime, is characterized by short return interval crown/ severe surface fires (25-100 year intervals).

Aggressive fire suppression practices have resulted in increased vegetative biomass in all but the harshest sites within the watershed. Fuels on the forest floor (including coarse woody material) have accumulated far beyond their historic levels. In most stands an understory of reproduction has developed that had not been allowed with frequent fire intervals of the past. Vertical diversity is extensive throughout the watershed, except where site quality is poor. These dense-canopied stands maintain higher relative humidities and reduce heating and drying of surface fuels by solar radiation and wind, thus are less flammable under most conditions. As fuels accumulate, however, fires are increasingly likely to become large and damaging.

Where fire starts have overwhelmed fire suppression forces, fires that escape initial attack have burned large portions of the watershed.

These large fires contributed in the short-term to available snags and downed woody debris in the watershed. Much of the area that was burned by the Hog Fire (1977) and again by the Yellow Fire (1987) was denuded of snags, downed woody material, and remaining vegetation. These are now large patches of shrub/forb seral stages with recruitment of snags and large woody material expected in 70-110 years.

In areas that have not burned in recent years, (within 20 years) fire suppression has allowed for increases in cover and density. Fire exclusion favors shade-tolerant conifer species, hardwood species, and shrubs, at the expense of grasses and forbs. Mortality from stress, disease, and insects has increased in these stands adding snags and saturating the forest floor in some areas with downed woody material. These conditions have come in under the old dominants of the stand that survived many fires in the past regime. Stands are now dominated by younger trees that have been established during the fire suppression period.

Small openings created by fires of the past allowing for regeneration by shade-intolerant seed dependent species are mostly non-existent. Although Douglas-fir can establish under a canopy, ponderosa pine, sugar pine, Oregon white oak, and black oak are not able to regenerate in closed canopy conditions.

High elevation meadows, have been encroached upon during the period by shrub and conifers. Many meadow areas in the watershed were burned in the Yellow Fire which added snags and downed woody material to these meadows.

FUTURE TRENDS

Aggressive fire suppression practices have developed stands with greater vertical diversity and multiple layers. Snag and downed woody debris development has increased. Fire suppression in these stands may have improved habitat for late seral species, however, those benefits may be short lived. Fire will return to these stands. The longer fire is kept from these stands the higher the intensity of the next fire.

Recent fires, that have escaped initial attack, have been large and destructive. The Off Fire (1973) burned 9,200 acres in the watershed. Parts of this fire area were salvage logged, planted, and now consist of mixed-conifer plantations with heavy shrub. Much of the fire area that was not salvaged, consists of shrub with a large amount of woody material beneath shrub. This is an area of high fire risk, with at least one fire expected in 0-10 years per thousand acres. Based on the potential fire effects analysis it has a very high likelihood of the stand being lost to fire. The next fire, based on analysis of areas of repeat fires within the watershed, will include a larger area, entering bordering stands. The Hog Fire (1977) burned 39,000 acres

in the watershed. Some of the burned area within the Nordheimer Creek drainage was helicopter salvage logged and fuels were not treated. This is an area of low-risk, with one fire expected every 20 or more years per thousand acres. This area still has remnants of the previous stand, although with the fuel conditions on the ground, most of these will be lost in next fire. The area of the Hog Fire in the Crapo Creek drainage was also helicopter salvaged and the fuels not treated. This area reburned in the Yellow Fire (1987) and has regenerated in shrub. Much of the area has been planted with mixed-conifers, but sprouting and competition by shrub species is the major stand component. The Yellow Fire burned 23,000 acres in the watershed. Most of this area is a moderate risk, one fire expected every 11-20 years per thousand acres. The lower elevations of these fire areas (the river corridor) are high-risk, with one fire expected in 0-10 years per thousand acres.

Based on their fuel characteristics, old-growth stands are classified as having a High Fire Behavior Potential. Most of the old-growth stands in the watershed are in Somes, Monte, Duncan, Grant, and Butler Creeks. Most of these stands fall into a low-risk area, although the portions entering the river corridor are high-risk. Risk identifies the amount of time expected between fire occurrences. Fire Behavior Potential identifies expected fire behavior. Although risk is mostly low for these stands, expected fire behavior once fire enters the stands is high. Overlaying Risk on Fire Behavior Potential identifies these stands as having a moderate likelihood of being lost to wildfire.

WILDLIFE SPECIES HABITAT

This section addresses key questions regarding wildlife habitats for specific species in the analysis area. The species addressed include those that are Federally listed, Sensitive, Candidates for Federal Listing, Late-Successional forest associated species, and Management Indicator Species from the *Draft Forest Land and Resources Management Plan*.

Federally Listed Species

BALD EAGLE

Along the Salmon River, large snags or dead-top trees (especially pines) with sound, open upper limbs are important habitat features for bald eagle foraging (and potential nesting) perches.

The previous discussion of the effects of the historic fire regime on bald eagle is pertinent in its reference to effects on the availability of large trees.

Historically, fish populations were more numerous and thus, likely supported a greater population of wintering birds as well as nesting birds.

The current use of habitats by bald eagles in the analysis area is for foraging. The Salmon River and adjacent late-mature and old-growth conifer stands (used for perching) are considered bald eagle winter foraging habitat. There are approximately 2,400 acres of this habitat occurring within one mile on either side of the Salmon River within the analysis area (refer to the Bald Eagle: Foraging Habitat Map contained in the Map Atlas located at either the Ukonom or the Salmon River Ranger District).

The previous discussion regarding the effects of the current fire regime is pertinent in its reference to the effects on the availability of large trees and mature and older forest.

Although stand replacing fires have had the most apparent affect on the vegetative components of foraging habitat, suppression tactics have had affects as well. Setting backing fires along the river may have resulted in a "pulse" of snags created that will be followed by a large cohort of snags falling to decay within a relatively short period of time. This would result in a decrease of this important habitat element.

Recent salvage of hazard snags along the Salmon River Road has resulted in a loss of perches where bald eagles had been seen perching, but many additional snags remain that are used by bald eagles.

Fish are important subsistence features for bald eagles. The populations of fish in the Main Salmon analysis area indirectly affect the bald eagle and are probably the single most important "barrier" (at a Provincial scale) to their recolonization of the area.

Foraging habitats, particularly those in areas of infrequent human-use, have potential to provide nesting habitat. Bald eagles do not tolerate much disturbance around their nests. Since roads provide a source of disturbance, other factors being equal, those portions of foraging habitat in the

analysis area that are away from (or on the other side of the river from) roads are important because they have the greatest potential to become colonized by breeding bald eagles.

PEREGRINE FALCON

The most important habitat element for peregrine falcons is a cliff greater than 50', with a suitable nest ledge inaccessible to terrestrial predators. Also important are nearby perch trees (generally ridgetop snags) used for resting and surveying the area for prey and competitors/enemies.

Peregrine falcons are opportunistic avian predators. Diverse and healthy populations of birds (residents and migrants) using openings or above-canopy habitats, are important subsistence features for peregrine falcons. A variety of habitat types surrounding the eyrie provides for a diverse population of prey species.

The previous discussion regarding historical effects of fire is pertinent in its reference to watershed-wide vegetative patterns and snags used for perching.

There is currently one active (Site A) and one historically active (Site B) cliff nests, or eyries, within the analysis area. Site A was observed in 1969. Monitoring records are available for the site since 1975; it has been active each year since 1975. Site B was monitored for nine years, from 1975 to 1983. It was active for two of those years, in 1978 and 1979. Management areas have been established around both sites A and B. A cursory assessment of suitable terrane type and steepness identified numerous potential cliff sites within the analysis area (map on file). These sites have yet to be surveyed for peregrine falcon occupancy.

An assessment of seral stage composition within the foraging zone surrounding Site A is summarized in Table 4 - Acres By Seral Stage Within Three-Mile Radius of Site A (map on file). Observations have reported prey taken by peregrines at site A. They include spotted sandpiper, rock dove, band-tailed pigeon, common flicker, western meadowlark, common merganser, California gull, and Steller's jay.

Table 4 - Acres By Seral Stage Within Three-Mile Radius of Site A

SERAL STAGE	ACRES	PERCENT
Shrub/Forb	365	2
Pole/Early-Mature	4,320	24
Mid-Mature	8,300	46
Late-Mature/Old-Growth	4,270	24
Unclassified	838	4
TOTAL	18,093	100%

The previous discussion on the effects of the current fire regime on habitats is pertinent in its reference to the effects on vegetative patterns and the availability of perching snags. Fire has the potential to alter peregrine falcon's prey base by causing changes to foraging habitats and shifts in the bird species guilds (prey) that use them. Currently, the vegetative composition within the estimated foraging zone around site A provides for a diverse prey base.

Reproductive success is the greatest "barrier" to peregrine falcon dispersal. Based on yearly monitoring of known eyries reproductive success is currently low. This is believed to be the result of residual accumulations of organochlorides in older breeding pairs, causing eggshell thinning (Pagel and Jarman 1991). Eggshell fragments were collected and measured from site A in 10 years since 1979. Reproductive failure is typically associated with 15% to 17% percent thin. The fragments exceeded 17% thin in five of those 12 years and the nest failed in three out of those five years. Overall, the site has been unsuccessful (i.e., eggs were laid, but no young fledged) in eight years during the last 18 years of monitoring, including no fledging in the last four years.

Unaccustomed human disturbance in the vicinity of nest cliff during courtship and breeding activities also has the potential to be a "barrier" to reproductive success. In 1983, a mining proposal (involving the use of a backpack dredge) within the vicinity of Site A was modified to occur after fledging in order to not disrupt feeding activity between adults and young. During 1993, heavy equipment used to maintain a River Access at the base of Site A was identified by the District Biologist and other

Peregrine Specialists as having the potential to disturb breeding peregrines at Site A. Coinciding with a steady increase in recreational river rafting, in 1994 the District Biologist identified that rafters using the River Access at the base of Site A as a take-out or put-in had the potential to disturb breeding peregrines at this Site.

Roads that existed prior to peregrine falcons colonizing an area do not seem to significantly affect them. However, road (or trail) construction, reconstruction, or infrequent periodic maintenance during the breeding season (January 1 - July 15) has the potential to disturb peregrine falcons from unaccustomed noise.

NORTHERN SPOTTED OWL

Continuous larger blocks of late-successional and old-growth forests are important habitat features for Northern spotted owls. The following is a summarized description of suitable nesting, roosting, and foraging habitat for the analysis area (refer to Appendix G - Northern Spotted Owl & Marbled Murrelet Habitat Description for detailed information).

In Douglas-fir and mixed-conifer types, the average diameter of all trees in the overstory is at least 18" (at 4.5 feet), the total canopy closure is at least 60%, and there are accumulations of large snags and logs. In the true fir type, the overstory trees must average at least 15", there must be a canopy closure of at least 60%, and in all types there must be the presence of deformed living trees.

Dispersal habitat generally consists of stands with an average dbh of 11" and a total canopy closure of 40% or greater.

The previous discussion of habitat under a historical fire regime is pertinent in is reference to vertical diversity within stands and horizontal diversity of stands across the watershed. Stands which provided for nesting and roosting, as described above, were less prevalent than they are today.

Currently, there are three pairs and one territorial single known to occupy the analysis area outside of mapped late-successional reserves. They occur in Somes (KL-4045), Monte (KL-0304), Duncan (KL-4044), and Butler (KL-0261) drainages. All four sites meet criteria for designation of 100-acre late-successional reserves.

Table 5 - Spotted Owl Habitat Acres by Land Allocation displays the acres of spotted owl habitat within the analysis area (see the Owl Range Habitat Types Map located in the Map Atlas either at the Ukonom or Salmon River Ranger District) by land allocations. See *Chapter 4* for a discussion of land allocations.

Table 5 - Spotted Owl Habitat Acres by Land Allocation

HABITAT TYPE *	LAND ALLOCATION				
	CD	LSR	AW	Harsh Sites	Matrix
Nesting	1,301	474	2,045	871	3,365
Roosting	409	464	2,323	1,536	4,582
Foraging	205	642	3,660	4,785	4,747
Dispersal	93	-	337	674	331
TOTAL % Analysis Area **	2,008 3	1,580 2	8,365 12	7,866 11	13,025 19

CD = Wilderness, LSR = Late-Successional Reserve, AW = Administratively Withdrawn

* Habitat types are hierarchical and are listed in order of descending suitability; i.e., nesting habitat also provides roosting, foraging, and dispersal habitat.

** Three percent of the total suitable habitat currently available within the analysis area occurs within Congressionally Designated lands.

Within the analysis area, large continuous blocks of nesting/roosting habitat occur in the Somes, Monte, Duncan, and Butler Creek drainages. These blocks are well connected outside the Analysis Area to the northeast into the Wooly Creek Drainage and west into Ikes Creek, also known to support a pair of breeding owls. Smaller relatively isolated blocks of nesting and roosting habitat (not yet surveyed for spotted owls) also occur between Lewis and Hammel Creeks, in the mid reaches of China and Nordheimer Creeks, and in the upper Crapo drainage inside the Wilderness. A relatively wide band made up mostly of non-habitat occurs diagonally across the Analysis Area from the mid reaches of Crapo Creek to the upper reaches of Granite Creek.

The previous discussion on the effects of the current fire regime are pertinent to northern spotted owl habitat, especially with regards to vertical diversity within stands, horizontal diversity across the watershed, snags, and coarse wood debris. Effective fire suppression has resulted in more ar-

eas becoming suitable habitat than were available under historical fire regimes. Within the Main Salmon analysis area, it is also believed that the effects of fire suppression have predisposed present suitable habitat to being destroyed by catastrophic wildfires. Suitable habitat in Merrill, Crapo and Nordheimer drainages, has been lost in the past two decades to catastrophic fires. Dense understory development has occurred in some areas, making them unsuitable for foraging. Fuels treatments to reduce the risk of habitat loss to wildfire need to consider retaining sufficient amounts of snags and large down logs, especially on north facing slopes, in cool draws and in the bottom one-third of slopes as these areas are generally where spotted owls roost and nest.

The greatest barrier to movement or dispersal are large areas of unsuitable habitat. Spotted owls generally avoid these areas, since they are at greater risk of predation. Barriers exist within areas rendered unsuitable due to catastrophic fire and subsequent logging, mostly in the Crapo and Nordheimer drainages, in logged areas (Duncan, Merril, and Monte drainages), and to a lesser extent naturally due to site conditions in the headwater areas of Crapo Creek and Nordheimer Creek and its tributaries (see the Northern Spotted Owls Habitat Shown with High Fire Behavior Potential Map contained in the Map Atlas at either the Ukonom or Salmon River Ranger District). Dispersal habitat has been assessed within the analysis area at the quarter township scale to determine whether at least 50% of the lands support tree canopies greater than 40% over conifers greater than 11" dbh (50-11-40 modified* analysis). All or portions of 23 quarter townships occur within the analysis area; of these, 16 have less than 50% of lands available for dispersal. All quarter townships meeting 50-11-40 modified (with appreciable acreage in the watershed) occur in T11N,R6&7E,HM, which corresponds to the Somes/Butler portion of the watershed. Table 6 - Summary of 50-11-40 Modified Analysis displays acres and percentages of dispersal or better habitat within the area of each quarter township occurring in the analysis area.

*Note: This assessment of 11-40 habitat included the entire analysis area. It was not applied to only the lands capable of supporting 11-40 habitat. This assessment will be supplemented with a 50-11-40 analysis applied only to capable lands.

Table 6 - Summary of 50-11-40 Modified Analysis

1/4 TOWNSHIP	ACRES OF HABITAT	1/4 TOWNSHIP ACRES WITHIN WATERSHED	PERCENT MEETING "11-40"
T10NR6E-NE	645	1,814	36
T10NR6E-SE	137	1,194	11
T10NR7E-NE	1,547	5,277	29
T10NR7E-NW	2,586	5,613	46
T10NR7E-SE	1,079	2,389	45
T10NR7E-SW	2,255	5,662	40
T10NR8E-NW	17	309	6
T11NR6E-NE	4,143	5,083	82
T11NR6E-NW	59	100	59
T11NR6E-SE	3,474	3,853	90
T11NR7E-NE	1,549	4,009	39
T11NR7E-NW	3,643	4,677	78
T11NR7E-SE	2,814	5,788	49
T11NR7E-SW	4,653	5,797	80
T11NR8E-NW	444	2,751	16
T11NR8E-SW	582	4,176	14
T12NR6E-NE	34	63	54
T12NR6E-SE	1,451	3,634	40
T12NR6E-SW	2	2	100
T40NR12W-N	510	1,919	27
T41NR12W-S	123	975	13
T9NR7E-NE	251	585	37
T9NR7E-NW	1,058	3,702	29
TOTALS	**33,056**	**69,374**	**48**

Unroaded areas can be important for the conservation of spotted owls since these areas generally have fewer management induced changes in suitable habitat. Vegetation patterns in unroaded areas often reflect a more "natural" variety of habitats that tend to grade into each other, whereas vegetation patterns in roaded areas often reflect intensive timber management practices with unnatural degrees of fragmentation and more drastic habitat edges and consequent edge effects. For a summary of the assessment of spotted owl habitat, see Appendix H - Spotted Owl Habitat Assessment.

MARBLED MURRELET

Current knowledge of suitable nesting habitat for marbled murrelets is limited. In Northern California, it is believed that stands within 50 miles of the coast may have the potential to provide nesting habitat.

Suitable habitat as defined in the *Proposed Designation of Critical Habitat for the Marbled Murrelet* (1994, 59 FR 3816) includes descriptions of suitable habitat in terms of individual trees, forest

stands, and landscapes. These descriptions are detailed in Appendix G and summarized below:

--Individual potential nest trees are large (generally over 32" dbh) and have some sort of platform broad enough to support an egg. Platforms can be made up of a variety of structures including large lateral limbs, but should have some sort of overhead cover for protection.

--Nest stands are either continuous mature and old-growth forests or younger stands with scattered potential nest trees.

--On a landscape basis, marbled murrelets may be associated with the presence of late-successional, mature and old-growth forests with substantial canopy closure within the flight and energetic capabilities of marbled murrelets to commute to from marine foraging environments.

The discussion regarding habitat conditions under historic fire regimes is pertinent to marbled murrelet, particularly in regards to effects on large trees. Large, dominant trees were likely conspicuous features of forested areas. However, stand conditions were likely more open and areas of suitable canopy cover were probably limited to north aspects and along drainages.

The analysis area is bisected by Marble Murrelet Zone 2, within which current conditions have been analyzed. No surveys have been conducted within the analysis area. The maximum inland distance for detections on the Forest is 35 miles.

There are approximately 8,300 acres of optimal nesting habitat and 3,200 acres of sub-optimal nesting habitat within Zone 2 of the analysis area. The largest of these habitat blocks are in the Somes, Monte, Duncan and Butler drainages, with smaller blocks occurring in the upper reaches of Hammel and Tom Payne Creeks.

Marbled murrelet critical habitat has been proposed for LSRs within Zones 1 and 2. Approximately 1,000 acres of the Ten Bear (RC349) and 1,170 acres of the Steinacher (RC348) LSR are within Zone 2. Approximately 230 acres in the Ten Bear and 520 acres in the Steinacher LSR are considered optimal marbled murrelet nesting habitat (based on habitat quality, but not distance from marine foraging habitats).

The discussion on the effects of the current fire regime is pertinent to marbled murrelet habitat, particularly where it references effects on within stand diversity and stand replacing fires.

A likely barrier to murrelet dispersal within the analysis area is the distance they must fly from their marine foraging habitats. This includes the risk of predation by peregrine falcons.

Unroaded areas of suitable habitat within murrelet range generally have larger continuous blocks of mature forest habitat and less fragmentation. Roads in marbled murrelet habitat can cause habitat loss from road rights-of-way, and disturbance associated with road construction, reconstruction or maintenance.

Sensitive Species

NORTHERN GOSHAWK

Hall (1982) found that nest stands in the Mad River Ranger District area were generally:

- dense conifer stands, with a canopy closure greater than 70%,
- exposed in a north to east direction,
- located on moderate slopes,
- of moderate size (average stand area = 25 acres),
- single storied with little or no understory, and
- composed of overstory trees classified as predominantly small sawtimber.

A mosaic of seral stages surrounding the nest stands provides a diversity of prey species.

The discussion of the effects of the historical fire regime on habitat conditions is pertinent to goshawk habitat, particularly in reference to within stand characteristics. Stands were more open and better suited to foraging.

Goshawks have sighted in Somes Creek, Duncan Creek, Hammel Creek, and Tom Payne Creek. Surveys to protocol have been conducted within Somes and Duncan Creeks, but no nests were detected.

There are about 6,300 acres of suitable goshawk nesting habitat and about 1,300 acres of suitable foraging habitat within the analysis area (see the Potential Goshawk Habitat Map contained in the Map Atlas located at either the Ukonom or Salmon River Ranger District). Most of this occurs within the Somes, Monte, Duncan and Butler creek drain-

ages, with relatively large gaps in habitat occurring in the Crapo and Nordheimer drainages.

A 333 acre Goshawk Management Area had been identified in the *Draft LMP* in the Somes Creek portion of the analysis area. There are currently 68 acres of late-mature and old-growth habitat and 265 acres of mid-mature habitat, all with greater than 95% canopy cover available within this management area.

The discussion of the effects of the current fire regime is pertinent to goshawk habitat, particularly in regards to the effects on within stand diversity. It has resulted in the development of multiple subcanopies which may restrict subcanopy foraging.

The effects of fire suppression have increased the densities of conifer forest understories which, along with areas where logging has removed conifer overstories, has resulted in habitat loss and could be considered a barrier to site occupancy.

Linear openings, such as roads, within forested stands are conducive to the goshawk's foraging strategy of high speed aerial ambush. Roads, probably function as convenient linear openings in densely vegetated habitats.

PACIFIC FISHER AND AMERICAN MARTEN

Primary habitat attributes are large decayed standing and down wood. These habitat elements are used for resting, denning, and foraging. Another habitat element is vegetative canopy greater than 60%, used for cover. These elements together with a sufficient small animal prey base results in habitat capable of supporting these carnivores. Riparian areas, saddles, and ridges are believed to be important travel ways. Generally marten are found at higher elevations than fisher.

The previous discussion of the effects of the historical regime on vegetative structure is pertinent, especially as it relates to snags and down wood. Accumulations of large decayed standing and downed wood were probably less prevelant than they are today.

Incidental sightings of fisher and marten have occurred within the analysis area, though no protocol surveys have been conducted.

A habitat analysis has been performed for fisher and marten in the analysis area using arithmetic means of habitat values found in the California Wildlife Habitat Relations (WHR) Model (see Table 7 - Acres and Percentage of WHR Habitat in LSRs for Fisher and Marten).

Table 7 - Acres and Percentage of WHR Habitat In LSRs for Fisher and Marten

FURBEARER	ACRES HIGH (%)	ACRES MED (%)	ACRES LOW (%)	ACRES NON (%)
FISHER: LSR	2,434 (64)	11 (<1)	171 (5)	1,212 (32)
Watershed	34,344 (50)	3,477 (5)	4,343 (6)	27,097 (39)
MARTEN: LSR	1,786 (47)	659 (17)	225 (6)	1,158 (30)
Watershed	28,353 (41)	10,391 (15)	3,782 (5)	26,756 (39)

The map (Fisher Habitat, Arithmetic Mean contained in the Map Atlas located at either the Ukonom or Salmon River Ranger District) generated from this WHR model for the fisher shows the largest continuous blocks of HIGH value habitat in the in the Somes (west side of drainage) Monte, Duncan, Butler, Lewis, Portuguese, and Tom Payne drainages, with less well connected blocks elsewhere and large areas of NON habitat in the lower Crapo and upper Granite Creek drainages. The large blocks of HIGH value habitat are well connected to areas outside the analysis area north up the Wooley Creek drainage and southwest over the ridge at the head of Butler Creek. There is also a continuous block of HIGH value habitat at the head of Merrill Creek that is somewhat isolated from other blocks in the analysis area, but is fairly well connected to other blocks to the north, east and west

The portions of the Ten Bear and Steinacher LSRs in the analysis area support relatively high percentages of HIGH value fisher habitat, while the Crapo LSR supports moderate percentages of a relatively isolated block.

The prior discussion of the effects of the current fire regime is pertinent in that it has probably favored these two species compared with the historic fire regime. Snags and down logs may get consumed in even relatively low intensity fires, so those areas of the analysis area that are well outside the historic fire return interval probably have a greater capacity to support fisher and marten today than historically. Fires also have the capacity

to cause a pulse or large increase in available snags and subsequent logs. This occurrence, while generally increasing habitat suitability, can greatly increase the risk of a stand replacing reburn if fire returns to an area before trees killed in the initial fire decompose.

Since fisher and marten are wide ranging and never common even in optimal habitats, it is difficult to identify specific barriers.

Open road densities are believed to be negatively related to habitat suitability for fisher and marten. Therefore, unroaded areas are significant to the conservation of these species since they have the potential to become optimal habitat. Since much of the watershed is relatively unroaded, this area may constitute a significant local refugia and population source.

GREAT GREY OWL

Nesting, roosting and foraging habitat attributes for great grey owls are mature/old-growth fir/lodgepole forests surrounding meadow type habitats.

The previous discussion of the past fire regime is relevant to the assessment of great grey owl habitat in its reference to high elevation meadows. In the past, it is likely that the frequent low intensity fires kept meadow habitats larger and more open from conifer encroachment. This probably resulted in there being more great grey owl foraging habitat.

There is one unconfirmed report of a great grey owl seen in the analysis area. The upper portions of Nordheimer Creek, and Morehouse and Crapo Meadows have potential of being occupied, though no surveys have been conducted.

The prior discussion of the current fire regime relates to great grey owl habitat in its mention that high elevation meadows have been decreased in size through the encroachment of conifers and shrub. The current fire regime has also had a positive effect on great grey owl habitat where it burned hot enough for stand replacement and/or where the majority of the conifers were salvaged in higher elevation areas (such as upper Crapo Creek). In these areas meadow-like conditions have been created, which may be used by great grey owls if sufficient perching snags remain.

There are approximately 3,300 acres of great grey owl nesting and roosting habitat currently within the analysis area. Most of this habitat is located within the wilderness portions of the analysis area in the upper Crapo, Morehouse, and Nordheimer drainages, with some other less extensive areas in the upper China, Granite, Lewis, and Hammel Creek drainages (see the Great Grey Owl Habitat Map contained in the Map Atlas located at either the Ukonom or Salmon River Ranger District).

The general lack of suitable habitat within the analysis area is the only identified barrier to dispersal.

With the exception of loss of habitat through road rights-of-way, there is no significance of unroaded areas to great grey owls.

Candidates for Federal Listing

PACIFIC WESTERN BIG EARED BAT

The Pacific Western or Townsend's big-eared bat is a colonial cave dwelling species and is considered "roost limited" in its distribution in Northern California (Pierson 1988). So therefore, its occurrence within the analysis area is contingent on habitat attributes provided by caves, mine shafts and seldom used buildings. Landscape level vegetative patterns are not thought to be particularly important to this species. Vegetation near the entrance of caves or mine shafts can be important in moderating the temperature, light and breezes near the entrances.

The prior discussion of the effects of the historic fire regime are not particularly pertinent to discussions of big-eared bats. The history of mining within the analysis area suggests there were once more mine shafts and old, seldom used structures that could have been used by big-eared bats.

A preliminary survey of a few hibernating/roost sites in northern California suggests populations may be stable in Siskiyou County (Pierson 1988). Townsend's western big-eared bats have been confirmed at two such locations within the analysis area. One is within the diversion tunnel under Sugarloaf near the mouth of the Salmon River (entrance on private land). The other known site is in an old mine shaft just above a mine shaft visible from the Salmon River Road at about the one mile mark. Other suspected sites include mine shafts near the Salmon River Road at about the 5, 5.5 and 6.5 mile marks, but these have not been surveyed for bats. It is reasonable to assume that as time

goes by, existing mine shafts may eventually cave in and unused buildings will eventually succumb to the ravishes of time, thereby suggesting a downward future trend.

As is believed the case with vegetative patterns, the effects of the current fire regimes are not thought to be particularly related to big-eared bat occurrence.

These bats are limited in their distribution to areas with available suitable roosts. They are also **very susceptible to human disturbance** and may permanently abandon a site from a single human visit. Therefore, disturbance of used sites and/or a lack of suitable roost sites constitute barriers to occupancy and dispersal.

Unroaded areas hold no particular significance to big-eared bats.

DEL NORTE SALAMANDER

The Del Norte salamander requires moist (but not wet) rotting logs, moist spaces beneath surface objects such as bark, and most commonly, damp rocky substrates, generally under forested canopies. It generally lives in the spaces between or under decaying wood or rock cobbles, and breaths through its skin, which must be kept moist through environmental conditions. During wet periods of above freezing weather it makes nocturnal forays on the surface. Welsh and Lind (1991) analyzed 18 sites where they located Del Norte salamanders in the Klamath/Siskiyou mountains and found their abundance varied positively with forest age, basal area of hardwoods, and large trees, and negatively with small trees.

The previous discussion on the historic fire regime may pertain to Del Norte salamander habitat conditions as probably less of the landscape was shaded, and the basal areas of hardwoods was probably less.

Little is known about its current status within the Analysis Area except that it reaches the eastern extreme of its known range there. It is listed as a "common yearlong resident" in Siskiyou and western Trinity counties (Zeiner et al 1988), but district records show it being found in only two locations in the northwest portion of the analysis area. These records probably reflect incidental sightings and not any systematic search.

The current vegetative patterns are thought to be an indirectly related habitat variable. Forests with closed canopies providing shade generally have damper surface and subsurface substrates, required by the Del Norte salamander, than open habitats. Geomorphic terranes that contain rocky substrates are important as mentioned above, and seeps within those rocky substrates can provide the dampness required by this amphibian even without high forest canopy shading.

An analysis using overlays of soil map units that have rocky soils or fractured rock under relatively closed tree canopies, and weighted towards the older seral stages determined that there are approximately 21,700 acres with moderate potential to support Del Norte salamanders, 7,500 acres estimated to have high potential and almost 1,000 acres estimated to have the highest potential within the analysis area. The largest blocks of areas estimated to have the highest potential occur within the Monte Creek drainage (see the Del Norte Salamander Potential Habitat Map contained in the Map Atlas at either the Ukonom or Salmon River Ranger District).

Management areas that preclude the removal of forest canopies will generally provide more of the needed microhabitat conditions than those areas where logging will be allowed to remove shading. Moist riparian areas may be important dispersal corridors.

The prior discussion of the overall vegetative effects of the current fire regime is pertinent in that it is believed to have been both positive in that it has probably facilitated the development of older stands with more closed canopies, and negative where it facilitated stand replacing fires that removed shading canopies. The current fire regime has probably also left more large pieces of decaying wood on the forest floor than would be expected under the historic fire regime. The removal of ladder fuels under relatively closed canopies for the purposes of fire presuppression will probably have positive implications for this salamander in the future, as long as adequate large down wood is retained.

Due to the Del Norte salamander's requirement for damp substrates , and due to its small size and relatively poor mobility, any expanse of dry substrate or area that is too wet (such as open water), is a possible barrier to movement and dispersal.

This species' ability to move from one area to another and to disperse into new areas is probably the most affected by barriers of all the terrestrial wildlife species analyzed in this document.

Since roads are believed to be barriers for Del Norte salamanders, unroaded areas with other favorable habitat variables are thought to be significant refugia.

Late-Successional Forest Associated Species
Due to similarities in life histories, these five bat species will be addressed together; specific differences will be discussed.

- Fringed Myotis
- Hoary Bat
- Long-eared Myotis
- Long-legged Myotis
- Silver-haired Bat

While all five of these bat species are associated with coniferous forests, they differ somewhat in their preference of roosting habitats. These preferences are related to these species degrees of colonialism. The colonial roosting **fringed myotis** requires the relatively roomy roosts found in caves, mine shafts, buildings and crevices. The semi-colonial **silver-haired bat** roosts and forms nursery colonies in caves, hollow trees, snags, buildings, crevices and under bark. The **long-eared and long-legged myotises** also form nursery colonies, but tend to roost individually or in small colonies in crevices in buildings or rock, in snags and under bark. Caves and mine shafts are used primarily for night roosts, with trees probably being the most important day roosts. The **hoary bat** is solitary and requires dense foliage in medium to large trees for roosting and reproduction. All these bats use ecolocation to forage on insects with the **fringed and long-eared myotises** specializing in beetles and the rest being moth specialists. All forage over forest openings and bodies of water.

The prior discussion of the historic fire regime pertains to this guild of bats in that it probably resulted in a greater amount of interspersed mosaic vegetative patterns that attract these bats.

With the exception of the **hoary bat**, which requires roosting habitats with dense foliage and larger trees, these bat species seem to be attracted to the mosaics of vegetative patterns that intersperse varying seral stages with openings and probably do not require high percentages of any one stand condition. However, the **long-eared myotis**, the **long-legged myotis** and the **silver-haired bat** all use hollow trees, snags and spaces under sloughing bark for roosting. These vegetative micro-habitats are most commonly found in abundance in older seral stages or in residual trees in younger stands.

Geomorphic terranes that provide rock crevices and caves, or which have mine shafts, are important for most of these bats for roosts.

An analysis of habitats for these bats has been conducted using the California Wildlife Habitat Relationships Model. The results of this model are summarized in Table 8 - Acres of WHR Habitat in LSRs By Bat Species, and display the acres of habitat classified as High, Medium, or Low for mapped late-successional reserves, based on the arithmetic mean for breeding, foraging, and cover habitat values assigned in the California WHR Model.

Table 8 - Acres of WHR Habitat In LSRs By Bat Species

BAT SPECIES	Acres High in LSR (Total)	Acres Medium in LSR (Total)	Acres Low in LSR (Total)
Fringed Myotis	0 (0)	0 (0)	2,696 (45,556)
Hoary Bat	202 (1,965)	2,645 (45,810)	0 (225)
Long-Eared Myotis	877 (15,664)	1,970 (32,124)	228 (6,793)
Long-Legged Myotis	268 (7,379)	2,580 (42,121)	722 (15,110)
Silver-Haired Myotis	144 (2,739)	2,704 (47,146)	228 (4,464)

Generally speaking for this guild of bats, the largest areas of the highest arithmetic mean occur in the northwestern one-third of the analysis area, with the lowest value habitat occurring in the middle reaches of Crapo Creek and the headwaters of Granite Creek. See the discussion on the Townsend's western big-eared bat for the locations of known or suspected bat roosts.

The impacts of the current fire regime on these bat habitats is probably negative compared with the historic fire regime. It is believed that the current fire regime is facilitating both the development of larger blocks of older seral forest and large stand replacing fires. Both of these trends tend to in-

crease habitat homogeneity and reduce the interspersed mosaic qualities of vegetative patterns that seem to attract these bats

Since these bats can fly, there are no physical barriers to movement and dispersal, although a lack of well dispersed roosting habitats such as caves, in an area, may limit foraging habitat utilization.

Although little is known about the historical occurrence of these bat species, it is reasonable to assume that they have always occurred within the analysis area. Concern has been expressed by bat experts recently that modifications to late-successional forest habitats through timber harvesting have led to a downwards trend. It is more likely that recent large stand replacing fires have impacted vegetative roosting habitats within the analysis area more than the relatively low percentage of regeneration timber harvesting. It is believed that the future outlook for these flying mammals will depend on fuels management, especially in areas that have not burned recently.

Management Indicator Species

As a guild of "Snag Associates", these six species will be addressed together. Differences in habitat use will be discussed.

- Downy Woodpecker
- Hairy Woodpecker
- Red-breasted Sapsucker
- White-headed Woodpecker
- Pileated Woodpecker
- Vaux's Swift

Standing dead trees (snags) provide nesting habitat for all species in this guild. Habitat preferences can be used to subdivide these birds into those preferring habitats associated with tree/shrub ecotones and deciduous hardwoods including riparian areas; the **downy and hairy woodpeckers** and the **red-breasted sapsucker**, and those preferring habitats associated with mature coniferous forests; the **white-headed and pileated woodpeckers** and the **Vaux's swift.**

This guild can also be divided based on preferences of tree density or canopy cover. The **pileated and white-headed woodpeckers** prefer relatively dense stands with canopy covers greater than 40%, while the others tolerate relatively more open or patchy stands.

Nest tree size preferences distinguish these species and can be used to order them in in ascending minimum requirements with the **downy woodpecker** needing snags >9" dbh., the **hairy woodpecker** >13"dbh., the **red-breasted woodpecker** somewhat larger, the **pileated woodpecker** >20"dbh., the **white-headed woodpecker** >24" diameter at the nest, and the **Vaux's swift** requiring hollow trees or snags large enough for it to fly down the middle of.

Relatively open mixed-coniferous/deciduous riparian habitats are important for the first three species listed. Relatively dense mature coniferous forest habitats are important for the **white-headed and pileated woodpeckers**, while large hollow snags or declining hollow trees in Douglas-fir forests are crucial for the **Vaux's swift.**

The previous discussion on the effects of the historic fire regime is pertinent to this guild in its disclosure of the estimated relative abundance of snags, tree densities, and canopy cover. For the most part it is believed that this guild may be more abundant now than under the historic fire regime.

An analysis of currently available habitats for this guild of snag dependent birds has been done using the California WHR model. The results of this analysis are summarized in Table 9 - Acres of WHR Habitat for Snag Dependent Species. This table displays acreages by habitat values (high, medium, low) based on the arithmetic mean of values assigned to habitats suitable for nesting, foraging, and cover by the California Wildlife Habitat Relationships model (see maps contained in the Map Atlas located either at the Ukonom or Salmon River Ranger District).

Table 9 - Acres of WHR Habitat for Snag Dependent Species

SNAG DEPENDENT SPECIES	ACRES HIGH	ACRES MEDIUM	ACRES LOW
Downy Woodpecker	0	34,070	27,331
Hairy Woodpecker	30,035	10,398	7,570
Red-Breasted Sapsucker	33,627	11,123	3,250
White-Headed Woodpecker *	6,942	26,944	7,673
Pileated Woodpecker	30,469	10,147	3,935
Vaux's Swift	588	0	66,088

* The WHR model does not take elevation into account, so the acres of habitat are probably overestimated for this true-fir zone woodpecker.

