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Forest Service

Klamath
National
Forest

Ishi-Pishi / Ukonom Ecosystem Analysis

Ukonom & Happy Camp
Ranger Districts
Klamath National Forest
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Acknowledgments

ISHI-PISHI / UKONOM *Ecosystem Analysis*

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Introduction

ANALYSIS OVERVIEW

Watershed analysis is ecosystem analysis at the watershed scale; it is both an analysis and an information gathering process. The purpose 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 within. That is the purpose of this analysis of the Ishi-Pishi/Ukonom watershed (refer to Figure 0-1 Klamath Basin and Ishi-Pishi/Ukonom Ecosystem Analysis Vicinity Map, located on Page 0-3).

This analysis focuses on the issues and Key Questions specifically identified for this watershed. They are assessed in terms of biological, physical, and social importance. Some aspects may include beneficial uses, vegetative patterns and distribution, wind, fire, wildlife, migration routes, dispersal habitat, human use patterns, and 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 Forest Land and Resource Management Plan (*Forest Plan*), current policy, and other applicable State and Federal regulations.

The *Forest Plan* was updated in 1994 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* (*FSEIS*), also known as the *President's Northwest Forest Plan*. There are ten different Management Areas contained within the Ishi-Pishi/Ukonom analysis area: Research Natural Area, Wilderness, Wild and Scenic River, Late-Successional Reserves (LSRs) and Other Special Habitat, Special Interest Area, Cultural Area, Riparian Reserve, Retention, Partial Retention VQO, and General Forest. Critical Habitat Units (CHUs) and Released Roadless Areas are also found in the analysis area.

PROCESS AND DOCUMENT ORGANIZATION

The analysis was conducted by a core Forest Ecosystem Analysis Team (FEAT) and an expanded team of District resource specialists. During the analysis phase, participation and involvement of other Federal agencies was encouraged.

Following is a summary of the six steps utilized in conducting ecosystem analysis:

Step 1 - Characterization
Step 2 - Issues and Key Questions
Step 3 - Current Conditions
Step 4 - Reference Conditions
Step 5 - Interpretation
Step 6 - Recommendations

Step 1 - Characterization: The purpose of this step is to place the watershed in context within the river basin, provinces, or a broader geographic area. It briefly describes the dominant physical, biological, and human dimension features, characteristics, and uses of the watershed.

Step 2 - Issues and Key Questions: This step identifies the variety of uses and values associated with the watershed. It focuses the analysis on key elements of the ecosystem that are most relevant to the management questions, human values, or resource conditions within the watershed. Also involved in this step is the formulation of analysis questions using the indicators most commonly used to measure or interpret these ecosystem elements.

Step 3 - Current Conditions: This step documents the current range, distribution, and conditions of the relevant ecosystem elements.

Step 4 - Reference Condition: Step 4 develops an historic reference for comparison with current conditions. This step explains how existing conditions from Step 3 have changed over time as the result of human influence and natural disturbances.

Step 5 - Interpretation: This step compares existing, historical, and reference conditions of specific landscape elements, and explains significant differences, similarities or trends, and their causes. Desired conditions for each issue are discussed.

Step 6 - Recommendations: This step identifies those management activities that could move the ecosystem towards management objectives or desired conditions, as appropriate. Management Opportunities specified in Step 6 are expressed in general terms; they identify what needs to be done and why, but not how. This step ultimately provides the purpose and need for implementation of individual projects designed to achieve desired conditions.

Appendices A through K are included in support of information and findings contained within the analysis and are as follows:

A - LMP Feedback
B - Cumulative Watershed Effects
C - Aquatic Habitat
D - EUI Defined
E - Fire and Fuels
F - Endangered Species Act and Other Species Considerations Questions and Answers
G - Numerical Listing of Roads and Their Status
H - Results of Roads Analyses
I - Mining
J - Vegetation
K - Timber Management Options

The final portion of this document is the Map Packet containing the majority of maps (Figures) referred to within the text of this analysis.

For ease of reading, common names for wildlife and plant species have been used throughout the document, for the most part.

As part of the process, an appendix was created for feedback to the *Forest Plan*, e.g., changes in land allocations, refinements to existing data layers, etc. Refer to Appendix A - LMP Feedback, for details specific to the analysis area. Reference to other appendices appear where appropriate throughout the document.

RELATIONSHIP TO OTHER ANALYSES AND PLANNING

As stated previously, this level of analysis occurs between the *Forest Plan* and project-level analysis. A more detailed assessment is necessary for *NEPA* sufficiency, therefore, individual project analyses will focus on site-specific issues and their potential effects.

The Ishi-Pishi/Ukonom Ecosystem Analysis is one of many completed analyses; see Figure 0-2 Completed Ecosystem Analyses/Watershed Boundaries, located on Page 0-4 for a display of completed analyses on the Forest.

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, updated as appropriate, and additional map layers and Ecological Unit Inventory (EUI) data were the source for the following geographic information system (GIS) layers which were used during the process; **Watershed Layer** (with analysis area and subwatersheds delineated), **Geologic Layer** (with rock types and geomorphic terranes), **Digital Elevation Data Layer, Precipitation Layer, Soils and Existing Vegetation Layer** (derived from EUI), **Fire Layer** (includes past fire perimeters, starts, and intensity), **Stream Layer** (watercourses delineated to approximate the extent of annual scour), **Land Allocations** (from *Forest Plan*), and **Roads Layer**. From these data layers, information such as fire hazard, current vegetation communities, and Riparian Reserve vegetation were derived.

Additional non-GIS sources of information were incorporated into the analysis. Stream surveys and fisheries habitat typing data were 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 also through personal communications.

AN ITERATIVE PROCESS

Watershed analysis will be an ongoing 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 0–1

Klamath Basin Vicinity

Ishi–Pishi/Ukonom Ecosystem Analysis

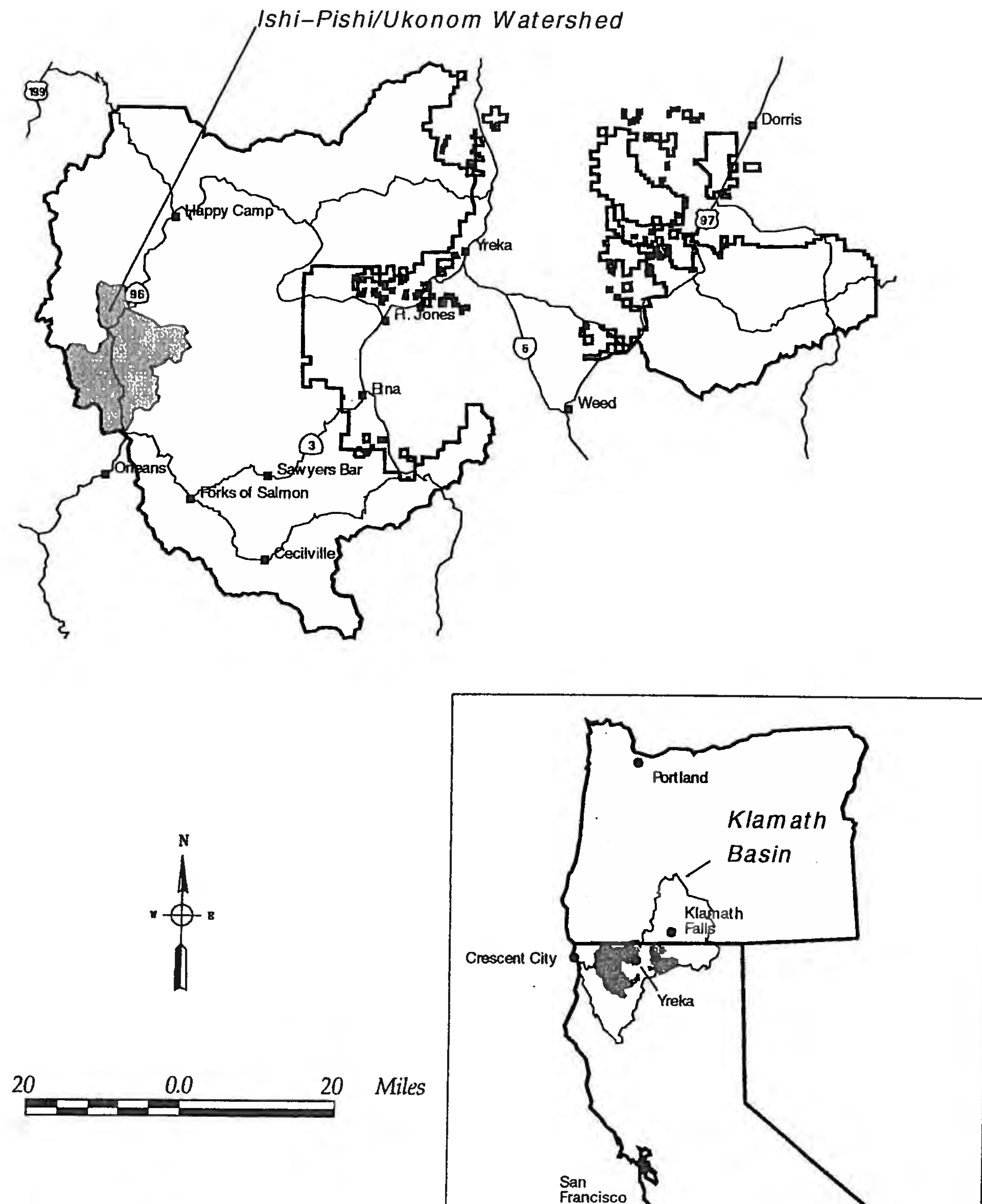
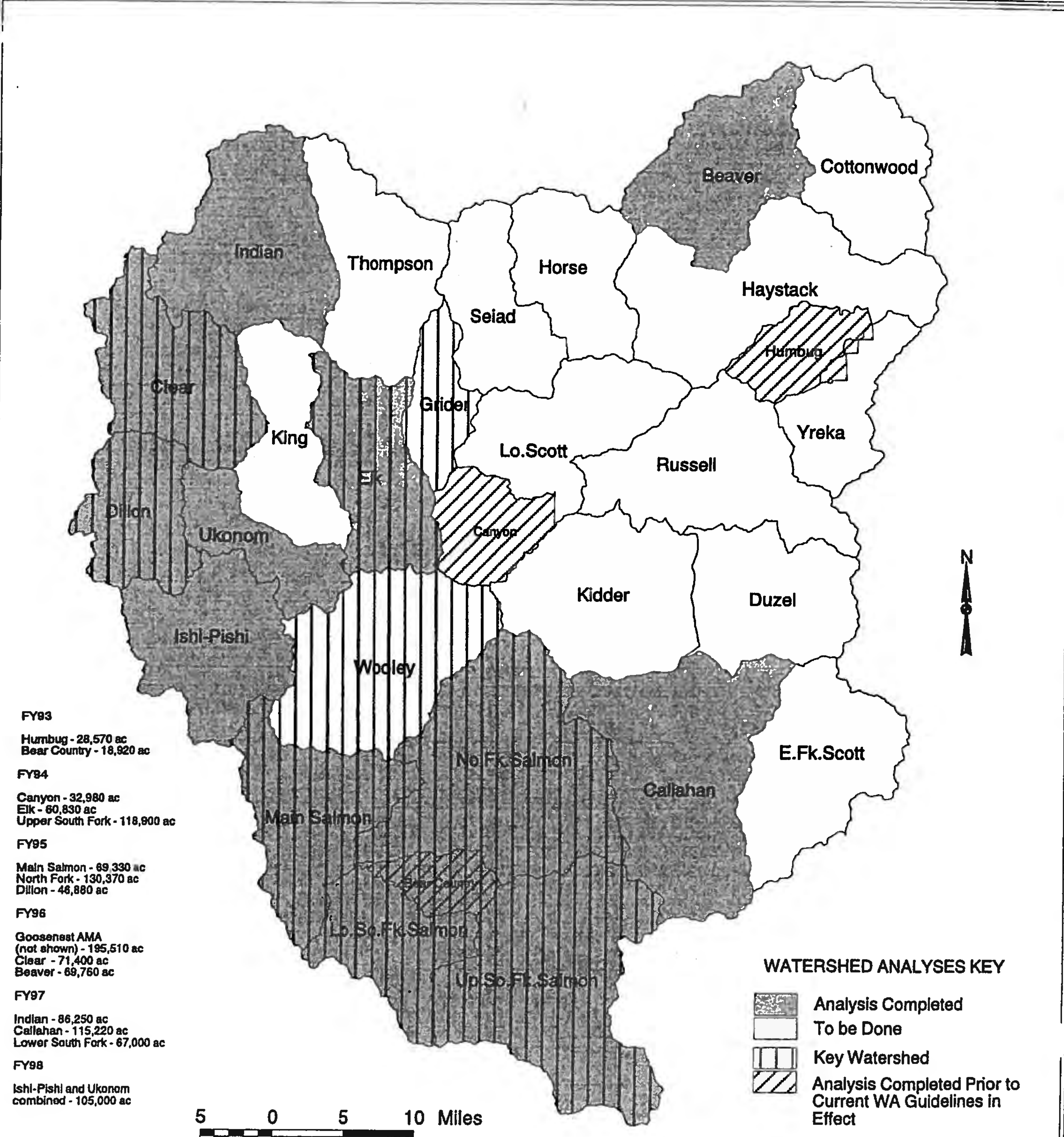


Figure 0-2 Completed Ecosystem Analyses/Watershed Boundaries

Completed Ecosystem Analyses/ Watershed Boundaries Klamath National Forest



Step 1 - Characterization

This analysis addresses an area that covers approximately 105,000 acres of the Klamath Mountains province in Northern California. The majority of land is administered by the Klamath National Forest, primarily the Ukonom Ranger District but also includes a portion of the Happy Camp Ranger District (see Figure 0-1 Klamath Basin Vicinity and Ishi-Pishi/Ukonom Ecosystem Analysis Vicinity Map [Page 0-3] and Figure 1-1 Base Map, contained in the Map Packet located at the end of this document). The area is almost evenly divided by the Klamath River, which flows from north to south through the middle of the analysis area.

Approximately 98% of the area is public lands administered by the Klamath National Forest (KNF). A small portion near Somes Bar (about 200 acres) is administered by the Six Rivers National Forest. This portion is the result of a disjunct between the watershed boundary and Forest Boundary and is being analyzed in the concurrent Lower Middle Klamath Analysis. The Six Rivers portion will not be looked at in detail in the Ishi-Pishi/Ukonom analysis.

About two percent of the analysis area is owned by local, private landholders (see Figure 1-1). Most private lands are located along the Klamath River with a few parcels just over a mile from the river. The largest population center is Somes Bar (pop. 225) at the southern end of the analysis area. Primary access is from California State Highway 96 which follows the Klamath River between Yreka and Willow Creek.

The landscape covers two watershed analysis areas, Ishi-Pishi and Ukonom. These two areas will be analyzed together but information may be grouped by the different watersheds in certain analysis products. The Ishi-Pishi watershed area is entirely on the Ukonom Ranger District while the Ukonom watershed area is on both the Happy Camp and Ukonom Ranger Districts. The landscape borders six other watershed analysis areas on the Klamath National Forest (Main Salmon, Wooley, Elk, King, Clear, and Dillon) and the Lower Middle Klamath analysis area on the Six Rivers National Forest (see Figure 0-2 Completed Ecosystem Analyses/Watershed Boundaries [Page 0-4]).

The Ukonom watershed area includes all drainages that flow into the Klamath River between Ukonom Creek (including the Ukonom Creek subwatershed) and Dillon Creek. The Ishi-Pishi watershed area includes all drainages between Dillon Creek and the Salmon River. Ukonom Creek is the largest tributary east of the Klamath River, with other streams including Carter, Burns, Kennedy, Ti, Eyese, Sandy Bar, Stanshaw, Irving, and Rogers Creeks. Rock Creek is the largest tributary west of the river with others including Swillup, Aubrey, Halverson, Reynolds, Teneyck, and Natuket Creeks.

The Klamath National Forest has been divided into distinct land allocations by the Klamath National Forest Land and Resource Management Plan (*Forest Plan*). This analysis area includes several of these land allocations (see Figure 1-2 *Forest Plan* Management Areas Updated During This Analysis, contained in the Map Packet located at the end of this document). About eight percent of the analysis area is within the Marble Mountain Wilderness and 68% is administratively withdrawn from programed timber yields. This includes the KNF land allocations of Late-Successional Reserves, Sensitive Species Management Areas, Cultural Areas, and Riparian Reserves. The remaining 24% are land allocations available for programmatic timber harvest.

Elevations within the watershed area range from below 800' along the Klamath River (lowest point 460' at the mouth of the Salmon River) to 6,900' at Tickner Peak in the Marble Mountain Wilderness, near Ukonom Lake. West of the river elevations are somewhat lower with the highest elevation 5,200 feet at Rock Creek Butte. The climate is one of a temperate, Mediterranean type, typified by hot, dry summers, and cool, moist winters. The hot summers in this landscape are occasionally moderated by coastal fog moving up the Klamath River valley. Precipitation ranges from an annual rainfall of about 64" in the lower elevations near the Klamath River, to about 95" in the highest elevations, with approximately 90% falling between October and May. Below 3,500' elevation, the predominate precipitation is rainfall, while above 4,000' elevation winter precipitation is predominantly snowfall with rain-on-snow events occurring in the transition zone. Summer precipitation occurs predominantly as thunderstorm activity, with high-intensity, short-duration thunderstorms common.

The parent material for soils within the watershed area are predominately metamorphic rocks but also include granitic rocks and ultramafic outcrops. The metamorphic rock soils sometimes contain hard rock outcrops but more commonly are deeply weathered and subject to large earthflow landslides. Soils derived from the granitic material may be easily compacted and are highly erodible when disturbed.

The ultramafic outcrops and soils support unique plant associations and often contain sensitive plant populations.

The analysis area provides important habitat and migration corridors for resident and anadromous fish species and other aquatic organisms. Indigenous fish stocks include fall and winter steelhead trout, fall-run chinook salmon, coho salmon, rainbow trout, Pacific lamprey, speckled dace, Klamath smallscale sucker, and marbled sculpin. The construction of gravel pits and mining ponds along the mainstem of the Klamath River in the analysis area have permitted development of a warm water fish fauna in recent times, most notably a combination of introduced species comprised mainly of yellow perch, pumpkinseed, largemouth bass, and brown bullhead. Freshwater mussels have been observed within the Klamath River but species information, abundance, and distribution are poorly known. Indigenous Pacific giant salamander and tailed frogs are common in most of the tributaries to the Klamath River within the analysis area. The foothill yellow-legged frog is a Forest Service Region 5 Sensitive Species and is found in the watershed. Bullfrogs are an exotic species that have been introduced to the Klamath River and can be found within the analysis area. Numerous aquatic invertebrate insects inhabit all flowing and standing water bodies in the analysis area.

The two largest Klamath River tributaries in this landscape, Ukonom Creek and Rock Creek, both have fish passage barriers near their confluence with the Klamath. Other tributaries are smaller and contain relatively few miles of suitable habitat for salmon and steelhead. Although there is little anadromous suitable spawning and rearing habitat in the Ishi-Pishi/Ukonom tributaries, they are critically important for maintenance of anadromous fisheries in the Klamath Basin because they contribute high quality water to the Klamath River.

Vegetative cover in the landscape area is primarily of the mixed evergreen type. The Douglas-fir/tanoak type dominates, but grades to a Douglas-fir/live oak type on the harsher sites. Mixed conifer and true fir types are found at higher elevations. Some areas of ultramafic soils occur that are occupied by a Jeffrey pine/mixed conifer type. A scattering of shrub/forb, meadows, and riparian vegetation occur throughout the landscape. Habitat exists for three plant species listed as sensitive by the Regional Forester: *Lewisia cotyledon* var. *howelli*, (Howells *lewisia*), *Silene marmorensia*, (Marble Mountain catchfly), and *Pedicularis howelli*, (Howells lousewort).

Wildfire is the primary natural disturbance in the landscape. All the natural vegetation types have adapted to a fire disturbance regime, and many are dependant upon fire for their persistence. Lightning and American Indian ignited fires were the primary factors shaping the vegetation. Fire suppression became effective in the 1930s through efforts of the Civilian Conservation Corp. (CCCs). Mechanized support (fire engines, dozers, aircraft, etc.) increased fire suppression efficiency in later years. With effective fire suppression, stand densities and fuel loadings have increased over presuppression periods.

Wildlife habitats are determined by the distribution of vegetation communities on the landscape, by their structure and mix of species within a community. The analysis area supports a variety of wildlife species, representative of animals found throughout northwestern California. The mix of species is diverse because of the range of habitats found within these large watersheds, from small intermittent streams to high mountain meadows. All vegetative seral stages are represented here with a corresponding compliment of wildlife species.

There are several species found in the watershed which have special and unique habitat needs. They are recognized as threatened, endangered, or sensitive based on current population estimates and threats to their habitats. Federally listed threatened and endangered species include: northern spotted owl, marbled murrelet, bald eagle, and peregrine falcon. Forest Service Region 5 sensitive species include: goshawk, willow flycatcher, fisher, western pond turtle, and marten. Big game species such as bear, Roosevelt elk, and black-tailed deer are abundant within the landscape, as well as small game species such as mountain and California quail, ruffed grouse, and gray squirrel.

The analysis area provides for human uses and values as diverse as the biological features and habitats found within them. The diversity of forest habitats near the Klamath River provided ideal conditions for pre-historic settlement along the river. The rich riverine habitat setting in the southern portion of the watershed became part of the largest cluster of Karuk settlement prior to 1850. Offield Mountain and a large area in the vicinity of the confluence of the Salmon and Klamath Rivers continues to be significantly important to the contemporary Karuk due to inherent geographic, historic, cultural, and ceremonial character. Areas upslope were used and are still being used by the Karuk for hunting, fishing, and gathering. The Karuk used fire to improve hunting and gathering conditions. This type of activity over thousands of years is likely to have had an influence on the distribution and structure of plant and animal habitats. The Katimin Ceremonial Area, located in the southern portion of the watershed, is important to contemporary use. Karuk descendants who live in the region continue to practice traditional ceremonies in a manner consistent with their cultural origins.

The first major use of the area by Europeans started in the mid-1800s with the discovery of gold. Numerous miners quickly entered the region. For the next fifty years it is estimated that several thousands of miners from various ethnic backgrounds, including large numbers of Chinese, worked the river bars and stream channels. As the population expanded, cattle grazing and farming increased. Many of the first roads and trails were built for mining access. Hardrock, placer, and dredge mining occurred extensively in the past, and continues largely on a recreational scale today.

The numerous streamcourses provide water for domestic and agricultural use. Timber harvest occurs both on private lands and on National Forest managed lands within the watershed. Several high mountain meadows and lower elevation spring range provide forage for Forest Service permitted cattle grazing. There is one grazing allotment within the Ishi-Pishi watershed area, comprising 29,550 acres. Of these, about 1,370 acres (approximately two percent) are grazeable. Permitted livestock numbers on this allotment total fifty cow/calves for a three month season, from July 15 through October 15.

Recreational use within the landscape is relatively low, compared to other National Forests in the California Region that are closer to urban centers. As the more accessible areas become over-populated, the importance of this area is increasing. Recreational experiences in this landscape are unique in that the number of users are still relatively low. Whitewater rafting and fishing are important recreational uses for this area. This segment of the Klamath receives considerable use from commercial guides for both of these activities. Forest Service campgrounds, dispersed recreation sites, access to the Marble Mountain Wilderness, and livestock packing all occur within the analysis area. Hunting and fishing occurs throughout the area. In the winter, the higher elevations are used for cross country skiing, snow shoeing, and other snow-play activities.

Step 2 - Issues And Key Questions

The following nine issues have been identified by the Analysis Team and District Ranger: *AQUATICS*; **Hillslope Processes, Riparian Areas,** and **Aquatic Dependent Species,** *TERRESTRIAL*; **Vegetative Biodiversity** and **Terrestrial Wildlife,** and *HUMAN DIMENSION*; **Roads, Commercial Timber Outputs on Public Lands, Cultural,** and **Human Uses.** A background statement for each issue was developed to provide the context of the issue and focus for the analysis. Key Questions follow and are presented for Steps 3, 4, and 5.

Other possible key questions concerning desired conditions and recommendations are implied rather than stated directly. The desired conditions will be discussed under each issue in Step 5 and recommendations are presented in Step 6.

ISSUES AND KEY QUESTIONS

AQUATICS

HILLSLOPE PROCESSES - Watershed conditions within the Ishi-Pishi/Ukonom watershed is influenced by various watershed disturbances in combination with a large percentage of unstable or easily eroded land types. Portions of the watershed have high road densities and have received extensive timber harvest, while other areas, specifically the Ukonom Creek drainage, have been adversely impacted by recent (1987) wildfires. The land types of the watershed include easily eroded granitic soils and both dormant and active landslides. This analysis will discuss the important hydrologic and erosion processes, re-evaluate cumulative watershed effects, and make recommendations for future management throughout the analysis area.

STEP 3 - CURRENT CONDITIONS

1- What are the dominant hydrologic and erosional characteristics and processes within these watersheds, including impacts of the 1997 flood?

2- What parts of the watershed are considered Areas with Watershed Concerns (AWWCs) in the *Forest Plan* and what additional areas will be evaluated in the process? What parameters are used to make this determination?

STEP 4 - REFERENCE CONDITIONS

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

STEP 5 - INTERPRETATION

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

2- What are the hydrologic/erosional concerns in the analysis area and in each subwatershed? What management strategies should be used to minimize impacts from human activities?

3- Which subwatersheds have continued watershed concerns, when will they be considered recovered, and how can recovery be promoted?

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

RIPARIAN AREAS - The January, 1997 flood event had a considerable affect on the Ishi-Pishi/Ukonom watershed and contributed large amounts of sediment into analysis area streams. Riparian area disturbances, including roads, wildfire, and timber harvest, may have compounded and contributed to stream impacts. As a result, instream habitat conditions are of concern as well as the condition of streamside vegetation. Minimizing the impacts in riparian areas from past and future disturbances, including additional riparian area damage from future wildfires, is also a concern. Riparian Reserves are a National Forest land allocation intended to protect riparian areas. This analysis will discuss current and reference conditions of riparian areas and delineation and management of Riparian Reserves. It will also make recommendations for future management and stabilization of riparian areas in the watershed.

STEP 3 - CURRENT CONDITIONS

1- What are the current vegetative conditions of the riparian areas?

2- What are the current stream channel characteristics and aquatic species habitat conditions?

3- What is the extent of disturbances that are currently affecting riparian areas and downstream conditions?

4- What are the water quality, quantity, and beneficial use conditions of streams within the analysis area? What is the water quality contribution of the Klamath River within the analysis area?

5- What is the extent of interim Riparian Reserves, how are they defined, and what is the vegetative condition within them?

STEP 4 - REFERENCE CONDITIONS
1- What are the historic and reference riparian conditions in the watershed?

STEP 5 - INTERPRETATION
1- How have Riparian Reserve acreage estimates evolved from the *Forest Plan* through this analysis?

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

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

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

5- What is the role of Riparian Reserves for terrestrial wildlife habitat and connectivity?

6- What activities are appropriate in the different types of Riparian Reserves?

AQUATIC DEPENDENT SPECIES - The analysis area contains a significant portion of the middle Klamath River which is the corridor for anadromous fish species to access habitat both upstream and downstream. Several of these species are considered at-risk and are placed on the Federal Endangered Species list. Other, less studied fish species and aquatic dependent amphibians and reptiles also utilize this portion of the Klamath River and its face drainages. This analysis will describe the current status of aquatic dependent species, as compared to historic populations, describe their trends, and describe maintenance, protection, and recovery needs of species at-risk.

STEP 3 - CURRENT CONDITIONS
1- What is the distribution and population size of anadromous and resident salmonid species? What is the status and role of non-salmonid aquatic dependent species?

2- What aquatic dependent species are identified as at-risk?

3- To what extent does Ishi-Pishi and Ukonom anadromous fish populations contribute to Klamath River basin fisheries?

STEP 4 - REFERENCE CONDITIONS
1- What were the distributions and population sizes of aquatic dependent species?

STEP 5 - INTERPRETATION
1- What are the natural and human causes of change between historical/reference and current species distribution and population sizes?

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

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

TERRESTRIAL

VEGETATIVE BIODIVERSITY - Intensive management and fire suppression activities have changed the character of the vegetation in this landscape from pre-settlement times. Current concerns center around remaining late-seral conifer forests, a lack of vegetative diversity, the amount and condition of culturally significant vegetation, and an increased risk of catastrophic wildfire. This analysis will evaluate current vegetation communities and the current fire regime to make recommendations on how to maintain and enhance vegetative diversity and provide an ecological role for fire in the watershed.

STEP 3 - CURRENT CONDITIONS
1- What are the current vegetation communities found in the watershed and what is their distribution?
- **a-** What vegetation communities provide late-successional habitat?
- **b-** What unique plant species or communities are found in the watershed (either natural or human introduced)?

2- What are the current seral stage distributions and stand densities found in the watershed (including old-growth)?
- **a-** How much of the watershed is currently late-successional habitat and where is it located?
- **b-** What areas of the watershed are capable of supporting late-successional habitat?
- **c-** Where is the existing dispersal habitat for late-successional species and where are barriers to dispersal?

3- What are the disturbance regimes impacting the vegetation in the analysis area?
- **a-** What are the current risks (potential ignition sources) found in the analysis area?
- **b-** What are the current fuels and fire behavior potential in the watershed?

4- What plant communities provide socio-culturally significant vegetation and where is it located?

STEP 4 - REFERENCE CONDITIONS
1- What was the historic distribution and pattern of vegetation in the watershed (including late-successional and dispersal habitats)?

2- What were the historic disturbance regimes (fire, insects and disease)?

STEP 5 - INTERPRETATION

1- How have the vegetation communities changed over time and what have been the agents of change; including amounts and distribution of late-successional habitats?

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

3- What is the desired role of fire in the watershed and how can fire be incorporated as an ecological process?

a- How will this affect air quality in and around the watershed area?

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

5- Is there an adequate amount of socio-culturally significant vegetation, and what can be done to maintain and/or enhance this vegetation?

TERRESTRIAL WILDLIFE - This watershed provides habitat for many wildlife species. These include Threatened and Endangered Species, Forest Service Sensitive Species, species of local and cultural interest, and Survey and Manage Species from the *Forest Plan*. The distribution and condition of habitats for these species can have implications for management activities in the watershed. This analysis will evaluate the populations and habitats of these species and recommend strategies to provide for them over time.

STEP 3 - CURRENT CONDITIONS

1- For the species identified in this analysis: bald eagle, peregrine falcon, spotted owl, marbled murrelet, fisher and marten, Del Norte salamander, elk, and porcupine;

a- What are the habitat needs?

b- Where is the habitat in the watershed?

c- How much habitat is in the watershed?

d- What is our current knowledge of the populations in this watershed?

STEP 4 - REFERENCE CONDITIONS

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

STEP 5 - INTERPRETATION

1- For these wildlife species, what has changed from historic to present and what have been the agents of change?

2- What are the future trends for these wildlife species?

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

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

HUMAN DIMENSION

ROADS - The original road system was developed to provide access to private property, area gold mines, fire suppression, and later extended to timber extraction. In limited cases, short spurs were created for recreational river access. An extensive road system now provides access to many parts of the watershed for a variety of human uses, e.g., timber and fire management, recreation, access to wilderness trailheads, hunting, woodcutting, special forest product gathering, sightseeing, etc. These activities are responsible for resource impacts on streams, riparian areas, and to wildlife. A declining road management budget has decreased road maintenance. This analysis will identify current road system uses, impacts, and resource concerns, and recommend strategies for future transportation system management; decommissioning, restoration, and maintenance.

STEP 3 - CURRENT CONDITIONS

1- What are the current conditions and uses of roads within the watershed?

STEP 4 - REFERENCE CONDITIONS

1- Why and how was the road system developed?

STEP 5 - INTERPRETATION

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

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

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

COMMERCIAL TIMBER OUTPUTS ON PUBLIC LANDS - Significant logging took place in the analysis area during the 1960s. The timber industry became the most important element of the local economy. Until recently, it provided employment for the majority of people living in adjacent rural communities. Since little private property exists in Siskiyou County to provide a tax base, much of the County's funding comes from timber revenues. During the '60s, about 90% of the analysis area was available for timber entry. Since then, an additional 60% has been designated as reserves for wildlife, watershed, and other values. The *Forest Plan* prescribes some level of sustainable timber harvest on the remaining available 30% using an ecosystem management approach. Public opinion varies on whether to manage these lands for timber values as prescribed or not. This analysis will explore the public's perception of the timber program and identify opportunities for collaboration. Using our current understanding of ecosystem needs, it will predict future timber yields, refine *Forest Plan* estimates of available lands, and make recommendations for timber outputs.

STEP 3 - CURRENT CONDITIONS

1- What are the Forest Plan expectations for timber products from this watershed?

2- What is the public's perceptions and opinions of the timber sale program?

STEP 4 - REFERENCE CONDITIONS

1- What timber harvest activities have occurred in the watershed and where?

STEP 5 - INTERPRETATION

1- How do *Forest Plan* estimates for capable, available, and suitable lands compare to those recommended in this analysis?

2- What future trends affect timber management in the watershed?

CULTURAL - The Karuk Tribe has an inherent interest in stewardship and management of the Ishi-Pishi/Ukonom watershed as the center of their ancestral territory. Important ceremonial, historic, and contemporary use areas are located within the watershed. The southern portion, near the mouth of the Salmon River, known as the *Center of the World* to the Karuk, is strategic to ceremonial and traditional use. The Karuk are concerned about various environmental affects on water quality, forests, erosion, wildlife, plant life, anadromous fisheries, historic sites, contemporary uses, and ceremonial use. This analysis will discuss the Karuk tribal perspective on resource management, identify traditional and contemporary cultural use areas, and develop opportunities to incorporate Karuk land practices into management of the watershed.

Key questions will be listed for each step, but to maintain clarity of the Cultural discussion, all answers will be displayed together in Step 5; previous steps will refer the reader to Step 5.

STEP 3 - CURRENT CONDITIONS

1- What is the Forest Service relationship with the Karuk Tribe of California?

2- What heritage resources exist within the watershed?

STEP 4 - REFERENCE CONDITIONS

1- What were the prehistoric and historic land uses and management practices within the watershed?

STEP 5 - INTERPRETATION

1- How has land management after 1850 affected heritage resources?

2- What is the Karuk Cultural perspective on resource management in this watershed?

3- What is the Karuk desired condition for the watershed?

4- How can we integrate the Native American perspective into watershed management?

HUMAN USES - A variety of human uses occur in the watershed, both historically and currently, e.g., special forest products collection (mushrooms, firewood, etc.), recreational activities, and residential use. Use occurs primarily within the Klamath River corridor. Recreational uses include such things as river rafting, sightseeing, hiking, camping, fishing, etc. Local residents find the areas' natural beauty an attractive setting for a rural life-style. With approximately 90% of the watershed National Forest, local residents have taken a great deal of interest in public land management activities; a community interest group has been formed. This analysis will discuss current uses, explore community interests, and recommend opportunities that will maintain or enhance them.

STEP 3 - CURRENT CONDITIONS

1- What Special Forest Products are utilized in the watershed?

2- What are the recreational uses in the watershed?

3- What are private land uses and local community concerns and interests about this watershed?

STEP 4 - REFERENCE CONDITIONS

1- What are the historic human uses and trends in relation to Forest Products/Recreation/Community Interests of the watershed?

STEP 5 - INTERPRETATION

1- How have other commodity uses changed from the past and what are their trends?

2- How have recreation uses changed from the past and what are their trends?

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

Step 3 - Current Conditions

INTRODUCTION - This step describes the current range, distribution, and condition of ecosystem elements. It is organized by Issue as presented in Step 2 and answers Key Questions identified for each issue of this step.

AQUATICS

HILLSLOPE PROCESSES

Key Question 1- What are the dominant hydrologic and erosional characteristics and processes within these watersheds, including impacts of the 1997 flood?

The hydrologic characteristics of the Ishi-Pishi/ Ukonom analysis area are defined by climate and topography. Most precipitation falls between October and March; mostly as snow above about 5,000' elevation and as rain below 3,500'. Between 3,500' and 5,000' is a transitional snow zone where snow typically accumulates but can be partially or completely melted by mid-winter rains. Deep snowpacks accumulate in the higher mountains both east and west of the Klamath River, although snow accumulations in the lower elevations along the Klamath River are rare.

Peak stream flows typically occur between November and March, although sustained high flows can last into June. The majority of peak flows and floods in this landscape are caused by rain-on-snow storms where warm winter rains melt accumulated snow, adding snowmelt to rainfall runoff. Rain-on-snow events can occur in all but the lowest elevations in the analysis area but are most common in the transitional snow zone. Forest openings, roads, or burned areas allow greater snow accumulations, faster melt rates, and an increase in flood damage during rain-on-snow storms. Sustained high flows occur in spring from melting snowpacks.

Summer thunderstorms are occasionally heavy enough to cause localized flooding. Thunderstorm induced flows are typically flashy, lasting from a few hours to a few days, and are often quite muddy. Summer showers contribute a small proportion of annual stream flow but, due to heavy runoff induced erosion and channel scour, can contribute a significant amount of sediment to the stream system.

The erosional characteristics of the watershed are influenced by rock types and landforms. The geology and geomorphology of the watershed, like the rest of the Klamath Mountains, are a complex of intrusions, contact and shear zones, large dormant slides, moderate to steep mountain slopes, inner gorges, glacial deposits, and stream terraces.

Many different rock types and geologic terranes have been identified in this landscape. Geologic types include the Rattlesnake Creek terrane, the Galice formation of the Western Jurassic terrane, the Western Hayfork terrane, the Eastern Hayfork unit of the Sawyers Bar terrane, the Wooley Creek batholith, and the Pony Peak pluton (see Figure 3-1 Simplified Lithology, contained in the Map Packet located at the end of this document).

The Western Hayfork terrane is considered hard, competent bedrock; few large, dormant slides, while metamorphic rocks in the other terranes are more slide-prone; containing many large, dormant slides. Units of ultramafic rock occur in the Rattlesnake Creek terrane and Eastern Hayfork unit. An area of limestone (about 130 acres) occurs in the Eastern Hayfork unit, in the Upper Ukonom Creek subwatershed. Figure 3-2 Subwatersheds and *Forest Plan* Areas with Watershed Concerns, contained in the Map Packet located at the end of this document, shows subwatershed Locations in the analysis area. The Wooley Creek batholith and Pony Peak pluton contain plutonic rocks, granitoids with compositions ranging from diorite to granodiorite. For simplicity, the lithology of the watershed is combined into five types for this analysis; granitoid rocks, ultramafic bedrock, competent metamorphic bedrock, marble, and slide-prone metamorphic bedrock (see Figure 3-1).

The following Table 3-1 Acreage and Percentage of Bedrock Types by Subwatershed, displays acreage and percentage of bedrock type by subwatershed, see Figure 3-2.

Table 3-1 Acreage and Percentage of Bedrock Types by Subwatershed

Subwatershed	Total Acres	% Granitoid Bedrock	% Ultra-mafic Bedrock	% Competent Metamorphic Bedrock & Marble	% Slide-prone Metamorphic Bedrock
UKONOM ANALYSIS WATERSHED					
Upper Ukonom Cr.	5,740	85	9	3	3
McCash/Cub	8,400	98	0	2	0
Panther/Lick	6,820	44	4	52	>1
Coon	3,610	>1	35	4	61
Swillup Creek	5,580	29	36	>1	35
Thomas/Aubrey	5,930	33	11	17	39
Subtotal/Average	**36,080**	**55**	**13**	**14**	**18**
ISHI-PISHI ANALYSIS WATERSHED					
Carter/Kennedy	7,510	7	25	22	46
Ti Creek	6,060	33	0	45	22

Subwatershed	Total Acres	% Granitoid Bedrock	% Ultramafic Bedrock	% Competent Metamorphic Bedrock & Marble	% Slide-prone Metamorphic Bedrock
ISHI-PISHI ANALYSIS WATERSHED (cont.)					
Upper Rock Cr.	11,500	>1	1	1	98
Beans Gulch	7,060	>1	4	0	96
Lower Rock Cr.	2,770	0	16	0	85
Sandy Bar/Stanshaw	11,050	24	4	9	63
Irving Creek	5,420	63	>1	13	24
Rogers Creek	4,290	38	0	46	16
Reynolds/Natuket	13,800	1	4	3	92
Subtotal/Average	**69,460**	**15**	**5**	**12**	**68**
TOTAL	***105,540***	***29***	***8***	***12***	***51***

The granitoid rock types in these watersheds are composed of granodiorite and diorite. They comprise about 30,600 acres; 29% of the landscape. The Wooley Creek batholith is the largest granitoid body, occurring in the headwaters of Ukonom, Ti, Irving, and Rogers Creeks. The Pony Peak pluton lies in the northeast portion of the Ukonom analysis watershed; in the Swillup Creek and Thomas/Aubrey subwatersheds. Diorite and granodiorite in these granitoid bodies form sandy, easily eroded soil when deeply weathered, typically referred to as granitic soil. Deeply weathered granitic soil is susceptible to greatly accelerated surface erosion, channel erosion, and shallow debris sliding when vegetative and surface cover is disturbed or removed.

The ultramafic rock types include serpentine and peridotite. In general, the ultramafic sites are poorly vegetated due to unique soil geochemistry. The ultramafic type generally supports open stands of Jeffery pine or mixed conifer. Ultramafic soils are often prone to deep-seated landsliding. In total, the ultramafic type comprises about 8,400 acres, eight percent of the watershed, occurring in bands or as isolated blocks within predominately metamorphic terranes.

The competent metamorphic bedrock comprises about 12,700 acres, 12% of the watershed. These rock types can form deep soils, but shallow, rocky soils are most common. Deep-seated or shallow landslides can occur in this type, but in general, all types of erosion are of less concern in this type than in the other bedrock types.

Marble, or metamorphosed limestone, occupies about 130 acres in the Upper Ukonom Creek subwatershed. Although this is a small portion of the landscape, this marble body is one of the largest on the Klamath National Forest outside of the Marble Rim. Marble is of particular interest because of its aesthetic value and tendency to form caves.

Slide-prone metamorphic rock types occupy about 53,800 acres, 51% of the landscape. These rock types often form deep soils subject to deep-seated landslides, debris slides, and channel erosion. The landforms in this type are dominated by large, deep-seated, dormant landslides on gentle but irregular slopes. Steep slopes and rock outcrops are also found but are not as common as in the competent metamorphic bedrock type.

The landforms across the watershed consist of shallow to deeply weathered soils on steep to gentle mountain sideslopes or dormant landslide terrane. Inner gorges dissect the slopes along nearly all streams. Near the river, the terrain is a mix of steep inner gorges carved by the Klamath River and its tributaries, and narrow stream terraces and flood plain deposits. The high elevations in the watershed, mostly east of the river in the Marble Mountain Wilderness, have undergone glacial scour and deposition during the last ice age. Several glacial lakes occur in this landscape, the more well known being Ukonom and One Mile Lakes.

The geology and geomorphology are combined into several distinct geomorphic terranes having similar characteristics. These are active landslides, dormant, deep-seated landslides, toe zones of dormant landslides, granitic mountain slopes, non-granitic mountain slopes, inner gorges, debris basins and glacial till, moraines, and alluvial terraces. Table 3-2 Percentage of Geomorphic Terranes by Subwatershed, displays the percentage of each geomorphic terrane that comprise the 15 subwatersheds in the Ishi-Pishi/Ukonom analysis area. The acreage of geomorphic terranes are as mapped through September, 1997. It includes the landslides activated during the 1997 flood but not the additional unstable lands mapping done for this analysis. Figure 3-3 Geomorphic Terranes, contained in the Map Packet located at the end of this document, shows locations of geomorphic terranes.

Table 3-2 Percentage of Geomorphic Terranes by Subwatershed									
Subwatershed	% Active Land-slides	%Toe Zone Dormant Land-slides	% Dormant Land-slides	% Steep Granitic Mtn. Slopes	% Low to Mod Granitic Mtn. Slopes	% Non-Granitic Mtn. Slopes	% Inner Gorge	% Debris Basin	% Glacial Terrace Deposits
UKONOM ANALYSIS WATERSHED									
Upper Ukonom Cr	<1	<1	5	6	50	9	8	0	21
McCash/Cub	<1	0	<1	2	58	1	15	0	23
Panther/Lick	<1	<1	11	5	23	40	21	0	0
Coon	1	8	26	0	0	47	18	0	0
Swillup Creek	2	<1	32	5	16	25	20	0	<1
Thomas/Aubrey	1	1	24	6	18	27	21	0	2
Average	***1***	***1***	***14***	***4***	***32***	***22***	***17***	***0***	***9***
ISHI-PISHI ANALYSIS WATERSHED									
Carter/Kennedy	8	2	49	1	5	20	14	0	1
Ti Creek	1	<1	18	1	24	36	15	1	4
Upper Rock Cr.	7	2	33	0	0	41	16	1	0
Beans Gulch	8	3	37	0	0	30	22	0	0
Lower Rock Cr.	4	2	49	0	0	32	13	0	0
Sandy Bar/Stanshaw	1	3	44	1	15	16	14	0	6
Irving Creek	<1	2	13	3	40	12	21	1	8
Rogers Creek	<1	<1	18	2	31	33	16	0	0
Reynolds/Natuket	3	8	36	<1	1	31	19	0	1
Average	***4***	***3***	***35***	***1***	***10***	***28***	***17***	***<1***	***2***
OVERALL AVERAGE	**3**	**2**	**28**	**2**	**17**	**26**	**17**	**<1**	**4**

Active landslides occur as small to large, scattered patches on slopes throughout the watershed. The Ishi-Pishi/Ukonom area contains among the greatest concentrations of active landslides on the Klamath National Forest. Active landslides can be one of two basic forms; shallow debris flows or deep-seated slumps and earth flows. Shallow debris flows are characterized by exposed soil on steep slopes. These are usually small in area (less than a couple acres) but often have major downstream effects. Deep-seated slumps and earth flows are more difficult to recognize, characterized by cracks in the ground and leaning trees rather than large areas of exposed soil. The deep-seated slumps and earth flows are often larger in area than shallow debris slides (up to several tens of acres) but the landslide material is not all contributed to streams at one time.

Most active earthflows are naturally occurring movements of soil. Soils in the earthflows are typically wet and particularly weak. These weak soils are extremely sensitive to road cuts and fills and changes in drainage. Active landslides are very prone to additional landsliding given future rainstorms. Several active slides were reactivated during the winter, 1997 flood. Some very large active landslides occur in this area, particularly those at Soldier and Mud Creeks along the Klamath River. The large landslides which closed Highway 96 near Ti-Bar in 1995 and again in 1998 are reactivations of large, active landslide complexes.

The dormant, deep-seated landslide terrane comprises a large portion of the analysis area. This terrane type is composed of thick, typically red soils that have been uplifted and incised by streams and rivers. Dormant landslide terrane is a complex of deep-seated slump and earthflow-type landslides that have been active over the last few thousand years. The landform is characterized by irregular but generally gentle slopes with indistinct small streamcourses. Active earthflows are found almost exclusively in dormant landslide terrane and are activated during heavy rainfall years or a wet period of years. Toe zones are the most unstable portion of dormant landslide terrane and are typically, though not always, found adjacent to channels and below gently sloping portions of dormant landslide terrane. Toe zones are often coincident with inner gorges, and displayed as inner gorge in Table 3-2. The extent of toe zone outside of inner gorge is undermapped in the September 1997 geomorphic mapping and underrepresented in Table 3-2. Sediment delivery to streams from dormant landslides can be high, even if fully vegetated, and can be increased following wildfire, timber harvest, or road construction.

Granitic mountain slopes occur in the headwaters of Ukonom Creek, including the Panther, Cub and McCash Creek drainages, and in the heads of Swillup, Elliott, Aubrey, Ti, Sandy Bar, Stanshaw, Irving, and Rogers Creeks. Debris sliding and debris scour occur under pristine conditions but at a lower rate than in dormant landslide terrane. However, granitic mountain slopes are very sensitive to disturbances that remove soil cover, decrease rooting strength, and increase runoff. Debris sliding and erosion are greatly increased following disturbance such as fire, timber harvest, or road construction, especially on steep slopes.

Steep granitic mountain slopes are generally more prone to landsliding and erosion than low to moderate slope granitic soils. However, low to moderate slope granitic soils can be deeply weathered, highly dissected, and more prone to landsliding than steeply sloping areas. Highly dissected granitic soils are not mapped in the current geomorphic terrane mapping.

Non-granitic mountain slopes are much less sensitive to disturbance than granitic mountain slopes and less susceptible to landsliding than dormant landslide terrane. They occur in areas that have not formed deep-seated landslides due to either rock competence, slope position, or some other geomorphic factor.

Inner gorges are found along streams in all parts of the watershed. Three categories of inner gorge are recognized; inner gorges in unconsolidated soils, in granitic soils, and in other, more competent soils. All inner gorges have naturally high debris sliding rates but unconsolidated inner gorges are the most susceptible to debris sliding, second only to active landslides in debris sliding rates. Unconsolidated inner gorges are mostly coincident with toe zones of dormant slides but are also stream incisions through glacial/terrace deposits. Granitic inner gorges are those through granitic soils. They are very sensitive to disturbance with very high disturbance associated debris slide rates. Other inner gorges are those through other bedrock and geomorphic types. They are still considered unstable but do not have as great of landsliding rates as in the unconsolidated or granitic inner gorge types.

Debris Basins are rare in this landscape. The few locations they are present are in the headwaters of Rock Creek, and the heads of some tributaries to Ti and Irving Creeks. Debris basins are more susceptible to landsliding than adjacent mountain slopes.

Glacial deposits are found in the Marble Mountain Wilderness, in the headwaters of Ukonom, Ti, Sandy Bar, and Irving Creeks. Some terrace deposits are found along the Klamath River. This terrane type is not particularly susceptible to landsliding and erosion with some exceptions. Inner gorges that cut through these deposits are very unstable with narrow, deep gorges and raw banks. Glacial deposits formed mostly from granitic parent material are susceptible to disturbance related erosion similar to granitic mountain slopes.

Debris sliding, surface erosion, and channel erosion all contribute sediment to streams and impact downstream beneficial uses. Debris slides and flows typically occur with exceptionally heavy, warm winter rains and rain-on-snow events. Storm flows with a recurrence interval of ten years or greater (storms not likely to occur but once every ten or more years) are generally needed to trigger debris slides. Summer thunderstorms are sometimes capable of causing floods in small streams, triggering debris slides and torrents. Flooding with debris torrents can have major impacts on channel morphology and riparian vegetation.

Surface erosion occurs much more frequently than landsliding, typically several times each year during storms not necessarily intense enough to trigger debris slides. Surface erosion rates are low when soils are covered by duff, litter, and vegetation but increases when the soil cover is removed by disturbances such as wildfire, road construction, logging, and fuel treatment. Granitic soils have the greatest increases in erosion following disturbance.

Channel erosion is mostly associated with high flows, especially winter floods. Channel downcutting and bank sloughing occur, particularly in the steep gradient streams lacking bedrock streambeds and banks. The lower gradient streams can have downcutting, deposition, or lateral movement. Affects on riparian condition can be severe, particularly when upstream landsliding initiates a channel scouring debris torrent. Stream erosion often consists of redistributing stored sediment deposited in some past event. Channel erosion may be accelerated by peak flow increases and removal of protective riparian vegetation.

Roads and timber harvest contribute to accelerated erosion in the landscape. Roads contribute to increased debris sliding, especially in granitic soils, and to potentially unstable conditions in dormant landslide terrane. Road/stream crossings and fillslopes appear to be primary causes of road-related erosion increases. According to data collected throughout the Salmon River subbasin, road related landslide rates range from 60 to 800 times greater than undisturbed rates in granitic soils (de la Fuente and Haessig 1991). In other geomorphic terranes, increases in landslide rates range from 2.3 to 80 times greater with roads than in undisturbed areas. Refer to Appendix B-Cumulative Watershed Effects, for specific values by terrane type. The Salmon River study landslide rates are based on landsliding during the 1965-1975 time period and includes the effects of several large (greater than ten years) floods; excludes the large 1964 flood.

Roads increase surface erosion by exposing soil on the road surface, cut and fill slopes, and by channeling water down road ditches road surfaces. Road erosion is highly variable depending on road template, surfacing, wet weather use, the condition of the cut and fill slope, and the inherent erodibility of the soil. Some of these complex conditions are not well known in the analysis area.

Roads increase channel erosion by increasing stream flows during rainfall or snowmelt. Roads decrease infiltration through compaction and channel water in roadside ditches or down the road surface, increasing the amount of water and sediment reaching a channel.

But the greatest channel erosion caused by roads can occur when a road-caused debris torrent scours a channel below the debris source, often when a culvert plugs and high water washes out the road fill over the culvert.

A roads analysis has been completed for the west-side of the Klamath National Forest (FEAT 1997), including the analysis area. One index used in the roads analysis was a potential resource impact rating (resource rating). These ratings are based on the proportions of road segments within stable or unstable geomorphic types, proportions of roads near streams, and road density. The ratings are High (roads on unstable ground, near streams, and/or in areas with high road densities), Moderate, or Low. Roughly 66% of roads evaluated across the west-side have a resource rating of Moderate while 17% are rated High and 17% Low. For the analysis area, about 50 miles of road (including all FS system roads, County and State highways) are rated High, 318 miles are rated Moderate, and 31 are rated Low. An additional 15.5 miles of temporary (non-system) or private roads are unrated.

A *Travel and Access Management Plan* (KNF 1996) has also been completed for the Ukonom Ranger District. This plan provides some watershed impact statement for each road segment along with recommendations for future maintenance or closure.

Timber harvest can also increase landsliding, surface erosion, and channel erosion. Landslide rates can increase with timber harvest, as much as nine to twenty times in harvest units over undisturbed areas in granitic soils according to the *Salmon Sub-Basin Sediment Analysis.* Other geomorphic terranes range from 1.2 to seven times greater for harvest related rates compared to undisturbed (de la Fuente and Haessig 1991). The Salmon River study evaluated those areas of intensive timber harvest (clearcuts or other significant reduction of overstory) combined with areas impacted by stand replacing fire. Partial cuts or low intensity wildfire were assumed to have a small impact on landslide rates.

Timber harvest and associated fuel treatment increase surface erosion at a highly variable rates depending on residual soil cover, time since treatment, soil type, and degree of soil compaction. Timber harvest that leaves soil cover mostly intact will have little increased soil erosion compared to harvest and fuel treatment that highly disturb and compact the soil. Since soil erosion increases resulting from timber harvest usually return to background levels within a few years after final site-prep treatment, the amount of increased erosion is very time-dependent. Granitic soils are the most sensitive to surface erosion increases.

Timber harvest can also increase channel erosion due to increased peak flows following canopy removal and soil compaction. As canopy closure is reduced, more snow accumulates on the forest floor and due to lack of interception, a higher snowmelt rate occurs than on fully forested areas, causing increased runoff during rain-on-snow storms. Also, skid trails result in soil compaction and can create conditions of decreased infiltration and increased runoff.

Wildfire has impacted watershed conditions in the analysis area, especially in the Ukonom Creek drainage. The wildfires in 1987 burned much of Ukonom Creek, in some locations with high intensity. Although surface erosion has probably returned to pre-1987 rates in burned areas, impacts on landsliding and channel erosion are still present.

A preliminary study of landslide effects from the 1997 flood has been completed. This study covers much of the west-side of the Klamath National Forest (see Figure 3-4 Ongoing 1997 Flood Damage Study, contained in the Map Packet located at the end of this document). The study shows a similar pattern of increased landslide activity associated with roads, timber harvest, and wildfire as the Salmon River sediment study. The number of landslides per unit area associated with roads is 28 times that of undisturbed areas. Recent timber harvest (after 1977) and wildfire, each show landslide rates about six times that of undisturbed. A combination of timber harvest and wildfire on the same site shows landslide rates about 13 times that of undisturbed. Older plantations (planted before 1977) show landslide rates of 1.5 times undisturbed areas, a considerable recovery over the younger plantations.

In the Ishi-Pishi/Ukonom area, 48 new landslides were identified by an air photo inventory. Thirty-six of these slides occurred in the Ukonom Creek drainage, part of a band of new slide activity across the northern edge of the Marble Mountain Wilderness (see Figure 3-5 1997 Flood Damage and Flood Related Landslides, Contained in the Map Packet located at the end of this document). All of the Ukonom Creek slides are within the 1987 wildfire perimeter and most occurred in granitic soils. In Ukonom Creek, the high and moderate intensity burns have a higher landslide rate, relative to burn area, than the low intensity burns. Only two of these 36 landslides are directly associated with roads, although several others are close to roads and may be road related. The 12 landslides outside the Ukonom Creek drainage are all associated with inner gorges, mostly unconsolidated inner gorges that overlap with toe zones of dormant slides. Nine of these 12 slides are likely associated with roads.

Emergency Relief Federally Owned (ERFO) sites and altered channels were also studied in the 1997 flood damage study. In the entire study area, about 51% of ERFO sites were stream crossing failures, 18% road related landslides, 14% road fill failures, 8% stream undercuts, 6% road cut failures, and 3% other causes. Forty-six ERFO sites have been identified in the analysis area. About half are stream crossing failures with other proportions similar to the larger study area. Altered channels are those stream channels heavily impacted by flooding, scour, or deposition as noticeable on aerial photographs. In the landscape, Ukonom Creek and several of its tributaries are noticeably altered although most of the other streams are not noticeably altered from the 1997 flood.

Key Question 2- What parts of the watershed are considered Areas with Watershed Concerns (AWWCs) in the *Forest Plan* and what additional areas will be evaluated in the process? What parameters are used to make this determination?

The *Record of Decision* for the *Forest Plan* identifies Areas with Watershed Concerns (AWWCs) across the Klamath National Forest. For this analysis area, the AWWCs include all of the Ti Creek, Irving Creek, Rogers Creek, and Beans Gulch subwatersheds and parts of the Carter/Kennedy, Upper Rock, Sandy Bar/Stanshaw, and Reynolds/Natuket subwatersheds (see Figure 3-2).

Forest Plan AWWCs boundaries do not correspond well with the subwatersheds used for the Ishi-Pishi/Ukonom analysis. This is due to data limitations in the *Forest Plan* for analyzing areas; the *Forest Plan* analysis was limited to compartment boundaries. In addition, a higher resolution of data for analysis is currently available, along with about ten years of updates. While some of the same techniques used in the *Forest Plan* are used for this analysis, results may be different.

The *Forest Plan* AWWCs determinations are based upon cumulative watershed effects modeling results and the condition of stream system and fish habitat in areas all across the Forest. An AWWCs determination put restrictions on additional land disturbing activities, specifically timber harvest, on the National Forest lands until an analysis of the watershed had been completed.

The strategy for a watershed scale review of AWWCs is to reevaluate the subwatersheds overlapping the *Forest Plan* AWWCs along with other subwatersheds needing evaluation. Each watershed analysis examines the watershed conditions, processes, and functions for all subwatersheds that have some cumulative watershed effects concerns. The analysis determines current watershed conditions and discusses recommendations for future management. Determination through watershed analysis that an area has watershed concerns is not a planning decision. The determination advises managers that a subwatershed may not meet Aquatic Conservation Strategy (ACS) objectives if additional land disturbance occurs. Future analyses will determine the state of recovery for those areas with cumulative watershed effects concerns.

Factors used to determine AWWCs for the *Forest Plan* are the magnitude of watershed disturbances (roading, timber harvest, and wildfire), watershed sensitivities (includes soil and geomorphic types), riparian conditions, and quality of aquatic habitat. Riparian conditions and aquatic habitat are discussed under the Riparian issue but the other factors are discussed in this section.

The road density, density of road/stream crossings, roaded acres, and acres of timber harvest and wildfire are displayed in Table 3-3 CWE Analysis Subwatershed Road Density, Timber Harvest, and Wildfire Acreage, for each analysis subwatershed. Watershed disturbances are also displayed in Figure 3-6 Watershed Disturbances, contained in the Map Packet located at the end of this document. All roads over all ownerships are included in road density calculations, excepting those not identified on air photos. The road/stream crossing are based on an overlay of the roads and stream coverage used for this analysis. The stream coverage is described in the Riparian issue. Based on these two coverages, there are a total of 484 road/stream crossings in the analysis area. Roaded acres are based on road prism width, and vary depending upon road conditions. For this analysis, double lane roads (Highway 96 primarily) are assumed to be 28' wide. On low sloping ground (less than 35% slope), double lane road prisms, including cut and fill slopes, are assumed to be 33' wide. On steep ground (greater than 35% slope), double lane road prisms are assumed to be 70' wide. Most roads in the analysis area are single lane, assumed 16' wide with a 20' road prism width on low sloping ground and 40' road prism width on steep ground.

The timber harvest acreage reported includes the intensive harvest (regeneration harvested, currently plantations) in the Ishi-Pishi/Ukonom Managed Stand Layer. Wildfire acreage is from the burn intensity mapping of the 1987 fires and 1994 Dillon Fire. Moderate and high intensity acreage is reported for each of these fire periods. Most wildfire acreage reported in Table 3-3 data are from the 1987 fires with the Dillon Fire a small contributor in the Swillup and Upper Rock subwatersheds. In Table 3-3, harvest is grouped into two categories, 1978 to present and 1958 to 1977. Generally, recovery becomes significant after about twenty years and nearly recovered after forty years. In the analysis area, the oldest plantations originated in 1959. Older fires, previous to 1987, are considered recovered in this analysis. Younger disturbances mask older disturbances over the same area and roaded acres mask all other disturbances; assuring areas are not double counted. For example, areas burned in the 1987 fires, then salvaged and planted, are not counted as wildfire acreage but are counted as 1978 to present intensive timber harvest.

Subwatershed	Road Density Miles/sq.mi.	Road/Stream Crossings Number/sq. mi.	Roaded Acres	Intensive Harvest 1978-Present Acres	Intensive Harvest 1958-77 Acres	1987 or 1994 Wildfire Mod. or High Intensity Acres
UKONOM ANALYSIS WATERSHED						
Upper Ukonom Creek	0.0	0.0	0	20	0	1,450
McCash/Cub	1.4	1.6	67	650	210	900
Panther/Lick	1.1	0.6	49	510	70	1,200
Coon	2.0	2.1	49	280	150	40
Swillup Creek	1.6	2.2	46	290	480	5
Thomas/Aubrey	1.4	1.7	65	80	0	160
Subtotal/Average	**1.2**	**1.3**	**276**	**1,830**	**910**	**3,755**
ISHI-PISHI ANALYSIS WATERSHED						
Carter/Kennedy	3.3	6.5	157	230	620	10
Ti Creek	4.2	5.8	159	640	1,260	80
Upper Rock Cr.	2.3	1.6	170	990	910	1
Beans Gulch	2.9	1.1	128	430	450	0
Lower Rock Cr.	2.5	4.2	43	260	60	0
Sandy Bar/Stanshaw	3.7	5.8	228	750	1,350	0
Irving Creek	3.3	4.7	109	290	620	0
Rogers Creek	4.3	3.1	107	580	1,000	0
Reynolds/Natuket	2.8	2.7	244	1,050	1,550	0
Subtotal/Average	**3.2**	**3.8**	**1,345**	**5,220**	**7,820**	**91**
TOTAL	***2.5***	***2.9***	***1,621***	***7,050***	***8,730***	***3,846***

Table 3-3 CWE Analysis Subwatershed Road Density, Timber Harvest, and Wildfire Acreage

Watershed sensitivity indices are used in watershed modeling discussed in Step 5-Interpretation, and explained in Appendix B. The indices include potential impacts to beneficial uses, channel sensitivity, soil erodibility, hydrologic response, and slope sensitivity (see Table 3-4 Subwatershed Sensitivities). The indices are based on the characteristics of the subwatersheds. For example, a subwatershed with a large proportion of unstable lands will rate a large value for the slope sensitivity parameter. The riparian conditions and aquatic habitat are discussed under the Riparian issue in this document and integrated into the watershed condition determination in Step 5.

Table 3-4 Subwatershed Sensitivities 1/

Subwatershed	Beneficial Uses	Channel Sensitivity	Soil Erodibility	Hydrologic Response	Slope Sensitivity
Upper Ukonom Cr.	3.80	3.90	3.57	3.50	4.00
McCash/Cub	3.80	3.90	3.57	3.50	4.00
Panther/Lick	3.25	3.80	3.25	3.25	3.75
Coon	3.80	3.50	3.50	2.00	4.02
Swillup Creek	3.75	4.00	3.70	3.00	3.50
Thomas/Aubrey	3.00	3.50	3.00	3.00	3.50
Carter/Kennedy	5.00	4.00	3.30	2.00	5.00
Ti Creek	3.57	4.00	3.50	3.00	4.00
Upper Rock Cr.	3.00	4.00	3.50	4.00	4.00
Beans Gulch	3.25	3.80	3.03	2.00	5.00
Lower Rock Cr.	3.10	3.90	3.10	3.00	4.30
Sandy Bar/ Stanshaw	4.00	4.00	3.57	3.00	4.00
Irving Creek	4.00	4.00	3.57	3.00	4.00
Rogers Creek	4.00	4.20	3.57	2.00	4.00
Reynolds/Natuket	3.50	4.00	3.30	2.00	4.57

1/ Sensitivity: 5=Very High for the parameter, 4=High, 3=Moderate 2=Low, 1=Very Low

RIPARIAN AREAS

Key Question 1- What are the current vegetative conditions of the riparian areas?

The physical structure of streams plays a primary role in determining the suitability of aquatic habitats. Structural elements are created through interactions between natural geomorphic features, sediments, woody material and the power of flowing water. These elements give rise to a variety of habitat attributes that are used by various life stages of aquatic dependent species. Habitat attributes include substrate composition, shade, dimension and number of pools (slow water habitats) versus runs, and riffles (fast water habitats), and other parameters that are measured or visually estimated. The condition of some of the primary attributes of aquatic habitats in Ishi-Pishi/Ukonom area streams are discussed below and compared to reference values in Step 5.

Stream habitat and riparian surveys have been widely used to describe and quantify the physical characteristics and biota of streams. Stream surveys in the Ishi-Pishi/Ukonom assessment area began as spot checks in the 1930s and became more comprehensive and quantitative through time. Many of the larger streams, generally second to fourth order, have been surveyed in the 1980s and 1990s. This information has been used for assessing the existing condition of aquatic species habitat. Smaller zero to first order streams have not been surveyed. Figure 3-9 Habitat Inventory Reaches, displays locations of surveyed streams used in this analysis, contained in the Map Packet located at the end of this document.

The New Years Flood of 1996/97 caused high flows in most streams in the assessment area. These flows may have changed some of the stream habitat parameters recorded in earlier surveys and reported in this analysis. However, the survey data is still useful for portraying stream habitat conditions. Primary components of aquatic habitats included in this analysis are pool frequency - the ratio of pools (slow water) to runs and riffles (fast water), maximum pool depth, canopy cover (shade), instream cover, large woody debris, and substrate composition. Table 3-5 Fish Habitat Parameters displays values of primary habitat components for surveyed streams. More detailed quantitative and qualitative information on streams in the assessment area can be found in Appendix C - Aquatic Habitat. Quantitative information for 21 streams is presented in table form. Information for the other seven named streams is presented as narrative summaries because not enough quantitative information was available to complete tables for these streams.

Key Question 2- What are the current stream channel characteristics and aquatic species habitat conditions?

Analysis area stream information is presented in Table 3-5 Fish Habitat Parameters.

Table 3-5 Fish Habitat Parameters 1/

Stream Name	Pool Frequency (bankfull widths/ pool) 1/	Average Max Pool Depth (ft.) 2/	% Canopy Closure 3/	% Total Instream Cover 4/	LWM (pieces/mi.) 5/	% Substrate Composition 6/					% Embeddedness
						Bedrock	Boulder	Cobble	Gravel	Fines	
Bark Shanty	9.3	3.3	87	21	13	8	25	21	37	9	26
Beans Gulch	9.3	2.9	93	26	18	3	8	39	41	9	29
Coon Creek	12.4	2.3	87	34	11	10	36	17	31	6	30
Flems Creek	10.7	2.0	55	62	6	w/Boulder	40	43	14	3	-
Halverson Creek	12.4	1.9	92	40	9	6	39	13	30	12	27
Irving Creek	–	2.6	58	34	58	6	21	21	24	28	41
Lightning Gulch	49.0	2.2	95	8	5	2	23	21	47	7	40
Lower Ukonom	–	5.2	39	41	17	13	35	21	9	22	14
McCash Creek	8.9	3.3	51	21	9	w/Boulder	51	20	19	10	31
One Mile Creek	2.0	2.0	71	16	26	w/Boulder	31	37	22	10	28
Panther Creek	23.0	2.0	86	15	5	w/Boulder	19	24	27	30	15
Lower Rock Ck	–	3.8	42	40	–	2	33	38	15	12	25
Upper Rock Creek	4.8	2.2	81	17	2	w/Boulder	47	10	28	15	16
Rogers Creek	7.7	2.0	91	41	10	w/Boulder	27	20	22	31	27
Salal Creek	13.4	2.2	88	15	9	3	11	37	39	10	46
Sandy Bar Ck	11.8	2.6	96	54	14	7	28	16	31	18	37
Stanshaw Creek	14.4	2.3	92	46	18	9	34	11	26	20	41
Swillup Creek	7.8	3.0	87	34	7	2	39	16	29	14	28
Ti Creek	–	2.6	68	35	28	3	37	19	24	17	34
Lick Creek	18.9	1.8	89	32	3	w/Boulder	49	29	18	4	60
Upper Ukonom Ck	9.1	2.0	71	49	4	w/Boulder	62	20	13	5	26

– = No Data

1/ Pool Frequency: Pool frequency is the number of pools in a given length (scaled by multiples of channel width) of stream. Pool frequencies in Ishi-Pishi/Ukonom streams are generally much lower than the KLRMP-EIS minimum criteria of at least one pool per seven channel widths. Bankfull channel widths were not measured in some of the creeks which precluded calculation of this metric for some streams. Average pool frequencies ranged from as high as one per two channel widths to as low as 1 per 49 channel widths, but most streams had one pool per 8 to 12 channel widths.

2/ Maximum Pool Depth: Maximum pool depth is the deepest point measured in each pool. Average maximum pool depths in assessment area streams varied greatly. Average mean pool depth was 4.5', 2.1', and 2.3' for 4th, 3rd, and 2nd order streams, respectively.

3/ Canopy Cover: Canopy closure is a measure of the amount of stream shading provided by riparian vegetation (and to a lesser extent - topographic features). Canopy closure is high (>80% - KLRMP) on all streams except lower Rock Creek, most of Ukonom Creek mainstem and some of its' tributaries, Irving Creek, and Ti Creek. Shading is provided predominately by deciduous trees - white alder and big leaf maple, with a low proportion of shading being provided by conifers for most streams. Most streams had between 15- 40%shading by conifers but a few, notably the Rock Creek reaches, had 10% or less shading from conifers.

4/ Instream Cover: Instream cover is used by fish for shelter and hiding. Instream cover was estimated in pool habitats and was found to be provided primarily by boulders, white water, and larger pieces of wood. Terrestrial and aquatic vegetation, small woody material, and undercut banks made up only a small proportion of the instream cover in most assessment area streams.

5/ Large Woody Material (LWM): For this assessment, large woody material (LWM) is defined as pieces of wood at least 24" in diameter and at least 50' long. Most of the Ishi-Pishi/Ukonom streams had between 2 to 18 pieces of LWM per mile. Ti and Rogers Creek had the most LWM with 28 and 58 pieces per mile, respectively. Amounts of LWM in all streams was well below the KLRMP criteria of at least 100/mi..

6/ Substrate Composition: Percent fines and percent cobble embeddedness are standard metrics of substrate quality that were estimated during stream surveys. Fines in spawning gravels of assessment area streams varied widely from 6- 41%. Embeddedness ranged from 15- 41%. The amount of fines and degree of embeddedness in many of the Ishi-Pishi/Ukonom streams is high and generally exceeds the KLRMP criteria maximum of <15% fines and<20% embeddedness.

Key Question 3- What is the extent of disturbances that are currently affecting riparian areas and downstream conditions?

Road construction, timber harvest, and direct removal of trees and wood from streams and riparian areas constitute the primary human activities affecting Ishi-Pishi/Ukonom streams. These disturbances result in changes to soil compaction, topography, and vegetation, which in turn affect stream and riparian area processes including peak and base flows, water temperature, channel form, sediment regime and streamside vegetation (see *Step 3 Hillslope Processes, Key Question 1*). The mechanisms of how human disturbance within the Ishi-Pishi/Ukonom area can alter characteristics of watershed function and ultimately impact aquatic habitat is discussed below:

Land management activities disrupt natural hydrologic processes and can alter the routing of water through a given area. Characteristics of water runoff having the greatest influence on aquatic habitats are; the frequency and magnitude of peak flows which may scour, downcut, or widen the stream channel, and low base flows which restrict fish migration and reduce available habitat.

Ground compaction caused by road constructing and timber harvest can reduce soil porosity and water infiltration, therefore, increasing overland flow and rate of run-off. Road surfaces and cut slopes intercept and concentrate surface flow increasing water transport rates. This in turn increases delivery rates to streams, increasing peak flows. Ishi-Pishi subwatersheds have road densities ranging from 2.3 to 4.3 miles of road per square mile of watershed and an overall road density of 3.2 miles of road per square mile of land. The road density is generally less in Ukonom subwatersheds ranging from zero to 2.0 miles of road per square mile of watershed and an overall density of 1.2 miles of road per square mile of land. Table 3-3 CWE Analysis Subwatershed Road Density, Timber Harvest, and Wildfire Acreage, displays road density levels by subwatershed. The exact peak flow increase resulting from roads is not known, however, road densities approaching or exceeding 4 miles of road per square mile of watershed alter hydrological processes and will cause noticeable downstream impacts. Ti, Sandy Bar/Stanshaw, and Rogers subwatersheds are at these critical road densities.

Increased efficiency of drainage resulting from soil compaction, road building, and other forest management activities can result in less water infiltration into soils and less groundwater storage. Although tree harvest can decrease water demands from soils due to decreased evapotranspiration for a period of time, vegetation or plantations in older harvest units may deplete ground water faster than the original forest vegetation, particularly if coniferous vegetation is replaced by hardwood-dominated stands (Spence et al 1996). Some of the Ishi-Pishi watersheds have large acreages of old timber units, most of which are now plantations but other areas are dominated by brush and hardwoods. These old harvest units in conjunction with high road densities and compacted ground can cause decreased baseflows in summer.

The degree of stream heating and cooling is affected by changes in stream discharge. Management activities that cause higher rates of runoff and lower rates of groundwater infiltration decrease streamflows during the low flow season, thereby allowing greater heating of the water and higher summer water temperatures.

The direct removal of trees and large woody material from stream channels and riparian areas can cause changes in vegetation communities and the amount and composition of down wood within the channel. Removal of wood has occurred in several ways within the assessment area. Past timber sales occurred close to stream channels. Large woody material within stream channels, thought to be an impediment to fish migration, was removed. Trees and downed wood has been removed during road and stream crossing construction. Loss of wood in stream and riparian areas decreases habitat diversity and complexity and alters sediment composition and routing.

Sediment transported from upland areas into stream channels determines the nature and quality of salmonid habitats in streams, rivers, and estuaries. The magnitude, locations, and frequency of sediment delivery to streams is highly dependent upon climate, local topography, soil type, soil saturation, vegetative and other organic matter cover, and degree of upslope disturbance. Human activities, through alteration of soil structure, slope mass balance, vegetation, and hydrology, can significantly alter the delivery of fine and course sediment to streams, thereby affecting salmonid habitats. Hillslope and soil disturbance from logging, roading, and fire suppression activities can cause chronic erosion of upper tributary streams, hillslopes, landings, and roads resulting in increased sedimentation to stream courses below. Unstable road and landing fill, and fill washed out of stream crossings due to culvert failure also contributes to elevated sediment loads that must be moved through the stream channel. The highest increases in sedimentation rates from management activities occurs where ground disturbance has occurred on unstable terrains, primarily active landslides, toezones, inner gorges, and decomposed granite.

The degree to which human modification of disturbance regimes has affected assessment area streams depends largely on the extent of the disturbance in each subwatershed and the sensitivity of the land that has been disturbed. For instance, the watersheds of Ti, Sandy Bar, Irving, Rogers, Reynolds, and Halverson Creeks have had significant timber harvest, have high road densities, many stream crossings, and large areas of deep red soils formed in dormant landslide deposits. Disturbance regimes in these streams may be significantly altered as compared to streams such as Ukonom and Swillup that have overall low road densities, few stream crossings, lower levels of timber harvest, and less activity on unstable ground.

Key Question 4- What are the water quality, quantity, and beneficial use conditions of streams within the analysis area? What is the water quality contribution to the Klamath River within the analysis area?

The Ishi-Pishi/Ukonom assessment area is slightly over 3% of the land area in the Klamath Basin. The 105,000 acres of this analysis area are rainfall dominated and receive some of the highest annual precipitation found within the Klamath Basin. Streamflows and the maintenance of cool water during the hot dry season is maintained primarily by groundwater inputs. Large areas of dormant landslide terrain, typically composed of deep red soils, function as a sponge in storing and slowly releasing large quantities of water. Most of the subwatersheds in the assessment area generally have streams that flow dependably all year long, with relatively high baseflows and good to excellent water quality. Most named creeks in the analysis area support fish in their lower reaches before the channel gradient gets too high and upstream passage becomes restricted by waterfalls or debris jams in constricted channels.

KLAMATH RIVER WATER QUALITY

In most rivers, water quality decreases steadily as it flows downstream. Many parameters of water quality in the Klamath River are maintained or actually improved as the river flows downstream of Seiad Valley and is diluted by cool high quality water from numerous tributaries.

Water originating from the upper Klamath Basin and the Shasta and Scott valleys is often of poor quality in summer because of agricultural water diversions, pollution from agricultural runoff (animal wastes, fertilizers, pesticides, herbicides), impoundment behind dams, and industrial discharge. This sometimes results in increased water temperature, depletion of dissolved oxygen, increases in toxic substances (such as ammonia and phosphorus), and other factors that can make the river environment intolerable for salmon, steelhead, and other species. Pure cool water from Ishi-Pishi/Ukonom subwatersheds is important, and may be critical, in maintaining water quality in the Klamath River and providing thermal refugia for fish.

Water temperatures in the mid- and lower-Klamath River approach 80°F in some summers, and occasional fish kills are reported. For salmonids, temperatures above 72°F begin to cause stress, cessation of growth, and increased susceptibility to diseases. In the summer of 1997 the Klamath River was very warm. A maximum temperature of 81°F was recorded in the Klamath River approximately five miles downriver of Happy Camp. Widespread fish kills occurred concurrently with high water temperatures from Seiad Valley to Weitchpec. The epizootic that occurred involved chinook salmon, steelhead trout, suckers, and sculpins. The pathogens were several species of parasitic snails and/or various bacteria. The commonality between pathogens was that all were commonly found organisms in freshwater that are normally benign except when water quality is poor, particularly when water temperatures are high. Fish pathologist Gary Hendrickson of Oregon State University examined fish mortalities from the Klamath River in summer 1997 and had these comments in his report:

> "Based on my experience, I would **speculate** (and it is only speculation) that fish in the Klamath River are being stressed, probably by poor water quality. The most likely problems are high temperatures, low flows, low dissolved oxygen, and high ammonia. Fish of course try to maintain homeostasis [internal balance]. More stress means that more energy is required to maintain homeostasis. This energy is attained by 'shorting' other requirements, including the immune system. Consequently, ubiquitous bugs can become a problem. Unfortunately, these water quality parameters also favor completion of certain parasite life cycles which only exacerbates the problem."

The New Years Flood of 1996/1997 that hit the mid-Klamath region ripped out trees and widened stream channels which likely contributed to the excessive heating of the Klamath River witnessed in Summer 1997. Highest intensity of flooding was centered upstream of the Klamath River mainstem section which passes through the assessment area. Many streams near Happy Camp and upriver from there were heavily impacted. Much of the damage - channel scouring, channel widening, and loss of riparian vegetation - resulted from large quantities of sediment that was delivered to stream channels by the floodwaters. Rearrangement of stream channels by flood waters elevated many streams temperature regimes. This has changed the ability of up-river tributaries to cool the Klamath River water in summer, and probably will continue to do so for several more years. For this reason, Ishi-Pishi/Ukonom streams are even more crucial for providing high quality, cool water to the Klamath River in summer.

The entire Klamath River, particularly the lowest reach, is suffering from cumulative effects which may be leading to reduced survival of juvenile salmonids (Kier and Associates 1990). Elevated erosion and sedimentation rates in the tributaries and along the Klamath River corridor contribute to large-scale problems in the mainstem and estuary. Decreased depth in the Klamath River reduces the cold water strata along the river bottom, where fish may take refuge when temperatures are high. Indian fishermen and resort owners have noted that pools in the lower Klamath River and estuary have filled in considerably since the early 1970s. Decreased depth in the estuary results in reduced habitat and may change fresh and salt water mixing patterns. Wedges of relatively heavy salt water can form only with sufficient depth in the estuary. These wedges can host entire communities of aquatic organisms that may be an important food source and that may affect ocean survival of salmonids.

Key Question 5- What is the extent of Interim Riparian Reserves, how are they defined, and what is the vegetative condition within them?

Riparian Reserves are a land allocation applicable to National Forest lands and defined in the *Forest Plan.* As mapped in this stage of the analysis, Riparian Reserves include the geomorphic types of active landslides, inner gorges, and toe zones of dormant slides. They also include the extent of water bodies and wetlands, 340' buffers (two site potential tree heights for this area) on each side of fish-bearing streams and around lakes and natural ponds, 170' buffers (one site potential tree height) on each side of non fish-bearing perennial streams, around wetlands greater than one acre, and on each side of intermittent streams. The geomorphic types are as mapped on the geomorphic terranes coverage, update version September, 1997. The lakes, ponds, and wetlands used for Riparian Reserve boundaries include those mapped on USGS 1:24,000 quadrangle maps. The streams include those on 1:24,000 maps with additional streams added based on computer modeling, assuming a stream begins with twenty acres of accumulation.

The Riparian Reserve mapping used at this stage of the analysis depends on the interim Riparian Reserve guidelines in the *Forest Plan* and the unstable land and water feature mapping available when this analysis began. The geomorphic and stream mapping is not perfect; updates are required for project level analysis. Step 5 of this analysis will discuss the probable extent of Riparian Reserves not yet mapped at this stage.

The extent of lands currently mapped as Riparian Reserves, including all land allocations and private lands, are displayed in Figure 3-7 Pre-Analysis Riparian Reserve Components, contained in the Map Packet located at the end of this document. In total, about 33,000 acres are mapped as Riparian Reserves in the watershed. Excluding those riparian areas on private lands or within National Forest Wilderness, LSR, Special Habitat, or Special Management land allocations; Riparian Reserves include about 14,000 acres. Riparian Reserve types are displayed in order of precedence with active slides masking inner gorges which mask toe zones. All unstable land types mask buffers on streams, lakes, or wetlands. Using this order of precedence, about nine percent of the interim Riparian Reserve is active landslides, 53% is inner gorge, eight percent is toe zone, and 30% is buffers on water bodies.

Vegetation within the interim Riparian Reserves is characterized using the Ecological Unit Inventory (EUI) for the area. The EUI contains detailed information on vegetation seral stage, canopy closure, tree species present, soil types, Potential Natural Vegetation (PNV), and several other attributes over the mapped area (refer to Appendix D - EUI Defined). The existing vegetation for the analysis area is constructed from the Potential Natural Vegetation (PNV), primary and secondary species (see Vegetative Biodiversity issue for more details). Vegetation in the Riparian Reserves is described using the existing vegetation.

The existing vegetation in the analysis area has been divided into 11 distinct types. To describe Riparian Reserves vegetation, the types are regrouped as mixed conifer/hardwood stands on good site, mixed hardwood/conifer stands on harsh site, and riparian/meadow types. The good sites, mixed conifer/hardwood include the existing vegetation types of Douglas-fir, Douglas-fir/tanoak, Douglas-fir/tanoak/liveoak, Douglas-fir/white fir, white fir/hardwood, and true fir. Good sites are capable of supporting dense stands of trees that provide shade to streams and sources of large woody material. Without intensive disturbance (such as high intensity wildfire or timber harvest), these sites should be dense (greater than 60% tree cover) and dominated by late-seral stages (mid-mature to old-growth).

Other mixed conifer stands are on harsher sites and may not be capable of growing dense stands of large trees. These existing vegetation types include Douglas-fir/live oak, ultramafic mixed conifer, and subalpine conifer. Other sites contain riparian or meadow vegetation communities. These are the montane meadow and riparian tree existing vegetation types. A compilation of these vegetation types in the mapped Riparian Reserves is displayed in Table 3-6 Vegetation Classification in Mapped Riparian Reserves, and Figure 3-8 Riparian Reserve Vegetation (using Pre-analysis Riparian Reserve Boundary), contained in the Map Packet located at the end of this document.

Table 3-6 Vegetation Classification in Mapped Riparian Reserves

Vegetation Classification	Acres	% of Good Site	% of Riparian Reserve
GOOD SITE, MIXED CONIFER/HARDWOOD 1/			
Early-Seral, <60% tree	2,190	7	5
Early-Seral, >60% tree	2,790	12	9

Vegetation Classification	Acres	% of Good Site	% of Riparian Reserve
GOOD SITE, MIXED CONIFER/HARDWOOD (cont.) 1/			
Late-Seral, <60% tree	2,320	5	4
Late-Seral, >60% tree	18,630	76	60
Subtotal	***25,930***	***100***	***78***
Harsh Sites	3,890	—	12
Riparian Types	3,140	—	10
TOTAL	32,960	—	100
1/ Consists of vegetation types DF, DF/TQ, DF/TQ/LQ, DF/WF, WF/HW, and TF.			

AQUATIC DEPENDENT SPECIES

Key Question 1- What is the distribution and population size of anadromous and resident salmonid species? What is the status and role of non-salmonid aquatic dependent species?

The analysis area provides approximately 43 miles of anadromous habitat for fall and spring run chinook salmon, winter and summer run steelhead, winter coho salmon, and Pacific lamprey. There are approximately 45 additional miles of habitat provided for other native fish species including rainbow trout, speckled dace, Klamath small scaled sucker, marbled sculpin, and Pacific brook lamprey. Non-native species including American shad, brown bullhead, green sunfish and yellow perch have been observed in portions of the Klamath River while brook trout occupy approximately 11 miles of habitat (see Figure 3-10 Fish Species Range, contained in the Map Packet located at the end of this document).

The analysis area provides critical spawning, rearing and holding habitat for both adult and juvenile fish. The presence and timing of the anadromous fish species in the watershed are listed in Table 3-7 Adult Fish Species.

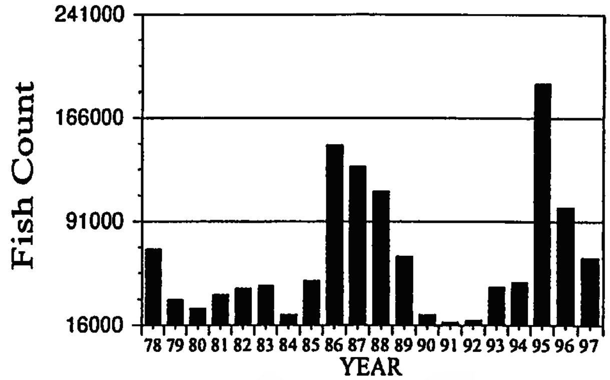
Table 3-7 Adult Fish Species

ADULT SPECIES	MONTHS PRESENT
spring chinook salmon	From July through October
fall chinook salmon	From October through early December
coho salmon	From December through January
summer steelhead	From July through May
winter steelhead	From November through May
Pacific lamprey	From April through June

Anadromous young are found within the landscape year-round. Steelhead juveniles remain in the system up to three years and lamprey young (*ammocoetes*) remain up to seven years before outmigrating to the ocean. Most coho juveniles prefer to remain within freshwater for about one year before moving into the ocean; apparently a very low percentage of chinook juveniles will do likewise (Olson 1996). Most chinook juveniles appear to move out of Klamath River tributaries the first summer after emerging as fry from gravels.

Within the last five years, the spawning population of chinook salmon has ranged from 43,500 to 190,700 fish (PFMC 1998). Severe fluctuations in populations have been occurring since 1955. Overall, coho and steelhead populations are believed to be following the same trends (CH2MHill 1985). Chart 3-1 Klamath River Basin Chinook Escapement, shown below, displays the population trend of chinook salmon in the Klamath River basin from 1978 to the present.

Chart 3-1 Klamath River Basin Chinook Escapement



Source: Pacific Fishery Management Council

Key Question 2- What aquatic dependent species are identified as at-risk?

The Klamath Mountain Province Evolutionarily Significant Unit (ESU) of Steelhead, including both the summer and winter run, have been proposed for Threatened status under the *Endangered Species Act* (ESA). Summer steelhead are Regional Forester-designated sensitive species. The Southern Oregon/Northern California Province ESU of coho salmon have been designated threatened under the ESA. The chinook salmon is currently in petitioned status under the ESA. Spring chinook are Regional Forester-designated sensitive species. Pacific lamprey and Western pond turtles are both State of California species of special concern. Eastern pond turtles are also Regional Forester-designated sensitive species.

Key Question 3- To what extent does Ishi-Pishi and Ukonom anadromous fish populations contribute to Klamath River basin fisheries?

From information gathered during stream surveys anadromous populations are found only in the lowest reaches of Ukonom, Coon, Swillup, Ti, Rock, Sandy Bar, Stanshaw, Irving, Rogers and Reynolds Creeks.

The smaller, steep, bedrock dominated, stream systems found within the analysis area are generally more suited to resident trout populations than to anadromous species. However, these streams are important to anadromous populations because of the high quality, cool water they provide to the Klamath River system.

VEGETATIVE BIODIVERSITY

Key Question 1- What are the current vegetation communities found in the watershed and what is their distribution?

In order to describe the current vegetation in the analysis area, an accurate representation of the existing vegetation is needed. For this analysis area, an Ecological Unit Inventory (EUI) has been completed (for more in-depth discussion of the EUI mapping process used on the Klamath National Forest refer to Appendix D - EUI Defined). The EUI provides current information on seral stage, conifer size, hardwood size, tree cover, primary species, secondary species, and ecological vegetation series and sub-series. Information on soils and geomorphology is also incorporated into the EUI.

Working together with Forest Ecologists, District Silviculturists, and members of the analysis team, the EUI information was combined into eleven vegetation communities to represent the existing vegetation patterns within the analysis area, see Figure 3-11 Existing Vegetation Based on EUI, contained in the Map Packet located at the end of this document. Table 3-8 Acreage and Percentage by Vegetation Community, identifies the acreage within each of these communities and the percentage of the analysis area occupied by each.

Table 3-8 Acreage and Percentage by Vegetation Community

Vegetation Community	Acres	% of Watershed
Sub-Alpine Conifer	1,359	1
True Fir	6,542	6
Douglas-Fir/White Fir Mixed Conifer	12,420	12
Douglas-Fir/White Fir/Hardwood	3,372	3
Douglas-Fir	3,409	3
Douglas-Fir/Tanoak	41,794	40
Douglas-Fir/Tanoak/Live Oak	21,234	20
Douglas-Fir/Live Oak	10,819	10
Ultramafic Mixed Conifer	1,106	1
Montane Meadow/Lake	602	<1
Riparian Shrub	2,847	3

The **Subalpine Conifer Community** is found at the highest elevations of the analysis area, with most found at the headwaters of Ukonom Creek in the Marble Mountain Wilderness area. The largest blocks are found around McCash Lake and No Mans Mountain. The subalpine forest is characterized by glaciated slopes with thin soils and abundant moisture. Nearly barren slopes are common although a variety of high elevation species are found scattered in the community. The harsh sites and short growing season often limits conifer size and density. The principal overstory species are red fir, mountain hemlock, Brewer spruce and white fir. The understory can consist of oceanspray, Drummond pasque flower, pinemat manzanita, and quill-leaved *lewisia*. Table 3-9 Subalpine Conifer Seral Stages, displays acreage and percentage of community for each seral stage.

Table 3-9 Subalpine Conifer Seral Stages

Seral Stage	Acres	% of Community
Shrub/Forb	60	4
Pole	0	0
Early-Mature	392	28
Mid-Mature	566	41
Late-Mature/Old-Growth	340	25

The **True Fir Community** is found on good sites at high elevations (typically above 5,500') in the analysis area. Most of the true fir is found in a band from Irving Mountain to Ukonom Lake, with some found in the southwest part of the analysis area near the head of Beans Gulch. White fir and red fir dominate and are maintained with high densities. Small amounts of Brewer spruce, mountain hemlock, Douglas-fir, western white pine and incense-cedar are also found in this type. Table 3-10 True Fir Seral Stages, displays acreage and percentage of community for each seral stage.

Table 3-10 True Fir Seral Stages

Seral Stage	Acres	% of Community
Shrub/Forb	491	8
Pole	0	0
Early-Mature	458	7
Mid-Mature	2,687	41
Late-Mature/Old-Growth	2,971	45

The **Douglas-Fir/White Fir Mixed Conifer Community** is in a transition zone between the true fir and the conifer/hardwood communities. This community is typically found above 4,000 feet. It lies along both the west and east edges of the analysis area. Douglas-fir and white fir are the most common conifer species with ponderosa pine, incense-cedar, and sugar pine also found in this community. Some hardwoods, including black oak, pacific madrone, and giant chinquapin are also found. Stands in the mid-mature and late/mature/old-growth-seral stages are moderately dense with 37% very dense (80-100% canopy closure). Table 3-11 Douglas-Fir/White Fir Mixed Conifer Seral Stages, displays acreage and percentage of community for each seral stage.

Table 3-11 Douglas-Fir/White Fir Mixed Conifer Seral Stages

Seral Stage	Acres	% of Community
ShrubForb	1,103	9
Pole	944	8
Early-Mature	876	7
Mid-Mature	2,806	23
Late-/Mature/Old-Growth	6,688	54

The **Douglas-Fir/White Fir/Hardwood Community** is found on very good sites high on the slope; some of the better growing sites in the area. Mostly found in the southeast portion of the analysis area (Rodgers and Irving Creek drainages). White fir and giant chinquapin are the dominant species, with Douglas-fir, black oak and tanoak also found here. This community is a transition from the conifer dominated communities at higher elevations and the conifer hardwood, mixed evergreen forests at lower elevations. Mid-mature and late-mature/old-growth seral-stages in this community are very dense, with 85% having 80-100% canopy closure. Table 3-12 Douglas-Fir/White Fir/Hardwood Seral Stages, displays acreage and percentage of community for each seral stage.

Table 3-12 Douglas-Fir/White Fir/Hardwood Seral Stages

Seral Stage	Acres	% of Community
Shrub/Forb	786	23
Pole	848	25
Early-Mature	186	6
Mid-Mature	237	7
Late-Mature/Old-Growth	1,315	39

The **Douglas-Fir Community** is one of the most varied communities. In some places it is a transition from the mixed conifer to the Douglas-fir/tanoak and in other places it is primarily Douglas-fir and deciduous hardwoods (black oak and Oregon white oak). The one constant is that Douglas-fir is the dominant tree species. Deciduous hardwoods are not common in the analysis area but provide important wildlife habitats, and materials and products for American Indians. In the mid/mature and late/mature/old-growth seral-stages 37% are at 80-100% crown closure. Table 3-13 Douglas-Fir Seral Stages, displays acreage and percent of community for each seral stage.

Table 3-13 Douglas-Fir Seral Stages

Seral Stage	Acres	% of Community
Shrub/Forb	440	13
Pole	165	5
Early-Mature	577	17
Mid-Mature	1,229	36
Late-Mature/Old-Growth	999	29

The **Douglas-Fir/Tanoak Community** is the dominant community in the analysis area, covering over 40% of the area. Douglas-fir usually dominates the overstory with tanoak found in the understory and filling gaps in the fir dominated overstory. The relative amounts of Douglas-fir and tanoak are variable depending on past management, fire history, and aspect with Douglas-fir being more dominant on north slopes. There is a wide variety of species that occur in this community. Associated conifer species include; ponderosa pine, sugar pine, white fir, and incense cedar. Hardwoods associated with this community include alder, bigleaf maple, black oak, white oak, California laurel, giant chinquapin, and pacific madrone. This community is found on very good sites and 83% of the mid-mature and late-mature/old-growth are at 80-100% crown closure. Table 3-14 Douglas-Fir/Tanoak Seral Stages, displays acreage and percentage of community for each seral stage.

Table 3-14 Douglas-Fir/Tanoak Seral Stages

Seral Stage	Acres	% of Community
Shrub/Forb	5,017	11
Pole	6,004	14
Early-Mature	3,055	8
Mid-Mature	11,323	28
Late-Mature/Old-Growth	16,326	39

The **Douglas-Fir/Tanoak/Live Oak Community** is found on somewhat harsher sites than the Douglas-fir/tanoak community and is most often found on south and west aspects. Douglas-fir is the dominant conifer, found mostly on the lower slope positions. Other conifers including ponderosa pine and sugar pine and other hardwoods, including black oak and madrone are also found in this vegetation community. Live oak dominates the harsher sites (dry and rocky) in the community. Even though this community is found on harsher sites in the analysis area, densities in the mid-mature and late-mature/old-growth are also high with 71% having crown closure of 80-100%. Table 3-15 Douglas-Fir/Tanoak/Live Oak Seral Stages, displays acreage and percentage of community for each seral stage.

Table 3-15 Douglas-Fir/Tanoak/Live Oak Seral Stages

Seral Stage	Acres	% of Community
Shrub/Forb	1,135	5
Pole	719	3
Early-Mature	2,903	14
Mid-Mature	10,992	52
Late-Mature/Old-Growth	5,489	26

The **Douglas-Fir/Live Oak Community** is found on steep warm rocky sites. It is characterized by a high cover of canyon live oak both in the overstory and the understory. On slightly better sites pacific madrone occurs, and conifers (usually Douglas-fir) can be found scattered on better sites within the community. Table 3-16 Douglas-Fir/Live Oak Seral Stages, displays acreage and percentage of community for each seral stage.

Table 3-16 Douglas-Fir/Live Oak Seral Stages

Seral Stage	Acres	% of Community
Shrub/Forb	540	5
Pole	288	3
Early-Mature	2,968	27
Mid-Mature	5,026	46
Late-Mature/Old-Growth	2,006	19

The **Ultramafic Mixed Conifer Community** consists of vegetation adapted to Ultramafic soils. This is a mid-elevation community found on warm open sites on serpentine soils. These soil conditions limit growth density and plant species. Among the conifers Jeffrey Pine is the most adaptable, with Douglas-fir and incense-cedar also found here. The understory is often dominated by grass, primarily California fescue; ceanothus species are the most common shrubs. Many rare plants are endemic to these ultramafic soil types. Table 3-17 Ultramafic Mixed Conifer Seral

Stages, displays acreage and percentage of community for each seral stage.

Table 3-17 Ultramafic Mixed Conifer Seral Stages		
Seral Stage	Acres	% of Community
Shrub/Forb	140	13
Pole	0	0
Early-Mature	531	48
Mid-Mature	152	14
Late-Mature/Old-Growth	186	17

The **Meadow/Lake Community** is found on gentle slopes and depressions containing wet areas at high elevations. Typical herbaceous species include mountain heather, Labrador tea, California pitcher plant, swamp onion, meadow lotus, trillium, monks hood, lady slipper, bog rein orchid, and yampah. Sedges, rushes, and wet-loving grasses are also characteristic. Many of the meadows in this watershed, have a large component of shrubs, often alder, willow or bitter cherry.

The **Riparian Shrub Community** is found along the Klamath River, major tributaries, which include Rock Creek and Swillup Creek drainages, and wet seeps and slumps. Along the Klamath River the primary plant species is willow and in the other areas alder and big leaf maple dominate. Conifers are not common, with Douglas-fir the most prevalent. Most of this community is in younger seral stages, which is mostly due past floods and landslides. Table 3-18 Riparian Shrub Seral Stages, displays acreage and percentage of community for each seral stage.

Table 3-18 Riparian Shrub Seral Stages		
Seral Stage	Acres	% of Community
Shrub/Forb	1,243	44
Pole	101	4
Early-Mature	1,354	48
Mid-Mature	140	5
Late-Mature/Old-Growth	8	<1

Key Question 1a- What vegetation communities provide late-successional habitat?

Not all vegetation communities in the analysis area are capable of providing the habitat characteristics that late-successional wildlife species need. One of the criteria used in delineating the vegetation communities was the ability in providing late-successional habitat. Based on an analysis of the structural characteristics found in the various vegetation communities, these communities were determined to be capable of providing late-successional habitat: true fir, Douglas-fir/white fir, Douglas-fir/white fir/hardwood, Douglas-fir, Douglas-fir/tanoak, and Douglas-fir/tanoak/live oak. Altogether, these communities add up to 88,760 acres (84% of the watershed). For more information on late-successional habitat see the spotted owl discussion in the Terrestrial Wildlife section.

Key Question 1b- What unique plant species or communities are found in the watershed? (either natural or human introduced)?

Plants listed as Sensitive that are found in the analysis area include Howell's *lewisia*, Heckner's *lewisia*, pale yellow stonecrop, and marble mountain campion. Survey and Manage species include clustered lady slipper and mountain lady slipper (contact KNF Forest Botanist for further information regarding sensitive plants).

There is a population of Brewer spruce in the analysis area near Rock Creek Butte. Much of this population has been designated as a Research Natural Area. Brewer spruce is a conifer endemic to the Klamath Mountains, found in localized disjunct populations and often is an indicator of cold and wet environments. Preferred habitat is steep northfacing slopes, rocky ridges, cold hollows and dry talus and moraines. Brewer spruce has a wide range of habitat adaptability, but is restricted to less fertile soils because of competition from other conifers. Brewer spruce is very shade tolerant and regenerates well under dense stands. Regeneration is not as good under open conditions. Brewer spruce is not fire resistant, the thin bark and shallow roots make it very susceptible to damage even with low intensity fires. The sensitivity to fire is a primary factor in limiting the range.

Key Question 2- What are the current seral stage distributions and stand densities found in the watershed (including old-growth)?

The following Table 3-19 Acreage and Percentage Seral Stage and Stand Density by Vegetation Type, displays acreage and percentage of seral stage by vegetation community and percent average density of total tree cover.

Table 3-19 Acreage and Percentage Seral Stage and Stand Density by Vegetation Type			
VEGETATION COMMUNITY --Seral Stage	Acres	Percent	% Average Density o Total Tree Cover
SUB-ALPINE CONIFER			
--Shrub	60	4	<20
--Pole	0	0	0
--Early-Mature	392	3	30-40
--Mid-Mature	566	42	40-50
--Late-Mature/Old-Growth	340	25	55-65
TOTAL	1,358		
TRUE FIR			
--Shrub	503	8	10-20
--Pole	0	0	0
--Early-Mature	458	7	35-45
--Mid-Mature	2,687	41	45-55
-Late-Mature/Old-Growth	2,894	44	60-70
TOTAL	6,542		
DOUGLAS-FIR/WHITE FIR			
--Shrub	1,103	9	15-25
--Pole	944	8	50-60
--Early-Mature	876	7	50-60
--Mid-Mature	2,806	23	55-65

VEGETATION COMMUNITY --Seral Stage	Acres	Percent	% Average Density of Total Tree Cover
DOUGLAS-FIR/WHITE FIR (cont.)			
--Late-Mature/Old-Growth	6,688	54	65-75
TOTAL	12,417		
DOUGLAS-FIR/WHITE FIR/HARDWOOD			
--Shrub	786	23	30-40
--Pole	848	25	55-65
--Early-Mature	186	6	50-60
--Mid-Mature	237	7	70-80
--Late-Mature/Old-Growth	1,315	39	80-90
TOTAL	3,372		
DOUGLAS-FIR			
--Shrub	440	13	20-30
--Pole	165	5	45-55
--Early-Mature	577	17	60-70
--Mid-Mature	1,229	36	65-75
--Late-Mature/Old-Growth	999	29	70-80
TOTAL	3,410		
DOUGLAS-FIR/TANOAK			
--Shrub	5,087	12	35-45
--Pole	6,004	14	70-80
--Early-Mature	3,055	7	70-80
--Mid-Mature	11,323	27	75-85
--Late-Mature/Old-Growth	16,326	39	85-95
TOTAL	41,795		
DOUGLAS-FIR/TANOAK/LIVE OAK			
--Shrub	1,135	5	25-35
--Pole	719	3	55-65
--Early-Mature	2,903	14	75-85
--Mid-Mature	10,992	52	75-85
--Late-Mature/Old-Growth	5,489	26	75-85
TOTAL	21,238		
DOUGLAS FIR/LIVE OAK			
--Shrub	540	5	20-30
--Pole	288	3	55-65
--Early-Mature	2,962	27	70-80
--Mid-Mature	5,026	46	70-80
--Late-Mature/Old-Growth	2,006	19	75-85
TOTAL	10,822		
ULTRAMAFIC MIXED CONIFER			
--Shrub	140	13	5-15
--Pole	0	0	0
--Early-Mature	531	48	35-45
--Mid-Mature	252	23	25-35
--Late-Mature/Old-Growth	186	17	45-55
TOTAL	1,109		
MONTANE MEADOW/LAKE			
--Shrub/Forb	486	81	0
--Lake	116	19	0
TOTAL	602		
RIPARIAN			
--Shrub	1,243	44	5-15
--Pole	101	4	60-70
--Early-Mature	1,354	48	60-70
--Mid-Mature	140	5	50-60
--Late-Mature/Old-Growth	8	<1	75-85
TOTAL	2,846		

Seral stages are determined by the dominate overstory layer in a stand. The dominate tree layer must occupy at least ten percent of the stand area; it cannot consist of scattered predominate trees. Seral stage is primarily by size class, with some modification for site capability. For example, a stand that fits the size class for early/mature-seral stage, but has slow growing trees because of site limitations, may be classified as mid/mature. Table 3-20 Seral Stage Classification, shows size classes for each seral stage.