Generally, the most continuous blocks of the highest value habitats for this snag dependent guild occur within the northwestern one-third of the analysis area, with blocks of non-habitat occurring in the middle reaches of the Crapo Creek drainage, and in the headwaters of Granite Creek. This situation is less true for the **downy woodpecker**, which has continuous blocks of MEDIUM and LOW value habitat well distributed across the analysis area except in the headwaters of Morehouse, Crapo, and Nordheimer Creeks.

The prior discussion on the effects of the current fire regime is pertinent to this guild in that it has probably been mostly beneficial compared with the historic fire regime. Aggressive fire suppression under the current fire regime has probably resulted in greater numbers of insects and foraging sites for this guild. Snags resulting from competition induced mortality tend to be more evenly distributed than snags resulting from fire, which tend to occur in clumps. Fire suppression is believed to have resulted in more acreage being in later seral stages which would favor those species more associated with mature forest habitats. This benefit has been somewhat offset in the analysis area by the effects of recent large stand replacing fires, but it should also be pointed out that **Vaux's swifts** and **hairy woodpeckers** are known to key in on burned areas for foraging. The historic fire regime that facilitated more open stands may have been more favorable to the **downy and hairy woodpeckers** and the **red-breasted sapsucker** which prefer more open habitats.

The future maintenance of habitats for species in this guild will require fuels managers to understand the snag resource and its response to fire, and to taylor the use or suppression of fire to the requirements of these species where appropriate.

Since all the species in this guild are birds, there are no physical barriers to movement and dispersal. However, a lack of large snags in some portion of the Analysis Area would mean it would not be used for nesting by those members of the guild requiring large snags.

Unroaded areas are not particularly significant to any of these snag associated species except as they relate to the logistics of managing the lands where they occur.

Past conditions probably favored the first three members of this guild due to there being generally more open habitats. Present conditions within the watershed probably favor those species using denser forests with larger trees. There is a concern that logging mature stands has caused a downward trend in populations of **pileated woodpeckers, white-headed woodpeckers** and **Vaux's swifts** within their respective ranges, but the overall impacts of logging to mature habitats within the Mainstem Analysis Area have been relatively light. Future trends for these species will depend on how mature forests and fire is managed within this watershed.

HARDWOOD ASSOCIATES

The following pair of Management Indicator Species can be addressed together based on their association with and dependence upon large oaks and snags.

- Acorn Woodpecker
- Western Grey Squirrel

Relatively low density stands of large oaks with sparse canopies and large snags in hardwood and hardwood/conifer forests are habitat attributes that provide habitat for **acorn woodpeckers**. Acorns are a primary food, especially in winter, and snags are used for storing acorns individually in small surface holes.

Mature stands of most conifer types, hardwood and mixed-conifer/hardwood types with large trees, acorn producing trees and snags are required by **Western grey squirrels**. Acorns are a very important summer, fall, and winter food. Grey

squirrels bury nuts singly three to four inches deep and then dig them up to eat in the winter.

The prior discussion on the historical fire regime is pertinent to this guild where it addresses hardwoods, stand densities, and stand maturities. It is known that American Indians living in the analysis area used fire under the historic fire regime to manage for large acorn producing oaks, and for ease of gathering acorns. These practices no doubt favored this guild and other acorn eating wildlife as well.

The current vegetative patterns occurring in the analysis area appear to provide extensive, fairly well connected stands of mature hardwood/conifer forests with available large snags. This situation is more apparent in the northwestern portion of the analysis area, and less in a poorly defined band running roughly southwest to northeast from Granite Creek towards Crapo Creek where recent large stand replacing fires have resulted in large areas of less than mature stands. An analysis of habitat values was conducted using arithmetic means of values assigned to reproductive, foraging, and cover habitats by the California WHR Model. The results of this analysis are that there are estimated to be 32,300 acres of HIGH, 4,300 acres of MEDIUM, and 12,300 acres of LOW value habitat for the **western grey squirrel**, and 23,400 acres of HIGH, 13,300 acres of MEDIUM, and 1,500 acres of LOW value habitat for the **acorn woodpecker**. Relatively large areas of non-habitat for this guild occur in the middle reaches of the Crapo drainage, and in the upper elevation areas of the Analysis Area in Crapo and Morehouse meadows, and in the headwaters of Granite and Nordheimer Creeks.

Since both of these species require mature stands of large trees, those management areas directed towards conserving mature forests will be important. It should be noted here that these species tolerate (or favor in the case of the **acorn woodpecker**) more open stands of large trees.

The earlier discussions of the current fire regime pertain to this guild where it addresses the effects to acorn bearing hardwoods, snags, tree sizes and tree densities. It is likely that the current fire regime has had a more negative effect on the **acorn woodpecker** and the **western grey squirrel** than the historic fire regime. There is evidence in and around the analysis area of (e.g., the upper east slope of the Monte Creek drainage) aggressive fire suppression, as practiced under the current fire regime, which has allowed conifers (especially Douglas-fir) to overtop and shade out mature black oaks, and to crowd the canopies of the more shade tolerant tanoaks. This situation has probably had a negative effect on this guild, and the implications for maintenance of these habitats in the future are that conservation of these species will not be favored by attempting to maximize conifer production.

Both the **acorn woodpecker** and the **western grey squirrel** have relatively high mobility, so there are not believed to be any significant physical barriers to movement and dispersal. Although they can probably swim, bridges across the Salmon River probably aid the **Western grey squirrel** in dispersing from one side of the river to the other.

Western grey squirrels occasionally become roadkills on the Salmon River Road, but other than that, unroaded areas are not thought to be of any particular significance to the members of this guild.

These species undoubtedly occurred historically in the analysis area and probably at higher populations than today due to American Indian land management practices of using fire to promote the production and ease of gathering acorns. There is concern that the loss of snags through fire and timber harvest (including salvage) has and will continue to cause declines in these species.

BLACK BEAR

Black bears utilize and require a variety of habitats. They are seasonal specialists, feeding on grasses and forbs in early spring, insects and fruits in the summer, and on acorns and other nuts and fruits in fall. They require large trees and various cavities and hollows in trees, snags, stumps, logs, uprooted trees, talus slopes, or in the earth for denning. These habitat elements must be in mature, dense vegetation, and on sheltered slopes to be adequate. Mature vegetation provides escape cover and the specific habitat elements for denning breeding and feeding. Riparian, deciduous, and earlier seral stage provide grasses, forbs, and fruits.

The prior discussion on the effects of the historic fire regime on vegetation densities, snags, logs and early seral stages pertains to the black bear in

that under the historic fire regime there were probably fewer denning sites available, but that spring foraging sites may have been more plentiful. Because black bears use a variety of habitats it is difficult to draw conclusions about how the historic fire regime affected them.

Since the current vegetative patterns in the analysis area are dominated by a variety of mature habitats, and generally includes an abundance of the required habitat elements, this area is important to black bears. Exceptions would be the extensive areas of shrub cover in the Crapo and Nordheimer drainages, which could provide early season foraging habitat, but lack the habitat elements for denning and escape cover.

The current geomorphic terranes in the analysis area are not thought to be particularly important, but saddles and ridges are used as travel routes in the highly dissected terrains commonly found in the area.

The prior discussion on the effects of the current fire regime on snags, logs, seral stages, and vegetative densities is relevant to black bears, but since it is not well understood what if any of the variety of habitats used by black bears limits their population, the effects of the current fire regime are difficult to identify.

Within the analysis area, there seems to be no identifiable barriers to black bear dispersal.

Roads are not believed to be particularly significant to black bears, but it is notable that black bears often use minor forest roads as travel ways, and that roads facilitate hunter access into black bear habitats. A long-term study by California Department of Fish and Game to examine population demographics in roaded and unroaded areas is currently underway.

BLACK TAILED DEER & ROOSEVELT ELK

Due to similarities in these two harvest species' habitat requirements and response to habitat disturbances, they will be addressed together. The discussion of site specific examples within the analysis area will pertain to **black tailed deer**, as **elk** have only recently been reintroduced into areas adjacent to the analysis area.

Environmental documentation has been completed by the Forest Service to allow the California Department of Fish and Game to reintroduce **elk** into the analysis area at two locations; Crapo and Nordheimer drainages.

Deer and **elk** are generally considered early seral stage habitat users, but a more complete description of habitat attributes would include their need for a mosaic of habitat conditions including shrub-by openings, meadows, riparian areas, and areas of dense vegetation that may be in mature seral stages. **Deer** and **elk** feed on forbs, grasses, shrub, fungi and acorns, with **deer** selecting more browse and **elk** utilizing grasses more often. Both of these herbivores require areas of dense vegetation (interspersed with openings used for foraging), for thermal and escape cover. Late-successional and old-growth forests within the analysis area can occasionally be categorized as "optimal cover" which means there is a sufficient layer of forbs, grasses and herbaceous vegetation for foraging under a canopy that is providing thermal cover.

Ecotones, or the edge where one broad habitat characteristic changes to another, are probably the most important vegetative pattern for **deer** and **elk**. Large areas of just foraging habitat or thermal cover do not receive much use if they are a long distance away from each other.

Ridges and saddles receive a disproportionate amount of use as travel ways, as do trails and roads, simply because they require less physical effort to traverse. Slope aspect is also selected for thermoregulatory requirements with south slopes used more in cold weather and north slopes more in hot.

The previous discussion on the effects of the historical fire regime on early seral habitats, forest openings, and subcanopy densities is pertinent to **deer** and **elk**. It is likely that habitat conditions were more favorable for these two species under the historic fire regime.

Overall, the analysis area can be characterized as having moderate value for **deer** and moderate to low habitat value for **elk** compared to other areas of prime habitat in the state; based on WHR analysis. Habitats with value for **deer** reproduction, cover, and forage occur throughout the analysis area, but the higher value areas are concentrated within a poorly defined belt running from southwest to northeast across the southern half of the analysis

area. This area corresponds with those parts of the watershed that have been most recently impacted by wildfire. Habitats with value for **elk** are relatively widely scattered across the analysis area, with the higher value areas for forage assigned to the high elevation meadow complexes in the headwaters of Morehouse and Crapo Creeks, and in areas along the Salmon River. Areas with relative value for **elk** reproduction and cover are concentrated in the northwest portion of the analysis area, but can also be described as scattered across the watershed within dense early-mature stands.

There is concern that large areas managed for late seral forest associated species will suffer reductions in habitat quality for **deer** and **elk**. Conversely, those management areas such as lands designated as "Matrix" and open for logging, could be managed to improve the habitat conditions for these species by converting or maintaining lands in early seral conditions in proximity to high quality thermal and escape cover.

The prior discussion of the effects of the current fire regime on stand densities, understory conditions, and seral stage distribution pertains to **deer** and **elk**, where it is believed to be having a negative effect on landscape level habitat quality compared to the historic fire regime. Productive forage areas of oak woodlands have converted to feed-poor conifer stands, and there are fewer interspersed patches of early seral stage habitats. At the same time, there are the interiors of larger areas, where recent catastrophic fires have burned, especially in the Crapo and Nordheimer drainages, that do not have enough escape cover nearby for **deer** to feel comfortable enough to use.

Fire is arguably the best tool for maintaining high quality **deer** and **elk** habitat in the future. Underburning mature stands can promote grass, forb, and shrub development on the forest floor leading to the establishment of optimal cover. Prescribed burning of moderate sized shrubfields and openings can rejuvenate the palatability and nutrition of forage there. However, due to accumulations of fuels under the current fire regime, it will not often be practical to simply allow fire to return naturally. The use of fire for the maintenance of high quality **deer** and **elk** habitat in the future will require carefully determined prescriptions and/or aggressive pretreatment.

As mentioned earlier, geomorphic terrains affect the movements of these large animals. Slopes exceeding 100%, especially if composed of bedrock, are not regularly used and so can be considered barriers to movement and dispersal. It is possible, for instance, that the steep rocky inner gorges of Wooley Creek where it flows into the Salmon River are acting as a barrier to movement of **elk** (recently reintroduced in the Steinacher Creek drainage) into other parts of the analysis area.

As hunted species, **deer** and **elk** have become sensitive to relative road densities. Open road densities in excess of one and one-half miles per section are believed to decrease habitat suitability for **deer** and **elk**. Therefore, unroaded areas are significant for them primarily because they decrease hunter (and poacher) access. Duncan Creek, Horn Creek Gap, and Hog Range areas of the mainstem have road densities that exceed one and one-half miles per section, so the significance of unroaded areas is relative to this.

Deer numbers have rebounded following the first wave of intensive mining, but are believed to be declining due to the effects of fire suppression. **Elk** numbers are expected to increase following the nearby successful reintroduction, but suitable habitat within the analysis area is believed to be decreasing as more accessible habitat patches in early seral stages mature.

Future Trends

With aggressive fire suppression practices, stands have developed greater vertical diversity, with multiple layers. Snag and downed woody debris development has increased. It appears that fire suppression in these stands has improved habitat for late seral species. Although benefits to the species may be short lived and in the long run detrimental. Fire is inevitable to these stands. The longer fire is kept from these stands the more intense the inevitable fire.

Recent fires in the watershed, that have escaped initial attack, have been large and destructive; the Off Fire (1973) burned 9,200 acres. Part of this fire area was salvaged, planted, and now consists of mixed-conifer plantations with heavy shrub. Much of the fire area was not salvaged, and consists of shrub with a large amount of dead woody debris beneath the shrub. Based on the risk analysis, this area is high-risk, with at least one fire expected in 0-10 years per thousand acres. Based on the po-

tential fire effects analysis it has a very high likelihood of the stand being lost to fire. The next fire, based on analysis of areas of repeat fires within the watershed, will include a larger area, entering bordering stands.

The Hog Fire (1977) burned 39,000 acres in the watershed. Some of the burned area within the Nordheimer Creek drainage was helicopter salvaged and the fuels not treated. Based on the risk analysis, this is an area of low-risk, with one fire expected every 20 or more years per thousand acres. This area still has remnants of the previous stand, although with the fuel conditions on the ground, most of these will be lost in the next fire. The area of the Hog Fire in the Crapo Creek drainage was also helicopter salvaged and the fuels not treated. This area reburned in the Yellow Fire (1987) and has regenerated in shrub. Much of the area has been planted with mixed-conifers, but sprouting and competition by shrub species is the major stand component. The Yellow Fire burned 23,000 acres in the watershed. Most of this area is a moderate risk, with at least one fire expected every 11-20 years per thousand acres. The lower elevations of these fire areas, (the river corridor) is a high-risk, with one fire expected in 0-10 years per thousand acres.

Based on their fuel characteristics, old-growth stands are classified as having a High Fire Behavior Potential. Most of the old-growth stands in the watershed are in Somes, Monte, Duncan, Grant, and Butler Creeks. Most of these stands fall into a low-risk area, although the portions entering the river corridor are high-risk. Risk identifies the amount of time expected between fire occurrences. Hazard identifies expected fire behavior. Although risk is mostly low for these stands, expected fire behavior once fire enters the stands is high. Potential wildfire effects identifies these stands as having a moderate likelihood of being lost to wildfire.

An assessment of the distribution of mature and old-growth forest habitats within the analysis area shows that the largest and most contiguous stands occur within Somes, Monte, Duncan, and Butler Creeks. All or some of these areas were highlighted as providing high quality habitat for Northern spotted owl, fisher, Del Norte salamander, Northern goshawk, and potentially, marbled murrelet. All known Northern spotted owl activity centers occur within these drainages. One hundred acres of the "best northern spotted owl habitat will be retained" around the owl activity centers in order to meet objectives for spotted owls and other late-successional forest associated species (ROD 1994). In the meantime, management efforts should be directed at improving habitat conditions within late-successional reserves.

AQUATIC ECOSYSTEM

Climate

The climate for the analysis area has already been discussed in the TERRESTRIAL ECOSYSTEM section of this chapter, however some aspects of climate are of particular importance to the aquatic ecosystem. High stream flows, floods, and landslides which influence riparian condition and stream channels are dependent on climatic events. Most of the flooding and landsliding in the analysis area over the last 90 years has occurred from 1953 to 1974 during years of above average precipitation. The years with average or below average precipitation have little flooding and landsliding. Also, summer thunderstorms in the area are occasionally very intense and cause local flooding and landsliding even during otherwise dry years.

Upslope Processes

Upslope processes affect stream flows, sediment production, and riparian conditions. Each of these subjects will be discussed in more detail under its own subheading. The purpose of this section is to discuss the upslope conditions and processes which influence the aquatic system.

Some watershed conditions, such as rock types, landforms, soils, and topography, are inherent to sites and rarely change over short time frames. Other conditions, such as vegetation patterns and soil cover, change much more quickly in response to disturbance by fire.

Landsliding occurs when the shear stress due to gravity exceeds the shear strength of the soil and rock. Transpiration of vegetation effects slope stability by reducing ground water and decreasing shear stress. Vegetative root support increases the shear strength of the soil and rock. Following a high intensity fire which kills most of the vegetation, slope stability is decreased. As vegetation density and size increases over time, the likelihood of landsliding decreases.

The amount of soil erosion which occurs on a given site during any storm is highly dependent on

the ground cover conditions. Undisturbed vegetation and associated litter is effective at minimizing soil erosion. Disturbances by fire can effect soil erosion. Low intensity fires reduce the amount of vegetation and organic soil cover which can increase run-off and allow soil erosion. Low intensity ground fires will reduce the amount of vegetation in lower canopy layers, this provides for maintenance of primary species. Not all vegetation and soil cover are lost in low intensity fires. Soil erosion increases, but recovery of soil cover is achieved within a short time period, possibly less than one year. High intensity fires have a much greater effect than lower intensity. They also kill nearly all live vegetation and remove most of the organic soil cover which greatly increases soil erosion, storm run-off, and channel erosion in intermittent and ephemeral streams.

Riparian areas are usually cooler and have higher moisture contents in soil and vegetation than upslope areas. These conditions generally provide a barrier to fire spread or slow fire spread. The cooler temperatures, moister air, and less flammable vegetation combine to retard fire intensities, except in extreme conditions.

The effects of fire suppression have increased the cover and density of vegetation within riparian areas. Fire exclusion tends to favor conifer species, hardwood species, and shrubs, at the expense of grasses and forbs. Snags and down logs are important for the structure and function of hydrologic processes, associated wildlife, and fisheries. There has been an increase in snags and down logs with successful fire suppression. Large amounts of dead woody material increase the likelihood of stand replacing fires, especially during drought.

Fire intensities are usually low in riparian areas. With fire suppression has come increases in fuel accumulations in all areas. As fuels accumulate, potential fire intensities increase. As fire intensities increase in areas bordering riparian areas, intensities will increase in the riparian area due to this bordering influence. This increases damage to riparian vegetation which will increase run-off and soil erosion, reduce canopy closure and stream shade, and increase the short-term large wood recruitment to the stream.

In steep narrow canyons and side drainages, fire behavior is influenced less by the cool and moist conditions and more by the steep topography and chimney effects of the drainages. Narrow stream corridors will experience more frequent and higher intensity fires than broad stream channels. Riparian areas located upslope in the watershed, that contain multi-layered vegetation, large amounts of down material, and homogeneous closed canopy are very susceptible to high intensity fire.

Two fires, the Hog Fire (1977) and Yellow Fire (1987), both burned in the Crapo Creek drainage, an area with granitic soils. After the Hog Fire some salvage logging was done. No fuels treatment followed the salvage due to concerns over soil erosion. Ten years later the Yellow Fire burned through the same area. With high dead fuel accumulations still present, combined with steep slopes and ten years of shrub growth on a south aspect, this fire burned with much higher intensities than the area had experienced in previous fires. The Yellow Fire was so intense, it melted the soil in some locations where these fuel conditions were present.

Large wildfires have occurred over most of the analysis area in recent years. The effects of these fires have been a greater short-term impact to the affected watersheds in soil erosion, stream flow regime, and slope stability than the historical fire regime.

Stream flows and riparian conditions are also effected by vegetative conditions. Reductions in vegetation by fire can increase late summer stream flows by decreasing water use through transpiration. The presence or absence of a canopy of large trees influences snow accumulation and melting. The loss of canopy increases snow accumulation and melt rates resulting in increased peak streamflows, especially during rain-on-snow events. Increased stream flows can increase the rates of channel erosion.

Previous to fire suppression, forested stands were more open and maintained with less vegetative densities than areas where wildfires have been effectively suppressed. In the analysis area, only the Somes-Butler area has not experienced a recent large fire. This likely causes lower late summer streamflows, lower peak flows, and greater slope stability than occurred in the Some-Butler area previous to fire suppression.

The riparian areas along perennial streams typically had the most continuous stands of large trees in the pre-suppression fire regime. The generally cooler and moister conditions along the streams resulted in little overstory mortality in the frequent fires. The more intense fires in recent decades resulted in greater overstory mortality along perennial streams than likely would have happened with more frequent fires. The existing vegetation in the Nordheimer and Crapo Creek riparian areas reflect the riparian damage from recent fires.

Human Uses and the Aquatic Ecosystem

Fishery conservation is important to the life ways of local American Indian Tribes. Generally only oral accounts qualify past use. Based on consultation with the Karuk Department of Natural Resources, indigenous fisheries management included ritualistic and conservatory regulation of salmon use which included cooperative efforts to construct river dams at specific times at particular locales. Considering past Karuk domain near northwestern areas of the analysis area, purposeful and deliberate fishery management in the watershed boundary would be highly probable, although specific effects to fish populations would be difficult to quantify.

Fishing is still popular on the mainstem Salmon River today; although salmon fishing is closed, several guides and other sports fishermen angle for resident trout and steelhead. The current effects of sports fishing on steelhead populations within the analysis area is considered small.

Poaching also occurs on the Salmon River. It consists of taking salmon or steelhead when the season is closed or by using illegal methods. Several cases of poaching are reported each year although the extent of the illegal catch is unknown. It is believed that during years with very small runs of anadromous fish, poaching significantly effects the numbers of spawning fish. Years with larger runs are less impacted.

The transportation system (roads and trails) effects the aquatic system in several complex ways. Roads increase the potential for mass wasting and channel scour by decreasing stability in potentially unstable landforms and altering the flow of water. The cut and fill slopes of roads have vegetation removed and slopes steepened decreasing slope stability potentially causing failures in either the cut or fill slope. Also water does not infiltrate into roads well and water moving downslope to a road is often rerouted causing increased flow during storms where the water leaves the road, potentially causing mass wasting and channel scour. Roads in the analysis area which are associated with past landslides are the main Salmon River Road, the Monte Creek Road, and the Horn Creek Road.

Roads also greatly increase soil erosion. Factors which influence the erosion rates from roads are inherent soil erodibility, road surfacing and drainage, size and condition of the cut and fill slopes, road gradient, and wet weather usage of native or gravel surfaced roads. The analysis area roads which are of particular concern from a soil erosion standpoint are the Shoofly Road and the Yellow Jacket Ridge Road.

Timber harvest and fuel treatment effects the aquatic system similar to fire. The primary effect of green tree harvest is the removal of trees which help stabilize the ground against mass wasting and shade streams, if in riparian areas. Timber harvest, both green tree and salvage, also removes logs which may have served as large wood recruitment to streams. Skidding logs by tractor or skyline increases erosion potential by exposing soil and channeling overland flow. Fuel treatments after harvest, burning or tractor piling, remove soil cover which increases erosion but decreases the likelihood of a future high intensity wildfire.

In the analysis area only relatively small areas have been harvested in green tree timber sales. These harvested areas are along the Monte Creek road system and along the road system near Horn Creek. Several mass failures have occurred in the Monte Creek area since the timber was harvested but the failures seem to be more closely related to the road construction than the timber harvest. The harvest in the Horn Creek area did not have similar mass wasting problems.

Larger areas of salvage harvest occurred in Crapo, Nordheimer, and Merrill Creeks following the Off, Hog, and Yellow Fires. Mostly dead trees were taken in these salvage efforts but some living trees as well. And trees were removed from what is now the Riparian Reserve. Downstream effects were noticed but the impact of harvest was likely very small compared to the effects of the fires.

Cattle grazing annually occurs during the summer and fall in the headwaters of Crapo and More-

house Creeks. Although the effect of this grazing on channel conditions and aquatic habitat has not been studied in depth, there are indications that stream conditions are not optimum due to the grazing. A field analysis of the grazing impacts on streams in this area is needed.

Mining has impacted the analysis area beginning in 1851 and continuing through the turn of the century. Miners exposed river bars and river and stream channels in search of gold. Placer, hardrock, and hydraulic mining methods were utilized primarily in the Salmon River channel and the Nordheimer drainage. Hydraulic mining activities from the late 1800s to the mid-1900s discharged millions of cubic yards of sediment causing major channel and riparian vegetation modifications along the Salmon River. This amount of sediment probably exceeds the sum of natural sediment delivered from 1944 to 1993 (de la Fuente and Haessig 1993). Mining declined by the 1920s but has continued to contribute to the area's local economy to a limited degree. Surface disturbance from historical mining appears strongest near Nordheimer and Crapo drainages where tailing piles and cut banks are most evident, although the current condition of the riparian area along the Salmon River is likely influenced by historic mining.

At present there is an estimated 45 mining claims in the analysis area. These are recreational placer operations with 16 claims having seasonal variances to operate outside the normal dredging season. Studies of the biological impacts of dredging have identified localized effects on invertebrates and fishes which are influenced by species specific habitat requirements (Harvey 1986; Griffith and Andrews 1981). The effects to aquatic species from dredging in the analysis area is unknown, however, dredges operating outside of the normal season could be locally impacting subgravel salmon and steelhead eggs, alevin, and fry.

Watershed restoration activities have taken place within the analysis area, primarily focused on riparian planting and landslide stabilization along roads. Riparian planting projects have been completed along the mainstem Salmon River and Crapo Creeks. Landslide stabilization projects have been completed along the Monte Creek Road.

Dispersed recreation including both day-use and camping takes place along the mainstem Salmon River in many undesignated locations. These uses may cause damage to riparian vegetation and affect water quality from surface erosion and lack of toilet facilities. Two areas of special concern are Grant Creek and upstream of Butler Creek. Grant Creek has an undesignated access trail through the riparian zone which results in surface erosion as water channels to the river. Butler creek has an undesignated, unhardened raft-launch site where erosion problems result from rafts sliding down the river bank.

There are nine areas along the mainstem that supply water for approximately 50 residences. These are for domestic use only and are supplied out of small springs or tributaries to the Salmon River. The impact to the aquatic resources from these diversions is minimal.

Streamflow

Streamflow originates as rain or snow which runs off directly, soaks into the groundwater to sustain streamflows through the dry summer months, or accumulates in snowpacks to melt and run-off later. Therefore the most important influence on streamflows is the timing and types of precipitation and subsequent snowmelt with the lesser influence of evaporation and transportation.

High elevation snow-dominated areas provide the majority of the spring through early summer sustained high run-off through snowmelt. The lower elevation rain-dominated areas provide short duration high run-off directly related to the winter storms. The rain/snow transition areas provide spring snowmelt run-off to a certain extent but also provide large peak run-off during rain-on-snow events. The analysis area contains a small percentage of high elevation area in relation to the rest of the Salmon River watershed although some of the streams originate above 5,000 feet (see the Annual Precipitation Map contained in the Map Atlas located at either the Ukonom or Salmon River Ranger District.

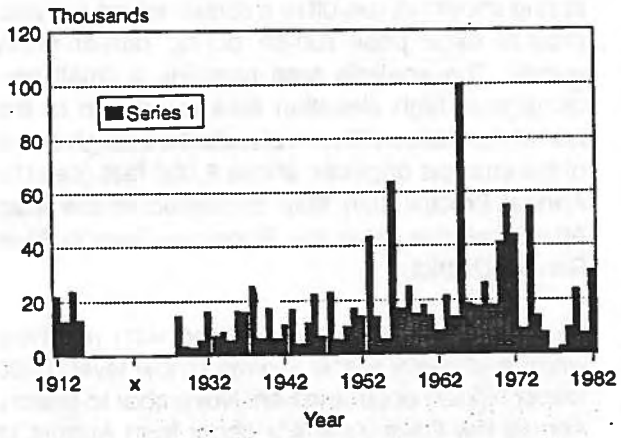
Peak streamflows are associated with relatively warm and heavy winter storms (snow level 5,000 feet or higher) occurring from November to March. Annual low flows generally occur from August to October before the first fall rains. High streamflows dominated by snowmelt occur from March to June, occasionally into July, for the Salmon River and tributaries with a large portion of the drainage in the snow dominated areas. The tributaries with

origins at lower elevation drop to summertime flows much earlier.

Most of the water flowing into the Salmon River, approximately 55%, comes from the North or South Fork Salmon River and enters the analysis area at Forks of the Salmon. Another 25% (approximate) is added to the river from Wooley Creek. The remaining 20% of the Salmon River streamflow originates within the analysis area. The relative contribution of each area changes by season. The analysis area contributes greater than average streamflow during winter storms, due to its low elevation compared to the rest of the watershed, and less than average streamflow during spring run-off.

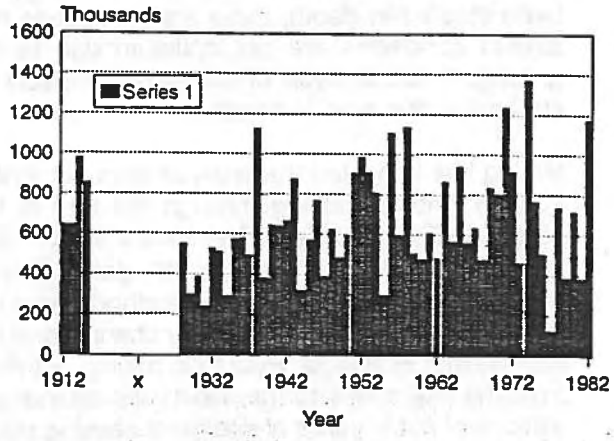
The Salmon River has a stream gage near the mouth which has continuously recorded flows since 1912. The average flow for the entire time period is 1,774 cubic feet per second (cfs). The highest instantaneous peak flow recorded is 133,000 cfs during the 1964 flood and the lowest is 70 cfs in August, 1931. The highest average for a year is 3,754 cfs in water year (October to September) 1974 and the lowest is 339 cfs in water year 1977. Bankfull discharge, an approximate for where the river begins to flood, is about 10,000 cfs. The typical springtime rafting flows range from about 1,000 to 4,000 cfs and normal summertime low flows are between 100 and 200 cfs.

Figure 14 - Salmon River Maximum Peak Flow



Tributary streams within the analysis area do not have flow measurements except for a short-term record in Crapo Creek, from 1988 to 1993, and other sporadic measurements.

Figure 15 - Salmon River Annual CF/S/Day



Sediment

Landsliding is currently the primary sediment producing process in the watershed. Hydraulic mining has been a major sediment producer in the past but has not been practiced recently (de la Fuente and Haessig 1993). The potential contribution of channel erosion and surface erosion must be considered, particularly in soils derived from granitic parent materials.

Within the analysis area, landsliding can be categorized into three main types of mass wasting phenomena: 1) Rock falls are gravity induced failures that form talus deposits on steep slopes with little or no soil cover, 2) Debris slides, avalanches, or torrents are rapid failures of short duration. This type of failure is most often caused by excess groundwater exerting excessive shear stress and reducing shear strength in an unstable mass. These failures usually occur during high rainfall events, and 3) Deep, rotational -translational failures are landslides that fail under the influence of gravity along deep-seated zones of weakness. These failures are most directly related to the underlying rock structure and lithology, and are often triggered by undermining of slopes by stream erosion. They can be very large, are relatively slow moving, and may progress over many centuries. Portions of these features may be relatively stable while other areas may be extremely prone to failure if disturbed.

Processes occurring within the geomorphic terranes (see Figure 6 in *Chapter 2*) are:

Granitic Mountain Slope --The dissected granitic terrane is prone to shallow debris slides and tor-

rents which generally scour small tributary drainages in larger (2nd or 3rd order) streams. Due to the large amount of sand in such debris, it can severely damage spawning gravels by filling void space. In addition, debris torrents can radically change channel morphology.

Non-Granitic Mountain Slopes --Since this terrane includes a wide variety of bedrock and associated structural features, as well as geomorphic settings, landslide potential is much more variable than in the other terranes. It has been found that slope steepness alone provides a useful characterization of landslide potential. Within the entire Salmon River watershed, slopes steeper than 65% produced 4 to 5 times more landslides than slopes less than 65%.

Debris Basins --Due to the steepness and location high in the watershed, debris slides which occur in these basins can be very damaging to the watershed for considerable distances downstream.

Inner Gorge --The incision that forms this terrane occurs rapidly in geologic terms and usually involves the periodic passage of debris flows which scour the banks and produce nearly vertical walls. These debris flows originate upslope in the debris basin/ headwall areas, from the toe zones of slump/earthflow deposits, and from the inner gorge itself. The vertical walls created by the passage of the debris flow, gradually fall back to a more stable gradient (usually in the 65 to 100% range) by hillslope erosion processes. Due to its position on the hillslope the inner gorge typically experiences high groundwater levels and seepage rates during the wet season. The inner gorge is an extremely critical zone in the management of watershed values.

Studies on the Klamath National Forest in Rock Creek on the Ukonom District, and Grider Creek on the Oak Knoll District have shown that the inner gorge contributes heavy sediment volumes to the watersheds. In Rock Creek, the inner gorge made up about 12% of the total area, while 62% of the active landslides were located in the inner gorge. In Grider Creek it was found that 65% of the sediment originated in an inner gorge system that made up about 11% of the watershed.

Slump/Earthflow Deposits --The toe zones of the slump/earthflow deposits (terrane number 2) are usually steep (60 to 80%), and overlap with inner gorge terranes. The are often the site of springs and other indicators of high groundwater levels. Debris slides occur regularly in the toe zones due to the steepness of slopes, weakness of the soils and rocks, and high groundwater conditions. Soil, rock, and organic debris mobilized by these landslides often travel long distance through ephemeral channels to enter perennial streams.

Glacial, Terrace, and Fan Deposits --An important source of landsliding in this terrane was noted where these deposits occur perched on steep valley walls created by glacial erosion or stream downcutting.

Active Landslides --Processes within this terrane type are those that are depicted in the other terranes, combined with surface erosion. Active landslides occur in all terranes, with a high percentage occurring within the inner gorge. Two large active landslides make up a large proportion of the active landslide terrane in the analysis area. These are the Murderers Bar landslide just south of the Salmon River, upstream of Wooley Creek and the Bloomer slide on the south side of the Salmon River, downstream of Nordheimer Creek. Each of these landslides has directly impacted the Salmon River in the past. Future effects of these and other active landslides is difficult to predict although the areas are considered unstable.

The landslide sediment yield model used for this analysis was developed by first stratifying the analysis area into geomorphic terranes just described. These terranes are land types that share common sets of physical attributes such as slope gradient, bedrock type and structure, as well as geomorphic processes. With these similarities in attributes, hydrologic processes are relatively uniform throughout a specific terrane, thus landslide rates are likely to be similar.

The second step of the development of the model was to assign sediment coefficients to each terrane for three categories, roaded, harvested and burned, and undisturbed categories. These coefficients are designed to reflect the effects of a climatic sequence similar to such as that of 1965 to 1975, excluding the 1964 flood event.

The final step in the model development was the determination of acreage of the geomorphic ter-

ranes, by disturbance class, by subwatershed of the analysis area.

Landslide sediment yield is then determined by multiplying the acres of geomorphic terrane, by its corresponding coefficient, to determine sediment yield. The respective sediment yields for each terrane are added to determine total sediment volume in cubic yards.

Sediment coefficients by disturbance class are displayed in Table 10 - Sediment Coefficients Acreage By Geomorphic Terranes, followed by Table 11 - Landslide Coefficients Acreage By Geomorphic Terranes, Table 12 - Summary of Sediment Yield By Subwatershed, Table 13 - Summary of Sediment Yield By Geomorphic Terranes, and Table 14 - Summary of Sediment Size Classes By Subwatershed.

Table 10 - Sediment Coefficients Acreage By Geomorphic Terranes

SPECIFIC GEOMORPHIC TERRANES	TERRANE #	ACRES
Active Slides	1	655
Slump/Earthflow Toe Zone	2	395
Slump/Earthflow Deposits	3	4,811
Granitic Mountain Slopes > 65%	4	7,659
Granitic Mountain Slopes 0-65%	5	5,034
Non-Granitic Mtn. Slopes > 65%	6	24,106
Non-Granitic Mtn. Slopes 0-65%	8	8,305
Inner Gorge developed in Landslide, Glacial, or Terrace Deposits	9	1,338
Inner Gorge developed in Granitics	10	3,672
Inner Gorge developed in Non-Granitics	11	9,307
Debris Basins	12	439
Glacial, Terrace, and Fan Deposits	13	3,546

Table 11 - Landslide Coefficients Acreage By Geomorphic Terrane

TERRANE #	UNDISTURBED	HARVEST 1950-1974	HARVEST 1975-1987 HOG AND 1987 FIRES	ROADS (ALL AGES)
1	25	75	125	1,000
2	2.76	2.98	3.20	225
3	2.76	2.99	3.22	225.05
4	1.25	6.53	11.81	1,005.48
5	0.60	5.93	11.26	36.33
6	1.69	2.48	3.26	81.84
8	0.30	1.21	2.12	18.72
9	26.48	39.98	51.48	375.58
10	7.32	76.85	146.38	1,201.31
11	7.22	9.21	11.20	285.28
12	1.26	3.78	50.41	25.20
13	3.23	4.85	6.48	7.45

Assumptions inherent in this model are fourfold:

1. Future storms will produce landslides at a rate similar to past storms.

2. Hydrologic recovery of logged and burned land is essentially complete after 50 years.

3. Since roads are essentially permanent modifications of the landscape which change slope hydrology and mass distribution, there is no recovery factor.

4. The figures for sediment yield are relative to one another, for comparing conditions within the Salmon River watershed.