Table 3-20 Seral Stage Classification

Seral Stage	Description
Shrub	Trees (if present) <5" DBH or trees not present
Pole	Trees from 5-11" DBH
Early-Mature	Trees from 11-21" DBH
Mid-Mature	Trees from 21-36" DBH
Late-Mature and Old-Growth	Trees >36" DBH

Intense timber harvest has had an effect on almost all of the vegetation communities in the analysis area. The seral-stage distribution in many of the vegetation communities has been altered by regeneration harvesting. This has been particularly noticeable in Douglas-fir/white fir, Douglas-fir/white fir/hardwood, Douglas-fir, and the Douglas-fir/tanoak communities. These vegetation communities are often on deep fertile soils, and have some of the best conifer growth rates. Large conifers with good distribution were common in these communities, making them the most valuable for timber harvest. Table 3-21 Acres of Plantations by Vegetation Community, shows the distribution of plantations.

Table 3-21 Acres of Plantation by Vegetation Community

Vegetation Community	Acres of Planation in Community	% of Community	% of Plantations Non-Stocked
Sub-Alpine Conifer	0	0	0
True Fir	207	3	0
Douglas-Fir/White Fir	1,982	16	2
Douglas-Fir/White Fir/Hardwood	1,513	45	<1
Douglas-Fir	458	13	4
Douglas-Fir/Tanoak	9,892	24	4
Douglas-Fir/Tanoak/Live Oak	1,787	8	4
Douglas-Fir/Live Oak	592	6	5
Ultramafic Mixed Conifer	13	1	0
Montane Meadow/Lake	2	<1	0
Riparian Shrub	31	1	0

Old-growth is distinguished from late-mature in the EUI database by characteristics of structural diversity; holes in the canopy, high number of down logs and snags, etc. But for most purposes, the late/mature and old-growth seral stages are collectively referred to as old-growth.

The late/mature old-growth type (LM/OG) is of particular importance for planning. The *Northwest Forest Plan ROD* standards and guidelines "specify retention of old-growth fragments in fifth field watersheds containing less than 15% of such stands." Ishi-Pishi/Ukonom, a fifth field watershed, currently contains 35,650 acres of the LM/OG seral stages, or 34% of the 105,500 acre watershed. The distribution of LM/OG stands in Ishi-Pishi/Ukonom is displayed in Figure 3-12 Late/Mature and Old-Growth Stands, contained in the Map Packet located at the end of this document, and management implications are discussed in Step 5. Table 3-22 Acres of Old-Growth by

Vegetation Community, shows the distribution of old-growth.

Table 3-22 Acres of Old-growth by Vegetation community

Vegetation Community	Acres of Old-Growth	% of Community
Sub-Alpine Conifer	341	25
True Fir	2,724	42
Douglas-Fir/White Fir	6,464	52
Douglas-Fir/White Fir/Hardwood	1,316	39
Douglas-Fir	1,032	30
Douglas-Fir/Tanoak	16,855	40
Douglas-Fir/Tanoak/Live Oak	5,005	24
Douglas-Fir/Live Oak	1,795	17
Ultramafic Mixed Conifer	136	12
Riparian Shrub	8	<1

Key Question 2a- How much of the watershed is currently late-successional habitat and where is it located?

The Forest definition of suitable spotted owl nesting/roosting habitat is used to describe late-successional habitat (see spotted owl discussion in the wildlife section for a description of this habitat). Suitable spotted owl habitat, as sorted from the EUI data, includes only those vegetation types considered capable (see vegetation types discussion) with dominate trees larger than 20" (Mid-Mature and Late-Mature/Old-Growth seral stages), total tree cover greater than 60%, and at elevations less than 6,000 feet. The EUI sort of this criteria shows 46,630 acres of suitable spotted owl nesting/roosting late-successional habitat in the watershed. See Figure 3-13 Suitable Northern Spotted Owl Habitat, contained in the Map Packet located at the end of this document).

Spotted owl dispersal habitat includes those areas not meeting nesting/roosting criteria but contain dominate trees larger than 11" and total tree cover >40%. Dispersal habitat can occur in vegetation types not capable of supporting nesting/roosting habitat. Based on an EUI data sort of vegetation that meets these criteria, there are 29,720 acres of dispersal habitat in the watershed. For the distribution of dispersal habitat, see Figure 3-13. These numbers indicate that 44% of the analysis area is currently suitable nesting/roosting habitat and 28% is dispersal habitat.

Key Question 2b- What areas of the watershed are capable of supporting late-successional habitat?

There are few portions of the analysis area that are not capable of supporting late-successional habitat. The dry southwest aspects in the south and west parts of the analysis area, and the harsh ultramafic sites are the largest areas of incapable ground. The map of the vegetation communities can be used to show the general patterns of areas capable of supporting late-successional habitat. Except for small areas of rock outcrop and areas of poor soils, the following vegetation communities are all capable of supporting late-successional habitat; true fir, Douglas-fir/white fir mixed conifer, Douglas-fir/white fir/hardwood, Douglas-fir, Douglas-fie/tanoak, and Douglas-fir/tanoak/live oak. These communities cover 84% of the analysis area. See Figure 3-11 Existing Vegetation Based on EUI, contained in the Map Packet located at the end of this document, for the distribution of the vegetation communities that can support late-successional habitat.

Key Question 2c- Where is the existing dispersal habitat for late-successional species and where are barriers to dispersal?

Dispersal habitat is found throughout of analysis area, see Figure 3-13. For wide ranging species such as the spotted owl there are no identifiable barriers in the analysis area. For smaller species such as amphibians and reptiles dependent on microclimates associated with late-successional habitat, the hot dry southwest slopes, wide roads, and possibly the Klamath River can be barriers to dispersal.

Key Question 3- What are the disturbance regimes impacting the vegetation in the analysis area?

The fire regime is the most widespread and the largest disturbance regime effecting the analysis area. Lightning fires are ignited in the watershed nearly every fire season. Fires occurring in the area effect the vegetation communities with a variety of severities. The more infrequent the fire return interval, the greater the potential severity to the vegetation. Effects found within large fires include areas of high, moderate and low severity. The amounts of each depend on conditions existing at the time of the fire occurrence. Weather conditions, available fuels, and topography being the deciding conditions for severity of fire. An aggressive fire suppression response has been affective since approximately 1920. Most fires have been contained within small areas (less than one acre) but on occasion, the number of starts overwhelms the suppression forces and large fires are the result. The most recent example for the analysis area occurred in 1987 when 18,900 acres of the watershed (mostly within the Ukonom Creek drainage) was burned by lightning ignited fires (see Figure 3-14 Fire History, contained in the Map Packet located at the end of this document). With a successful fire suppression record, a lack of fire has allowed the development of overly dense vegetation communities with high fuel loadings. In general, these conditions will increase fire severity throughout the analysis area. This will be discussed more in Step 5.

Flooding and landslides are the next most widespread disturbance in the analysis area, often occurring during or in association with winter storms. Rain on snow events are the most damaging, resulting in flooding, debris torrents, and landslide activation. Intense summer thunderstorms can also cause isolated flooding and debris torrents. For a more complete discussion on flooding and landslides, see Hillslope processes.

Insects and disease also are an impact on vegetation. Insect and disease outbreaks are usually found in areas where stand densities exceed site capability. Mortality flights have not identified any significant areas of recent mortality in the analysis area.

Wind throw is another disturbance that occurs infrequently mostly at higher elevations in the watershed. During the winter of 1995-96, a storm with high winds caused a large amount of wind throw mostly found within the Marble Mtn Wilderness area. Snow breakage occurs occasionally when there is a particularly heavy wet snow. Evergreen hardwoods are particularly susceptible to this especially when this occurs at lower elevations.

Key Question 3a- What are the current risks (potential ignition sources) found in the analysis area?

Based on historic disturbances to the watershed, and current vegetative conditions, high severity fires are the greatest threat to the watershed. For the period 1922-1994, 513 fires occurred in the analysis area. Lightning fires have over the 72 year period accounted for 58% of the fire starts. Lightning ignited fires have occurred within the watershed 51 of the 72 years (71% of the time).

The other main ignition source is human activity, the extensive road network allows human activity throughout much of the watershed. In the period from 1975 to 1994, 30% of the ignitions in the analysis area were human caused. Of the human caused fires, escaped camp fires, debris burning and arson accounted for 70%. The most common human caused fire is from escaped camp fires, most of these are from dispersed camping areas, not improved campgrounds. Arson fires account for 19% of the human caused fires. Escaped fires caused by debris burning around residences accounts for 18% of the human ignited fires. Another potential source for fires is industrial activity, which can include mining, roadwork and timber harvest.

Key Question 3b- What are the current fuels and fire behavior potential in the watershed?

Fire behavior potential modeling is done in order to estimate the severity and resistance to control that can be expected, when a fire occurs during what is considered the worst case weather conditions. Late summer weather conditions are referred to as the 90th percentile weather data, which is a standard used when calculating fire behavior (90th percentile weather is defined as the severest ten percent of the historical fire weather, i.e., hot, dry, windy conditions occurring on mid afternoons during the fire season). The modeling incorporates fuel condition, slope class, and 90th percentile weather conditions in calculating projections on flame lengths and rates of spread. To identify fuel conditions, a crosswalk is developed from the existing vegetation layer to fuel models (see Figure 3-15 Fuel Models, contained in the Map Packet located at the end of this document). Three slope classes are utilized in the fire behavior potential modeling <35% slope, 35-65% slope and >65% slope. Aspect is also incorporated by varying one hour fuel moisture content by aspect. The 90th percentile weather data is based on twenty years of data collected at Somes Bar, which is the representative weather station for the watershed.

Fire behavior potential ratings of low, moderate and high are identified from the fire behavior modeling, see Figure 3-16 Fire Behavior Potential, contained in the Map Packet located at the end of this document. A low rating indicates that fires can be attacked and controlled directly by ground crews building fireline and will be limited to burning in understory vegetation. A moderate rating indicates that hand built firelines alone would not be sufficient in controlling fires and that heavy equipment and retardant drops would be more effective. Areas rated as high represent the most hazardous conditions in which serious control problems would occur i.e., torching, crowning, and spotting. Control lines are established well in advance of flaming fronts with heavy equipment and backfiring may be necessary to widen control lines. For more information on fuel modeling and the development of fire behavior potential for this analysis, refer to Appendix E - Fire and Fuels.

Table 3-23 Fire Behavior Potential, identifies the areas of high, moderate and low fire behavior potential within each vegetation community.

Table 3-23 Fire Behavior Potential

Vegetation Type	High FBP Acres	Moderate FBP Acres	Low FBP Acres
Sub-Alpine Conifer	16	513	823
True Fir	2,467	3,211	848
Douglas-Fir/White Fir	4,554	5,925	1,913
Douglas-Fir/White Fir/Hardwood	1,549	1,558	257
Douglas-Fir	1,544	1,729	127
Douglas-Fir/Tanoak	17,955	23,322	503
Douglas-Fir/Tanoak/Live Oak	9,258	11,663	304
Douglas-Fir/Live Oak	3,637	80	7,096
Jeffrey Pine	810	35	257
Montane Meadow/Lake	0	0	602
Riparian Shrub	9	78	2,759
TOTAL	**41,799**	**48,114**	**15,489**
Percent	**40%**	**45%**	**15%**

Key Question 4- What plant communities provide socio-culturally significant vegetation and where is it located?

American Indians use materials found in all the vegetation communities. Some of the vegetation used include; tanoak, black oak, hazel, willow, bear grass, woodwardia and maiden hair ferns, and mushrooms. Most of these plants are found in the Douglas-fir/tanoak, riparian, and the Douglas-fir communities. These plants are found throughout the analysis area, but become socio-culturally significant where they are accessible by the people wanting to use them. For the most part, this means areas on moderate slopes and accessed by the existing road system.

TERRESTRIAL WILDLIFE

Key Question 1- For the species identified in this analysis: bald eagle, peregrine falcon, spotted owl, marbled murrelet, fisher & marten, Del Norte salamander, elk, and porcupine;
a. What are the habitat needs?
b. Where is the habitat in the watershed?
c. How much habitat is in the watershed?
d. What is our current knowledge of the populations in this watershed?

The analysis area contains potential habitat for a variety of vertebrate wildlife. Many of these habitats have been altered by management activities on public and private land. For this analysis, the wildlife focus will be on the bald eagle, peregrine falcon, northern spotted owl, northern goshawk, Pacific fisher, American marten, willow flycatcher, black-tailed deer, elk, and black bear. Amphibian and reptile species will also be discussed if information is available. These species were selected for analysis because of their status as either protected by the Endangered Species Act, listed as Forest Service sensitive, or they have high social interest. These species are also included as part of the Forest Management Indicator Species (MIS) in the *Forest Plan.* Refer to Appendix F - *Endangered Species Act* and Other Species Considerations Questions and Answers.

Other MIS species or assemblages from the *Forest Plan* found in the analysis area include hardwood and snag assemblages. Information developed and tracked in the analysis, for vegetative biodiversity and other wildlife species should cover habitat concerns for the hardwood assemblages. Information on snags and snag densities is not available at the watershed scale, but expected snag densities for natural forest types found in the watershed will be presented.

Bald Eagle: status-Federal Threatened

Bald eagles in inland Northern California are found in close association with lakes, reservoirs, and rivers that provide prey and suitable nesting and roosting habitat. Nests are usually located in multistoried forest stands with large trees and generally the largest ponderosa pine, sugar pine, or Douglas-fir are used for nests and roosts. Bald eagles feed primarily on fish during the spring and summer but often shift to waterfowl and carrion in the winter.

There is one nest within the analysis area in the Soldier Creek drainage. The eagles forage for fish along the Klamath River and have been seen up Dillon and Ukonom Creeks.

Peregrine Falcon: status-Federal Endangered

Peregrine falcons primarily nest on large cliff, usually near water. Peregrines begin nesting in February and the young fledge in early summer. Peregrines hunt for birds over large areas and many different habitat types. Perches, in prominent locations (high rocks, cliffs, and snags) are important to peregrines as observation posts in foraging, territorial defence, and reproductive behavior. There are 2 known peregrine eyries within the analysis area, on the Klamath River at Somes Bar and in Rock Creek.

Northern Spotted Owl: status-Federal Threatened

On the Klamath National Forest, suitable nesting/roosting habitat for spotted owls is defined as multi-layered, multi-species conifer stands with greater than 60% total canopy cover. Large (>18" dbh) overstory trees, large amounts of down woody debris, and the presence of trees with defects or other signs of decadence in the stand are also important habitat components. The size of the stand and adjacency to other habitat types that owls can use are important factors in determining suitability.

Suitable spotted owl habitat is found over almost all of the analysis area (see Figure 3-13). The suitable habitat has been fragmented by timber harvest in many areas and non-capable plant communities limit stand size in some areas of the area. There are 28 spotted owl activity centers in the analysis area; 16 are in LSRs, two are in Cultural areas, three are in Riparian Reserves, and seven are in Matrix lands.

There is currently 46,630 acres of suitable nesting/roosting habitat and 29,720 acres of dispersal habitat in the analysis area. Table 3-24 Suitable Spotted Owl Nesting/Roosting and Dispersal Habitat Acreage by Existing Vegetation Community, gives a breakdown of spotted owl habitat by management area for lands within the watershed.

Table 3-24 Suitable Spotted Owl Nesting/Roosting and Dispersal Habitat Acreage by Existing Vegetation Community

Land Designation	Nesting/Roosting Acres	Dispersal Acres
Sub-Alpine Conifer	458	470
True Fir	3,641	1,266
Douglas-Fir/White Fir	7,359	1,655
Douglas-Fir/White Fir/Hardwood	1,462	185
Douglas-Fir	1,961	625
Douglas-Fir/Tanoak	20,094	8,968

Land Designation	Nesting/Roosting Acres	Dispersal Acres
Douglas-Fir/Tanoak/Live Oak	8,699	8,707
Douglas-Fir/Live Oak	2,786	6,408
Ultramafic Mixed Conifer	166	307
Riparian Shrub	9	1,131
TOTAL	46,635	29,722

Marbled Murrelet: status-Federal Threatened

Marbled Murrelets are small robin-sized sea birds found from Alaska south to Central California. Marbled murrelets forage in the ocean near shore and in inland saltwater areas such as bays, sounds, and channels. Marbled murrelets have also been observed foraging on inland freshwater lakes.

Marbled murrelets feed below the water surface on small fish and invertebrates during the day and at night. During the breeding season marbled murrelets forage as singles or pairs, but during the winter they form loose aggregations.

From southeast Alaska southward, marbled murrelet nesting habitat is described as mature or old-growth forest stands near the coastline. These stands are generally characterized by large trees, multistoried canopy, and a moderate to high canopy closure, Marbled murrelets tend to nest in the oldest trees in the stand (see Figure 3-17 Suitable Habitat for Marbled Murrelet, contained in the Map Packet located at the end of this document).

Based on marbled murrelet tree nests found before 1990, the following general characteristics can be described; 1. Located in a large tree with an open crown structure, 2. On a moss-covered limb that is camouflaged, partially shaded, and horizontal with a diameter of at least 14', and 3. Located within the middle or lower part of a live crown. Nests were located high above the ground and had good overhead protection, but allowed access to the exterior.

Stand size seems to be important to marbled murrelets in nest site selection. They are more often found in stands greater than 500 acres than in stands less than 100 acres. However, marbled murrelets may nest in remnant old-growth trees or groves that are surrounded by younger trees.

For this analysis, suitable marbled murrelet nesting habitat is described as late mature and old-growth with greater than 40% total tree cover and also early and mid mature stands with predoms (scattered large conifers). Subalpine conifer and true fir vegetation communities were excluded because they do not provide the tree and limb structure needed by marbled murrelets. Using this criteria, there are 32,450 acres of suitable nesting habitat in the analysis area.

Northern Goshawk: status-Forest Service R-5 Sensitive

In northern California, goshawks use mature and old-growth conifer forest with dense canopy closures and little understory. Goshawks often nest on north and east aspects and low on the slope on moderate to flat terrain. Good goshawk habitat contains abundant large snags and large logs for prey habitat and plucking perches. Goshawk nest stands are composed of large dense trees and are often associated with forest openings such as meadows and riparian areas. Goshawks do most of their foraging in open mature forests, meadows, and other forest openings.

On the west side of the Klamath, suitable goshawk habitat is similar to spotted owl habitat and for this analysis it will be described as the same. For a display of suitable goshawk habitat, see Figure 3-13. Currently there are four managed goshawk nesting territories in the watershed;

For the amount of suitable goshawk habitat in the watershed see the table of suitable spotted owl habitat (Table 3-24).

Pacific Fisher: status-Forest Service R-5 Sensitive

Fishers are medium sized forest carnivores weighing between 5 and 12 pounds, with males larger than females. Fishers are generalized predators of small to medium sized mammals, birds, and carrion; with snowshoe hares, squirrels, mice and porcupines important prey species. In the pacific northwest, fisher are categorized as closely associated with late-successional forests. For fisher, tree species is less important than forest structure that affects prey abundance and vulnerability, and provides denning and resting sites. Conifer stands that provide these features have a diversity of tree sizes and shapes, light gaps and associated understory vegetation, snags, fallen trees and limbs, and trees with limbs close to the ground.

American Marten: status-Forest Service R-5 Sensitive

The American marten is a forest carnivore about the size of a small cat. Martens are found in climax conifer and mixed forests, at higher elevations usually above 5,000'. They need a moderately dense overstory and sufficient understory cover for hiding and denning. Moist sites that support dense succulent understory vegetation for prey species are considered prime marten habitat. Understory structure, including slash or rotten logs and stumps is necessary for denning, hiding, and foraging. Martens usually den in rotten logs, but have been known to use rock slides and slash piles.

Martens prey on small mammals, especially mice and voles. Other small mammals including ground squirrels, flying squirrels, chipmunks, and snowshoe hares are also important prey species. Seasonally, martens utilize insects, fruits, nuts, and small birds.

Over most of the west side of the Klamath, marten habitat is described as being above 5,000' and usually associated with true fir stands. The exception is the area historically occupied by the Humboldt marten which occurred at all elevations in Northwestern California. The analysis area is within the historic range of the Humboldt marten. For this analysis, suitable marten and fisher habitat will be mapped together as Forest carnivore habitat. The criteria used to describe Forest carnivore habitat is as follows: suitable denning/resting uses suitable spotted owl nesting/roosting and forest carnivore foraging habitat includes riparian, motane meadow, and the other vegetation communities that are pole size and larger and greater than 40% total tree cover. Based on these criteria, there is 46,730 acres of denning/resting habitat and 48,980 acres of foraging habitat in the analysis area (see Figure 3-18 Suitable Habitat for American Marten and Pacific Fisher).

Elk: status-Species of Local Concern

After having been extirpated from the analysis area by the early 1900s, elk are again repopulating the area. Most of these animals are believed to have come from the animals released in Elk Creek. In the analysis area, the more concentrated elk uses occurs in Sandy Bar, Stanshaw, and Irving Creeks. Elk use on the west side of the Klamath River is concentrated in the area from Rock Creek to Halverson Creek.

Elk forage in wet meadows, springs and seeps, and young plantations. In the analysis area, plantations with a high grass and forb component are important foraging areas. Older plantations with high tree densities and natural thickets are used for hiding and thermal cover. Elk migrate seasonally, moving to higher elevations in the summer and using lower elevations and drainage bottoms for cover and forage during the winter.

An important factor in maintaining a healthy elk population in the analysis area is providing adequate calving habitat. Good calving habitat is found on gentle slopes with dense cover, down woody material, close to forage and away from roads or other disturbance sources.

Studies have shown elk to be extremely sensitive to roads; this is mostly related to hunting pressure, and high traffic. In areas where elk are hunted, open road densities greater than 2.5 miles per square mile can reduce habitat effectiveness by half.

Survey and Manage Species

Survey and Manage standards and guidelines were developed in the *Northwest Forest Plan* where there was a concern for the viability for certain late-successional associated species. Generally the standards and guidelines were for species which other mitigation was not developed.

Survey and manage wildlife species known or suspected to occur in the analysis area are: Del Norte salamander and three species of mollusks; Oregon shoulderband, Tehama chaparral, and papillose taildropper.

Del Norte salamander is a terrestrial salamander with a limited distribution in southwest Oregon and northern California. It most often occurs in moist situations, usually associated with talus or rock outcrops in older forests (Herrington 1988). Abundance seems to correlate with mature and old-growth forests with a hardwood understory. For this analysis, a display of possible suitable Del Norte salamander habitat was developed from soil map units that contain rock outcrops and talus. These soil map units were combined with EUI vegetation cover of >40% total tree cover to map areas with a higher probability of finding suitable Del Norte salamander habitat in the analysis area.

Information on habitats for the three species of mollusks is quite limited. All three are assumed to have association with conifer forests.

Oregon shoulderband: has been found in rocky areas including talus, but is not restricted to those areas. It is suspected to be found in areas of permanent ground cover and moisture. Rock fissures or large woody debris can be important habitat factors.

Tehama chaparral: usually associated with limestone rockslides, but can be found under leaf litter and woody debris on the ground near limestone outcrops.

Papillose taildropper: appears to be strongly associated with hardwood logs and leaf litter on sites with relatively higher shade and moisture levels.

HUMAN DIMENSION

ROADS

Key Question 1- What are the current conditions and uses of roads within the watershed?

The analysis area contains approximately 414 miles of road. There are 389 miles under Forest Service jurisdiction, including temporary non-system roads. There are 21 miles of road under State or County jurisdiction and 4 miles under private jurisdiction. Refer to Appendix G- Numerical Listing of Roads and Their Status, and see Figure 3-19 Current Transportation System, contained in the Map Packet located at the end of this document).

State Highway 96 provides primary access to the watershed and communities along the Klamath River from I-5 to State Route 299 at Willow Creek. Within the analysis area, the double lane, paved highway parallels the Klamath River for approximately 21 miles.

The floods of 1997 and heavy rainfall in 1998 created significant impacts to the existing road system. Forty-six sites were identified from last year's storm damage, with damage ranging from complete washouts to culvert replacements. Because of the extensive nature of the damage, emergency funding (ERFO) was applied for and approved. Repairs are expected to be completed in about three years. See Figure 3-4, which identifies the 1997 flood damage road sites.

The four miles of road under private jurisdiction provide access to residences and are maintained by those individuals. They were generally constructed as low standard, native surface roads.

Forest Service road maintenance is grouped into five maintenance levels. Level 5 roads are double lane pavement, maintained to provide a high degree of user comfort. Level 4 roads have paved or aggregate surface, and are maintained to provide a moderate degree of user comfort and convenience at moderate travel speeds. Level 3 roads have an aggregate surface, and are maintained for travel by a prudent driver in a standard passenger car. Level 2 roads are those roads maintained for use by high clearance vehicles. Level 1 roads are intermittent service roads not maintained for use. Temporary non-system roads are those roads on National Forest land which were constructed to provide access for a single use, such as to a mining claim, water source, disposal site, harvest unit, landing, etc.

Road maintenance is accomplished through timber sale contract requirements, Forest Service road maintenance crews, and service contracts.

The following Table 3-25 Road Maintenance Level Mileage, displays miles of Forest Service Jurisdiction roads by Maintenance Level.

Table 3-25 Road Maintenance Level Mileage

Level	Miles
1 - Intermittent Service	146
2 - High Clearance Vehicles	135
3 - Passenger Car	69
4 - All Weather Surface	18
5 - Paved, Double Lane	10
Temporary Non-System	11
TOTAL	389

Through the years many of the roads within the watershed area have stabilized and both cut slopes and fill slopes are vegetated. Often erosion is triggered by intense seasonal thunderstorms, however severe erosion problems associated with roads may be chronic, and generally can be traced to one or more causes (e.g. geometric design of the road, road grades, surface type, soil type, road location, steepness of terrain, inadequate drainage structures, road location, lack of maintenance, or vehicle use during wet weather conditions). See the "Hillslope Processes" section for more information on roads and their affect on watershed processes. Road surfaces in the watershed area vary with considerations of soil type, slope stability, steepness of grades, proximity to stream courses, and patterns of use.

The following Table 3-26 Road Miles by Surface Type, displays miles of Forest Service jurisdiction roads by their surface type.

Table 3-26 Road Miles by Surface Type

Surface Type	Miles
Pavement	24
Chipseal	4
Crushed Aggregate	49
Pitrun Aggregate	82
Native Surface	230
TOTAL	389

Forest Service system roads within the watershed area were constructed for administration of National Forest lands. Public use has been allowed by the Secretary of Agriculture on most roads. Various travel and access management strategies are used within the watershed area to minimize resource use conflicts. These conflicts may include special wildlife considerations, erosion related water quality concerns, or public safety. Approximately 44% of the roads in the watershed area provide year round access, although snow frequently limits winter travel. Seasonal access is provided by 16% of the roads, and 40% of the roads have permanent closures.

The following Table 3-27 Travel Access Management Mileage, displays miles of Forest Service jurisdiction roads by access strategy.

Table 3-27 Travel Access Management Mileage

Travel Access Management Strategy	Miles
Year-Round Access	170
Seasonal Access	64
Permanent Closure 1/	155
TOTAL	389
1/ Includes Non-System roads	

Sixteen percent of the watershed is more than one half mile from any road. Road density in the analysis area varies from zero to greater than four miles of road per square mile. The average overall road density (all roads) for the entire analysis area is 2.5 miles/square mile which includes Wilderness and 2.7 miles/square mile excluding Wilderness. The average road density for the Ishi-Pishi and Ukonom watersheds is 3.2 and 1.2 miles/square mile respectively outside of wilderness. The highest densities are located in the Rodgers and Ti Creek watersheds (see Figure 3-20 Road Density, contained in the Map Packet located at the end of this document). The road densities for individual subwatersheds are discussed and displayed in the *Hillslope Processes* section (Page 3-1).

The following Table 3-28 Mileage and Road Density Acreage by Land Allocation, lists the miles of road and acres of road density by land allocation type.

Table 3-28 Mileage and Road Density Acreage by Land Allocation

Land Allocation	Miles of Road	Road Density Acres 1/ (miles/sq.mi.)			
		0.1-1.0	1.0-2.5	2.5-4.0	>4.0
Wilderness	<1	1,000	900	<100	0
Late-Succ Res.	186	5,200	8,700	11,200	11,500
Special Habitat	<1	<20	<100	<100	<100
Special Mgmt	32	700	2,900	3,100	1,000
Riparian Reserve	54	2,000	6,700	6,000	2,400
Retention	7	86	1,100	800	170
Partial Retention	61	1,293	2,800	3,700	3,000
Recreational River	1	165	100	130	6
General Forest	61	1,300	3,400	3,500	2,400
TOTAL 2/	403				

1/ Rounded to the nearest 100 acres
2/ Total includes some State and County roads

A Forest-scale roads analysis was recently (November 1997) completed by the Forest to determine the potential resource costs of roads versus the need for human access. This analysis attempts to provide a coarse filter or starting point for road projects such as improvement, decommissioning, maintenance, etc. However additional site specific knowledge and information needs to be applied during the NEPA process. The preliminary results of each road or road segment are identified in Appendix H - Results of Roads Analyses.

A *Travel and Access Management Plan* was completed in 1996 for the Ukonom District. This plan identifies roads which are candidates for decommissioning, seasonal or year-round closure, or restoration opportunities. The preliminary results of each road or road segment are identified in Appendix H. Copies of the *Travel and Access Management Plan* are on file at the Ukonom District Office.

COMMERCIAL TIMBER OUTPUTS ON PUBLIC LANDS

Key Question 1- What are the *Forest Plan* expectations for timber products from this watershed?

There are four land allocations from the *Forest Plan* which provide for a sustained yield of timber harvest: Retention, Partial Retention, General Forest, and Recreational River. Partial Retention, General Forest, and Recreational River comprise Regulation Class 2 lands, and Retention is Regulation Class 3. The Klamath Forest Plan estimates a Probable Sale Quantity of 1.0 MMBF/decade and 0.6 MMBF/decade from the Ishi-Pishi and Ukonom watersheds respectively. This watershed analysis will refine the matrix land allocation acres and the estimated timber volume from available lands in the Step 5 for this issue. Table 3-29 Existing Acres of Matrix Lands By Management Area, displays existing acreage for matrix lands by management area land allocations.

Table 3-29 Existing Acres of Matrix Lands By Management Area 1/

Management Area	Acres	% of Analysis Area	Capable	Non-Capable
Retention	3,700	4	3,430	270
Partial Retention	15,200	14	13,600	1,600
General Forest	13,700	13	13,000	700
Recreational River	1,100	1	870	40
TOTAL	33,700	32	30,900	2,610

1/ Source: LMP data layer

The following Table 3-30 Acreage of Seral Stage for Matrix Lands By Management Area, shows existing acres by seral stage by management area for matrix lands in the analysis area.

Table 3-30 Acreage of Seral Stage for Matrix Lands By Management Area 1/

Management Area	Shrub/ Forb 2/	Pole/Early-Mature 3/	Mid-Mature 4/	Late-Mature/ Old- Growth 5/
Retention	100	800	2,100	700
Partial Retention	1,700	4,500	5,400	3,600
General Forest	1,900	4,000	4,200	3,600
Recreational River	100	300	500	200
TOTAL	3,800	9,600	12,200	8,100

1/ Source: EUI data sort
2/ Trees (if present) <5" dbh or trees not present
3/ Trees from 5-11" dbh
4/ Trees from 11-21" dbh
5/ Trees from 21-36" dbh

The following Table 3-31 Existing Acres of Plantations for Matrix Lands By Management Area, displays acreage of plantations by management area and their respective percentage of the total management area acreage.

Table 3-31 Existing Acres of Plantations for Matrix Lands By Management Area 1/

Management Area	Plantation Acres	Total Management Area Acres	Percent of Total
Retention	100	3,700	3
Partial Retention	3,400	15,200	22
General Forest	3,300	13,700	24
Recreational River	100	1,100	9
TOTAL	6,900	33,700	20

1/ Source: Managed Stands data layer

Key Question 2- What is the public's perceptions and opinions of the timber sale program?

The public's perceptions and opinions of the Forest Service timber sale program in general, and within the analysis area cover a broad spectrum of diverse points of view. However, based on past public scoping efforts involving local timber sale projects, Regional and National news articles, and public statements from individuals and organizations interested in the timber sale program, general observations can be made.

Generally, most people are not opposed to some level of timber harvest. However, there is a growing trend in public opinion that considers thinning of smaller young trees as an acceptable approach, and the harvest of large older trees and the creation of large forest openings as unacceptable.

A large percentage of the national and regional public does not support new road construction in roadless areas, and is only minimally supportive of new road construction in other areas.

The local public in the vicinity of the analysis area is highly concerned about forest health issues such a vegetation overstocking, and the risk of catastrophic wildfire, and feel that the forest should be utilized to provide wood products to society and to promote a healthy local economy. However, at the same time, this local public puts a very high value on scenic beauty and the protection of wildlife and fisheries resources, and there is much disagreement about the best methods to reach the desired objectives.

Tribal governments are becoming more assertive about their views as to what constitutes good forest management in their ancestral lands, and environmental groups, along with other regulatory agencies within the government are continuing to apply intense scrutiny to all proposals involving timber harvest. These social and administrative trends have the effect of creating more influential voices in the debate about what is the most socially acceptable role of the timber sale program, at a time when the society at large is demanding that the Forest Service make the planning process more of a cooperative process among a diverse group of interests. The result is that in the analysis area, it is becoming more difficult to design economically feasible timber sale projects that are supported by a majority of the public and other interested groups..

CULTURAL

Key Question 1- What is the Forest Service relationship with Karuk Tribe of California?

Refer to Step 5 Cultural (Page 5-27) for the answer to this question.

Key Question 2- What heritage resources exist within the watershed?

Refer to Step 5 Cultural (Page 5-28) for the answer to this question.

HUMAN USES

Key Question 1 - What Special Forest Products are utilized in the watershed?

A variety of Special Forest Products are gathered from this watershed. With the exception of the tanoak mushroom, most products are gathered for traditional subsistence or basketry use by local Native Americans. These products include hazel sticks, bear grass, willow sticks, willow roots, tanoak acorns, tanoak mushrooms, fronds from several fern species, and a variety of berries, nuts, and medicinal plants. The cultural importance of these items is discussed under the cultural resource issue. Since 1991 the matsutake mushroom, locally known as tanoak mushrooms has been discovered as valuable for export to Japanese markets.

Commercial permits are issued for tanoak mushrooms, firewood, poles, and occasionally (during holiday season) for floral greens such as huckleberry, salal, and conifer boughs.

Recent years have shown an increased interest in quality basketry materials and some other materials needed for ceremonial and/or spiritual use.

Key Question 2 - What are the recreational uses in the watershed?

A variety of recreational uses occur in the analysis area, mostly dispersed in nature (see Figure 3-22 Recreation Features and Existing Private Land Uses, contained in the Map Packet located at the end of this document). Activities include rafting, camping, photography, sightseeing, recreational mining, hiking, and fishing. A majority of these recreational activities occur either in or along the Klamath River corridor, or in the Marble Mountain Wilderness.

Listed below are the four key recreational user groups on the Klamath River:

Rafting: Commercial and recreational rafting on the Klamath, which has been the most popular recreation use of the river since the 1970s, has grown dramatically in recent years. Rafting draws more recreationists to this rural area than any other recreational activity. There are currently 60 commercial outfitters offering rafting on the Klamath. Total commercial user days vary by year but average 12-15,000 people per year. The typical three day rafting trip originates in Happy Camp and ends at Persido or Ti-Bar. The last 1-1/2 days are spent on this stretch of river. The last night of the trip is typically spent at Ukonom Creek, Coon Creek or Dillon Creek. Recreational rafting is on the increase due to the relative ease of this portion of river. Kayaking is also growing in popularity on the Klamath River, possibly due to a world class kayak school located on the Salmon River. That school showed 50 trips with students in 1997.

Fishing: The Klamath River is very popular for recreational fishing. There are currently ten permitted commercial fishing guides who operate driftboats on this stretch of river. They typically fish eight to ten miles of river a day. Depending on the weather, some clients will camp in early fall, but generally they stay at local lodging facilities. The average stay is three to five days.

River accesses are very important to all river users. Rafters, fishermen and miners depend on access that will allow them to get to the rivers edge for boat launching and take out. Strategic access points are Coon Creek, Persido Bar, Ti-Bar, Stuarts Bar and Green Riffle. However, because of the floods of 1997, river access was closed at Coon Creek and Green Riffle, but expected to reopen for the rafting season of 1998.

Camping: Recreational camping is enjoyed in two forms, dispersed and developed. Developed camping is at Dillon Creek Campground which offers 21 sites and facilities (toilet, water, garbage). Dillon Creek is considered a primary use facility and its season is from May to Nov. User groups vary by season starting with recreational rafting and swimming and ending with fishermen and hunters in the fall. Based on records from the mid 1990s, Dillon Creek campground receives over 8,000 recreation visitor days (RVDs) of use each season. This makes it the fourth most popular CG of the 22 primary and secondary CGs on the Klamath NF. Dispersed camping is enjoyed at Ti-Bar Flat and Persido Bar, both of which are adjacent to the Klamath river.

Dispersed camping is also enjoyed at Lake Oogaromtok (Frog Pond), Beans Camp, and Camp Three.

Mining: Recreational mining on the Klamath has been on a downward trend the last few years. This is probably due to the continued decline in gold prices and the increased fees imposed by BLM. Additional restrictions by CAF&G for dredge intake sizes and season of operation are likely in the years to come.

Currently there are 29 mining claims recorded within this stretch of the river. 6 of these are held by recreational mining clubs (GPAA and 49ers) and are located near the mouth of Dillon Creek and at Persido Bar. These club claims receive moderate use each year by club members. The other 23 claims are held by individuals or small groups with little to no activity each year.

Most "mining" on this stretch of the river is done using small dredges and/or pans. The duration of stay is generally 1 or 2 weeks and they usually camp near their equipment at dispersed sites adjacent to the river. Those who utilize the club mining sites travel from all over the US as they tour and try out many of the clubs claims during a particular season. The individual or small group claims are held by more local residents (CA or OR).

MARBLE MOUNTAIN WILDERNESS

Wilderness Use: Most users of this portion of the wilderness are hikers and backpackers, however stock use is on the increase and is now up to about 40% overall. During the hunting season stock use clearly exceeds foot use. Almost all users who enter from Stanshaw and Ten Bear are en route to one of the lakes located east of this watershed boundary (Monument, Meteor, One-mile, and Cuddihys). Most use is associated with camping and fishing at the stocked lakes. Approximately 70% of the people that use the western portion of the Wilderness are from the northern CA coast (Humboldt, Del Norte, Mendocino, and Sonoma Counties), approximately 20% are from the San Francisco Bay area, and the remainder come from Siskiyou County and other areas. The greatest number of users from outside the local region occurs during the hunting season.

Trailheads: This watershed includes two trailheads that provide access into the Marble Mtn Wilderness; Stanshaw and Ten Bear. The **Stanshaw trailhead** receives moderate overall use and is growing in popularity with stock users. Facilities have been installed and improved in recent years through a partnership with the backcountry horsemen's association. The Stanshaw trailhead now has a nice toilet facility, two corrals with water, several picnic tables, dispersed camping spots, adequate room to park vehicles and trailers, and an information/sign board. Each spring the backcountry horsemen and women perform maintenance work (repair fences, paint bathroom and sign boards, and remove fallen limbs and debris) at the trailhead and they also do log-out and tread repair on the main trails in the western part of the Wilderness. The **Ten Bear trailhead** has a small corral and parking area. It receives low overall use but is important to the permittee of a range allotment that encompasses the western portion of the wilderness. The permittee runs 50 cow-calf pairs from mid-July to mid-October. The cows come in from Ten Bear trailhead and range through Ti Creek meadows, Stanshaw, Long, Big, Haypress, and Let'er Buck Meadows.] It also receives hunting use.

Sightseeing occurs along Highway 96 by both residents of the area and tourists. River recreationists also view the area while fishing or floating the river. The area was inventoried for existing visual condition levels in 1988 as part of the *Forest Plan*, and displayed in Table 3-32 Acreage and Percentage by Existing Visual Condition Levels below (see Figure 3-21 Existing Visual Condition, contained in the Map Packet located at the end of this document).

Table 3-32 Acreage and Percentage by Existing Visual Condition Levels

Visual Condition Level 1/	Acres	% of Watershed
Untouched	29,300	28
Unnoticed	15,200	14
Minor Disturbance	12,300	12
Disturbance	11,500	11
Major Disturbance	12,900	12
Drastic Disturbance	24,200	23
TOTAL	**105,400**	**100**

1/ Source - LMP data layer
<u>NOTE:</u> This information is general in nature and requires further refinement at the project scale.

The information in this table could be interpreted that 54% of the watershed is natural appearing to the average forest visitor. On the other hand, 46% of the watershed has a modified appearance from management activities. Noticeable activities include: timber harvest, roads, and mining.

Key Question 3 - What are private land uses and local community concerns and interests about this watershed?

The watershed includes 105,300 acres. Scattered private lands are located in watershed, found primarily along the Klamath River/Highway 96 corridor. However some parcels are located upslope several miles from the river. Generalized land uses include residential, commercial, ranching, mining, non-corporate timber, and some home businesses which total approximately 1,700 acres or 2% of the total acres. See Figure 3-22, which identifies generalized private land uses.

Local residents enjoy the rural lifestyle, with its quality of life and natural beauty. "Natural beauty, beauty of the area, majestic beauty and scenery" were comments listed by local residents as "Strengths" of the area (Final Draft Orleans Somes Bar Community Action Plan 1998).

The following Table 3-33 Private Land Uses Within the Ishi-Pishi/Ukonom Watersheds, displays acres by land use along with the corresponding percentage.

Table 3-33 Private Land Uses

Land Use	Acres	% of Private Lands
Residential	900	53
Commercial	<10	<1
Mining	100	6
Non-Corporate Timber	500	29
Unknown	200	12
TOTAL	1,700	100

Residences include 900 acres, and are scattered throughout the analysis area. Many are occupied year-round, by the property owner(s) while some properties retain a caretaker who resides on the property.

Commercial property includes less than ten acres, and includes businesses such as the Somes Store, a nursery, and recreational cabin rentals.

Mining uses occupy 70 acres, and are believed to be inactive at this time. However rising prices for gold could trigger new mining activity.

Non-corporate timber lands occupy 500 acres, and are those parcels which are owned by private individuals and have had fairly recent timber harvest or in the past.

There are 200 acres of private lands where, based on local knowledge, the land use is unknown.

The communities of Somes Bar (population 225) and Orleans (population 550) are located within or adjacent to the analysis area. An important social interaction relates to the local community culture, economy, and quality of rural life. In 1996 a community interest group was formed to represent the communities of Orleans and Somes Bar. The group is composed of individuals representing a variety of interests, including local business- men and women, long-time residents, Forest Service employees, and tribal members. Several meetings were held and a listing of "Problems to be Solved" was developed. Table 3-34 Community Work Group Statement of Issues, shows that thirteen categories of concern were expressed at the community meeting, and include:

Table 3-34 Community Work Group Statement of Issues

ISSUE	LOCATION IN DOCUMENT WHERE DISCUSSED
1. School	N/A
2. Law Enforcement	N/A
3. Salvage Logging/Forest Health	Terrestrial
4. Economic Diversity (non-Forest related economies)	N/A
5. Recreation/Tourism (trails, river accesses, etc.)	Human Uses
6. Fish	Aquatic
7. Transportation/Gates	Roads
8. Special Forest Products	Human Uses
9. Sustainability	Terrestrial
10. Property Issues	N/A
11. Information in General	N/A
12. Local vs Outside Workers	N/A
13. Quality of Life	N/A

* Source: Final Draft Orleans Somes Bar Community Action Plan.

For a list of strategic action plans regarding each of the issues listed above, refer to the Final Draft Orleans Somes Bar Community Action Plan; copy available at the Ukonom Ranger District.

The watershed analysis interdisciplinary team, after reviewing this list of issues, felt that several of these issues, namely numbers 3, and 5-9, should be considered during this process. This watershed analysis will provide some information and discussion of these 6 issues which might be useful to the community interest group.

Special-use authorizations include the following activities: private land access, water transmission lines, power utility lines and/or relay facilities, mineral materials (sand, gravel, cobble), a school, waste disposal sites, and applications for Small Tracts Act land adjustments.

Other lands program-type information include:

--There are 31 Indian allotments within this section of the Klamath River corridor. Indian allotments are lands held in trust for tribal members by the BIA.
--There is a power site withdrawal located near Ishi-Pishi Falls that is still in place from the once planned hydro electric dam at Sugar Loaf. At one time a tunnel went all the way through the mountain.
--There are two mineral withdrawals that encompass the Ti-Bar work station and what was the Somes Bar work station. A mineral withdrawal is a formal designation that closes the area to entry and development.

Step 4 - Reference Conditions

INTRODUCTION - This step describes how ecological conditions have changed over time, resulting in current conditions as described in Step 3. A reference will be developed based on historic conditions for comparison with current conditions. This is an attempt using historical data to determine how the ecosystem adapted/developed. The time period will vary by ecosystem features and data availability. Where actual data is lacking, descriptions of historical conditions will be constructed from a multitude of sources, inferences, and professional judgement.

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

HISTORIC OVERVIEW

THE FIRST RESIDENTS

The regions past ethnographic cultures are some of the most complex in the United States, reflecting diverse prehistoric and historic use patterns and human adaptations. Early settlement patterns centered around the most advantageous fishing, hunting, and food collection sources. The river was a lifeway and thoroughfare for settlement and use. The Katimin area near the Salmon River and Klamath River was one of the greater populated vicinities, strategic to travel, fishing, and community and ceremonial use.

American Indian settlement possessed marked economic stability from annual runs of salmon, the diversity of nearby upslope resources, and more remote forested locations. In terms of food supply, acorn collecting economies were pronounced. Game and vegetable foods supplemented fish and acorn sources.

Most resources were family owned and managed. Early trails followed ridge systems or alongside river corridors. Northwestern California Indian Cultures developed a sophisticated trade network with other neighboring Tribes.

The Katimin vicinity near Ishi-Pishi Falls, known as the *Center the World* to the Karuk Tribe, was one of three principal ceremony centers for enhancing *World Renewal* institutions. Areas in the vicinity embodied supernatural phenomena, oral literature, and culturally was where many creatures, immortal beings, and events originated.

Prior to the arrival of miners, settlement and aboriginal management of fish, wildlife, plants, food, construction materials, travel, and trade was comprehensive. Land management practices were based around various ritualistic observances, conservation, and environmental adaptations, e.g., underburning the landscape.

Aboriginal land management, especially fire based management is clearly documented. There is unequivocal evidence that early management of California was pronounced, widespread, and long-term. The long time presence of the Karuk over centuries and their reliance on forest resources cause them to be highly integrated with ecosystem functions. A careful investigation of Karuk land use patterns can reveal conclusive modifications.

Conservation practices included judicious harvesting, cultivating, planting, weeding, burning, and pruning. Tobacco was planted and harvested. As the productivity of resources grew in local demand, horticultural practices became more sophisticated in order to rejuvenate culturally significant species.

Understory burning was widely applied near some settings to promote plant changes, populations, plant associations, and habitat relationships. Indian burning was also applied to help optimize soil nutrients and reduce pest and plant diseases. Around tanoak groves, fire was used to setback fir species competition.

Religious institutions played a role in land management. *World Renewal* religious practices included ritual restoration, first fruits, new fire building, and other observances which were performed to prevent disease and environmental calamity. Rituals helped regulate management of fisheries and other resources. For example, a first salmon ceremony was an event in which a spiritual and ritual leader cooked and ate the salmon in a yearly run. Prior to this event, salmon were allowed to pass unimpeded to their spawning grounds. This ceremony required complex institutional working relations between those Tribes living along the Klamath River from the Pacific into Oregon. The prohibition on individuals taking salmon helped provide for the sustainability of salmon.

A study of air photos from 1944 reveals that watershed ridges were more open, especially south facing slopes. Inner gorges and lower elevations were more heavily forested. Generally, the 1944 photo interpretations indicate lightning caused and human induced fires contributed to this historic pattern. Offield Mountain was burned each year in conjunction with the *World Renewal* ceremonies; prior to 1850.

The watershed areas that were most intensely managed by the Karuk were moderate to low elevation settings adjacent to the Klamath River, secondary streams, and flanking drainages.

Accounts are varied, but possibly up to 1,000 Karuk who lived in the watershed experienced traumatic displacement as a result of confrontations with miners and disease after 1850. As the miner population declined over the next three decades the Karuk who survived began to resettle in their territory. In 1887 under the *Dawes General Allotment Act,* small parcels of land were assigned to a few local Karuk households.

HISTORIC GOLD RUSH ERA

The dominant economic pattern for land use of American Anglo settlement conformed to rural patterns of colonial exploitation. Mountainous lands contained precious minerals, timber, and water. Urban areas were dependent upon the shipment of raw materials from outside areas. The American West settlement was based upon production of free resources and land. Gold was free to the miner as a monetized commodity within the context of a National and International economy. Cattle ranching, logging, mining, and agriculture exemplify the rural industrial use.

The first record of non-natives to pass through the region was Hudson Bay trappers around 1828. With gold discoveries in 1848 in California, miners from many ethnic groups began migrating to the state; from the east, Europe, and China. In 1850, a group of miners crossed the Trinity Alps and followed the Salmon River to the Forks of the Salmon River where they found rich deposits of gold. Another party moved up the Klamath River to the mouth of Salmon River. By 1851, several hundreds of miners entered the region in search of gold. From 1850 to 1854, mining camps were established within the analysis area.

Miners relied on importing supplies in and exporting gold from the area. Rugged mountainous terrain prevented rapid development of travel routes other than trails. Pack trails were built that followed the Klamath River in the 1850s. Other trails went east, up the Salmon River and south toward Orleans. Higher elevation ridges were also used for access, so trails were eventually constructed on a few ridge systems. The Kelsey Trail, traversing from Crescent City to Scott Valley, may have split and crossed the northern portion of the watershed. Some trail systems served as access routes into the 1920s.

Mining included tunnel and placer excavations, see Figure 4-1 Historic Mines and Dumps, contained in the Map Packet located at the end of this document, and for locations of mines in the analysis area, refer to Appendix I-Mining, for a detailed description of significant mines. Streams and Klamath River channels experienced the most disturbance. Following the initial rush of the early 1850s, mining developed a corporate base. Much of the easily extracted gold was taken out. This resulted in the development of mining corporations and more complex technologies. From 1850 to 1880 many riverbar and stream bottoms were unearthed, stripped of vegetation, and rechanneled by mining. Vegetation at mining sites were cut, milled, cleared, burned, or debris set aside. Hydraulic methods washed huge quantities of earth aside, or into streams or rivers; now evident as mine tailing remains along with exposed cut banks. Most year-round streams were tapped for hydraulic mining near the Klamath River. Ditch alignments are a common historic feature. Based on archaeological records, mining disturbance was greater near stream confluences and within a half-mile distance of the Klamath River.

By 1870 to 1890, the majority of miner populations moved to other gold bearing regions. Small numbers remained to homestead, mine, ranch, or become merchants or lumbermen. From 1850 to 1920, homesteads, Indian Allotments, and mining camps were established. Mining, homesteading, ranching, and farming activity had greater influence on riverine and stream environments than upland areas.

Over ten decades, the local settlement patterns in the watershed shifted in response to the rural economy and use. By 1920, mining had declined significantly. Residents depended more upon ranching, farming, and logging, than on mining. In the '30s, the WPA - Conservation Corps provided for rural development, and mining slightly reemerged with a number of single men working claims. This activity declined with the onset of World War II. Limited levels of mining exploration took place during the war years in western Siskiyou County.

Shifts in rural use resulted in dispersed (sparse) settlement in the Klamath River corridor. For example, Cottage Grove, near the mouth of Swillup Creek, had a school, Post Office, store, and hotel; Dillon Creek consisted of a few residences and a school; and Somes Bar had a Post Office, school, and store. Somes Bar was considered a small community, however the watershed continued to become less populated. Most residences were scattered along the Klamath River and by 1960, most developments were gone, leaving behind abandoned mines and old dumps.

NATIONAL FOREST AND RURAL USE

The *Forest Reserve* established the Klamath National Forest in 1905 through provisions of the *Organic Act of 1897*. Forest Service management from 1906 to 1940, consisted primarily of improving trail and road access, mining regulation enforcement, grazing management, recreational service, logging activities, and fire suppression. The WPA-Conservation Corps in the 1930s also played an important role in developing road systems, constructing fire lookouts, trails to lookouts, and fire suppression. The Klamath River Road, from Yreka to Orleans, was constructed in the 1920s.

After 1950, the Administration placed a greater emphasis on timber production in response to Congressional and Industrial desires. From 1950 to 1985, the watershed experienced widespread alteration of naturally established timber stands. Road development increased concurrently with even-aged clearcut practices. The regional population increased as timber based economies increased. From 1960 to 1985, the watershed experienced considerable alteration of established mature forests. Timber alteration since the late 1980s declined, leaving local communities to undergo economic transitions due to reduced timber harvest. Currently, environmental laws, endangered species, land use demands, past alteration, and political pressures have significantly reduced logging in the Pacific Northwest. Economic opportunities today are more dependent upon recreational tourism, cottage industries, and Government or Tribal employment.

AQUATICS

HILLSLOPE PROCESSES

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

Erosion rates previous to Euro-American settlement were influenced by natural erodibility and instability, the occurrence of flood events, and natural wildfire or American Indian burning. The geomorphology of the area was basically the same as today with similar processes as described in Step 3. Active landslides, inner gorges, toe zones of large earthflows, and other unstable features provided the majority of sediment to streams during periodic flood events. The timing and frequency of floods was primarily dependent on heavy rainfall or rain-on-snow climatic events.