Analysis Results:

Table 12 - Summary of Sediment Yield By Subwatershed

GENERAL LOCATION AND WATERSHED NO.	UNDISTURBED CONDITION	DISTURBED CONDITION	TOTAL YIELD	% INCREASE
Lewis Crk, Sauerkraut Gl. (10010101)	12,483	27,835	32,224	158
Morehouse Crk. (10010102)	18,296	32,011	41,634	128
Portuguese, Grant Crk. (10010103)	15,700	34,074	44,179	181
Butler Crk. (10010104)	17,652	12,422	22,527	28
Tom Payne, Duncan Crk.10010105	4,499	77,030	89,499	517
Monte, Somes Crk. (10010301)	21,896	19,854	40,724	86

GENERAL LOCATION AND WATERSHED NO.	UNDISTURBED CONDITION	DISTURBED CONDITION	TOTAL YIELD	% INCREASE
Merrill Crk. (10010302)	12,265	34,536	42,450	248
Mainstem Front (10020310)	13,810	82,974	87,058	530
Upper Crapo Crk (10020321)	12,094	82,227	88,577	632
Lower Crapo Crk (10020322)	16,955	126,577	128,037	655
Upper Nordheimer Crk. (10020331)	25,023	26,791	44,961	80
Middle Nordheimer Crk. (10020332)	35,280	103,076	110,589	213
Lower Nordheimer Crk. (10020333)	12,159	47,097	51,840	323

From the above table, it can be seen that the highest sediment yield, as well as the highest per cent increase, is in the Crapo Creek watershed. This is undoubtedly due to the amount of granitic terrane that underwent impacts from the Hog Fire and the Fires of 1987, as well as associated fire salvage operations. Road Construction on granitic terranes has also contributed to this increase.

Table 13 - Summary of Sediment Yield By Geomorphic Terrane

TERRANE NO.	TOTAL UNDISTURBED	TOTAL DISTURBED	PERCENT INCREASE
1	16,375	50,540	209
2	1,090	1,429	31
3	13,278	44,205	233
4	9,574	75,304	687
5	3,021	37,837	1,152
6	40,740	67,888	67
8	2,493	14,737	491
9	35,468	36,019	2
10	26,872	286,620	967
11	67,197	75,140	12
12	554	11,399	1,958
13	11,450	22,221	194

Within the analysis area, it can be seen that the Geomorphic Terrane that contributes the highest quantity of sediment is Inner Gorge in Granitic Material (Terrane #10). This terrane comprises five percent of the analysis area, yet contributes 39% of the total sediment input. Steep Granitic Mountain Slopes (Terrane #5) and Debris Basins show the greatest percent increase in sediment input over undisturbed conditions.

Summary of Sediment Size Classes by Subwatershed

Sediment size class volumes were determined by taking a percentage of the total sediment yield by geomorphic terrane of each watershed. The percentage representing each size class was estimated for each terrane by determining the degree of sorting, lithologic characteristics, and soil characteristics inherent in each terrane. Sieve analysis of several several sample sites from several terranes, helped refine the estimated percentage. No attempt was made to account for material that would be carried as suspended sediment in the watercourses.

The size classes used are cobble and greater, 64mm and larger; gravel, 2-64mm; and sand, 0.0625-2mm. The sand category actually includes silts and clays that may be introduced to the watercourses.

Table 14 - Summary of Sediment Size Classes By Subwatershed

WATERSHED #	>COBBLE	GRAVEL	SAND
10010101	4,324	5,694	17,817
10010102	7,728	13,094	36,667
10010103	4,724	8,586	20,465
10010104	2,047	2,848	7,527
10010105	10,656	21,258	45,042
10020301	3,040	4,247	14,577
10020302	1,749	2,365	8,151
10020310	15,545	17,907	49,522
10020321	10,950	21,973	49,278
10020322	17,444	32,087	77,026
10020331	3,987	5,570	17,570
10020332	13,460	26,070	62,795
10020333	6,870	11,114	29,107

Sediment delivery to streamcourses is a function of two mechanisms, mass wasting, described previously, and surface soil erosion. Mass wasting delivers both coarse (gravel and larger) and fine (sand and smaller) sediment to the streams. Sur-

face erosion delivers only fine sediment to streams. In years of drought, such as we have experienced for the last several years, soil erosion is the primary origin. The distribution and magnitude of soil erosion is controlled by the location of burned and roaded areas, as well as by extreme climatic events, such as short duration, high-intensity, summer showers.

Sediment production rates following a fire can be as much as 100 times pre-fire rates on granitic soils, based on monitoring after the Yellow Fire. Increases from roads can be of a similar magnitude but are quite variable depending on the specific road conditions. The magnitude of surface erosion decreases quickly following disturbance which is allowed to recover. Increased sediment production following the Yellow Fire dropped off quickly in the three years after the fire and was near background levels in about five years. Road beds which are continuously used do not recover, however cut and fill slopes produce less sediment as they become vegetated. No attempt to quantify surface erosion is done for this analysis due to the high degree of error associated with such estimates.

Sediment enters streams and either settles out or passes through each stream reach. The finer particles, silts and clays, are easily suspended in the water column and constitute the majority of suspended sediment. Larger particles, sand and larger, generally move near the streambed as bedload. The suspended sediment generally passes through all stream reaches in the high energy systems which are present in the analysis area, except the material deposited on floodplains and in mixtures with coarser materials.

Bedload deposition is more complicated. Streams move bedload at various rates, faster for smaller particles, slower for larger particles. Bedload entering a stream reach will move through the reach as long water velocities are high enough to move the particles. If flows and velocity drop below what is required to move the particles, deposition occurs. If the input of sediment stops before the stream looses the required energy to move material, no deposition and possibly some downcutting will occur.

The analysis area contains three primary stream types as described in *Chapter 2*, high gradient headwater streams, lower gradient bedrock confined channels (lower Nordheimer Creek and the middle reach of the Salmon River), and unconfined alluvial channels (upper and lower Salmon River). The high gradient streams generally contain sufficient stream power to move the bedload sediment which enters them, as do the bedrock confined channels. These types of channels generally have boulders or cobbles as the dominate substrate. The unconfined alluvial channels are much more likely to deposit sediment than the other channels and contain a higher percentage of gravel substrate.

Large floods accompanied by large inputs of coarse and fine sediment to the stream channels, typically from upstream landslides, cause channel scour. The scoured channels are stripped of bank vegetation and channel complexity is decreased with the loss of pools and widening of channels. Deposition of sediment occurs, mostly in the alluvial channels but to a lesser extent in the higher stream power areas. Subsequent high stream flows which have relatively low sediment loads downcut through the deposited material reforming pools, decreasing channel width, and increasing channel complexity. In the analysis area the 1964 flood and flooding in the early '70s deposited coarse sediment in the Salmon River and other streams. The streams have downcut through these deposits in later years and the configuration of the Salmon River is very similar today as it appeared in the 1944 photos. However, the Salmon River channel in 1944 may be different from pre-mining days due to the extensive hydraulic mining in upstream reaches and within the Salmon River channel before 1944.

Fine sediment from soil erosion is added to streams much more frequently than coarse and fine sediment from landslides, and is generally accompanied by lower stream flows. The lower stream flows still provide sufficient energy to transport the suspended sediment but may not be able to transport all the sand. The analysis area streams generally have low amounts of fine sediment in the substrate (refer to the *Aquatic Species Habitat* section later in this chapter) except for streams such as Crapo Creek which have experienced recent high intensity fires in granitic soils.

Riparian Vegetation

The primary functions of the riparian zone in relation to the aquatic habitat are stream temperature moderation, bank stability and channel delinea-

tion, large woody debris recruitment, organic nutrient contribution to streams, nutrient buffering, and sediment filtration. The direct influence of riparian vegetation is reduced as channel width increases to the scale of fifth order and larger streams (Sedell et al 1988) Floods and fire have influenced riparian areas as have human activities including mining, timber harvest and roads.

Flood events occurred in 1955, 1964, 1970 and 1972 within the analysis area. A review of air photos allow an assessment of riparian damage in terms of scour and estimated recovery rates of riparian vegetation after these events. Studies of the 1944 and 1955 photos (taken before the 1955 flood) show minor disruptions in riparian vegetation. Pre-1964 flood photos show riparian vegetation recovering from the 1955 flood with some disturbance along the mainstem Salmon, Crapo, Morehouse, and Portuguese Creeks. Photos taken after the 1964 flood show extensive damage to riparian vegetation along all streams especially Nordheimer, Crapo Butler, and Monte Creeks, as well as the entire reach of the mainstem of Salmon River.

Damage was still discernible on the 1975 photos but to a much lesser extent. Recovery rates of riparian areas in terms of the amount of scour along the stream channel for the ten year interval (1965-1975) ranged from 65% to 90% in most streams. However, riparian scour increased in Monte and Somes Creeks due to the floods of 1972 and increased in Merrill and Crapo Creeks due to later storms and the Off and Hog fires.

Along the mainstem Salmon River the 1944 photos show less riparian vegetation than the 1992 photos. The lack of earlier riparian vegetation is probably primarily due to river alterations associated with mining during the turn of the century. While the active channel shows recovery in recent photos the vegetation in riparian reserve areas is still recovering from past flood, fire and mining impacts.

The cool, moist conditions in riparian zones promote slow fire spread and tend to retard fire intensities except in extreme conditions. Low intensity fires in riparian zones can top kill shrubs and deciduous trees that resprout such as willow, cottonwood, and alder. Fire behavior in steep narrow canyons, side drainages, and upslope headwater riparian zones is less influenced by cool moist conditions. These areas can experience more frequent and higher intensity fires than broader stream channels.

Table 15 - Percent of Riparian Reserve By Seral Stage, displays the existing seral stage and cover for riparian reserves along several streams. The effects of fire suppression have increased the cover and density of upslope vegetation. The less frequent, high intensity fires recently experienced in the watershed have had severe effects in the riparian zones of Crapo Creek and have also affected Nordheimer and Merrill Creeks as shown in Table 15. These types of fires killed or consumed all vegetation initiating primary succession where plants must be seeded from outside sources. The fire effects in upslope vegetation are important to riparian zones. Effects of upslope fire activity may impact run-off, loss of soil, increased sedimentation and loss of habitat within the riparian zone. Roads and timber harvest also affect riparian vegetation.

Table 15 - Percent of Riparian Reserve By Seral Stage

SERAL STAGE	STREAM NAME				
& % COVER	SOMES	BUTLER	MER-RILL	CRAPO	NORD.
LM/MM/OG >70	77	83	25	24	35
LM/MM/OG <70	1	2	12	24	34
EM/POLE >70	12	10	21	2	5
EM/POLE <70	9	1	37	10	6
SHRUB /FORB	1	4	5	40	20

LM = Late-Mature, **MM** = Mid-Mature, **OG** = Old-Growth
EM = Early-Mature

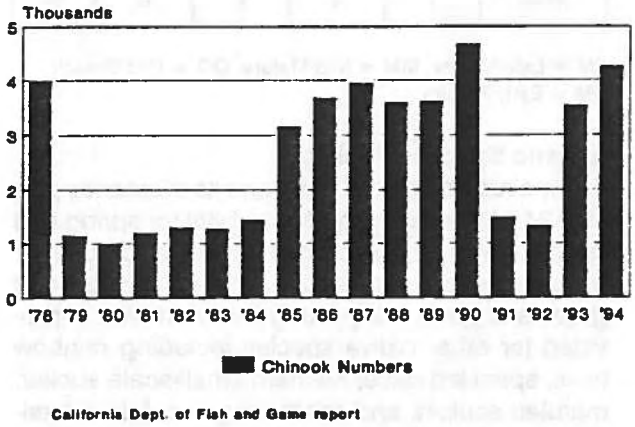
Aquatic Species Habitat

The mainstem Salmon River and its tributaries provide 24 miles of anadromous habitat for spring and fall run chinook salmon, fall, winter and summer run steelhead, coho salmon, pacific lamprey, and green sturgeon. Forty-four miles of habitat is provided for other native species including rainbow trout, speckled dace, Klamath small-scale sucker, marbled sculpin, and coast range sculpin. American shad have been introduced into the Salmon

River system. Although spawning does occur within the analysis area, the mainstem of Salmon serves as a corridor for upstream and downstream migration for anadromous species and provides critical holding habitat and cover for both adult and juvenile fish.

It was estimated that historically 15,000 chinook salmon spawned in the Salmon River basin (CH2MHill 1985). Within the last five years the spawning population of chinook salmon has ranged from 1,000 to 4,600 fish (California Department of Fish and Game 1994). Overall coho and steelhead populations are believed to be following the same declining trends (CH2MHill 1985). Several variables, both natural and human-caused, have contributed to dramatic population declines of anadromous fishes in the Salmon River. The floods of 1964 and the early 1970s left many channels aggraded and devoid of riparian vegetation. Catastrophic fires in recent decades left an imprint on Crapo and Nordheimer Creeks by decreasing riparian vegetation, increasing surface erosion and sediment delivery to the channels. Human activities, such as mining, roading, fire suppression, timber harvest, and adult fish harvest, have exacerbated the impact of these natural disturbances (Faustini and Van de Water 1991). California Department of Fish and Game has estimated fall chinook salmon populations in the Salmon River from 1978 to 1994 using ongoing fall redd and carcass counts. Figure 16 - Salmon River Chinook Escapement 1978 to 1994, shows the population trend of chinook salmon in the Salmon River Basin.

Figure 16 - Salmon River Chinook Escapement 1978 to 1994



Surveys to estimate the summer steelhead (SS) and spring chinook (SC) runs have been completed from 1980 through 1994. Table 16 - Estimated Holding Adult Populations of Summer Steelhead and Spring Chinook shows these results.

Table 16 - Estimated Holding Adult Populations of Summer Steelhead and Spring Chinook

SURVEY YEAR	STREAM REACH							
	Mainstem Salmon		South Fork		North Fork		Total	
	SS	SC	SS	SC	SS	SC	SS	SC
1980	53	64	164	155	69	26	286	245
1981	30	57	59	159	71	3	160	219
1982	59	136	226	344	31	41	316	521
1985*	22	91	53	252	44	6	119	349
1986	25	159	76	302	33	149	134	610
1987	24	124	82	260	22	92	128	476
1988	83	310	364	822	0	54	447	1,186
1989	15	31	65	59	0	30	80	120
1990	15	56	21	98	12	15	48	169
1991	24	22	26	139	17	19	67	180
1992	24	58	59	236	15	49	98	343
1993	44	349	47	571	16	363	107	1,283
1994	68	478	79	688	22	83	169	1,249

* No counts were made in 1983 or 1984.

Physical habitat inventories and biological surveys were conducted in the mainstem Salmon River, Nordheimer Creek, Crapo Creek, Somes Creek and Butler Creek in 1989, 1990, 1993, and 1994 during summer low flow conditions. These inventories provide quantitative information of key aquatic habitat parameters and fish species and location that can be used to assess the overall suitability of stream habitat from a fisheries perspective. Appendix I - Fish Habitat Data, shows detailed summaries of habitat data by channel type and stream. Important parameters for fisheries habitat include in-channel large woody material, woody material recruitment potential, pools, surface fines, embeddedness, substrate composition, and temperature. The *Draft LMP* outlines desired habitat criteria for these parameters.

Large wood provides a source of cover and habitat diversity for fish through a range of flows and sea-

sonal conditions. Wood also plays a role in maintaining healthy stream channels. Following the 1964 flood the U.S. Forest Service and State agencies removed large amounts of wood from the Salmon River basin. The existing wood in Crapo and Nordheimer Creeks was surveyed in 1993 and 1994. Woody material recruitment potential and occurrence of key wood (24"dbh X 50' length minimum) was surveyed in Nordheimer, Crapo, Somes, and Butler Creeks and in the mainstem of the Salmon River. All channel types within all the surveyed streams fall significantly below the habitat criteria for coarse woody material which is 20 pieces of key large wood per 1,000 lineal feet. Nordheimer and Crapo Creeks average one piece per 1,000 feet, Somes Creek two pieces per 1,000 feet, and Butler Creek five pieces per 1,000 feet. Large woody material recruitment potential is also extremely low ranging from 14 stems per 1,000 feet in Somes Creek to one stem per 1,000 feet in Nordheimer Creek.

Cool, deep pools in the lower Salmon River are critical for summer holding and rearing habitat. Spawning occurring in the mainstem Salmon takes place in the deposited gravels in pool tailouts. Pools can also be highly sensitive indicators of changes in watershed condition (EPA 1991). Mainstem Salmon pool frequencies appear to fall within the natural range expected given our estimates of the bankfull channel width (Olson and Dix 1993). Somes Creek also has a high number of pools. However, the entire surveyed section of Butler Creek, two out of seven reaches of Crapo Creek, and one out of five reaches of Nordheimer Creek do not meet pool frequency criteria.

The composition of material composing the stream bed influences the flow resistance in the channel, stability of the bed, and quantity as well as quality of aquatic habitat available to developing eggs, small fish and invertebrates (Olson and Dix 1993). Streambed quality measured by percent surface fines and percent embeddedness was estimated in the surveyed streams. All reaches in all streams met the desired criteria of less than 15% surface fines except Crapo Creek. All seven reaches of Crapo Creek exceeded the criteria and ranged from 17% to 36%. Similarly all stream reaches met the criteria for less than 20% embeddedness except one reach of Nordheimer Creek (35%) and all reaches of Crapo Creek which ranged from 35% to 66%.

Summer water temperatures are a concern in the Salmon River basin. Stream temperatures are related to water temperatures in headwater streams, solar radiation, air temperature, stream gradient, and flow. The amount of solar radiation hitting the stream is influenced by the amount of vegetative and topographic shade. During the summer months temperatures greater than the optimum required for salmonid growth exist in portions of the analysis area. Two recording stream temperature gages are located in mainstem Salmon near Wooley Creek and near the mouth of Crapo Creek. Somes Creek and Crapo Creek have cool temperatures well below the 69°F criteria. The mainstem Salmon, however, has sustained average seven-day maximum temperatures in excess of 81°F. These recent elevated temperatures have been aggravated by drought conditions and low flows.

Riparian Associated Species Habitat

Information regarding the specific occurrence and habitat needs for many of the riparian associated species highlighted in this analysis is lacking. The following discussions are based primarily on habitat association information in the literature.

Flooding, mining, and fire have affected riparian associated species through resulting changes in riparian vegetation. Refer to the previous discussion on riparian vegetation for information on how past mining, flooding, and past and present fire regimes have affected habitats of riparian associated species.

WESTERN POND TURTLE

Habitats used by western pond turtles include slow-moving or still water bodies. Basking substrates (logs, rocks, etc.) and undercut banks are also important. Upland habitats which provide well-drained soils and solar exposure provide nesting and overwintering habitat.

Within the analysis area, suitable habitats occur along the Salmon River in side channel bedrock pools, in backwater pools, and in sag ponds associated with springs and slumps. The Logger's Pond on Yellow Jacket Ridge may provide habitat but the pond has filled in with sediment and no longer provides yearlong open water. Other suitable habitat occurs in an off-channel pond near the mouth of Nordheimer Creek, and in a pond on private land near the mouth of Hammel Creek. Basking sites are provided primarily by rocks, since large wood tends to move through the river

channel. An accurate inventory of suitable sites is lacking.

Under past fire regimes, vegetation within the riparian areas and adjacent uplands was probably more open and suitable for nesting than it is today.

Juvenile survival is believed to be a barrier to the long-term viability of western pond turtles. Regionally, predation of hatchlings by bullfrogs (an introduced exotic) and mortality from roadkill have been identified as significant causes of mortality.

Although the roadless drainages within the analysis area contain little to no suitable habitat, the unroaded areas adjacent to the Salmon River lack the potential for roadkill.

WILLOW FLYCATCHER

Willow flycatchers require dense patches of shrubby willows and alders adjacent to wet meadows, ponds or streams for nesting and roosting. The analysis area includes approximately 540 acres of optimal and 1290 acres of sub-optimal nesting/ roosting habitat. These areas are located along the margins of the Salmon River, between the mouth of Nordheimer Creek and Forks of the Salmon; and in the high elevation wet meadows of Crapo, Morehouse, Nordheimer, and China Creeks. Information on the presence of and current habitat use within the analysis area is lacking.

Monitoring of dispersing songbirds along the Klamath River Corridor suggests that river corridors, such as the Salmon River, are functioning as dispersal routes.

Under a historic fire regime, recurring low intensity fires probably resulted in frequent top kill of willow and alder. Past hydraulic mining and flood events removed riparian vegetation. Riparian areas are still recovering from those events. Additionally, recent high intensity fires removed nesting/roosting habitat from riparian zones within Nordheimer and Crapo Creeks. Browsing by livestock may also affect willow flycatcher habitat, although this has not been assessed. The potential exists to increase the amount of habitat available to willow flycatchers within the analysis area, particularly within Crapo and Nordheimer drainages.

TAILED FROG, SOUTHERN TORRENT SALAMANDER

Tailed frogs and southern torrent salamanders are associated with cold, well-shaded, fast-flowing permanent streams and head waters. They use habitat within and immediately adjacent to stream channels. Rocks and wood are used as cover. Tailed frogs appear to be sensitive to sedimentation. Undisturbed stream channels within older seral stage forests appear to provide optimum habitat conditions.

Information on the location of and habitat use of these species within the watershed is lacking. Surveys conducted elsewhere on the Forest have located tailed frog and southern torrent salamanders in surrounding areas (Welsh and Lind 1989).

In-stream habitat conditions have been measured for some streams within the analysis area; refer to previous discussion on fish habitat. Based on vegetative conditions (percent seral stage and canopy cover within riparian reserves) Somes Creek, Monte Creek, Duncan Creek, and Butler Creek appear to provide high quality habitat for these species. Temperature data measured from Somes Creek, upstream from the junction with the Salmon River, indicate that summer highs (measured in 1992) are suitable for tailed frogs and five degrees Celsius above optimum conditions for southern torrent salamanders. Summer highs from Crapo in 1993 were slightly above optimum conditions for tailed frogs and several degrees above optimum conditions for southern torrent salamanders.

It is unknown what the affects of flooding may have been on the habitats of tailed frogs and southern torrent salamanders. Frequent low intensity fires of the historic fire regime may have resulted in a more open canopy within riparian areas. The stand replacing fires of recent decades, however, have removed riparian vegetation completely, affecting temperatures and water quality.

As riparian vegetation within Nordheimer and Morehouse Creeks recover, they have potential to provide habitat for these amphibians. It is unknown whether sediment levels in Crapo are too high for these species. Inventories throughout the watershed are needed to establish areas of occurrence.

BLACK SALAMANDER

Very little is know about the habitat associations of black salamanders. They are typically found in

small isolated, moist, pockets under rocks, surface litter and coarse woody material, often near streams. Headwater streams may be important refugia.

The lack of information which exists on this species limits our ability to assess current and potential habitat conditions. Locations within the analysis area that may be important for the black salamander include headwater streams. Riparian areas which have not been impacted by recent catastrophic fire (i.e., Somes, Monte, Duncan, and Butler Creeks) have the greatest potential of providing habitat for black salamanders.

RED-LEGGED FROG
Red-legged frogs occur in quiet pools of streams, marshes, and occasionally ponds. They prefer shorelines with emergent vegetation that provide a substrate for egg attachment.

Within the analysis area, suitable habitats for red-legged frogs probably occur along the Salmon River, particularly the lower three miles in backwater and side channel pools.

Historic hydraulic mining, flooding, and recent moderate and high intensity fires along the Salmon River corridor removed vegetation and likely degraded habitat. After channel morphology, the presence of emergent vegetation is probably the most important factor in determining habitat quality. Emergent vegetation is likely recovered from the disturbances mentioned above.

COMMON MERGANSER
Common mergansers are closely associated with large, low gradient streams in forested areas. They forage for fish and other aquatic organisms and nest in tree cavities, root wads or other structures which offer concealment from predators. They are vulnerable to loss of large trees and snags within riparian zones.

Within the analysis area, mid-mature stands (and older) adjacent to the Salmon River likely provide optimum nesting habitat for common mergansers. Most of these stands are located between Somes and Portuguese Creeks.

Past disturbances; historic hydraulic mining, flooding, and recent catastrophic fires, affected nesting habitat in some areas of the watershed, primarily from Merril to Somes Creek, and at scattered sites from Portuguese Creek to Forks of Salmon. Based upon site capability, other areas which have the potential to provide mid-mature (and older) forested stands are between Crapo Creek and Forks of Salmon.

MANAGEMENT INDICATOR SPECIES
Three Forest management indicator species have been selected to represent river and stream habitats (USDA Forest Service 1994): American dipper, Northern water-shrew, and long-tailed vole. Survey information is lacking for these species within the analysis area.

American dippers inhabit clear, fast-flowing streams. They nest and roost in cover of sheltered cavities or crevices (such as those provided by logs or root-wads) along streambanks.

Northern water-shrews are primarily restricted to riparian habitats and depend on dense grass/forb cover and wood debris for food and shelter. This species is sensitive to reduction of vegetative cover and channel cutting.

Long-tailed voles inhabit mesic habitats and are closely associated with dense riparian vegetation, particularly grasses, forbs and shrubs.

Past disturbances (hydraulic mining, flooding, and fire) removed vegetative cover from riparian zones throughout the analysis area. Early seral vegetation has recovered in many parts of the watershed, however, outside of Somes, Butler, Monte, and Duncan Creeks, dense mature riparian vegetation is lacking. This would affect important habitat components, such as large woody debris.

Future Trends
The future trends are projections of the conditions of the aquatic ecosystem, assuming no new projects which would require environmental analysis but the continuation of ongoing activities such as fire suppression, road maintenance, grazing, suction dredge mining, recreation, and special forest products gathering.

Climate will continue to be a major factor influencing upslope and stream processes although what the climate will be in the future is unknown.

Vegetation and soil cover will continue to recover from the effects of recent fires which will increase slope stability and decrease sediment production.

Fires will be suppressed resulting in little effect on the aquatic ecosystem except when conditions are severe enough to preclude fire suppression efforts. See the Terrestrial Ecosystem section for details on future fires.

Human uses will continue to have a similar effect as they do today, roads will continue to be a sediment source but past harvest effects will recover. Increased recreational use will cause more impacts than the current situation.

Stream flows will be strongly tied to future climate although there may be some slight decreases in summer flows in the areas that have been recently impacted by fire as the vegetation recovers.

Sediment production from landslides will be strongly tied to the magnitude of future flooding but when the future flooding occurs, landslide rates will be many times higher in most subwatersheds than if the subwatersheds were "undisturbed". As time passes, landslide rates will decrease for a given storm for burned and harvested areas as vegetation becomes reestablished. Road-related landslide rates will not decrease.

Surface erosion will continue but at rates near undisturbed conditions, except along roads. The streams will continue to flush fine sediment, likely decreasing the amount of sand embedded in the substrate of Crapo Creek.

The riparian vegetation will continue to recover from past floods and fires, at various rates depending on site conditions. Sites continuously disturbed, such as recreational accesses, will not recover fully to site-potential vegetation.

Natural disturbances such as floods and fire will continue to impact riparian areas. Subwatersheds with the highest landslide rate will suffer the greatest riparian disturbance from flooding and channel scour. High fuel loadings in riparian areas may contribute to more riparian damage from wildfire than would have occurred under a more frequent fire regime.

The size of future runs of anadromous fish is unknown and dependent on many variables outside of this analysis area. However, fisheries habitat should improve or remain the same in this area, given no major disturbances. Improved habitat could occur with increases of instream large wood and recruitment potential in all streams, although reaching the LMP desired condition is not likely, and increased pool frequency and decreased fine sediment in some streams, especially Crapo Creek as it recovers from recent fire effects. Increasing riparian vegetation would also benefit stream shade and potentially stream temperatures.

Future floods with large sediment inputs to the streams would decrease pool frequency, increase surface fines, and impact riparian vegetation. Future wildfires could impact riparian vegetation and increase erosion, effecting stream substrate composition.

The habitat of riparian dependent species should remain the same except for improvement of riparian conditions along streams recently effected by fire or channel scour. The habitat conditions could be degraded by future wildfire or floods.

NOTES:

CHAPTER 4

Management Direction

INTRODUCTION

This chapter briefly describes the management direction; goals, desired conditions, and standards and guidelines provided by the *Draft Klamath National Forest Land and Resource Management Plan (LMP)*, as modified by the *ROD* for the *President's Plan*, and how that direction applies to the analysis area. The information from the *Draft LMP* determines management direction for the watershed. This is achieved by summarizing the applicable direction and discussing what it means at this scale. The *Draft LMP* statements included in this chapter are only a summary of the management direction that influence the analysis watershed. The *Draft LMP* must be referenced for the complete description of the management direction.

Two categories of direction are applied to management of the Forest. **Forest-Wide direction** refers to programs which are not identified with only one management area. **Management area direction** applies only to the specific management areas (see Figure 17 - LMP Preferred Alternative Map located in the Map Packet at the end of this document).

The management area acreages are provided in Table 17 - Management Area Acreages. The acreages are derived from a hierarchical data sort of the LMP database with the most restrictive management area taking precedence. For example, Riparian Reserves within wilderness are counted as wilderness acres, but not as Riparian Reserve acres.

Table 17 - Management Area Acreages

MANAGEMENT AREA	ACRES
Private Lands	487
Congressionally Designated (Wilderness)	8,052
Late-Successional Reserve	3,830
Eagle, Falcon, Sensitive Plant	888
Special Management (RNA, SIA, Cultural) Areas	3,341
Mapped Riparian Reserve	12,619
Harsh Sites	19,010
Scenic River	769
Recreational River	799
Partial Retention	10,203
General Forest	8,424

Note: The ecosystem analysis process allows for an opportunity to apply Forest level LMP direction at a more site specific level. This step resulted in generating feedback to the LMP regarding modeling assumptions, management direction, or map layers (Appendix J - LMP Feedback).

FOREST-WIDE DIRECTION

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

Key Watersheds

The Salmon River, of which the Main Salmon analysis area is a part, is a Tier 1 Key Watershed as described in the *President's Plan*. The purpose of this Key Watershed is to provide high quality habitat for spring chinook salmon and other at-risk anadromous salmonids. The *ROD* specifies that in Key Watersheds no new roads will be constructed in Released Roadless areas which still qualify as roadless. It also specifies that the amount of roads should be reduced through decommissioning or at a minimum there will be no net increase in the amount of roads.

The Main Salmon analysis area contains 43,200 acres of Released Roadless lands which are currently classified as roadless. About 33% of the Released Roadless lands are in the matrix; the rest is

in LSR, Riparian Reserves, or other Administratively Withdrawn areas (see Figure 18 - Released Roadless Area Map located at the end of this chapter). Timber harvest is an expected management activity in the matrix and while the Key Watersheds/Released Roadless direction does not prohibit timber harvest, without new roads some matrix lands will remain difficult to access.

Cultural Resource Management
The analysis area is very significant to the American Indian community, specifically the Karuk Tribe. The *Draft LMP* goal is to develop partnerships with local American Indian organizations and consultation with the Karuk Tribe is very important. A portion of the analysis area is designated a Cultural Management Area (Management Area 8) in the *Draft LMP* at this time and an on-going ethnographic study will further identify the cultural significance and contemporary American Indian uses in the watershed.

Transportation Management
The management goal of the transportation system is to provide an economical, safe, and environmentally sensitive access for the Forest. Maintenance and restoration of existing roads is emphasized over the construction of new roads. The primary County road through the analysis area contains narrow, winding segments not designed to accommodate recreational vehicles with trailers. This road traverses very steep and geologically sensitive ground and upgrading the road without decreasing its stability would be difficult. The Forest system roads in the analysis area are in fairly good shape except for multiple slides on the Monte Creek road system and one slide on the Horn Creek road system. A Travel and Access Management Plan is currently being completed for the Ukonom Ranger District portion of the analysis area and will be done later for the Salmon River portion. This plan will contain more details on future road management.

Visual Resource Management
The goal of visual resource management is to meet, or where possible strive for higher adopted visual quality objectives (VQOs). Management Areas are assigned VQOs which are listed below:
- Preservation: Wilderness

Retention: Scenic Rivers, Retention VQO Management Areas
- Partial Retention: LSRs, Special Habitat, Special Management, Riparian Reserves, Harsh Sites (about 30%), Recreational Rivers, Partial Retention VQO Management Areas
- Modification: Harsh Sites (about 50%), General Forest (about 80%)
- Maximum Modification: Harsh Sites (about 20%), General Forest (about 20%)

Management strategies to rehabilitate landscapes that do not currently meet adopted VQOs should be developed for areas of concentrated use.

Timber Management
The goal for the analysis area is to prepare and offer sawtimber which contributes to the Probable Sale Quantity (PSQ) for the Forest as specified in the *LMP* and utilize dead or dying trees to produce wood products consistent with management areas. The PSQ will come dominately from the General Forest and Partial Retention Management Areas but some salvage or hazard tree removal will occur in other management areas if consistent with their goals.

The use of herbicides continues to be an issue of concern, particularly for
some residents near and within the watershed. The *Draft LMP* states:

> "Herbicides may be used where their use is essential to attain a desired future condition that otherwise could not be met. Use of herbicides only after an evaluation of the treatment alternatives, including effectiveness, environmental effects and benefits/costs, clearly demonstrates that herbicide use is essential to achieve project objectives."

The use of herbicides, or any other project level specific "tools" was not assessed in this document. Such assessment is more appropriate at the project level.

Fire and Fuels Management
The goal is to manage wildland and prescribed fires to reduce unacceptable fuel buildups, which will reduce the intensity of future wildfires. Use of prescribed fire, either by itself or in conjunction with other fuels reduction methods, is considered the appropriate method in all management areas. Prescribed natural fire is appropriate in wilderness and late-successional reserves.

The analysis area has about 39,000 acres (57%) of High Fire Behavior Potential. By overlaying identi-

fied resource concerns with the Fire Behavior Potential Map (Figure 13), management opportunities aimed at reducing fuel loadings may be identified. With proper use of prescribed fire and other fuels reduction methods, High Fire Behavior Potential can be reduced, resulting in greater assurance of long-term maintenance of the desired conditions, increased safety to firefighters, and increased effectiveness of fire suppression.

Range Management
The goal of range management is to provide forage on a sustainable basis for use by livestock and wildlife while remaining compatible as possible with other resources. There is currently one range allotment in the analysis area which includes Crapo and Morehouse Meadows in the Marble Mountain Wilderness and some land outside the wilderness along Yellow Jacket Ridge. This allotment has a current Allotment Management Plan which is up for renewal in 1996. Past affects of cattle grazing in this allotment have been discussed in the *Chapter 3*, Aquatic Ecosystem section.

Recreation Management
The goal is to offer a wide range of recreational attractions and opportunities that are responsive to a variety of recreational users. River-dependent recreation (rafting, swimming, suction dredging) is the primary recreational use in the analysis area. Backpacking is also important and occurs mostly within the wilderness, although other trails outside wilderness receive some use. Hunting, mountain biking, and special forest product gathering occurs along Forest roads. Conflicts between recreationists and other Forest users are few at this time but potential for conflict would rise with increased recreational use.

Late-Successional Forest
The distribution of late-successional stands throughout a landscape is an important component of ecosystem diversity. The *ROD* specifies that each watershed analysis area contain at least 15% late-successional forest, considering all land allocations. Currently about 24% of the analysis area is late-successional habitat; includes late-mature and old-growth seral stages. It is distributed across the land allocations with 22% in wilderness, nine percent in LSR, 38% in administratively withdrawn, and 31% in the matrix.

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

Sensitive Plants - *Tauschia howellii* (Howell's *tauschia*) is located in the headwaters of Crapo Creek; avoid disturbance to plant populations during critical periods of plant growth. *Silene marmorensis* (Marble Mountain catchfly) is located at the mouth of Duncan and Wooley Creeks and along the Salmon River Hwy. *Trillium ovatum ssp. oettingeri* (Salmon Mountain wake-robin) have been located in the Riparian Reserve Management Areas. *Lewisia Cotyledon var. howellii and var. hecknerii*, Siskiyou *lewisia* are widely distributed throughout the watershed on rock outcrops.

Plant species identified in the *FSEIS* for the *Presidents Plan - Allotropa virgata* and *Cypripedium spp.* have been located in the watershed at at Duncan Creek.

Wildlife Management
The goal is to develop and/or maintain unique wildlife habitats on the Forest, such as wetlands, meadows, rocky cliffs, etc. Coordinate habitat improvement activities with the California Department of Fish and Game (CDFG) to help meet the State's management goals for deer and other species. Emphasize the maintenance of improvement of Endangered, Threatened and Sensitive Species, Management Indictor Species (MIS), and game species habitat. Manage to provide good habitat conditions for these groups, if that habitat type is within the range of the natural ecosystem. Endangered Species Act consultation with the U.S. Fish and Wildlife Service is required (in the form of a Biological Assessment) for any activity authorized or carried out by the Forest Service that may affect Federally Listed wildlife species or their critical habitat, with the goal to provide habitat conditions and management activities that contribute to their recovery. Biological Evaluations are required for any activity authorized or carried out by the Forest Service that may impact Regional Forester Sensitive Species in order to disclose those impacts to the Deciding Officer with the goal that

there not be a trend towards Federally listing those species.

•Bald Eagles: Management areas are established on the Forest around known nests or winter roosts. There are no known nests or winter roosts within the analysis area, but areas within sight of the Salmon River are considered bald eagle winter foraging habitat.

•American Peregrine Falcon: Two eyries are located in the analysis area and are protected within Special Habitat Management Areas; neither having a management plan. Goals are to develop peregrine nest site (eyrie) management strategies within five years of completion of the *Forest Plan*.

Desired Condition for peregrine falcons will be nesting on tall cliffs across the Forest with adjacent habitat areas that provide an adequate prey base and where human disturbance during the breeding season will be infrequent.

Standards and guidelines specific to peregrine falcon eyrie protection zones, summarized to pertain to situations affecting the eyries within the Mainstem Analysis Area, include requirements to:

--Direct management activities to minimize human disturbance during the nesting periods.

--Monitor the success of the peregrine nest site annually.

--Dispersed recreation activities should be directed away from nesting and foraging habitat.

--Review existing road and facility use to determine if the road or improvement meets the need for which it was constructed.

--Design fire prescriptions to maintain or improve peregrine falcon habitat and restore ecological processes.

•Northern Spotted Owl: Parts of two mapped Late-Successional Reserves (RC349, RC348), and all of another (RC347) are within the analysis area to provide, along with administratively withdrawn and wildernsess areas and Riparian Reserves, long-term habitat for late-successional and old-growth forest related species, including the Northern spotted owl. Critical habitat as determined by the USFWS also occurs in the analysis area within and outside of LSRs. These areas of critical habitat require consultation with the USFWS on any action which may affect the primary constituent elements of spotted owl critical habitat. Outside of the LSRs and critical habitat, 100 acres of the best habitat (unmapped LSRs) will be retained around the four known activity centers and adequate dispersal habitat will be maintained.