While flooding provided the mechanism to trigger large inputs of sediment to streams, fire was the primary upslope disturbance. Fires, either lightning or human started, frequently burned through the area and impacted watershed conditions. Fires were generally of low intensity with some patches of high intensity in upslope areas. Fires were less common and of lower intensity in riparian areas due to the low slope position and moist conditions, refer to the Vegetative Biodiversity section later in this step. Fires increased erosion and landsliding, especially when high intensity fire occurred on granitic soils.

Fire recurrence intervals in pre-settlement times have been studied in the Klamath Mountains area but the watershed impacts of these fires are not well known. Most burned acreage was likely burned at low intensity but patches of high intensity fire certainly occurred at various times and places. Therefore, while pre-settlement fire is acknowledged to have caused watershed disturbance historically, quantifying historic effects of wildfire is difficult. For modeling purposes, reference watershed conditions are considered pristine; no effects of fire or other disturbance.

RIPARIAN AREAS

Key Question 1- What are the historic and reference riparian conditions in the watershed?

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

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

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

Riparian areas are essential in maintaining stream temperature, dissolved oxygen levels, and other elements of water quality. They also ensure large wood recruitment, stabilize the channel, provide for filtration of sediment, and increase habitat diversity.

Forested riparian ecosystems should have a diversity of plant communities. Late-seral stages should predominate and consist of endemic conifer and hardwood species, with intermingled areas of early-seral stages such as grasses and forbs. Ideally, this should be a multi-layered canopy including signs of decadence such as standing and fallen dead trees. An overstory of conifers should provide future recruitment of large wood, and shade and thermal cover of streams and lakes. An intermediate layer of mixed deciduous and coniferous vegetation should provide thermal buffering, nutrient cycling, bank stability, and recruitment of terrestrial insects as an aquatic food source. The vegetative canopy should provide stream surface shading during the summer and should be at site potential.

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

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

AQUATIC DEPENDENT SPECIES

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

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

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

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

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

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

TERRESTRIAL

VEGETATIVE BIODIVERSITY

Key Question 1- What was the historic distribution and pattern of vegetation in the watershed; including late-successional and dispersal habitats?

For this analysis, the best available information for historic vegetative conditions are the 1944 aerial photos. Analysis of the 1944 photos shows for the most part, open stands of hardwoods and conifers covering much of the area with dense stands limited to the lower half of north slopes and drainage bottoms. Openings in the forest were prevalent. Open grass and shrub covered slopes, and patches of small trees are found throughout the watershed. An analysis of openings that covered a portion of this analysis area was done from 1944 through 1985 aerial photos. The analysis shows a reduction in opening size by an average of 39% during this 40 year period (Skinner 1995). The picture from the 1944 photos is that of a spatially and structurally diverse landscape.

Earlier accounts from European settlers that came to the area in the 1850s describe very open conditions with ample grass to sustain livestock. Much of the area was described as a hardwood/conifer savanna. It was described as mostly grass covered with scattered hardwoods and conifers. Blue wild rye was probably the dominant grass found in the area, with many other shade intolerant grasses and forbs contributing to the diversity of the community. The hardwoods consisted mostly of tanoak in the lower elevations, black oak and chinquapin in the mid and higher elevations. Conifers were found mostly near drainage bottoms and the lower half of north slopes. Douglas-fir was the dominant conifer, but higher proportions of ponderosa pine and sugar pine than today were present. Ponderosa pine, sugar pine, and incense-cedar were found higher on north aspects.

By definition (refer to Step 3), late-successional habitat was found only near drainage bottoms and on the lower third of north aspects. Late-successional habitat was limited to sites which experienced fire less frequently. These were found mostly on north and east aspects of the hardwood/conifer communities and the higher elevation true fir community. Dispersal habitat was found throughout the analysis area. Scattered hardwoods and conifers with open understories were found through much of the low to mid elevations and provided good dispersal habitat. High elevation true fir and wet meadow areas provided late-successional and dispersal habitats. Dispersal and foraging habitat covered most of the analysis area.

Key Question 2- What were the historic disturbance regimes?

The natural disturbance regime for the watershed was dominated by fire. Natural occurring fires were ignited by lightning. Fires were also ignited by American Indians. Fire was commonly used by American Indians as a management tool. Acorns were a staple in the diet of American Indians living in the analysis area. Enhancing acorn production was one example of managed fire by the American Indians living in the analysis area. Burning improved acorn crops by encouraging larger, more productive trees and reducing losses to insects. Burning in and around important oak groves also ensured that fuel accumulations under these trees would remain low, thus protecting them from high severity fire. A large severe fire could top-kill the oaks that provided acorns. These trees could not produce sufficient supplies for many years following this type of fire. The production of basketry materials was another reason for burning. The better materials for making baskets were young, straight shoots of many sprouting species. As the shoots matured, they would become unsuitable due to side branching and lack of flexibility. The vegetation in all plant communities developed and adapted to a disturbance regime dominated by fire.

A fire history study (Wills 1991) done near the analysis area in the Lower South Fork of the Salmon River, identifies a frequent pre-settlement (1742-1849) fire return interval for low intensity fires, ranging from 5-41 years, with the mean range of plots being 10-17 years. This study also indicates higher intensity fires occurred much less frequently (>100 years) and complete stand replacement fires occurring at even longer intervals of up to 500 years. The study area is located in the Hotelling Gulch area, in a Douglas-fir/live oak vegetation type, at elevations ranging from 2,950'-3,200'.

Cultural burning both by American Indians and Euro-Americans was common practice in the analysis area until the establishment of the Klamath National Forest in 1905. Early records (R. W. Bower 1978) indicate that around 1910 the Klamath National Forest experienced problems with human-caused fires. This was attributed to cultural burning, forage improvement, carelessness, and people hoping to get employment in fire suppression. Forest Service policy was to encourage fire exclusion so that wood production would be higher in the future. Disagreements between local residents and Forest Service policy continued and large fires (>100 acres) were common in the analysis area up until successful enforcement of fire prevention and suppression practices were accomplished in the 1930s. Effective fire suppression began in the analysis area in 1933, with the establishment of Civilian Conservation Corps (CCC) camps in Orleans and other locations on the Klamath, making men and equipment readily available to fight fire. The *New Deal* and Civilian Conservation Corps of the 1930s, gave fire suppression a dramatic boost in personnel, equipment, and facilities. After WWII, mechanized equipment was easier to obtain to fight fires and fire suppression became more efficient.

Fire control, suppression of all fires, was standard Forest Service policy until the early 1980s. At this time fire became a more accepted management tool. Fire was used for site preparation after timber harvest and some natural fires were allowed to burn within contained areas.

Endemic levels of insects and diseases have always been present in the landscape. However, the amounts of these infestations were probably less prior to active fire suppression activities, than today. Decreases in natural stand densities were largely due to mortality from lightning strikes, minor insect activity, and ground fires. This kept stocking at or below site capacity which tended to moderate the amount of mortality experienced during drought periods. Root disease pockets, blowdown, or areas which escaped American Indian underburning, would accumulate fuel. This would eventually promote a hot fire and develop a mosaic of size and age classes over the area. Also, because there were less incidence of high stocking levels, and resultant competition for moisture and nutrients, vegetation remained more vigorous overall and less susceptible to large scale mortality.

Broad scale mortality in natural stands in California ranges from 0.2 to 0.5% of the standing volume per acre per year. Natural mortality due to lighting strikes, insects, and disease is approximately 0.2%/ac/yr. (personal communication David Schultz PSW Entomologist).

In the low elevation hardwood/conifer savanna, frequent fires were the most common natural disturbance. Frequent fires eliminated most hardwood/conifer seedlings and helped perpetuate the grass, scattered larger trees, and open understories in the landscape. Fire spread was mostly dependent on cured grasses, forbs, and leaf and needle litter, which was available annually. This community could be ready for fire to return within one or two years after a fire. Grasses, forbs, hardwoods, and shrubs in this community adapted to this frequent fire regime by crown sprouting after a fire and/or by sprouting from seed banks in the soil. Conifers typically provide a seed rain after a fire and seedlings would sprout in mineral soil and ash.

In the Douglas-fir/evergreen hardwood communities, frequent fires maintained an open understory and a scattered large tree overstory. The frequent low intensity fires cleaned up the surface litter and removed concentrations of small trees. This disturbance regime helped to maintain a conifer/oak woodland with a grass understory. The mature trees were resistant to damage by low intensity fires. The grass would carry a fast moving low intensity fire and also choke out competing shrubs. The frequent burning stimulated acorn production, which was important to American Indians and many wildlife species.

In the mixed conifer communities, frequent fires were the primary ecological process shaping them. These fires varied in frequency and intensity depending on their position on the slope, the steepness of the slope, aspect, elevation, time of year, and size and density of the trees. With frequent influence by fire, the understory of these stands was maintained relatively open, with few sapling and pole-size trees or shrubs. Fires were more frequent on south and west aspects. This had a great affect on overall stand density, with overstory and understory density less on south and west and denser on north and east. Frequent fires cleaned the forest floor of litter and understory vegetation. In this frequent low to high intensity fire regime, there were pockets of moderate to high fire intensity that helped to create a mosaic of seral stages. Some sites experienced fire less frequent than others. These were found mostly on north and east aspects and riparian areas, where a thicker understory of shade-tolerant vegetation was often present. Even these areas were maintained with much less coarse woody material and fewer snags than found on these sites today.

The higher elevation true fir community was much cooler and moister than the lower elevation vegetation communities, resulting in a different natural disturbance regime. Lightning fires, windthrows, and insect out-breaks were the primary agents of change in this community. True fir is very sensitive to damage by fire and sometimes even low to moderate intensity fires can kill large trees. Fires were mostly limited in size, with infrequent large fires. In combination, windthrow, insect damage, and lightning fire would create a pattern of groups of even-aged trees that covered areas from several acres to several thousand acres.

In the higher elevation sub-alpine areas, lightning fires were common, but moist conditions, lack of fuel continuity, and barren areas limited the spread and intensity of fires.

TERRESTRIAL WILDLIFE

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

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

BALD EAGLE depends on fish for a food source and large conifers for nesting habitat. The historic anadromous fish runs would have provided an excellent food source and the old-growth forests near the river would provide nesting habitat. The Klamath River corridor would have been very good bald eagle habitat. The territoriality of bald eagles would have been the limiting factor for population density, not a lack of habitat.

PEREGRINE FALCON are limited by suitable cliffs for nest sites. These type of cliffs are limited in the analysis area. The historic peregrine population was probably not much different than today. The diversity of habitats found historically; riparian areas, oak woodlands, conifer forests, and mid-slope meadows, would provide a diversity of bird prey species for peregrines.

MARBLED MURRELET nest in old-growth conifers with large limbs and being a seabird nesting close to the coast would be the most preferred. Before logging started on the coast, murrelets probably would not range this far inland to nest. If they did come this far inland the scattered stands of old-growth Douglas-fir and ponderosa pine would have provided suitable nesting habitat. There is no evidence of current or historic use of marbled murrelets in the analysis area.

SPOTTED OWL --With the historic fire regime of more frequent low to moderate intensity fires, the suitable nesting/roosting habitat of dense multi-storied stands would have been limited to fire refugia; low on north and east aspects and in drainage bottoms. Dense multi-storied stands with ladder fuels are not very stable in a frequent fire environment. Low slope positions on north and east aspects and drainage bottoms would be the areas least affected by the historic fire regime. Suitable nesting/roosting habitat even limited to these type of areas would still be found across most of the analysis area. As the mixed conifer graded into true fir, larger blocks of suitable nesting/roosting habitat would be found, due to less frequent fire in these vegetation communities. Since over 70% of the analysis area is a mixture of conifer and hardwood the suitable nesting/roosting habitat in these vegetation types would have been very linear following the drainages and the north and east aspects of the drainages, with foraging/dispersal habitat covering most of the area in between. The distribution of nesting/roosting and foraging/dispersal habitat across the analysis area was dictated by the fire regime (both natural fire and cultural burning).

GOSHAWK prefer moderately dense canopy closure and an open understory for foraging through the forest. Their preferred nesting sites are in large trees located low on slopes of north and east aspects. The historic fire regime would provide good conditions for goshawks. The habitat diversity including oak woodlands, conifer forests, meadows, and riparian areas in all seral stages would have provided a diverse and abundant prey base for goshawks. The denser conifer dominated stands on north and east aspects would have provided nesting opportunities. Historically much of the analysis area below the true fir zone would have been good goshawk habitat.

MARTEN/FISHER --The habitat conditions that supported spotted owl and goshawk would also have supported marten and fisher. The historic habitat diversity should have made the analysis area good habitat for these two forest carnivores.

ELK are grazers that move up and down the slope depending on the season. The more open oak woodlands and conifer forests with a grass understory would have provided excellent elk habitat. The east side of the analysis area from Carter Creek to Rodgers Creek would have most likely been the best elk habitat. The more gentle slopes in this area would have provided easier migration routes between high elevation summer range in the Haypress Meadow area and winter range along the Klamath River.

PORCUPINE were never common to the analysis area, they use herbaceous vegetation from meadows and riparian areas for a food source. They seem to prefer pine trees for climbing and foraging, and rock talus areas for winter denning. Rocky areas for winter dens can be a limiting factor for porcupine use of an area. Historically there were more pines in the hardwood/conifer and more herbaceous vegetation as a result of the fire regime. These conditions would have made the area more suitable for porcupine and it can be assumed that they were more common in the past.

SURVEY AND MANAGE SALAMANDER AND MOLLUSKS --There is little or no historic information on these species. The timing of most of the fires under the historic fire regime would have been at times these species would have underground or in protected areas. This would allow them to occupy these areas even with the frequent fire regime.

Under the early conditions, the combination of good growth sites, favorable moisture regime, plants species diversity, and frequent fire created and maintained a diversity of habitat types and/or ecological niches for a wide variety of wildlife species. The abundance and distribution of individual species would have changed through time depending on the intensity and distribution of the fires.

HUMAN DIMENSION

ROADS

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

Prior to inception of the Forest Highway Program in 1915, the Forest Road Development Program in 1925, and the Works Progress Administration, the normal method of travel in the analysis area was by foot, mule, or horse over early historic trails with a few rough wagon roads. The transportation system in the landscape has developed over the years primarily in association with resource development and/or extraction. Early road construction followed old trail alignments and centered around providing access for fire suppression and mining activities.

Development began in the early 1920s with the construction of Highway 96 from Happy Camp to Somes Bar. Further development did not occur until the early 1930s when the Civilian Conservation Corps began constructing the main access roads to Cedar Camp, Dillon Mountain, Elk Valley, Camp Three, Ukonom Mountain, and Offield Mountain.

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

Most of the remaining roads in the area were constructed to access timber harvest beginning in the late 1950s. Examination of aerial photos and Forest Visitor Maps show the progression of road building within the analysis area. See Appendix G - Numerical Listing of Roads and Their Status, which identifies the approximate decade roads were built, see Figure 4-2 Road System Development, contained in the Map Packet located at the end of this document.

COMMERCIAL TIMBER OUTPUTS ON PUBLIC LANDS

Key Question 1- What timber harvest activities have occurred in the watershed and where?

A total of 28,800 acres (29%) of the watershed has had some level of timber harvest. The EUI identifies areas with stumps present - this information can be used to approximate the 12,700 acres which were partial cut areas (thinnings, salvage, etc.). A review of the Managed Stands data layer identifies 16,100 acres where regeneration harvest prescriptions have been applied, see Figure 4-3 Historical Logging, contained in the Map Packet located at the end of this document.

The decades in which these were harvested are identified in Table 4 - 1 Acres of Plantations by Decade.

Table 4 - 1 Acres of Plantations by Decade

Decade	Acres	% of Plantations	% of Total Area
1990-Present	2,300	14	2
1980-1989	3,900	24	4
1970-19790	4,500	28	1
1960-1969	5,300	33	5
1950-1959	100	<1	<1
TOTAL	16,100	100	15

Source: Managed Stands layer

CULTURAL

Key Question 1- What were the prehistoric and historic land uses and management practices within the watershed?

Refer to Step 5 Cultural section (Page 5-28) for the answer to this question.

HUMAN USES

Key Question 1- What are the historic human uses in relation to Forest Products/Recreation/Community interest of the watershed?

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

Step 5 - Interpretation

INTRODUCTION - This chapter begins with a brief outline of planning direction as it applies to the Ishi-Pishi/Ukonom analysis area. Included with planning direction is a brief overview of management areas and a summary of desired conditions by management area. Following the management area overviews are answers to the Step 5 key questions by issue as outlined in Step 2. Issue-specific desired conditions based on *Forest Plan* guidance and landscape characteristics are also discussed.

PLANNING DIRECTION

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

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

Table 5-1 Management Area Acreage

Management Area	Acreage 1/	% NF Lands
Wilderness	8,400	8
Late-Successional Reserve	44,480	43
Other Special Habitat	200	<1
Special Management	7,760	8
Riparian Reserve	17,740	17
Retention VQO	2,180	2
Recreational River	450	<1
Partial Retention VQO	11,620	11
General Forest	10,790	10
TOTAL	**103,620**	**100**

1/ The reported acreage contains updates of land allocation estimates from the *Forest Plan*, particularly Riparian Reserve; and does not include the 1,660 acres of private lands in the watersheds.

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

LATE-SUCCESSIONAL RESERVES (LSRs) and OTHER SPECIAL HABITAT - Portions of the Ten Bear, Dillon, and Flint Valley/Bark Shanty LSRs are within the analysis area. The Ten Bear LSR occupies much of the analysis area east of the Klamath River adjacent to the Klamath River. The Dillon LSR occupies the northwest portion of the analysis area around Pony Peak and the Flint Valley/Bark Shanty LSR occupies much of the high country in and near the Rock Creek drainage. Several 100 acre LSRs are located in the area between these large LSRs. A Special Habitat area in located near Somes Bar. The goal of late-successional reserves and special habitat areas is to provide habitat for late-seral dependent wildlife and other terrestrial T&E species over the long-term.

SPECIAL MANAGEMENT - Special management areas include Research Natural Areas (RNAs), Special Interest Areas (SIAs), and Cultural Areas. The Ishi-Pishi/Ukonom analysis area contains two RNAs, the Haypress Meadows and Rock Creek Butte RNAs. All of the Haypress Meadows RNA is within the Marble Mountain Wilderness, partially within this analysis area and partially in the Wooley Creek analysis area. The Rock Creek Butte RNA is entirely within the Ishi-Pishi/Ukonom analysis area, partially within the Flint

Valley/Bark Shanty LSR and partially its own management area. RNAs are to provide unmodified conditions and natural processes for non-manipulative research in those places of important vegetative, aquatic, or geologic interest. The Haypress Meadows RNA contains stands of Red Fir and extensive mountain meadows. The Rock Creek Butte RNA contains mountain chaparral and Brewer spruce. The Katimin Cultural Area is also mostly within this analysis area. Cultural Areas are to provide protection of the ceremonial values that exist in these areas

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

WILD AND SCENIC RIVERS - The Klamath River is a designated National Wild and Scenic River. The portion of the Klamath River within the analysis area is classified Recreation River. The boundaries of the Wild and Scenic River corridor have been established. In the Recreational River management area, timber harvest is allowed but should meet Partial Retention VQO. Timber output expectations are the same as for Partial Retention. Ukonom Creek is a proposed Wild River although the entire stream is within an LSR and the river corridor does not have its own Management Area designation.

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

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

Released Roadless Areas were unroaded (RARE II) areas released for multiple use management under the *California Wilderness Act.* Some of these areas have since become roaded, about 200 acres in this analysis area, but are retained in the database as released roadless. Controversy concerning entering roadless areas affects management of these areas. Released roadless designation has some present impacts on those management areas available for scheduled timber harvest and may affect management in LSRs and Riparian Reserves as well. The management implications of Released Roadless Areas will be discussed in more detail under the Commercial Timber Harvest Outputs on Public Lands issue. The acreage of Critical Habitat Units and Released Roadless Areas is displayed for each management area in Table 5-2 Released Roadless Areas and Critical Habitat Units.

Table 5-2 Released Roadless Areas and Critical Habitat Units

Management Area	Critical Habitat Unit Acreage	Released Roadless Area Acreage 1/
Late-Successional Res.	28,700	8,420
Special Management	120	0
Riparian Reserve	1,250	1,410
Retention VQO	0	150
Recreational River	0	20
Partial Retention VQO	1,870	960
General Forest	1,230	200
TOTAL	33,170	11,160

1/ The acreages listed include 200 acres of released roadless area that have been roaded.

AQUATICS

HILLSLOPE PROCESSES

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

There is a general increase in current erosion rates compared to reference/historical erosion rates. In the Ishi-Pishi Analysis Watershed, roads and timber harvest are the primary causes in increased erosion. In the Ukonom Analysis Watershed, the 1987 wildfire plays a primary role in increased erosion, along with roads and timber harvest. While wildfire has always played a role in the Ukonom watershed, the intensity and extent of the 1987 fires is probably greater than what generally occurred under reference conditions. Any surface erosion increases from the 1987 wildfires has probably recovered to near reference condition, but increased landslide potential and channel erosion still exist.

Roads constitute a large percentage of increased erosion rates. Roads increase landslide, surface, and channel erosion over the long-term, until a road is decommissioned or obliterated and has become revegetated. Erosion impacts of individual roads are variable, from large erosion increases to erosion increases a little above background rates. In general, road densities greater than about 4 miles per square mile will cause noticeable downstream impacts. Fixing known road erosion problem sites is the best way to decrease erosion rates from roads.

Timber harvest, including salvage, has also contributed to current increased erosion rates. While some harvest has minimal impact (salvaging only dead trees after a high intensity wildfire), regeneration harvest and fuel treatment of green stands has a larger impact.

Landslide sediment production modeling is one way to estimate increases in erosion rates. The landslide model is based on landslide rates quantified in the *Salmon Sub-Basin Sediment Analysis* (de la Fuente and Haessig 1993). This model is used throughout the Klamath National Forest westside although verification for areas outside the Salmon subbasin is not yet complete. Modeled landslide volumes are estimates and should not be used as absolute values. However they do provide a basis for comparison. Two different landslide volumes are compared in this analysis. The first is current condition, modeled by overlaying the wildfire, roading, and intensive timber harvest acres (displayed in Step 3) with the geomorphic terranes and multiplying by landsliding rates. The second is a hypothetical reference condition, assuming the watershed is in pristine condition with no natural or management disturbances. Reference condition does not reflect actual historic condition with the influence of fire, as discussed in Step 4, but does provide a consistent basis for comparison. Results of the modeling for the 15 analysis subwatersheds are displayed in Table 5-3 Subwatershed Landslide Volumes. The process used for modeling landslide rates is described in Appendix B - Cumulative Watershed Effects.

Table 5-3 Subwatershed Landslide Volumes 1/

Subwatershed	Current Condition	Reference Condition	% Over Reference 2/	Percent of Threshold 3/
UKONOM ANALYSIS WATERSHED				
Upper Ukonom Creek	4.9	2.3	107	0.54
McCash/Cub	7.2	3.0	136	0.68
Panther/Lick	5.4	2.7	101	0.51
Coon	6.0	3.7	63	0.32
Swillup Creek	5.3	4.0	32	0.16
Thomas/Aubrey	6.4	4.0	61	0.31
Subtotal/Average	**5.9**	**3.2**	**84**	0.42
ISHI-PISHI ANALYSIS WATERSHED				
Carter/Kennedy	12.1	6.0	100	0.50
Ti Creek	7.0	2.7	160	0.80
Upper Rock Cr.	7.8	5.5	42	0.21
Beans Gulch	10.7	7.0	53	0.27
Lower Rock Cr.	9.2	5.7	62	0.31
Sandy Bar/Stanshaw	8.3	4.1	104	0.52
Irving Creek	10.1	3.6	182	0.91
Rogers Creek	8.2	2.7	199	1.00
Reynolds/Natuket	8.9	5.0	76	0.38
Subtotal/Average	**9.1**	**4.8**	**87**	0.44
TOTAL	***8.0***	***4.3***	***86***	***0.43***

1/ All landslide volumes are expressed as cubic yards per acre; based on landslide producing event or events with similar impacts to the floods of 1970-1974, approximately equivalent to one 20 year flood.

2/ % Over Reference is the current condition minus the reference condition divided by the reference condition. A percent over reference of 100 percent has sediment volume increased by a factor of 2.

3/ Percent of Threshold is the percent over reference divided by an assumed landslide threshold of 200 percent. A value greater than 1.00 is over threshold.

Another model is used to predict surface erosion. This model uses the Universal Soil Loss Equation (USLE) and parameters modified from the *Salmon Sub-Basin Sediment Analysis*. Roads are the primary disturbance influencing surface erosion model outputs, due to assumptions of high erosion rates, high sediment delivery potential, and no recovery of impacts from roads. In addition, site specific conditions such as road surfacing, are not used in this analysis due to lack of data and modeling complexities. Verification of USLE parameters, thus surface erosion model outputs, is not as straight-forward as the verification of landslide model parameters. Surface erosion model outputs can be highly variable depending on assumptions and should, like the landslide model outputs, be used as a comparative tool rather than as an absolute measure. Model outputs are displayed in Table 5-4 Subwatershed Surface Erosion Volumes.

Table 5-4 Subwatershed Surface Erosion Volumes 1/

Subwatershed	Current Condition	Reference Condition	% Over Reference 2/	Percent of Threshold 3/
UKONOM ANALYSIS WATERSHED				
Upper Ukonom Creek	0.012	0.012	1	0.00
McCash/Cub	0.051	0.013	297	0.37
Panther/Lick	0.080	0.023	243	0.30
Coon	0.103	0.020	404	0.51
Swillup Creek	0.058	0.019	206	0.26
Thomas/Aubrey	0.088	0.020	344	0.43
Subtotal/Average	**0.063**	**0.018**	**257**	**0.32**
ISHI-PISHI ANALYSIS WATERSHED				
Carter/Kennedy	0.116	0.016	629	0.79
Ti Creek	0.177	0.017	939	**1.17**
Upper Rock Cr.	0.109	0.019	474	0.59
Beans Gulch	0.141	0.020	621	0.78
Lower Rock Cr.	0.107	0.018	494	0.62
Sandy Bar/Stanshaw	0.112	0.015	664	0.83

Subwatershed	Current Condition	Reference Condition	% Over Reference 2/	Percent of Threshold 3/
ISHI-PISHI ANALYSIS WATERSHED (cont.)				
Irving Creek	0.143	0.020	611	0.76
Rogers Creek	0.171	0.020	775	0.97
Reynolds/Natuket	0.114	0.017	565	0.71
Subtotal/Average	**0.127**	**0.018**	**622**	**0.78**
TOTAL	***0.105***	***0.018***	***483***	*0.60*

1/ All surface erosion volumes are expressed as cubic yards per acre per year.

2/ % Over Reference is the current condition minus the reference condition divided by the reference condition. A percent over reference of 400 percent has sediment volume increased by a factor of 5.

3/ Percent of Threshold is the percent over reference divided by an assumed surface erosion threshold of 800 percent. A value greater than 1.00 is over threshold.

Other models also exist for the prediction of channel erosion. These models use many of the same parameters as the landslide model (e.g., the extent of watershed disturbance and soil types) but use different computations. The channel erosion models closely parallel the landslide model, show similar results, and are not calculated for this analysis.

Key Question 2- What are the hydrologic/erosional concerns in the analysis area and in each subwatershed? What management strategies should be used to minimize impacts from human activities?

The landslide and surface erosion models give some indication of hydrologic/erosional concerns for each subwatershed. The thresholds used in these models act as indicators that subwatersheds may have some erosion concerns that would affect management. For the Ishi-Pishi/Ukonom watersheds, Ti Creek is over threshold in the surface erosion model and Rogers Creek is at threshold in the landslide model.

Another modeling technique used in the *Forest Plan* is the Equivalent Roaded Area (ERA) methodology. The ERA model provides a simplified accounting system for tracking disturbances that affect watershed processes. This model, while not intended to be a process-based sediment model, does provide another indicator of watershed conditions. The methodology combines roaded acres with acres of other disturbance, using coefficients which equate other types of disturbance to an equivalent acre of road. The amount of roads and regeneration harvest are presented in Step 3 for each subwatershed in the Ishi-Pishi/Ukonom watersheds. These are multiplied by coefficients presented in Appendix B - Cumulative Watershed Effects. The sum of the disturbances (ERA) is divided by the area of each subwatershed to arrive at a relative disturbance rating, percent ERA.

The percent ERA is then compared to a Threshold of Concern (TOC). The TOC is derived considering the beneficial uses, channel sensitivity, erosion potential, hydrologic response, and slope sensitivity for each subwatershed, as discussed in Step 3. These factors are combined in a formula that determines the TOC (refer to Appendix B). In general, a lower TOC indicates a greater chance of having watershed impacts than in an area with a higher TOC given the same amount of watershed disturbance. The TOC is compared to the percent ERA for each subwatershed; values are displayed in Table 5-5 Equivalent Roaded Area and Threshold of Concern.

Table 5-5 Equivalent Roaded Area and Threshold of Concern

Subwatershed	%ERA	Threshold of Concern	%ERA/ TOC	Over Threshold 1/
Upper Ukonom Creek	5.4	6.32	0.85	No
McCash/Cub	5.1	6.32	0.80	No
Panther/Lick	6.2	7.43	0.83	No
Coon	3.6	7.69	0.47	No
Swillup Creek	2.8	6.65	0.42	No
Thomas/Aubrey	2.0	8.50	0.23	No
Carter/Kennedy	3.5	5.35	0.66	No
Ti Creek	7.0	6.65	1.06	**Yes**
Upper Rock Cr.	4.2	6.75	0.63	No
Beans Gulch	4.2	7.54	0.55	No
Lower Rock Cr.	3.7	7.35	0.50	No
Sandy Bar/Stanshaw	4.6	6.22	0.73	No
Irving Creek	4.6	6.22	0.74	No
Rogers Creek	9.1	6.42	1.42	**Yes**
Reynolds/Natuket	4.7	7.07	0.66	No

1/ Over threshold occurs when the % ERA divided by the TOC exceeds 1.00.

A %ERA/TOC greater than 1.0 means that a watershed or subwatershed is over threshold. Over threshold has been interpreted as approaching an unacceptable level of cumulative watershed effects. Two of the Ishi-Pishi/Ukonom subwatersheds have %ERA/TOC of 1.0 or greater as determined by this model.

A cumulative watershed effects assessment should include consideration of all model results. Three watershed effects models have been run for the Ishi-Pishi/Ukonom area with results summarized in Table 5-6 Summary Cumulative Watershed Effects Models. Models were weighted equally, with one-third to the ERA model and two-thirds to the two sediment production models. Model-derived sediment production (in cy/ac/yr) suggest that 75% of the total is from mass wasting and 25% from surface erosion. Therefore the mass wasting model is weighted three times the surface erosion model. The final weighting for the three watershed models is 50% for the landslide model, 17% for the surface erosion model, and 33% for the ERA model. There is not yet a threshold established for the combined model, the results are shown in Table 5-6 for comparative purposes.

Table 5-6 Summary Cumulative Watershed Effects Models

Subwatershed	Landslide Percent of Threshold	Surface Erosion Percent of Threshold	Percent ERA/ TOC	Combined Model 1/
Rogers Creek	1.00	0.97	1.42	1.13
Ti Creek	0.80	1.17	1.06	0.95
Irving Creek	0.91	0.76	0.74	0.83
McCash/Cub	0.68	0.37	0.80	0.67

Subwatershed	Landslide Percent of Threshold	Surface Erosion Percent of Threshold	Percent ERA/TOC	Combined Model 1/
Sandy Bar/Stanshaw	0.52	0.83	0.73	0.64
Carter/Kennedy	0.50	0.79	0.66	0.60
Panther/Lick	0.51	0.30	0.83	0.58
Upper Ukonom Creek	0.54	0.00	0.85	0.55
Reynolds/Natuket	0.38	0.71	0.66	0.53
Beans Gulch	0.27	0.78	0.55	0.45
Lower Rock Cr.	0.31	0.62	0.50	0.42
Upper Rock Cr.	0.21	0.59	0.63	0.41
Coon	0.32	0.51	0.47	0.40
Thomas/Aubrey	0.31	0.43	0.23	0.30
Swillup Creek	0.16	0.26	0.42	0.26
1/ Combined model assumes 50% weighting for the land slide model, 17% for surface erosion, and 33% for the ERA model.				

A cumulative effects assessment should also include consideration of riparian area and stream conditions, land allocations for each subwatershed, and any other relevant site-specific information that has not been included in any watershed models. The riparian area and stream conditions are displayed under the Riparian Areas issue. Land allocations by subwatershed are displayed in Table 5-7 Subwatershed Land Allocations. Detailed information for each subwatershed, including recommendations for future management, is contained in the following paragraphs.

Table 5-7 Subwatershed Land Allocations 1/

Subwatershed	Total	Wilderness		Administratively Withdrawn		Matrix		Private Lands	
	Ac	Ac	%	Ac	%	Ac	%	Ac	%
UKONOM ANALYSIS WATERSHED									
Upper Ukonom Creek	5740	3860	67	1880	33	0	0	0	0
McCash/Cub	8390	3210	38	5190	62	0	0	0	0
Panther/Lick	6810	0	0	6790	99	20	1	0	0
Coon	3610	0	0	1660	46	1920	53	20	1
Swillup Creek	5580	0	0	4280	77	1300	23	0	0
Thomas/Aubrey	5930	0	0	3470	58	2250	38	210	4
Subtotal/Average	**36060**	**7070**	**20**	**23270**	**64**	**5490**	**15**	**230**	**1**
ISHI-PISHI ANALYSIS WATERSHED									
Carter/Kennedy	7510	0	0	3770	50	3360	45	380	5
Ti Creek	6060	270	4	5360	89	420	7	0	0
Upper Rock Cr.	11500	0	0	6920	60	4570	40	0	0
Beans Gulch	7060	0	0	5810	82	1250	18	0	0
Lower Rock Cr.	2760	0	0	1260	46	1500	54	0	0
Sandy Bar/Stanshaw	11050	610	6	6820	62	3150	28	470	4
Irving Creek	5420	440	8	3900	71	1070	20	10	1
Rogers Creek	4290	0	0	3160	74	1040	24	80	2
Reynolds/Natuket	13800	0	0	9910	72	3160	23	730	5
Subtotal/Average	**69450**	**1320**	**2**	**46910**	**68**	**19520**	**28**	**1670**	**2**
TOTAL	***105510***	***8390***	***8***	***70180***	***66***	***25010***	***24***	***1900***	***2***
1/ Land allocations have been updated in this analysis and include the most recent unstable lands and stream mapping available included in Riparian Reserves.									

There are some general management actions that should be used regardless of subwatershed or land allocation. Most of these involve road location and the ability of roads to handle flooding. According to "The Flood of 1997: Klamath National Forest" (de la Fuente and Elder, in preparation), over half (51%) of ERFO (road damage) sites from the 1997 flood are road/stream crossing failures. This includes all road damage sites at stream crossings regardless of cause, including culvert capacity exceeded by water and debris, landslides, and fill failures from soil saturation. Many culverts were unable to pass the water and debris that flowed down the streams during the 1997 flood. Portions of the roads and adjacent hillslopes were severely eroded as culverts plugged or were overtopped, causing streams to flow across or down roads then down slopes not capable of handling the large amounts of water. The standard design practice when most road/stream crossings were built included specifications for handling 20 year floods. These are at risk to fail during larger floods. To minimize impacts, road/stream crossings should be upgraded to handle the water and debris during a 100 year or larger flood. This can be done through culvert upsizing or by designing crossings so that, if culvert capacity is exceeded, water overtopping the road will cause minimal damage and erosion. Site-specific cross drain inventory should be conducted to determine the sites most in need of crossing upgrades.

Road-related landslides are another cause cited in the flood damage study, accounting for about 18% of ERFO sites. In general, stabilization projects on earthflow landslides have had little success as these landslides are too large and complex for easy fixes. Failure is slow and not readily apparent in some cases. Some earthflows are activated or aggravated by road cuts, road fills, and changes in drainage. Some drainage changes are done in honest attempts to stabilize slopes. The trick in reducing road aggravated damage by active earthflows is to minimize the size of cuts and fills, and avoid disturbance of drainage (surface and subsurface).

Numerous failures of the road cut face and natural foundation of the fill are observed in unconsolidated inner gorges and toe zones. These landslides range in size from maintenance tasks to large masses that are difficult to repair. In some cases structural repairs can be effective, when competent local foundation can be achieved. Without achieving a competent foundation, repairs often won't survive subsequent flood events, failing in much the same fashion as before. Cut failures can often be stabilized with a drained, reinforced-earth buttress behind the cut. Foundation failures may be stabilized by over-excavating the foundation to competent material.

One of the best approaches to the management of unconsolidated inner gorge and toe zone instability is avoidance. Often there is gently sloping ground upslope where even earthflow movement results in little more than movement of a segment of road a few feet sideways. High maintenance road segments in inner gorges and toe zones make good candidates for road decommissioning. Earthflows may continue to move, but suspending activities that keep the road open will often result in significant abatement of other landslide processes.

Road fill failures account for about 14% of the road damage sites as reported in the flood damage study. On steep slopes, the dominant factor in the stability of fill is soil strength due to compaction. Most local roads were constructed without controlled compaction. Achieving adequate compaction in repair of fill failures is key to preventing a subsequent failure at the same site. Important in getting effective compaction is that the soil moisture be within the narrow range required to achieve good compaction and that the required compactive effort be applied. Mechanical reinforcement of fill (such as layered geotextile) and surface and subsurface drainage also serve to improve the strength of fill. Mechanical reinforcement is very important in situations where the location or soil properties make good compaction difficult to achieve.

Many fill failures are called wash outs or blow outs, as if the failure was due to the erosive action of flowing water. The improvement in soil strength from good compaction, mechanical reinforcement and drainage would prevent, or at least reduce, the damage by flowing water, such as by culvert failure. A well compacted soil has fewer and smaller void, so absorbs less water and remains stronger when inundated.

Fill failures often result in mudflow landslides which are often very destructive for a long distance down stream. Fill failure is likely a significant, if not major contributor to management related increase of sediment production.

There are substantial restoration opportunities in preventing fill failure. First is in stable repair of 1997-98 storm damage. Such a storm series would activate many but not necessarily all of the unstable fills. Second would be a program to identify low-density fills, fills constructed of cohesionless soil (decomposed granite) or other unsuitable material and sites where surface or subsurface drainage threatens stability.

The majority of non-road-related landslides from the 1997 flood occurred within the perimeter of the 1987 wildfire in Ukonom Creek. Granitic soils, as found in Ukonom Creek, are particularly susceptible to landsliding following wildfire although large-scale, high intensity wildfire will create hydrologic and erosional concerns in any soil type. Reducing fire hazard is important to prevent large-scale, high intensity wildfire and reduce the risk of extensive watershed disturbance from wildfire.

All management activities, including road construction and maintenance, timber harvest, prescribed fire, etc., should be done following Best Management Practices (BMPs). BMPs are the result of an agreement between the National Forests in California and the State of California to allow Forest Service self-regulation of *Clean Water Act* compliance. In essence, the Forest Service agreed to many management practices (BMPs) designed to minimize the degradation of water quality. Implementation of BMPs is the job of project administrators following the guidelines of project preparatory environmental documents. With effective implementation of BMPs, adverse impacts to water quality will be minimized.

Specific management strategies to minimize hydrologic and erosion concerns for each subwatershed are discussed in the following paragraphs.

The Rogers Creek and Ti Creek subwatersheds are each over threshold in at least one of the watershed models. The primary reason for the high watershed impacts in each of these subwatersheds is the high road densities, 4.3 miles per square mile in Rogers Creek and 4.2 miles per square mile in Ti Creek (from Table 3-3). The Rogers and Ti Creek subwatersheds also have the greatest extent of past timber harvest in the most recent mapping of Riparian Reserves, greater than 20 percent harvested for each of these subwatersheds. **Rogers and Ti Creek should be considered Impaired Watersheds, based on the results watershed modeling and these other considerations.** In impaired watersheds, activities should consist of restoration (such as road decommissioning) or stand tending activities aimed at long-term watershed health. The extensive plantations may be in need of precommercial thinning, including those plantations in Riparian Reserve. Prescribed fire may be appropriate to protect these areas from future wildfire.

The Irving Creek, Sandy Bar/Stanshaw, Carter/Kennedy, and Reynolds/Natuket subwatersheds are each below threshold in all three watershed models although each are approaching threshold in one or more of the models. The primary watershed impact for each of these subwatersheds is roads. All have moderately high road densities between 2.5 and four miles per square mile. In addition, Riparian Reserves have been harvested though not as extensively as the Riparian Reserves in Ti and Rogers Creek. None of these four subwatersheds should be considered impaired. Activities in these watersheds should include restorative activities as appropriate but may also include additional disturbance (i.e., timber harvest) as appropriate by land allocation.

The Upper Ukonom, McCash/Cub, and Panther/Lick subwatersheds are below threshold in all watershed models but are approaching threshold in one or more model. Road densities are moderate to low in each subwatershed (less than 1.5 miles per square mile) and the primary watershed impact has been wildfire. The 1997 flood had the greatest impact (for the analysis area) in these three subwatersheds of Ukonom Creek, at least partially attributable to the wildfire effects in the area's granitic soils. These three subwatersheds are almost entirely within Wilderness or Late-Successional Reserves, programed timber harvest in the future is not an issue. They should not be considered impaired watersheds. Future activities should include restoration and stand tending to promote late-successional habitat, improve watershed health, and reduce the risk of future catastrophic wildfire.

The Upper Rock, Lower Rock, and Beans Gulch subwatersheds are each below threshold in each watershed model and well below threshold in the combined model results. Road densities are moderate (between two and three miles per square mile) and most roads are on or near ridge tops. These subwatersheds should not be considered impaired watersheds. However, past flooding, primarily the 1964 flood, has impacted Rock Creek and its tributary stream channels. The Rock Creek drainage contains large areas of active landslides and otherwise unstable land that impact stream conditions regardless of the extent of management activities. Future management should concentrate on decommissioning or repairing roads on unstable lands and avoid additional disturbances on unstable lands.

The Coon, Swillup Creek, and Thomas/Aubrey subwatersheds are all well below threshold in the models run for this analysis. Road densities are low (2 miles per square mile or less) and mostly avoid unstable lands. These subwatersheds should not be considered impaired. Activities should consist of those consistent with the land allocations and subject to project level NEPA analysis.

Key Question 3- Which subwatersheds have continued watershed concerns, when will they be considered recovered, and how can recovery be promoted?

The Rogers Creek and Ti Creek subwatersheds are considered "impaired watersheds" due to continued watershed concerns. An "impaired watershed" designation is similar to an Areas with Watershed Concerns (AWWCs) designation in the *Forest Plan*. The primary difference (besides terminology) is that AWWCs are part of a management decision in the *Forest Plan* and **impaired watershed** is a label used to classify watersheds but is not a management decision. The same principles of watershed concerns apply but the AWWCs management direction no longer applies after a watershed analysis has been completed. Overall, about 10,350 acres of the Ishi-Pishi/Ukonom analysis area is considered impaired watershed, compared to the 39,310 acres of AWWCs for this area in the *Forest Plan* (see Figure 5-1 Impaired Watersheds, contained in the Map Packet located at the end of this document).

Recovery can be promoted in the "impaired" subwatersheds primarily through road decommissioning. Decommissioning those roads in the most unstable ground would have the greatest benefit. For example, the Ti Creek subwatershed has about 40 miles of road, four of those road miles are in inner gorges. Decommissioning the four miles of road in inner gorge would lessen the percent over background to about half of threshold in the landslide model. This is the same positive effect that would occur if all 36 miles of road outside of inner gorges were decommissioned, according to the landslide model. Rogers Creek would also benefit from road decommissioning in inner gorges and other unstable lands although only about 1 mile of road (of the total 27 miles in the subwatershed) are in inner gorges. The Rogers and Ti Creek subwatersheds will be considered recovered after a sufficient amount of road decommissioning has occurred or large numbers of plantations are old enough (>40-50 years) to no longer be considered a watershed disturbance. Future analysis will determine if the subwatersheds are recovered.

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

Unstable areas will continue to be subject to natural processes beyond management control. Landslides will occur when the analysis area is subject to heavy, sustained rainfall or flooding. However, accelerated landslide rates resulting from timber harvest or wildfire will decrease, approaching background rates, as these disturbances recover. Direct management impacts (i.e., timber harvest) will decline overall compared to the past several decades, primarily due to the designation of many areas as administratively withdrawn from programmed timber harvest. The extent of the road system will likely remain static or decrease but long term lack of road maintenance will render culverts less effective. The roads will continue to suffer damage during floods due to inadequate road/stream crossings, landslides, and other road stability problems. The probability of severe fire affecting hillslope processes will increase as fuel levels continue to increase.

DESIRED CONDITIONS

—Management activities lead to recovery of impaired watersheds. Future management activities in other subwatershed do not lead to impaired conditions so that over the long-term, no subwatersheds in the analysis area are impaired watersheds.

—Management of the road system is adequate to manage the land while minimizing downstream adverse impacts.

—Fuels conditions are such that the risk of catastrophic wildfire is small throughout the watershed.

RIPARIAN AREAS

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

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

Table 5-8 Riparian Reserve Acres

Description	Acres Outside Wilderness and Administratively Withdrawn Areas	Total Acres
Original Klamath *Forest Plan*	9,640 1/	Not Available
Updated with Forest-Scale Unstable Lands & Stream Mapping 2/	14,000	32,960
Updated Mapping supplemented in this analysis 3/	17,740	39,300

1/ *Forest Plan* assumes 44% of remaining Matrix is considered unmapped Riparian Reserves. This would be about 14,600 acres of unmapped Riparian Reserves in addition to the value shown.

2/ uses unstable lands mapping as of September, 1997 and updated stream buffers, using 20 acre accumulation model for streams mapping and 170 ft. buffer on each side of stream.

3/ uses additional unstable lands mapping done for this project (Happy Camp District and west side of Ukonom District) and additional stream mapping using 10 acre accumulation model and 170 ft. stream buffers.

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

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

The Ishi-Pishi/Ukonom analysis area includes the wettest and most unstable lands on the Forest. Because of the greater precipitation compared to the rest of the Klamath NF, the 20 acre accumulation model likely underestimates stream extent for this area. Therefore a 10 acre accumulation model was run to supplement the Forest-Wide streams coverage. The 10 acre model has not been field checked but should provide a good estimate, possibly over-mapping, of stream extent. These additional streams are also buffered to 170 feet to add to Riparian Reserve acreage estimates. In addition, unstable lands (primarily toe zones of dormant landslides) are under-mapped for the Ishi-Pishi/Ukonom area in the Forest-Wide geomorphic mapping. Local geomorphic knowledge is used to supplement the unstable lands mapping and the Riparian Reserves acreage estimates. Updated unstable lands mapping is included in this analysis for the Happy Camp Ranger District portion of the analysis area and the portion of the Ukonom Ranger District west of the Klamath River. The east side of the Klamath River will have unstable lands mapping updated as needed for projects.

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

Mining was the earliest Euro-American activity to impact to riparian areas in the analysis area. Placer mining along the Klamath River and several tributaries disrupted stream channels and riparian vegetation, primarily in the 1890 to 1920 time period. Most of these old placer workings have become revegetated although evidence of past workings can still be seen. The 80 acre Ten Eyck Placer Mine, near the mouths of Teneyck and Natuket Creeks, was last worked in 1991. The mine area was revegetated, seeded with grass, and otherwise reclaimed in 1995. The revegetation efforts appear to have been successful. Other mining that occurred in ore deposits generally had little effect on riparian areas. Currently, the mining that occurs in the analysis area is primarily suction dredging in the Klamath River.

Roads and timber harvest are the primary human-caused disturbances affecting the riparian areas today. Roads are the greatest impact due to the long-term loss of growing site for vegetation and potential sources of eroded sediment. Timber harvest is a temporary change erosion potential and vegetation seral stage, affecting sediment inputs to streams, stream shading, and large wood recruitment. The wildfires of

1987 also impacted many acres of riparian area by changing vegetation seral stage and increasing erosion potential. The roaded acres, timber harvest acres (plantations), and wildfire acres are presented in Table 5-9 Roads, Timber Harvest, and Wildfire in Riparian Reserves, for the Riparian Reserves in each subwatershed.

Table 5-9 Roads, Timber Harvest, and Wildfire Acreage in Riparian Reserves

Subwatershed	Total RR Acres 1/	Roaded Area		Intensive Harvest 1978-Present Acres		Intensive Harvest 1958-'77		'87 or '94 Wildfire Mod. or High Intensity	
		Ac	% RR	Ac	% RR	Ac	% RR	Ac	% RR
UKONOM ANALYSIS WATERSHED									
Upper Ukonom Creek	1,670	0	0.0	1	0.1	0	0.0	321	19.2
McCash/Cub	2,540	10	0.4	61	2.4	36	1.4	219	8.6
Panther/Lick	2,120	4	0.2	53	2.5	14	0.7	242	11.4
Coon	1,650	17	1.0	133	8.1	48	2.9	22	1.3
Swillup Creek	2,480	7	0.3	102	4.1	137	5.5	0	0.0
Thomas/Aubrey	2,140	28	1.3	4	0.2	0	0.0	54	2.5
Total/Average	**12,600**	**66**	**0.5**	**354**	**2.8**	**235**	**1.9**	**858**	**6.8**
ISHI-PISHI ANALYSIS WATERSHED									
Carter/Kennedy	3,200	74	2.3	38	1.2	224	8.0	0	0.0
Ti Creek	1,760	33	1.9	100	5.6	274	15.5	1	0.1
Upper Rock Cr.	3,970	21	0.5	98	2.4	146	3.7	0	0.0
Beans Gulch	2,950	26	0.9	55	1.8	126	4.3	0	0.0
Lower Rock Cr.	1,260	23	1.8	71	5.7	32	2.6	0	0.0
Sandy Bar/Stanshaw	4,220	61	1.4	200	4.7	284	6.8	0	0.0
Irving Creek	1,820	23	1.3	56	3.1	132	7.3	0	0.0
Rogers Creek	1,330	16	1.2	152	11.5	233	16.8	0	0.0
Reynolds/Natuket	6,190	93	1.5	261	4.3	487	8.1	0	0.0
Total/Average	**26,700**	**370**	**1.4**	**1,031**	**3.9**	**1,938**	**7.3**	**1**	**0.0**
TOTAL	***39,300***	***436***	***1.1***	***1,385***	***3.5***	***2,173***	***5.5***	***859***	***2.2***

1/ Riparian Reserve acres reported in this table include the Forest-scale mapping supplemented with new information during this analysis.

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

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

Because optimum habitat conditions for Ishi-Pishi/Ukonom streams are largely unknown, reference habitat parameters from three sources are used in this analysis. Reference conditions for instream habitat components have been identified in measurable elements in the *Forest Plan.* National Marine Fisheries Service (NMFS) has established measurable indicator criteria to determine if stream ecosystems are at a properly functioning condition. Habitat parameters from two relatively unmanaged watersheds, Dillon and Wooley, are also used as reference conditions. Table 5-10, Reference Habitat Components, summarizes the three sets of reference habitat values (only water temperature and fish habitat parameters presented in Step 3 are displayed).

Table 5-10 Reference Habitat Components

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

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

The National Marine Fisheries Service Matrix of Factors and Indicators is used to document baseline stream and watershed conditions. Current aquatic conditions for each surveyed stream in the assessment area are compared to NMFS indicator criteria to determine "Functioning", "At-Risk", or "Not Properly Functioning" habitat components. The indicator criteria used for this assessment are shown in Table 5-11, Matrix of Factors and Indicators for the Ishi-Pishi/Ukonom Watershed Assessment. Appendix C - Aquatic Habitats, contains completed comparison tables titled "Justification of Matrix of Factors and Indicators" for each surveyed stream. These tables display determinations of "Properly Functioning", "At-Risk", and "Not Properly Functioning" habitat components and the justification behind each determination. The NMFS matrix criteria must be used for each Klamath National Forest proposed project to meet obligations of compliance under the *Federal Endangered Species Act.*

Table 5-11 Matrix of Factors and Indictors

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

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

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

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

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

Cool, deep pools are critical for summer holding and rearing habitat. Spawning takes place in the deposited gravel in pool tailouts. Several amphibian species require cool, deep pools high in dissolved oxygen for successful breeding. Pools can also be highly sensitive indicators of changes in watershed conditions (EPA 1991). The small streams found in this analysis area generally do not meet the primary pool depth criteria of three feet. Pool frequencies are highest in One Mile, Upper Rock, Rogers, and Swillup Creeks. Lightening Gulch and Panther Creek have extremely low pool frequencies. Additionally, Coon, Flems, Halverson, Salal, Sandy Bar, and Stanshaw Creeks do not meet *Forest Plan* or NMFS properly functioning pool frequencies.

Stream temperatures are related to water temperatures in headwater streams, solar radiation, air temperature, stream gradient, and flow. The amount of solar radiation hitting the stream is influenced by the amount of vegetative and topographic shade. During the summer months, temperatures greater than the optimum required for salmonid growth can occur in the mainstem Klamath River. However, the surveyed tributaries to the Klamath have high canopy closure values and, therefore, adequate stream shading and low summer temperatures. Over 90% canopy closure exists in Beans and Lightening Gulch, Rogers, Sandy Bar, and Stanshaw Creeks. Flems, Irving, Lower Ukonom, McCash, One Mile, Lower Rock, Ti, and Upper Ukonom Creeks do not meet *Forest Plan* canopy closure criteria. All streams exceed the Wooley/Dillon reference stream canopy closure value of 34%.

Large wood provides a source of cover and habitat diversity for fish through a range of flows and seasonal conditions. It is important for diversifying the habitat of amphibians and other riparian dependent species. Wood serves an important roll in maintaining healthy stream channels. Two streams in the assessment area, Upper Rock and Lick Creeks did not meet the Wooley/Dillon reference LWM value of four pieces/mile. Irving, One Mile, and Ti Creek exceeded the NMFS properly functioning value of 20 pieces/mile. None of the streams met or exceeded the *Forest Plan* value of 105 pieces/mile.

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

Key Question 4- What is the role of Riparian Reserves for terrestrial wildlife habitat and connectivity?

The *Northwest Forest Plan* (*NFP*) and the *Forest Plan* specifically mention Riparian Reserves as contributing to wildlife habitat, especially late-successional habitat, as well as protecting aquatic systems. Terrestrial wildlife habitat and connectivity is a broad issue and is covered, including the role of Riparian Reserves, in the Vegetative Biodiversity section.

Key Question 5- What activities are appropriate in the different types of Riparian Reserves?

Only management actions that are consistent with *ACS* objectives should be implemented within Riparian Reserves. The determination of whether a management action is consistent with the *ACS* depends upon the nature of the action, its timing, intensity, duration, and effect on the riparian environment. There are three different types of management actions appropriate to Riparian Reserves as they relate to the *ACS*, as outlined in the *Riparian Reserve Evaluation Techniques and Synthesis* (1997).

1. **Actions with special standards and guidelines.** Specific standards and guidelines describe how the *ACS* objectives are to be attained for some management actions, such as road construction and mining. An example of specific standards would be the requirement that new culverts or other stream crossings be constructed to accommodate at the 100-year flood level. Guidelines could include recommendations to outslope roadways and locate structures and support facilities for mining outside of Riparian Reserves. See *NFP* Pages C-29 through C-38 and the *Forest Plan* Pages 4-136 to 144 for standards and guidelines relating to actions in Riparian Reserves. For these types of actions, adherence to the specific standards and guidelines ensures that the action is consistent with the *ACS*.

2. **Actions that must be neutral relative to the *ACS*.** Some management actions, such as construction of recreational facilities, grazing, or temporary crossings of Riparian Reserves to facilitate management of adjacent lands, may be implemented if they do not prevent or retard attainment of *ACS* objectives. Therefore, analysis of the action must include a description of the existing condition, a description of the range of natural variability of the important physical and biological components of a given watershed, and an explanation of how the proposed project or management action at least maintains the existing condition or mitigates the effects of the action.

3. **Actions that must be positive relative to the *ACS*.** Management actions, such as road decommissioning, silvicultural practices, prescribed burning, instream restoration projects, and salvage after catastrophic events, should be implemented when needed to attain *ACS* objectives. That is, such actions must contribute to attainment of at least one *ACS* objective and must not prevent or retard attainment of any of the *ACS* objectives. Therefore, analysis of the action must include a description of the existing condition, a description of the range of natural variability of the important physical and biological components of a given watershed, and an explanation of how the proposed project or management action contributes to attaining the objectives of the *ACS*.

To implement many of the management opportunities in the watershed, activities will take place within Riparian Reserves. Instream habitat improvements, repair of road related erosion problems, reduction of high fuel loadings to reduce the risk of catastrophic fires, and treatment of timber stands for development of late-successional habitat all could take place in the analysis area. Any action proposed to be implemented within Riparian Reserves, whether it be covered under special standards and guidelines, neutral relative to the ACS, or positive relative to the ACS, must be analyzed for its purpose and need, its expected effects on riparian features, how it relates to the nine ACS objectives, and must be documented during the NEPA process.

Key Question 6- What are the trends for riparian areas in the watershed?

The proportion of dense, late-seral vegetation in riparian areas will increase as trees grow larger and older. Some dense, early-seral stands may stagnate as tree densities approach site capacity. Poor site quality areas will probably change little over time. A future wildfire could impact riparian areas, increasing the amount of early-seral vegetation.

Effects of the 1987 wildfires will continue to recover in the Ukonom subwatershed as trees become established and grow. Effects of the 1997 flood are also recovering throughout the assessment area. Repair of known road-related erosion problems will help decrease road impacts. Provided future wildfires, road building, and timber harvesting activities do not severely impact large areas, watershed processes should continue toward reference conditions.

Overall aquatic habitat should slowly improve over time as the impacts of the fire and flood continue to diminish. Streams within subwatersheds with high road densities, high disturbance histories, and poor road conditions will continue to experience chronic sediment inputs. Road repairs, appropriate logging practices in matrix and road decommissioning projects will decrease sediment impacts in the long-term.

DESIRED CONDITIONS

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

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

--Habitat is sufficient for sustainable populations of indigenous aquatic species. Fine sediment in streams is reduced to levels consistent with good quality aquatic habitat.

--Roads, dispersed recreation sites, and other human developments in riparian areas are maintained to achieve attainment of *Aquatic Conservation Strategy* objectives.

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

AQUATIC DEPENDENT SPECIES

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

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

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

Most lakes have outlets that allow planted stocks to escape into downstream habitat. The presence of brook trout below McCash, Secret, One Mile and Ukonom Lakes is due to their migration downstream after being planted. Escaped fish from lakes interact with downstream native resident fish, compete for food and space and can influence their range.

Road culvert and crossings have restricted and disrupted the natural movement of watershed products (water, LWM, sediment) and fish passage into some of the Ishi-Pishi/Ukonom streams. Fish passage problems related to culverts have been identified on Rogers, Sandy Bar, and Stanshaw Creeks. Anadromous fish passage into Rock Creek may be difficult or impossible because of landsliding on the north bank, approximately 1/2 mile from the mouth. This problem has been aggravated by construction of a road on unstable ground above the stream channel.

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

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

Clusters of stocks in large geographic areas (such as the Klamath River Basin) are called metapopulations, and collectively comprise a distinct population segment that: 1) is reproductively isolated from other population units and 2) represents an important component in the evolutionary legacy of the species (Waples 1991). The streams within the Ishi-Pishi/Ukonom watershed containing stocks of salmon and steelhead are critical for the survival of the metapopulation because of the genetic diversity that exists among the stocks. The most important of these for salmon and steelhead include Ukonom Creek, Swillup Creek, Ti Creek, and Irving Creek. The most important of these for steelhead include Coon Creek, Stanshaw Creek, Halverson Creek, Rogers Creek and Reynolds Creek.

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

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

Fall chinook populations within the Klamath River Basin have increased dramatically the last two years, primarily as a result of sever restrictions on ocean harvest of the species. Steelhead and coho populations remain largely unassessed but general observations and local input from residents indicate that populations have declined over the last decade. The anadromous fish populations within the Ishi-Pishi/Ukonom analysis area will continue to be influenced by ocean conditions, harvest levels and inland habitat conditions. Long-term solutions for this area will require continued improvement of habitat factors including obtainment of a suitable temperature regime, especially in the mainstem Klamath, suitable sediment regimes in the tributaries, and the correction of fish passage problems in Rogers, Sandy Bar, Stanshaw, and Rock Creeks.

TERRESTRIAL

VEGETATIVE BIODIVERSITY

Key Question 1- How have the vegetation communities changed over time and what have been the agents of change; including amounts and distribution of late-successional habitats?

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

The European settlers coming into the area in the 1850s were pleased to find abundant grass and turned out large numbers of domestic livestock. The large amount of grazing removed the grass and encouraged growth of shrubs, hardwoods, and conifers. The native grasses were the primary carrier for the frequent low intensity fires as the grass was lost, shrubs and thickets of small trees became more numerous. This changed the fire regime from frequent low intensity fires to less frequent moderate to high intensity fires. Lack of grass to help spread the fires helped early fire suppression efforts. By the 1930s the more frequent medium scale fire disturbances had been removed and continued fire suppression efforts allowed conifers and hardwoods to fill in almost all openings. The high densities of tanoak and Douglas-fir found throughout much of the analysis area are the result of this successful fire suppression effort, and has set the stage for large catastrophic fire events to occur.

Of the ten vegetative communities found in this analysis area some have changed more than others. The ones with the greatest change are the ones that were accessible and offered the highest value commodities; these include the Douglas-fir/white fir/mixed conifer, Douglas-fir/white fir/hardwood, Douglas-fir, Douglas-fir/tanoak, and the Douglas-fir/tanoak/live oak communities. These plant communities were accessible and provided large high value conifers. The other vegetation communities in the analysis area were either almost inaccessible until very recently (sub-alpine conifer and true fir) or had little value such as the Douglas-fir/live oak and the ultramafic mixed conifer. A short discussion of all of the vegetation communities will follow.

Subalpine Conifer - This plant community is found almost entirely in the wilderness area at high elevations. There has been very little change in this plant community. Effective fire suppression from the 1950s to present has almost eliminated the primary agent of change. The current seral stage distribution in this community is skewed towards the larger size classes. Under a more natural fire regime one would expect a more patchy landscape and a slightly more even seral stage distribution, but still most of the plant community in a larger tree character.

True Fir - This plant community is found at high elevations on good site. Very little logging has taken place, only 3% of the community has been harvested. True fir stand structure is typified by even-aged groups of trees that cover tens to thousands of acres. The agents that cause this pattern are probably lightning fires, windthrows and insect outbreaks. Due to the historically longer fire return intervals and the shorter fire season that occurs at these upper elevations, this community is believed to be closer to its historically maintained condition than other communities. Fire suppression has eliminated the small to moderate scale fires that maintained the structural diversity and the current conditions are large areas of dense even-aged/even-sized trees, with few openings and breaks in this continuity. The lack of fire has increased fuel loadings, this coupled with the lack of breaks and openings can lead to fire events that will cover large areas with high intensities.

Douglas-Fir/White Fir/Mixed Conifer - Regeneration harvest has occurred in 16% of this plant community. Under a natural disturbance regime dominated by fire this was a mixed conifer community. Primary species was Douglas-fir with ponderosa pine, sugar pine, white fir, black oak, giant chinquapin, and pacific madrone. Fire tolerant shade intolerant species would have been the most prevalent, these were also the most valuable conifers for harvesting. By removing those conifers and suppressing fire, fire intolerant/ shade tolerant species have become more prevalent. In this community the primary beneficiary has been white fir. Without fire, white fir will become the dominate species in this community. The lack of reproduction by shade intolerant species (such as multistory ponderosa pine and black oak) has lead to a loss of species diversity. The ingrowth of white fir has also created dense multistoried stands that are not stable in an ecosystem where fire is the primary disturbance agent.

Douglas-Fir/White Fir/Hardwood - Regeneration harvest has occurred in 45% of this plant community. This community is the transition zone from the Douglas-fir/hardwoods to the mixed conifer. Under the natural conditions this community maintained the highest percentage of old-growth. Currently the seral stage distribution is skewed to shrub and pole due to past logging. With 48% of the plant community in shrub and pole-seral stages and 39% left in old-growth. There is a gap with very little early mature and mid mature. This community shows the same pattern as the Douglas-fir/white fir/mixed conifer, with the removal fire tolerant/shade intolerant species and ingrowth of more shade tolerant species.

Douglas-Fir - Regeneration harvest has occurred in 14% of this plant community. This is the plant community where most of the deciduous hardwoods are found (black oak and Oregon white oak). The deciduous hardwoods which historically made up the oak woodlands are disturbance adapted species that are being lost in this landscape. The mature hardwoods are being shaded out by the increased size and density of the Douglas-fir and the lack of fire has allowed tanoak and Douglas-fir to reproduce under the mature deciduous hardwoods. Without frequent low intensity fires to reduce competition from Douglas-fir and especially tanoak very little reproduction of black oak is taking place. To reintroduce a deciduous oak woodland back into the landscape, a program of vegetation management to preserve the remaining mature oaks and a burning program to reduce competition and allow regeneration.

Douglas-Fir/Tanoak - Regeneration harvest has occurred in 24% of this plant community. This is the dominant plant community in the analysis area, covering 40% of the area. It is found on good site with good moisture, but without frequent fires the shade tolerant tanoak fills in everywhere. Except in areas that have been previously harvested the stand conditions can be characterized as a top layer of conifers dominated by Douglas-fir and an understory of dense tanoak and Douglas-fir. These multistoried stands, with their high density and ladder fuels are in a condition to create large-scale catastrophic fires.

Douglas-Fir/Tanoak/Live Oak - Regeneration harvest has occurred in 8% of this plant community. This community is found on somewhat harsher sites than the Douglas-fir/tanoak. These shallower soils tend to limit conifer density, but without the influence of frequent fire total density is much higher than was maintained historically. This is a community that is also losing the fire adapted shade intolerant species and filling in with shade adapted species.

Douglas-Fir/Live Oak - Regeneration has only occurred where pockets of conifer were located, 5% of the community. This is a steep harsh site plant community except for the 5% that has been regeneration harvested, is little changed from historic conditions. Seral stage distribution has moved more to the mid-mature with less shrub and pole that was probably maintained historically. Fires in this community would often top kill the live oak, but live oak is a vigorous crown sprouter and would quickly recover.

Ultramafic Mixed Conifer - This a harsh site community, with only 1% regeneration harvested. This community is often associated with serpentine outcrops. Usually Jeffery pine is the dominant conifer, with inclusions of incense cedar and Douglas-fir. The understory usually consists scattered grass, shrubs and scattered conifer regeneration. With a lack of frequent fire, understory densities have increased. This is a community with unique plants that are adapted to the restrictive soil conditions and frequent low intensity fires. This is another plant community that reestablishing a frequent fire regime is needed in order maintain species diversity and community health.

Montane Meadow - Based on best available information including review of 1944 aerial photos the acreage of montane meadow is less than what was maintained in the past. Many montane meadows were culturally maintained by American Indian burning. Since this practice stopped, conifer encroachment has reduced the size of many meadows and some mid-slope meadows have been lost to tanoak and Douglas-fir reproduction. To maintain and enhance this plant community, an active burning program needs to be started and continued.

Riparian Shrub - This plant community is a product of disturbance in the riparian zone. It is found along channels and recent landslides. This is a dynamic plant community depending on frequent disturbance from floods and soil movement. Depending on natural events, this community has fluctuated in size. In the more stable riparian areas conifers and upslope hardwoods will fill in and often overtop the riparian shrubs.

The most significant effects on this analysis area have been fire suppression, timber harvest and road building. We have replaced the natural seral stage distribution with an artificial distribution created by timber harvest. Fire suppression has allowed increased stand densities and a filling in of the understory with conifer and hardwood reproduction. The greatest evidence of this is in the mixed conifer communities and the Douglas-fir/tanoak community. With successful fire suppression for the last 60-80 years, shade tolerant fire intolerant species have been able to expand out of the fire refugia areas and now dominate the understory of these fire adapted plant communities. Many of the fire adapted species such as ponderosa pine and black oak have trouble reproducing under these conditions and have become scarce and could be eliminated from the analysis area. With the dense understories and ladder fuels currently found and increasing in the analysis area, we have changed the fire regime from one of a frequent low to moderate intensity fires to a less frequent moderate to high intensity regime. These future fires will cover large acreages with much more high intensity fire than was experienced in the past and have severe effects on wildlife habitats, especially late-successional dependent wildlife.

Because the amount of old-growth conifer forest left in the analysis area has been raised as a concern, an analysis was done to determine how much of the area was old-growth prior to timber harvest and how much is currently old-growth conifer forest. Using the EUI definition of late/mature/old-growth, 34% of the Federal lands in the analysis area are currently classified as old-growth. Using the assumption that regeneration harvest was done in old-growth stands, an estimation of the historic old-growth acreage was developed by adding the current old-growth acreage and the regeneration harvest. See Table 5-12 Historic and Current Old-Growth by Vegetation Community. Based on this analysis, historic old-growth covered about 50% of the analysis area and the percentage was quite variable depending on vegetation community.

Table 5-12 Historic and Current Old-Growth by Vegetation Community

Vegetation Community	Historic % of the Community	Current % of the Community
Subalpine Conifer	25	25
True Fir	45	42
Douglas-Fir/White Fir	68	52
White Fir/Hardwood	84	39
Douglas-Fir	44	30
Douglas-Fir/Tanoak	64	40
Douglas-Fir/Tanoak/Live Oak	32	24
Douglas-Fir/Live Oak	22	17
Ultramafic Mixed Conifer	13	12
Riparian	1	<1
Total within Analysis Area	49	34

For Forest Management purposes, the old-growth acreage in the analysis area has been displayed by District and by updated *Forest Plan* land allocations. See Table 5-13 Old-Growth Acreage by Land Allocation --Happy Camp District, and Table 5-14 Old-Growth Acreage by Land Allocation --Ukonom District.

Table 5-13 Old-Growth Acreage by Land Allocation --Happy Camp District (18,562 [illegible]

LMP Land Allocation	Acres of Old-Growth/>40% Crown Closure (%)	Acres of Old-Growth ... Clo...
Private Lands	12 (6)	
Wilderness	603 (32)	[illegible]
Late-Successional Reserves	5,635 (62)	[illegible]
Riparian Reserve	1,765 (51)	[illegible]
Retention	207 (47)	
Recreational River	12 (50)	
Partial Retention	1,116 (50)	[illegible]
General Forest	430 (36)	
Total	9,780 (53)	[illegible]

Table 5-14 Old-Growth Acreage by Land Allocation --Ukonom District (86,727 acres[illegible]

LMP Land Allocation	Acres of Old-Growth/>40% Crown Closure (%)	Acres of Old-Growth ... Clo...
Private Lands	19 (1)	
Wilderness	2,715 (42)	1 [illegible]
Late-Successional Reserves	14,957 (42)	1 [illegible]
Special Habitat --Eagle/Falcon	0	
Cultural Area	1,179 (15)	[illegible]
Riparian Reserve	3,195 (22)	1 [illegible]
Retention	218 (13)	
Recreational River	45 (10)	
Partial Retention	1,482 (16)	1 [illegible]
General Forest	2,073 (22)	3 [illegible]
Total	25,883 (30)	4 [illegible]

TRENDS - Currently in the analysis area we [illegible] merous plantations with high stocking levels [illegible] growth of shade tolerant hardwoods and [illegible] across the area below the true fir zone. These [illegible] tions are very prone to a high severity fire [illegible] Even with active fire suppression efforts, th[illegible] high likelihood that a large portion of the analy[illegible] will be involved in large-scale wildfire event in [illegible] near future. With dense multistoried stands [illegible] stable vegetative condition has been create[illegible] area where fire is the dominant agent of distur[illegible]

Key Question 2- Where are large areas [illegible] from catastrophic disturbance and what ar[illegible] important to treat or protect?

Fire starts have occurred in all but two years o[illegible] year history of data we have for the area. The [illegible] disturbance regime for the watershed inclu[illegible] quent fires. Fire suppression efforts over the [illegible] proximately 70 years have been for the most p[illegible] successful in limiting fire spread and effects [illegible] analysis area. This has allowed for vegetat[illegible] litter (fuels) to increase dramatically from the [illegible] that were historically maintained. The current [illegible] pression organization is still successful most [illegible] time, but can be quickly stretched to its limits [illegible] multiple start events. With the high fuel ac[illegible] tions, creating higher fire intensities and [illegible] greater difficulties for building fireline, fire supp[illegible] forces will have less success in the future. D[illegible] ning storms igniting multiple fires will continue [illegible] the source of most fire starts. Based on co[illegible] increases in fuels, these fires will more often overwhelm fire suppression forces, escape initial attack, burn more area, and burn with higher intensities.

Fire behavior modeling has identified 85% of the watershed as having high to moderate fire behavior potential. See Figure 3-16 Fire Behavior Potential, contained in the Map Packet located at the end of this document. Fires occurring in these areas have the potential of becoming large high intensity burns. These fires have the potential of reducing the amounts of pole, early/mature, mid/mature, late/mature and old-growth-seral stages, while increasing the amounts shrub and forb seral stages.

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

The EUI vegetation layer was used to develop the Fuel Model Layer; see Figure 3-15 Fuel Models, contained in the Map Packet located at the end of this document, to identify these locations. Timbered fuel models (Fuel Models 8, 9, and 10) were historically maintained with frequent low to moderate intensity fires. To continue to maintain these stands, it is important that they be treated (underburned). Areas modeled as Fuel Model 10 tend to correspond with areas of late-successional habitat. Many areas of late-successional habitat have accumulated high fuel loadings and are modeled as having high fire behavior potential. These factors impact the health of stands and the ability of larger trees to survive large-scale fire disturbance.

Plantations on good sites are big investments. Protecting these sites is important for wildlife values, visual quality enhancement and future harvest opportunities. These stands should be evaluated for treatment needs, see Figure 5-3 Fuels Treatment and Fire Management Considerations, contained in the Map Packet located at the end of this document.

As stated in the Aquatic Dependent Species Step 5 write-up, the streams in this analysis area provide important high quality cold water to the Klamath River during summer low flows. Drainages providing this cold water also have vegetative conditions that make them prone to high severity wildfire. The complete removal of vegetation, as in a stand replacement fire, can increase sedimentation, change the flow regimes, and increase stream temperatures thus degrading aquatic species habitats. This makes it critical to protect these areas from catastrophic fire, which can be done by making the upslope areas more resilient to the effects of fire.

Private residences are features to protect in the analysis area. All residents in the watershed should be concerned and take precautions to protect themselves and their homes from wildfire. Wildfires will continue to threaten residences in the analysis area. Area residents should be encouraged to clear fuels and use defensible space precautions around their homes.

In the analysis area, areas at risk of catastrophic disturbance are also found in the wilderness, particularly in headwaters of Ukonom Creek, due to previous fire effects and recent blow-down. In order to maintain an appropriate fire regime that allows maintenance of fire dependent plant communities in the wilderness, a wilderness fire plan which includes pro-active use of fire should be developed.

Wildfires respond to breaks in topography and vegetation (natural and/or constructed fuelbreaks). Some natural fuelbreaks exist in the watershed as well as some fuelbreaks which are remnants from wildfire suppression and fuels treatment activities. Some very important wildlife habitats are found in the analysis area along with private residences and other Forest investments. Fire behavior potential modeling has identified 85% of the analysis area as having high to moderate fire behavior potential (hazard). Based on the number of fire starts that occur in the analysis area, risk is determined to be moderate. In order to enhance and protect these important features, the development of a coordinated system of natural and managed shaded fuelbreaks has been identified as a first step. In looking at aerial photos from 1995, some fuelbreaks have been identified as well as roads and ridges that can be used to develop shaded fuelbreaks into a coordinated system. Once developed, this system can be used for fire suppression and for implementing fuels treatment activities that use prescribed fire, along with other types of fuels removal, to protect important features now found in the area and to develop desired conditions.

Key Question 3- What is the desired role of fire in the analysis area and how can fire be incorporated as an ecological process?
3a. How will this affect air quality in and around the analysis area?

The desired role of fire in this analysis area is to use it as a management tool to; control vegetation density and fuel loadings, maintain vegetation communities in conditions that are more resistant and resilient to the effects of high intensity fire, reduce the probability of a large catastrophic fire occurrence, promote vegetation species diversity, enhance and maintain disturbance adapted plant species, enhance and maintain important wildlife habitats, protect private residences and important investments.

Throughout this analysis fire has been identified as either a management tool which if utilized can develop and maintain desired conditions or a threat to current and desired conditions. It certainly is both. Managed fire in this analysis area by itself and in conjunction with other vegetation management can be used to develop and maintain desired conditions. Large-scale catastrophic wildfire on the other hand will set-back the development of these same desired conditions.

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

Most small-scale burning within the analysis area will maintain air quality within allowable limits. To meet air quality objectives, prescriptions for burning should include weather parameters that will carry smoke quickly from residential areas and also from viewsheds in the analysis area. To maintain air quality, burning can be done when weather conditions (open windows) are present that will be favorable for smoke dispersal. Managers should try to avoid burning under a stable air mass (inversion). Temperature inversions are common in the analysis area during late evening and morning hours. Burns should be timed so that the majority of smoke generated is transported out of the area during afternoon hours. Prescriptions can be developed that will avoid extended periods of smoldering. Large-scale wildfire events will not meet air quality guidelines. Temperature inversions and long-term smoldering will work together under a stable air mass to hold smoke and particulates in the analysis area for long periods. Depending on size and timing of the fire event this could last from several days to months.

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

DESIRED CONDITIONS:

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

--Disturbance adapted communities (black oak woodlands, open conifer forest) are maintained/increased

--Fire tolerant disturbance adapted plant species are maintained in the analysis area

--Spatial, structural, species, seral diversity is maintained/increased

--Area more resilient to catastrophic fire, drought disturbance

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

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

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

--On the better sites in the Douglas-fir/tanoak and Douglas-fir/tanoak/live oak, maintain most of the hardwoods in a tree character. This will more closely match the pre-settlement conditions and provides more acorn production which is important for many wildlife species.

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

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

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

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

Key Question 5- Is there an adequate amount of socio-culturally significant vegetation, and what can be done to maintain and/or enhance this vegetation?

See Step 3, Human Uses, Special Forest Products, Key Question 1 (Page 3-24).

TERRESTRIAL WILDLIFE

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

Key Questions:

1- For these wildlife species, what has changed from historic to present and what have been the agents of change?

2- What are the future trends for these wildlife species?

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

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

Bald Eagle: Bald eagle depend on fish in the river and larger creeks (Dillon, Ukonom) for a food supply. The limiting factors for bald eagles are an available food supply and secure nest sites. The severe reduction of anadromous fish and timber harvest and road building have restricted both the food supply and nesting sites. Of the two limiting factors, food source is most critical. Bald eagle use in the watershed will be closely tied to the continuance of anadromous fish runs and resident fish in the River. Management implications is to limit activities around known nest areas and maintaining roost trees (hunting perches) along the River, this is especially important near the mouths of large Creeks, where fish congregate during summer months.

Peregrine Falcon: Peregrine falcons are limited by suitable cliffs for nesting and snags and large trees available nearby for perches. Peregrines hunt birds often in riparian areas because of the species richness. Need to maintain riparian areas and habitat diversity around the nesting cliffs to provide an abundant and diverse prey base. Management implications, peregrines can be susceptible to disturbance while nesting, so limit activity near nesting cliffs. Maintain large trees and snags near nesting cliffs for perches.

Northern Spotted: With successful fire suppression, the distribution of suitable nesting/roosting habitat has changed, expanding from historic ranges out onto drier sites. As it was stated before, these multistoried conifer stands are not very stable in a fire environment and would have only been found in fire refugia. This expansion has been partially offset by timber harvest, i.e., clear cuts.

On the Happy Camp portion of the analysis area, 79% of the spotted owl habitat both nesting/roosting and foraging is within protected *Forest Plan* management areas (Wilderness, LSR, Riparian Reserve). On the Ukonom portion of the analysis area, 65% of the current spotted owl habitat is protected by *Forest Plan* management areas. See Table 5-15 Spotted Owl Habitat Acreage -- Happy Camp District, and Table 5-16 Spotted Owl Habitat Acreage -- Ukonom District for a complete breakdown of spotted owl habitat by updated *Forest Plan* management areas.

Currently over 70% of the riparian reserve vegetation is providing nesting/roosting or dispersal habitat for spotted owls. Maintaining this condition will go along way in providing connectivity across the analysis area. Management implications are that there is a possible conflict with fuels reduction and moving towards a more natural fire regime with more frequent low intensity fires and maintaining dense multistoried stands for nesting/roosting. Since some spotted owl nesting/roosting stands are not fire resistant they may need to be protected or buffered from the effects of fire. For a more comprehensive write-up of management of LSRs, refer to the *Klamath Forest-Wide LSR Assessment* (1998).

Table 5-15 Spotted Owl Habitat Acreage – Happy Camp District (18,562 acres)

LMP Land Allocation	Acres Nesting/ Roosting Habitat (%)	Foraging Habitat (%)
Private Lands	25 (11)	109 (50)
Wilderness	693 (37)	412 (22)
Late-Successional Reserves	4,710 (52)	3,040 (33)
Riparian Reserves	1,042 (30)	1,480 (43)
Retention	145 (33)	219 (50)
Recreational River	9 (38)	9 (38)
Partial Retention	732 (33)	996 (44)
General Forest	358 (30)	437 (37)
Total	7,714 (42)	6,702 (36)

Table 5-16 Spotted Owl Habitat Acreage – Ukonom District (86,727 acres)

LMP Land Allocation	Acres Nesting/ Roosting Habitat (%)	Foraging Habitat (%)
Private Lands	445 (31)	621 (43)
Wilderness	3,565 (55)	1,146 (18)
Late-Successional Reserves	19,271 (54)	5,778 (16)
Falcon	22 (11)	85 (43)
Cultural Area	2,588 (33)	2,975 (38)
Riparian Reserves	5,314 (37)	5,392 (38)
Retention	804 (46)	790 (45)
Recreational River	136 (32)	212 (49)
Partial Retention	3,649 (39)	2,635 (28)
General Forest	3,124 (33)	3,395 (35)
Total	38,918 (45)	23,029 (27)

Marbled Murrelet: Marbled Murrelets are small seabirds that depend on old-growth coastal conifers for nesting. Historically they nested in dense stands of conifers near the coast. They have been pushed inland for nesting sites after logging eliminated most of the old-growth near the coast. Nesting farther from the coast exposes murrellets to more predators including peregrine falcons, crows, ravens, and great horned owls. This increased exposure to predation and nest predation could be factor in the reduction of reproduction success.

Although no marbled murrellets have been documented as using the analysis area, the west half of the landscape is in the Recovery Zone (Zone 4) of the Siskiyou Coast Range Zone, see *Recovery Plan Marbled Murrelet Washington, Oregon, and California Populations*, US Fish and Wildlife Service, Portland, Oregon 1995. On the Happy Camp portion, 81% of the suitable nesting habitat is protected by *Forest Plan* land designations of Wilderness, LSR, or Riparian Reserve, and on the Ukonom portion 78% is found in protected land designations, see Table 5-17 Marbled Murrelet Habitat Acreage --Happy Camp District, and Table 5-18 Marbled Murrelet Habitat Acreage -- Ukonom District. Management implications are that within the recovery zone, requirements of the recovery plan need to be followed.

Table 5-17 Marbled Murrelet Habitat Acreage -- Happy Camp District (18,562 acres)

LMP Land Allocation	Acres of Nesting Habitat (%)	Acres of Marginal Nesting Habitat (%)
Private Lands	12 (6)	0
Wilderness	194 (10)	0
Late-Successional Reserves	5,531 (61)	165 (2)
Riparian Reserves	1,765 (51)	137 (4)
Retention	207 (47)	0
Recreational River	12 (50)	0
Partial Retention	1,116 (50)	148 (7)
General Forest	430 (36)	45 (4)
Total	**9,267 (50)**	**495 (3)**

Table 5-18 Marbled Murrelet Habitat Acreage -- Ukonom District (86,727 acres)

LMP Land Allocation	Acres of Nesting Habitat (%)	Acres of Marginal Nesting Habitat (%)
Private Lands	20 (1)	134 (9)
Wilderness	482 (7)	8 (<1)
Late-Successional Reserves	14,524 (41)	2,218 (6)
Falcon	0	9 (5)
Cultural Area	1,176 (15)	947 (12)
Riparian Reserves	3,180 (22)	2,107 (15)
Retention	217 (12)	260 (15)
Recreational River	44 (10)	71 (17)
Partial Retention	1,482 (16)	1,425 (15)
General Forest	2,061 (21)	747 (8)
Total	**23,186 (27)**	**7,926 (9)**

Goshawk: Suitable goshawk habitat is similar to suitable spotted owl habitat and at this level of analysis it is difficult to discern differences. Goshawks fly under the forest canopy when foraging for food, so the ingrowth as a result of fire suppression could be reducing habitat suitability for goshawks by making it much more difficult to fly through the canopy. We have very little information on goshawk use, but there are four activity centers in the analysis area that were identified in the *Forest Plan.* Reintroducing fire to clear out the understory and provide more habitat diversity such as oak woodlands, and mid-slope meadows would improve goshawk habitat. Management implications are to do surveys to determine goshawk use in the analysis area. If goshawk use is determined, a vegetation management plan such be implemented to provide good foraging and nesting habitat.

American Marten & Pacific Fisher: There is almost no information on marten and little on fisher in the analysis area. Fisher have been documented in the area, but marten have not. Logging and road building and fire suppression have changed the structure of the forest, but there is still is suitable habitat. See Table 5-19 Marten and Fisher Habitat --Happy Camp District, and Table 5-20 Marten and Fisher Habitat --Ukonom District, for a break down of habitat by District and LMP land allocation. Increasing habitat diversity by bringing back oak woodlands and mid-slope meadows should help provide improved habitat suitability for these forest carnivores. Maintaining suitable spotted owl nesting/roosting habitat should provide the structure needed for denning/resting.

Table 5-19 Marten and Fisher Habitat --Happy Camp District (18,562 acres)

LMP Land Allocation	Acres Denning/ Resting Habitat (%)	Acres Foraging Habitat (%)
Private Lands	25 (11)	180 (83)
Wilderness	693 (37)	967 (52)
Late-Successional Reserves	4,710 (52)	4,084 (45)
Riparian Reserves	1,042 (30)	2,252 (65)
Retention	145 (33)	295 (67)
Recreational River	9 (38)	15 (63)
Partial Retention	732 (33)	1,432 (64)
General Forest	358 (30)	689 (58)
Total	**7,714 (42)**	**9,914 (53)**

Table 5-20 Marten and Fisher Habitat --Ukonom District (86,727 acres)

LMP Land Allocation	Acres Denning/ Resting Habitat (%)	Acres Foraging Habitat (%)
Private Lands	445 (31)	902 (63)
Wilderness	3,565 (55)	2,706 (41)
Late-Successional Reserves	19,271 (54)	11,810 (33)
Falcon	22 (11)	155 (78)
Cultural Area	2,588 (33)	4,455 (57)
Riparian Reserves	5,314 (37)	8,319 (58)
Retention	804 (46)	894 (51)
Recreational River	136 (32)	276 (64)
Partial Retention	3,649 (39)	4,401 (47)
General Forest	3,124 (33)	4,998 (52)
Total	**38,918 (45)**	**38,916 (45)**

Elk: Elk were hunted out of the analysis area early in this century and are now repopulating from animals released on the Happy Camp District. Most of the use is on the east side of the Klamath River, they use the road system to travel, forage in young plantations and winter near the river. They are not hunted to any great extent as of yet and have little fear of human beings. When elk are hunted, they become very sensitive to open roads and high open road density can greatly reduce habitat utilization by elk.

The east side of the analysis area with its more gentle slopes make it easier to move up and down from summer to winter range. The west side is much more steeply dissected and therefore less conducive to up and down slope movements. It is expected that will be less elk use on the west side than on the east side of the analysis area. If fire is reintroduced into the analysis area, creating more open stands , oak woodlands, mid-slope meadows, this would provide good elk habitat, with abundant forage. Management implications, elk are currently foraging within young plantations, as these plantations mature new foraging habitat needs to be found, if elk are to be maintained in the analysis area.

Porcupine: Porcupine seem to prefer drier forested habitat that is found east of this analysis area. They have been hunted as pests for 80 years, and are susceptible to many diseases carried by domestic animals such as distemper. They were most likely never common in the analysis area, but the effects of hunting, road kill, and disease have reduced populations to very low levels. If an oak woodland, mid-slope meadow habitat was reintroduced should make the analysis area better porcupine habitat.

Survey and Manage Amphibians and Mollusks: With no historic surveys and only limited current surveys, it is not possible to draw conclusions about any changes from past to present population numbers and amount of habitat. Historic mining reduced habitats for riparian dependent species and possibly isolated populations. Most likely, road building and logging have done the same to terrestrial species. Without more information, the long-term trends for amphibians and mollusks cannot be determined.

All of the wildlife species found in the analysis area have adapted to the natural disturbance regime of infrequent large-scale disturbance and more frequent moderate and small disturbances of low intensity. A return to a disturbance regime that more closely follows the natural regime should benefit most wildlife species. To lessen the effects of management activities, projects should be planned and implemented in a way similar to the natural disturbance regime.

GENERAL WILDLIFE CONSIDERATIONS

Open Road Density: Many wildlife species are sensitive to open road density. High density of open roads exposes wildlife to harassment and poaching. Elk, deer, bear, and mountain lion, fisher, and marten have been shown to be effected by high open road densities and lower the open road density has been shown to increase habitat effectiveness for these species. Closed roads are often used by many of these species as travel corridors. Travel and access management plans need to consider wildlife habitat use in determining roads for decommissioning and long-term closure.

Snags: Maintaining snags across the analysis area is important for many wildlife species including management indicator specie in the *Forest Plan.* Standards and guidelines for snags from the *Forest Plan* are consistent with expected snag densities from *Forest Service Research Paper PNW-RP-491*, June 1996. Following these guidelines should provide for snag dependent wildlife.

Oak Woodlands: Oak woodlands contribute to habitat diversity and provide important habitat for many wildlife species. Including deer, black bear, elk, woodpeckers and squirrels.

DESIRED CONDITIONS:

--More viable populations of goshawk.
--High quality diverse habitats exist in a mosaic of patch sizes, shapes, and age classes.
--Late-successional habitat is resistant to large-scale disturbance and connectivity for late-successional species is maintained across the analysis area.
--Management activities do not create dispersal barriers to late-successional species.
--Habitat conditions that support a growing elk population.
--Increased late-successional habitat in LSR's (sustainable over time).
--Habitat for meadow/woodland species is maintained/enhanced/increased.
--A mosaic of various seral stages and habitats distributed across the watershed.
--Large enough blocks of late-successional habitat are maintained to provide habitat requirements for species needing forest interiors; spotted owls and forest carnivores.
--Connectivity between LSR's is provided along with dispersal corridors into adjacent watersheds.
--Shrubfields are maintained in a condition to provide for early/seral wildlife species habitat needs; deer.
--A road system that does not significantly impact wildlife or contribute to habitat degradation.

HUMAN DIMENSION

ROADS

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

The types of road uses have changed considerably from the past. Historically, road use centered around resource use and extraction such as mining and timber harvest. Early road construction followed old trail alignments and was constructed to provide access for fire suppression and mining activities. As the Forest Service began offering timber sales in the late 1950s, new road construction was required to provide access for equipment and log transport. Road construction increased dramatically in the late 1960s through the late 1980s to provide access for the increased demand for lumber. Logging continued until the early 1990s, at which time the road use related to the timber resource declined significantly in response to reduced timber harvest levels from the northern spotted owl issue.

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

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

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

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

Resource and social concerns include more immediate needs and longer-term concerns. The recent heavy rainfall for the winter 1998 and the January, 1997 flooding impacted the existing road system. Flood affects on the road system occurred across the analysis area, but were concentrated in the Ti Creek and Lightening Gulch areas. For further analysis discussion on hydrologic factors and roads see Hillslope Processes Step 5. The Forest survey identified 46 sites in the watershed which were damaged by the floods and would require repairs, see Figure 5-4 Roads Analysis Results, contained in the Map Packet located at the end of this document. Immediate resource concerns include repairing sites so they do not become chronic sediment sources. Immediate social concerns involve opening roads needed for fire suppression, and administrative or recreation access.

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

Social concerns about roads have been expressed at the national level; in response the Chief recently placed an 18 month moratorium on road construction in roadless areas. The analysis area contains approximately 11,000 acres of released roadless area. Forests that had their plans revised by the *Northwest Forest Plan* are exempt from the moratorium. (The Klamath NF is exempt.) The objective of the moratorium is provide time to develop a scientifically-based and long-term Forest road policy. The Chief is quoted as saying, "We anticipate that the final long-term road policy will apply to all Forests."

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

The original road system was primarily constructed to provide access for logging operations. The change in LMP land allocations has created management goals/objectives where logging is either not allowed or is not the primary land use. Portions of the current road system (maintenance levels, density, miles, etc.) may not be consistent with these land allocations and should be reviewed at the (NEPA) level for compatibility. Refer to Appendix H - Results of Roads Analyses, which provides a starting point for developing road improvement, maintenance, and decommissioning opportunities.

Vegetation encroachment on the roadway is a continuing safety concern by restricting safe sight distances at road intersections or along road curves.

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

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

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

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

Timber harvest will continue on matrix lands in the watershed, placing limited demands on the existing road system.

Cooperation will continue between road users, landowners, and advisory groups.

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

Stream crossings will be upgraded (size) as opportunities arise.

Total open road mileage will decrease.

DESIRED CONDITIONS

--Roads are designed, constructed, maintained, or improved to minimize resource affects and meet *ACS* objectives while meeting human needs.

--The miles of open roads are managed at road density levels that do not contribute to reduced wildlife habitat quality.

--Fire suppression access is maintained commensurate with risk and fire behavior potential.

--The roads providing access to private lands are in a condition that minimize road resource damage.

--The effects of roads in Riparian Reserves and LSRs are minimized, and road densities are reduced where appropriate.

COMMERCIAL TIMBER OUTPUTS ON PUBLIC LANDS

Key Question 1- How do *Forest Plan* estimates for capable, available, and suitable lands compare to those recommended in this analysis?

Through refinement of land allocation estimates made in this analysis, the land allocations available for scheduled timber harvest (Matrix lands) total 25,420 acres or 24% of the analysis area; with Happy Camp 3,500, and Ukonom 21,100 acres respectively. This is slightly more than the 21% matrix lands estimated in the LMP for the entire Klamath National Forest. Revised Matrix land allocations are: Retention (2,180 acres), Partial Retention (11,620 acres), General Forest (10,790 acres), and Recreational River (450 acres). However, because a watershed analysis is a mid-level analysis and not a decision document, these refinements in acres available lands are still estimates unless a *Forest Plan* amendment formally adopts them.

According to the LMP, the Retention land allocation (2,180 acres) is expected to provide for low levels (approximately five percent of standing timber volume per decade) of timber harvest. Recreational River, Partial Retention, and General Forest (22,860 acres) are expected to provide moderate levels (approximately 16% of standing timber volume per decade) of timber harvest.

Other conditions in the watershed have the potential to affect the amount of land available for scheduled timber harvest. These are identified in the *Forest Plan* and further refined through this analysis. They are discussed below:

Harsh Sites - Sites were identified in the *Forest Plan* based on local experience and timber management practices. A site is considered capable if it can support 20 cubic feet of conifer growth per acre per year, which is equivalent to Forest Survey Site Class (FSSC) 6 or lower. FSSC 7 sites and higher are incapable of supporting this level of growth and were considered in the *Forest Plan* as harsh sites.

In this analysis, the harsh site determination was based more on professional judgement than soil or vegetation inventory. In addition to FSSC 7 sites and higher, certain vegetation types (Douglas-fir/live oak and Douglas-fir/live oak/tanoak) on FSSC 6 or better soils have few commercial conifers and are very difficult to regenerate so are also considered harsh sites. Based on EUI vegetation and soils data, there are 8,400 acres of the Douglas-fir/live oak and Douglas-fir/live oak/tanoak type, or FSSC 7 in the Matrix lands in the analysis area. This is considerably more than the 3,700 acres of harsh site estimated in the *Forest Plan*.

Mapped Riparian Reserves - The mapped Riparian Reserves in the *Forest Plan* consisted of mapped unstable lands, using the *Forest Plan* unstable lands definition and the data available at the time. Stream buffers were not used in the *Forest Plan*.

For the Ishi-Pishi/Ukonom analysis, mapped Riparian Reserves were updated with additional unstable lands mapping (toe zones of dormant landslides) and additional stream mapping, and applying interim Riparian Reserve buffer widths (from *Forest Plan*) on known and interpreted streams. This increased the mapped reserves significantly.

For a more detailed description of the Riparian Reserve revisions made during the watershed analysis process, refer to the Riparian Areas section.

Unmapped Riparian Reserves - In the *Forest Plan*, 44% of the mapped capable, available, and suitable land was assumed to be unmapped Riparian Reserves (buffers on streams). The acres estimated as unmapped Riparian Reserves were not used in *Forest Plan* modeling to calculate the potential timber sale quantity.

For this analysis, mapped, updated Riparian Reserves reflect a refinement of *Forest Plan* estimates. This refinement was used in determining lands available for timber harvest. A percentage of unmapped Riparian Reserves still exist and will only be determined during project level analysis.

The acreage calculations for the *Forest Plan* and Updated lands available for timber harvest are displayed in Table 5-21 *Forest Plan* and Updated Lands Capable, Available, and Suitable for Scheduled Timber Harvest.

Table 5-21 *Forest Plan* and Updated Lands Capable, Available, and Suitable for Scheduled Timber Harvest

Land Allocation or Modification	Updated Acreage	Forest Plan Acreage
Initial Land Base Outside Wilderness, LSR, and Sensitive Species	43,160	43,340
Mapped Riparian Reserves	-17,740	-9,640
Lands Available for Timber Harvest 1/	25,420	33,700
Harsh Sites 2/	-8,400	-3,700
Subtotal	**17,020**	**30,000**
Unmapped Riparian Reserve 3/	00	-14,600
TOTAL	**17,020**	**17,400**

1/ Lands available for timber harvest include Retention, Partial Retention, Recreational River, and General Forest land allocations, collectively referred to as Matrix lands.
2/ Forest soil survey Site Class 7 and the EUI vegetation types of Douglas-fir/canyon live oak was used in the analysis update.
3/ *Forest Plan* assumes 44% of mapped capable, available, and suitable lands are unmapped Riparian Reserves.

Table 5-21 shows a slight decrease of about 380 acres of lands capable, available, and suitable for timber harvest, comparing *Forest Plan* estimates to updated estimates. The acreage decrease is due to significant increases in harsh site and Mapped Riparian Reserves acreage offset by no additional unmapped riparian reserves. It is assumed that the unmapped riparian reserves have been considered when updating the Mapped RRs. This is the first KNF WA where the ten acre accumulation model was used to calculate streams (and resultant RRs); the programmatic accuracy of the this model's use should be monitored and validated. See Figure 5-5 Lands Available for Scheduled Timber Harvest, contained in the Map Packet located at the end of this document.

The acres of Harsh Site increased with the updated estimate. This information provides feedback to the *Forest Plan*, and could be useful in modeling assumptions for future timber yield calculations at the Forest scale. Table 5-22 Acres of Harsh Site by Matrix Land Allocation --Happy Camp District, and Table 5-23 Acres of Harsh Site by Matrix Land Allocation -- Ukonom District, shows the distribution by land allocation.

Table 5-22 Acres of Harsh Site by Matrix Land Allocation --Happy Camp District

Land Allocation	Total Acreage	Harsh Site Acreage	% of Total	Capable Acreage	% of Total
Retention	440	250	57	190	43
Recreational River	20	<10	50	10	50
Partial Retention	2,250	570	25	1,680	75
General Forest	1,190	250	21	940	79
TOTAL	3,900	1,080	31	2,820	69

Table 5-23 Acres of Harsh Site by Matrix Land Allocation --Ukonom District

Land Allocation	Total Acreage	Harsh Site Acreage	% of Total	Capable Acreage	% of Total
Retention	1,700	1,140	67	560	33
Recreational River	400	120	30	280	70
Partial Retention	9,400	2,720	29	6,680	71
General Forest	9,600	3,400	35	6,200	65
TOTAL	21,100	7,300	35	13,800	65

Other factors must also be considered when programing timber harvest over the short-term. Two subwatersheds (Rogers and Ti Creek) are identified in this analysis as impaired watersheds (refer to Hillslope Processes issue). Activities should be designed to accomplish restoration for long-term watershed health. Programed timber harvest may be differed or restricted until these subwatersheds have recovered.

Another factor to consider for programing timber harvest is seral stage distribution, see Appendix J - Vegetation. Tables 5-24 Existing and Desired Seral Stage Distribution --Happy Camp District, and Table 5-25 Existing and Desired Seral Stage Distribution -- Ukonom District, lists the existing and desired mix of seral stages for the Retention, Recreational River, Partial Retention, and General Forest land allocations.

Desired conditions are from the *Main Salmon Watershed Analysis (1995)*, assuming an even flow of timber yield, and are appropriate for use across the Forest. The analysis area should be managed toward the desired mix of seral stages.

Table 5-24 Existing and Desired Seral Stage Distribution --Happy Camp District

Size Class	% Retention & Rec. River1/ (Existing)	% Retention & Rec. River (Desired)	% Partial Retention & General Forest 1/ (Existing)	% Partial Retention & General Forest (Desired)
Shrub/Forb	0	5-10	5	5-20
Pole/Early/Mature	12	30-40	35	40-55
Mid/Mature	42	30-45	19	15-30
Late/Mature/Old-Growth	46	15-25	42	15-20
1/ Source - EUI Data Sort; based on the Vegetation/Biological Diversity section earlier in this step (vegetation communities and seral stage distribution).				

The Happy Camp portion of the analysis area is identified as having a high percentage of late/mature/old-growth seral stages, and a low percentage of shrub/forb seral stage, primarily due to exclusion of wildfire.

Table 5-25 Existing and Desired Seral Stage Distribution --Ukonom District

Size Class	% Retention & Rec. River1/ (Existing)	% Retention & Rec. River (Desired)	% Partial Retention & General Forest 1/ (Existing)	% Partial Retention & General Forest (Desired)
Shrub/Forb	3	5-10	15	5-20
Pole/Early/Mature	21	30-40	27	40-55
Mid/Mature	64	30-45	37	15-30
Late/Mature/Old-Growth	12	15-25	19	15-20
1/ Source - EUI Data Sort; based on the Vegetation/Biological Diversity section earlier in this step (vegetation communities and seral stage distribution).				

Tables 5-24 and 5-25 identify mid/mature seral stages as having a high percentage in all four Matrix land allocations. Shrub/Forb seral stages are below desired levels in Retention and Recreational River land allocations. Future harvest opportunities should concentrate on reducing the mid mature seral stage class to desired levels, creating a concurrent increase in shrub/forb levels.

An economic analysis was conducted of timber stands on matrix lands. The analysis is intended to provide a coarse filter evaluation of economic viability at the initial stages of project development. The analysis is based on vegetation subseries, seral stage, silvicultural treatment, logging system, and limited operating period. See Appendix K - Timber Management Options, for a detailed discussion of the process and assumptions used. This preliminary analysis needs refinement at the project scale.

The vegetation subseries within the analysis are grouped based on evaluation of productivity and economic viability. A more detailed discussion of the volume per acre and diameter distribution within these various groups can be found in the appendix. General conclusions about economic viability are listed below and are based on an assessment of the subseries values compared to the economic analysis assumptions. Options are evaluated by seral stage for each group. The information is also displayed by the amount of overstory conifer cover.

VEGETATION SUBSERIES GROUP 1 - 11,131 acres (44% of Matrix lands) This group includes plant communities with a canyon live oak component and those that are influenced by serpentine parent material. Generally these subseries have low to moderate productivity. Regeneration difficulties are more likely to occur due to site conditions or hardwood competition.

General trend in this group is small mbf/acre returns for all seral stages, with much of the stumpage in lower value class. The early mature stands have a low likelihood of providing economically viable thinning options. The densest mid/mature stands may be viable with tractor systems, cable yarding costs may exceed value in these stands. Late/mature stands appear to have viable options for with all systems, although low density stands which incur high treatment costs are likely to be economically marginal.

VEGETATION SUBSERIES GROUP 2 - 11,482 acres (46% of Matrix) This group consists plant communities with a significant hardwood component. Generally these subseries are moderate to highly productive. The proportion of hardwoods to conifers will influence economic viability.

General trend in this group is a low probability of economically viable intermediate treatment options in most early mature stands. A moderate probability that thinning options in mid/mature stands are economically feasible. A high probability that mid/mature stands can be economically regenerated with conventional logging systems. It is possible that low density late mature stands may provide viable treatment options with all logging systems.

VEGETATION SUBSERIES GROUP 3 - 2,126 (9% of matrix) Hardwoods are present in low numbers in these subseries, with few concerns about hardwood release in intermediate treatments and reduced costs associated with regeneration harvest activities. These subseries are moderate to highly productive.

General trend within this group is high probability of economically viable intermediate treatment options in most early and mid/mature stands using conventional logging systems. A high probability that mid/mature stands can be economically regenerated with conventional logging systems. It is possible that low density late mature stands may provide viable treatment options with all logging systems.

Table 5-26 below, summarizes the total acres within matrix for each subseries group by seral stage and percent conifer cover in the overstory. The percentage value are the amount of matrix represented by that category (also see Figure 5-6 Timber Management Options, contained in the Map Packet located at the end of this document).