•Marbled Murrelet: This analysis area is bisected by the Marbled Murrelet Zone 2. Late-successional reserves within Zone 2 are proposed marble murrelet critical habitat. Pre-project surveys of marbled murrelet habitat are required to assess possible impacts to marbled murrelets or their proposed critical habitat. If stands are found to be occupied by marbled murrelets, those stands will be protected from modifications adverse to the marbled murrelet.

•Northern Goshawk: Goshawk management areas were mapped under a previous Draft of the *LMP*. The current *Draft LMP* includes standards and guidelines which are to be applied to those areas if occupied by nesting birds. Three sites were previously established within the analysis area, though no nests were confirmed at the time. Recent goshawk sitings indicate presence in the Somes Creek drainage. Further surveys are necessary to determine the status of the site; appropriate management will be applied pending their outcome.

Other Managed Wildlife and Plant Species

These species will be managed as directed by the *LMP*. General Forest-Wide Standards and Guidelines that may apply to the analysis area include the Survey and Manage provisions found in the *President's Plan*, and the Species Associations (Guilds, Management Indicator Species, Assemblages and Forest Emphasis Species) identified in the *LMP*.

•For Amphibians: Within the known or suspected ranges and within the habitat types or vegetation communities associated with the species, surveys for Del Norte and Siskiyou Mountain salamanders prior to ground disturbing activities that will be implemented in 1997 or later.

•For Snag Association: Assess the availability of snags within each landscape. Provide for an average of five snags per acre, in a variety of decay classes, within each landscape.

•For Hardwood Association: Maintain a significant component of mature, mast producing hardwoods and oak species (e.g., 10-35 sq. ft. basal

area per acre) in areas where oak stands occur within conifer stands.

•For Riparian Association: See Water Resources (below) and the following section on Management Area 10. Manage to promote desirable emergent vegetation within marshes, ponds and lakes.

•For Bat Assemblage: Within matrix forests, conduct surveys of crevices in caves, mines and abandoned wooden bridges and buildings for the presence of roosting bats including Townsend's big-eared bat, fringed myotis, silver-haired myotis, and long-eared myotis. If bats are found, identify the species using the site and determine for what purpose it is being used by bats. Protect the site from destruction, vandalism, disturbance from road construction or blasting, or any other activity that could change cave temperatures or drainage patterns.

•Black Bear: Manage open road densities, manage to increase mast producing oaks, and maintain large snags (>36"dbh) for denning.

•Black Tailed Deer: Improve, create, or maintain a mix of forage and cover conditions that will benefit deer populations including winter forage areas not being more than 300 yards from cover, fawning/rearing forage areas no more than 150 yards from cover, and promoting roadside vegetative screening along open roads in areas important for migration, fawning/rearing or concentrated seasonal use.

•Roosevelt Elk: Manage for a high habitat rating using a management strategy in consultation with the CDFG including considerations for habitat enhancement and open road management, especially in key use areas.

Water Resources

The goal of water resource management is to meet the goals of the *Aquatic Conservation Strategy* and *Clean Water Act*, promote slope stability, and provide instream flows of sufficient quality water to support existing or desired habitats for fish and riparian dependent species. The immediate stream environment is within the Riparian Reserves but disturbances outside of the Riparian Reserves effects the aquatic and riparian habitat. In this analysis area the primary upslope influence on the streams is sediment production as described in the *Processes* section.

Drainages with some combination of high landslide sediment yield and poor quality fish habitat are described as "watersheds of concern" in the environmental documentation for the *Forest Plan*. Only activities which do not cause additional watershed disturbance or will improve watershed health should occur in these drainages until subsequent analysis determines that the area has recovered. The Crapo Creek drainage, the Tom Payne Creek area, and the Merrill Creek area have been identified as "watersheds of concern". An assessment of potential sediment yields at the subwatershed scale (refer to *Chapter 3 - Aquatic* section) reveals that the Crapo Creek and Tom Payne subwatersheds have very high potential sediment production levels, therefore should still be considered "watersheds of concern". Merrill Creek has a much lower potential landslide production level so can be considered no longer "of concern".

"The goal of fisheries is to maintain suitable fish habitat that will support well-distributed viable populations of native and desirable non-native fish" (*Draft LMP*). Habitat criteria have been identified for measurable components associated with high quality fisheries habitat.

The determination of desirable levels of each criteria is based on a 1988 *Draft Proposal for Managing and Monitoring Streams for Fish Production* by James Sedell, Pacific Northwest Range and Experiment Station; local data and current literature. Sedell's proposal was intended to provide direction for forest plan application in Oregon and Washington Forests in the Columbia River Basin (*Draft LMP*). These criteria may be adjusted as additional local data is collected and analyzed. These components and criteria are displayed in Table 18 - Fisheries Habitat Criteria.

Table 18 - Fisheries Habitat Criteria

COMPONENT	CRITERIA
Water Temperature	Do not exceed a maximum summer temperature of 69°F or the site potential.
Instream Flows	Maintain flows to maintain aquatic ecosystems processes.
Nutrient Levels	Maintain at background levels. Background may be determined by sampling in wilderness streams or other suitable reference waters.
Stream Channel Integrity	Maintain or restore stream channel integrity and channel processes to protect aquatic resources.

COMPONENT	CRITERIA
Fines	Maintain less than 15% fines as the area-weighted average in spawning habitat (pool tail-outs and glides).
Embeddedness	Maintain less than 20% embeddedness as the area-weighted average in riffle areas.
Pool Frequency	Maintain one pool every three to seven channel widths (bankfull widths). In anadromous reaches, these pools should occupy at least 50% of the low-flow channel width and have a maximum depth of at least 36".
Plant Communities	Maintain or restore native and desired non-native plant community diversity and productivity.
Coarse Woody Material	Manage for an average of 20 pieces of large wood per 1,000 lineal feet (100/mile) or to achieve site potential in perennial and fish-bearing streams. Westside minimum length 50' and diameter 24"; eastside minimum length 35' and diameter 12".
Stream Canopy Cover	Provide 80% stream surface shading in summer or achieve the site potential.
Riparian Ground Cover	Provide 85 trees/acre with a minimum basal area of 250 square feet/acre of which at least 90% are conifers, or achieve the site potential.

Refer to Figure 19 - Stream Reaches Map, located at the end of this chapter, that displays stream reaches and habitat criteria.

Lands Program Management

The goal is to achieve a land ownership pattern that improves Forest management options, reduces resource conflicts, and reduces administrative costs. Land ownership adjustment proposals should be accepted for study when preliminary analysis indicates that such a proposal is clearly in the public interest and supports ecosystem management, as defined in the *Forest Plan*. For land ownership adjustment activities where advocacy exists with the proposing unit, the land adjustments should proceed as defined in the eight situations listed in the *Forest Plan*. There currently exists on the Ukonom Ranger District a proposal for an exchange of an estimated two acres of Federal ownership in the Salmon corridor for seven and one-half acres of private in-holdings within the Klamath corridor.

Historically, land ownership adjustments within the Salmon corridor have resulted in the transfer of title to private in-holdings as a result of trust patents, patents of mineral deposits, *Small Tract Act* adjustments, and the *Homestead Act*.

The goal of special-use management authorizations within the Salmon corridor is to authorize land uses for transportation right-of-ways, road use for access to private in-holdings, domestic water sources, utility corridors, public education facilities, disposal sites, recreational residences, and misc. commercial uses. Administration is to include periodic inspections of these permits which is essential to determining if the permits are in compliance with provisions as stipulated with their issuance. Appropriate use fees are to be determined and collected for, on an annual or term basis.

Minerals Management

The goal is to manage mineral exploration and protection of surface resources to maintain the environmental quality (to the extent feasible). To administer all locatable, leasable and saleable mineral resource activities according to the 36 CFR 228 regulations and other applicable laws and regulations. Locatable mineral deposits within the Salmon analysis are made up of placer deposits within ancient streambed channel. Any surface disturbing activity to extract mineral values will require a Plan of Operations consistent with environmental documentation as defined an EA or an EIS.

The primary mineral activities in the Main Salmon area currently are suction dredge operations regulated by the California Department of Fish and Game. A surface placer mining operation is proposed in the area which would impact the Riparian Reserves.

MANAGEMENT AREA 2 - WILDERNESS

Congressionally Designated

There are approximately 2,900 acres of the Marble Mountain Wilderness and about 1,900 acres of the Trinity Alps Wilderness located in the analysis area. These areas are managed for wilderness characteristics and values. Naturally occurring ecological processes should be predominate within wilderness ecosystems. The wilderness provides recreationists a primitive and semi-primitive, non-motorized recreation opportunity. Other uses and activities such as grazing must be consistent with wilderness legislation.

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

There is an estimated nine miles of developed trails; three miles primary and six miles secondary, in the Marble Mountain Wilderness within the analysis area. The Garden Gulch Trail is the main designated access to this portion of the Marble Mountain Wilderness. This trail accesses Chimney Rock and Crapo and Morehouse Meadows. The Crapo Creek Trail accesses this area from the Yellow Jacket Ridge Road. This trail is not a Forest Service maintained trail, but is used for access by recreationists and livestock. This trail does not meet appropriate design standards and poses resource concerns, such as erosion in the meadow areas. The Salmon Summit National Recreation Trail accesses the Trinity Alps Wilderness along the boundary of the analysis area.

MANAGEMENT AREA 5 - SPECIAL HABITAT
Late-Successional Reserves

There are approximately 3,830 acres of mapped Late-Successional Reserves (LSRs) within the analysis area. They occur within three reserves and are summarized in Table 19 - LSR Acreages Within Analysis Area:

Table 19 - LSR Acreages Within Analysis Area

LSR #	NAME	TOTAL LSR AC.	ACRES/(%) WITHIN ANALYSIS AREA
347	Crapo	1,530	1,530/(100)
348	Steinacher	2,210	1,300/(59)
349	Ten Bear	45,860	1,000/(2)

In addition, there are four activity centers around which 100-acre LSRs are to be designated.

The management goal for LSRs is to maintain and enhance late-successional and old-growth forests in order to provide habitat for species associated with them.

The desired condition is to maintain forested stands with large overstory trees, with obvious signs of decadence, coarse woody material, and multi-layers of canopy. These conditions are most likely to be maintained on north-facing slopes, at high elevations, and in cool, moist areas such as riparian areas; site capability allowing.

There is a management concern regarding vegetative or surface manipulations in all sensitive soil types within LSRs.

The existing condition within each LSRs is summarized below, followed by a desired range of late-mature and old-growth seral stage. The desired range is an estimated projection based upon consideration of site class, topography, and fire behavior potential. Also summarized is a discussion of the seral stage distribution and possible management opportunities to reach desired conditions, along with the known spotted owl occurrences within the analysis area portions of the LSRs.

Crapo - Site class within Crapo LSR is primarily moderate with some inclusions of high and very low. Currently the potential wildfire effects within the LSR are primarily high with some inclusions of low and moderate. Table 20 displays Crapo LSR acreages sorted by seral stage and site class. The table also displays seral stage representation within the LSR expressed in percent.

Table 20 - Crapo LSR Acreages by Seral Stage and Site Class

SERAL STAGE	FS SITE CLASS	ACRES (% OF TOTAL LSR)
Shrub/Forb & Pole	3	25
	4	640
	6&7	2
Total	-	667 (44)
Early-Mature	3	25
	4	3
Total	-	28 (2)
Mid-Mature	4	60
Total	-	60 (4)
Late-Mature/Old-Growth	3	172
	4	602
Total	-	774 (51)

Desired range of late-mature/old-growth: 60% to 70%.

This LSR is entirely within the analysis area and can be described as having relatively poor seral stage distribution. There are such low amounts of early-mature and mid-mature seral stages that it won't be until the shrub/forb and pole seral stages mature that the desired range of late-mature/old-growth can be achieved. What late-mature/old-growth that exists in this LSR is fairly well connected in a U-shaped band connecting the riparian area of Crapo Creek to upper elevation late-mature/old-growth patches around Crapo Meadows in the wilderness.

There may be opportunities to treat fuels to reduce fuel continuity and develop fire resiliency around early seral stages, and within late-mature and old-growth stringers on the upper two-thirds of the slopes and on south aspects, without overly degrading the snag and large down wood components of the LSR.

There are no known Northern spotted owls within this LSR, but no surveys have been done since the area was impacted by wildfire in 1987.

Ten Bear - Site class within Ten Bear LSR is primarily high with some inclusions of low. The LSR is within an area identified as having a high fire behavior potential. Currently the potential wildfire effects within the LSR is an equal proportion of high and moderate. Table 21 displays Ten Bear LSR acreages sorted by seral stage and site class. The table also displays seral stage representation within the LSR expressed in percent.

Table 21 - Ten Bear LSR Acreages by Seral Stage and Site Class

SERAL STAGE	FS SITE CLASS	ACRES (% OF TOTAL LSR)
Shrub/Forb & Pole	2&3	157
	6	20
Total	-	177 (18)
Early-Mature	3	25
	6	19
Total	-	44 (4)
Mid-Mature	2&3	364
	6	127
Total	-	491 (49)
Late-Mature/Old-Growth:	3	287
Total	-	287 (29)

Desired range of late-mature/old-growth: 40% to 55%

Only about 0.2% of this LSR occurs within the analysis area. Discussions pertain just to this small portion and are not necessarily relevant to the LSR as a whole.

There may be opportunities to manipulate younger stands to provide old-growth structural conditions. This should first be planned for the lower one-third of the slopes where, in general, most spotted owl roosting and nesting takes place. There may also be opportunities to reduce ground fuels within the area (as well as in the large fire-salvaged area downslope of this LSR) in order to reduce the chances of loss of mature habitats through wildfire. This should first be practiced on the upper two-thirds of the slopes in order not to overly reduce spotted owl prey habitats in coarse woody materials.

Protocol surveys for spotted owls were conducted throughout the portion of this LSR that is within the analysis area during 1988 and 1989 with the result that an owl was found to be roosting in the area on one occasion, but no owls were nesting there. Suitable spotted owl habitat within this portion of the LSR is considered to be part of the home range of the Offield Mt. (KL-4059) spotted owl pair.

Steinacher - Site class within Steinacher LSR is primarily moderate with some inclusions of high and very low. Currently the potential wildfire effects within the LSR is very high and high (nearly equal proportions) with some inclusions of low and moderate. Table 22 displays Steinacher LSR acreages sorted by seral stage and site class. The table also displays seral stage representation within the LSR expressed in percent.

Table 22 - Steinacher LSR Acreages by Seral Stage and Site Class

SERAL STAGE	FS SITE CLASS	ACRES (% OF TOTAL LSR)
Shrub/Forb & Pole	4	17
Total	-	17 (1)
Early-Mature	4	42
Total	-	42 (3)
Mid-Mature	4	530
	6&7	174
Total	-	704 (54)
Late-Mature/Old-Growth	3	425
	4	108
Total	-	533 (41)

Desired range of late-mature/old-growth: 70% to 85%

Approximately 59% of this LSR occurs within the analysis area. The discussion pertains to this portion and may not be pertinent to the LSR as a whole.

This area appears to have a seral stage distribution that will provide for the desired amount of late-mature/old-growth habitat once the mid-mature stands develop. The current amounts of

older seral habitats are continuous and well connected outside the analysis area.

There may be opportunities to treat fuels in the low site class and south aspects of the LSR to increase the resiliency of those areas from fire, without overly degrading the snag and large down wood components of the LSR.

The northern portions of the part of this LSR that are within the analysis area have been surveyed for spotted owls with the result that there was a pair found roosting together in 1990 just beyond the edge of the analysis area. Portions of this LSR may be within the home range of the Tom Payne (KL-1055) activity center.

Summary - Approximately 40% of the area within mapped LSRs are in a mature and old-growth forested condition. This is less than what the area can sustain. Additionally, these LSRs are part of a large Critical Habitat Unit, which is currently deficit the number of known owl pairs in relation to the recovery target number of owl pairs.

The habitats within Somes, Monte, Duncan and Butler Creeks may be important in contributing to late-successional forest associated species until habitat objectives within LSRs are met. "Production of timber and other commodities is an important objective for the matrix. However, forests in the matrix function as connectivity between LSRs and provide habitat for a variety of organisms associated with both late-successional forest and younger forest" (*ROD*).

Peregrine Falcon Management Area

As mentioned previously, two peregrine falcon eyries occur within the watershed (previously referred to as Site A and Site B). A management area has been established around each of the sites. Each management area approximates a one-half mile radius around the eyrie. This area is also referred to as the nest protection area. The management area for Site B overlaps with an LSR, however no conflicts in management direction are apparent at this time.

The management goals are to protect these sites in accordance with the US Fish and Wildlife's approved *Recovery Plan*. 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 sites; via a mosaic of vegetative types.

The desired condition is to maintain nest protection areas which are free of disturbance that would interfere with the breeding cycle of peregrine falcons. Additionally, large scale vegetative changes should be avoided. The existing condition of the management area is summarized in Table 23 - Site A Eyrie Acreages by Seral Stage Within Analysis Area and Table 24 - Site B Eyrie Acreages by Seral Stage Within Analysis Area. The total acres reflect what occur within the analysis area only; they do not include the acres that overlap with LSRs.

Table 23 - Site A Eyrie Acreages by Seral Stage Within Analysis Area

SERAL STAGE	ACRES (%) OF MGMT. AREA
Shrub/Forb & Pole	35 (5)
Early-Mature	315 (48)
Mid-Mature	120 (18)
Late-Mature/Old-Growth	140 (21)
Gravel Bar	45 (7)

There is currently one river access and one trailhead within the management area. Mining and road reconstruction activities have been identified in the past as having the potential to disturb breeding peregrine falcons at this site, and current use of the river access at this site has the potential to disturb breeding peregrine falcons here.

There may be an opportunity to reduce the potential disturbance from current river access use by gating or increasing signing and patrols at this river access until monitoring has determined that the birds are not breeding. Another river access is available for use about one mile downstream, and there may be opportunities to develop other river access points upstream, outside of the management area.

Table 24 - Site B Eyrie Acreages By Seral Stage Within Analysis Area

SERAL STAGE	ACRES (%) OF MGMT. AREA
Shrub/Forb & Pole	40 (21)
Early-Mature	0 (0)
Mid-Mature	140 (75)

SERAL STAGE	ACRES (%) OF MGMT. AREA
Late-Mature/Old-Growth	5 (3)
Gravel Bar	45 (7)

This management area has a wilderness trail going through it, but the current potential for human disturbance from users is considered low due to the low use of this trail during the breeding season, and due to this site not having been occupied recently.

Activities or processes which would affect primarily the sub-canopy of the surrounding vegetation could be compatible with management of these areas providing they do not result in unaccustomed disturbance during the nesting season. Maintenance of or enhancement of vegetative conditions which would provide foraging opportunities, such as maintaining large snags or maintenance of existing openings is desirable.

*** A small portion of a third management area overlaps the analysis area, however, the actual eyrie occurs outside of this assessment area.***

MANAGEMENT AREA 7 - SPECIAL INTEREST AREAS

Administratively Withdrawn

There are three geologic Special Interest Areas (SIAs) in the analysis area. The **Murderers Bar Landslide** occupies about 50 acres on the southwest side of the Main Salmon River. It consists of a large complex landslide that dammed the river in 1955. This feature, involving traditional, slump and debris flow processes, offers opportunities to learn more about the uplift history of the area, and about the inter-relationships between bedrock features and landsliding. The **Bloomer Debris Avalanche** consists of a large debris avalanche that occurred on the southwest bank of the Salmon River during the 1964 flood. This debris avalanche temporarily dammed the river. This debris avalanche is the best example of a landslide that dammed a river on the Forest. Additionally, it is an excellent example as a debris avalanche that involves both soil and bedrock. The **Wooley Creek Batholith** Roof Zone consists of a corridor a few hundred feet along the Salmon River Road (County Road 2B01). This area is of geologic interest because it coincides with the western margin of the Wooley Creek Batholith, the second largest body of granitic rock in the Klamath Mountains.

The management goal is to manage the SIAs for the unique geologic features for which they were designated. Manage for activities which promote education, research, interpretation and enjoyment of the special interest values of the area when such activities do not harm the values for which the area was designated.

The desired condition of these SIAs is to emphasize the unique resource for which it was designated. Minimal signs of management activities, other than to provide public access should occur in these areas. Individual management plans need to be developed. Sites will be developed to foster research and educational experiences.

MANAGEMENT AREA 8 - CULTURAL

Administratively Withdrawn

Approximately 2,800 acres of the Cottimien Cultural Area, as currently defined, lies within the analysis area. This area has significant historical and contemporary spiritual values and uses for the Karuk Tribe. The management goal is to provide protection of the ceremonial uses and values and to manage this area to preserve and protect traditional cultural emphasis.

The desired condition of Cottimien is to maintain the integrity of the area in a manner consistent with the Karuk Tribe's customs and culture. This area will be influenced primarily by ecological processes and traditional management practices with signs of management activities not readily apparent.

While the *Draft Forest Plan*, as amended by the *ROD*, addresses the general management goals and desired condition for Cottimien, a Memorandum of Understanding (MOU), developed jointly between the Forest and the Karuk Tribe of California, should address the specific Forest management activities that may effect Cottimien. One such activity is the reintroduction of the traditional use of fire for ceremonies, also to enhance gathering areas, improve habitat, and reduce fuels. The MOU will also define the boundaries of the cultural areas, including Cottimien. This is expected to be addressed in 1995 and the current indication suggests the Tribe's desire to increase the size of these areas.

MANAGEMENT AREA 10 - RIPARIAN RESERVES

Administratively Withdrawn

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. Riparian dependent resources receive primary emphasis in Riparian Reserves.

Riparian Reserves are delineated and protected as a major component of the *Aquatic Conservation Strategy* in the *President's 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.

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. In the mainstem Salmon intermittent streams on south aspects underlain by shallow soils should include manzanita, live oak, knobcone pine, ponderosa pine, and other drought resistant species. The floodplains of major streams should include a multitude of species such as pines and other upland species as well as lowland species such as maples, alders, and willows. In unstable areas the desired plant communities would depend on local site conditions with attention to deep rooted species capable of providing root support to the slope. In meadow areas, overhanging banks with herbaceous and/or shrubby vegetation providing canopy cover should be present. Riparian Reserves should provide shade, thermal buffering, large wood, organic matter, habitat, nutrient cycling, bank stability, and sediment filtration as appropriate to site capability. Wildlife habitat needs should play an important role in desired plant communities in most reserves. Emphasis should be placed on native species, but in some situations non-native species may be desirable.

The detailed description of interim Riparian Reserves can be found in the *ROD* and in the *Draft LMP*. In summary, they include the land two potential tree heights (about 340 feet) from the edge of fish bearing streams, lakes, and ponds, one potential tree height (about 170 feet) from other streams up to the extent of evidence of annual scour or deposition, and includes floodplains, riparian vegetation, and unstable lands. Unstable lands include active landslides, inner gorges, toe zones of slumps and earthflows, severely dissected granitic lands, and other combinations of slope, aspect, landform, and rock structure which are identified as unstable at the project level. The acreage reported for this management area is the LMP approximate based on inner gorges on the Geomorphic Terranes Map (Figure 6).

The riparian dependent resources intended to benefit from Riparian Reserves include fish, mollusks, amphibians, lichens, fungi, bryophytes, vascular plants, American marten, red tree voles, bats, marbled murrelets, and Northern spotted owls. Information regarding the ecological requirements of most of those species is lacking. Since any proposed changes to Riparian Reserve widths must take into account all of the species that were intended to benefit from them. It is recommended that the Interim Riparian Reserve widths not be reduced in the analysis area 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.

Riparian Reserves are determined on the ground during implementation of site specific projects. The location of fish-bearing streams is currently mapped accurately although some updating may be done as needed. The extent of annual scour has been approximated for this analysis but needs to be field verified for projects. Unstable lands have been mapped at LMP resolution and will also need field verification. Project teams should field verify existing mapping of intermittent streams and unstable lands and evaluate other lands for inclusion in or withdrawal from the Riparian Reserve. Monitoring will then allow tracking of changes in the area and distribution of the Riparian Reserve.

In delineating individual Riparian Reserves, teams should stratify them by primary function. For example, an 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; e.g., boundaries for the Riparian Reserve will not be shifted across the landscape as different management activities are planned for the area.

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. 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.

MANAGEMENT AREAS 12 & 13 - SCENIC AND RECREATIONAL RIVERS

Matrix

Eighteen miles of the Salmon River are designated components of the National Wild and Scenic Rivers System. Seven miles of the Salmon River from Lewis Creek to Wooley Creek are classified as Scenic River. Eleven miles of the river is classified as Recreational River. The two segments of Recreational River are from Forks of Salmon to Lewis Creek and from Wooley Creek to the Klamath River. Current interim guidelines require managing for wild and scenic values within a one-quarter mile-wide corridor from the ordinary high water mark on each side of the river. Detailed final boundaries for each of these segments will be established in the Forest Plan process (refer to Appendix J in the *Draft EIS*). These segments of the Salmon River are designated for their outstanding fisheries value. Both the scenic and recreational portions of the river are to be preserved in a free-flowing condition, to protect and enhance its outstanding value, while providing recreation and resource uses that do not adversely impact or degrade it.

The desired condition for the scenic segments are for the river to be primitive and undeveloped; shorelines do not show substantial evidence of human activity. The river environment presents an overall natural character and the physical and biological integrity of the aquatic system is maintained. The desired condition for the recreation segments are for the river to remain generally natural and riverine in appearance. The physical and biological integrity of the aquatic system is maintained. Recreation rivers may be developed for a full range of forestry practices and may show evidence of past and on-going timber harvest.

The Main Salmon is the most important habitat for anadromous and resident fish species. The habitat is in good condition and capable of supporting viable populations although there are high amounts of surface erosion from the river access roads. County Road 2B01 follows the Main Salmon for its entire length, but is seldom visible along the Scenic section of the river. The river canyon retains a natural character, with limited evidence of structures, roads, bridges, and other land-disturbing features or activities.

MANAGEMENT AREA 15-PARTIAL RETENTION

Matrix

The Partial Retention Management Area represents 10,200 acres, or 15% of the analysis area. This management area is the largest single management area in matrix lands. These areas are generally located in the northern half of the analysis area.

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

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

Middleground views, as seen by travelers along the Salmon River Road, and by river recreationists on the Salmon River, a designated component of the National Wild & Scenic Rivers System, will appear near-natural. Middleground views from the

Steinacher Trail and foreground views from the Somes Glade Trail would also appear near-natural.

The existing visual conditions generally meet the desired condition (of Partial Retention) on 86% of the area. However, there are some past activities that do not meet Partial Retention; primarily timber harvest, and some road construction. These areas would require further review to determine the nature and extent of rehabilitation, if necessary.

To maintain or promote the desired condition, an existing or proposed management activity should meet or exceed the definition of the Partial Retention VQO, listed in desired condition above, and an activity should meet the stated objective within three years.

It is desired to maintain stand health as well as resilience to wildland fire, insect, disease, and other damage.

Within seen areas, the forested condition of these stands will promote the growth of closed canopy forest with scattered openings. Regeneration harvests will generally be small in size; one to five acres.

Unseen areas in the partial retention zone will be managed for larger openings. Stand sizes will vary with topography and the landscape pattern of surrounding areas.

The shrub component for the higher sites (FSSC 1-5) is currently at 2,100 acres; 21% of the Partial Retention area. The shrub component for the lower sites (FSSC 6-7) is currently at 800 acres; eight percent of the Partial Retention area.

The poorer sites in the shrub/forb seral stage will be dominated by a grass/forb complex with shrub and hardwood seedlings and saplings being present. Hardwoods would generally be scattered; dominant species would be canyon live oak. Shrub species would be dominated by those that are adapted to shallower soils and drier, harsher sites. Conifer seedlings and saplings would generally be sparse and dominated by shade intolerant species.

The higher sites in the shrub/forb seral stage will contain grass/forbs, shrub, hardwood seedlings and saplings, and an abundant amount of conifer seedlings and saplings. Scattered overstory trees from the previous stand will be present. Snags and down woody material will be present. Dominant hardwood species will consist of tanoak, black oak, and madrone. Shrubs will consist of deerbrush and manzanita. The dominant conifer species will be Douglas-fir with minor amounts of sugar pine, ponderosa pine, and white fir and red fir. The desired range for the shrub/forb seral stage on good sites is five to ten percent; currently at 29%.

The pole/early-mature seral stage for the higher sites currently contains 1,100 acres; eleven percent of the Partial Retention area. The poor sites currently contain 800 acres; eight percent of the Partial Retention area.

The desired condition for the poorer sites is to have young hardwoods and shrubs beginning to dominate the sites. Grass/forbs will still be prevalent as the trees and shrubs will be fairly scattered. Conifers will be very sparse.

The higher sites in the pole/early-mature seral stage will contain a mixture of hardwoods and conifers that are generally single layered except for the predominants that are remaining from the previous stand. Snags will be present within the stands. Fuel loadings will be fairly low, some down woody material will be present. The grass/forbs and shrubs are beginning to be shaded out of the stands. These stands will generally have crown closures of 40-70%. Diameters for the conifers will range from 6"-18". In-stand vertical and horizontal diversity will generally be lacking. These stands will be relatively free of insect and disease problems. The desired range for pole/early-mature on good sites is 30-40%; currently at 15%.

The mid-mature seral stage for the higher sites currently contains 2,400 acres; 24% of the Partial Retention area. The poor sites currently contain 1,800 acres; 18% of the Partial Retention area.

This seral stage on poor sites will contain open grown healthy hardwood and shrub species. There will be scattered conifers throughout the stands. Grass/forbs will still be prevalent due to the openness of the stands. There will be minor amounts of coarse woody material and minor presence of decadence within these stands.

The desired condition for higher sites is to have healthy vigorous stands of conifers intermixed with hardwoods. Predominants are present and scattered throughout the stands. Occasional snags and down logs are present. Duff and ground cover are evident in greater quantities as compared to this seral stage on low sites. These stands tend to have minimal within-stand structural diversity. The stands will be somewhat open grown in order to allow the hardwoods to continue to be present. Diameters for the conifers will range between 18" and 30". The desired range for mid-mature on good sites is 30-45%; currently at 32%.

The late-mature/old-growth seral stage for the higher sites currently contains 1,800 acres; 18% of the Partial Retention area. The poor sites currently contain 600 acres; six percent of the Partial Retention area).

This seral stage on poorer sites will contain scattered large conifers associated with shrub and hardwoods. Stands are predominately occupied by hardwoods. The stands are fairly open with a grass component still present. Some snags may be present with a slight increase in coarse woody material. The older stands will have trees with broken tops and more decadence appearing.

The desired condition for the better sites contain conifer stands intermixed with hardwoods. The crown closure for the stands will range from 40-80%. Conifer species will generally be over 30" and some vertical diversity will be present. Shade tolerant forbs and shrub species are present. Shade tolerant tree species may be found in draws and on north slopes. Predominants will exist in many of the stands. Snags are present. The duff layer and coarse woody material has increased. There are very few holes in the overstory but as senescence increases, more openings will be present as trees begin to die. The desired range for late-mature/old-growth on good sites is 15-25%; currently at 24%.

MANAGEMENT AREA 17 - GENERAL FOREST
Matrix

General Forest Management Area varies in size and locations within the watershed. The majority of areas are located within the northwest portion of the watershed; generally in the Butler, Lewis, Morehouse, and Somes Creeks area. Approximately 8,400 acres of the analysis area is within the General Forest Management Area. The vegetation in General Forest has been characterized into four seral stages for the purpose of this discussion; shrub, pole/early-mature, mid-mature, and late-mature/old-growth.

Management goals for General Forest Area is to provide a programmed, non-declining flow of timber products, sustainable through time. These levels may vary from year to year, based on ecological processes.

Conifer stocking levels are to be maintained at levels which commensurate the capability of the site to produce wood fiber. Generally, Region Five Site Class I stocking level, for all forest types except red & white fir, is approximately 150-300 trees per acre. Site Class II stocking levels is approximately 125-225 trees per acre. Site Class III stocking levels is approximately 125-150 trees per acre. Site Class IV stocking levels is approximately 75-125 trees per acre. Red fir and white fir stocking will tend to be higher due to available soil moisture longer seasonally.

Manage young regenerated stands to maximize growth potential. Accomplish management activities such as thinning, to maintain stand vigor and resilience to disturbances such as wildfire, insects, and disease. Emulate ecological processes and watershed patterns where possible.

Within harvest units maintain the structure, composition, and ecological function of the area. Provide snags and hardwood habitat to help maintain viable populations of wildlife species that require these structural functions.

As discussed in *Chapter 3*, reintroduce fire into the watershed ecology to attain pre-fire suppression stocking levels and fuel loadings. Stocking levels can be reduced by thinnings or logging. Fuel loading can be reduced with repeated restoration burnings within the first decade or two until the area is restored to Fire Regime #2.

Utilize the adjacent vegetation patterns of a mosaic of seral stages and stocking levels. By utilizing vegetative patterns and past disturbance occurrences VQOs of Modification and Maximum Modification will be met or exceeded.

Ninety percent of the General Forest Management Area is located in Released Roadless Areas. The desired condition of these areas as incorporated

by the *ROD* is to have no new road construction in released roadless areas within Key Watersheds. Since much of the area still meets the criteria of roadless, helicopter logging is the primary vehicle for harvesting timber. Some of the areas may be currently unfeasible due to distance to existing roads. Refer to the Preliminary Logging Feasibility Report which can be found in the Map Atlas kept on the Ukonom or Salmon River Ranger District. Due to this accessibility problem, harvest and post sale activity costs will be higher.

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 Condition for Main Salmon Watershed in General Forest Management Area will be to create a mosaic of vigorous growing forest stands. This area will be made up of a variety of vegetation species and structure which will vary overtime from plantations to mature stands. Generally the area will be managed for timber production to provide goods for the human element. Plantations will become available for regeneration between 80-120 years. Clearcutting will be infrequent. Regeneration with residuals and uneven-aged stand structure will be more common. Regeneration harvest will require retention of groups of green trees (15%-20%/unit) and individual scattered trees two to five trees per acre of average stand diameter. Pre-commercial and commercial thinning will be used frequently to maintain healthy, vigorously stands.

The general stand characteristics for each seral stage will be very similar to those listed in the Partial Retention area. The primary difference between these two management areas the desired range (percent) for each seral stage and the retention zone will be managed to maintain forest cover for a longer rotation.

Seral stage components are likely to change in size, condition, and/or arrangement within general forest management area. The shrub component contains 1,600 acres (19%) in General Forest, some which has a large percentage of hardwood dominance. Although shrub species will be more prevalent in regenerated areas understories, acres classified as this type will change little. Some areas dominated by shrubs are a result from high intensity disturbance such as wildfire, soil movement, or floods.

The shrub component for the higher sites (FSSC 1-5) is currently at 800 acres; nine percent of the General Forest area. The shrub component for lower sites (FSSC 6-7) is currently at 800 acres; nine percent of the General Forest area. The desired range for the shrub/forb seral stage on good sites is 5-20%; currently at 15%.

Pole/early-mature seral stage generally consist of single layer stands. This seral stage totals 1,100 acres in the General Forest Management Area. Currently 13% of this seral stage in General Forest is in pole/early-mature. These areas will be a mosaic of vigorously growing stands made up of a variety of vegetative species. Diameters will range from 6" to 18" and vertical and horizontal diversity is generally lacking. This seral stage is considered high priority for pre-commercial and commercial thinning. In areas with high fire risk, a high degree of contrast or edge is needed to reduce potential loss of this resource. Pre-commercial thinning areas without removal of boles and reduction of resulting slash increases the fire risk exponentially. Management of stands for commercial thinning should be prioritized for greatest conifer growth potential or where disease or insect problems jeopardize the health of the resource.

The pole/early-mature seral stage for the higher sites currently contain 600 acres; seven percent of the General Forest area. The poor sites currently contain 500 acres; six percent of the General Forest area. The desired range for pole/early-mature on good sites is 40-55%; currently at 11%.

Mid-mature seral stage may have one or two layers present within the stand. Acres in mid-mature seral stage is 3,200 in General Forest; currently at 38%. Mid-mature can be dominated by trees with diameters 18" to 30" and this seral stage is the first pulse of snag appearance (>20" diameter). Vertical and horizontal diversity will generally be lacking. Mid-mature type provides the second greatest opportunity to meet General Forest objectives. Conversion of this type to younger conifer stands would approach a more regulated forest condition. Since conversion may be rare due to other constraints within this watershed, thinning would be beneficial and maintain stand integrity. The majority of these

stands exist in the Lewis Creek area and are dominated by hardwoods.

The mid-mature seral stage for the higher sites currently contains 1,900 acres; 23% of the General Forest area. The poor sites currently contain 1,300 acres; 15% of the General Forest area. The desired range for mid-mature on good sites is 15-30%; currently at 38%.

Late-mature/old-growth seral stage acres in General Forest are 2,600, which equates to 31%. Late-mature/old-growth seral stage usually have two or more layers present with trees of various size classes. Vertical and horizontal diversity is beginning to appear and may be high in old-growth stands. A significant portion of this seral stage will be converted to younger stands to meet General Forest objectives. If any conversion to early seral stage is accomplished, structural diversity will be maintained with the retention of green tree grouping (15-20%/unit) and scattered two to five trees per acre. The majority of these stands exist in the Somes and Butler Creek areas.

The late-mature/old-growth seral stage for the higher sites currently contain 1,800 acres; 21% of the General Forest area. The poor sites currently contain 800 acres; ten percent of the General Forest area. The desire range for late-mature/old-growth on good sites is 15-20%; currently at 36%.

Disaggregation of Probable Sale Quantity (PSQ) from *Klamath National Forest LMP*, without any watershed constraints, estimates 3.3 MMBF per year from the analysis area. With current watershed constraints, management direction and value of the cultural landscape the estimated PSQ may be approximately .8 MMBF (or less) per year. These estimates are just that "estimates", actual ground verification and the NEPA level analysis, may bring to view other constraints not identified at this level of analysis.

On-going consultation with the Karuk Tribe and completion of the ethnographic study may affect the extent and type of timber harvest completed in the General Forest Management Area in the watershed. Due to the sensitivity and cultural value of the watershed, Standard and Guidelines 24-23 & 24-24 will identify potentially affected areas. The opportunity to follow management direction for General Forest and intensively complete conversions of late-mature/old-growth to a regulated state is a direct conflict to significant tribal cultural values and religion.

HARSH SITES

Administratively Withdrawn

The harsh site areas were originally part of General Forest but not considered for full timber yield due to economic considerations in the proposed *LMP*. Many of these areas are harsh sites with low yields; cannot produce 20 cubic feet of wood fiber per acre per year, and difficult regenerability. While other sites have better potential but are not economically accessible depending on the current seral stage of the vegetation or economic situation.