Table 5 - 26 Total Acres Within Matrix For Each Subseries Group By Seral Stage And Percent Conifer Cover In The Overstory

Group/ Seral Stage 1/	Acres(%) of <30% Conifers	Acres (%) of 30-60% Conifers	Acres(%) Of >60% Conifers	Total Acres (%)
G1 Shrub/Pole	N/A	N/A	N/A	1,102 (4)
G1 Early/Mature	1,252 (5)	1,048 (4)	190 (1)	2,491 (10)
G1 Mid/Mature	1,573 (6)	3,682 (15)	366 (1)	5,621 (22)
G1 LM/OG	621 (2)	1,142 (5)	154 (1)	1,916 (8)
G2 Shrub/Pole	N/A	N/A	N/A	4,020 (16)
G2 Early/Mature	376 (2)	716 (3)	286 (1)	1,378 (6)
G2 Mid/Mature	550 (2)	2,147 (8)	372 (1)	4,394 (18)
G2 LM/OG	98 (<1)	2,706 (11)	212 (1)	3,069 (12)
G3 Shrub/Pole	N/A	N/A	N/A	751 (3)
G3 Early/Mature	65 (<1)	105 (<1)	243 (1)	413 (2)
G3 Mid/Mature	75 (<1)	107 (<1)	137 (<1)	319 (1)
G3 LM/OG	1 (<1)	344 (1)	298 (1)	643 (2)

1/ Includes non-capable lands (harsh sites).
NOT AVAILABLE --This information is not available due to the fact that this seral stage represents precommercial stands and therefore were not defined by percent conifer cover.

The *Forest Plan* estimates an 11 and 7 MMBF/decade timber yield from the Ishi-Pishi and Ukonom watersheds respectively. An analysis method using the updated EUI inventory estimate 26.8 MMBF/decade yield for the analysis area. Using regeneration harvesting to meet *Forest Plan* assumptions and desired conditions, approximately 960 acres/decade of regeneration harvest would need to occur.

Key Question 2- What future trends affect timber management in the watershed?

TRENDS - The high public sensitivity to timber harvest in released roadless areas (1,330 acres in matrix land) will probably continue making these lands in essence unavailable for harvest.

The probable threats from large fires burning in the watershed is great. Out year investments (plantations) must be protected when and wherever possible.

Overall timber outputs will probably be driven more by forest health issues, rather than just outputs.

Wildlife considerations, including Survey & Manage species will continue to strongly influence timber project scheduling, location, and design.

The recent T&E designation for coho salmon will strongly affect the timber program.

The potential presence of Del Norte salamanders on Matrix lands will affect the amount of planning time and cost for timber sales in the area.

Existing plantations are 35-40 years old, excluding fire, a large timber volume will be available for the market in approximately ten years.

To maintain Forest health on all National Forest lands, it is likely there will be some timber outputs from non-Matrix lands.

DESIRED CONDITIONS

--The watershed contributes to a Forest-Wide ecologically sustainable timber program that provides an even flow of wood products.
--Lands available for scheduled timber harvest in Forest Planning reflect as near as possible the actual watershed conditions for capable, available and suitable lands.
--Timber output opportunities are consistent with land allocation goals.
--Timber mortality in the watershed is reduced to near endemic levels.

CULTURAL RESOURCES

Many National Forest system lands are tribal ancestral lands too. Federally recognized Indian Tribal Governments like the Karuk Tribe of California have a unique relationship with the U.S. Government as sovereign governments. Their rights include developing partnerships, sharing technical assistance, and coordinating management activities that affect historic, cultural, and traditional resources.

Government to Government relationships between the Karuk and Klamath National Forest help identify and provide management policies that protect Karuk interests in their ancestral territory. Tribes along with other local, State, and Federal entities can help provide more responsible and effective Forest management.

The perspectives expressed in the following section represent Karuk views, independent of National Forest system management views. While many Karuk objectives and desires for ecosystem management are similar to National Forest Management objectives, specific policies, practices, and methods may vary considerably. ***THE FOLLOWING IS THE PERSPECTIVE OF THE KARUK TRIBE OF CALIFORNIA:***

Step 3 Key Question 1- What is the Forest Service relationship with Karuk Tribe of California?

Tribes are recognized as governmental sovereigns in the Commerce Clause of the United States Constitution (Art. 1, Sec. 8), and have been referred to as quasi-sovereign domestic dependent nations (nations within a nation) by the courts (USDI 1994).

Federal Indian Policy and "trust responsibilities" have developed from court decisions, congressional laws, and policies articulated by the President. The trust responsibility is the U.S. Government's permanent legal obligation to exercise statutory and other legal authorities to protect tribal lands, assets, resources, and treaty rights, as well as a duty to carry out the mandates of Federal law with respect to American Indian Tribes (USDA 1997).

The Forest Service has an obligation to consult with Federally Recognized Indian Tribes on a government-to-government basis throughout the Forest Service planning process. (USDA 1997). The purpose of this to ensure tribes sovereignty over their ancestral lands and a voice in management over those lands.

Recognizing that tribes are not just another user-group or interest group requiring attention, the relationship requires going beyond simply discussing, exchanging views, or seeking tribal comment on internal policies and decisions which may affect the rights and status of tribal governments, the input from which may or may not be incorporated into decision making. Direct and continuous tribal participation is required in planning, consensus seeking, and decision making processes involving line officers (USDI 1994).

Government-to-government relations between the Forest and the Tribe are continuing to develop. The Forest Service is gaining a clearer understanding of how policies and practices affect traditional uses. Many resource management goals are similar for both parties. The challenge is to find common ground on approaches and solutions to achieving those goals.

The Tribe and Forest are working on a variety of issues together. The Administrative Forest Service facility adjacent Ishi-Pishi Falls is now being relocated to accommodate Karuk sacred ceremonial uses. Sustaining the integrity of ceremonial use in and around sacred landscape settings is critical to protecting American Indian Religious freedoms. The highly private spiritual nature of religious use can present management dilemmas. Disclosures of use and sites in the past have resulted in impacts to sites and visitor intrusions on sacred observances. Administrative barriers, environmental laws, and the decline of logging has undermined the Karuk communities ability to work in their homeland. Traditional gathering areas and resources need to be enhanced and protected. The dependence of Tribes on salmon and the cultural relationship that exists with salmon makes it essential for the Karuk to be involved in all aspects of fisheries management and habitat restoration.

The Proposed Ti Bar Demonstration Project

The Ti Bar watershed, within this analysis area was selected for addressing Karuk values and uses. The demonstration project is designed to illustrate aboriginal practices in harmony with Karuk land management philosophy and forest ecosystem management. The Ti Bar undertaking is anticipated to improve administrative processes which help enhance trust obligations while enhancing cultural, social, economic, and subsistence use of the Karuk.

Goals and objectives include:

--Develop methods to overcome administrative barriers;

--Improve on the ground practices which restore desired fire dependent plant communities in selected areas;

--Develop approaches to implement similar collaborative projects at the landscape scale;

--Demonstrate indigenous techniques and methods of altering vegetation;

--Be responsive to concerns of both the Karuk and Forest Service while implementing ecosystem management;

--Increase awareness of aboriginal and management practices; and

--Promote and understanding of the desired outcomes early in the planning process.

The Ti Bar watershed was selected as a demonstration project because of its location and historical integrity of cultural, spiritual, artisan, and subsistence use. While not designated as a special cultural management area by the *Forest Plan,* the demonstration may serve as a model for managing cultural landscapes.

Step 3 Key Question 2- What heritage resources exist within the watershed?

For the Karuk Tribe, Ishi-Pishi and the surrounding landscape is the most culturally significant area within the Klamath National Forest. In the southern end of the watershed is the *Forest Plan* cultural area called Katimin which is approximately 12,000 acres. As the "center of the world" the Katimin area has an extraordinary relationship with Karuk history, contemporary use, and World Renewal Ceremonies.

For the Karuk the Katimin landscape features embody a profound supernatural significance and power. The Karuk cultural legacy of the Katimin landscape provides several important features; it is the place where many immortal beings, landscape features, and creatures originated from. It is the ceremony location where cultural events take place between the Karuk, Tolowa, Hoopa, and Yurok Tribes.

More significant and important contemporary sites include but are not limited to: those associated with origin stories and legendary events; those associated with contemporary ceremonies; guardian spirit questing, spiritual cleansing and prayer; graves and graveyards; fire circles; family use areas; village and archaeological sites; hunting and gathering uses for food, artisan, and medicinal plant gathering. Ishi-Pishi Falls provides the major most important fishing site for the Karuk Tribe.

Many Indians still gather basketry and artisan resources including hazel, willow, ceanothus, beargrass, and acorns or make fine arts or construction materials from yew, Port-Orford-cedar, woodpecker scalps, deer bone, elk horn, and Porcupine quills.

At one time the Karuk population in the watershed was estimated between 1,000 and 2,500. Although there are fewer Karuk and life-styles have changed many of the cultural sites and uses are crucial for contemporary cultures.

Consultation with the Karuk helps identify important cultural resources. This includes consulting: Ceremonial leaders about specific ceremonial coordination and use; the Karuk Natural Resources Department; the Karuk Tribal Council; and other Karuk individuals or groups.

Step 4 Key Question 1- What were the prehistoric and historic land uses and management practices within the watershed?

Most American Indians do not distinguish spirituality and sacred activities apart from everyday life. Spiritual and natural worlds are the same. Spiritual concepts embody cultural, socio-economic, and physical associations. A river, mountain, wind, or artifacts, inert or living things, may have a common ancestry and deserve respect and consideration in order to generate harmony between human communities and other life forms.

In Karuk land management the underlying role of humans in the natural system is one of responsibility to all living creatures. One of the roles of the Karuk is to ceremoniously fix the world each year, making right the wrongs of the past season. This perpetuates a reaffirming behavior and perspective which promote sustainable relations with nature.

Sustaining nature has deep spiritual and historic associations for the Karuk. The knowledge to discover an ideal way of life was passed to the Indians of the Klamath River in exchange to be responsible to make the world right through ceremonial reenactment of ancient Spirit Beings first successful World Renewals which fixed the world and provided well being for the Karuk. Ceremoniously stabilizing the world is a unique and profound Karuk cultural institution. Several hundred Native Americans from Yurok, Hoopa, Tolowa, and Karuk Tribes participate in the World Renewal events above Ishi-Pishi Falls every fall.

Biophysical and cultural practices arranged by the Karuk were sacred and utilitarian. (Karuk adaptation was characterized by sustainability without landbase degradation). Management practices were diverse, adaptive, and highly precise. The local effect on the watershed ecosystem would have been pronounced. Aboriginal use enhanced a greater diversity of meadow, grass, and woodland habitats.

In addition to effectively enhancing forest foods and construction materials key features and places are important for world renewal, spirit questing, prayer and meetings. Ishi-Pishi is the most important Salmon harvest site for the Karuk. Natural resources such as mushrooms, acorns, berries, basketry materials, and medicinal plants are significant to the Karuk Tribe.

The Karuk applied effective and highly refined practices that were based on knowledge obtained over thousands of years of living close to nature. Although not taught in books, their methods were scientific, based on trial, observation and adaptation. Scientific knowledge was mixed with spiritual associations, recognizing that everything is mutually dependent, the Karuk intensively managed tanoak woodlands, meadows, ridge areas, water courses and areas upslope of the villages. Natural resource use was strictly controlled and regulated.

For the Karuk generating desired domestic materials required direct and intense manipulation of plants. This was often accomplished with fire. As natural scientists the Karuk utilized wild natural foods and opted not to grow crops, except for tobacco. Fire played a important role in distributions of plant communities. Foods, fibers, and basketry materials were burned upslope of villages. Through controlled burning the Karuk created a productive, varied, and healthy forest land environment. Fire was understood as a essential positive natural process, reflecting sacred and utilitarian concepts.

Karuk use of fire is only one example of adaptive management. Some remarkable ritual institutions also regulated aspects of the natural ecosystems i.e.; the first salmon ceremony was and event in which the Medicine Man, a spiritual and ritual leader, cooked and ate the first salmon in the yearly spring run. Prior to this event, salmon were allowed to pass through to their spawning ground in order to guarantee their return, this required complex working relations between tribes in the Klamath Basin. A series of strictly enforced laws and regulations were respected by people living throughout the river systems.

Fire was used to promote species habitat and maximize available resources. Some of the tribal objectives to be achieved with fire include: clearing undergrowth for hunting and access, reducing severity of wildfire, controlling insect attack and plant disease, removing litter and clean up debris, enhancing acorn habitat, to attract animals by altering their food sources, to enhance soils for planting tobacco, to encourage pliable basketry shoots, and to control invasions of competing vegetation

Suitable basketry shrubs have adaptive traits which develop epicomic branches when disturbed by fire, cutting, or floods. Fire perpetuated plant populations, species patches, and distributions for sustained yields. Fire physically optimizes the plant architecture for construction arts.

Fire was a primary factor in securing the proper shape and sizes of shrub material for domestic use. The constant need for young plant growth called for frequent treatments, usually at two year intervals. The extent of burning varied for individual plants, from patches to hillsides. Burning was often conducted soon after harvesting. One account cited July and August was best for burning upslope.

Family use continues through subsistence use, traditional gathering, ceremonial use, burial grounds, and ceremony enhancement.

Tribal elders who have a broad scale grasp of the past often have valuable insight and land management wisdom. Traditional ethics are based on sacred protocol and sanctions, and other directives based on ecological concepts. Sacred associations, and affinities held by the Karuk for their ancestral landscape have not been abandoned. For the Karuk traditional uses and skills are also a means for sustaining the culture for generations to come by learning to share, respect, and provide for the care of elders, the land, and other people.

Step 5 Key Question 1- How has land management after 1850 affected heritage resources?

"After the discovery of gold in California in 1848, immigrants and miners of all kinds began to pour into California." "The miners did not come onto the middle course of the Klamath River until 1850 because of its remote location. In that year, however, three hundred miners claimed land upon the Klamath and Salmon rivers. Hundreds more soon followed" (Bell 1991).

By the end of 1851, according to the population estimates of S.F. Cook, over half of the Karuk Tribe had died off. The Karuk community had been devastated by introduced disease. The rivers had been contaminated with muddy water washed in from the mines, and the Karuk, no longer able to catch the same amount of fish as in previous years, were starving (Bell 1990). Considering them "just a bunch of savages" the miners and settlers at this time severely mistreated the Karuk. With the miners came a severe breakdown in the Karuk culture and impacts on the ecological systems in which they lived.

Forest Service management of Karuk lands started in 1905. The main objective of the Forest Service was to protect the nations forests from fire. Where fires once shaped the vegetation of the area and burning was common to enhance desired vegetation conditions, a policy of fire exclusion was invoked. Although the Indians realized the positive effects of fire on the environment, they were not allowed to continue burning practices that they had refined over centuries. After nearly 100 years of fire suppression, vegetation species distribution and stand structure has changed significantly.

Other changes included the reduction of high quality anadromous fisheries habitat, timber harvest reducing forest cover and diminishing gathering areas, and the degradation of ceremonial and burial sites. When the ability to obtain tribal ownership of land was lost, the Karuk people became dependent on the National forests to locate resources. Today certain types of resources are on longer readily available. Basketry materials in the watershed are not suitable due to fire exclusion.

Forest Service management has emphasized production of conifers and exclusion of fire. This has resulted in a reduction of tanoak stands that were managed by the Karuk to produce acorns. The Karuk used fire to reduce conifer competition and keep hardwood stands healthy. The Forest Service not only excluded fire but also have, at times, managed hardwood stands by converting them to conifer stands. Now, good sources of the acorn resource especially the older, larger tanoaks are difficult to find and the acorns are full of bugs. The Karuk also feel that Forest Service managed forests are more susceptible to severe wildfires.

Karuk observations are that logging has decreased the native species and forest diversity. They also feel that past logging, road development, fire exclusion, and other uses has had negative impacts on soil, water quality, and the ecosystem. The magnitude, duration, quantity of water run off , and fisheries habitat has changed. Logging has altered most of the Katimin cultural landscape. The Karuk also feel that cattle grazing in the Marble Mountain wilderness has produced high sediments to stream headwaters.

Recreational uses have had adverse impacts on heritage resources. Archaeological and cultural sites become known due to increased recreational access and degradation still occurs. Rafting and river use has conflicted with the highly private nature of some ceremonial activities.

Step 5 Key Question 2- What is the Karuk cultural perspective on resource management in this watershed?

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

The Karuk Tribe is the second largest Indian Tribe in California with over 2,500 members nation wide. The Karuk are a living culture, a changing community, adapting and maintaining identify consistent with their origins.

Geographic and cultural alienation due to Euro-American settlement and conflicts have influenced and displaced traditional land uses and life-styles. Despite the fact that Karuk experienced traumatic historical displacement, their heritage, ways of relating to the land, ceremonial institutions, and traditional uses continue to be important. Today, some individuals adhere more closely than other to traditional ways.

The Karuk believe that their ecosystem was more balanced, self sustaining, and in harmony with natural systems. They are not suggesting that society return to historic life-styles. Few if any would abandon modern life-styles and technologies to live a entirely consistent with realities of 150 years ago. Integrating traditional cultural knowledge with contemporary approaches can improve understanding of forest ecosystems and land management practices

The Karuk have long recognized their commitment to protect the resources within their Territorial lands. Tribal concerns include but are not limited to: interruptions affecting sacred integrity, including unnatural modification to sacred sites and views, intruder confrontation, or obtrusive noise disturbances; depletion of gathering resources and areas; fisheries; timber sale practices; fire and fuels treatment; restoring basketry resources; grazing; and recreation development. American Indian disclosure about specific use in the region has been limited in part by the very private nature of religious observance. Many have strong concerns over changes that might affect lands their families traditionally used.

The recent history of much of the American west is a history of exploitation. The dominant economic pattern conforms to colonial use which involved capital and technology from outside the area, mostly to export goods to urban areas. With financial control in urban areas political power is most often responsive to outside interests. In this region gold and timber provided the incentives for rural industrial use.

Outside political interests have historically motivated most federal management actions. Although timber is considered sustainable and renewable, the short-term environment consequences of past logging practices is substantial. For the Karuk "colonial land use" patterns are largely unbalanced, not including the inherent inter-relationships of complex ecosystems and other phenomena.

If we look back at the continuum of Native American systems over time, they were largely self regulated and sustaining. Karuk essentially obtained nearly every needed resource within watersheds. Interaction with natural systems were highly adaptive.

The Karuk consider much of Forest Service management as being out of balance. That economic incentives override stewardship goals. They believe unbalanced land use can result in extreme reactionary measures. The policy of isolating threatened and endangered species in protective islands as reactionary. The natural systems that many preservationists think would be obtained through lack of management are settings once shaped by Native Americans.

Traditional management concepts are summarized by the following excerpt from the Main Salmon Scoping Document: The first paragraph is a quote from a tribal elder and the second paragraph is an interpretation by the Author of that document.

> "For thousands of years, people lived off the natural resources of the earth. Over the years of praying and studying the world, the Karuk became pretty darn good natural resource managers. We danced, pruned, burned and cultivated all the time. Ceremony played a big role in management of ancestral territories. We were always studying nature. Because of this background of our ancestors, I believe that we too can take good care of the earth. We are still the same old Indians; we have far more to deal with now, but that is why we have the medicine."
>
> There is a tendency for modern land managers to dismiss "aboriginal accumulated knowledge" as unmeaningful. Karuk knowledge is adaptive as a means to evaluate new technologies and socio-economic situations which evolve around empirical practices understood in a corrective process. Sharing knowledge and expertise is vital to resource survival, restoration, and ecosystem management. Technical knowledge in itself is often insufficient to interpret the multi-leveled complexity of ecosystems. Rational and technical approaches should only be aspects of more inclusive approaches to knowledge. Spiritual, social, and cultural sciences are as dynamic as bio-physical sciences.

Most Karuk have no desire to live in the past. They are an evolving culture and like many other cultures, are ties strongly to ancestral origins. Like many other Native Americans, the Karuk are closely connected with their ancestral lands and strong concerns about changes affecting places their families have used for centuries. Ethnic identity and spirituality are closely tied to this watershed and the Karuk have strong concerns about changes affecting places their family used. When the ability of tribal land ownership was lost, the National Forest became the primary source of tribal resources. Today, certain types of materials are no longer readily available. Reinstatement of traditional practices is considered absolutely critical for survival of the culture. Federal policies have often not been responsive to the spiritual linkages to the land and obligations to future Karuk generations.

From the Karuk perspective Federal management has had a tendency to conflict with their strong responsibility to care and provide for the protection and environmental integrity of their home lands. The narrowly focused conventions of modern uses has resulted in irreversible loses to some of the Karuk historic and contemporary resources as well as disruption to water quality, anadromous fisheries, the natural fire regime, and native vegetation. Modern land use has diminished traditional uses, values and sites.

Administrative --Administrative barriers, environmental laws, and the decline of logging had undermined the Karuk's ability of work in forest related jobs. Federal project contracting procedures seem insensitive to rural economic needs. The Karuk community has been trying to sustain itself in under difficult socio-political, ecological, and economic conditions.

Federal permit procedures and land uses have restricted uses, customs, and freedoms. Some Karuk feel that permit policies are insensitive to traditional freedoms.

From a Tribal perspective, integrating Tribal needs into resource management has been a slow process. Particularly acute today are issues related to the maintenance, integrity, enhancement of fishing, ceremonial and sacred use, historic sites, and gathering resources. The Tribe needs to be involved in all stages of activities that affect those issues. Tribal awareness is generally based on concerns that often allude the management planning process. Taking the Tribal perspectives into account would provide a broader base of information on which to base decisions.

The Klamath National Forest has made considerable progress in considering Tribal values over the past two decades. The Karuk have sincerely appreciate the KNF efforts in addressing Tribal issues. Feedback through tribal consultation helps identify concerns for resources and values at-risk so often misunderstood or ignored in the past. Due to this progress, the Karuk anticipate a growing range of opportunities for cooperative management of their ancestral heritage and lands.

Resources --The forest landscape is thought to be in delicate balance where unnatural disturbances can easily disrupt the delicate cycles and natural processes. From the Karuk perspective, what Forest Service management once considered as harmless activity has resulted in unpredictable and adverse disturbance.

Fishery restoration is of profound concern of the Karuk Tribe. The Karuk consider this watershed to be strategic to water quality in the mid-Klamath basin. It provides critical storage capacity and release of water throughout the dry season.

After 1950, the Forest Service emphasized timber outputs. The model at this time was for clear cut management. The intensity of management has caused dramatic disturbance to forest watersheds and water quality. Logging activities have reduced the quality of some important cultural sites. High cost maintenance is required to keep these areas from converting to brush vegetation and being more susceptible to wildfires. Large-scale timber harvesting are considered destabilizing because the disturbances are so rapid that nature does not have time to respond or adapt.

While road development has improved access there are concerns about erosion related problems and the intensity of past development.

Forest Service management practices are thought to have converted many of the important hardwood stands into conifer stands. This not only depleted gathering resources but Douglas-fir stands are considered to be more susceptible to fire.

Another unnatural disturbance is considered to be the exclusion of fire. American Indian view wildfire as an important natural process. Now, due to fire exclusion, Tribal members are concerned that underburning will burn too hot with unpredictable patterns and upset the delicate ecological system. Concentrations of fuels would burn hot and sterilize and disturb fragile soil environments or kill fire sensitive plants. Many feel that fire exclusion has set up these forests to be quite vulnerable to severe wildfire.

Understory burning was widely applied to promote plant conditions for basketry. This was done up slope of the villages that were at one time common along the Klamath River. The exclusion of fire has greatly reduced the availability of basketry materials. Underburning practices the Karuk once used were opposed until recently. The Karuk Natural Resources Department feels there is resistance to Tribal input into a process which the Karuk are attempting to recreate.

Tanoak mushrooms *(tricholoma magnivelare)* are a traditional food. The commercial use of tanoak mushrooms in western Siskiyou County has presented environmental, social, community, and tribal conflicts. There is still no management scheme that adequately regulates commercial mushroom use and protect traditional uses. Commercial use by migrant pickers presents highly unfavorable conditions for the Tribe. Economic incentives appear to overshadow mushroom environmental needs. Littering and violence associated with mushroom harvesters is a concern. Collaborative planning, monitoring, and further scientific studies are needed to guide a management scheme for tanoak mushrooms.

Recreation development can conflict with Karuk needs and uses. Close Tribal collaboration is essential when recreation use and development take place.

To safeguard contemporary uses, watershed management should provide for the full scale restoration of water quality, anadromous fisheries, the natural fire regime, and diverse natural vegetation.

Step 5 Key Question 3- What is the Karuk desired condition for the watershed?

Administrative --To achieve the American Indian desired condition, administrative barriers would be diminished and there would be an increased understanding and acknowledgment of ancestral tribal rights, tribal sovereignty, and federal trust responsibilities. The unique relationship between the Tribe and the United States Government would foster an environment where collaboration between the Forest Service, the Tribe and the local community would lead to improved decisions in harmony with the values and belief systems of the local cultures and peoples. Adaptive management would allow for better integration of human values are that derived through working as a community. Cultural needs such as ethnic identity, love of place, reverence for life, historic identity, natural beauty, sense of place, and spirituality are considered inherent and integral to ecosystem management.

Some of the components of Native American desired condition are limited by what can be resolved at the watershed level. The Karuk Tribe have a desire to change Forest Service funding conventions. The desire is for funding to be based more on the work required to maintain a healthy ecosystem and less on outputs of goods, specifically timber. There is also a desire for the management work to be conducted by Karuk and members of the local community. Federal permit procedures and land use policies would be more sensitive towards traditional uses and customs. Permit polices should evolve to meet an array of needs. The people who live in the National Forests would have more say in land use policy. Since the funding conventions, contracting regulations, permit procedures and land use policies are government wide, the Tribe has nearly as much opportunity to influence these conditions as the Forest.

Rural communities would still be able to make a living from the forests. Management practices would be in harmony with nature, more consistent with aboriginal concepts.

Government to Government Relationship --Government to government agreements between the Forest and the Karuk Tribe help identify and acknowledge needs, and attempt reasonable accommodation without compromising legal positions of either Tribal or Federal government. Collaborative planning ensures that Karuk values, uses and needs are not compromised, inadvertently dismissed, or misunderstood. The timing of interactions between the Tribe and Forest Service are adequate. Data transfer between Tribe and Forest Service allows for the Tribe to access and examine information more readily and completely. Demonstration projects, collaborative partnerships and community development programs are used by the Forest to protect sacred integrity of settings dependent on Karuk conducting the undertakings.

Working relations between the Tribe and the Forest Service would be founded on the following: 1) respect of Karuk traditional knowledge, concepts, uses and values; 2) commitment to be flexible to overcome bureaucratic, environmental and economic barriers; 3) ecologically sound strategies to restore watersheds; 4) programs to employ Karuk and the local community in forest management; 5) enhancement of basketry resources through Karuk recovery of traditional horticultural arts; 6) avoiding disturbance to sensitive cultural or traditional sites and preventing public disclosure; 7) management of timber more in harmony with ecosystem management; 8) prevention of further degradation of anadromous fisheries; 9) sustaining the integrity of spiritual uses; 10) involvement of the local community and the Tribe in the decision making process.

Consultation will continue to help identify important cultural use and resources. In addition to consulting with the Karuk Tribal Council, Karuk Natural Resources Department, and interested Karuk individuals or groups consultation with ceremonial leaders takes place for all Tribal ceremonial times and events.

Resource Management --Rèsource management would integrate Karuk traditional knowledge of the elders with contemporary scientific understanding. On-the-ground knowledge is obtained through contacting long time residents and tribal elders who can recount historic settings, practices and uses. The wealth of information gained through experience is not lost and is used to improve contemporary stewardship strategies. Traditional ecosystem model is one where humans facilitate ecological stability and change.

Resource management is based on entire landscapes and is not as focused on individual species.

Karuk resource issues are mainly focused on water quality and anadromous fisheries, forest health and fuel loading, traditional gathering resources, management of special uses, and protection of culturally sensitive areas, The overriding desired condition for these resource areas is that the Karuk Tribe be involved from proposing actions to implementing them.

Chronic sediment sources are corrected and prevention measures are taken to reduce risk of landslides. Erosion control strategies address transportation systems and road maintenance. Road construction, use and maintenance is managed carefully to the highest standards. Road systems are examined and decommissioning is implemented where appropriate. Unstable headwater, inner gorges, landslides, and erosive road surfaces are identified, monitored and stabilized where possible. Long-term management of riparian areas is based on integrating all ecosystem functions. Timber management practices incorporate considerations that affect fish such as shade, water quality, sediment production, and hydro-storage capacities.

Timber management practices use individual or group selection methods so that natural diversity and stand structure are maintained. Uneven-aged management is applied by the individuals who write the prescriptions. Skid trail designation and directional felling are closely monitored so that residual stand is not damaged and disturbance is minimal.

Forested stands are managed so they can withstand periodic fire so forest cover can be retained over the long-term. A strong partnership between the Forest, Tribe and the community is in place to restore the historic fire regime. The fire management program has been reassessed with Tribal participation. The Karuk Fire Management organization carries out undertakings which have potential to disturb Karuk resources. Where important cultural resources need to be avoided by fire, Karuk would implement protection measures. All wildfire suppression activities are all cooperative efforts between the Forest and the Tribe.

Measures are taken to recover the historic fire refine. Fire is reintroduced across the landscape including LSRs and Wilderness. Underburning techniques are refined to mimic historic fire patterns. Monitoring and adaptive management practices complement timber management practices described above. Low intensity underburning consistent with aboriginal practices is used throughout the forest. The prescribed fire is applied in a manner that leaves delicate ecosystems undamaged. Fuels are managed to reduced the severity of wildfires. Fuels are reduced along roads and ridge tops leaving them more open and at reduced risk of fire.

Thinning dense plantations is a primary goal in matrix lands and on other land allocations to accelerate growth and improve stand health and fire resistance.

Stands are managed to allow for reintroduction of native hardwoods. Hardwoods are an important component of most stands and large hardwoods are not cut. A wide range of native species are retained across the watershed. Acorn collecting sites are identified and managed for subsistence. Tanoak mushroom picking areas are protected. Underburning is avoided in these areas. Basketry materials are well managed by the weavers and highly available.

Meadow environments, native grasses, and natural springs are protected and restored. Cattle use is restricted to protect pristine waters and other delicate systems. Wilderness trails are designed to stay off meadow areas. Where meadow crossings can not be avoided, bridges are constructed to reduce sediments to stream headwaters.

Stand dead trees are available for firewood --Recreation development, rafting and other river uses are carefully coordinated with Tribal leaders to avoid interruptions to ceremonial activities. Some areas are not developed for recreation to reduce risk of inappropriate activities or uses in the vicinity of ceremonial areas or potential degradation of cultural resources. Management in the Katimin areas has restored sacred characteristics. Management activities on Offield Mountain are conducted by Karuk. A MOU between the Forest and the Tribe has been developed for these areas.

Key Question 4- How can we integrate the Native American perspective into watershed management?

Many of the Karuk perspective desired conditions for Resource Management are consistent with the desired conditions of other issue areas in this analysis. The Karuk focus on water quality and anadromous fisheries is entirely consistent with the other Ishi-Pishi/Ukonom analysis issues of Hillslope Process, Riparian Areas, and Aquatic Dependent Species. Both the Karuk tribe and Forest Service managers want unstable lands identified and protected, roads decommissioned where appropriate and stabilized where possible, and chronic sediment sources corrected.

Both the Karuk tribe and Forest Service Ecosystem Management policies are aiming toward natural vegetative diversity and stand structure. Restoring fire's role in the landscape is a high priority for both the Karuk and FS managers. Prescribed fire and other forms of fuels reduction are recognized as necessary to maintain diversity and reduce the severity of wildfires. Thinning of dense plantations is recognized as needed to accelerate growth and improve stand health. Areas dominated by large hardwoods have been lost to conifers and dense undergrowth of small hardwoods; an increase of large hardwood areas is desired.

National Forest land allocations and management guidance dictate some different emphasis than those desired by the Karuk, depending on the land allocation. Late-Successional Reserves are for sustaining long-term late-successional habitat; managing for oak stands in LSRs may not be appropriate. Matrix lands are for multiple use management, including expected timber yields. Regeneration harvest, rather than thinning and uneven-aged management, may be silviculturally required to meet the expected output.

HUMAN USES

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

Commercial mushroom collection will probably increase from past levels, causing a corresponding increase in conflicts between traditional and commercial users.

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

Mineral extraction was a much greater land use in the past, but will probably remain near current levels. However, mining activities fluctuate with the gold market and could increase.

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

Key Question 2- How have recreation uses changed from the past and what are their trends?

Recreational fishing has declined and will likely continue to decline with increased regulations and listing of fish.

Use patterns have changed somewhat from an exclusively locally-dominated use to now include a Regional and National market. This is based on lifestyles oriented to the outdoors, ability to travel further, and National Wilderness and Wild & Scenic River designations; drawing visitors from out of the area.

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

Driving for pleasure, river rafting/kayaking, camping, and fishing have increased from past levels as a result of corresponding population increases. They will continue to be popular activities.

Past management activities have created visual impacts which sometimes currently exceed the desired visual conditions identified in the *Forest Plan*. Although overall visual condition has and will continue to improve as vegetation recovers, some potential opportunities exist to reduce visual contrasts from past management activities. Table 5-27 VQOs for the Analysis Area, lists the VQOs found within the landscape; see Figure 5-7 Visual Quality Objectives, contained in the Map Packet located at the end of this document.

Table 5-27 VQOs for the Analysis Area

Visual Quality Objective	Acres	% of Total
Preservation	10,600	10
Retention	9,500	9
Partial Retention	69,000	68
Modification	10,200	10
Maximum Modification	3,600	3
TOTAL	103,700 1/	100

1/ Includes VQO acres for all NF lands.

Both bear and deer hunting will continue to be popular activities in the watershed.

Key Question 3- How has community interest/involvement changed from the past and what is likely to change in the future?

Community interest in Forest management activities has been high since the early to mid-1970s. The development of the Orleans Somes Bar Community Action Group in 1997 is the culmination of local interest in community well-being through the development of a Community Action Plan. This plan also addresses activities on National Forest lands with the issue of *Forest Management* receiving the highest number of votes from the group. In the document, the USFS is listed many times as a source for projects; creating numerous opportunities for cooperative working relationships.

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

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

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

DESIRED CONDITIONS

--Non-timber commodity needs are met.

--Recreational access and opportunities are provided commensurate with public needs.

--The Forest Service works closely with the Community Action Group.

Step 6 - Recommendations

This step synthesizes results of the ecosystem processes discussed in previous steps and generates management recommendations responsive to issues and key questions. The goal of the recommendations is to identify changes in ecosystem conditions and functions that require management action to achieve desired ecologic, economic, and social objectives.

Management recommendations are broken into nine issue areas; **Hillslope Processes, Riparian Areas, Aquatic Dependent Species, Vegetative Biodiversity, Terrestrial Wildlife, Roads, Commercial Timber Outputs on Public Lands, Cultural**, and **Human Uses**. Recommendations are developed based on analyses and conclusions reached in previous steps. Recommendations are displayed in narrative format in Tables 6-1 through 6-9 on the following pages.

Recommendations focus on Management Opportunities which are also contained in the tables in narrative format and visually displayed in Figures 6-1 through 6-4, contained in the Map Packet located at the end of this document. Narratives are to be used in conjunction with these maps to arrive at opportunity locations.

Tables in this step provide general descriptions of the Existing Situation, Desired Conditions, Management Opportunity, Benefitting Resources, and Considerations. .

TABLE COLUMN DEFINITIONS

Existing Situation & Desired Condition - These narratives are qualitative and quantitative determinations identified through the analysis process. Existing Situation summary statements are generated directly from integrating information on management practices and/or ecological processes from Steps 3, 4, and 5; most are situations not meeting Desired Conditions.

Desired Conditions are developed from Step 5 - Interpretation and represent a refinement of direction from the *Forest Plan.*

Management Opportunity - This is the identification of management actions, projects, and other activities that promote Desired Conditions. During the analysis process, comparisons were made between Existing Situation and Desired Condition to determine how close a particular resource or ecological function was to achieving the Desired Condition. Opportunities were developed that either maintained the Desired Condition, or improved ecosystem trends to move towards Desired Condition.

Benefitting Resources - This identifies a priority list of multiple resources that most benefit from the completion of the listed opportunity.

Considerations - Factors identified in this column should be taken into account when implementing Management Opportunities. They may include Karuk perspectives, risks or benefits to other resources, or options and alternatives to consider when accomplishing the Management Opportunity. Comments found under Considerations should be reviewed during development and implementation of site-specific projects.

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, through a project environmental analysis.

To assist with establishing work priorities for project development, an emphasis rating system can be used. The following format is suggested when establishing ratings.

Opportunities are given a rating by each individual based on their professional judgement, assigning a High, Medium, or Low value to the following five questions:

1- Are there resources at-risk if the opportunity does not occur?
2- Is the opportunity an immediate need?
3- Are there amenity or commodity benefits from doing the opportunity?
4- Does the opportunity have implications outside the watershed?
5- What is the value of the completed opportunity as opposed to the cost of implementation?

These five values are averaged to establish an overall emphasis rating. When an across the board rating of High is given, it is referred to as a **Red Flag** opportunity. It implies a sense of urgency for implementation to bring an ecosystem function or system back in balance or respond to human needs or values. **Red Flag** opportunities should be given the highest priority.

Table 6-1 ISSUE - Hillslope Processes

EXISTING SITUATION	DESIRED CONDITION	MANAGEMENT OPPORTUNITY	Benefitting Resources	Considerations
1- Two watersheds have been identified as impaired (Rogers & Ti Creeks); high road density is the primary contributor.	**1-** These two watersheds recover so that they are no longer considered impaired.	**1-** Decommission high impact roads following a site specific analysis. Any other management activities in these impaired watersheds are neutral to or contribute to recovery; see Figure 6-1.	1- Hillslope Processes and Aquatic Species	1- Utilize the *Westside Roads Analysis* and the *Ukonom Transportation Plan.*
2- Much of the analysis area has high road densities (>4 miles/sq. mile); many of these roads are not consistent with current land allocations. There are also sediment concerns especially associated with unstable lands.	**2-** Resource impacts from roads are minimized while maintaining a road system adequate to manage National Forest lands.	**2-a.** Decommission roads where appropriate, upgrade needed roads to reduce resource impacts. **2-b.** Use appropriate location and construction techniques for reconstruction and any new construction, avoiding unstable lands whenever possible; see Figure 6-1.	2- Hillslope Processes, Aquatic Species, Terrestrial Wildlife and Transportation Management	2- Geotechnical input is used for any reconstruction or new construction. This area was identified in the *Klamath Basin Analysis*, as a high priority for watershed restoration.
3- Some watersheds are nearing impairment threshold; Carter/Kennedy, Sandy Bar/Stanshaw, Irving Creek, and Reynolds/Natuket.	**3-** The watersheds are resilient to natural disturbance and management activities. Within the analysis area, none of the watersheds are impaired or approaching impairment threshold.	**3-a.** Design and placement of future management activities are consistent with the Aquatic Conservation Strategy and improve or maintain subwatershed conditions. Examples; avoid unstable lands, use prescribed fire and vegetation management to reduce fuel loadings. **3-b.** Monitor conditions of sub-watersheds. Use Watershed Improvement Needs Inventory to identify threats to watershed health. Prioritize restoration based on an analysis of ecological and economic cost effectiveness.	3- Hillslope Processes, Aquatic Species, and Terrestrial Wildlife	3- None identified at this time.

Table 6-2 ISSUE - Riparian Areas

EXISTING SITUATION	DESIRED CONDITION	MANAGEMENT OPPORTUNITY	Benefitting Resources	Considerations
4- Mid to late-seral stands currently occupy about 62% of Riparian Reserves on National Forest lands. Riparian Vegetation is found on 10% and harsh sites make up another 12% of Riparian Reserves. Currently 75% of Riparian Reserves provide connectivity for late-seral wildlife species.	**4-** Healthy, fully functioning Riparian Reserves with approximately 60-75% mid to late-seral stands. Maintain structural vegetative diversity to provide riparian dependent species habitat. Connectivity for late-seral wildlife is maintained over the long-term.	**4-a.** Protect existing mid to late-seral stands in Riparian Reserves. **4-b.** Increase percentage of mid to late-seral stands in Riparian Reserves through vegetation management treatments (such as thinning older plantations) to improve growth and reduce risk of loss. Monitor the site specific conditions of Riparian Reserves to identify those areas that would most benefit from treatments; see Figure 6-2.	4- Aquatic Species	4- Treat upslope areas that pose a risk to Riparian Reserves.
5- High amounts of instream fine sediments are reducing habitat quality for many aquatic species. Streams most highly affected are Irving, Stanshaw, Ti, and Rogers.	**5-** Habitat is sufficient for sustainable populations of indigenous aquatic species. Fine sediment input, accumulation, and transportation are reduced to reference levels.	**5-** Restore natural stream processes allowing streams to become resilient to disturbance; decrease amounts of fine sediment entering stream systems; see Figure 6-1.	5- Aquatic Species	5- None identified at this time.
6- Varying interpretations exist for identifying features needing Riparian Reserve delineation. Mapping of Riparian Reserves is incomplete at this level.	**6-** Delineation of Riparian Reserves continues through project level planning.	**6-** Develop consistent guidelines for identifying features in need of Riparian Reserve protection. Mapping of Riparian Reserves is complete for the analysis area.	6- Hillslope Processes, Aquatic Species, and Terrestrial Wildlife	6- None identified at this time.
7- Low levels of instream Large Woody Material and recruitment exist in some streams, especially Upper Rock and Lick Creeks. Trees and woody material are removed from Riparian Reserves by firewood cutting.	**7-** Public is aware of the importance of large trees and wood in the Riparian Reserve and removal of these items is minimized.	**7-** Increase instream wood and improve site conditions to promote growth of large trees in capable Riparian Reserves. Discourage removal of trees and woody material from stream channels and Riparian Reserves through better public education, posting of signs, and through enforcement of existing laws.	7- Aquatic species	7- None identified at this time.

Table 6-3 ISSUE - Aquatic Dependent Species

EXISTING SITUATION	DESIRED CONDITION	MANAGEMENT OPPORTUNITY	Benefitting Resources	Considerations
8- Barriers to historical anadromous fisheries habitat exist in Rock, Stanshaw, Sandy Bar, and Rogers Creeks.	**8-** No Barriers to anadromous fish habitat exists. Streams are accessible for fish passage in all seasons.	**8-** Examine feasibility and cost benefit of eliminating fish passage barriers in Rock, Stanshaw, Sandy Bar, and Rogers Creeks; see Figure 6-1.	**8-** Aquatic Species	**8-** Work with cooperators.
9- Tributaries within analysis area provide important cold, high quality water to the Klamath River.	**9-** Aquatic Dependent Species management activities maintain or improve cold water contribution to Klamath. Tributaries continue to provide cold, high quality water.	**9-** Design and placement of future management activities does not contribute to water degradation . Monitor, identify crucial cold water streams.	**9-** Aquatic Species	**9-** None identified at this time.
10- Populations of coho and steelhead are largely unassessed within analysis area. Critical habitat (spawning/rearing) areas are unknown.	**10-** Aquatic populations within analysis area are maintained; current fish range resembles historic range.	**10-** Gather population information and complete spawning surveys on smaller streams. Future management activities do not impact these species.	**10-** Aquatic Species	**10-** None identified at this time.

Table 6-4 ISSUE - Vegetative Biodiversity

EXISTING SITUATION	DESIRED CONDITION	MANAGEMENT OPPORTUNITY	Benefitting Resources	Considerations
11- The analysis area is susceptible to large catastrophic fire. Fire Behavior Potential Modeling identified 40% of the analysis area as having high fire behavior potential and 45% as having moderate fire behavior potential. It is possible for a large catastrophic fires to move from watershed to watershed.	**11-** The landscape is not conducive to large catastrophic fire. Stand conditions don't promote high severity fires. Catastrophic fires that initiate in the analysis area are limited in size and severity.	**11-a.** Develop a strategy for improving fire suppression capabilities as appropriate and introduce fire into various subwatersheds (firesheds) to move landscape towards a more fire resilient system. **11-b.** Utilize key ridges, existing firelines, and roads to develop a fire and fuels management strategy. **11-c.** Utilize vegetation and fuels management activities to reduce fuel loadings, stand densities, and develop shaded fuel breaks. **11-d.** Develop a strategy to treat and/or protect high priority areas, (private residences, LSRs, impaired watersheds, plantations, etc.); see Figure 6-3.	**11-** Fire and Biodiversity	**11-** None identified at this time.
12- Fire intolerant species and conditions have been allowed to develop throughout much of the area and put the area at risk to high severity fire.	**12-** Oak woodlands, meadows, open areas, and serpentine balds are maintained with the appropriate plant species and at densities compatible with site conditions.	**12-** Develop a vegetation management strategy that includes an appropriate schedule of burning within vegetation communities to develop and maintain desired conditions.	**12-** Fire and Biodiversity	**12-** None identified at this time.
13- Vegetation communities have become less fire tolerant. Species dependant on disturbance are losing their ability to persist in the analysis area. Of special concern, is the loss of black oak woodlands which have high wildlife and cultural values. A lack of fire disturbance has contributed to a loss of forest openings and spatial diversity. Species diversity is being lost with fire intolerant species dominating much of the area.	**13-** Disturbance adapted vegetation communities are maintained/increased (black oak woodlands, mid-slope meadows, and serpentine balds). Vegetative diversity in stand structure, species composition, patch size, and seral stage is increased and maintained over time.	**13-a.** Develop a desired range of seral stages and patch sizes based on LMP land designations and vegetation communities. **13-b.** Develop and maintain the disturbance adapted communities such as oak woodlands, where appropriate in the analysis area. **13-c.** Some possible actions include thinning overstory conifers, controlling competing conifers and tanoak, and using the appropriate fire return frequencies to maintain black oak and oak woodlands.	**13-** Biodiversity and Wildlife	**13-** Consult with Karuk Tribe on sensitive areas and sites.
14- Many stands have high tree densities and high fuel loadings. High densities reduce growth and increase mortality risks. The high fuel loading and high density can increase fire severity and aggravate fire suppression efforts.	**14-** Area more resilient to drought disturbance and catastrophic fire. Stands are maintained with densities commensurate with site capability and stand heath. Fuel loadings do not contribute to increased fire severity.	**14-** Verify high density stands and areas with high fuel loadings on-the-ground. Utilize vegetation management to reduce stocking to appropriate levels. Treat and/or isolate concentrations of fuels. In future management, look for opportunities to treat any past activity fuels; see Figure 6-3.	**14-** Biodiversity, Terrestrial Wildlife and Fire	**14-** Emphasize plantations for thinning and fuel reduction treatment.
15- Increased understory development has put much of the late-mature/old-growth stands at risk of being lost to high intensity fire.	**15-** Fire plays a natural role in the development and maintenance of late-mature/old-growth stands.	**15-** Reduce understory fuels that jeopardize survival of late-mature/old-growth stands. Implement actions that minimize conditions that put these stands at risk; see Figure 6-3.	**15-** Late-Seral Dependent Wildlife	**15-** None identified at this time.

Table 6-5 ISSUE - Terrestrial Wildlife

EXISTING SITUATION	DESIRED CONDITION	MANAGEMENT OPPORTUNITY	Benefitting Resources	Considerations
17- Stand densities and ingrowth have reduced habitat suitability for goshawk.	17- In historic goshawk areas, stand conditions are favorable for goshawks.	17- Survey for habitat suitability, treat as appropriate by reducing height and density of understory vegetation. Focus on historic goshawk activity centers.	17- Wildlife	17- Check for habitat suitability for spotted owls, and potential conflicts between spotted owls and goshawks.
18- Shrub fields, small upslope springs, seeps, mid-slope meadows, and oak woodlands are being lost to encroaching conifers and tanoak. This is reducing diversity in the analysis area.	18- High quality diverse habitats exist in a mosaic of patch sizes, shapes, and age classes.	18- Survey for these habitat types and prioritize areas in need of treatments. Use vegetation management (thinning, prescribed fire, group selection) to increase plant species and structural diversity in the landscape. Use appropriate fire return frequencies to maintain these habitats over time.	18- Wildlife and Biodiversity	18- Select for plant species diversity in management activities.
19- Much of the late-successional habitat contains extremely dense understory vegetation and high fuel loadings which puts the habitat at risk to large scale disturbance. This will make it difficult to maintain late-successional habitat over time.	19- Late-successional habitat is resistant to large scale disturbance. Connectivity for late-successional species is maintained across analysis area. Management activities do not create dispersal barriers to late-successional species. The amount of late-successional habitat in LSRs is sustainable.	19- Use vegetation management (thinning, prescribed fire, shaded fuelbreaks) to make late-successional habitat more resistant and resilient to the adverse effects of large scale disturbance. Consideration of late-successional species dispersal occurs during design and placement of management activities; see Figure 6-4.	19- Late-Seral Dependent Wildlife	19- Check for consistency with the *Forest- Wide LSR Assessment.*
20- The elk population is increasing and early-seral habitat is decreasing, due to a lack of management activities and fire suppression. It is likely that habitat limitations will influence herd size and distribution.	20- Habitat conditions that support a stable elk herd population as identified in an elk herd management plan.	**20-a.** Work with CDF&G to develop an elk management plan that identifies desired population size and habitat requirements. **20-b.** Use vegetation management to provide for a mix of foraging and cover types to support the desired elk herd size. Management opportunities can include harvesting, prescribed fire, thinning from below, and development of shaded fuel breaks. **20-c.** Manage open road densities at a level that does not adversely effect elk use.	20- Wildlife and Recreation	20- Work with Karuk Tribe and local Sportsman groups.

Table 6-6 ISSUE - Roads

EXISTING SITUATION	DESIRED CONDITION	MANAGEMENT OPPORTUNITY	Benefitting Resources	Considerations
21- High road mileage, high road densities, and decreasing maintenance budgets have reduced road maintenance to inappropriate levels.	21- A stable road system that meets management objectives, public access needs, minimizes sediment delivery to stream channels, and reduces recurring maintenance costs.	**21-a.** Utilize list in Appendix H - Results of Roads Analysis, as well as additional site-specific information to develop opportunities for road improvements, including culvert upgrades, out-sloping, surfacing, reinforcing fills, etc. **21-b.** Utilize list in Appendix H, as well as additional site-specific information to develop proposed actions for environmental analysis that lead to decisions on decommissioning of roads. **21-c.** Continue road maintenance to facilitate access needs and resource protection; see Figure 6-1.	21- All	21- Integrate ERFO damage assessment and repair strategy with integrations for decommissioning. Road maintenance practices decrease spread of noxious weeds.
22- When most of the roads in the analysis area were constructed, a 20 year flood standard was used in road and culvert design. These culverts do not meet current design standards and regional policy and will likely fail during large flood events.	22- Stream crossings meet current design standards and policy which is to meet 100 year flood event.	22- Field verify the size of stream crossings, identify those sites that have highest risk of causing resource damage, and use this information to set priorities and upgrade, as opportunities arise.	22- Aquatic Species and Human Uses	22- Update road logs and develop GIS data

Table 6-7 ISSUE - Commercial Timber Outputs on Public Lands

EXISTING SITUATION	DESIRED CONDITION	MANAGEMENT OPPORTUNITY	Benefitting Resources	Considerations
23- Large acreage of existing plantations need thinning. To thin, force account is high cost. Currently a market for commercial thinning does not exist.	23- Plantations are treated and there is a commercial market for the product.	23- Develop a small scale, small diameter thinning program which focuses on older plantations and provides an economic benefit to the community; see Figure 6-4.	23- Human Uses and Vegetative Biodiversity	23- None identified at this time.

Table 6-7 ISSUE - Commercial Timber Outputs on Public Lands

EXISTING SITUATION	DESIRED CONDITION	MANAGEMENT OPPORTUNITY	Benefitting Resources	Considerations
24- There are 25,000 acres of matrix land in the analysis area that are intended to provide sustainable timber outputs.	**24-** A seral stage distribution that sustains a long-term, even flow of timber commodities commensurate with site capabilities and administrative constraints; contributing to community stability.	**24-a.** Develop and implement an environmentally sustainable timber program based on site potential seral stage distribution and management objectives (refer to Appendix K). **24-b.** Development of lists of stands/conditions which indicate regeneration priority; see Figure 6-2.	**24-** Timber	**24-** Timber sales are planned and administered to meet ACS objectives.
25- Costly single species surveys and numerous restrictions drive up unit costs and reduce project marketability. Terms and conditions for timber sale activities limit operations to a very short time period.	**25-** Surveys are coordinated so as to be more cost effective. Sale opportunities are offered through greater portion of dry period.	**25-** Complete long range distribution studies (threatened and endangered, survey and manage) to reduce project level survey requirements and operating restrictions.	**25-** Timber and Wildlife	**25-** None identified at this time.
26- A process or methodology for considering economic feasibility does not exist when integrating timber management goals and watershed resource goals. Project planning costs for volume provided are higher than present funding allows.	**26-** A coarse filter analysis provides a general economic feasibility assessment for project proposal development. Timber sale planning process identifies areas where timber harvest opportunities can be developed to achieve and or maintain desired watershed conditions.	**26-** Use analyses provided in this assessment to develop a sustainable timber sale program which can meet desired conditions for watershed resources and become more cost efficient.	**26-** Timber	**26-** None identified at this time.

Table 6-8 ISSUE - Cultural

EXISTING SITUATION	DESIRED CONDITION	MANAGEMENT OPPORTUNITY	Benefitting Resources	Considerations
27- Memorandums of Understanding (MOUs) are being negotiated, but have not been finalized.	**27-** MOUs that integrate compatible Karuk and Forest Service perspectives are in place for cultural partnerships.	**27-** Continue to improve relationship with the Tribe. Develop MOUs and stewardship programs, e.g., fire, vegetation management, watershed restoration.	**27-** Forest Service and Karuk Tribe	**27-** None identified at this time.
28- Federal Government policy and regulations are creating difficulties in establishing collaboration and stewardship contracts with the Karuk Tribe.	**28-** Funding and policy barriers are minimized to allow for increased collaboration and stewardship projects.	**28-** Explore opportunities with Tribe to perform stewardship contracts.	**28-** Forest Service and Karuk Tribe	**28-** None identified at this time.
29- Important traditional use areas are not always identified and protected during management activities. Some no longer exist due to past land management activities.	**29-** Important traditional use areas are protected from disturbance. Sustained traditional uses are provided.	**29-** Identify sensitive sites as appropriate. Coordinate closely with Tribe during project design and implementation to protect sites.	**29-** Karuk Tribe	**29-** Incorporate these concerns into the MOU.

Table 6-9 ISSUE - Human Uses

EXISTING SITUATION	DESIRED CONDITION	MANAGEMENT OPPORTUNITY	Benefitting Resources	Considerations
30- Readily accessible and available firewood is in short supply. Conflicting and inconsistent firewood cutting policies exist across District boundaries. This creates confusion and frustration for Forest users.	**30-** A regular supply of available firewood cutting opportunities is provided. Conflicting firewood cutting policies are minimized across District boundaries.	**30-** Develop a consistent firewood policy across District boundaries. Establish firewood cutting areas along open roads where firewood cutting can be used as a tool to accomplish Forest management.	**30-** Local community	**30-** Focus on areas with high dens ties of hardwoods.
31- Commercial use of mushrooms/craft resources is increasing rapidly and conflicts between commercial and traditional subsistence users are increasing.	**31-** Resources are protected, opportunities for commercial use is provided while conflicts between users is minimized.	**31-** Develop a management strategy that protects mushroom/craft material resources while allowing sustainable extraction plus protects traditional subsistence uses.	**31-** Forest Users	**31-** Adapt Special Forest Products S&Gs; *Six Rivers National Forest LMP*, Page IV - 125-128.

Table 6-9 ISSUE - Human Uses

EXISTING SITUATION	DESIRED CONDITION	MANAGEMENT OPPORTUNITY	Benefitting Resources	Considerations
32- The Somes Bar/Orleans Community Work Group has identified community stability as a major issue, and would like to see, at some level, a stable local economy. A steady flow of commodities coming from the National Forest, including commercial timber and special forest products, is seen as one stabilizing factor. Commercial timber harvest levels have declined significantly from the past which has decreased local employment opportunities for woods workers.	**32-** An even flow of forest products from NF lands (both commercial timber and special forest products) that the local community can count on annually. Activities and products from NF lands contribute to community stability and economic diversity.	**32-** Implement a long term timber program which provides an even flow of timber, market special forest products. Explore market opportunities for special forest products, and develop a strategy for protecting the resource and allowing commercial use.	**32-** Local community and Karuk Tribe	**32-** Involve interested local community members.
33- The 1997 floods and other natural disturbance has damaged some river access points, and passability of wilderness trails. Currently due to reduced budgets the trail system is not being adequately maintained.	**33-** A wide variety of recreational uses are offered and/or maintained, especially along the Klamath River and access to wilderness.	**33-** Repair/maintain critical river access points; maintain heavily used trails for public health and safety; see Figure 6-4.	**33-** Recreation	**33-** None identified at this time.
34- Opportunity deleted, space kept to maintain consistent numbering.				
35- Conflicts between river users and tribal members sometimes occur during ceremonial practices.	**35-** Ceremonial activities are conducted with a minimal amount of disturbance. River users are sensitive to cultural/spiritual and ceremonial issues.	**35-** Work with the Tribe to educate river users and river outfitters of American Indian ceremonies; discourage river use during sensitive time periods. Facilitate dialog between the Tribe and the commercial outfitters to reduce conflicts and improve relationships; see Figure 6-4.	**35-** Karuk Tribe	**35-** None identified at this time.
36- There are many recreational facilities and opportunities that are little known and under utilized.	**36-** Recreational opportunities and benefits are known to potential visitors.	**36-** An aggressive Forest marketing strategy is developed to inform potential users of the recreation niches that the Klamath NF and the analysis area offer. Involve local community members in development and marketing of recreational opportunities; see Figure 6-4.	**36-** Local Community	**36-** Work closely with Community action group.
37- There are two closed landfills and several old mining sites in the analysis area that present concerns for potential problems developing from contamination.	**37-** Closed landfills and old mine sites are identified and monitored for potential environmental degradation.	**37-** Develop a strategy to identify and monitor closed landfills and abandoned mine sites; see Figure 6-2.	**37-** All	**37-** Work with Karuk Tribe to identify potential conflicts with traditional gathering areas and these sites.
38- Direct lines of communication between the Forest Service and the community regarding policy and management of National Forest lands have sometimes been sporadic and unclear. There is a community action group that can provide a forum to improve communications.	**38-** Good lines of communication between FS and diverse members of community exist.	**38-** Participate in joint venture groups such as the community action group to communicate and deal with local concerns.	**38-** Forest Service and Local Community	**38-** None identified at this time.
39- Some areas of the National Forest do not meet Visual Quality Objectives (VQOs) due to past management activities.	**39-** Previously disturbed areas meet VQOs.	**39-** Develop and implement management strategies for areas of concentrated use to rehabilitate landscapes not meeting desired VQOs. Design new projects to meet VQOs; see Figure 6-2.	**39-** Recreation and Local Community	**39-** Develop priorities consistent with *Forest Plan* S&Gs.

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APPENDICES

Appendix A - LMP Feedback

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APPENDIX A - *LMP Feedback*

The goal of ecosystem management is to promote sustainability by protecting the ecosystem elements within and across spatial and temporal scales. One roll is to guide site level projects and decision making by providing a larger scale context. Another roll of ecosystem analysis is to provide feedback to the *Forest Plan*.

The following recommendations were developed during the Ishi-Pishi/Ukonom Ecosystem Analysis process. These recommendations primarily involve data layers, estimates of land allocation acreage, and assumptions used for Forest-Wide calculations.

1- The Ishi-Pishi/Ukonom analysis provides an updated estimate of Riparian Reserve acreage and a sample of ground-truthed riparian features for comparison. This allows a more accurate representation of both mapped and unmapped Riparian Reserve acreage than was used in the *Forest Plan*. It is recommended that more sampling of ground-truthed riparian features be done across the forest and future Forest-Wide analyses used updated mapping and sampling to estimate Riparian Reserve acreage.

2- The Ecologic Unit Inventory in the Ishi-Pishi/Ukonom analysis area provides the best information available for determining lands not capable of providing programmed timber harvest due to site limitations, i.e., Harsh Sites. This updated Harsh Site information should be used when updating *Forest Plan* capable, available, and suitable lands. EUI updates were also used to derive a more accurate mapping of Riparian Reserves. For future modeling, it is recommended that updated Riparian Reserve mapping be used.

3- The requirement in the *Klamath Forest Plan Record of Decision* for a watershed analysis in Areas with Watersheds Concerns (AWWCs) has been met for the AWWCs in the Ishi-Pishi/Ukonom watershed. However, two subwatersheds (Ti Creek and Rogers Creek) have been determined to be impaired and in need of continued limitations from watershed disturbances

4- Using the updated Riparian Reserve mapping, updated Areas with Watershed Concerns, and refined vegetation mapping, an identification of areas capable of supporting timber harvest has been developed in this analysis. It is recommended that this refinement of capable acres in the General Forest and Partial Retention land allocations be used in developing expected timber yields from the watershed.

APPENDIX B - *Cumulative Watershed Effects*

Landslide Model - The landslide model results are based on the *Salmon Sub-basin Sediment Analysis,* completed in 1993 by two geologists from the Klamath National Forest, Juan de la Fuente and Polly Haessig. The sediment study has identified landslides and estimated landslide volumes based on air photo interpretation with some ground verification. Each landslide in the Salmon River sub-basin has been identified by location, geomorphic terrane, disturbance history (road, timber harvest, or fire related, or in an undisturbed area), and time period the landslide was activated. Landslide prediction is based on actual landslide production for the period 1970 to 1975. Several large floods occurred in this time period but not the exceptionally large 1964 flood. The coefficients, expressed as cubic yards per acre given a series of floods similar to the 1970 to 1975 period, are displayed in the following table.

Landslide Model Coefficients				
Geomorphic Type	Road Related	Harvest/Fire		Undisturbed
	cu yd/ac	<20 years cu yd/ac	20-40 yrs cu yd/ac	cu yd/ac
Active Landslides	1,000	125	75	25
Dormant Slides/Toe Zone	225	3.2	3.0	2.8
Granitic Mtn. Slopes >60%	1,005	12	6.5	1.3
Granitic Mtn. Slopes <60%	36	11	5.9	0.6
Non-Granitic Slopes >60%	82	3.3	2.5	1.7
Non-Granitic Slopes <60%	19	2.1	1.2	0.3
Unconsolidated Inner Gorge	376	51	39	26
Granitic Inner Gorge	1,201	146	77	7.3
Other Inner Gorge	285	11	9.2	7.2
Debris Basins	25	50	3.8	1.3
Glacial Moraine & Terraces	7.5	6.5	4.9	3.2

To estimate future landslide production, the appropriate coefficient is multiplied by the acres of each geomorphic type by disturbance for each subwatershed. Background landslide production is based on the undisturbed landslide model coefficients and the acres of each geomorphic type.

Surface Erosion Model - Surface erosion modeling is based on the Universal Soil Loss Equation (USLE) which is $A = RxLSxDxCxKxc$. A is cubic yards per acre per year estimated sediment delivery to streams, R is rainfall/runoff factor (40 for the Ishi Pishi/Ukonom area), LS is the length/slope factor (2.5 for gentle <35% slopes, 7.32 for steep slopes), D is delivery ratio (.29 for roads, .05 for everything else), C is cover factor (.5 for roads, .06 for < 10 year old plantations or fire, .01 for everything else), K is inherent soil erodibility from soils coverage, and c is 0.7 tons/cu yds conversion. Current surface erosion uses the acreage and coefficients for roads and 1988-1997 plantations and background surface erosion includes only the background coefficients.

Roads, plantations, wildfire, slope classes, geomorphic and soil types are Geographic Information System (GIS) layers. Variable road prism widths are used to convert road lengths to acreage. A road prism width of 33 feet is used for double-lane roads (Hiway 96 and county roads) on gentle slopes (<35%) and 70 feet for double lane roads on steep slopes (>35%). For single lane roads (all FS and private roads in this analysis area), a road prism width of 20 feet is used on gentle slopes and 40 foot road prism width on steep slopes. Through use of GIS, acres of different disturbance histories on different geomorphic and soil types, on different slope classes, and in different subwatersheds are generated and plugged into sediment modeling equations. The sediment model results are displayed in Step 5.

Equivalent Roaded Area (ERA) Methodology - The ERA methodology is commonly used throughout the Forest Service Region 5 (California Region) for assessing Cumulative Watershed Effects (CWE). The basis for this methodology is converting road, harvest, fire, or other disturbance into Equivalent Roaded Area (ERA) using coefficients. The coefficients used for Ishi Pishi/Ukonom are derived from the *Forest Plan.* Road miles are converted to acres as described under the sediment models. 0-20 year old regeneration harvest areas and 1987 moderate and high intensity wildfire acres are multiplied by 0.21 ERA/acre to convert to ERAs. 20-30 year old plantations are multiplied by 0.17 and 30-40 year old plantations are multiplied by 0.06 ERA/acre to convert to ERAs. The information needed to calculate ERA is in GIS and the percent ERA for each subwatershed is displayed in Step 5.

The percent ERA for each subwatershed is compared with a Threshold of Concern (TOC). The TOC is calculated based on the channel sensitivity (C), beneficial uses (B), soil erodibility (E), hydrologic response (H), and slope stability (S). The index for each of these factors is plugged into the equation - Watershed Sensitivity Level (WSL) = 3C + 2B + E + H + S. Watershed Sensitivity is converted to a Threshold of Concern in the equation - Threshold of Concern (TOC) = (43 - WSL)/2. The number "43" is used because it best fits a regression of the watershed sensitivity levels and previously determined Thresholds of Concern.

The watershed sensitivity parameters for all subwatersheds are displayed in Step 3, Table 3-4. The explanation and index value for each is discussed in the following paragraphs.

Channel Sensitivity (C) is based on Pfankuch stream stability ratings or Rosgen channel types for each sub-watershed.

Parameter	Sensitivity Class	Index	Description
Channel Sensitivity	Very High	5	Pfankuch >130 Rosgen A4, B4, C4
	High	4	Pfankuch 115-130 Rosgen A3, A5, B3, B5, C3
	Moderate	3	Pfankuch 77-114 Rosgen B2, C1, C5
	Low	2	Plankuch 39-76 Rosgen A2, B1
	Very Low	1	Pfankuch <39 Rosgen A1, F

Beneficial Use (B) is an index of the significance of the stream for beneficial uses, by the highest beneficial use of surface water. Five beneficial use stream classes are defined in the Forest Plan. A Class 1A stream is a highly productive anadromous stream, is a municipal or campground water source (>5 domestic uses), provides highly productive resident fisheries habitat, major fishing use, or major recreation use. Class 1B stream provides domestic use for 1-5 surface water users, moderately productive anadromous fisheries, or highly productive resident fisheries habitat with major fishing use. Class II provides agricultural or industrial use, low productivity anadromous fisheries, or moderately productive resident fisheries with moderate fishing or recreation. Class III provides low productivity resident habitat and is rarely used for fishing or recreation. Class IV provides no beneficial uses.

Parameter	Significance Class	Index	Description
Beneficial Use	Very Highly	5	Class 1A.
	High	4	Class 1B.
	Moderate	3	Class II.
	Low	2	Class III.
	Other	1	Class IV.

Soil Erodibility (E) is based on the relative proportions of soils with different inherent erosion potentials where:

Erodibility = [6(A + C) + 5(B + D) + 3(E + F + H) + 2(G + I) + J]/Watershed Acres; and A = acres of granitic soils, B & D = acres of metamorphic units on steep slopes, C = acres of mica schist, E = acres of dormant landslides, F = acres of shallow soil and rock outcrops, G = acres of very to extremely gravelly surface, H = acres of cobbly surface, I = acres of glacial till, and J = acres of all other units

Parameter	Sensitivity Class	Index	Erodibility Rating
Soil Erodibility	Very High	5	> 5
	High	4	4-5
	Moderate	3	3-4
	Low	2	1.3-3
	Very Low	1	1-1.3

Hydrologic Response Potential (H) is based on the percent of the watershed in the transient snow zone (between 3,500 and 5,000 feet elevation), relative rain area (RRA or ratio of precipitation falling as rain vs. snow), and the dominant aspect of the watershed.

Parameter	Peak Runoff Potential	Index	Description
Hydrologic Response	Very High	4	High risk for rain-on-snow event every 1-5 years, rain-on-snow zone > 1/2 watershed, RRA > 0.9, aspect S high, N low.
	High	3	Ocassional rain-on-snow event (5-10 years), 1/4 to 1/2 watershed in rain-on-snow zone, RRA 0.5-0.7.
	Moderate	2	Average risk of rain-on-snow event (10-25 years) <1/4 of the watershed in rain-on-snow zone, RRA 0.5-0.7.
	Low	1	Low risk of high runoff peaks, RRA < 0.5

Slope Stability (S) is based on the proportion of the watershed in various slope stability categories where

Stability Rating = [10A + 6B + 4(C + D) + 3E + F]/Watershed Area

- A = acres of active landslide
- B = acres of unconsolidated inner gorge
- C = acres of consolidated inner gorge
- D = acres on toe zones of dormant landslides
- E = acres on highly dissected, steep granitics
- F = acres of all other terranes

Parameter	Risk Class	Index	Stability Rating
Slope Stability	Very High	5	> 1.5
	High	4	1 - 1.5
	Moderate	3	0.75 - 1
	Low	2	0.5 - 0.75
	Very Low	1	<0.5

APPENDIX C - *Aquatic Habitat*

BARK SHANTY GULCH

Surveyed 9/3-7/96

Location of Stream Mouth is T13N,R5E,S25 (confluence with Rock Creek)
Surveyed from mouth to 14,889'

PHYSICAL SUMMARY

HABITAT TYPE	# of Units	Total Lngth (ft)	Mean Lngth (ft)	% Total Lngth	Total Area (ft²)	Mean Area (ft²)
POOL						
Backwater/Log	2	45	22.5	0.3	828	414
Plunge	12	266	22.2	1.8	3,965	330
LSP/Log 1/	1	30	30.0	0.2	320	320
LSP/Root Wad	1	27	27.0	0.2	441	441
LSP/Bedrock	9	302	33.6	2.0	4,672	519
LSP/Boulder	11	308	28.0	2.1	5,425	493
Dammed	3	93	31.0	0.6	1,540	513
Mid-Channel	4	166	41.5	1.1	2,872	718
Corner	2	60	30.0	0.4	652	326
Step	2	103	51.5	0.7	2,281	1,141
Subtotal	***47***	***1,400***	***30***	***9***	***22,995***	***489***
RUN						
Glides	1	41	41.0	0.3	697	697
Run	32	1,038	32.4	7.0	15,929	498
Step	39	4,005	102.7	26.9	67,699	1,736
Subtotal	***72***	***8,084***	***71***	***34***	***84,325***	***1,171***
RIFFLE						
Low Gradient	46	4,348	94.5	29.2	70,984	1,543
High Gradient	59	4,050	68.6	27.2	75,217	1,275
Bedrock Sheet	1	7	7.0	0.0	16	16
Subtotal	***106***	***8,405***	***79***	***57***	***146,218***	***1,379***
TOTAL	***225***	***14889***		***100***		

-- Widths available for all units
1/ LSP = Lateral Scour Pool

DEPTH AND VOLUME

POOL					
Residual Depth (ft) 1/		Maximum Depth (ft) 1/		Residual Volume (ft3) 1/	
Mean	Range	Mean	Range	Mean	Range
2.6	0.9-7.3	3.3	1.8-8.0	1,336	238-6,891

1/ Sample Size: 47

COVER IN POOL HABITATS BY TYPE 1/

Instream Cover Type	Percent Cover
Total Cover	21
Undercut Banks	1
Small Woody Material	4
Large Woody Material	17
Terrestrial Vegetation	0
Aquatic Vegetation	0
White Water	44
Boulders	30
Bedrock Ledges	3

Average Cover Complexity = 1.7 (Scale of 1 to 3; low to high complexity) = Low/Moderate
1/ Sample Size: 47

MEAN STREAM WIDTH, DEPTH, VOLUME, & SHADE/CANOPY CLOSURE

Habitat Type	Sample No.	Lngth (ft)	Width (ft)	Depth (ft)	Vol (ft3)	Shade (%)
Pool	12	32	16	1.2	657	84
Run	13	60	19	0.7	705	90
Riffle	12	52	15	0.5	351	88

COARSE WOODY MATERIAL TOTALS

Diameter	LENGTH IN FEET						
	3.3-6.5	6.6-13	13.1-26.2	26.2-36.1	36.1-49.2	49.2-73.4	75.4-124.6 1/
4"	386	249	192	44	14	12	0
18"	51	64	80	12	12	9	0
24"	41	46	49	22	23	34	3

-- LWM Recruitment: 20 recruits per 1,800' sampled; approximately 13% of survey length.
1/ No LWM was found above length shown.

PERCENT SUBSTRATE COMPOSITION

Habitat Type	Sample No.	Bed-rock	Boulder	Cobble	Gravel	Sand/ Fines
Pool	12	11	28	18	37	6
Run	13	5	26	20	39	9
Riffle	12	7	22	24	36	11

Substrate particle size breakdown: Boulder = >256mm, Cobble = 64-256mm, Gravel = 2-64mm, Fines = <2mm

PERCENT EMBEDDEDNESS

Habitat Type	Sample No.	Mean (%)
All	20	26
Pool	12	27
Run 1/		
Riffle 2/	8	25

1/ No Data
2/ All low gradient

JUVENILE FISH DENSITY AND PROPORTION

Habitat Type	Sample No.	Sample Lngth	Density (fish/ft2)		Proportion (%)	
			0+ Steelhead	1+ Steelhead	0+ Steelhead	1+ Steelhead
Pool	12	383	.008035	.010043	32	47
Run	13	779	.005473	.004160	46	41
Riffle	12	625	.004043	.001748	22	12

BEANS GULCH

Surveyed 9/3-7/96

Location of Stream Mouth is T13N,R5E,S36 (confluence with Bark Shanty Gulch)
Surveyed from mouth to 11,382'

PHYSICAL SUMMARY

HABITAT TYPE	# of Units	Total Length (ft)	Mean Length (ft)	% Total Length	Total Area (ft^2)	Mean Area (ft^2)
POOL						
Backwater/Boldr	1	20	20.0	0.2	253	253
Plunge	10	219	21.9	1.9	3,635	364
LSP/Log 1/	10	266	26.6	2.3	3,218	322
LSP/Root Wad	1	27	27.0	0.2	324	324
LSP/Bedrock	10	360	36.0	3.2	4,320	432
Dammed	3	100	33.3	0.9	2,451	817
LSP/Boulder	1	51	51.0	0.4	561	561
Step	5	390	78.0	3.4	6,447	1289
Subtotal	***41***	***1,433***	***35***	***12.6***	***21,209***	***517.3***
RUN						
Glide	3	90	30.0	0.8	1,141	380
Run	24	922	38.4	8.1	10,266	428
Step	24	2,206	91.9	19.4	22,731	947
Subtotal	***51***	***3,218***	***63***	***28.3***	***34,138***	***669.3***
RIFFLE						
Low Gradient	57	5,526	96.9	48.6	66,751	1171
High Gradient	15	1,179	78.6	10.4	15,202	1013
Cascade	1	26	26.0	0.2	260	260
Subtotal	***73***	***6,731***	***92***	***59.1***	***82,212***	***1,126***
TOTAL	***165***	***11382***		***100***		

-- Widths available for all units
1/ LSP = Lateral Scour Pool

DEPTH AND VOLUME

POOL					
Residual Depth (ft) 1/		Maximum Depth (ft) 1/		Residual Volume (ft^3) 1/	
Mean	Range	Mean	Range	Mean	Range
2.3	1.0-4.9	2.9	1.4-5.6	1291	180-4579

1/ Sample Size: 40

COVER IN POOL HABITATS BY TYPE 1/

Instream Cover Type	Percent Cover
Total Cover	26
Undercut Banks	3
Small Woody Material	10
Large Woody Material	46
Terrestrial Vegetation	1
Aquatic Vegetation	0
White Water	12
Boulders	21
Bedrock Ledges	7

Average Cover Complexity = 1.5 (Scale of 1 to 3; low to high complexity) = Low/Moderate
1/ Sample Size: 40

MEAN STREAM WIDTH, DEPTH, VOLUME, & SHADE/CANOPY CLOSURE

Habitat Type	# of Samp's	Length (ft)	Width (ft)	Depth (ft)	Vol. (ft^3)	Shade (%)
Pool	10	28	15	0.98	431	94
Run	8	59	11	0.47	316	94
Riffle	10	88	12	0.35	398	91

Shade Sample Size: 11 Pool, 8 Run, 10 Riffle

COARSE WOODY MATERIAL TOTALS

Diameter	LENGTH IN FEET						
	3.3-6.6	6.6-13	13.1-26.2	26.2-36.1	36.1-49.2	49.2-75.4	75.4-124.6 1/
4"	386	234	109	25	9	0	0
18"	156	155	138	47	20	5	0
24"	51	89	118	86	57	32	7

-- LWM Recruitment: 97 recruits per 1,200' sampled; approximately 10.5% of survey length.
1/ No LWM was found above length shown.

PERCENT SUBSTRATE COMPOSITION

Habitat Type	Sample No.	Bedrock	Boulder	Cobble	Gravel	Sand/Fines
Pool	11	5	4	33	44	14
Run	8	2	12	38	41	7
Riffle	10	2	7	48	38	5

Substrate particle size breakdown: Boulder = >256mm, Cobble = 64-256mm, Gravel = 2-64mm, Fines = <2mm

PERCENT EMBEDDEDNESS

Habitat Type	Sample No.	Mean (%)
All	18	29
Pool	11	29
Run 1/		
Riffle	7	28

1/ No Data

JUVENILE FISH DENSITY AND PROPORTION

Habitat Type	Sample No.	Sample Length	Density ($fish/ft^2$)		Proportion (%)	
			0+ Steelhead	1+ Steelhead	0+ Steelhead	1+ Steelhead
Pool	12	283	.002723	.009005	19	47
Run	8	475	.004522	.004899	35	28
Riffle	9	822	.002872	.002131	46	25

COON CREEK

Surveyed 7/15-18/96

Location of Stream Mouth is T14N,R6E,S9 (confluence with Klamath River)
Surveyed from mouth to 10,371'

PHYSICAL SUMMARY

HABITAT TYPE	# of Units	Total Lngth (ft)	Mean Lngth (ft)	% Total Lngth	Total Area (ft²)	Mean Area (ft²)
POOL						
Plunge	6	177	29.5	1.7	1,911	319
LSP/Bedrock 1/	15	432	28.8	4.2	4,601	307
Dammed	5	146	29.2	1.4	1,929	386
LSP/Boulder	5	118	23.6	1.1	1,562	312
Pocket Water	1	71	71.0	0.7	994	994
Subtotal	***32***	***944***	***29.5***	***9.1***	***10,997***	***344***
RUN						
Run	6	251	41.8	2.4	2,194	366
Step	42	5,007	119.2	48.3	68,788	1638
Subtotal	***48***	***5,258***	***109.5***	***50.7***	***70,982***	***1479***
RIFFLE						
Low Gradient	13	991	76.2	9.6	15,760	1212
High Gradient	37	3,045	82.3	29.4	42,601	1151
Cascade	3	133	44.3	1.3	1,578	526
Subtotal	***53***	***4,169***	***78.7***	***40.2***	***59,939***	***1131***
TOTAL	***133***	***10371***		***100***		
-- Widths available for all units						
1/ LSP = Lateral Scour Pool						

DEPTH AND VOLUME

POOL					
Residual Depth (ft) 1/		Maximum Depth (ft) 1/		Residual Volume (ft3) 1/	
Mean	Range	Mean	Range	Mean	Range
1.7	1.1-3.1	2.3	1.6-3.8	553	92-1554
1/ Sample Size: 31					

COVER IN POOL HABITATS BY TYPE 1/

Instream Cover Type	Percent Cover
Total Cover	34
Undercut Banks	1
Small Woody Material	15
Large Woody Material	13
Terrestrial Vegetation	6
Aquatic Vegetation	0
White Water	15
Boulders	36
Bedrock Ledges	14
Average Cover Complexity = 2.39 (Scale of 1 to 3; low to high complexity) = Moderate	
1/ Sample Size: 31	

MEAN STREAM WIDTH, DEPTH, VOLUME, & SHADE/CANOPY CLOSURE

Habitat Type	# of Samp's	Lngth (ft)	Width (ft)	Depth (ft)	Vol (ft3)	Shade (%)
Pool	8	28	11	1.2	399	89
Run	8	61	12	0.8	547	88
Riffle	7	70	14	0.7	631	85

COARSE WOODY MATERIAL TOTALS

Diameter	LENGTH IN FEET						
	3.3-6.5	6.6-13	13.1-26.2	26.2-36.1	36.1-49.2	49.2-75.4	75.4-124.6 1/
4"	107	78	63	47	25	9	0
18"	19	30	32	27	26	15	4
24"	10	17	20	24	21	17	5
-- LWM Recruitment: no data taken							
1/ No LWM was found above length shown.							

PERCENT SUBSTRATE COMPOSITION

Habitat Type	Sample No.	Bed-rock	Boulder	Cobble	Gravel	Sand-Fines
Pool	8	10	30	16	36	8
Run	8	13	38	19	25	5
Riffle	7	6	41	15	33	5
Substrate particle size breakdown: Boulder = >256mm, Cobble = 64-256mm, Gravel = 2-64mm, Fines = <2mm						

PERCENT EMBEDDEDNESS

Habitat Type	Sample No.	Mean (%)
All	31	30
Pool	31	30
Run 1/		
Riffle 1/		
1/ No Data		

JUVENILE FISH DENSITY AND PROPORTION

Habitat Type	Sample No.	Sample Length	Density (fish/ft2) 0+ Steelhead	Density (fish/ft2) 1+ Steelhead	Proportion (%) 0+ Steelhead	Proportion (%) 1+ Steelhead
Pool	8	220	.003695	.006979	41	38
Run	8	488	.001384	.003113	36	40
Riffle	7	493	.000750	.001501	23	22

Habitat Type	Sample No.	Sample Length	Density (fish/ft2) 0+ Chinook		Proportion (%) 0+ Chinook	
Pool	8	220	.00000		0	
Run	8	488	.00000		0	
Riffle	7	493	.000150		100	

FLEMS CREEK

Surveyed 7/18-19/96

Location of Stream Mouth is T14N,R7E,S28 (confluence with Ukonom Creek)
Surveyed from mouth to 11,152'

PHYSICAL SUMMARY

HABITAT TYPE	# of Units	Total Length (ft)	Mean Length (ft)	% Total Length	Total Area (ft²)	Mean Area (ft²)
POOL						
Backwater/Boldr	1	10	10	0.1	ND	ND
Backwater/Log	2	33	16.5	0.3	ND	ND
Plunge	1	11	11	0.1	ND	ND
LSP/Log 1/	7	88	12.57	0.8	276	276
Mid-Channel	3	55	18.3	0.5	ND	ND
LSP/Boulder	26	343	13.19	3.1	1,528	255
Step	15	628	41.86	5.6	1,931	644
Subtotal	***55***	***1,168***	***21.2***	***10.5***	***3,459***	***346***
RUN						
Glide	1	248	248	2.2	ND	ND
Run	12	1,326	110.5	11.9	3,379	1,126
Step	57	7,406	129.92	66.4	23,362	2,124
Subtotal	***70***	***8,980***	***128.3***	***80.5***	***26,741***	***1,910***
RIFFLE						
High Gradient	19	932	49.05	8.4	2,710	452
Cascade	4	72	18	0.6	ND	ND
Subtotal	***23***	***1,004***	***43.7***	***9.0***	***2,710***	***452***
TOTAL	***148***	***11152***		***100***		

-- Widths available for biological sample units only
ND = No Data
1/ LSP = Lateral Scour Pool
Sample size for Total and Mean Areas are: 1 LSP/Log, 6 LSP/Boldr, 3 Step Pool, 3 Run, 11 Step Run, and 6 High Gradient

DEPTH AND VOLUME

POOL					
Residual Depth (ft) 1/		Maximum Depth (ft) 1/		Residual Volume (ft3) 2/	
Mean	Range	Mean	Range	Mean	Range
1.8	0.5-3.3	2.0	0.6-3.6	622	124-1562

1/ Sample Size: 51
2/ Sample Size: 9

COVER IN POOL HABITATS BY TYPE 1/

Instream Cover Type	Percent Cover
Total Cover	62
Undercut Banks	0
Small Woody Material	6
Large Woody Material	5
Terrestrial Vegetation	49
Aquatic Vegetation	1
White Water	17
Boulders	21
Bedrock Ledges	1

Average Cover Complexity = 2.0 (Scale of 1 to 3; low to high complexity) = Moderate
1/ Sample Size: 55

MEAN STREAM WIDTH, DEPTH, VOLUME, & SHADE/CANOPY CLOSURE

Habitat Type	# of Samp.	Length (ft)	Width (ft)	Depth (ft)	Vol (ft3)	Shade (%)
Pool	11	22	17.7	1.25	419	60
Run	15	112	14.6	0.60	1163	58
Riffle	6	39	10.6	0.50	256	46

Shade Sample Size: 4 Pool, 33 Run, 3 R ffle

COARSE WOODY MATERIAL TOTALS

Diameter	LENGTH IN FEET						
	3.3-6.6	6.6-13	13.1-26.2	26.2-36.1	36.1-49.2	49.2-75.4	75.4-124.6 1/
4"	60	107	58	21	0	0	0
18"	27	57	88	60	8	1	0
24"	11	20	41	58	40	11	1

-- LWM Recruitment: 121 recruits per 1,666' sampled; approximately 6% of survey length.
1/ No LWM was found above length shown.

PERCENT SUBSTRATE COMPOSITION

Habitat Type	Sample No.	Bedrock 1/	Boulder	Cobble	Gravel	Sand/Fines
Pool	3		19	49	29	3
Run	8		32	49	13	6
Riffle	1		69	31	0	0

Substrate particle size breakdown: Boulder = >256mm, Cobble = 64-256mm, Gravel = 2-64mm, Fines = <2mm
1/ Bedrock included in Boulder count

PERCENT EMBEDDEDNESS

Habitat Type	Sample No.	Mean (%)
Pool 1/		
Run 1/		
Riffle 1/		

1/ No Data

JUVENILE FISH DENSITY AND PROPORTION

Habitat Type	Sample No.245	Sample Length	Density (fish/ft2)		Proportion (%)	
			0+ Steelhead	1+ Steelhead	0+ Steelhead	1+ Steelhead
Pool	11	245	.00073	.00364	30	45
Run	15	1,711	.00025	.00057	70	49
Riffle	6	237	.00000	.00074	0	6
Habitat Type	Sample No.	Sample Length	Density (fish/ft2)		Proportion (%)	
			0+ Brook	1+ Brook	0+ Brook	1+ Brook
Pool	11	245	.00146	.00437	22	49
Run	15	1,711	.00075	.00068	78	51
Riffle	6	237	.00000	.00000	0	0

HALVERSON CREEK

Surveyed 7/25/96

Location of Stream Mouth is T12N,R6E,S4 (confluence with Klamath River)
Surveyed from mouth to 2,920'

PHYSICAL SUMMARY

HABITAT TYPE	# of Units	Total Length (ft)	Mean Length (ft)	% Total Length	Total Area (ft²)	Mean Area (ft²)
POOL						
Plunge	2	27	13.5	0.9	199	100
LSP/Log 1/	2	32	16.0	1.1	415	208
LSP/Bedrock	1	20	20.0	0.7	220	220
LSP/Boulder	3	52	17.3	1.8	423	141
Step	4	248	62.0	8.5	3,409	852
Subtotal	***12***	***379***	***31.6***	***13.0***	***4,666***	***389***
RUN						
Step	14	1,360	97.1	46.6	14,969	1,069
Subtotal	***14***	***1,360***	***97.1***	***46.6***	***14,969***	***1069***
RIFFLE						
High Gradient	14	1,181	84.4	40.4	13,425	959
Subtotal	***14***	***1,181***	***84.4***	***40.4***	***13,425***	***959***
TOTAL	***40***	***2,920***		***100***		

-- Widths available for all units
1/ LSP = Lateral Scour Pool

MEAN STREAM WIDTH, DEPTH, VOLUME, & SHADE/CANOPY CLOSURE

Habitat Type	# of Samp s	Lngth (ft)	Width (ft)	Depth (ft)	Vol (ft3)	Shade (%)
Pool	3	17	9	1.1	197	96
Run	3	56	11	0.7	387	87
Riffle	2	49	9	0.4	194	94

COARSE WOODY MATERIAL TOTALS

Diameter	LENGTH IN FEET						
	3.3-6.6	6.6-13	13.1-26.2	26.2-36.1	36.1-49.2	49.2-75.4	75.4-124.6 1/
4"	78	34	23	15	6	1	0
18"	12	11	20	12	8	5	0
24"	2	2	6	2	4	5	0

-- LWM Recruitment: no data taken
1/ No LWM was found above length shown.

DEPTH AND VOLUME

POOL					
Residual Depth (ft) 1/		Maximum Depth (ft) 1/		Residual Volume (ft3) 1/	
Mean	Range	Mean	Range	Mean	Range
1.4	0.7-2.3	1.9	1.5-2.6	602	28-3300

1/ Sample Size: 12

PERCENT SUBSTRATE COMPOSITION

Habitat Type	Sample No.	Bedrock	Boulder	Cobble	Gravel	Sand/Fines
Pool	3	10	34	10	31	15
Run	3	4	39	13	31	13
Riffle	2	5	45	17	25	8

Substrate particle size breakdown: Boulder = >256mm, Cobble = 64-256mm, Gravel = 2-64mm, Fines = <2mm

COVER IN POOL HABITATS BY TYPE 1/

Instream Cover Type	Percent Cover
Total Cover	40
Undercut Banks	4
Small Woody Material	8
Large Woody Material	21
Terrestrial Vegetation	13
Aquatic Vegetation	0
White Water	27
Boulders	28
Bedrock Ledges	0

Average Cover Complexity = 2.5 (Scale of 1 to 3; low to high complexity) = Moderate/High
1/ Sample Size: 10

PERCENT EMBEDDEDNESS

Habitat Type	Sample No.	Mean (%)
All	12	27
Pool	12	27
Run 1/		
Riffle 1/		

1/ No Data

JUVENILE FISH DENSITY AND PROPORTION

Habitat Type	Sample No 245	Sample Lngth	Density (fish/ft2)		Proportion (%)	
			0+ Steelhead	1+ Steelhead	0+ Steelhead	1+ Steelhead
Pool	3	52	.009862	.003945	15.6	25.0
Run	3	167	.011056	.001658	62.5	37.5
Riffle	2	98	.007830	.003356	21.9	37.5

Habitat Type	Sample No	Sample Lngth	Density (fish/ft2)		Proportion (%)	
			0+ Coho		0+ Coho	
Pool	3	52	.001972		100	
Run	3	167	.00000		0	
Riffle	2	98	.00000		0	

IRVING CREEK

Surveyed 6/22-7/7/92 & 7/31/92

Location of Stream Mouth is T13N,R6E,S33 (confluence with Klamath River)
Surveyed from mouth to 9,499'

PHYSICAL SUMMARY

HABITAT TYPE	# of Units	Total Length (ft)	Mean Length (ft)	% Total Length	Total Area (ft²)	Mean Area (ft²)
POOL						
Backwater/Log	1	20	20.0	0.2	320	320
Plunge	14	265	18.9	2.8	3,640	260
LSP/Log 1/	2	67	33.5	0.7	589	295
LSP/Bedrock	3	90	30.0	0.9	488	163
Dammed	3	45	15.0	0.5	525	175
LSP/Boulder	14	249	17.8	2.6	3,709	265
Pocket Wateerl	4	232	58.0	2.4	3,002	751
Step	6	366	61.0	3.9	3,598	600
Subtotal	***47***	***1,334***	***28.4***	***140***	***15,871***	***338***
RUN						
Run	12	344	28.7	3.6	4,054	338
Step	8	6,634	79.3	6.7	6,901	863
Subtotal	***20***	***978***	***48.9***	***103***	***10,955***	***548***
RIFFLE						
Low Gradient	13	730	56.2	7.7	6,747	519
High Gradient	52	5,622	108.1	59.2	65,167	1,253
Cascade	14	786	56.1	8.3	8,293	592
Bedrock Sheet	3	49	16.3	0.5	360	120
Subtotal	***93***	***7,187***	***77.2***	***757***	***80,567***	***866***
TOTAL	***149***	***9,499***		***100***		

-- Widths available for all units
1/ LSP = Lateral Scour Pool

DEPTH AND VOLUME

POOL					
Residual Depth (ft) 1/		Maximum Depth (ft) 1/		Residual Volume (ft3) 1/	
Mean	Range	Mean	Range	Mean	Range
2.0	0.9-4.6	2.6	1.7-5.2	612	3-129

1/ Sample Size: 45

COVER IN POOL HABITATS BY TYPE 1/

Instream Cover Type	Percent Cover
Total Cover	34
Undercut Banks	4
Small Woody Material	11
Large Woody Material	6
Terrestrial Vegetation	3
Aquatic Vegetation	2
White Water	37
Boulders	28
Bedrock Ledges	9

Average Cover Complexity = 1.6 (Scale of 1 to 3; low to high complexity) = Low/Moderate
1/ Sample Size: 47

MEAN STREAM WIDTH, DEPTH, VOLUME, & SHADE/CANOPY CLOSURE

Habitat Type	# of Samps	Length (ft)	Width (ft)	Depth (ft)	Vol (ft3)	Shade (%)
Pool	14	29	13	1.3	505	58
Run	6	40	12	0.8	387	52
Riffle	14	77	12	0.7	658	65

Shade sample size: 15 Pool, 5 Run, 14 Riffle

COARSE WOODY MATERIAL TOTALS

Diameter	LENGTH IN FEET						
	3.3-6.6	6.6-13	13.1-26.2	26.2-36.1	36.1-49.2	49.2-75.4	75.4-124.6 1/
4"							
18"							
24"					105		

-- LWM Recruitment: 44 recruits per 2,031' sampled; approximately 21% of survey length.
1/ No LWM was found above length shown.

PERCENT SUBSTRATE COMPOSITION

Habitat Type	Sample No.	Bed-rock	Boulder	Cobble	Gravel	Sand/Fines
Pool	15	8	13	13	25	41
Run	6	6	12	27	28	27
Riffle	14	5	39	23	19	14

Substrate particle size breakdown: Boulder = >256mm, Cobble = 64-256mm, Gravel = 2-64mm, Fines = <2mm

PERCENT EMBEDDEDNESS

Habitat Type	Sample No.	Mean (%)
All	25	41
Pool	14	40
Run	3	52
Riffle	8	34

JUVENILE FISH DENSITY AND PROPORTION

Habitat Type	Sample No.	Sample Length	Density (fish/ft2)		Proportion (%)	
			0+ Steelhead	1+ Steelhead	0+ Steelhead	1+ Steelhead
Pool	14	410	.02041	.00398	39	45
Run	6	240	.02716	.00369	25	21
Riffle	14	1080	.00900	.00141	36	34
Habitat Type	Sample No.	Sample Length	Density (fish/ft2)		Proportion (%)	
			0+ Chinook		0+ Chinook	
Pool	14	410	.00166		21	
Run	6	240	.00000		0	
Riffle	14	1080	.00289		79	

LIGHTNING GULCH

Surveyed 9/8-9/96

Location of Stream Mouth is T13N,R5E,S23 (confluence with Rock Ck.)
Surveyed from mouth to 7,406'

PHYSICAL SUMMARY

HABITAT TYPE	# of Units	Total Lngth (ft)	Mean Lngth (ft)	% Total Lngth	Total Area (ft^2)	Mean Area (ft^2)
Dry Channel	1	34	34.0	0.5	159	159
POOL						
Backwater/Root Wad Formed	1	22	22.0	0.3	521	521
Backwater/Log	1	17	17.0	0.2	153	153
Plunge	2	24	12.0	0.3	321	161
LSP/Bedrock 1/	1	15	15.0	0.2	105	105
Subtotal	***5***	***78***	***16***	***1***	***1,100***	***220***
RUN						
Run	10	258	25.8	3.5	2,400	240
Step	16	1249	78.1	16.9	19,530	1,221
Subtotal	***26***	***1,507***	***58***	***20***	***21,930***	***843***
RIFFLE						
Low Gradient	3	285	95.0	3.8	4,414	1,471
High Gradient	29	5502	189.7	74.3	73,558	2,536
Subtotal	***32***	***5,787***	***181***	***79***	***77,972***	***2,437***
TOTAL 2/	***64***	***7,406***		***100***		

-- Widths available for all units
1/ LSP = Lateral Scour Pool
2/ Excludes Dry Channel Habitat

DEPTH AND VOLUME

POOL					
Residual Depth (ft) 1/		Maximum Depth (ft) 1/		Residual Volume (ft^3) 1/	
Mean	Range	Mean	Range	Mean	Range
1.6	1.1-2.1	2.2	1.7-2.4	352	147-833

1/ Sample Size: 5

COVER IN POOL HABITATS BY TYPE 1/

Instream Cover Type	Percent Cover
Total Cover	8
Undercut Banks	22
Small Woody Material	4
Large Woody Material	40
Terrestrial Vegetation	0
Aquatic Vegetation	0
White Water	28
Boulders	6
Bedrock Ledges	0

Average Cover Complexity = 1.6 (Scale of 1 to 3; low to high complexity) = Low/Moderate
1/ Sample Size: 5

MEAN STREAM WIDTH, DEPTH, VOLUME, & SHADE/CANOPY CLOSURE

Habitat Type	# of Samp's	Lngth (ft)	Width (ft)	Depth (ft)	Vol (ft^3)	Shade (%)
Pool	1	17	9	0.7	108	98
Run	4	67	14	0.5	493	90
Riffle	5	173	12	0.4	646	96

COARSE WOODY MATERIAL TOTALS

Diameter	LENGTH IN FEET						
	3.3-6.6	6.6-13	13.1-26.2	26.2-36.1	36.1-49.2	49.2-75.4	75.4-124.6 1/
4"	148	90	93	19	5	5	0
18"	36	41	28	9	6	5	0
24"	11	16	25	16	16	7	0

-- LWM Recruitment: 12 recruits per 600' sampled; approximately 8% of survey length.
1/ No LWM was found above length shown.

PERCENT SUBSTRATE COMPOSITION

Habitat Type	Sample No.	Bed-rock	Boulder	Cobble	Gravel	Sand/Fines
Pool	1	0	20	14	56	10
Run	4	1	27	26	39	7
Riffle	5	4	22	22	48	4

Substrate particle size breakdown: Boulder = >256mm, Cobble = 64-256mm, Gravel = 2-64mm, Fines = <2mm

PERCENT EMBEDDEDNESS

Habitat Type	Sample No.	Mean (%)
All	1	40
Pool	1	40
Run 1/		
Riffle 1/		

1/ No Data

JUVENILE FISH DENSITY AND PROPORTION

Habitat Type	Sample No.	Sample Lngth	Density (fish/ft2) 0+ Steelhead	Density (fish/ft2) 1+ Steelhead	Proportion (%) 0+ Steelhead	Proportion (%) 1+ Steelhead
Pool	1	17	.026144	.00000	4	0
Run	4	269	.006136	.002045	29	25
Riffle	5	837	.007389	.003117	67	75

LOWER UKONOM

Surveyed 7/2-31/90

Location of Stream Mouth is T14N,R6E,S10 (confluence with Klamath River)
Surveyed from mouth to 47,132'

PHYSICAL SUMMARY

HABITAT TYPE	# of Units	Total Lngth (ft)	Mean Lngth (ft)	% Total Lngth	Total Area (ft^2)	Mean Area (ft^2)
POOL						
Backwater/Boldr	2	53	26.5	0.1	1,148	574
Plunge	49	1,724	35.2	3.7	43,610	890
LSP/Bedrock 1/	22	1,029	46.8	2.2	24,772	1,126
Dammed	3	61	20.3	0.1	1,231	410
Mid-Channel	51	2,766	54.2	5.9	69,284	1,359
Channel Confluence	1	37	37.0	0.1	592	592
LSP/Boulder	24	732	30.5	1.6	18,360	765
Step	10	896	89.6	1.9	19,804	1,980
Subtotal	***162***	***7,298***	***45***	***15***	***178,801***	***1,104***
RUN						
Trench/Chute	3	280	93.3	0.6	4,120	1,373
Run	69	2,729	39.6	5.8	62,264	902
Step	116	20378	175.7	43.2	596559	5,143
Subtotal	***188***	***23387***	***124***	***50***	***662943***	***3,526***
RIFFLE						
Low Gradient	32	2,536	79.3	5.4	74,450	2,327
High Gradient	173	12443	71.9	26.4	327524	1,893
Cascadet	18	1,355	75.3	2.9	31,800	1,767
Bedrock Sheet	3	113	37.7	0.2	1,027	342
Subtotal	***226***	***16447***	***73***	***35***	***434801***	***1,924***
TOTAL	***576***	***47132***		***100***		

-- Widths available for all units
1/ LSP = Lateral Scour Pool

DEPTH AND VOLUME

POOL					
Residual Depth (ft) 1/		**Maximum Depth (ft) 2/**		**Residual Volume (ft3) 1/**	
Mean	Range	Mean	Range	Mean	Range
3.8	1.3-14.7	5.2	1.6-16.0	5234	130-59535

1/ Sample Size: 158
2/ Sample Size: 162

COVER IN POOL HABITATS BY TYPE

Instream Cover Type	% Pool 1/	% Run 1/	% Riffle 1/
Total Cover	29	31	63
Undercut Banks	0	0	0
Small Woody Material	4	7	6
Large Woody Material	5	5	4
Terrestrial Vegetation	4	5	4
Aquatic Vegetation	1	0	0
White Water	60	50	60
Boulders	17	28	25
Bedrock Ledges	9	5	1

Average Cover Complexity is on a Scale of 1 to 3; low to high complexity: 1.2 Pool, 1.5 Run, 1.4 Riffle
1/ Sample Size: 162 Pool, 188 Run, 226 Riffle

MEAN STREAM WIDTH, DEPTH, VOLUME, & SHADE/CANOPY CLOSURE

Habitat Type	# of Samp's	Lngth (ft)	Width (ft)	Depth (ft)	Vol (ft3)	Shade (%)
Pool	162	45	23	2.8	3,692	40
Run	188	124	24	1.3	4,758	43
Riffle	225	73	25	1.0	2,024	35

Shade Sample Size: 36 Pool, 39 Run, 45 Riffle

COARSE WOODY MATERIAL TOTALS 1/

Diameter	LENGTH IN FEET 3.3-6.6	6.6-13	13.1-26.2	26.2-36.1	36.1-49.2	49.2-75.4	75.4-124.6 2/
4"							
18"							
24"						152	

-- LWM Recruitment: 191 recruits per 9,088' sampled; approximately 19% of survey length.
1/ Only key LWM recorded; >=50' x 24"
2/ No LWM was found above length shown.

PERCENT SUBSTRATE COMPOSITION

Habitat Type	Sample No.	Bed-rock	Boulder	Cobble	Gravel	Sand/ Fines
Pool	36	11	31	18	10	30
Run	39	14	31	22	10	23
Riffle	45	14	44	23	7	12

Substrate particle size breakdown: Boulder = >256mm, Cobble = 64-256mm, Gravel = 2-64mm, Fines = <2mm

PERCENT EMBEDDEDNESS

Habitat Type	Sample No.	Mean (%)
All	117	14
Pool	35	20
Run	37	2
Riffle	45	20

JUVENILE FISH DENSITY AND PROPORTION

Habitat Type	Sample No.	Sample Lngth	Density (fish/ft2) 0+ Steel-head	1+ Steel-head	Proportion (%) 0+ Steel-head	1+ Steel-head
Pool	39	1,711	.001681	.008954	19	40
Run	41	4,633	.001385	.003475	48	46
Riffle	45	2,513	.001813	.002115	33	14
Habitat Type	**Sample No.**	**Sample Lngth**	**Density (fish/ft2) 0+ Chi-nook 1/**		**Proportion (%) 0+ Chi-nook**	
Pool	39	1,711	.000213		76	
Run	41	4,633	.00000		0	
Riffle	45	2,513	.000043		24	

1/ The Chinook 0+ were found through habitat Unit #20, no further.

McCASH CREEK

Surveyed 7/13-16/94

Location of Stream Mouth is T14N,R7E,S32 (confluence with Ukonom Creek)
Surveyed from 21,702'

PHYSICAL SUMMARY

HABITAT TYPE	# of Units	Total Lngth (ft)	Mean Lngth (ft)	% Total Lngth	Total Area (ft^2)	Mean Area (ft^2)
POOL						
Backwater/Log	2	58	29	0.3	189	189
Plunge	27	675	25	3.1	2,883	577
LSP/Log 1/	6	116	19	0.5	216	216
LSP/Root Wad	1	35	35	0.2	ND	ND
LSP/Bedrock	6	124	21	0.6	120	120
Dammed	1	28	28	0.1	ND	ND
Mid-Channel	31	653	21	3.0	2,121	265
LSP/Boulder	19	410	22	1.9	1,238	248
Step	18	715	40	3.3	2,448	490
Subtotal	***111***	***2,814***	***25***	***13.0***	***9,215***	***354***
RUN						
Trench/Chute	5	186	37	0.9	ND	ND
Glide	7	597	85	2.8	999	999
Run	27	2,337	87	10.8	8,278	1,035
Step	67	7,190	107	33.1	14,278	1,020
Subtotal	***106***	***10310***	***97***	***47.5***	***23,555***	***1,024***
RIFFLE						
High Gradient	126	8,273	66	38.1	13,308	554
Cascade	13	280	22	1.3	97	49
Bedrock Sheet	1	25	25	0.1	ND	ND
Subtotal	***140***	***8,578***	***61***	***39.5***	***13,405***	***516***
TOTAL	***357***	***21702***		***100***		

-- Widths available for biological sample units only
ND = No Data
1/ LSP = Lateral Scour Pool
Sample Size for Total and Mean Areas are: 1 Backwater, 5 Plunge, 1 LSP/Log, 1 LSP/Bedrock, 8 Mid-Channel, 5 LSP/Boldr, 5 Step Pool, 1 Glide, 8 Run, 14 Step Run, 24 High Gradient, 2 Cascade.