These areas had no scheduled timber harvest and became part of the Administratively Withdrawn land allocation in the *President's Plan*. The Harsh Sites' grouping does not contain management area specific direction but rather defaults to the Forest-Wide direction which applies to areas with no scheduled timber harvest. The Harsh Site designation at the Forest planning level is general and needs refinement. 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. In summary, management direction allows salvage, fuel reduction, and other activities under the guidance of other management direction such as visual quality objectives.

Figure 18 *Released Roadless Areas*

Main Salmon Watershed
Released Roadless Areas

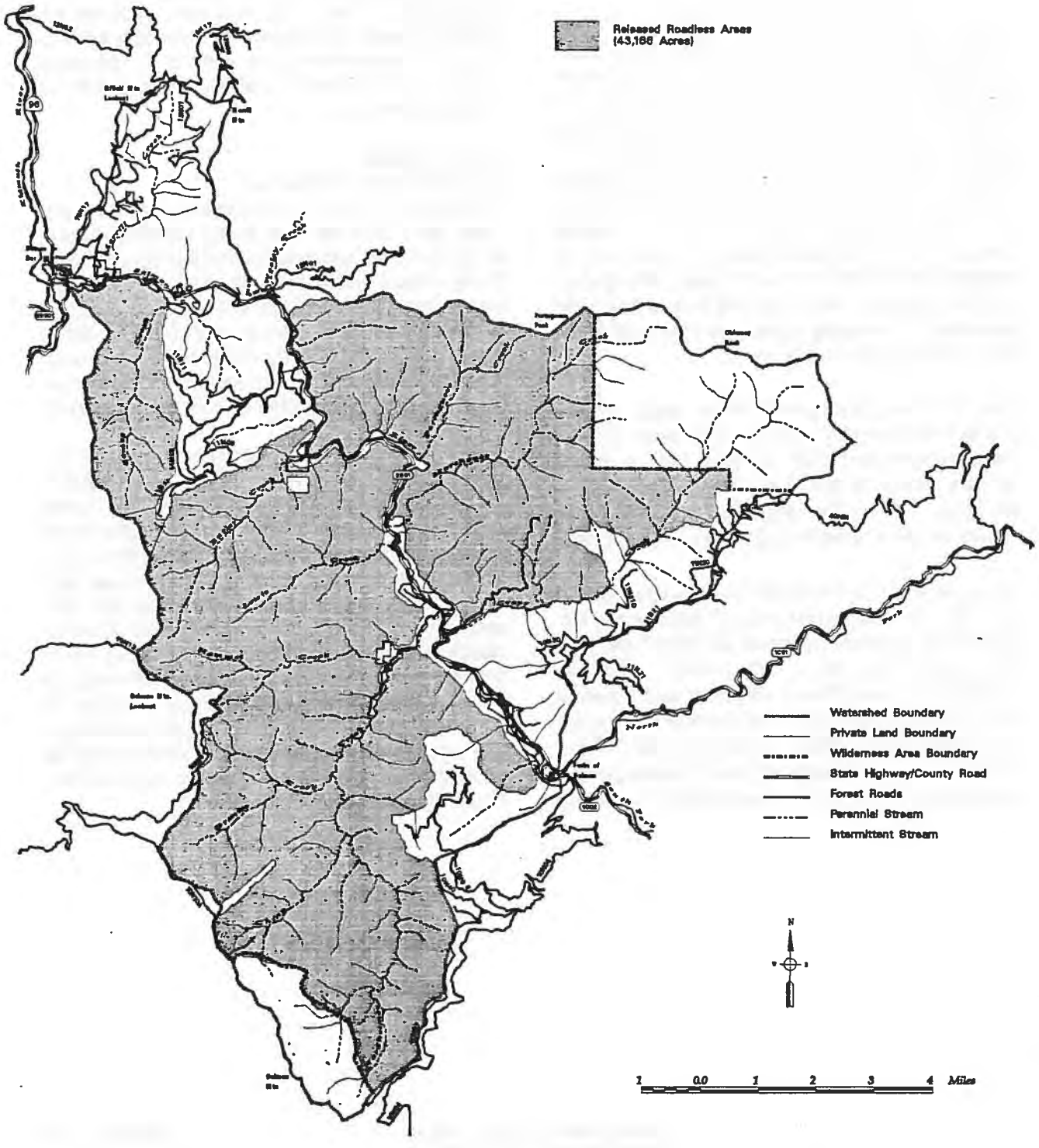


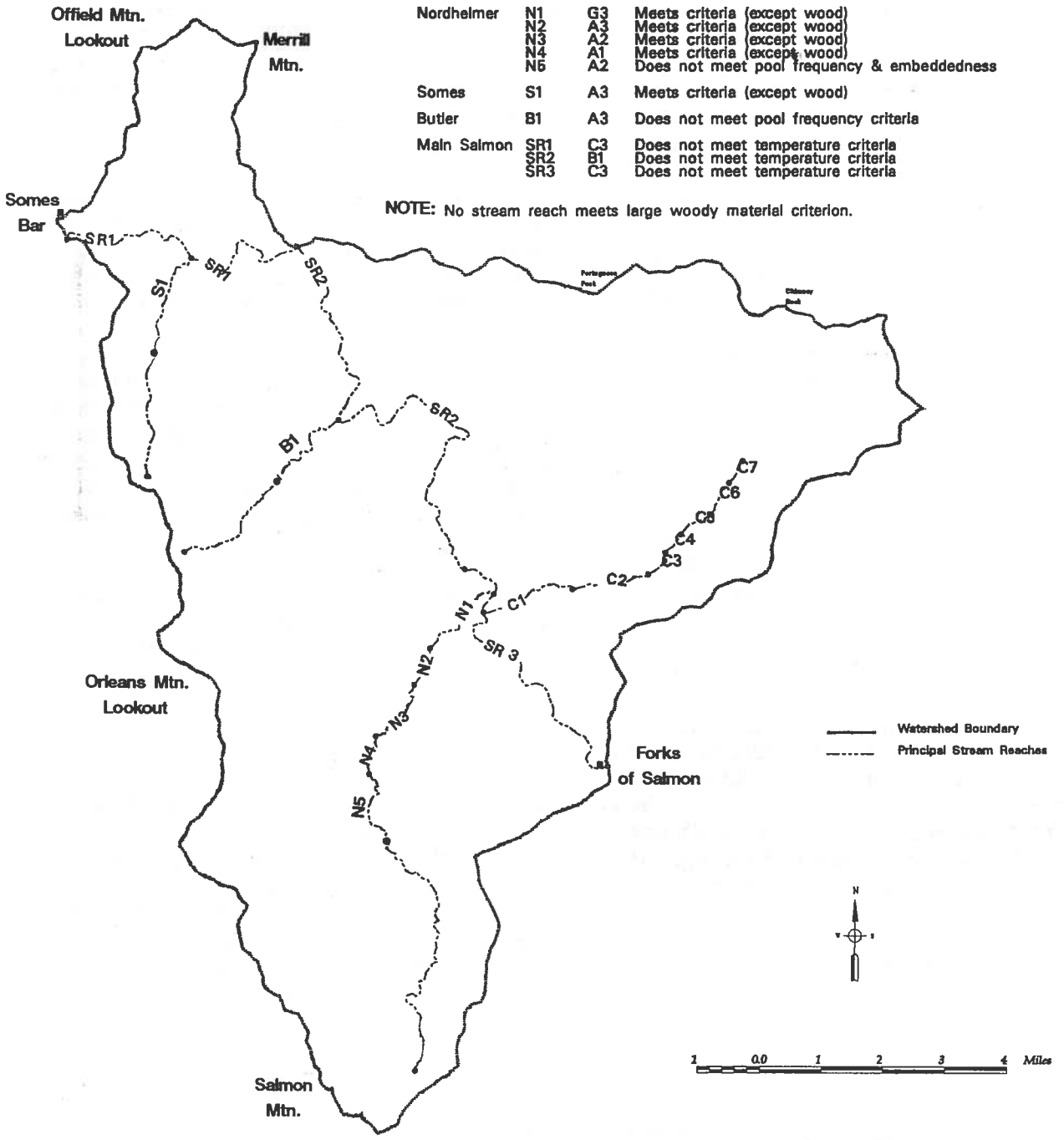
Figure 19 *Stream Reaches*

Main Salmon Watershed
Stream Reaches

Stream Reaches & Fisheries Habitat Criteria

Stream	Reach	Type	Comments
Crapo	C1	B2	Does not meet surface fines & embeddedness
	C2	A1	Does not meet surface fines & embeddedness
	C3	B2	Does not meet surface fines & embeddedness
	C4	B1	Does not meet surface fines & embeddedness
	C5	B5	Does not meet surface fines, embeddedness & pool frequency
	C6	G5	Does not meet surface fines & pool frequency
	C7	A2	Does not meet surface fines
Nordheimer	N1	G3	Meets criteria (except wood)
	N2	A3	Meets criteria (except wood)
	N3	A2	Meets criteria (except wood)
	N4	A1	Meets criteria (except wood)
	N5	A2	Does not meet pool frequency & embeddedness
Somes	S1	A3	Meets criteria (except wood)
Butler	B1	A3	Does not meet pool frequency criteria
Main Salmon	SR1	C3	Does not meet temperature criteria
	SR2	B1	Does not meet temperature criteria
	SR3	C3	Does not meet temperature criteria

NOTE: No stream reach meets large woody material criterion.



CHAPTER 5

Management Opportunities

A general description of the Existing Condition, Desired Condition, Management Opportunity, Benefitting Resources, Management Considerations, and Emphasis Rating are described narratively in Tables 25 - 29; Human/Social Dimensions, Terrestrial Ecosystem, Aquatic Ecosystem, Additional Plans Needed, and Inventory/Additional Info/Research Needs Management Opportunities, each in seperate tables which begin on the following page. General ground locations are displayed in Figures 20 - 23 which follow the same naming convention as above and are contained in the map packet located at the end of this document.

Comparisons were made between existing and desired conditions to yield how close the watershed was to achieving the desired condition. Management Opportunities were then developed which would either maintain the desired condition, or move the watershed toward the desired condition.

These Management Opportunities were broken into three general resource groupings: Human/ Social Dimensions, Terrestrial Ecosystem, and Aquatic Ecosystem. Opportunities are displayed in the resource group most benefited by the activity; if multiple resourses are benefited, they have been identified.

Other opportunities that did not fall into the above groupings were identified under Additional Plans Needed, and Inventory/Additional Information/ Research Needs. Some of the additional planning is required by law, such as the Wild and Scenic River Plans, others are subject to funding availability and prioritization. Inventory, and additional information and research needs may be required for other opportunities before implementation; funding availablilty may also be applicable.

It is important to note that all identified opportunities are general in nature; specific "how tos" will be determined later, during project development and implementation at the District level. Projects will then be evaluated on a site-specific basis following the procedures according to the *National Environmental Policy Act.*

Management Considerations have been identified, when appropriate, for various opportunities. Comments found under Management Considerations should be regarded during the development and implementation of site-specific projects.

To assist with establishing work priorities for project development, an "Emphasis Rating" system was created. Other less tangible factors such as management emphasis, partnerships, available funding, etc. still need to be taken into consideration. The following criteria was used for rating individual opportunities:

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?

Each opportunity was given an Emphasis Rating by the Interdisciplinary Team, assigning a High, Medium, or Low value to the four questions listed above. These four values were averaged to establish the overall Emphasis Rating displayed in Tables 25 - 29. When an across-the-board rating of High was given, it was referred to as a "red flag" opportunity and given a special notation on the appropriate map legend on Figures 20 - 23. In addition, an 8.5" x 11" map displaying the "red flag" opportunities (Figure 2) is contained in the Summary at the beginning of this analysis.

Table 25 - Human/Social Dimensions Management Opportunities

EXISTING CONDITION	DESIRED CONDITION	MGMT. OPPORTUNITY	BENEFITTING RESOURCES	MGMT. CONSIDERATIONS	Emphasis Rating
1- Karuk culture has a strong identity with the watershed. A government to government relationship exists between KNF and the Tribe. Forest Service consultation with Tribe occurs prior to activity implementation on ancestral lands. Ethnographic research is in progress to increase our understanding of Tribal culture, use, and values.	1- American Indian values are enhanced, protected, or sustained in harmony with other social values/concerns. –Our understanding of American Indian values is increased. –Our cooperative relationship with the Tribe is improved.	1- Utilize ethnographic research when completed.	1- All	1- None identified at this level of analysis.	1. L, 2. H, 3. M, 4. H, AVG. M+
2- The completion of Oak Bottom administrative site directly affects the ability of the Ukonom District to proceed with closure of the Somes Bar Work Center.	2- To have a timely completion of the Oak Bottom administrative site in order to vacate the Somes Bar Work Center as per existing agreement with the Karuk Tribe.	2- Improve relationship with the Tribe. b) Complete Oak Bottom facilities as planned, and decommision Somes Bar Work Center.	2- American Indian values	2- None identified at this level of analysis.	1. L, 2. H, 3. L, 4. L, AVG. L+
3- Part of the decommissioning of the Somes Bar site includes the relocation of the helispot to the Uncle Pete's helispot location. This relocation is part of the agreement with the Karuk Tribe. The new location requires additional work to meet safety and security concerns.	3- Uncle Pete's helispot location will meet safety and security standards as an improved selispot; meets functional capabilities to support fire suppression, search and rescue, and other interagency flight requirements.	3- Additional vegetation clearing and slash treatment around helispot. Gate and fence for security purposes. Finish rocking helispot and harden surface, particularly landing pad. Rock access road. Clear vegetation and rock parking area; include room for crew bus parking.	3- American Indian values, Fire Suppression, Search & Rescue, Law Enforcement.	3- None identified at this level of analysis.	1. L, 2. H, 3. L, 4. H, AVG. M
4- At times, ceremonial activities are interrupted by recreationists or management activities.	4- Consultation and coordination with Tribe continues/ improves on case-by-case basis to ensure proposed management activities will not interrupt ceremonial activities.	4- Limit the potential for disturbance to ceremonial activities through planning and mitigation of various audio, visual, and human disturbances.	4- American Indian values.	4-None identified at this level of analysis.	1. H, 2. H, 3. L, 4. M, AVG. M+

EXISTING CONDITION	DESIRED CONDITION	MGMT. OPPORTUNITY	BENEFITTING RESOURCES	MGMT. CONSIDERATIONS	Emphasis Rating
5- Ceremonial burning on Offield Mtn. has not occurred for many years. Heavy fuels have built up, making reinitiation of ceremonial burning difficult.	5- Ceremony is allowed to include all of its traditional elements (i.e., burning).	5- Work with Tribe to define areas that fire should encompass. Develop strategies to reduce intensity and contain fire within defined area.	5- American Indian values	5- Ten Bear LSR is located upslope, areas w/ high Fire Behavior Potential are located on Offield Mt.	1. H, 2. H, 3. H, 4. H, AVG. H
6a) The availability and productivity of American indian gathering areas for special forest products are being affected both positively and negatively by land management activities. b) Productive areas of oak stands have been invaded by conifers, and there are limited interspersed patches of early seral stage habitats.	6a) Sites are enhanced to improve traditional values. b) Enhance acorn bearing trees throughout area and perpetuate development of early seral oak stands.	6a) Utilize ethnographic research. b) Enhance stands of tanoak on Butler Flat, Nordheimer Creek, across from mouth of Wooley Creek, Oak Bottom, old Somes Bar townsite, and bottom of Monte Creek Road. - Survey for future stands to develop.	6a) Road Management b) Mushroom populations on Monte Ridge, American Indian gathering areas, Deer, Squirrel, Woodpeckers.	6a&b) American indian consultation - human access to gathering areas.	1. L, 2. M, 3. M, 4. M, AVG. M-
7- Large sections of the Salmon River Road are functionally deficient from a current use standpoint. Problems range from poor horizontal alignment and sight distance, to inadequate widths.	7- Visitor safety is promoted along the Salmon River road.	7- Close coordination with the County to assess road improvements for safety, design, & environmental documentation.	7- Human Uses	7- Grants Bluff is an environmentally sensitive area, 1996 FHA priority for funding	1. H, 2. H, 3. M, 4. H, AVG. H-
8- Existing facilities are being impacted by increased recreational use.	8- Facilities are provided which meet demand and use is managed in concert with demand and/or resource capability.	8- Develop and improve facilities along the Salmon River corridor including, but not limited to the river access at Hippo Rock, and Nordheimer Campground.	8- Recreation	8- American Indian values, Riparian values.	1. H, 2. H, 3. H, 4. M, AVG. H-

EXISTING CONDITION	DESIRED CONDITION	MGMT. OPPORTUNITY	BENEFITTING RESOURCES	MGMT. CONSIDERATIONS	Emphasis Rating
9- Previous activities have created visual impacts that vary from not noticeable, to very noticeable; in some areas these impacts are not consistent with Visual Quality Objectives.	9- Previously disturbed areas meet desired VQOs.	9- Develop & implement 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; consider: Sauerkraut roads, Crapo logged areas, etc. (Refer to Appendix K - Visual Quality Improvement Opportunities.)	9- Scenery	9- None identified at this level of analysis.	1. L, 2. L, 3. M, 4. L, AVG. L+
10- Upon completion of the LMP, there is an expectation that matrix lands within the analysis area will contribute to the Forest PSQ.	10- An ecologically sustainable timber management program designed to maintain the desired condition of the watershed and contribute to the PSQ.	10a) Using watershed analysis as the framework, supplement and refine the watershed scale information with site specific analysis. b) Develop a sustainable timber program output through a combination of site specific and watershed scale analysis.	10- Human Uses- Commodities, Forest Health	10- Site capability, logging access, logging economics. "Watersheds at Risk". Prior to the completion of LSR Assessments for RC347, RC348, and RC349, avoid reducing nesting /roosting /foraging habitat within the four spotted owl activity centers (KL0261, KL0304, KL4044, KL4045) below incidental take thresholds established by FWS. This equates to 1,136 acres of suitable habitat within a 1.3 mile radius circle centered on the activity center.	1. H, 2. M, 3. H, 4. M, AVG. H-
11- Mineral exploration/ development activities are increasing.	11- Mineral exploration & protection of surface resources is managed to maintain the environmental quality(to the extent feasible).	11- Administer locatable minerals according to 36CFR 228 regulations.	11- Human uses-commodities	11- Environmental analysis will be done to assess affects. b) Restore riparian habitat thru reclamation. c) possible wildlife enhancement thru reclamation.	1. M, 2. M, 3. M, 4. L, AVG. M-
12- Local residents are activitely involved in management issues. Typically there is much disagreement with management policies.	12- Better relationships with the public.	12- Continue to build partnerships.	12- All	12- None identified at this level of analysis.	1. M, 2. M, 3. M, 4. H, AVG. M+

EXISTING CONDITION	DESIRED CONDITION	MGMT. OPPORTUNITY	BENEFITTING RESOURCES	MGMT. CONSIDERATIONS	Emphasis Rating
13- Currently there is a cooperative agreement between the USFS and Forks of Salmon School for a shared potable water source. There is an insufficient supply available to meet both needs.	13- A water source that meets both the School's and FS needs.	13- Develop & implement alternatives to meet both facilities needs.	13-Human uses-county school, federal government	13- None identified at this level of analysis.	1. L, 2. M, 3. M, 4. L, AVG. M-
14- There are a variety of special use authorizations in the corridor now; a land exchange is currently under review.	14- Land uses are authorized that do not conflict with management area objectives. Special use permits are reviewed periodically. Land ownership proposals should be accepted for study when preliminary analysis indicates that such adjustement is clearly in the public interest.	14- Evaluate impacts of proposed special use activities and land exchanges.	14- Human uses-communities/ private lands	14- None identified at this level of analysis.	1. L, 2. M, 3. M, 4. L, AVG. M-

Table 26 - Terrestrial Ecosystem Management Opportunities

EXISTING CONDITION	DESIRED CONDITION	MGMT. OPPORTUNITY	BENEFITTING RESOURCES	MGMT. CONSIDERATIONS	Emphasis Rating
15- Large fires with high intensities, have occurred in the area, and have the potential to occur. a) Areas burned by the Off Fire, both salvaged and unsalvaged, have a high fuels buildup. Their condition has been identified as being in a Very High Likelihood of a stand being lost to wildfire. b) Areas in Nordheimer Creek drainage burned by the Hog Fire also have a high fuel loading.	15a & b) Percent of high intensity wildfires is reduced. Stands are maintained in a fire resilient condition, within Forest Standards.	15a & b) Assess stand and fuels conditions. As per Forest direction, develop and implement fuels and vegetation management plans to reduce the likelihood of the stand being lost to wildfire. (Refer to Appendix L - Fuels Treatment & Fire Opportunities.)	15a & b) All, Fire suppression costs will be reduced as fuels and vegetation management plans are implemeneted throughout the area.	15a & b) LSRs, Sensitive Soils, T & E Habitats, High Quality fisheries habitat, Cultural sites, Private Lands, Facilities, Plantations, Sensitive Plants, Riparian Reserves. a)- Ten Bear LSR directly upslope of these stands. Re-introduction of American Indian burning on Offield Mtn. b) remnant stands.	1. H, 2. H, 3. H, 4. H, AVG. H

EXISTING CONDITION	DESIRED CONDITION	MGMT. OPPORTUNITY	BENEFITTING RESOURCES	MGMT. CONSIDERATIONS	Emphasis Rating
16- Much of the river corridor has a "High" fire risk, and given the topography, it is likely that large destructive fires will be initiated from the river corridor by humans. Some of these same areas are also identified as having a "high" Fire Behavior Potential.	16- a) Fire risk is reduced to moderate, b) Fire behavior potential is reduced where possible.	16- a) Continued fire prevention program. b) Areas identified on the Risk/Fire Behavior Potential Map as being in a Very High Likelihood of being lost to a wildfire need to be treated and reduced to a lower likelihood, as per Forest direction. Protect investments such as recreation sites, & residences.	16-All	16- Tribal participation. -Cultural Resource inventories, LSRs, Sensitive Soils, T & E Habitats, High Quality fisheries habitat, Cultural sites, Private Lands, Facilities, Plantations, Sensitive Plants, Riparian Reserves. "Watersheds at Risk"	1. H, 2. H, 3. H, 4. H, AVG. H
17- Areas reburned by the Yellow Fire have regenerated in brush. Much of the area has been planted with mixed conifers, but sprouting and competition by brush species is the major component. The area is a moderate risk.	17- Mosiac of vigorously growing stands consisting of a variety of vegetative species with resiliency from future disturbance factors.	17- Develop fuels treatment, veg. management, and fire protection plans. - Implement silviculture activities that will promote long term, forested condition. - Assess ways to isolate fire potential(ie fuel breaks).	17- All	17- Increased fire behavior potential with some silvicultural treatments. Increased sediment from treatments. Crapo LSR directly upslope this area. "Watersheds at Risk". Prior to the completion of LSR Assessments for RC347, RC348, and RC349, avoid reducing nesting /roosting /foraging habitat within the four spotted owl activity centers (KL0261, KL0304, KL4044, KL4045) below incidental take thresholds established by FWS. This equates to 1,136 acres of suitable habitat within a 1.3 mile radius circle centered on the activity center.	1. M, 2. M, 3. M, 4. H, AVG. M+
18- Certain forested stands are densely stocked, creating conditions of stress and stagnation.	18- Forested stands are resilient & sustainable to disturbances such as insects, disease, and fire.	18- Stocking control treatment, thinnning of overstocked stands.	18- Forest Health, Human uses-commodities	18- Consider concurrent fuels treatment.	1. H, 2. M, 3. M, 4. M, AVG. M+

EXISTING CONDITION	DESIRED CONDITION	MGMT. OPPORTUNITY	BENEFITTING RESOURCES	MGMT. CONSIDERATIONS	Emphasis Rating
19- Mistletoe problems will continue to increase; successful regeneration and growth of infected species will be unlikely in areas of high infestation. Mortality will become a problem which will exacerbate insect and fire problems.	19- Healthy forests with low levels of infestation, since it inhibits growth.	19- In matrix lands, focus on pockets of infestation, or adjacent to regeneration areas. Treat stands adjacent to plantations in Butler Creek and in the headwaters of Somes Creek.	19- Forest Health, Human Uses-Commodities	19- Mistletoe can add to quality of T & E species habitat. Consider concurrent fuels treatment. Maintain high quality fisheries habitat.	1. M, 2. M, 3. M, 4. L, AVG. M-
20- There are four Forest Sensitive plant species known to occur in the assessment area. a) Howell's Tauschia-populations are potentially being impacted by adjacent trail use, b) Marble Mt. Catchfly, c) Salmon Mt Wake Robin, d) Siskiyou Lewisia.	20- Prevent listing as T & E by maintaining, protecting, or enhancing known populations.	20- a) Complete study on species, and improve or reroute trail if appropriate, b) Complete species management guide, c) Implement ROD guidelines for Riparian Reserves, d) None identified at this level of analysis	20- Botany, bio-diversity, native plant communities	20- a) Re-routed trail in granitics may cause more erosion, b) Light understory burn may enhance populations, c) Grazing impacts potentially threanten populations, d) development of rock sources potentially threatens populations.	1. M, 2. M, 3. M, 4. L, AVG. M-
21- Two known C-3 species (from President's Plan) are known to occur in assesssment area: a) Allotropa virgata, b) *Cypripedium fasciculatum* (Klamath).	21- Viable populations are maintained or protected.	21- a) Manage known sites. b) Survey for new populations.	21- Biodiversity, botany	21- Species are very sensitive to surface disturbance	1. M, 2. M, 3. M, 4. L, AVG. M-
22- There are several species of noxious weeds found in the area. a) Yellow star thistle is found in the area; its extent is unknown. It is also known to occur in large numbers immediately adjacent to area.	22- Distribution and abundance of noxious weeds are controlled. a) Reduced populations of yellow star thistle and ability to spread to new areas.	22- Identify locations & populations of noxoious weeds. a) Introduce biological control, in a well designed release and monitoring program, in cooperation with California Dept of Ag. (refer to Appendix M - Monitoring).	22- Botany, biodiversity, native plant communities	22- None identified at this level of analysis.	1. M, 2. M, 3. M, 4. M, AVG. M

EXISTING CONDITION	DESIRED CONDITION	MGMT. OPPORTUNITY	BENEFITTING RESOURCES	MGMT. CONSIDERATIONS	Emphasis Rating
23- The amount of late successional habitat(late/mature and old-growth) within portions of LSRs provides less than optimum habitat. Existing percentages of late/mature and old-growth by LSRs: a) Crapo - 50%, b) Steinacher - 41%, Ten Bear - 29%.	23- Within LSRs, late successional or old growth forests are maintained or enhanceed to provide habitat for species associated with them. Desired ranges of late/mature and old growth by LSRs, where capable: a) Crapo 60-70%, b) Steinacher 70-85%, Ten Bear 40-55%. Stands are maintained in a condition that is resilient to fire.	23- Complete LSR assessment. - Conduct vegetation management activities that will promote development of late successional habitats to desired ranges, where capable: Crapo 60-70%, b) Steinacher 70-85%, c) Ten Bear 40-55%.	23- Old-growth dependent wildlife, watershed values, fisheries, visual quality.	23- Consider outside influences on LSRs, fuel loadings, vegetation structure and patterns, high Fire Behavior Potential.	1. M, 2. M, 3. M, 4. M, AVG. M
24- Known sites of Townsend Big Earred Bats are found in the assessment area.	24- Sites are maintained with minimal disturbance.	24- a) Survey known sites, b) identify & survey potential sites. -Reduce potential for disturbances.	24- Wildlife	24- This species is very suspectible to disturbances.	1. L, 2. M, 3. L, 4. L, AVG. L+
25- Enviromental documentation has been completed to facilitate the reintroduction of Elk in Crapo & Nordheimer drainages.	25- High quality habitat described in Habitat Capability Models & CDFG objectives is improved and managed to maintain herd in ecological balance.	25- a) Reintroduce Elk in Crapo & Nordheimer drainages. - Monitor success of reintroduction & impacts of combined elk & livestock utilization in wet & dry meadows.	25- Wildlife, Human uses-recreationists	25- Soils erosion in Crapo Creek, sensitive plants, inconclusive livestock utilization of meadows complex & impacts to ecological balance.	1. L, 2. L, 3. M, 4. L, AVG. L+
26- Incidental sightings of goshawks have occurred in the area. No nest sites have been located.	26- a) Manage known goshawk territories. b) Upon location of nest, foraging habitat is developed/improved in accordance with Forest LMP S & Gs.	26- a) Survey for active nest sites. b) Thin understory of foraging area in Somes Creek.	26- Fuel reduction - tree growth	26- Avoid nesting area.	1. L, 2. L, 3. M, 4. L, AVG. L+

Table 27 - Aquatic Ecosystem Management Opportunities

EXISTING CONDITION	DESIRED CONDITION	MGMT. OPPORTUNITY	BENEFITTING RESOURCES	MGMT. CONSIDERATIONS	Emphasis Rating
27- Good fisheries habitat stream conditions are found especially in Somes, Nordheimer, and Butler Creeks, and the Salmon River.	27- a) Good fisheries habitat conditions are found especially in Somes Creek and the lower portion of Nordheimer Creek. b) High amounts of surface fines, high embeddedness values, and low pool frequencies exist in Crapo Creek and the Upper portion of Nordheimer Creek. c) Butler Creek has a lower than desired pool frequency. d) Good fisheries habitat conditions are found in the Mainstem Salmon, however summer water temperatures often exceed desired conditions.	27- Survey and evaluate remaining streams in area. a) Protect & enhance good quality fisheries habitat. b) Reduce current and future sediment inputs to Crapo and Upper Nordheimer Creeks. c) Minimize sediment inputs to Butler Creek from future management activities. d) Evaluate stream temperatures upstream from this analysis area.	27- Riparian dependent species	27- Assess effects of any site disturbing activities in these drainages to fisheries habitat values, high Fire Behavior Potential.	1. M, 2. H, 3. M, 4. M, AVG. M+
28- Low stream shading in portions of Crapo and Nordheimer Creeks.	28- Where site capability allows, stream shading should be 80%.	28- Planting of vegetation in riparian areas, concentrating on areas where tree component is lacking, perennial streams, areas with low stocking levels and high site potential. - Assess and develop opportunities for Crapo Creek using map from WIN inventory of high priority areas for replanting. - Assess Nordheimer area for potential improvements. - Enhance growth in areas with high stocking levels.	28- Riparian dependent species; Wildlife using riparian areas for dispersal	28- Concurrent fuels treatment, high Fire Behavior Potential	1. H, 2. M, 3. H, 4. M, AVG. H-
29- Historic mining operations still display low soil productivity, sparse vegetation and soil cover. Back walls have, and will continue to produce sediment unless stabilized.	29- Mined areas are revegetated to support vegetation equal to the site potential. Where significant erosion is occurring, site potential is enhanced to provide additional vegetative cover.	29- Revegetate back wall of terrace and mine site to minimize sediment production.	29- Willow flycatcher, fisheries, recreation, visual quality.	29- Historic considerations	1. M, 2. M, 3. M, 4. L, AVG. M-

EXISTING CONDITION	DESIRED CONDITION	MGMT. OPPORTUNITY	BENEFITTING RESOURCES	MGMT. CONSIDERATIONS	Emphasis Rating
30- Loggers Pond (T11NR8E,Sec 28,NE/SE) no longer provides open yearlong water for wildlife. The pond was a unique habitat for wildlife within the Hog and Yellow Fire area.	30- Pond provides open, yearlong water for wildlife use.	30- Improve water holding capacity of Loggers Pond.	30- Wildlife, riparian dependent species, fire suppression, range	30- Area is unique and provides high value to wildlife.	1. L, 2. L, 3. M, 4. L, AVG. L+
31- Riparian vegetation around Logger's Pond is recovering from two catastrophic fires, and is in fair to good condition.	31- Riparian vegetation in key locations is in good to excellent condition.	31- Enhance, maintain, or improve riparian values around Logger's Pond.	31- Wildlife, watershed, range	31- Livestock use & effects need to be considered.	1. M, 2. L, 3. L, 4. L, AVG. L+
32- Certain geomorphic terranes have the potential to produce high levels of sediment when disturbed. These terranes are: Inner Gorge, Debris Basins, and Granitic Mt. Slopes. As a result of recent disturbance on granitic soils, Crapo Creek has high levels of sediment.	32- Future sediment production is less than 15% surface fines.	32- Maintain vegetative conditions & fuel levels that will prevent large high intensity fires; Stabilize roads and/or landings on Yellow Jacket Ridge; Avoid short term disturbance to landslide on 11N21D road.	32- Watershed Values	32- Assess sediment increases when proposing activities these terrane types. Meet Forest S &G s for any projects proposed on these terrane types. -High Fire Behavior Potential.	1. H, 2. H, 3. H, 4. H, AVG. H
33- Landslides are a major sediment-producing process in the analysis area. Monte Creek, Salmon River and Horn Creek Gap Roads are associated with past landslides.	33- Slide stability is promoted where possible.	33- Stablize landslides along the Monte Creek and Horn Creek Gap roads. a) Survey and explore any other slide areas for stabilization. b) Conduct geologic investigations of Crapo Creek and Horn Creek road systems.	33- Human, Watershed Values, Fish, Amphibians	33- None identified at this level of analysis.	1. H, 2. H, 3. H, 4. H, AVG. H
34- There is high amounts of road-related surface erosion from segments of river accesses and other roads, including: an inactive earthflow and dormant landslides w/ landing in Crapo Creek, and steep grade on Shoofly Road.	34- Surface sediment production from road systems is minimized.	34- a) Reduce erosion from the Shoofly road and from the designated and non-designated river accesses. b) Road systems as identified in road analysis. -Construct Shootfly bypass.	34- Watershed values, Fisheries, recreation.	34- Protect existing cultural resources.	1. H, 2. H, 3. M, 4. M, AVG. H-

EXISTING CONDITION	DESIRED CONDITION	MGMT. OPPORTUNITY	BENEFITTING RESOURCES	MGMT. CONSIDERATIONS	Emphasis Rating
35-Several trails and trail segments pose resource or safety concerns, or do not meet appropriate design standards - specific trail segments: Crapo Creek Trail-erosion problems in meadow areas; Somes Bar Trail- safety concerns, Old Salmon River trail-resource concerns.	35- All trails meet recreation management objectives, user needs, ensure user safety, and provide resource protection.	35- Construct, maintain, or reconstruct trails or trail segments to meet design standards, resource, and/or safety concerns.	35- Fisheries, meadow-dependent Wildlife, Plants, water quality	35- Travel Access Management Plan.	1. M, 2. M, 3. M, 4. L, AVG. M-

Table 28 - Additional Plans Needed Management Opportunities

EXISTING CONDITION	DESIRED CONDITION	MGMT. OPPORTUNITY	BENEFITTING RESOURCES	MGMT. CONSIDERATIONS	Emphasis Rating
36- The three geologic SIAs (Murderer's Bar Landslide, Bloomer Debris Avalache, Wooley Creek Batholith Roof Zone) are recommended in the final LMP for SIA designation. No management plan has been initiated.	36- Murderer's Bar Landslide, Bloomer Debris Avalanche, and Wooley Creek Batholith Roof Zone SIAs have completed management plans. Interpretation is enhanced of their unique geologic feature(s).	36- Develop management plans for SIAs.	36- Geology, Human uses-recreation	36- None identified at this level of analysis.	1. L, 2. L, 3. L, 4. L, AVG. L
37- Portions of the Salmon River (Forks of Salmon downstream to Klamath confluence) are a designated component of the National Wild & Scenic Rivers System.	37- A river management plan completed within three full fiscal years after final approval of the LMP.	37- Develop & implement a Wild & Scenic Rivers Management Plan for designated components of the National Wild & Scenic River System.	37- Fisheries, Human Uses/ Values	37- None identified at this level of analysis.	1. M, 2. M, 3. M, 4. L, AVG. M-
38- Currently there are no managment plans for Peregrine Falcon.	38- Manage peregrine falcon to protect and maintain nesting and foraging sites.	38- Develop management plans for pereigrine falcon nest sites.	38- Wildlife-Peregrine Falcons	38- None identified at this level of analysis.	1. M, 2. M, 3. M, 4. M, AVG. M

EXISTING CONDITION	DESIRED CONDITION	MGMT. OPPORTUNITY	BENEFITTING RESOURCES	MGMT. CONSIDERATIONS	Emphasis Rating
39- A Road Management Plan is nearing completion for the Ukonom District portion of the analysis area. A transportation analysis has been completed for the Salmon River District portion.	39- Completed road management plans to meet resource objectives for both Ukonom and Salmon River Districts.	39- Complete road management plans.	39- All	39- See road management plan or transportation analysis for a complete listing of management concerns.	1. H, 2. M, 3. H, 4. M, AVG. H-
40- A fire management plan does not exist for the Marble Mountain Wilderness.	40- Natural processes operate freely without unnatural consequences.	40- Develop fire management plan to allow fire processes to operate.	40- All	40- Be compatible with LSR Assessment Fire Plan.	1. H, 2. H, 3. M, 4. H, AVG. H-

Table 29 - Inventory/Additional Info/Research Needs Management Opportunities

EXISTING CONDITION	DESIRED CONDITION	MGMT. OPPORTUNITY	BENEFITTING RESOURCES	MGMT. CONSIDERATIONS	Emphasis Rating
41- There is little information currently available on thresholds for the quality of the recreation experience for Forest users. Users include communities, Tribal members, and forest visitors.	41- Provide a variety of high quality recreational experiences which meet customer's expectations.	41- Evaluate recreationists perceptions regarding the quality of their experience.	41- Human uses	41- None identified at this level of analysis.	1. L, 2. M, 3. M, 4. M, AVG. M-
42- Current information on special forest products use, demand, availability is limited.	42- Sufficient information on special forest products to determine collection is not likely to have negative effects.	42- Gather information on demand, use, and location.	42- Human uses-American indian & commmodities	42- None identified at this level of analysis.	1. M, 2. M, 3. M, 4. M, AVG. M
43- Wet meadow inventories are very limited for floral species. Morehouse meadows is likely to contain similar sensitive species found in the Haypress RNA wet meadow complex.	43- Ecologically sound wet meadow complexes are maintained to perpetuate flora species habitat & aquatic values.	43- Inventory and maintain wet meadows for floral species. - Assess grazing interactions in riparian areas.	43- sensitive plant populations, wildlife, livestock mgmt	43- None identified at this level of analysis.	1. M, 2. M, 3. M, 4. M, AVG. M

EXISTING CONDITION	DESIRED CONDITION	MGMT. OPPORTUNITY	BENEFITTING RESOURCES	MGMT. CONSIDERATIONS	Emphasis Rating
44- There is a lack of information regarding the presence and habitat needs of many wildlife species, including sensitive, species of concern, and other rare species.	44- Enough information to manage habitat for sensitive, species of concern, and other rare species is based on current data and research information on species habitat needs and interactions.	44- Develop a data base on many species using research, administrative studies, and established survey methods. Species include, but are not limited to willow flycatcher, Del Norte salamander, western pond turtles, tailed frog, Great Grey Owl, Northern Goshawks, Marbled Murrelet, and Townsend big eared bat.	44- Wildlife	44- None identified at this level of analysis.	1. M, 2. M, 3. M, 4. M, AVG. M
45- There is little information available on the potential impacts of river recreation activities to nearby Peregrine Falcon nesting sites.	45- Minimize potential disturbance to nest.	45- Evaluate potential effects from recreational activities and t ke appropriate steps to minimize disturbance.	45- Peregrine Falcon	45- None identified at this level of analysis.	1. H, 2. H, 3. M, 4. M, AVG. H-
46- According to Sedell's criteria, there are low levels of instream wood and recruitment in all streams. The validity, and hence appropriateness of using Sedell's criteria for the analysis area has not been completed.	46- High quality fisheries habitat with adequate amounts of large wood in the streams, where site capability allows.	46- Evaluate the validity/ applicability of Sedell's criteria for use on-Forest. - Based on above results (if neccessary), increase instream wood and improve site conditions which promote the growth of large trees in capable areas.	46- Riparian dependent species	46- None identified at this level of analysis.	1. M, 2. H, 3. M, 4. M, AVG. M+

Additional opportunities identified which are beyond the scope of this analysis:

Additional assessment should occur which better estimates the number of spotted owl pairs which can be supported within CHA #21/22. The assessment should consider the capability of the area to provide spotted owl habitat.

The analysis area should be assessed at a larger scale in order to identify its primary role in spotted owl recovery. For instance, since relatively few acres of mapped LSR occur within the analysis area, the primary role of the area may be its function as dispersal habitat. If this is so, then what are the likely dispersal routes (currently and in the future) through the analysis area?

The Forest should consider developing other standards of assessing Northern spotted owl dispersal habitat (other than 50-11-40) which take into account site capability and watershed level management objectives.

Focus priority on conducting an LSR Assessment to determine the status of RC349.

APPENDICES

APPENDIX A
ATTACHMENT TO KEY FEATURES AND INDICATORS

Current direction as developed by BLM and USFS, requires that the following questions are to be answered through watershed analysis. The resulting baseline information will then be available for use in planning and subsequent Section 7 consultation and monitoring of these species. Some of these questions will be addressed within the main chapters of watershed analysis report, however, the best format in terms of future use of this information (BAs, EAs, consultation) is to answer each question directly and include as an appendix to the report.

NORTHERN SPOTTED OWL

1- Are spotted owl activity centers located within the watershed?
- If so, how many and in what ROD land allocations are they located?
- Which of these are currently above "take" thresholds and which are below?
- When were the activity centers located?
- Describe the reproductive history.

2- Has a 100 acre core area seen designation around each activity center located in matrix lands?

3- How many acres of nesting, roosting, and foraging (NRF) habitat are there in the watershed?
- What percentage of the watershed is this?
- Which of these stands have been surveyed to protocol (two years)?
- Which were not?

4- What is the amount of NRF habitat in each ROD land allocation within the watershed?

5- Does any portion of the watershed contain LSRs?
- What percent of the total watershed is this?
- What are the current totals of NRF habitat and capable habitat in the LSR?

6- What is the amount of dispersal habitat (11-40 and above) in each ROD land allocation within the watershed?

7- Is distance between LSRs (those over 10,000 acres) greater than 4 miles?
- If so, then what is the amount of dispersal habitat on Federal lands for all 1/4 townships between the LSRs?
- What % of the total Federal lands in these 1/4 townships is this?
- 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?
- Is this total greater than 50%?
- Describe, if present, the natural barriers to dispersal.
- Is connectivity, or dispersal habitat, sufficient to allow movement?

8- How much critical habitat has been designated within the watershed?
- How much of this total overlaps with LSRs?
- For areas that do not overlap, how much is currently NRF habitat?
- And how much is capable?
- How many activity centers are located in this non-overlap area of CHU?
- How many are currently above "take"? How many below? (Use acres established by FWS for .7 and 1.3 mile radius.)
- What role does this non-overlap critical habitat play in this watershed in relation to the reasons for the designation of the CHU?

BALD EAGLE

1- Are occupied bald eagle activity areas (nesting, foraging, winter roosts, or concentration areas) located within the watershed?
- If so, what type?
- How many?
- What ROD land allocations are they located?
- Describe reproductive history based on monitoring data.
- Has a final site-specific protection/management assessment been developed for each site?
- Does this watershed analysis corroborate the findings of the management assessment?

2- 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?
- If so, what type?
- How many?
- What ROD land allocations are they located?
- Have these areas been surveyed to protocol to determine they are unoccupied?

3- Describe historical bald eagle occurrence and nesting within the watershed.

4- 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?
- If not, then are there capable eagle activity areas located within the watershed?
- If capable activity areas are present, what type are they?
    - How many?
    - What ROD land allocations are they located?
- What type of project or enhancement could develop sites into potential or occupied sites?

5- If present, describe significant habitat within the watershed that is not under Federal ownership.

AMPHIBIANS

1- Have any amphibian inventories been done on a project or watershed level?
- What species does the literature suggest may be present in the watershed?

2- Are sensitive species and ROD Table C-3 species present or possibly occur?

3- Have intensive or extensive inventories been conducted in adjoining drainages/ subwatersheds?
- If so, can those inventories be extrapolated to this watershed?

4- Are endemic species known to occur in the general geographic region?

5- Are exotic species known or suspected to be in the watershed? (e.g. bullfrogs)

PEREGRINE FALCON

1- Are any cliffs located within the watershed? (rock wall >50 feet)

2- Are any cliffs present that are historic (pre-1975) or traditional (post-1975) peregrine eyries?

3- For past projects near historic cliffs, have mitigation measures for habitat been considered?
- At these historic cliffs, have surveys to protocol (Pagel 1992) been accomplished for at least 2 years prior to the activities?

4- For traditional cliffs, have surveys/monitoring been conducted to determine nest site occupancy and reproductive status?
- Has a draft or final site mgt plan been created?
    - Is this plan based on site specific and PNW sub-population nesting ecology?

5- Have the cliffs located been rated or monitored for falcon potential or presence?

6- If cliffs are un-rated, have surveys been accomplished to protocol?

7- Describe site habitat variables within a 3 mile radius of historic and traditional nest sites. (cliff parent material, distance to water/riparian, vegetative habitat, seral stages, human activities)

MARBLED MURRELET (Zone 1 & 2)

1- Are occupied sites within the watershed?

2- Has a 0.5 mile radius mgt area been delineated for each site?

3- Within this mgt are, what stands are currently murrelet habitat?
- What stands are recruitment habitat (capable of becoming suitable within 25 years; see ROD description)?
- What stands are non-habitat?

4- Do stands of potential habitat exist in the watershed?
- Describe habitat (acres, quality, quantity, spatial relationship to nearby habitat).
- Describe past surveys.
- What stands of habitat have not been surveyed?

5- Is there recruitment habitat in the watershed?
- At various points in the future (e.g. 25, 50, 100, 200 years), what will the be the percent of the watershed that will be suitable habitat?

NORTHERN SPOTTED OWL -

1. Are spotted owl activity centers located within the watershed?

(A) Yes.

a. If so, how many and in what ROD land allocations are they located?

(A) There are four spotted owl Activity Centers located in the Mainstem Salmon River watershed: KL-4045 in Matrix; KL-0304 in Matrix; KL-4044 in Matrix, and KL-0261 also in

Matrix. One hundred acre LSRs have not yet bee designated for these Matrix Activity Centers, but most if not all would include acres of Riparian Reserve.

b. Which of these are currently above "take" thresholds and which are below?
(A) All of these Activity Centers currently have suitable habitat that is more than the "take" threshold.

c. When were the activity centers located?
(A) Activity Center KL-4045 was first located in 1981, KL-0261 in 1991, KL-4044 in 1989, and KL-0304 also in 1989.

d. Describe the reproductive history.
(A) Activity Center KL-4045 had reproduction confirmed in 1990 and 1991; KL-0261 had repro. confirmed in 1987 and 1991; KL-4044 had repro. confirmed in 1989, '90, and '91; KL-0304 has only had a single owl present based on surveys since 1989,

2. Has a 100 acre core area seen designation around each activity center located in matrix lands?
(A) Not yet, but they will be prior to any vegetation management in the areas.

3. How many acres of nesting, roosting, and foraging (NRF) habitat are there in the watershed?
(A) There are 31,610 acres of NRF habitat in the Mainstem Salmon River Watershed based on current estimates.

a. What percentage of the watershed is this?
(A) This constitutes 46% of the watershed.

b. Which of these stands have been surveyed to protocol? (2 years)
(A) Suitable stands in the Merrill, Somes, Monte, Duncan and Butler Creek Drainages were surveyed to Protocol.

c. Which were not?
(A) All the rest were not, but based on a current map produced during the Watershed Analysis, there does not appear to be enough continuous nesting and roosting habitat in any other area to support an Activity Center.

4. What is the amount of NRF habitat in each ROD land allocation within the watershed?
(A) There are currently estimated to be 1,580 acres of NRF habitat within LSRs in the Mainstem Salmon River analysis area. There are also 1,915 acres of Congressionally Reserved lands that meet NRF, 8,329 acres of NRF that have been Administratively Withdrawn, 6,891 acres of NRF in mapped Riparian Reserves, and 12,694 acres meeting NRF in Matrix.

5. Does any portion of the watershed contain LSRs?
(A) Yes, it contains all or portions of 3 unmananaged LSRs.

a. What percent of the total watershed is this?
(A) Large LSRs constitute about six percent of the Mainstem Salmon River watershed.

b. What are the current totals of NRF habitat and capable habitat in the LSR?
(A) There are currently estimated to be 1,630 acres of NRF + Capable NSO habitat in LSRs in the analysis area.

6. What is the amount of dispersal habitat (11-40 and above) in each ROD land allocation within the watershed?
(A) There are currently estimated to be 93 acres of dispersal habitat in Congressionally Reserved Areas, none (0) in LSRs, 308 acres in Riparian Reserves, 703 acres in Administratively Withdrawn areas, and 331 acres in Matrix.

7. Is distance between LSRs (those over 10,000 acres) greater than four miles?
(A) No. So answers to the following subquestions are not applicable.

a. If so, then what is the amount of dispersal habitat on Federal lands for all 1/4 townships between the LSRs?
b. What percent of the total Federal lands in these 1/4 townships is this?
c. How much (percent 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?
d. Is this total greater than 50%?
e. Describe, if present, the natural barriers to dispersal.

f. Is connectivity, or dispersal habitat, sufficient to allow movement?

8. How much critical habitat has been designated within the watershed?

(A) There are 5,654 acres of Northern Spotted Owl Critical Habitat within the Mainstem Salmon River Watershed.

a. How much of this total overlaps with LSRs?

(A) Approximately 1,859 of these acres are within LSRs.

b. For areas that do not overlap, how much is currently NRF habitat?

(A) There are 1,047 acres of NRF habitat in the non-overlap areas.

And how much is capable?

(A) There are an additional 2,351 acres of non-overlap CHU that are Capable.

c. How many activity centers are located in this non-overlap area of CHU?

(A) None are known.

d. How many are currently above "take"? How many below? (use acres established by FWS for .7 and 1.3 mile radius)

(A) Due to the answer given to 8c above, this question is not applicable.

e. What role does this non-overlap critical habitat play in this watershed in relation to the reasons for the designation of the CHU?

(A) Presently it plays a very minor role due to it's lack of NRF habitat continuity and amount.

BALD EAGLE

1. Are occupied bald eagle activity areas (nesting, foraging, winter roosts, or concentration areas) located within the watershed?

(A) No.

a. If so, what type?

(A) The above answer renders the following sub-questions not applicable.

b. How many?

c. What ROD land allocations are they located?

d. Describe reproductive history based on monitoring data.

e. Has a final site-specific protection/ management assessment been developed for each site?

f. Does this watershed analysis corroborate the findings of the management assessment?

2. 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?

(A) No, there have not been dedicated assessments for these areas. However, district records are kept of mature bald eagles seen during the breeding season, and yearly bald eagle mid-winter counts are done to protocol along the length of the Salmon River. These records show that there appears to be a very low likelihood of breeding bald eagles in the watershed, but that it does receive some use by individual foraging eagles in the winter. Use appears to be concentrated along the main river gorge, mostly in Matrix and Administratively Withdrawn ROD land allocations. Answers to sub-questions a-d are not applicable.

a. If so, what type?

b. How many?

c. What ROD land allocations are they located?

d. Have these areas been surveyed to protocol to determine they are unoccupied?

3. Describe historical bald eagle occurrence and nesting within the watershed.

(A) As mentioned above, historical bald eagle use of the watershed has been for winter foraging. There are old district records of bald eagle nesting, but no nesting is believed to be taking place currently.

4. What is the status of the watershed as it relates to the Recovery Plan? (target territories, including beyond watershed boundaries)

(A) The Salmon River is not mentioned in the Bald Eagle Recovery Plan. It is believed that there is plenty of potential nesting areas along the Salmon River, but that low populations of fish in the river may be limiting breeding colonization by bald eagles. The following sub-questions are not applicable.

a. Does the watershed and the surrounding area meet objectives of the Recovery Plan?
b. If not, then are there capable eagle activity areas located within the watershed?
c. If capable activity areas are present, what type are they?
1). How many?
2). In what ROD land allocations are they located?
d. What type of project or enhancement could develop sites into potential or occupied sites?

5. If present, describe significant habitat within the watershed that is not under Federal ownership.
(A) There is no significant habitat within the watershed that is not under Federal ownership.

AMPHIBIANS

1. Have any amphibian inventories been done on a project or watershed level?
(A) There has been a recent cursory search for Del Norte salamanders within a small proposed mining plan-of-operation area. No amphibian inventories have been done on a watershed level.

a. What species does the literature suggest may be present in the watershed?
(A) The literature (and the available habitats) suggest that the Del Norte salamander, tailed frog, red-legged frog, southern torrent salamander, black salamander, rough-skinned newt, northwestern salamander, long-toed salamander, Pacific giant salamander, ensatina, clouded salamander, western toad, Pacific tree-frog, foothill yellow-legged frog, and bullfrog may be present in the watershed.

2. Are sensitive species and ROD Table C-3 species present or possibly occur?
(A) Yes; the Del Norte salamander.

3. Have intensive or extensive inventories been conducted in adjoining drainages/ subwatersheds?
(A) No, so the remaining sub-questions are not applicable.

a. If so, can those inventories be extrapolated to this watershed?

4. Are endemic species known to occur in the general geographic region?
(A) The Shasta and Siskiyou Mountain salamanders are endemic to small localities in the general geographic region, but are not known to occur within the Main Salmon River watershed.

5. Are exotic species known or suspected to be in the watershed? (e.g., bullfrogs)
(A) Yes; bullfrogs are known to occur in the lower reaches and sidechannel pools of the Salmon River.

PEREGRINE FALCON

1. Are any cliffs located within the watershed? (rock wall >50 feet)
(A) Yes.

2. Are any cliffs present that are historic (pre-1975) or traditional (post-1975) peregrine eyries?
(A) Yes.

3. For past projects near historic cliffs, have mitigation measures for habitat been considered?
(A) No.

a. At these historic cliffs, have surveys to protocol (Pagel 1992) been accomplished for at least tow years prior to the activities?
(A) No.

4. For traditional cliffs, have surveys/monitoring been conducted to determine nest site occupancy and reproductive status?
(A) Yes.

b. Has a draft or final site mgt plan been created?
(A) Yes (for one whos territory appears to be entirely within the watershed, no for one that has most foraging territory outside the watershed).

1). Is this plan based on site specific and PNW sub-population nesting ecology?
(A) Yes.

5. Have the cliffs located been rated or monitored for falcon potential or presence?
(A) No (except for known sites).

6. If cliffs are un-rated, have surveys been accomplished to protocol?

(A) No.

7. Describe site habitat variables within a 3 mile radius of historic and traditional nest sites. (cliff parent material, distance to water/riparian, vegetative habitat, seral stages, human activities)

(A) Site habitat variables for currently occupied Site A include a seral stage distribution comprised of 2% Shrub/Forb; 24% Pole/Early-Mature; 46% Mid-Mature; 24% Late-Mature/Old-Growth; and 4% Unclassified (occurs off Forest) within a 3 mile radius of the eyrie. The cliff parent material can be described as meta-volcanic in origin. The vegetative community can be described as low elevation Douglas-fir/hardwood, with the Salmon River (and associated riparian habitats) directly at the base of the eyrie cliff. Human activities associated with this site include a recreational river rafting and fishing access point directly across the Salmon River from the base of the eyrie cliff, and a major Wilderness trailhead across the Salmon River and the Salmon River Road (93) from the eyrie cliff. Historically, gold dredge mining has also been conducted in proximity to this site.

Site habitat variables for the historical Site B include a seral stage distribution comprised of 7% Shrub/Forb; 16% Pole/Early-Mature; 60% Mid-Mature; and 16% Late-Mature/Old-Growth (1% non-vegetated). The cliff parent material is meta-sedimentary in origin, and also supports a Douglas-fir/hardwood type forest. Peregrine falcons using this site would have to fly about a quarter mile to get to riparian habitats. Human activities include hikers and pack stock using the Portuguese Peak trail which runs across the top of the eyrie cliff.

MARBLED MURRELET (Zone 1 & 2)

1. Are occupied sites within the watershed?
(A) None are known or suspected.

2. Has a 0.5 mile radius mgt area been delineated for each site?
(A) Not applicable (see 1. above).

3. Within this mgt are, what stands are currently murrelet habitat?
(A) This question and the following subquestions are not applicable as per 1 above.

a. What stands are recruitment habitat (capable of becoming suitable within 25 years; see ROD description)?
b. What stands are non-habitat?

4. Do stands of potential habitat exist in the watershed?
(A) Yes, based on what we think we know is potential habitat.

a. Describe habitat (acres, quality, quantity, spatial relationship to nearby habitat).
(A) Within Marbled Murrelet Zone 2, there is estimated to be 8,295 acres of Optimal Nesting Habitat, and 3,213 acres of Sub-optimal Nesting Habitat within the mainstem Salmon River watershed. Optimal habitat includes late-mature and old-growth forest stands with interlocking canopies, while Sub-optimal habitat includes stands including mid-mature stands with scattered large trees. Continuous blocks of optimal nesting habitat occur within the Somes, Monte, Duncan, Tom Payne, Butler and Hammel Creek drainages, with all but the habitat in Tom Payne Creek connected to each other and to other blocks beyond the borders of the Watershed.

b. Describe past surveys.
(A) There have been none within the watershed.

c. What stands of habitat have not been surveyed?
(A) All of them.

5. Is there recruitment habitat in the watershed?
(A) Yes.

At various points in the future (e.g., 25, 50, 100, 200 years), what will the be the percent of the watershed that will be suitable habitat?
(A) We believe there are some unsupportable assumptions made by this question in terms of our ability to predict habitat conditions far into the future based on the fire ecology of the watershed, but within Zone 2 it is estimated that an additional 3,715 acres of habitat will become suitable within 25-50 years, and that 389 acres may become suitable within 100-200 years.

APPENDIX B
LIST OF ANALYSIS AREA MAPS

The following information is a listing of maps contained in a Map Atlas located at either the Ukonom or Salmon River Ranger District; each District has an atlas.

Main Salmon Analysis Watershed
Base Map
Base Map Overlay
Recreation Features
Visual Quality Objectives
Visual Quality Improvement Opportunities
Management Opportunities:
- Aquatic Ecosystem
- Human/Social Dimension (1 of 2)
- Human/Social Dimension (2 of 2)
- Terrestrial Ecosystem

Productivity Class by PNV

WILDLIFE
WHR Types (EUI data)
Potential Goshawk Habitat
Owl Range Habitat Types
Northern Spotted Owl Habitat Shown with High Fire Behavior Potential
Northern Spotted Owl Habitat
Marbled Murrelet: Nesting Habitat
Del Norte Salamander-Potential Habitat
Great Gray Owl Habitat
Willow Flycatcher Habitat
Peregrin Falcon: Existing and Potential Nesting and Foraging Habitat
Bald Eagle: Foraging Habitat

VEGETATION
Soils: Site Class and Regenerability
Soil Map Units
Order III Soil Map Units
Potential Natural Vegetation by Series
Harsh Site Management Areas - Vegetation
Vegetation Types (Strata)
EUI Seral Stages
Vegetation (Partial Retentaion Management Areas)
Vegetation (General Forest Management Areas)
General Forest Management Areas-Vegetation
Seral Stages
Sensitive Plants
Bedrock
Older, Mature Stands
Vegetation Types (Pre-1987 Fires)
Vegetation Types (Post-1987 Fires)
Vegetative Condition

FUELS/FIRE
Fuel Models
Probability of Losing a Stand-Risk/Fire Behavior Potential Matrix
Fire History
Fuel Models and Historic Large Fires

TIMBER
Thinning Opportunities
Timber Types
Isolated Stands

FISHERIES
Sub-Basins and Stream Types
Fish Species Distribution (1 of 4)
Fish Species Distribution (2 of 4)
Fish Species Distribution (3 of 4)
Fish Species Distribution (4 of 4)

COLOR MAPS FROM USFWS
Stream Designations
WHR Vegetation Types
Long-legged myotis (M027)-Arithmetic Mean

WHR Habitat Values-Arithmetic Mean
M030 Silver-Haired Myotis
M154 Marten
M026 Fringed Myotis
M034 Hoary Bat
M025 Long-Eared Myotis
M155 Fisher
B373 American Dipper
M010 Water Shrew
M136 Long-tailed Vole
B303 Downy Woodpecker
B304 Hairy Woodpecker
B305 White-Headed Woodpecker
B299 Red-breasted Sapsucker
B308 Pileated Woodpecker
B281 Vaux's Swift
B296 Acorn Woodpecker
M077 Western Gray Squirrel
B306 Black-backed Woodpecker

WHR Habitat Values-Reproductive and Cover Average
M151 Black Bear
M181 Mule Deer
M177 Roosevelt Elk

M151 Black Bear
M181 Mule Deer
M177 Roosevelt Elk

APPENDIX C
SURVEY AND MANAGE SPECIES

Survey and manage species known or suspected to occur within the Main Salmon Analysis Area:

FUNGI
Gastroboletus subalpinus
Gastroboletus turbinatus
Gautieria otthii
Leucogaster citrinus
Gymnomyces sp. nov. #Trappe 7545
Cantharellus cibarius
Cantharellus subalbidus
Gomphus clavatus
Gomphus gloccosus
Ramaria largentii
Ramaria aurantiisiccescens
Tricholomopsis fulvescens
Cudonia monticola
Gyromitra california
Gyromitra esculenta
Gyromitra infula
Gyromitra montana (syn.*G.gigas*)
Sarcosoma mexicana
Pithya vulgaris
Sparassis crispa
Galerina vittaeformis

LICHENS
Bryoria tortuosa
Lobaria linita
Nephroma helveticum
Nephroma parile
Nephroma resupinatum
Peltigera collina
Pseudocyphellaria anomala
Pseudocyphellaria anthraspis
Sticta fuliginosa
Calicium viride
Chaenotheca furfuracea
Dermatocarpon luridum

VASCULAR PLANTS
Allotropa virgata
Cypripedium fasciculatum (Klamath)
Cypripedium montanum (West Cascades)

AMPHIBIANS
Del Norte salamander

BIRDS
Great grey owl

MAMMALS
Fringed myotis
Silver haired bat
Long-eared myotis
Long-legged myotis

APPENDIX D
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. They include;
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 game 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 cleanup, 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.

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.

Law Enforcement

LAW ENFORCEMENT PROBLEMS--Will highlight which roads or system of roads 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 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.

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 even, 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.

Timber

MATRIX LANDS--Areas where access is needed for timber management opportunities.

OTHER LANDS--Areas where access may be needed to provide vegetation manipulation for other resource concerns.

Lands and Minerals

ACTIVE CLAIMS--Roads utilized for access to active mining claims.

PRIVATE LAND--Roads needed to access private property or have special use assessments attached to them.

Fisheries

STREAM PROXIMITY--Roads that are located very close to streams. This issue is very closely related to the chronic sedimentation issue for watershed.

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 need to be included in the decision making process.

MAIN STEM WATERSHED ANALYSIS
APPENDIX D - TRANSPORTATION SYSTEM INTERACTIONS

Transportation Area - Salmon River

DISCIPLINE	GENERAL ISSUES AND CONCERNS	SPECIFIC ROAD ISSUES AND CONCERNS	REMARKS AND RECOMMENDATIONS FOR MANAGEMENT OPPORTUNITIES
Wildlife	Disturbance	Horn Gap Area, problem keeping gate closed to year round access.	Enforce road closure policy.
		Hog Range/Yellow Jacket Ridge, existing closure period from November 1 thru April 15.	Reduce miles of open road.
	Open road density and road fragmentation.	Hog Range/Yellow Jacket Ridge	Reduce miles of open road along with decommissioning of roads not needed to manage the National Forest.
Fire	Fire Management Access (Key location for strategic fire management)	Critical roads are 10N05, 10N05A, 10N29, 10N30, 11N21, 11N21D, 10N10Y, and Sauerkraut.	Critical roads need to be maintained and accessible for fire emergency equipment during fire management season.
		Important roads are most other system roads.	Important roads need to be maintained as part of the transportation network to provide access for strategic type project work. Road maintenance would only be done to prevent resource damage, and provide access during project work activities.
Visuals	Road segments that do not meet current visual objectives.	Segments of Hog Range Road system, Sauerkraut Road and portions of County Road 2B01.	Need additional verification for actual vantage points and location of visual restoration.
Recreation	Trailhead access	Road 11N21 (Safety a concern for horse trailers and stock trucks because of steep grades.)	Continued seasonal access desired. Normally, snow prevents access to trailheads by mid-November to first of May. Need to provide warning signs and direct trailers and stock trucks over another route.
			Analyze the transportation system to determine the best access route to the trailhead.
	General uses (Hunting, sight seeing, woodcutting, etc.)	Road 11N21 key access to Yellow Jacket Ridge and Hog Range hunting and sight seeing.	Continue providing access for these uses on a seasonal basis. This road is not designed for winter travel.
Watershed	Erosion related sediment.	Low to moderate erosion on 11N21. 10N10Y has rutting. Upper end of 10N10Y	Identify problem areas and prioritize to correct or mitigate adverse impacts.
		Loop road 11N20; possible decommission.	Analyze to determine if road is needed to manage the National Forest. Possibly an opportunity to decommission a road to reduce sedimentation and reduce road density.
	Landslide risk (sedimentation)	Landings of landslide on roads 11N21 and 11N21D.	Decommission landing areas, or stabilize surface area.
		Road 10N05 at Horn Creek Slide, and a couple of smaller slides.	Stabilize road cut and fill slopes across slide areas to minimize sedimentation from erosion.
		Road 10N05A located in unconsolidated material within inner gorges.	Stabilize road cut and fill slopes to minimize risk of landsliding within inner gorges.
	Storm flow capacity of culverts.	No specific road.	Evaluate culverts and their ability to handle 100-year storm flow. Correct deficiencies if needed.
	Compacted area density (Peak flow runoff).	Landings, excessive road widths and parallel roads.	Minimize compacted areas to reduce peak flow runoff.
Timber	Management of the Timber Resource within General Forest/Partial Retention Areas.	Need to maintain access to Yellow Jacket Ridge/Hog Range Area, and Road 10N05 to Horn Gap for management of plantations and scattered timbered areas.	Maintain all system roads as part of the transportation network to provide access to manage the timber resource.
Lands and Minerals	Access to private land and active mining sites	Road 10N10Y (Private land access).	Maintain as part of the transportation system.
		Sauerkraut Road (Non-system - Access to Evergreen Mine).	Maintain as a non-system road.

DISCIPLINE	GENERAL ISSUES AND CONCERNS	SPECIFIC ROAD ISSUES AND CONCERNS	REMARKS AND RECOMMENDATIONS FOR MANAGEMENT OPPORTUNITIES
Fisheries	Sedimentation from roads. (Location of roads and landings near streams.)	Roads 10N10Y, 10N17, and Sauerkraut.	Minimize sedimentation from roads. Identify problem areas, and prioritize to correct or mitigate adverse impacts.
Law Enforcement	Poaching	Yellow Jacket Ridge and Horn Creek.	Needs roads for access and personal safety.
	Access needed.	Critical road 11N21.	Maintain access for law enforcement activities.
	Maintaining gate closure.	Road 10N05.	Evaluate for possible different type of closure device or changing closure period.
Cultural	Access	Road 10N14.	Limit or restrict access. Further surveys are needed for other roads.
Botany	No issues related to roads at this time.	-----	Further surveys are needed.
Road Management	Traffic management for travel and access.	Use restrictions to minimize resource-use conflicts on all roads.	Develop a travel and access management plan to identify those roads that are not needed to manage the National Forest, and those roads that shall be permanently or seasonally closed.
	Road maintenance obligation.	All system roads.	Assign appropriate level of maintenance to all roads. Identify and correct problems that contribute to high maintenance cost.
			Decommission system roads that are not needed.
	Non-system roads.	All	Determine if these roads are needed to manage the National Forest. Decommission those roads that are not needed. Roads that are needed, need to be reconstructed to bring them up to standard to minimize impacts.
	Public	Restricted access	Involve public during travel and access planning.

APPENDIX E
SPECIAL FOREST PRODUCTS

Special forest products found in analysis area:

Pennyroyal
Bear grass
Maiden hair fern
Prince's pine
Woodwardia chain fern
Umbrella plant
Slender tubed iris
Yarrow
Wild celery
Indian tobacco
Yerba buena
Miner's lettuce
Yellow mountain moss
Tanoak mushroom
Sadler oak
Evergreen huckleberry
Blackcap raspberry
Red huckleberry
Mock orange
Manzanita uva ursa
Serviceberry
Green manzanita
Redbud
Oregon grape
Mountain mahogany
Dwarf Oregon grape
Creek dogwood
California wild grape
Manzanita
Thimbleberry
Hazel
Gooseberry
Nine bark
Sandbar willow
Salal
Blackberry
California black oak
Ponderosa pine
Pacific dogwood
Tanoak
Oregon white oak
Red willow
Red alder
Bigleaf maple
Elderberry
Sugar pine
Pacific madrone
Chinkapin
White alder
California bay laurel
Pacific yew

APPENDIX F
RISK/FIRE BEHAVIOR POTENTIAL

FIRE RISK

Historical records indicate lightning and human caused fires have been common in the watershed. Little precipitation (May to September) and high summer temperatures allow fuels to dry, which allows for ease and spread of wildfire ignitions.

There are numerous fire-risks within and adjacent to the watershed. Several year round occupancies, both day use and overnight campgrounds, recreational use, travel corridors, and a powerline that crosses the lower portion of the Salmon River, all contribute to the possibility of a wildfire occurrence from human causes.

Lightning poses a fire-risk along the Salmon River corridor. Thunder storms generally track down the river only to turn and go back up the river from the direction of which they originally came. Lightning and erratic winds accompany these storms, but are usually accompanied by precipitation which limits the actual number of ignitions.

The Forest's fire history data base indicates that the watershed had 265 fire starts from 1922-1993. Using this information and the vegetative composition of the watershed, determines the general fire-risk assessment.

It is important to realize that risk is not the probability of a fire occurring, but the probability of when a fire will occur. In this watershed, the fire will occur.

A mathmatical formula is used to derive a risk value. Included in the formula are the number of starts, number of years of historical information, and number of acres involved. The values in the formula are:

x = Number of starts recorded for the area from the fire start data base (265).
y = Period of time covered by the data base (for this analysis, 71 years).
z = Number of acres analyzed (displayed in thousands 69,280 = 69.28).

{(x/y)10}/z = Risk rating

{(265/71)10}/69.28 = 0.54

The value derived corresponds to a likelihood of fire starts per 1000 acres per decade. The following are the risk ratings and range of values used to determine the risk.

Low-Risk = 0-0.49 This projects one fire every 20 or more years per thousand acres.

Moderate-Risk = 0.5-0.99 This projects one fire every 11-20 years per thousand acres.

High-Risk = $\geq$ 1.0 This level projects one fire every in 0-10 years per thousand acres.

The watershed as a whole, has a Moderate-Risk rating, or one fire start per 11-20 years per thousand acres can be expected.

The fire start map indicates that the river corridors and the population centers have the highest densities of fire starts within the watershed. By separating the watershed into three risk areas, the river corridors, the north side, and the south side, three risks are identified.

High-Risk-The river corridor, from Forks of Salmon to Somes Bar and Merrill Creek have a risk of 1.06.

Moderate-Risk-The north side of the watershed, north of the Salmon River has a risk of 0.5.

Low-Risk-The south side of the watershed, south of the Salmon River has a risk of 0.36.

Acres Within Risk Classes

Risk	Acres
High	12,273
Moderate	33,753
Low	23,346

FIRE BEHAVIOR POTENTIAL

This is a layer that is developed from the slope map and the fuel model map.

Three slope classes are used, consistent with the slope classes used in the LMP geologic hazard classification (0-34%, 35-65%, and >65%). For this analysis only the two steeper classisfications were considered, the amount of area <34% slope is insignificant in this watershed, for fire behavior calculations..

Each fuel model is run through the BEHAVE program. This program uses fuel model, slope , and weather parameters to predict fire behavior and resistance to control for fire suppression purposes. The 90th percentile weather from the most representive weather station was used to model late summer afternoons, typical of late July thru early September. All fuel models were run through each of the two slope classes, to determine increases in fire behavior with increased steepness of terrain.

The output of this is a rating of low, moderate, or high fire behavior based on flame lengths, which are good indicators of fire line intensity and resistance to control, and/or rate of spread (ROS), which is also a good indicator of resistance to control.

Using the CONTAIN model of BEHAVE, it was determined whether or not a fire with Low Flame Lengths could be contained by the initial attack forces. These runs indicated that given, responce times, terrain, fuels, and available forces, a Low Fire Behavior rating had to have a ROS <30 chains per hour, for containment to be accomplished.

Low-Flame lengths <4' and ROS <30 chains per hour.

- Fires can generally be attacked at the head or flanks by firefighters using handtools. Handline should hold the fire.

Moderate-Flame lengths 4-8'

- Fires are too intense for direct attack at the head of the fire by firefighters using handtools. Handline cannot be relied on to hold the fire. Equipment such as dozers, engines, water and/or retardent dropping aircraft can be effective.

High-Flame lengths >8'

- Fires may present serious control problems, such as torching, crowning, and spotting. Control efforts at the head of the fire will be ineffective.

The derived layer incorporates the information into a spatial display of fire behavior classifications for the watershed. This begins to provide a link to risk and the resource values.

A fuels inventory was done in the area of Somes and Bulter Creeks over the span of two field seasons (1990 and 1991). Fuel loadings for plots sampled ranged from 2.4 tons per acre on the low end to 59.1 tons per acre on the high end. Residue depth ranged from 0.1 foot to 0.6 foot. Average duff depth ranged from 0.6 inches to 4 inches.

Existing vegetation plots in these drainages were sampled through the use of photo series (USDA 1980, 1981) interpretation and correlation. This fuels inventory has been used to describe fuels throughout the watershed that have the same attributes as fuels in the Somes Butler area.

For this watershed analysis, an Ecological Unit Inventory (EUI) was accomplished to determine existing vegetation. This was done using aerial photos and sample plots.

A crosswalk was developed to characterize the existing vegetation layer as fuel models. Each vegetative type was assigned a predictive fuel model (Fire Behavior Predictive System, Anderson 1982). A fuel model is a set of numerical values that describes a fuel type for the mathematical model that predicts rate of spread and fire intensity (Rothermel 1972) for each vegetation.

The summary report for the number of acres in each of the represented fuel models is as follows:

Fuel Model	Acres
1	760
2	1,398
4	4,361
5	5,842
6	9,454
8	22,371
9	945
10	10,426
11	4,858
12	5,833
13	2,929

FUEL MODELS WITHIN WATERSHED

Based on discussions with the Forest Fuels Officer, Fuels Officers from both of the Districts that the watershed resides, and the two key developers of the EUI database, a crosswalk has been developed between the EUI vegetation layer and the fuel models.

Fuel model 1 is being used to describe high meadows in the watershed. Shrub forb is the seral stage being described as fuel model 1.

Fuel model 2 is used to describe sites that are too harsh to support vegetation other than scattered shrub and/or trees and grass. Shrub natural is the seral stage used.

Fuel model 4 is used to describe vegetative conditions that exist largely in the Off Fire area and in other areas that have been burned once and come back in shrubs that occur on hot aspects. Some of these areas were planted with conifers and contain stockings of conifers, shrub, and a dead fuel component of mortality from the previous fire. Early-mature seral stages occurring on south and west aspects are described as fuel model 4, also pole stands, burned and salvaged.

Fuel model 5 is describing areas that have young shrub or plantations. Fuel model 5 is used to describe early-mature seral stages on north aspects, shrub harvested and shrub salvaged on south and west aspects. These are areas of young shrub and plantation growth.

Fuel model 6 is describing early-mature seral stages occurring on north and east aspects. It is also used to describe pole seral stages where they are plantations established after green timber harvest. Shrub burned and salvaged on north and east aspects is also a fuel model 6.

Fuel model 8 is used to model mid-mature stands with a short needle primary species. These include most of the live oak and tan oak stands. It is also used to model late-mature stands on south and west aspects, and late-mature that has been burned and salvaged.

Fuel model 9 is used to model long needle mid-mature stands and stands of deciduous hardwoods.

Prior to European settlement, the watershed was generally dominated by open hardwood stands with scattered conifers. Due to effective fire suppression the watershed has had dramatic increases in stand densities. North aspects were typically dominated by conifers, but have increased in denisity. These stands now consist of scattered old-growth trees and a heavy loading of trees between 80-100 years of age. The hardwood stands have increased in both hardwood and conifer densities, suppressed trees are dead and dying under the shade of the conifers. These sites are growing more trees than they are capable of keeping

healthy. Competition for water and nutrients is high. This has increased stress and mortality in suppressed trees, which adds to the dead fuel loading. Areas where these conditions exist are described as a Fuel Model 10. Old-growth seral stage is fuel model 10.

Fuel model 11 is a light slash model. It is being used to describe young plantations with a precommercial thin. Early-mature stands that have been burned and not salvaged on south and west aspects. Mid-mature stands of live oak and tan oak that have burned and were not salvaged. Pole stands that were burned and not salvaged, and areas that are now shrub that were burned and not salvaged.

Fuel model 12 describes early-mature that has burned and not salvaged on north and east aspects. Late-mature that has burned and not salvaged on south and west aspects, and mid-mature conifer stands that have burned and not salvaged.

Fuel model 13 describes late-mature stands that have burned and not salvaged on east and north aspects, and old-growth stands that have burned and were not salvaged, but that maintain old-growth characteristics.

ENHANCED FIRE BEHAVIOR CLASSIFICATION

Fuel models are an excellent tool for modelling the fire behavior of ground fuels. Fuel models can be used to accurately predict a fires horizontal spread. Vertical fuels and their role in fire behavior need to also be considered in determining effects on vegetation. It has been determined that no analysis of fuels can be considered complete without some assessment of the vertical fuel layer. This layer adds the fuel ladder, which increases the likelihood for stand replacement wildfire in the watershed.

The basis for the following assumptions were derived from the USDA Fire Behavior Analyst Field Notebook. The assumptions are:

- 100% live fuel moisture during August burning conditions.
- Burning composition-some species have low enough fuel moistures and structural characteristics to sustain burning. Eg: true firs.
- Greater than 70% total crown cover must be present to support crown fire.
- Five feet to live crown from the ground.
- Greater than four foot flame lengths, sufficient to carry flames into the fuel ladder and up into the crowns of trees.

Fire behavior must be at a moderate rating for flame lengths to be carried into the understory (flame lengths greater than 4 feet). Fuel Models 10 and 11 were sorted and addressed by individual types to determine whether they fit the model and should be bumped from a Moderate hazard to a High hazard classification.

Based on the assumptions and data sorts, changes did occur in the number of acres within the hazard class ratings:

- High Fire Behavior-went from 30,111 to 38,994 acres or from 44% to 57%.
- Moderate Fire Behavior-went from 15,549 to 6,666 acres or from 23% to 10%.

Results from an analysis of the fire effects experienced on the Dillon Fire 1994, support these assumptions. The analysis also indicates that during the period of the day when weather conditions are in or near the 90th percentile weather, fire runs and high intensity crowning can be expected in less continuous fuels (i.e., <70% crown closure) on exposed aspects (i.e., south aspects, and upper two-thirds of east and west aspects). On northern aspects, conditions described in the assumptions can be expected to crown while in or near the 90th percentile weather.

Fuel Model to Fire Behavior Potential

FUEL MODEL	ASPECT	SLOPE < 65%	SLOPE > 65%	CRN CLSR > 70%
1	--	HIGH	HIGH	--
2	--	HIGH	HIGH	--
2	N	MOD	HIGH	--
4	--	HIGH	HIGH	--
5	--	HIGH	HIGH	--
5	N	MOD	HIGH	--
6	--	HIGH	HIGH	--
8	--	LOW	LOW	--
9	--	LOW	LOW	--
10	--	MOD	MOD	HIGH
11	--	MOD	MOD	HIGH
12	--	HIGH	HIGH	--
13	--	HIGH	HIGH	--

The following is the summary of acres in each fire behavior class for the watershed:

High- 38,994 acres for 57%.
Moderate- 6,666 acres for 10%
Low- 23,316 acres or 33%

POTENTIAL WILDFIRE EFFECTS MATRIX

By incorporating Risk and Fire Behavior Potential, a matrix is developed which measures the likelihood that a stand will be lost to wildfire. The output is a tabular report identifying the number of acres in each category, and a spacial display of location of those acres.

The effects matrix will be computed as follows:

FIRE BEHAVIOR	LOW-RISK	MOD-RISK	HIGH-RISK
Low	1	1	2
Moderate	1	2	3
High	2	3	4

1/ Low probability of a stand being lost to wildfire
2/ Moderate probability of a stand being lost to wildfire
3/ High or very probable chance of a losing stand to wildfire
4/ Very high or quite probable that stand will be lost to wildfire.

The summary for acres within each potential loss category for the assessment area are as follows:
Class 1 - 21,055 acres for 31%
Class 2 - 25,324 acres for 37%
Class 3 - 16,208 acres for 23%
Class 4 - 6,389 acres for 9%

Standards for Treatment of Activity Fuels

FIRE EFFECTS CLASS	DESCRIPTION	MANAGEMENT ACTION
4	Very high likelihood stand will be lost to a fire.	Treat fuels, reduce to a Class 3 or lower level.
3	High likelihood stand will be lost to a fire	Fuel build-up at this level may be permitted about 25% of the time.
2	Moderate likelihood stand will be lost to a fire.	Fuel build-ups at this level may be permitted about 75% of the time.
1	Low likelihood stand will be lost to a fire.	May be permitted anytime.

FUEL

Forest Service Manual (FSM) Chapter 5105, defines fuel as combustible wildland vegetative materials, living or dead. *FSM*, Chapter 5150 on fuel management provides direction to evaluate, plan, and treat wildland fuel to control flammability and reduce resistance to control including mechanical, chemical, biological, or manual means including the use of prescribed fire, to support land and resource management objectives.

The objectives of fuels management are to:
- Reduce fire hazard to a level where cost effective resource protection is possible should a wildfire ignition occur. Fire hazard is the potential fire behavior (intensity and rate of spread) of a fire burning in a given fuel profile and its ability to be suppressed by fire forces.
- Reduce the potential fire severity.

The reason fire managers are concerned with fuels is that of the three critical elements of fire behavior-weather, topography, and fuels, the only element that can be manipulated is vegetation or fuels.

FUEL MODEL DEFINITIONS

The criteria for choosing a fuel model (Anderson 1982) is based on the fact that fire burns in the fuel stratum best conditioned to support it. This means situations will occur where one fuel model represents rate of spread most accurately and another best depicts fire intensity. In other situations, two fuel conditions may exist, so the spread of fire across the area must be weighed by the fraction of the area occupied by each fuel. Fuel models are simply tools to help the user realistically estimate fire behavior.

Description of fuel models used in fire behavior as documented by Albini (1976).

Grass and Grass-Dominated

		FUEL LOADING*				
FUEL MODEL	TYPICAL FUEL COMPLEX	1 hr	10 hr	100 hr	Live	FUEL BED DEPTH‡
1	Short Grass(1 ft.)	.74	0	0	0	1
2	Timber (Grass & Understory)	2	1	.5	.5	1
3	Tall Grass(2.5 ft.)	3.01	0	0	0	2.5

* Tons per acre
‡ Feet

		FUEL LOADING*				
FUEL MODEL	TYPICAL FUEL COMPLEX	1 hr	10 hr	100 hr	Live	FUEL BED DEPTH‡
4	Chaparral (6 ft.)	5.01	4.01	2	5.01	6
5	Shrub (2 ft.)	1	.5	0	2	2
6	Dormant Shrub Hardwood Slash	1.5	2.5	2	0	2.5
7	Southern Rough	1.13	1.87	1.5	.37	2.5

* Tons per acre
‡ Feet

Timber Litter

		FUEL LOADING*				
FUEL MODEL	TYPICAL FUEL COMPLEX	1 hr	10 hr	100 hr	Live	FUEL BED DEPTH‡
8	Closed Timber Litter	1.5	1	2.5	0	.2
9	Hardwood Litter	2.92	.41	.15	0	.2
10	Timber(litter and understo-ry)	3.01	2	5.01	2	1

* Tons per acre
‡ Feet

Slash

		FUEL LOADING*				
FUEL MODEL	TYPICAL FUEL COMPLEX	1 hr	10 hr	100 hr	Live	FUEL BED DEPTH‡
11	Light Logging Slash	1.5	4.51	5.51	0	1
12	Medium Logging Slash	4.01	14.03	16.53	0	2.3
13	Heavy Logging Slash	7.01	23.04	28.05	0	3.0

* Tons per acre
‡ Feet

The prediction of fire behavior has become more valuable for assessing potential fire damage to resources. A quantitative basis for rating fire danger and predicting fire behavior became possible with the development of mathematical fire behavior fuel models. Fuels have been classified into four groups- grasses, shrub, timber, and slash. the differences in these groups are related to the fuel load and the distribution of the fuel among the size classes. Size classes are: 0-1/4", 1/4- 1", 1- 3", and 3" and greater.

The criteria for choosing a fuel model includes the fact that the fire burns in the fuel stratum best conditioned to support the fire. Fuel models are simply tools to help the user realistically estimate fire behavior. Modifications to fuel models are possible by changes in the live/dead ratios, moisture contents, fuel loads, and drought influences. The 13 fire behavior predictive fuel models are used during the severe period of the fire season when wildfire pose greater control problems and impacts on land resources.

The following is a brief description of each of the 13 fire behavior fuel models.

GRASS GROUP

Fire Behavior Fuel Model 1

Fire spread is governed by the very fine, porous, and continous herbaceous fuels that have cured or are nearly cured. Fires are surface fires that move rapidly through the cured grass. Very little timber or shrub is present.

Fire Behavior Fuel Model 2

Fire spread is primarily through cured or nearly cured grass where timber or shrubs cover one to two-thirds of the open area. These are surface fires that may increase in intensity as they hit pockets of other litter.

Fire Behavior Fuel Model 3

Fires in this grass group display the highest rates of spread and fire intensity under the influence of wind. Approximately one-third or more of the stand is dead or nearly dead.

SHRUB GROUP

Fire Behavior Fuel Model 4

Fire intensity and fast spreading fires involve the foliage and live and dead fine woody material in the crowns of a nearly continuous secondary overstory. Stands of mature shrubs, six feet tall or more are typical candidates. Besides flammable foliage, dead woody material in the stands contributes significantly to the fire intensity. A deep litter layer may also hamper suppression efforts.

Fire Behavior Fuel Model 5

Fire is generally carried by surface fuels that are made up of litter cast by the shrubs and grasses or forbs in the understory. Fires are generally not

very intense because the fuels are light and shrubs are young with little dead material. Young green stands with little dead wood would qualify.

Fire Behavior Fuel Model 6
Fires carry through the shrub layer where the foliage is more flammable than fuel model 5, but requires moderate winds, greater than 8 mi per hour.

Fire Behavior Fuel Model 7
Fires burn through the surface and shrub strata with equal ease and can occur at higher dead fuel moistures because of the flammability of live foliage and other live material.

TIMBER GROUP
Fire Behavior Fuel Model 8
Slow burning ground fuels with low flame lengths are generally the case, although the fire may encounter small "jackpots" of heavier concentrations of fuels that can flare up. Only under severe weather conditions do the fuels pose a threat. Closed canopy stands of short-needled conifers or hardwoods that have leafed out support fire in the compact litter layer. This layer is mostly twigs, needles, and leaves.

Fire Behavior Fuel Model 9
Fires run through the surface faster than in fuel model 8 and have a longer flame length. Both long-needle pine and hardwood stands are typical. Concentrations of dead, down woody material will cause possible torching, spotting, and crowning of trees.

Fire Behavior Fuel Model 10
Fires burn in the surface and ground fuels with greater intensity than the other timber litter types. A result of overmaturing and natural events creates a large load of heavy down, dead material on the forest floor. Crowning out, spotting, and torching of individual trees is more likely to occur, leading to potential fire control difficulties.

LOGGING SLASH GROUP
Fire Behavior Fuel Model 11
Fires are fairly active in the slash and herbaceous material intermixed with the slash. Fuel loads are light and often shaded. Light partial cuts or thinning operations in conifer or hardwood stands. Clearcut operations generally produce more slash than is typical of this fuel model.

Fire Behavior Fuel Model 12
Rapidly spreading fires with high intensities capable of generating firebrands can occur. When fire starts it is generally sustained until a fuelbreak or change in conditions occur. Fuels generally total less than 35 tons per acre and are well distributed. Heavily thinned conifer stands, clearcuts, and medium to heavy partial cuts are of this model.

Fire Behavior Fuel Model 13
Fire is generally carried by a continuous layer of slash. Large quantities of material 3 inch and greater is present. Fires spread quickly through the fine fuels and intensity builds up as the large fuels begin burning. Active flaming is present for a sustained period of time and firebrands may be generated. This contributes to spotting as weather conditions become more severe. Clearcuts are depicted where the slash load is dominated by the greater than 3 inch fuel size, but may also be represented by a "red slash" type where the needles are still attached because of high intensity of the fuel type.

WEATHER DATA
The following weather parameters were taken from the data collected at the Somes Bar weather station from 1973 through 1992. These parameters are representative of 90th percentile weather conditions.

1 Hour Fuel Moisture	3%
10 Hour Fuel Moisture	5%
100 Hour Fuel Moisture	9%
1000 Hour Fuel Moisture	11%

20 Foot Wind Speed
10 Miles Per Hour

Conversion factors used to adjust 20' windspeed to midflame windspeed are:

Fuel Model	Exposure	Adjustment Factor	Midflame Windspeed
1	Full	.36	4
2	Partial	.25	3
4	Exposed	.55	6
5	Exposed	.42	4
6	Exposed	.44	4
8	Partial	.25	3
9	Partial	.25	3
10	Partial	.25	3
11	Exposed	.36	4
12	Exposed	.43	4
13	Exposed	.46	5

Conversion factors used are taken from the NFES 1981 S-390 Fire Behavior Field Guide. Table 4A: Wind Adjustment Factors.

APPENDIX G
NORTHERN SPOTTED OWL & MARBLED MURRELET HABITAT DESCRIPTION

NORTHERN SPOTTED OWL

The following are forest types which provide nesting and roosting habitat for spotted owls on the Klamath National Forest. Each one includes habitat components that lead to a higher probability of the stand being used. These criteria result from current knowledge and professional judgement. Generally, all these attributes will exist in suitable owl habitat, but there will be instances when one or two of the parameters are not fully met. In these cases, the presence of some of the existing attributes or other environmental factor(s) (i.e., landform shading) may override the absence of another attribute, which may still warrant the stand suitable. District biologists are responsible for that ultimate determination.

In the Douglas-fir type:
- Elevation - River to 5,000 feet.
- Overstory - Douglas-fir.
- Understory - Douglas-fir, white fir, ponderosa pine, incense-cedar, and hardwoods.
- Overstory tree size - **Average** dbh ≥ 18 inches.
- Total canopy cover - ≥ 60% including hardwoods, but must be open enough to allow subcanopy flight.
- Dead and down - Snags ≥ 2/acre w/ ave. dbh ≥ 18". Logs ≥ 2/acre w/ dia. at large-end average ≥ 18 inches.
- Presence of deformed trees (mistletoe, heart rot, dead tops, "bayonet limbs", etc.).

In the Mixed-Conifer type:
- Elevation - Less than 6,500 feet.
- Overstory - Primary species: Douglas-fir, ponderosa pine, sugar pine, incense-cedar, white fir, red fir.
- Understory - Same species as the overstory, plus hardwoods.
- Overstory tree size - **Average** dbh ≥ 18 inches.
- Total canopy cover - ≥ 60% including hardwoods, but must be open enough to allow subcanopy flight.
- Dead and down - Snags ≥ 2/acre w/ ave. dbh ≥ 18". Logs ≥ 2/acre w/ dia. at large end average ≥ 18 inches.
- Presence of deformed trees (mistletoe, heart-rot, dead tops, "bayonet limbs", etc.).

In the True Fir type:
- Elevation - Up to 7,000 feet.
- Overstory - Primary species: White fir, red fir, incense-cedar, ponderosa pine.
- Understory - Saplings and poles of the same species as the overstory.
- Overstory tree size - **Average** dbh ≥ 15 inches.
- Total canopy cover - ≥ 60%, but must be open enough to allow subcanopy flight.
- Dead and down - Snags ≥ 2/acre w/ ave. dbh ≥ 18". Logs ≥ 2/acre w/ dia. at large-end average ≥ 18 inches.
- Presence of deformed trees (mistletoe, heart-rot, dead tops, "bayonet limbs", etc.).

MARBLED MURRELET

The following habitat description of suitable marbled murrelet habitat is taken from the *Proposed Designation for Critical Habitat for the Marbled Murrelet* (1994, 59 FR 3186).

Individual nest trees include large trees, generally over 32 inches (81 cm) dbh, with the presence of potential nest platforms or deformities such as large limbs (greater than five inches [13 cm]), broken tops, mistletoe infections, witches brooms, or other formations providing a broad platform. Because marbled murrelets do not build nests, moss or detritus to cusion or hold the egg may be important. Platforms should have overhead cover for protection from predators and weather, which may be provided by overhanging branches, limbs above the nest area, or branches from neighboring trees. In the analysis area, Douglas-fir is the tree most likely to provide suitable nesting structure.

Nesting habitat includes the forest stand in which the (suitable) nest trees are contained. Nest stands (for the purposes of survey and delineation), are defined as contiguous mature and old-growth forest with no separations of greater than 330 feet (100 m) wide. Nest trees may be scattered throughout the stand or clumped within portions of the contiguous stand. Nest stands in mature forests may contain fewer than one old-growth tree per acre. Reguardless of the distribution of nest trees, nesting habitat includes the entire contiguous forest stand with similar height and canopy closure. The forest stand surrounding the (suitable) nest tree provides protection from predators and climatic factors.

On a landscape basis, the presence of late-successional, mature, and old-growth forests with substantial canopy closure and canopy height of at least one-half the site-potential tree height also contribute to the conservation of the marbled murrelet, even if they do not contain potintial nest trees. The site-potential tree height is the average maximum height possible for a tree given the local growing conditions.

APPENDIX H
SPOTTED OWL HABITAT ASSESSMENT

In assessing spotted owl habitat for the Main Salmon Analysis Area, three points became obvious. First, the amount of late-mature and old-growth habitat within mapped Late-Successional Reserve (LSR) is less than what the area can support. Secondly, all known owl activity centers are located outside of the mapped LSRs. Lastly, the amount of dispersal habitat outside of LSRs is not evenly distributed and is less than adequate to ensure dispersal between large LSRs. The occurrence of stand replacing fires over the past few decades in combination with subsequent salvage harvest has resulted in a loss, and consequently and uneven distribution of late seral forested habitat.

There are 3,830 acres of mapped LSR within the analysis area. They consist of three parcels, which when considered connected to one another by the Marble Mountain Wilderness, constitute a 57,000 acre LSR. Approximately 22,000 acres of this "large LSR" currently provide forested habitat suitable for spotted owls. Out of the 3,830 acres of mapped LSR which occur within the analysis area, approximately 1,600 acres currently consist of late-mature and old-growth forest which is suitable for spotted owl nesting, roosting, and foraging. Based on site class, topography, and existing fire behavior potential, the LSRs are capable of providing an estimated 2,200 to 2,700 acres of late-mature and old-growth forest habitat. An assessment of the distribution of late-mature and old-growth forested habitats within the analysis areas shows that the largest and most contiguous stands occurs outside of mapped LSRs, in Somes, Monte, Duncan, and Butler Creeks.

The Management direction and land allocations in the *ROD* are intended to constitute the Forest Service contribution to the recovery of the Northern spotted owl. One aspect of the recovery plan is maintenance of a stable number of breeding pairs of owls over time. Four spotted owl activity centers (three pairs and one single) occur within the analysis area in Somes, Monte, Butler, and Duncan Creeks. They occur outside of the mapped LSRs. Few surveys have been conducted within the mapped LSRs of the analysis area, although given the current habitat conditions, there is a low likelihood that they are occupied. The mapped LSRs within Main Salmon are part of a large Critical Habitat Area (CHA) designated by the U.S. Fish and Wildlife Service (FWS). In the development of recovery goals for the Northern spotted owl, FWS calculated pair goals for most Critical Habitat Areas. The unit which the LSRs are a part of currently contains 18 known pairs out of a goal of 40 pairs. Much of the unit has not been surveyed. There are two large LSRs/CHAs in close proximity to the analysis area. One occurs approximately five miles to the southeast and the other occurs four miles to the west. Pair goals are nearly met in the unit to the southeast; pair goals have not been set for the unit to the west, though the number of known owl pairs is currently 27.

Movement of spotted owls between the large owl clusters is crucial to the long-term persistence and viability within these clusters. This is especially true for juveniles because of the random nature of their dispersal (USDI 1994). According to the ROD, it was assumed that dispersal habitat would be provided within a combination of land allocations, including riparian reserves, administratively withdrawn areas; and through management prescriptions within the matrix. In their Biological Opinion for *Alternative 9*, FWS stated that since previous spotted owl management strategies had relied on the 50-11-40 Rule as an approximation of the minimum forest conditions which would support adequate dispersal, it is useful as a comparison in assessing the dispersal strategy under *Alternative 9*.

An assessment of dispersal conditions within the Main Salmon Area reveals that several quarter townships are deficient:

Summary of 50-11-40 Modified* Analysis

1/4 TOWNSHIP	ACRES OF HABITAT	1/4 TOWNSHIP ACRES WITHIN WATER-SHED	PERCENT MEETING "11-40"
T10NR6E-NE	645	1,814	36
T10NR6E-SE	137	1,194	11
T10NR7E-NE	1,547	5,277	29
T10NR7E-NW	2,586	5,613	46
T10NR7E-SE	1,079	2,389	45
T10NR7E-SW	2,255	5,662	40
T10NR8E-NW	17	309	6
T11NR6E-NE	4,143	5,083	82
T11NR6E-NW	59	100	59
T11NR6E-SE	3,474	3,853	90
T11NR7E-NE	1,549	4,009	39
T11NR7E-NW	3,643	4,677	78
T11NR7E-SE	2,814	5,788	49
T11NR7E-SW	4,653	5,797	80
T11NR8E-NW	444	2,751	16
T11NR8E-SW	582	4,176	14
T12NR6E-NE	34	63	54
T12NR6E-SE	1,451	3,634	40
T12NR6E-SW	2	2	100
T40NR12W-N	510	1,919	27
T41NR12W-S	123	975	13
T9NR7E-NE	251	585	37
T9NR7E-NW	1,058	3,702	29
TOTALS	**33,056**	**69,374**	**48**

• NOTE: This assessment of 11-40 habitat included the entire analysis area. It was not applied to only the lands capable of supporting 11-40 habitat. This assessment will be supplemented with a 50-11-40 analysis applied only to capable lands.

Additionally, an assessment of dispersal habitat by land allocation reveals that although Riparian Reserves and Administratively Withdrawn Areas constitute 63% of the area outside of LSRs, Congressionally Designated, and private lands only 25% of land within that area currently provides dispersal habitat.

MAIN SALMON LMP MANAGEMENT AREAS

MANAGEMENT AREA	ACRES	PERCENT OF ANALYSIS AREA
(Private Land)	487	.7
Congressionally Designated	8,052	11.6
Falcon	888	1.3
Special Management	3,341	4.8
Mapped Riparian Reserve	12,619	18.2
Harsh Sites, Non-Capable	19,010	27.4
Scenic River	769	1.1
Late-Successional Reserve	3,830	5.5
Recreational River	799	1.2
Retention	902	1.3
Partial Retention	10,203	14.7
General Forest	8,424	12.2
TOTAL	**69,327**	

HABITAT TYPE*	CD	LSR	RR&AW	HARSH SITES	MATRIX
Nesting	1,301	474	2,045	871	3,365
Roosting	409	464	2,323	1,536	4,582
Foraging	205	642	3,660	4,785	4,747
Dispersal	93	---	337	674	331
Totals	**2,008 (3%)**	**1,580 (2%)**	**8,365 (12%)**	**7,866 (11%)**	**13,025 (19%)**

(% of Analysis Area; i.e., 3% of the total suitable habitat currently available within the analysis area occurs in Congressionally Designated lands).

CD = Wilderness LSR = Late-Successional Reserve AW = Administratively Withdrawn and Riparian Reserves RR = Riparian Reserve

* Habitat types are hierarchical and are listed in order of descending suitability; i.e., nesting habitat also provides roosting, foraging, and dispersal habitat.

There is a deficient amount of late-mature and old-growth habitat within the mapped LSRs of the analysis area. A more in depth assessment of dispersal habitat is needed in order to determine the appropriate amount and distribution to maintain within the analysis area. Lastly, information is lacking regarding pair occupancy within the larger CHA. This current situation, particularly the last point, places greater emphasis on the role of the known owl pairs in the Main Salmon analysis area. In the interim, the following management consideration is proposed to apply to the opportunities identified during the analysis:

> Until more information can be collected to assess pair occupancy within the large CHA (21/22), nesting/roosting/foraging habitat within the home ranges of the four activity centers should not be reduced below incidental take thresholds, established by FWS. This equates to 1,336 acres of suitable habitat within a 1.3 mile radius circle centered on the activity center.

Additionally, priority should be placed in improving habitat condition within the mapped LSRs (Management Opportunity #23) and in improving vegetative conditions in areas burned by the Yellow Fire (Management Opportunity #17).

APPENDIX I - FISH HABITAT DATA

"EXISTING CONDITIONS OF KEY PHYSICAL HABITAT PARAMETERS, BY REACH FOR THIS ANALYSIS AREA" data was taken by differing methods throughout the summers of 1989, 1990, 1993, and 1994. These data are the best available to compare to the habitat criteria displayed in *Chapter 4*, Table 18 - Fisheries Habitat Criteria.

Reaches begin at the mouth of a stream and continue upstream. Channel types are based on Rosgen channel classification (Rosgen 1994). Canopy closure is the percent surface shade on the stream. Surface fines represent the percent area of surface fines in pool tail-outs. The substrate compositions breakdowns are average percentages taken from all habitat types. Embeddedness data were gathered in runs and pool tailouts and averaged by reach. Both the instream and recruitable key large woody debris are a minimum size of 24" in diameter and 50' in length.

					PERCENT SUBSTRATE COMPOSITION							
STREAM	REACH	CHANNEL TYPE (ROSGEN)	PERCENT CANOPY CLOSURE	PERCENT SURFACE FINES	FINES	GRAVEL	COBBLE	BOULDER/ BED-ROCK	CHANNEL WIDTH/POOL	EMBEDDED-NESS	INSTREAM KLWM*/ 1000'	KLWM* RECRUITMENT/ 1000'
CRAPO	1	B2	80	30	28	12	18	42	6	44	0.9	4.3
	2	A1	78	27	17	9	17	57	6	66	0.9	4.0
	3	B2	72	16	30	10	20	40	7	45	2.1	15.2
	4	B1	24	21	20	4	19	57	5	38	0	7.3
	5	B5	32	10	20	5	23	52	9	35	1.2	5.2
	6	G5	75	24	36	7	21	36	18	N/A	0	6.4
	7	A2	N/A	23	32	6	25	38	7	N/A	0	9.7
NORDHEIMER	1	G3	58	3	1	14	47	38	7	0	0	0.6
	2	A3	59	2	4	25	35	37	6	0	0	1.5
	3	A2	52	15	4	22	35	39	7	11	0.3	1.2
	4	A1	70	32	10	24	27	39	6	13	1.5	2.1
	5	A2	70	4	2	26	31	41	8	35	3.3	1.2
SOMES	1	A3	71	N/A	11	20	35	34	4	22	2.0	14.0
BUTLER	1	A3	36	N/A	2	7	53	38	11	15	5.0	5.0
MAIN STEM SALMON	1	C3	3	N/A	AVE 16	AVE 18	43	23	3	7	0.13	N/A
	2	B1	1	N/A	AVE 16	AVE 18	--	--	3	17	0.22	N/A
	3	C3	1	N/A	AVE 16	AVE 18	--	--	3	10	0.13	N/A

*Key Large Woody Material

TEMPERATURE CRITERIA

From 1992 to the present, continuous recording temperature devices were placed in the mainstem Salmon near the mouth of Wooley Creek and in Somes Creek. The mainstem of Salmon average seven day maximum temperature was 76°F in 1992, 71°F in 1993, and 81°F in 1994. Somes Creek's average seven day maximum temperature was 64°F in 1992, 58°F in 1993, and 64°F in 1994. Thermographs were also placed in Nordheimer and Crapo Creeks for selected short periods of time. Nordheimer Creek had an instantaneous peak temperature of 70°F in 1984 and Crapo Creek had an instantaneous peak of 63°F in 1993.

APPENDIX J
LMP FEEDBACK

The following comments were developed throughout the planning process for the Main Salmon Ecosystem Analysis. Some recommendations call for changes to the Plan Standards and Guidelines, others require change to the LMP database (maps).

1- The Management Areas of Partial Retention and General Forest were evaluated for helicopter logging access using existing roads; no new road construction is allowed in released roadless areas within key watersheds. Based on current economics, several areas(3,424 acres total-both management areas) were identified as not accessible for logging - creating a false expectation for timber outputs.
- **Recommendation:** As other analysis areas are similarly reviewed, and if other inaccessible areas are identified, the cumulative effects from a lack of timber harvest on these lands may require a revision of the present land allocation.

2- The LMP Preferred Alternative Map for the analysis area includes a Retention VQO area. When using the actual VQO data layer, no Retention areas exist in the analysis area.
- **Recommendation:** A refinement of the LMP database is required.

3- Areas identified as Harsh Sites on the Preferred Alternative Map may in fact be capable lands which are also accessible. These areas were also evaluated for helicopter logging access(as #1 above). Based on current economics, several areas are both capable and accessible.
- **Recommendation:** As the harsh site areas are no longer considered part of the viability for late-successional species, these areas(capable, accessible) should be considered for return to the timber base.

4- The analysis team (both FEAT & District personnel) questioned the appropriateness of FORPLAN modeling Partial Retention/Recreational Rivers the same as General Forest for expected timber yields.
- **Recommendation:** The general consensus of the analysis team is the expected yields are too high for PR/ Rec. Rivers.

5- Forest Standard and Guideline MA5-61 incorrectly states the nest protection area may be 1/2 mile in diameter around the site.
- **Recommendation:** It should be corrected to read 1/2 radius.

6- The validity, and hence appropriateness of using Sedell's criteria for instream wood and recruitment in the analysis area is questioned.
- **Recommendation:** A Forest-wide evaluation should be conducted to validate this information.

7- There were three "Areas with Watershed Concerns" identified in the LMP for the Main Salmon area; they are: Merrill, Tom Payne, and Crapo Creeks. Analysis conducted during this process indicates that sediment levels are below thresholds(for areas with watershed concerns) for Merrill Creek; and still above thresholds for both Tom Payne and Crapo Creeks.
- **Recommendation:** The areas with watershed concerns list should be updated as follows: remove Merrill Creek and retain Tom Payne and Crapo Creeks.

8- The "Potential Wildfire Effects" matrix(LMP Table B-6, page B-16) is used for treatment of activity fuels. Fire Risk weighs heavily in this matrix. This means that some areas of high fuel loading and/or High Fire Behavior Potential (Hazard) will not be identified as needing treatment if they are in a Low-Risk Area.
- **Recommendation:** Change the matrix for determining Potential Wildfire Effects to allow risk to influence decisions for fuels treatment in areas of High-Risk, but not in areas of Moderate or Low-Risk. Areas in Moderate or Low-Risk will be influenced solely on the Fire Behavior Potential in those areas. For management of long range desired conditions, risk should not be considered as heavily as it is in the current matrix.

Here is a comparison of the current matrix and the proposed change.

CURRENT POTENTIAL WILDFIRE EFFECTS MATRIX

FIRE BEHAVIOR POTENTIAL	LOW-RISK	MODERATE-RISK	HIGH-RISK
Low	1	1	2
Moderate	1	2	3
High	2	3	4

The above matrix shows a reduction in Fire Behavior Potential (Hazard) when Moderate and High Fire Behavior Potential are in a Low-Risk Area. In a Low-Risk Area, a Moderate Likelihood of Losing a Stand (Value=2) is the highest level that can be reached using this matrix. This gives a false sense of security to these Low-Risk areas and will allow an unreasonable amount of High Fire Behavior Potential (fuel) to be accumulated.

PROPOSED CHANGE TO THE WILDFIRE SUSCEPTIBILITY MATRIX

FIRE BEHAVIOR POTENTIAL	LOW-RISK	MODERATE-RISK	HIGH-RISK
Low	1	1	2
Moderate	2	2	3
High	3	3	4

This matrix does not allow a Low-Risk Area to reduce the Fire Behavior Potential. This matrix will indicate the need to treat fuels when there is more than 25% of the project area in a High Likelihood.

Definitions for the numbers.

1/ Low probability of a stand being lost to wildfire
2/ Moderate probability of a stand being lost to wildfire
3/ High or very probable chance of a losing stand to wildfire
4/ Very high or quite probable that stand will be lost to wildfire.

PROPOSED STANDARDS FOR TREATMENT OF ACTIVITY FUELS

FIRE EFFECTS CLASS	DESCRIPTION	MANAGEMENT ACTION
4	Very high likelihood stand will be lost to a fire.	Treat fuels, reduce to acceptable lower levels.
3	High likelihood stand will be lost to a fire	After treatment, 25% of the area may be permited to be at this level.
2	Moderate likelihood stand will be lost to a fire.	After treatment, 75% of the area may be permitted to be at this level.
1	Low likelihood stand will be lost to a fire.	No action is required at this level.

APPENDIX K
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.

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 main salmon 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 are listed below:

EVC LEVELS	ACREAGE	PERCENT OF WATERSHED
Untouched	55,900	81
Unnoticed	0	0
Minor Disturbance	3,200	5
Disturbance	5,200	7
Major Disturbance	<100	0
Drastic Disturbance	5,000	7
TOTAL	69,400	100

VISUAL QUALITY OBJECTIVES (VQOs)

These objectives are established and adopted in the Forest's LMP. Data was taken directly from the LMP data base. The objectives identify acceptable levels of visual change to the landscape. The acreage totals for the main salmon watershed are listed below:

VISUAL QUALITY OBJECTIVES	
NATURAL OR NATURAL-APPEARING	ACRES
Preservation	8,100
Retention	2,400
Partial Retention	39,700
HUMAN DOMINATED	ACRES
Modification	15,900
Maximum Modification	2,800

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. The following table 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 table below). 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 & 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 5 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 10,257 acres. Most of the acres are in the Partial Retention VQO areas.

VQO	DELTA SCORE	ACRES
Preservation	2	0
•	3	2
•	4	2
TOTAL	--	4
Retention	1	248
•	2	703
•	4	12
TOTAL	--	961
Partial Retention	1	4,259
•	2	73
•	3	3,814
TOTAL	--	8,146
Modification	2	907
TOTAL	--	907
Maximum Modification	1	239
TOTAL	--	239
GRAND TOTAL	--	10,257

APPENDIX L
FUELS TREATMENT & FIRE OPPORTUNITIES

Fuels Treatment and Fire Opportunities are identified in *Chapter 5 Management Opportunities*. This paper documents in more detail, some of these

opportunities, and explains how they were identified.

The Probability of Losing a Stand is identified on the Fire Behavior Potential Map (Figure 13). This map highlights the Merrill Creek drainage, Monte Creek, the lower portions of Tom Payne, and Butler Creeks, and much of the Salmon River corridor as having a "Very High Likelihood of Stand Being Lost to Fire".

With much of the river corridor being identified as "Very High",and considering the topography of the area, it is likely that large destructive fires will be initiated from the river corridor. These conditions present opportunities for managers. The "Very High Likelihood that a Stand Will be Lost to a Fire", per Forest direction, is not to be allowed.

Risk weighs heavily on the likelihood of losing stands. A continued effective prevention program is essential for reducing risk.

Throughout this analysis, it has been obvious that fire has played and will continue to play an active role in the watershed. This presents many opportunities throughout the watershed for fuels reduction. Opportunities for commercial and noncommercial thinning, may be identified. Prescribed fire should be considered along with or independent of these treatments. It should also be considered for use prior and post of other fuels treatments.

Areas considered by the Main Salmon Watershed Analysis Team to be "Priorities" are Late-Successional Reserves (LSRs) within the analysis area, sensitive soils, and habitat for Threatened and Endangered (T&E) species.

By overlaying these priorities with the Fire Behavior Potential layer, priority areas may be identified. Strategies should be developed for managing these stands in conditions that are resilient to wildfire. Since these are priorities that need to be managed for a long time period, Fire Behavior Potential should be the focus. Risk should not be figured into the long-term management of these areas, since in this watershed, it is a given that fires are going to occur and effect all of the areas where these priorities exist.

Other "Management Considerations" were also identified by the team. These are areas where high quality fish habitat is known to exist, cultural sites have been identified, private lands are located, facilities are located, plantations have been established, sensitive plants have been identified, riparian areas occur, and areas known to have high fuel accumulations.

Some areas where high quality fish habitat occurs are also in areas identified as having High Fire Behavior Potential. Strategies can be developed to reduce fuel loadings while still maintaining the stands and protecting the habitat. By reducing the amount of available fuel in these stands the Fire Behavior Potential will be reduced.

Private lands and facilities need to be considerations, in that they should be protected from wildfire and that they are areas where fire starts may be generated. For these reasons, strategies should be developed for reducing fuels in and around these areas.

Considerable investment has been made in establishing plantations within the watershed. Based on the fire regime, some means of protecting these investments must be implemented in order to realize any future benefits from these stands and for protection of adjoining stands. Due to the size and location of most of these plantations, strategies should include considerations of both fire entering from outside of the plantations and fire initiated from within the plantations.

The ability to contain large fires within natural barriers (i.e., within side drainages) can be increased by reducing fuel loadings on and near ridge tops, on and around old fire lines, and along roads. By implementing strategies for reducing fuels in these areas, fire suppression efforts will be greatly enhanced. Also, as these strategies are implemented prescribed fire can be extended further into interior areas. With the fire occurrence and behavior of fire in this watershed, it is recommended that a plan be developed that would help fire suppression efforts and protect priority areas in this watershed. A program similar to the Defensible Fuel Profile Zones (DFPZs) developed on the Lassen National Forest, would fit well in this watershed.

Reducing fuel loadings in areas of heavy loadings that border Riparian Reserves, can help to protect the Riparian Reserves from encroachment of a high intensity fire. Strategies should also be developed to reduce the High Fire Behavior Potential in and around Riparian Reserves on south aspects.

The more exposed aspects, south and west, tend to have high fire behavior. These aspects were historically burned more often than other areas keeping their fuel loadings very low. Since these aspects historically were maintained with low fuel loadings, they are quick to accumulate beyond their historical range of fuel loading, which increases the intensities on these slopes. This may present an opportunity to bring these areas back into their historical range of fuel loadings.

The Fire Regime for the watershed has moved from a frequent, low to moderate intensity regime, to a less frequent, moderate to high intensity regime. This has changed the vegetation and fuel conditions throughout the watershed. The focus of this analysis has been on those areas with the highest Fire Behavior Potential, but it should be realized that the Fire Behavior Potential has increased throughout the watershed from what is was in the past fire regime. Opportunities exist to reduce fuels that will maintain or create stands resilient to fire throughout the watershed. Areas with the highest Fire Behavior Potential are the focus, but treatment of areas with lower potential may be necessary prior to treatment of the higher potential areas. The emphasis should be in the development of projects that provide fuels treatment.

Nordheimer Creek drainage burned in the Hog Fire (1977). Salvage logging with and without fuels treatment occurred after the fire. Areas of high fuel loading have been identified within the drainage, most of the area is unassessed, although some areas in the drainage are identified as having High Fire Behavior Potential. Remnant stands of conifers and hardwoods remain in the drainage. An assessment of the stands and fuels conditions is needed. A Fuels and Vegetation Management Plan should be developed for the drainage.

The cost of fire suppression is high. Charges for the Dillon Fire, (1994) a fire on the Klamath National Forest near this watershed were $19,470,000. Total acreage for this fire was 29,000. This equates to $670 per acre. The Specimen Fire, (1994) also a Klamath National Forest fire, on the Salmon River Ranger District in an adjoining watershed, had suppression costs of $3,289,000 and was 7,000 acres. This equates to $470 per acre. Typically, costs per acre are less on larger fires. The China Creek Fire (1992) mentioned in *Chapter 3*, was 2.5 acres, suppression costs were $8,500, this equates to $3400 per acre. Although this is a high per acre cost, this fire had the potential to become much larger, incurring much more resource and suppression costs. All three of fires were ignited by lightning. The cost of prescribed underburning for the Klamath is running at around $250 per acre. At this time, the prescribed fire program on the Klamath is small. As the size of the program increases, the cost per acre is expected to decrease.

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 the analysis area will be conducted consistent with the *ROD* Standards and Guidelines as discussed in *Section E, Implementation*. 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 *Klamath National Forest Land Management Plan* will provide the specific monitoring questions to be addressed at the watershed scale. Additional monitoring questions may result from updates and revisions of the ecosystem analysis.

MONITORING SPECIFIC TO LAND ALLOCATIONS

Late-Successional Reserves

Key items to monitor:

- All management activities are consistent with standards and guidelines and REO review, when required.
- Consistency of management activities with LSR Assessment. Update LSR Assessment as new information becomes available.
- To see if desired habitat conditions for late-successional forest species are maintained where adequate and restored where inadequate.
- Assess the size, location, spatial distribution, species composition and development of late-successional habitats.

•Species presence - abundance and diversity of species associated with late-successional reserves.
•Silvicultural treatments benefit late-successional conditions.
•Fire resiliency of stands both within and outside of LSRs.

Riparian Reserves and Aquatic Ecosystems
Key items to monitor:
•To see if desired habitat conditions for at-risk fish stocks are maintained where adequate and restored where inadequate.
a. Pool frequency and quality
b. Percent fine sediment
c. Course Woody Material (size & quantity)
d. Water Temperature
e. Width-to-depth ratio
f. Bank stability and lower bank angle
•Management activities in Riparian Reserves consistent with standards and guidelines.
•Determine effectiveness of restoration projects at achieving aquatic conservation strategy goals.

Matrix
Key items to monitor:
•Validate assumptions used in Forest Plan for ASQ expectations.
•Validate LMP predictions of impacts to resource programs including visual, wildlife, and earth science.
•Monitor costs associated with activities implemented and compare with those identified in the Forest Plan.

RESOURCE MONITORING
Fisheries
Key Items to Monitor:
•Effectiveness of restoration projects that may occur.
•Habitat areas identified as being in excellent condition. Monitor for any changes from this current condition.

Geologic Elements
Key Items to Monitor:
•Effectiveness of Monte Creek Slide stabilization.
•Updates to Forest Plan based on soil productivity assessment of Matrix and Harsh Site designations.
•Assess compliance with water quality BMPs.

Wildlife
Key Items to Monitor:
•Peregrine Falcon: Assessment of potential impacts of recreational activities to nesting success.
•Goshawk: Determination of nesting site within watershed area.
•Northern Spotted Owl: Determination of # of pairs within the LSRs. Trends in population levels.
•Identification of new locations.
•Determine occupancy and suitable habitat for TES species. Track trends and status over time.

Visual Management
Key Items to Monitor:
•Effectiveness of visual restoration projects.

Vegetation Management
Key Items to Monitor:
•The ability to sustain a long-term timber program on Matrix lands.
•Assessment of lands not suited for commodity products to determine if they have become suitable for timber management. Also, assess for lands currently identified as capable for timber management to determine actual suitability.

Fire Management
Key Items to Monitor:
•Effectiveness of prescribed fire to maintain natural processes.
•Effectiveness of fuel reduction program and fire strategy plans and their ability to promote resiliency and sustainability to the ecosystem.
•Effectiveness of fuel reduction program and fire strategy plans in reducing the costs of suppression efforts.
•Assess to see if fuel reduction activities are reducing the current fire behavior potential.

Range
Key Items to Monitor:
•Determine vegetative ecological condition and trends of the rangelands within the watershed. Of particular importance is the Crapo Meadows and Morehouse Meadows area.
•Assess impacts to other resources, primarily those associated with riparian values.
•Determine compliance with Forest Plan standards and guidelines for forage utilization and riparian health.

Botany
Key Items to Monitor:
•Impacts to *Howell's tauschia* from recreational use along the Chimney Rock trail have been corrected.

Lands Program Management
Key Items to Monitor:
•Conduct periodic inspections and administration of special use authorizations to determine if permits are in compliance with provisions as stipulated with their issuance.
•Continue to determine and collect appropriate use fees on an annual or term basis.
•Annual review of Lands program to include land ownership, adjustments, and property line location to determine advocacy of those items identified in the FLMP, LANDS.

Minerals Management
Key Items to Monitor:
•Monitor and inspect mining operations to assure compliance with approved Plan of Operations.
•Administer authorized Plan of Operations in accordance with provisions of the Plan (POO) in response to *36 CFR 228* Regulations.
•Monitor recreational panning, sluicing, dredging to determine that activities do not conflict with established management objectives or the rights of mining claimants.

Other Concerns
Key Items to Monitor:
•Management activities occurring within the various management areas are designed with desired conditions in mind.
•Population levels and trends for species identified in the C3 (table 4-3 in FLMP) list are being tracked.
•Sustainable levels of timber and non-timber resources are available and being produced.
  a. Timber harvest levels
  b. Recreation opportunities
  c. Scenic quality

American Indian
Key Items to Monitor:
•Sites of religious and cultural heritage adequately protected. Effective coordination and liaison to assure protection of religious or cultural heritage sites is occurring.
•Access for use or collection of forest species, resources, and places important for cultural, subsistence, or economic reasons is adequate.

CONCLUSION
Long-term systematic monitoring will be necessary to provide reference points for effectiveness and validation monitoring. Cooperative plans will be developed with inter-agency and research participation.

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MAP PACKET

The following figures are contained in the Map Packet:

Figure 5 - Base Map
Figure 6 - Geomorphic Terranes
Figure 7 - Vegetative Condition
Figure 13 - Fire Behavior Potential
Figure 17 - LMP Management Direction
Figure 20 - Management Opportunities: Human Social Dimension (1 of 2)
Figure 21 - Management Opportunities: Human Social Dimension (2 of 2)
Figure 22 - Management Opportunities: Terrestrial Ecosystem
Figure 23 - Management Opportunities: Aquatic Ecosystem

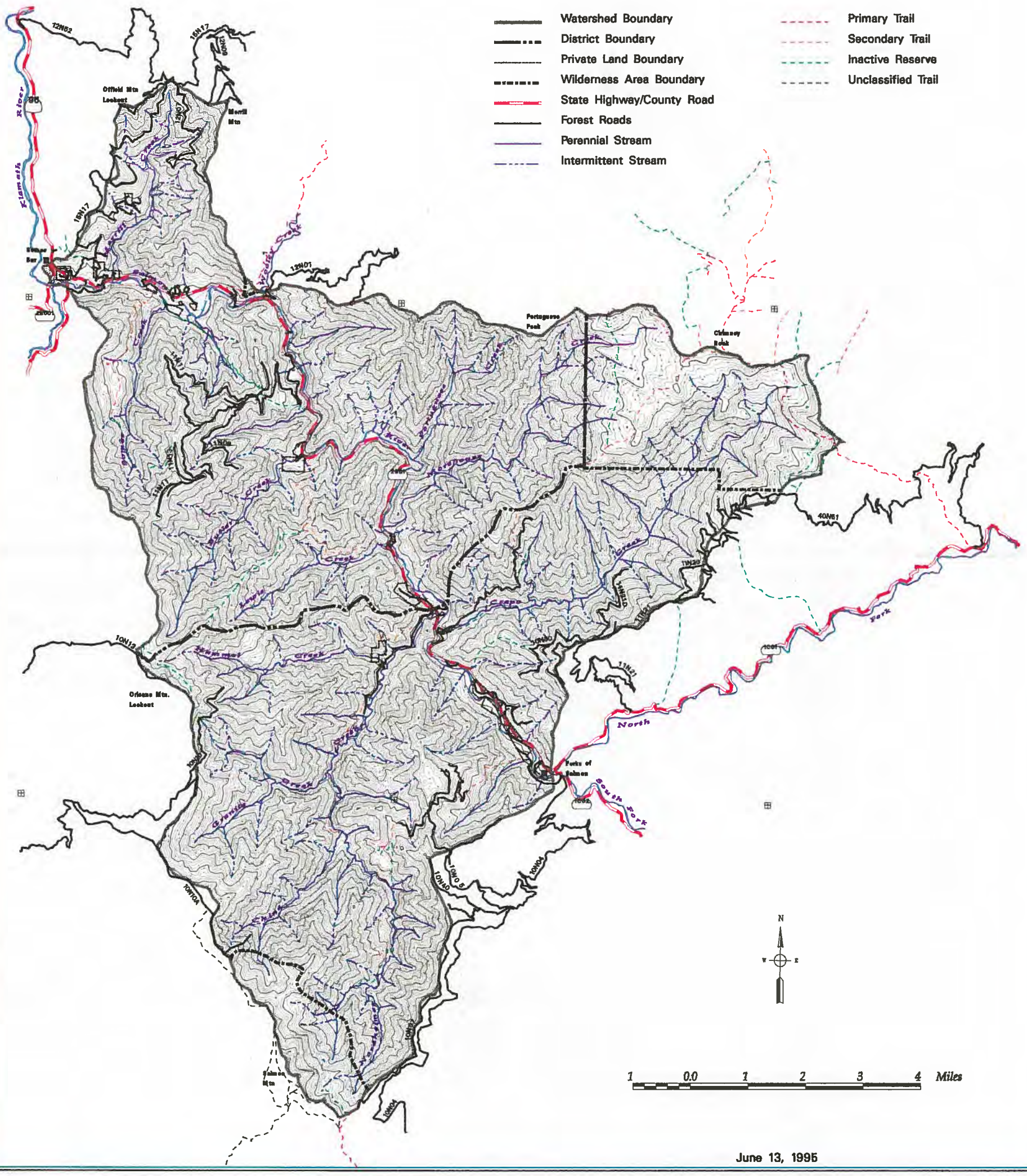
Figure 5 *Base Map*

Main Salmon Watershed

Base Map

Klamath National Forest

FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE



June 13, 1995

Figure 6 Geomorphic Terranes

Main Salmon Watershed
Geomorphic Terranes

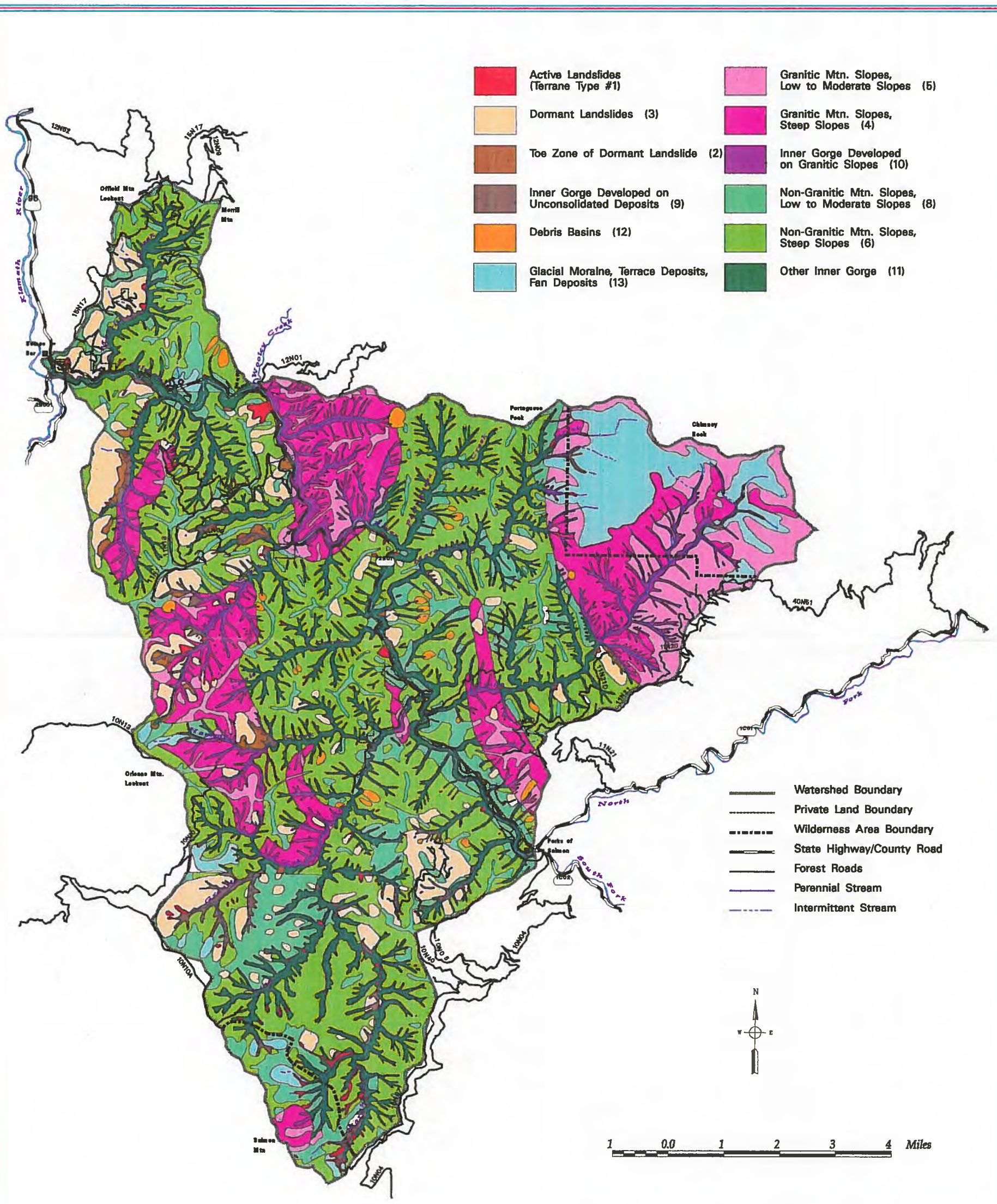


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Figure 7 *Vegetative Condition*

Main Salmon Watershed

Vegetative Condition

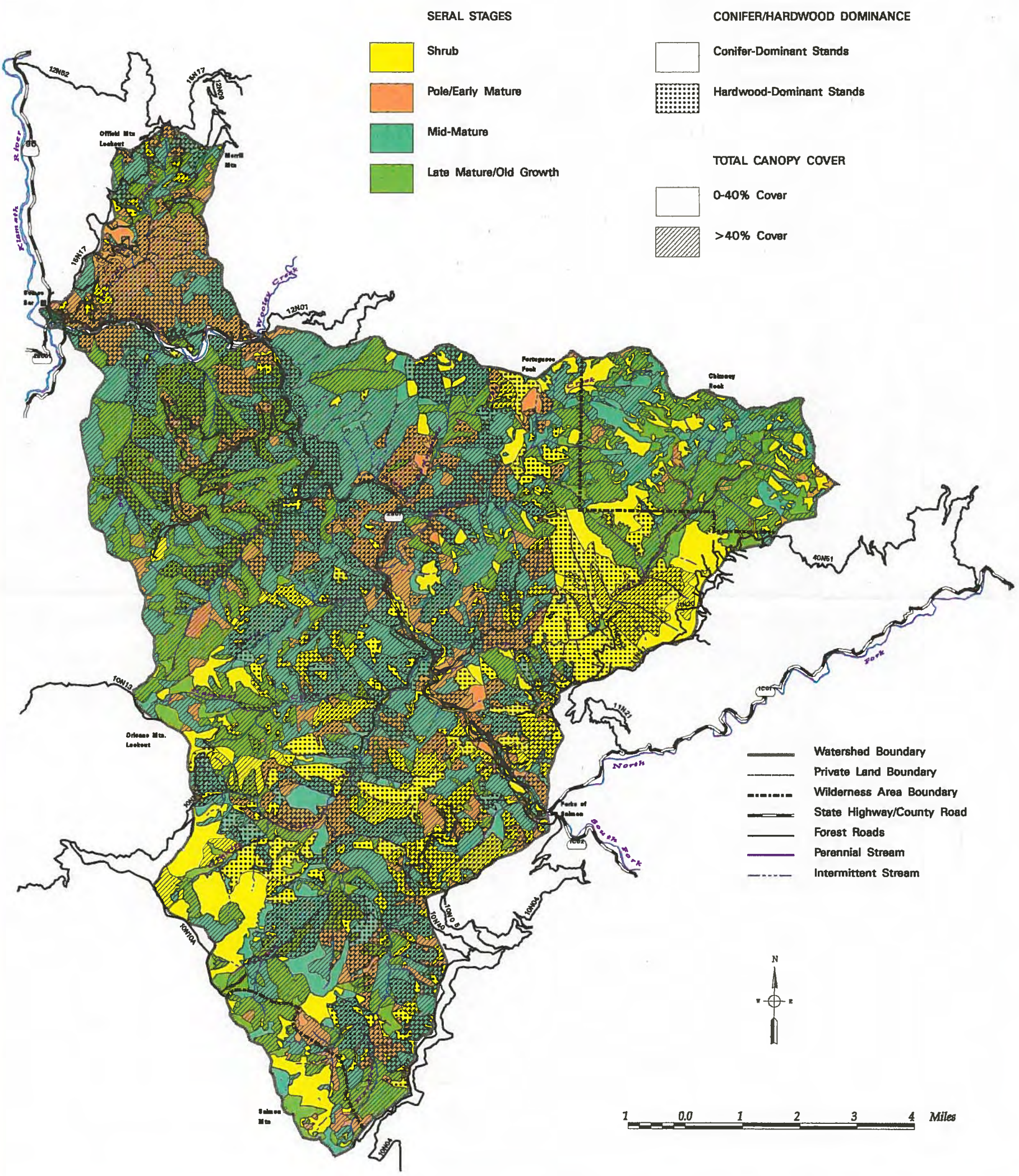

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Figure 13 *Fire Behavior Potential*

Main Salmon Watershed
Fire Behavior Potential

June 07, 1995

Figure 17 LMP Preferred Alternative

Main Salmon Watershed
LMP Management Direction

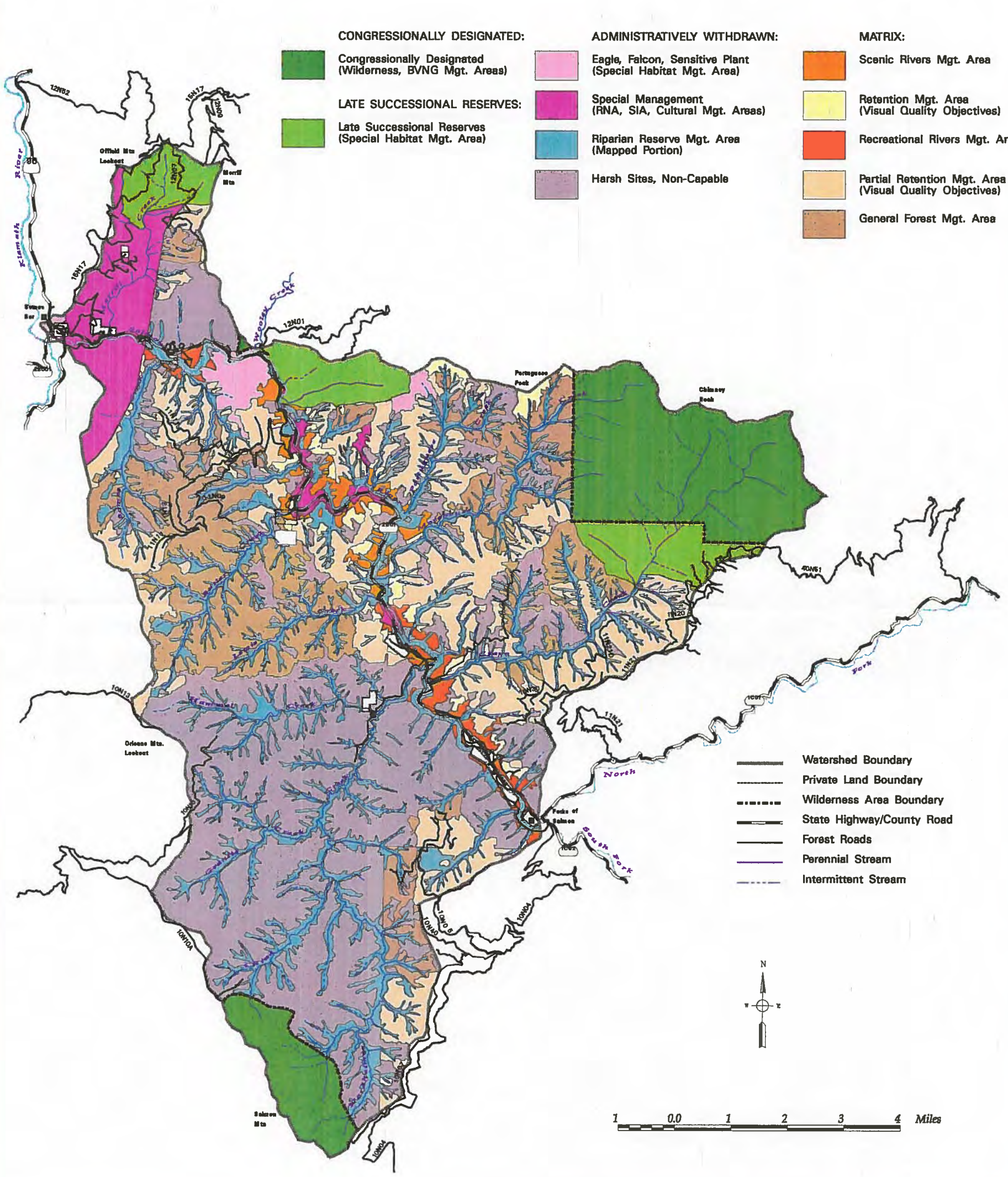

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Figure 20 *Management Opportunities: Human/Social Dimension (1 of 2)*

Main Salmon Watershed
Management Opportunities:
Human/Social Dimension (1 of 2)

Enhance Acorn-Bearing Trees (#6)

Enhance Mushroom-Producing Area (#6)

Rehabilitate Landscapes Not Currently Meeting Desired Visual Quality Objectives (#9)

Facilities Improvement Opportunities (Hippo Rock & Nordheimer Campground) (#8)

Land Exchange Opportunity (#14)

Note: This map does not display all opportunities identified. See the Management Opportunities Table for a complete listing.

Number shown in parentheses after an opportunity corresponds with the number used in the Management Opportunity Tables in document.

Watershed Boundary
Private Land Boundary
Wilderness Area Boundary
State Highway/County Road
Forest Roads
Perennial Stream
Intermittent Stream

N
W E

1 0.0 1 2 3 4 Miles

June 07, 1995

Figure 21 Management Opportunities: Human/Social Dimension (2 of 2)

Main Salmon Watershed
Management Opportunities:
Human/Social Dimension (2 of 2)

Timber Harvest Opportunities (#10)
(Partial Retention & General Forest Management Areas)

- General Forest Feasibility Class A
- General Forest Feasibility Class B
- Partial Retention Feasibility Class A
- Partial Retention Feasibility Class B
- ⊕ Potential Helicopter Landing

Note: This map does not display all opportunities identified. See the Management Opportunities Table for a complete listing.

Number shown in parentheses after an opportunity corresponds with the number used in the Management Opportunity Tables in document.

Helicopter Economic Feasibility

A. Logging Cost:
Merchantable Conifer - $300/M
Merchantable Hardwood - $60/Ton

Logging Cost w/ Whole-Tree Yarding
Merchantable Conifer - $420/M
Merchantable Hardwood - $85/Ton

B. Logging Cost:
Merchantable Conifer - $450/M
Merchantable Hardwood - $90/Ton

Logging Cost w/ Whole-Tree Yarding
Merchantable Conifer - $630/M
Merchantable Hardwood - $126/Ton

Note: Whole-tree yarding consists of yarding merchantable log segments and tops with limbs attached. Requires a minimum of 3 drop zones per landing. Drop zones should be 80 feet in diameter.

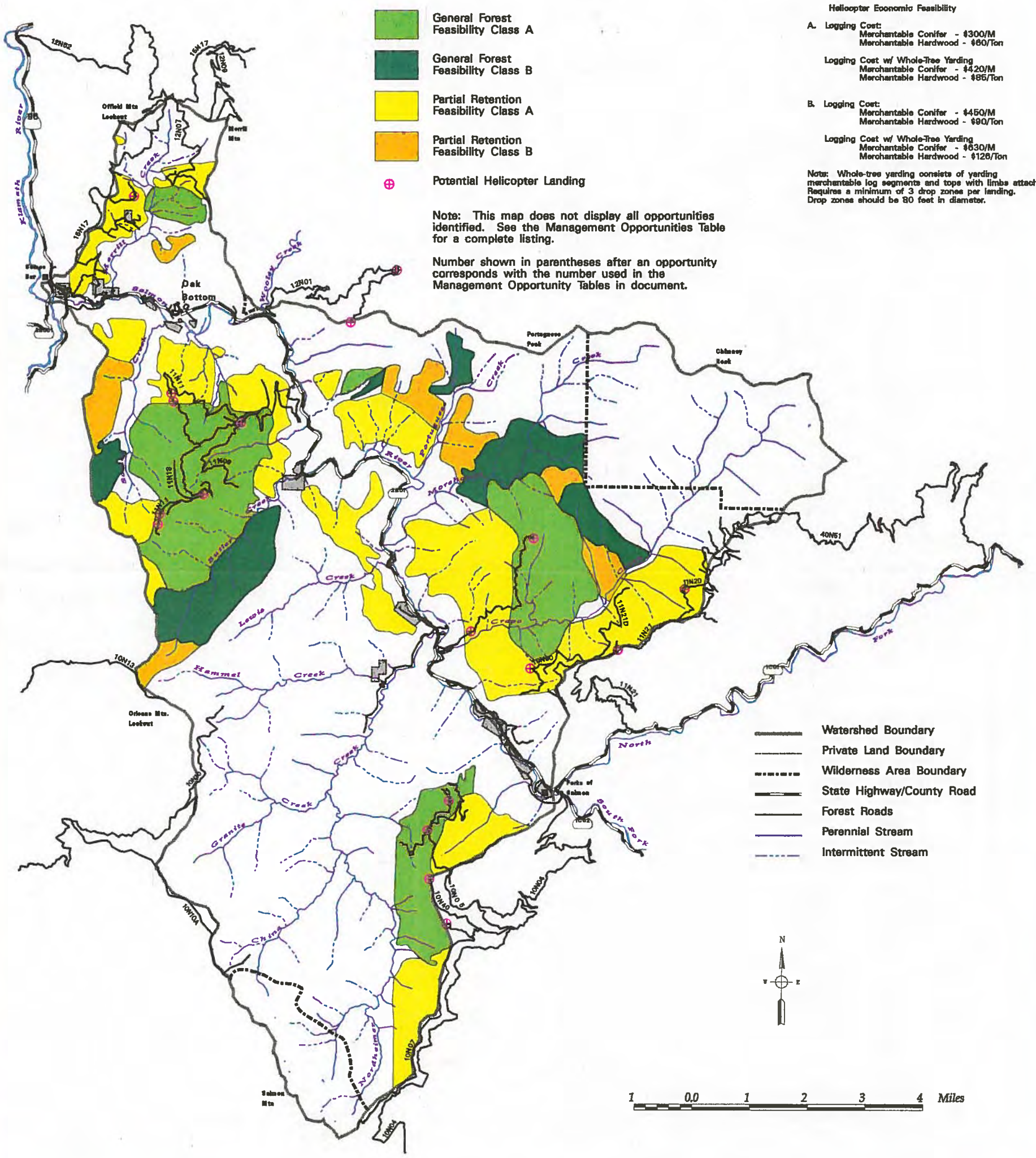

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Figure 22 Management Opportunities: Terrestrial Ecosystem

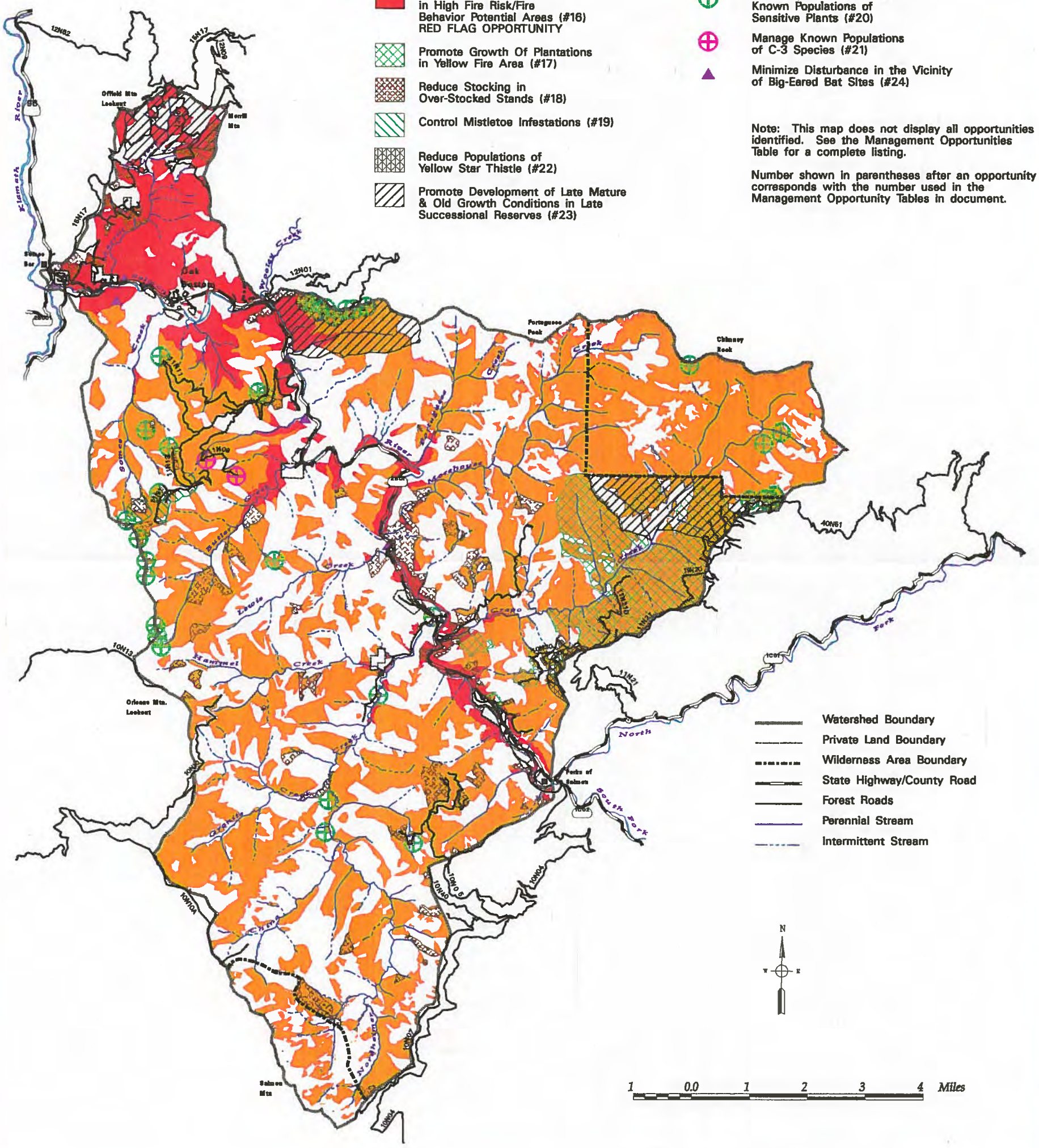
Main Salmon Watershed
Management Opportunities:
Terrestrial Ecosystem

Klamath National Forest

- Reduce High Fire Behavior Potential (#15) RED FLAG OPPORTUNITY
- Reduce Number of Starts in High Fire Risk/Fire Behavior Potential Areas (#16) RED FLAG OPPORTUNITY
- Promote Growth Of Plantations in Yellow Fire Area (#17)
- Reduce Stocking in Over-Stocked Stands (#18)
- Control Mistletoe Infestations (#19)
- Reduce Populations of Yellow Star Thistle (#22)
- Promote Development of Late Mature & Old Growth Conditions in Late Successional Reserves (#23)
- Maintain, Protect & Enhance Known Populations of Sensitive Plants (#20)
- Manage Known Populations of C-3 Species (#21)
- Minimize Disturbance in the Vicinity of Big-Eared Bat Sites (#24)

Note: This map does not display all opportunities identified. See the Management Opportunities Table for a complete listing.

Number shown in parentheses after an opportunity corresponds with the number used in the Management Opportunity Tables in document.

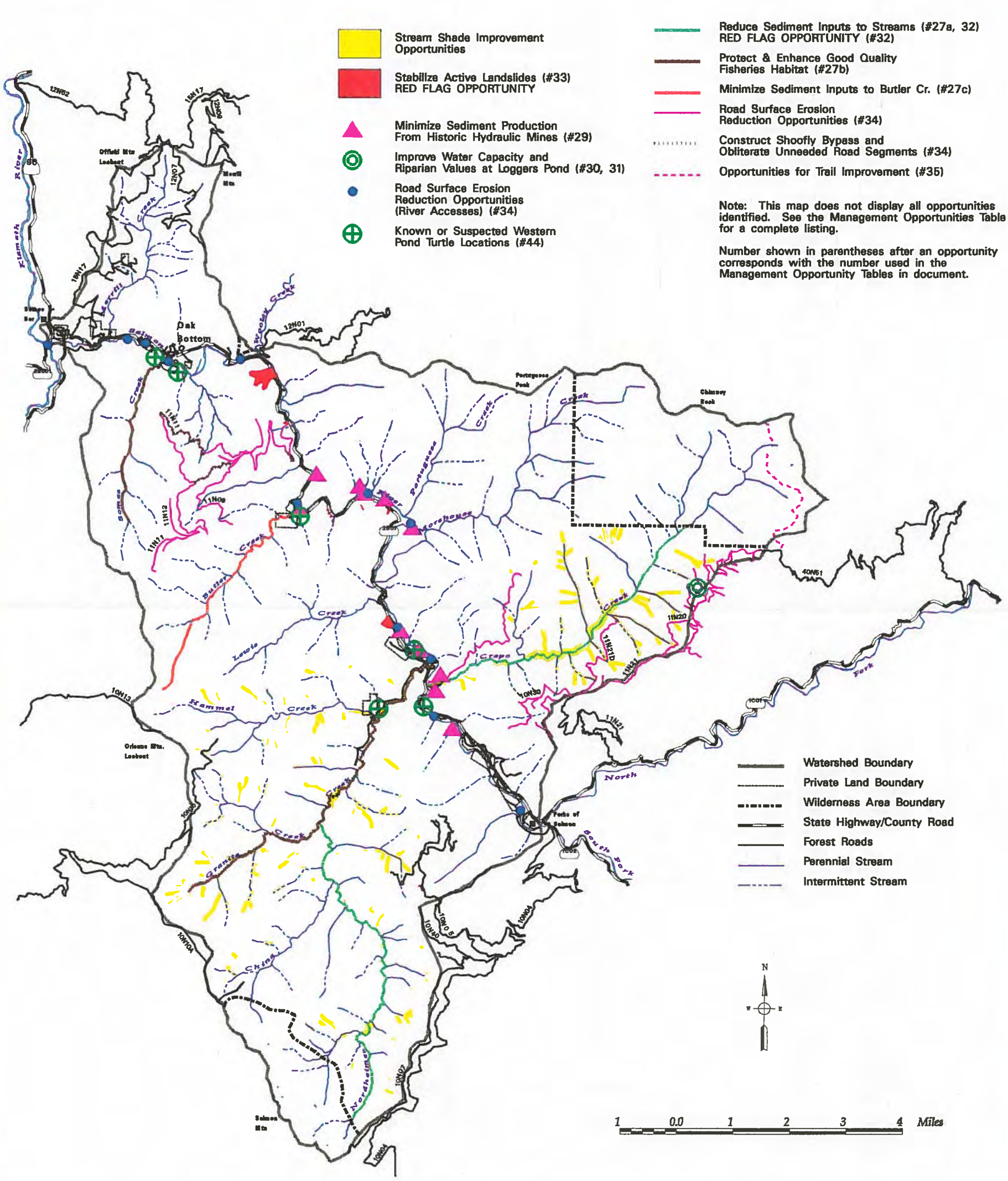


June 07, 1995

Figure 23 Management Opportunities: Aquatic Ecosystem

Main Salmon Watershed
Management Opportunities:
Aquatic Ecosystem

Klamath National Forest



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