DEPTH AND VOLUME

POOL					
Residual Depth (ft) 1/		**Maximum Depth (ft) 1/**		**Residual Volume (ft3) 2/**	
Mean	Range	Mean	Range	Mean	Range
2.7	0.4-15.0	3.3	0.8-16.0	1270	173-6643

1/ Sample Size: 107
2/ Sample Size: 25

COVER IN POOL HABITATS BY TYPE 1/

Instream Cover Type	Percent Cover
Total Cover	21
Undercut Banks	2
Small Woody Material	4
Large Woody Material	9
Terrestrial Vegetation	5
Aquatic Vegetation	1
White Water	37
Boulders	36
Bedrock Ledges	6

Average Cover Complexity = 2.0 (Scale of 1 to 3; low to high complexity) = Moderate
1/ Sample Size: 108

MEAN STREAM WIDTH, DEPTH, VOLUME, & SHADE/CANOPY CLOSURE

Habitat Type	# of Samp's	Lngth (ft)	Width (ft)	Depth (ft)	Vol (ft3)	Shade (%)
Pool	26	25	13.0	1.50	653	50
Run	23	104	9.7	0.70	517	62
Riffle	26	53	10.0	0.70	370	41

Shade Sample Size: 12 Pool, 35 Run, 33 Riffle

COARSE WOODY MATERIAL TOTALS

Diameter	LENGTH IN FEET						
	3.3-6.6	**6.6-13**	**13.1-26.2**	**26.2-36.1**	**36.1-49.2**	**49.2-75.4**	**75.4-124.6**
4"	192	274	166	121	62	23	11
18"	32	95	81	34	22	10	2
24"	36	84	79	63	31	18	13
Diameter	LENGTH IN FEET						
	124.6-173.8	**1/**					
4"	2						
18"	0						
24"	4						

-- LWM Recruitment: 18 recruits per 277' sampled; approximately 1.3% of survey length.
1/ No LWM was found above length shown.

PERCENT SUBSTRATE COMPOSITION

Habitat Type	Sample No.	Bedrock 1/	Boulder	Cobble	Gravel	Sand/ Fines
Pool	9		49	16	23	12
Run	7		48	16	25	11
Riffle	8		56	28	10	6

Substrate particle size breakdown: Boulder = >256mm, Cobble = 64-256mm, Gravel = 2-64mm, Fines = <2mm
1/ Bedrock included with Boulder count.

PERCENT EMBEDDEDNESS

Habitat Type	Sample No.	Mean (%)
All	22	31
Pool	10	31
Run	6	28
Riffle	6	34

JUVENILE FISH DENSITY AND PROPORTION

Habitat Type	Sample No.	Sample Lngth	Density (fish/ft2)		Proportion (%)	
			0+ Steelhead	1+ Steelhead	0+ Steelhead	1+ Steelhead
Pool	26	667	.00271	.01313	73	68
Run	22	2300	.00026	.00185	18	24
Riffle	26	1371	.00022	.00112	9	8
Habitat Type	**Sample No.**	**Sample Lngth**	**Density (fish/ft2)**		**Proportion (%)**	
			0+ Brook	1+ Brook	0+ Brook	1+ Brook
Pool	26	667	.00065	.00174	5	20
Run	22	2300	.00515	.00224	95	65
Riffle	26	1371	.00000	.00090	0	15

ONE MILE CREEK

Surveyed 8/24-25/94

Location of Stream Mouth is T14N,R7E,S28 (confluence with Ukonom Creek)
Surveyed from mouth to 14,067'

PHYSICAL SUMMARY

HABITAT TYPE	# of Units	Total Lngth (ft)	Mean Lngth (ft)	% Total Lngth	Total Area (ft^2)	Mean Area (ft^2)
Dry Channel	1	1,109	1109	7.9	ND	ND
POOL						
Plunge	9	177	19.6	1.3	825	413
LSP/Bedrock 1/	5	78	15.6	0.6	540	540
Dammed	1	15	15	0.1	ND	ND
Mid-Channel	13	218	16.7	1.5	1,725	431
Step	2	160	80	1.1	ND	ND
Subtotal	***30***	***648***	***21.6***	***5.0***	***3090***	***441***
RUN						
Run	13	807	62.07	5.7	4,280	1,427
Step	49	6,177	126.06	43.9	39,575	4,397
Subtotal	***62***	***6,984***	***112.6***	***53.9***	***43,855***	***3,655***
RIFFLE						
High Gradient	60	5,260	87.67	37.4	35,336	2,356
Cascade	3	66	22	0.5	ND	ND
Subtotal	***63***	***5,326***	***84.5***	***41.1***	***35,336***	***2,356***
TOTAL	***156***	***14067***		***100***		

-- Widths available for biologicl sample units only
ND = No Data
1/ LSP = Lateral Scour Pool
Sample Size for Total and Mean Areas are: 2 Plunge, 1 LSP/Bed-rock, 4 Mid-Channel, 3 Run, 9 Step Run, 15 High Gradient.

DEPTH AND VOLUME

POOL					
Residual Depth (ft) 1/		Maximum Depth (ft) 1/		Residual Volume (ft3) 2/	
Mean	Range	Mean	Range	Mean	Range
1.2	0.5-2.8	2.0	1.2-2.8	499	248-780

1/ Sample Size: 29
2/ Sample Size: 7

COVER IN POOL HABITATS BY TYPE 1/

Instream Cover Type	Percent Cover
Total Cover	16
Undercut Banks	1
Small Woody Material	9
Large Woody Material	19
Terrestrial Vegetation	1
Aquatic Vegetation	0
White Water	28
Boulders	42
Bedrock Ledges	0

Average Cover Complexity = 2.0 (Scale of 1 to 3; low to high complexity) = Moderate
1/ Sample Size: 30

MEAN STREAM WIDTH, DEPTH, VOLUME, & SHADE/CANOPY CLOSURE

Habitat Type	# of Samp's	Lngth (ft)	Width (ft)	Depth (ft)	Vol (ft3)	Shade (%)
Pool	7	18	24.3	1.89	841	72
Run	12	126	28.7	1.24	4297	68
Riffle	15	88	28.1	1.25	2766	73

Shade Sample Size: 4 Pool, 25 Run, 11 Riffle

COARSE WOODY MATERIAL TOTALS

Diameter	LENGTH IN FEET						
	3.3-6.6	6.6-13	13.1-26.2	26.2-36.1	36.1-49.2	49.2-75.4	75.4-124.6
4"	352	84	71	8	5	3	0
18"	120	100	89	21	10	3	0
24"	261	88	118	58	65	37	26
Diameter	LENGTH IN FEET						
	124.6-173.8	1/					
4"	0						
18"	0						
24"	6						

-- LWM Recruitment: 98 recruits per 1,553' sampled; approximately 11% of survey length.
1/ No LWM was found above length shown.

PERCENT SUBSTRATE COMPOSITION

Habitat Type	Sample No.	Bed-rock 1/	Boulder	Cobble	Gravel	Sand/ Fines
Pool	1		33	31	26	10
Run	6		24	41	22	13
Riffle	5		36	39	18	7

Substrate particle size breakdown: Boulder = >256mm, Cobble = 64-256mm, Gravel = 2-64mm, Fines = <2mm
1/ Bedrock included in Boulder count.

PERCENT EMBEDDEDNESS

Habitat Type	Sample No.	Mean (%)
All	4	28
Pool	3	28
Run 1/		
Riffle	1	25

1/ No Data

JUVENILE FISH DENSITY AND PROPORTION

Habitat Type	Sample No.	Sample Lngth	Density (fish/ft2) 0+ Steelhead	Density (fish/ft2) 1+ Steelhead	Proportion (%) 0+ Steelhead	Proportion (%) 1+ Steelhead
Pool	7	126	.00065	.00324	12.5	32
Run	12	1514	.00016	.00034	43.75	49
Riffle	15	1321	.00020	.00017	43.75	19
Habitat Type	**Sample No.**	**Sample Lngth**	**Density (fish/ft2) 0+ Brook**	**Density (fish/ft2) 1+ Brook**	**Proportion (%) 0+ Brook**	**Proportion (%) 1+ Brook**
Pool	7	126	.00097	.00906	43	50
Run	12	1514	.00009	.00064	57	50
Riffle	15	1321	.00000	.00000	0	0

PANTHER CREEK

Surveyed 8/29-9/1/94

Location of Stream Mouth is T14N,R6E,S25 (confluence with Ukonom Creek)
Surveyed from mouth to 3,295'

PHYSICAL SUMMARY

HABITAT TYPE	# of Units	Total Lngth (ft)	Mean Lngth (ft)	% Total Lngth	Total Area (ft^2)	Mean Area (ft^2)
POOL						
Plunge	6	103	17.2	3.1	120	120
LSP/Bedrock 1/	1	20	20.0	0.6	ND	ND
Mid-Channel	5	86	17.2	2.6	321	160
Subtotal	***12***	***209***	***17.4***	***6.3***	***441***	***147***
RUN						
Trench	1	15	15.0	0.5	ND	ND
Run	3	188	62.7	5.7	174	174
Step	3	383	127.7	11.6	804	804
Subtotal	***7***	***586***	***83.7***	***17.8***	***978***	***489***
RIFFLE						
High Gradient	15	2,472	164.8	75.0	4,722	1,181
Cascade	2	28	14.0	0.8	ND	ND
Subtotal	***17***	***2,500***	***147.1***	***75.9***	***4,722***	***1180.5***
TOTAL	***36***	***3295***		***100***		

-- Widths available for biological sample units only
ND = No Data
1/ LSP = Lateral Scour Pool
Sample Size for Total and Mean Areas are: 1 Plunge, 2 Mid-Channel, 1 Run, 1 Step Run, 4 High Gradient.

DEPTH AND VOLUME

POOL					
Residual Depth (ft) 1/		**Maximum Depth (ft) 1/**		**Residual Volume (ft3) 2/**	
Mean	Range	Mean	Range	Mean	Range
1.4	0.7-2.5	2.0	1.3-3.2	320	63-577

1/ Sample Size: 9
2/ Sample Size: 2

COVER IN POOL HABITATS BY TYPE 1/

Instream Cover Type	Percent Cover
Total Cover	15
Undercut Banks	0
Small Woody Material	5
Large Woody Material	5
Terrestrial Vegetation	2
Aquatic Vegetation	0
White Water	46
Boulders	42
Bedrock Ledges	0

Average Cover Complexity = 2.0 (Scale of 1 to 3; low to high complexity) = Moderate
1/ Sample Size: 10

MEAN STREAM WIDTH, DEPTH, VOLUME, & SHADE/CANOPY CLOSURE

Habitat Type	# of Samp's	Lngth (ft)	Width (ft)	Depth (ft)	Vol (ft3)	Shade (%)
Pool	3	17	8.3	0.9	132	ND
Run	2	82	6.0	0.6	293	86
Riffle	4	172	6.8	0.5	566	66

Shade Sample Size: 8 Run, 1 Riffle
ND = No Data

COARSE WOODY MATERIAL TOTALS

Diameter	LENGTH IN FEET						
	3.3-6.6	**6.6-13**	**13.1-26.2**	**26.2-36.1**	**36.1-49.2**	**49.2-75.4**	**75.4-124.6 1/**
4"	30	20	8	7	2	1	0
18"	8	13	11	11	1	0	0
24"	3	9	7	10	6	3	0

-- LWM Recruitment: 16 recruits per 166' sampled; approximately 6% of survey length.
1/ No LWM was found above length shown.

PERCENT SUBSTRATE COMPOSITION

Habitat Type	Sample No.	Bedrock 1/	Boulder	Cobble	Gravel	Sand/Fines
Pool 2/						
Run	2		10	15	30	45
Riffle	1		29	33	23	15

1/ Bedrock included with Boulder count.
2/ No Data
Substrate particle size breakdown: Boulder = >256mm, Cobble = 64-256mm, Gravel = 2-64mm, Fines = <2mm

PERCENT EMBEDDEDNESS

Habitat Type	Sample No.	Mean (%)
All	1	15
Pool	1	15
Run 1/		
Riffle 1/		

1/ No Data

JUVENILE FISH DENSITY AND PROPORTION

Habitat Type	Sample No.	Sample Lngth	Density (fish/ft2)		Proportion (%)	
			0+ Steelhead	**1+ Steelhead**	**0+ Steelhead**	**1+ Steelhead**
Pool	3	51	.01361	.00907	21	50
Run	2	163	.00511	.00102	17	13
Riffle	4	689	.00377	.00063	62	38

LOWER ROCK CREEK

Surveyed 9/12-27/89

Location of Stream Mouth is T13N,R6E,S17 (confluence with Klamath River)
Surveyed from mouth to 29,457'

PHYSICAL SUMMARY

HABITAT TYPE	# of Units	Total Lngth (ft)	Mean Lngth (ft)	% Total Lngth	Total Area (ft^2)	Mean Area (ft^2)
POOL						
Backwater/Root Wad	1	18	18.0	0.1	180	180
Plunge	16	547	34.2	1.9	14,318	895
LSP/Log 1/	10	430	43.0	1.5	9,873	987
LSP/Root Wad	1	39	39.0	0.1	624	624
LSP/Bedrock	35	2,123	60.7	7.2	42,478	1,214
Dammed	3	74	24.7	0.3	1,962	654
Mid-Channel	8	376	47.0	1.3	9,124	1,141
Channel Confluence	1	87	87.0	0.3	2,610	2,610
LSP/Boldr	18	729	40.5	2.5	19,012	1,056
Pocket Water	3	205	68.3	0.7	6,946	2,315
Subtotal	***96***	***4,628***	***48***	***16***	***107,127***	***1,116***
RUN						
Glide	2	262	131.0	0.9	8,086	4,043
Run	25	1,656	66.2	5.6	43,378	1,735
Step	59	18553	314.5	63.0	445,917	7,558
Subtotal	***86***	***20471***	***238***	***69***	***497,381***	***5,784***
RIFFLE						
Low Gradient	10	1,082	108.2	3.7	32,432	3,243
High Gradient	47	2,629	55.9	8.9	74,386	1,583
Cascade	12	647	53.9	2.2	14,798	1,233
Subtotal	***69***	***4,358***	***63***	***15***	***121,615***	***1,763***
TOTAL	***251***	***29457***		***100***		

-- Widths available for all units
1/ LSP = Lateral Scour Pool

DEPTH AND VOLUME

POOL					
Residual Depth (ft) 1/		Maximum Depth (ft) 1/		Residual Volume (ft3) 1/	
Mean	Range	Mean	Range	Mean	Range
3.0	1.0-7.4	3.8	1.5-7.9	3792	360-21845

1/ Sample Size: 96

COVER IN POOL HABITATS BY TYPE

Instream Cover Type	% Pool 1/	% Run 1/	% Riffle 1/
Total Cover	26	31	62
Undercut Banks	0	0	0
Small Woody Material	2	1	1
Large Woody Material	9	2	2
Terrestrial Vegetation	2	4	1
Aquatic Vegetation	0	0	0
White Water	21	31	46
Boulders	43	60	48
Bedrock Ledges	23	2	2

Average Cover Complexity is on a Scale of 1 to 3; low to high complexity: 2.6 Pool, 2.6 Run, 2.5 Riffle
1/ Sample Size: 96 Pool, 86 Run, 69 Riffle

MEAN STREAM WIDTH, DEPTH, VOLUME, & SHADE/CANOPY CLOSURE

Habitat Type	# of Samp's	Lngth (ft)	Width (ft)	Depth (ft)	Vol (ft3)	Shade (%)
Pool	96	48	23	1.9	2329	50
Run	86	238	24	0.9	5244	38
Riffle	69	63	26	0.7	1182	38

Shade Sample Size: 25 Pool, 19 Run, 12 Riffle

COARSE WOODY MATERIAL TOTALS 1/

Diameter	LENGTH IN FEET						
	3.3-6.6	6.6-13	13.1-26.2	26.2-36.1	36.1-49.2	49.2-75.4	75.4-124.6
4"							
18"							
24"							

1/ No wood data taken, either key large wood or recruitment.

PERCENT SUBSTRATE COMPOSITION

Habitat Type	Sample No.	Bed-rock	Boulder	Cobble	Gravel	Sand/ Fines
Pool	25	3	22	37	19	19
Run	19	1	35	40	15	9
Riffle	12	1	42	38	12	7

Substrate particle size breakdown: Boulder = >256mm, Cobble = 64-256mm, Gravel = 2-64mm, Fines = <2mm

PERCENT EMBEDDEDNESS

Habitat Type	Sample No.	Mean (%)
All	56	25
Pool	12	12
Run	25	34
Riffle	19	22

JUVENILE FISH DENSITY AND PROPORTION

Habitat Type	Sample No.	Sample Lngth	Density (fish/ft2)		Proportion (%)	
			0+ Steel-head	1+ Steel-head	0+ Steel-head	1+ Steel-head
Pool	23	1024	.016866	.009888	38	59
Run	18	1729	.013061	.003423	48	33
Riffle	10	603	.009604	.002035	14	8

UPPER ROCK CREEK

Surveyed 8/27-30/93

Location of Stream Mouth is T13N,R6E,S17 (confluence with Klamath River)
Surveyed from 29,457' to 48,781'

PHYSICAL SUMMARY

HABITAT TYPE	# of Units	Total Lngth (ft)	Mean Lngth (ft)	% Total Lngth	Total Area (ft^2)	Mean Area (ft^2)
Dry Channel	1	153	153.0	08	ND	ND
POOL						
Plunge	52	1,052	20.2	5.4	2,173	272
LSP/Root Wad 1/	1	15	15.0	0.1	ND	ND
LSP/Bedrock	11	247	22.5	1.3	446	149
Dammed	3	59	19.7	0.3	143	143
Mid-Channel	27	746	27.6	3.9	1,770	443
LSP/Boldr	35	646	18.5	3.3	981	491
Step	31	1,460	47.1	7.6	2,956	591
Subtotal	***160***	***4,225***	***26***	***22***	***8,469***	***368***
RUN						
Run	41	1,359	33.1	7.0	928	232
Step	123	9,547	77.6	49.4	13,545	847
Subtotal	***164***	***10906***	***67***	***57***	***14,473***	***724***
RIFFLE						
Low Gradient	4	79	19.8	0.4	504	504
High Gradient	133	3,818	28.7	19.8	6,306	287
Cascade	5	130	26.0	0.7	ND	ND
Bedrock Sheet	1	13	13.0	0.1	ND	ND
Subtotal	***143***	***4,040***	***28***	***21***	***6,810***	***296***
TOTAL	***468***	***19324***		***100***		

-- Widths available for biological sample units only
ND = No Data
1/ LSP = Lateral Scour Pool
Sample Size for Total and Mean Areas are: 8 Plunge, 3 LSP/Bedrock, 1 Dammed, 4 Mid-Channel, 2 LSP/Boldr, 5 Step Pool, 4 Run, 16 Step Run, 1 Low Gradient, 22 High Gradient.

DEPTH AND VOLUME

POOL					
Residual Depth (ft) 1/		Maximum Depth (ft) 1/		Residual Volume (ft3) 2/	
Mean	Range	Mean	Range	Mean	Range
1.7	0.9-6.4	2.2	1.2-7.0	697	122-3137

1/ Sample Size: 155
2/ Sample Size: 22

COVER IN POOL HABITATS BY TYPE 1/

Instream Cover Type	Percent Cover
Total Cover	17
Undercut Banks	1
Small Woody Material	3
Large Woody Material	7
Terrestrial Vegetation	1
Aquatic Vegetation	0
White Water	35
Boulders	50
Bedrock Ledges	3

Average Cover Complexity = 2.2 (Scale of 1 to 3; low to high complexity) = Moderate
1/ Sample Size: 157

MEAN STREAM WIDTH, DEPTH, VOLUME, & SHADE/CANOPY CLOSURE

Habitat Type	# of Samp's	Lngth (ft)	Width (ft)	Depth (ft)	Vol (ft3)	Shade (%)
Pool	23	27	13	1.2	479	79
Run	20	54	12	0.8	621	80
Riffle	23	24	11	0.8	184	83

Shade Sample Size: 23 Pool, 18 Run, 29 Riffle

COARSE WOODY MATERIAL TOTALS

Diameter	LENGTH IN FEET						
	3.3-6.6	6.6-13	13.1-26.2	26.2-36.1	36.1-49.2	49.2-75.4	75.4-124.6 1/
4"	391	333	304	61	4	0	0
18"	33	87	221	43	6	0	0
24"	24	43	102	49	20	8	0

-- LWM Recruitment: 158 recruits per 1,861' sampled; approximately 10% of survey length.
1/ No LWM was found above length shown.

PERCENT SUBSTRATE COMPOSITION

Habitat Type	Sample No.	Bedrock 1/	Boulder	Cobble	Gravel	Sand/ Fines
Pool	5		42	8	32	18
Run	10		44	13	28	15
Riffle	6		55	9	25	11

Substrate particle size breakdown: Boulder = >256mm, Cobble = 64-256mm, Gravel = 2-64mm, Fines = <2mm
1/ Bedrock included in Boulder count

PERCENT EMBEDDEDNESS

Habitat Type	Sample No.	Mean (%)
All	35	16
Pool	10	15
Run 1/	16	18
Riffle 2/	9	13

JUVENILE FISH DENSITY AND PROPORTION

Habitat Type	Sample No.	Sample Lngth	Density (fish/ft2)		Proportion (%)	
			0+ Steelhead	1+ Steelhead	0+ Steelhead	1+ Steelhead
Pool	23	630	.008738	.008029	41	77
Run	20	1081	.005458	.001244	44	20
Riffle	23	539	.004186	.000465	15	3

ROGERS CREEK

Surveyed 6/15-8/24/94

Location of Stream Mouth is T12E,R6E,S10 (confluence with Klamath River)
Surveyed from mouth to 28,141'

PHYSICAL SUMMARY

HABITAT TYPE	# of Units	Total Lngth (ft)	Mean Lngth (ft)	% Total Lngth	Total Area (ft^2)	Mean Area (ft^2)
POOL						
Backwater/Boldr	2	23	11.5	0.1	80	80
Backwater/ Root Wad	2	30	15.0	0.1	ND	ND
Backwater/Log	4	64	16.0	0.2	300	300
Plunge	41	896	21.9	3.2	1,246	178
LSP/Log 1/	24	449	18.7	1.6	414	138
LSP/Root Wad	1	16	16.0	0.1	ND	ND
LSP/Bedrock	20	435	21.8	1.5	956	239
Dammed	3	43	14.3	0.2	120	120
Mid-Channel	34	653	19.2	2.3	1,000	125
LSP/Boulder	24	552	23.0	2.0	771	154
Corner	1	19	19.0	0.1	ND	ND
Step	37	2,201	59.5	7.8	3,048	381
Subtotal	***193***	***5,381***	***27.9***	***19.1***	***7,248***	***191***
RUN						
Trench/Chute	1	11	11.0	0.0	ND	ND
Run	76	3,895	51.3	13.8	9,943	432
Step	123	8,643	70.3	30.7	12,456	733
Subtotal	***200***	***12549***	***62.7***	***44.6***	***22,400***	***560***
RIFFLE						
Low Gradient	16	1,272	79.5	4.5	1,790	597
High Gradient	150	8,503	56.7	30.2	14,959	453
Cascade	13	296	22.8	1.1	ND	ND
Bedrock Sheet	4	140	35.0	0.5	ND	ND
Subtotal	***179***	***10211***	***57.0***	***36.3***	***15,279***	***424***
TOTAL	***576***	***28141***		***100***		

-- Widths available for biological sample units only
ND = No Data
1/ LSP = Lateral Scour Pool
Sample Size for Total and Mean Areas are: 1 Backwater/Boldr, 1 Backwater/Log, 7 Plunge, 3 LSP/Log, 4 LSP/Bedrock, 1 Dammed, 8 Mid-Channel, 5 LSP/Boulder, 8 Step Pool, 23 Run, 17 Step Run, 3 Low Gradient, 33 High Gradient.

DEPTH AND VOLUME

POOL					
Residual Depth (ft) 1/		Maximum Depth (ft) 1/		Residual Volume (ft3) 1/	
Mean	Range	Mean	Range	Mean	Range
1.5	0.2-3.2	2.0	0.9-4.4	367	14-1039

1/ Sample Size: 35

COVER IN POOL HABITATS BY TYPE 1/

Instream Cover Type	Percent Cover
Total Cover	41
Undercut Banks	8
Small Woody Material	12
Large Woody Material	13
Terrestrial Vegetation	8
Aquatic Vegetation	0
White Water	23
Boulders	27
Bedrock Ledges	9

Average Cover Complexity = 2.0 (Scale of 1 to 3; low to high complexity) = Moderate
1/ Sample Size: 190

MEAN STREAM WIDTH, DEPTH, VOLUME, & SHADE/CANOPY CLOSURE

Habitat Type	# of Samp's	Lngth (ft)	Width (ft)	Depth (ft)	Vol (ft3)	Shade (%)
Pool	36	23	9.5	1.26	276	92
Run	38	54	10	0.73	395	89
Riffle	36	50	10	0.65	314	91

Shade Sample Size: 21 Pool, 39 Run, 29 Riffle

COARSE WOODY MATERIAL TOTALS

Diam-eter	LENGTH IN FEET						
	3.3-6.6	6.6-13	13.1-26.2	26.2-36.1	36.1-49.2	49.2-75.4	75.4-124.6 1/
4"	861	609	275	88	26	3	1
18"	237	198	184	79	30	14	2
24"	77	82	95	81	56	39	14

-- LWM Recruitment: 121 recruits per 1,666' sampled; approximately 6% of survey length.
1/ No LWM was found above length shown.

PERCENT SUBSTRATE COMPOSITION

Habitat Type	Sample No.	Bed-rock 1/	Boulder	Cobble	Gravel	Sand/ Fines
Pool	6		33	17	16	34
Run	9		26	23	31	20
Riffle	10		23	20	19	38

Substrate particle size breakdown: Boulder = >256mm, Cobble = 64-256mm, Gravel = 2-64mm, Fines = <2mm
1/ Bedrock included in Boulder count.

PERCENT EMBEDDEDNESS

Habitat Type	Sample No.	Mean (%)
All	18	27
Pool	18	27
Run 1/		
Riffle 1/		

1/ No Data

JUVENILE FISH DENSITY AND PROPORTION

Habitat Type	Sample No.	Sample Lngth	Density (fish/ft2) 0+ Steel-head	Density (fish/ft2) 1+ Steel-head	Proportion (%) 0+ Steel-head	Proportion (%) 1+ Steel-head
Pool	37	872	.00222	.00549	34.7	34.1
Run	38	2169	.00112	.00252	49.0	43.9
Riffle	36	1792	.00048	.00162	16.3	22.0

Habitat Type	Sample No.	Sample Lngth	Density (fish/ft2) 0+ Brook	Density (fish/ft2) 1+ Brook	Proportion (%) 0+ Brook	Proportion (%) 1+ Brook
Pool	37	872	.00000	.00144	0.0	36.7
Run	38	2169	.00047	.00028	34.5	20.0
Riffle	36	1792	.00114	.00078	65.5	43.3

SALAL CREEK

Surveyed 9/8-9/96

Location of Stream Mouth is T13N,R5E,S23 (confluence with Lightning Gulch)
Surveyed from mouth to 5,358'

PHYSICAL SUMMARY

HABITAT TYPE	# of Units	Total Lngth (ft)	Mean Lngth (ft)	% Total Lngth	Total Area (ft^2)	Mean Area (ft^2)
POOL						
Plunge	3	46	15.3	0.9	614	205
LSP/Log 1/	3	46	15.3	0.9	486	162
LSP/Root Wad	1	14	14.0	0.3	75	75
LSP/Bedrock	3	61	20.3	1.1	479	160
Dammed	5	78	15.6	1.5	1,045	209
LSP/Boldr	5	73	14.6	1.4	732	146
Subtotal	***20***	***318***	***16***	***6***	***3,429***	***171***
RUN						
Glides	1	34	34.0	0.6	295	295
Run	11	327	29.7	6.1	2,760	251
Step	20	1,550	77.5	28.9	13,344	667
Subtotal	***32***	***1,911***	***60***	***36***	***16,399***	***512***
RIFFLE						
Low Gradient	5	238	47.6	4.4	2,673	535
High Gradient	33	2,891	87.6	54.0	28,966	878
Subtotal	***38***	***3,129***	***82***	***58***	***31,639***	***833***
TOTAL	***90***	***5,358***		***100***		
-- Widths available for all units						
1/ LSP = Lateral Scour Pool						

DEPTH AND VOLUME

POOL					
Residual Depth (ft) 1/		**Maximum Depth (ft) 1/**		**Residual Volume (ft3) 1/**	
Mean	Range	Mean	Range	Mean	Range
1.7	0.9-3.2	2.2	1.4-3.6	327	54-1008
1/ Sample Size: 20					

COVER IN POOL HABITATS BY TYPE 1/

Instream Cover Type	Percent Cover
Total Cover	15
Undercut Banks	7
Small Woody Material	3
Large Woody Material	17
Terrestrial Vegetation	1
Aquatic Vegetation	0
White Water	21
Boulders	48
Bedrock Ledges	4
Average Cover Complexity = 1.2 (Scale of 1 to 3; low to high complexity) = Low	
1/ Sample Size: 20	

MEAN STREAM WIDTH, DEPTH, VOLUME, & SHADE/CANOPY CLOSURE

Habitat Type	# of Samp's	Lngth (ft)	Width (ft)	Depth (ft)	Vol (ft3)	Shade (%)
Pool	5	18	10	0.8	145	89
Run	5	39	8	0.5	149	85
Riffle	5	49	12	0.3	173	91
Shade Sample Size: 5 Pool, 4 Run, 5 Riffle						

COARSE WOODY MATERIAL TOTALS

Diameter	LENGTH IN FEET						
	3.3-6.6	**6.6-13**	**13.1-26.2**	**26.2-36.1**	**36.1-49.2**	**49.2-75.4**	**75.4-124.6 1/**
4"	190	69	41	10	2	1	0
18"	22	59	56	8	4	1	0
24"	13	24	46	32	20	9	0
-- LWM Recruitment: 23 recruits per 600' sampled; approximately 11% of survey length.							
1/ No LWM was found above length shown.							

PERCENT SUBSTRATE COMPOSITION

Habitat Type	Sample No.	Bed-rock	Boulder	Cobble	Gravel	Sand/ Fines
Pool	5	5	10	35	37	13
Run	5	2	12	33	42	11
Riffle	5	3	12	43	37	5
Substrate particle size breakdown: Boulder = >256mm, Cobble = 64-256mm, Gravel = 2-64mm, Fines = <2mm						

PERCENT EMBEDDEDNESS

Habitat Type	Sample No.	Mean (%)
All	5	46
Pool	5	46
Run 1/		
Riffle 1/		
1/ No Data		

JUVENILE FISH DENSITY AND PROPORTION

Habitat Type	Sample No.	Sample Lngth	Density (fish/ft2)		Proportion (%)	
			0+ Steel-head	**1+ Steel-head**	**0+ Steel-head**	**1+ Steel-head**
Pool	5	91	.006637	.007743	43	32
Run	5	195	.003296	.005933	36	41
Riffle	5	247	.001004	.002009	21	27

SANDY BAR CREEK

Surveyed 8/1-6/96

Location of Stream Mouth is T13N,R6E,S29 (confluence with Klamath River)
Surveyed from mouth to 8,781'

PHYSICAL SUMMARY

HABITAT TYPE	# of Units	Total Lngth (ft)	Mean Lngth (ft)	% Total Lngth	Total Area (ft^2)	Mean Area (ft^2)
POOL						
Plunge	12	274	22.8	3.1	3,711	309
LSP/Log 1/	3	153	51.0	1.7	1,933	644
LSP/Root Wad	1	25	25.0	0.3	317	317
LSP/Bedrock	5	170	34.0	1.9	1,830	366
Dammed	5	165	33.0	1.9	2,175	435
Mid-Channel	1	35	35.0	0.4	537	537
LSP/Boulder	4	117	29.3	1.3	1,175	294
Corner	2	75	37.5	0.9	730	365
Step	2	275	137.5	3.1	3,047	1,524
Subtotal	***35***	***1,289***	***36.8***	***14.7***	***15,455***	***442***
RUN						
Run	4	103	25.8	1.2	1,146	287
Step	31	3,130	101.0	35.6	34,016	1,097
Subtotal	***35***	***3,233***	***92.4***	***36.8***	***35,162***	***1,005***
RIFFLE						
Low Gradient	8	516	64.5	5.6	7,574	947
High Gradient	31	3,587	115.7	40.8	60,740	1,959
Cascade	6	148	24.7	1.7	1,215	203
Bedrock Sheet	1	8	8.0	0.1	168	168
Subtotal	***46***	***4,259***	***92.6***	***48.5***	***69,697***	***1,515***
TOTAL	***116***	***8781***		***100***		

-- Widths available for all units
1/ LSP = Lateral Scour Pool

DEPTH AND VOLUME

POOL					
Residual Depth (ft) 1/		Maximum Depth (ft) 1/		Residual Volume (ft3) 1/	
Mean	Range	Mean	Range	Mean	Range
2.0	0.6-5.8	2.6	1.4-6.0	908	69-3808

1/ Sample Size: 34

COVER IN POOL HABITATS BY TYPE 1/

Instream Cover Type	Percent Cover
Total Cover	54
Undercut Banks	16
Small Woody Material	12
Large Woody Material	11
Terrestrial Vegetation	11
Aquatic Vegetation	0
White Water	22
Boulders	25
Bedrock Ledges	3

Average Cover Complexity = 2.15 (Scale of 1 to 3; low to high complexity) = Moderate
1/ Sample Size: 35

MEAN STREAM WIDTH, DEPTH, VOLUME, & SHADE/CANOPY CLOSURE

Habitat Type	# of Samp's	Lngth (ft)	Width (ft)	Depth (ft)	Vol (ft3)	Shade (%)
Pool	9	31	11	1.2	411	96
Run	8	53	10	0.7	337	96
Riffle	5	58	11	0.5	360	97

COARSE WOODY MATERIAL TOTALS

Diameter	LENGTH IN FEET						
	3.3-6.6	6.6-13	13.1-26.2	26.2-36.1	36.1-49.2	49.2-75.4	75.4-124.6 1/
4"	267	135	47	30	23	6	1
18"	34	41	41	24	14	11	5
24"	3	5	17	11	4	12	4

-- LWM Recruitment: No data taken.
1/ No LWM was found above length shown.

PERCENT SUBSTRATE COMPOSITION

Habitat Type	Sample No.	Bed-rock	Boulder	Cobble	Gravel	Sand/ Fines
Pool	9	7	22	12	34	25
Run	8	4	27	16	33	19
Riffle	5	10	34	21	25	10

Substrate particle size breakdown: Boulder = >256mm, Cobble = 64-256mm, Gravel = 2-64mm, Fines = <2mm

PERCENT EMBEDDEDNESS

Habitat Type	Sample No.	Mean (%)
All	35	37
Pool	35	37
Run 1/		
Riffle 1/		

1/ No Data

JUVENILE FISH DENSITY AND PROPORTION

Habitat Type	Sample No.	Sample Lngth	Density (fish/ft2)		Proportion (%)	
			0+ Steel-head	1+ Steel-head	0+ Steel-head	1+ Steel-head
Pool	9	279	.001009	.004374	27.0	81
Run	8	423	.000981	.000490	36.5	13
Riffle	5	291	.001267	.000317	36.5	6

STANSHAW CREEK

Surveyed 8/12-14/96

Location of Stream Mouth is T13N,R6E,S33 (confluence with Klamath River)
Surveyed from mouth to 14,008'

PHYSICAL SUMMARY

HABITAT TYPE	# of Units	Total Lngth (ft)	Mean Lngth (ft)	% Total Lngth	Total Area (ft^2)	Mean Area (ft^2)
Dry Channel	1	375	3750	27	7,500	7,500
POOL						
2ndry Channel	1	56	560	04	1,680	1,680
Plunge	16	419	262	30	4,262	266
LSP/Log 1/	4	83	208	06	701	175
LSP/Bedrock	11	236	215	17	2,471	225
Dammed	1	30	300	02	340	340
LSP/Boulder	11	240	218	17	2,351	214
Pocket Water	4	237	593	17	3,833	958
Step	6	465	775	33	6,314	1,052
Subtotal	***54***	***1,766***	***32.7***	***12.6***	***21,952***	***407***
RUN						
Run	4	159	398	11	1,199	300
Step	65	5772	888	412	64,374	990
Subtotal	***81***	***6,311***	***77.9***	***45.1***	***83,836***	***1,035***
RIFFLE						
High Gradient	75	5811	775	415	74,857	998
Cascade	5	125	250	09	1,479	296
Subtotal	***69***	***5,931***	***86.0***	***42.3***	***65,573***	***950***
TOTAL	***204***	***14008***		***100***		
-- Widths available for all units						
1/ LSP = Lateral Scour Pool						

MEAN STREAM WIDTH, DEPTH, VOLUME, & SHADE/CANOPY CLOSURE

Habitat Type	# of Samp's	Lngth (ft)	Width (ft)	Depth (ft)	Vol (ft3)	Shade (%)
Pool	14	24	10	1.2	302	93
Run	14	57	10	0.7	391	94
Riffle	12	51	11	0.5	261	89

COARSE WOODY MATERIAL TOTALS

Diameter	LENGTH IN FEET						
	3.3-6.6	**6.6-13**	**13.1-26.2**	**26.2-36.1**	**36.1-49.2**	**49.2-75.4**	**75.4-124.6 1/**
4"	540	274	175	89	46	18	5
18"	75	88	97	59	40	24	5
24"	21	24	42	40	26	29	18
-- LWM Recruitment: No data taken.							
1/ No LWM was found above length shown.							

PERCENT SUBSTRATE COMPOSITION

Habitat Type	Sample No.	Bed-rock	Boulder	Cobble	Gravel	Sand/ Fines
Pool	14	9	28	12	27	24
Run	14	10	34	11	27	18
Riffle	12	8	38	11	25	18
Substrate particle size breakdown: Boulder = >256mm, Cobble = 64-256mm, Gravel = 2-64mm, Fines = <2mm						

DEPTH AND VOLUME

POOL					
Residual Depth (ft) 1/		**Maximum Depth (ft) 1/**		**Residual Volume (ft3) 1/**	
Mean	Range	Mean	Range	Mean	Range
1.8	1.0-3.8	2.3	1.5-4.0	701	73-6384
1/ Sample Size: 49					

PERCENT EMBEDDEDNESS

Habitat Type	Sample No.	Mean (%)
All	49	41
Pool	49	41
Run 1/		
Riffle 1/		
1/ No Data		

COVER IN POOL HABITATS BY TYPE 1/

Instream Cover Type	Percent Cover
Total Cover	46
Undercut Banks	5
Small Woody Material	10
Large Woody Material	14
Terrestrial Vegetation	10
Aquatic Vegetation	1
White Water	26
Boulders	26
Bedrock Ledges	8
Average Cover Complexity = 2.27 (Scale of 1 to 3; low to high complexity) = Moderate	
1/ Sample Size: 49	

JUVENILE FISH DENSITY AND PROPORTION

Habitat Type	Sample No.	Sample Lngth	Density (fish/ft2)		Proportion (%)	
			0+ Steel-head	**1+ Steel-head**	**0+ Steel-head**	**1+ Steel-head**
Pool	14	334	.004026	.003451	38	75
Run	14	798	.002130	.000473	49	25
Riffle	12	617	.000727	.00000	13	0

SWILLUP CREEK

Surveyed 7/8-15/96

Location of Stream Mouth is T14N,R6E,S16 (confluence with Klamath River)
Surveyed from mouth to 10,795'

PHYSICAL SUMMARY

HABITAT TYPE	# of Units	Total Lngth (ft)	Mean Lngth (ft)	% Total Lngth	Total Area (ft²)	Mean Area (ft²)
POOL						
Plunge	7	214	30.6	2.0	3,623	518
LSP/Root Wad 1/	1	20	20.0	0.2	247	247
LSP/Bedrock	10	411	41.1	3.8	6,137	614
Dammed	2	103	51.5	1.0	1,454	727
Mid-Channel	1	34	34.0	0.3	465	465
LSP/Boulder	9	296	32.9	2.7	4,828	536
Pocket Water	2	98	49.0	0.9	2,177	1,089
Step	3	236	78.7	2.2	3,440	1,147
Subtotal	***35***	***1,412***	***40.3***	***13.1***	***22,371***	***639***
RUN						
Run	6	229	38.2	2.1	4,275	713
Step	40	4,621	115.5	42.8	91,629	2,291
Subtotal	***46***	***4,850***	***105.4***	***44.9***	***95,904***	***2,085***
RIFFLE						
Low Gradient	1	175	175.0	1.6	3,850	3,850
High Gradient	48	4,343	90.5	40.2	114,864	2,393
Cascade	1	15	15.0	0.1	180	180
Subtotal	***50***	***4,533***	***90.7***	***42.0***	***118,894***	***2,378***
TOTAL	***131***	***10795***		***100***		
-- Widths available for all units						
1/ LSP = Lateral Scour Pool						

DEPTH AND VOLUME

POOL					
Residual Depth (ft) 1/		Maximum Depth (ft) 1/		Residual Volume (ft3) 1/	
Mean	Range	Mean	Range	Mean	Range
2.2	1.0-3.9	3.0	2.0-4.9	1487	292-4860
1/ Sample Size: 32					

COVER IN POOL HABITATS BY TYPE 1/

Instream Cover Type	Percent Cover
Total Cover	34
Undercut Banks	1
Small Woody Material	8
Large Woody Material	8
Terrestrial Vegetation	3
Aquatic Vegetation	2
White Water	34
Boulders	36
Bedrock Ledges	8
Average Cover Complexity = 2.03 (Scale of 1 to 3; low to high complexity) = Moderate	
1/ Sample Size: 32	

MEAN STREAM WIDTH, DEPTH, VOLUME, & SHADE/CANOPY CLOSURE

Habitat Type	# of Samp's	Lngth (ft)	Width (ft)	Depth (ft)	Vol (ft3)	Shade (%)
Pool	7	41	15	1.5	1060	86
Run	4	68	20	1.0	1396	88
Riffle	6	94	20	1.0	1111	86

COARSE WOODY MATERIAL TOTALS

Diameter	LENGTH IN FEET						
	3.3-6.6	6.6-13	13.1-26.2	26.2-36.1	36.1-49.2	49.2-75.4	75.4-124.6
4"	227	116	98	46	24	8	1
18"	22	37	36	16	6	4	1
24"	6	11	22	21	14	14	1
Diameter	LENGTH IN FEET						
	124.6-173.8	1/					
4"	1						
18"	0						
24"	0						
-- LWM Recruitment: No data taken.							
1/ No LWM was found above length shown.							

PERCENT SUBSTRATE COMPOSITION

Habitat Type	Sample No.	Bed-rock	Boulder	Cobble	Gravel	Sand/ Fines
Pool	7	4	38	15	27	16
Run	4	0	33	15	35	17
Riffle	6	1	46	18	26	9
Substrate particle size breakdown: Boulder = >256mm, Cobble = 64-256mm, Gravel = 2-64mm, Fines = <2mm						

PERCENT EMBEDDEDNESS

Habitat Type	Sample No.	Mean (%)
All	20	28
Pool	20	28
Run 1/		
Riffle 1/		
1/ No Data		

JUVENILE FISH DENSITY AND PROPORTION

Habitat Type	Sample No.	Sample Lngth	Density (fish/ft2)		Proportion (%)	
			0+ Steel-head	1+ Steel-head	0+ Steel-head	1+ Steel-head
Pool	7	282	.002163	.013569	18	52
Run	4	311	.007515	.008409	69	35
Riffle	6	340	.001192	.002532	13	13

T I CREEK

Surveyed 6/8-7/8/92

Location of Stream Mouth is T13N,R6E,S17 (confluence with Klamath River)
Surveyed from mouth to 16,196'

PHYSICAL SUMMARY

HABITAT TYPE	# of Units	Total Lngth (ft)	Mean Lngth (ft)	% Total Lngth	Total Area (ft²)	Mean Area (ft²)
POOL						
Plunge	47	1,053	22.4	6.5	16,683	355
LSP/Log 1/	11	282	25.6	1.7	5,425	493
LSP/Root Wad	1	24	24.0	0.1	264	264
LSP/Bedrock	22	531	25.5	3.5	8,203	373
Dammed	7	133	19.0	0.8	2,202	315
Mid-Channel	7	149	21.3	0.9	1,863	266
LSP/Boulder	14	374	26.7	2.3	5,789	414
Pocket Water	1	26	26.0	0.2	338	338
Step	8	463	57.9	2.9	6,067	758
Subtotal	***118***	***3,065***	***26***	***19***	***46,834***	***397***
RUN						
Trench/Chute	2	30	15.0	0.2	140	70
Run	31	985	31.8	6.1	15,342	495
Step	68	4,775	70.2	29.5	68,809	1,012
Subtotal	***101***	***5,790***	***57***	***36***	***84,291***	***835***
RIFFLE						
Low Gradient	6	382	63.7	2.4	6,192	1,032
LSP/Boulder	112	5,744	51.3	35.5	92,976	830
Cascade	14	1,063	75.9	6.6	18,372	1,312
Bedrock Sheet	4	152	38.0	0.9	1,027	257
Subtotal	***136***	***7,341***	***54***	***45***	***11,8567***	***872***
TOTAL	***355***	***16196***		***100***		

-- Widths available for all units
1/ LSP = Lateral Scour Pool

MEAN STREAM WIDTH, DEPTH, VOLUME, & SHADE/CANOPY CLOSURE

Habitat Type	# of Samp's	Lngth (ft)	Width (ft)	Depth (ft)	Vol (ft3)	Shade (%)
Pool	118	26	15	1.5	590	69
Run	101	57	14	0.9	733	70
Riffle	136	54	15	0.9	828	66

Shade Sample Size: 30 Pool, 24 Run, 24 Riffle

COARSE WOODY MATERIAL TOTALS 1/

Diameter	LENGTH IN FEET 3.3-6.6	6.6-13	13.1-26.2	26.2-36.1	36.1-49.2	49.2-75.4	75.4-124.6 1/
4"							
18"							
24"						85	

-- LWM Recruitment: 43 recruits per 2,921' sampled; approximately 18% of survey length.
1/ Only key LWM recorded; >=50' x 24"
2/ No LWM was found above length shown.

DEPTH AND VOLUME

POOL					
Residual Depth (ft) 1/		**Maximum Depth (ft) 2/**		**Residual Volume (ft3) 1/**	
Mean	Range	Mean	Range	Mean	Range
1.9	0.4-5.4	2.6	0.7-5.8	776	25-3499

1/ Sample Size: 113
2/ Sample Size: 118

PERCENT SUBSTRATE COMPOSITION

Habitat Type	Sample No.	Bed-rock	Boulder	Cobble	Gravel	Sand/Fines
Pool	30	3	30	19	27	21
Run	24	2	35	19	26	18
Riffle	24	4	46	20	18	12

Substrate particle size breakdown: Boulder = >256mm, Cobble = 64-256mm, Gravel = 2-64mm, Fines = <2mm

PERCENT EMBEDDEDNESS

Habitat Type	Sample No.	Mean (%)
All	55	34
Pool	29	34
Run	10	31
Riffle	16	36

COVER IN POOL HABITATS BY TYPE

Instream Cover Type	% Pool 1/	% Run 1/	% Riffle 1/
Total Cover	34	28	43
Undercut Banks	3	2	1
Small Woody Material	10	13	14
Large Woody Material	10	7	11
Terrestrial Vegetation	5	7	5
Aquatic Vegetation	0	0	0
White Water	27	25	34
Boulders	31	40	32
Bedrock Ledges	14	6	3

Average Cover Complexity is on a Scale of 1 to 3; low to high complexity: 2.0 Pool, 2.0 Run, 2.0 Riffle
1/ Sample Size: 118 Pool, 101 Run, 136 Riffle

JUVENILE FISH DENSITY AND PROPORTION

Habitat Type	Sample No.	Sample Lngth	Density (fish/ft2) 0+ Steel-head	Density (fish/ft2) 1+ Steel-head	Proportion (%) 0+ Steel-head	Proportion (%) 1+ Steel-head
Pool	30	716	.025863	.010755	36	55
Run	25	1238	.020280	.003901	45	31
Riffle	22	810	.012487	.002479	19	14

LICK CREEK

Surveyed 8/23/94

Location of Stream Mouth is T14N,R6E,S25 (confluence with Ukonom Creek)
Surveyed from mouth to 1,548'

PHYSICAL SUMMARY

HABITAT TYPE	# of Units	Total Lngth (ft)	Mean Lngth (ft)	% Total Lngth	Total Area (ft^2)	Mean Area (ft^2)
POOL						
Backwater/Log	1	10	10	0.6	ND	ND
Plunge	5	61	12.2	3.9	183	92
LSP/Bedrock 1/	2	20	10	1.3	ND	ND
Step	1	45	45	2.9	ND	ND
Subtotal	***9***	***136***	***15.1***	***8.8***	***183***	***91.5***
RUN						
Run	2	51	25.5	3.3	ND	ND
Step	8	671	83.8	43.3	1,332	666
Subtotal	***10***	***722***	***72.2***	***46.6***	***1332***	***666***
RIFFLE						
High Gradient	11	690	62.8	44.6	923	308
Subtotal	***11***	***690***	***62.8***	***44.6***	***923***	***308***
TOTAL	***30***	***1548***		***100***		

-- Widths available for biological sample units only
1/ LSP = Lateral Scour Pool
Sample Size for Total and Mean Areas are: 2 Plunge, 2 Step Run, 3 High Gradient.

DEPTH AND VOLUME

POOL					
Residual Depth (ft) 1/		**Maximum Depth (ft) 1/**		**Residual Volume (ft3) 2/**	
Mean	Range	Mean	Range	Mean	Range
1.5	1.0-2.4	1.8	1.2-2.6	113	91-135

1/ Sample Size: 9
2/ Sample Size: 2

COVER IN POOL HABITATS BY TYPE 1/

Instream Cover Type	Percent Cover
Total Cover	32
Undercut Banks	3
Small Woody Material	14
Large Woody Material	33
Terrestrial Vegetation	12
Aquatic Vegetation	0
White Water	28
Boulders	7
Bedrock Ledges	3

Average Cover Complexity = 1.0 (Scale of 1 to 3; low to high complexity) = Low
1/ Sample Size: 9

MEAN STREAM WIDTH, DEPTH, VOLUME, & SHADE/CANOPY CLOSURE

Habitat Type	# of Samp's	Lngth (ft)	Width (ft)	Depth (ft)	Vol (ft3)	Shade (%)
Pool	2	11.5	7.5	0.70	60	91
Run	2	100.5	6.5	0.3	200	90
Riffle	3	60	4.6	0.30	81	86

Shade Sample Size: 1 Pool, 7 Run, 2 Riffle

COARSE WOODY MATERIAL TOTALS

Diameter	LENGTH IN FEET						
	3.3-6.6	**6.6-13**	**13.1-26.2**	**26.2-36.1**	**36.1-49.2**	**49.2-75.4**	**75.4-124.6 1/**
4"	19	31	13	6	5	2	0
18"	0	10	5	4	0	0	0
24"	4	10	6	6	1	0	1

-- LWM Recruitment: 24 recruits per 211' sampled; approximately 13.6% of survey length.
1/ No LWM was found above length shown.

PERCENT SUBSTRATE COMPOSITION

Habitat Type	Sample No.	Bedrock 1/	Boulder	Cobble	Gravel	Sand/ Fines
Pool	1		50	28	16	6
Run	1		28	31	35	5
Riffle	1		68	29	3	0

Substrate particle size breakdown: Boulder = >256mm, Cobble = 64-256mm, Gravel = 2-64mm, Fines = <2mm

PERCENT EMBEDDEDNESS

Habitat Type	Sample No.	Mean (%)
All	1	60
Pool	1	60
Run 1/		
Riffle 1/		

1/ No Data

JUVENILE FISH DENSITY AND PROPORTION

Habitat Type	Sample No.	Sample Lngth	Density (fish/ft2)		Proportion (%)	
			0+ Steelhead	1+ Steelhead	0+ Steelhead	1+ Steelhead
Pool	2	23	.00000	.01093	0	44
Run	2	201	.00375	.00225	29	33
Riffle	3	182	.00217	.00433	71	22

UPPER UKONOM CREEK

Surveyed 8/24-25/94

Location of Stream Mouth is T14N,R6E,S10 (confluence with Klamath River)
Surveyed from confluence with Flems to 8,985'

PHYSICAL SUMMARY

HABITAT TYPE	# of Units	Total Lngth (ft)	Mean Lngth (ft)	% Total Lngth	Total Area (ft^2)	Mean Area (ft^2)
POOL						
Plunge	30	487	16.2	5.4	779	130
Mid-Channel	1	38	38.0	0.4	570	570
Step	10	347	34.7	3.9	672	336
Subtotal	***41***	***872***	***13***	***10***	***2,021***	***225***
RUN						
Run	6	119	19.8	1.3	831	208
Step	25	1,493	59.7	16.6	1,448	483
Subtotal	***31***	***1,612***	***52***	***18***	***2,279***	***326***
RIFFLE						
High Gradient	19	1,306	68.7	14.5	2,605	326
Cascade	58	4,550	78.4	50.6	ND	ND
Bedrock Sheet	9	645	71.7	7.2	ND	ND
Subtotal	***86***	***6,501***	***76***	***72***	***2,605***	***326***
TOTAL	***158***	***8,985***		***100***		

-- Widths available for biological sample units only
ND = No Data
1/ LSP = Lateral Scour Pool
Sample Size for Total and Mean Areas are: 6 Plunge, 1 Mid-Channel, 2 Step Pool, 4 Run, 3 Step Run, 8 High Gradient.

DEPTH AND VOLUME

POOL					
Residual Depth (ft) 1/		**Maximum Depth (ft) 1/**		**Residual Volume (ft3) 2/**	
Mean	Range	Mean	Range	Mean	Range
1.5	0.3-3.6	2.0	0.9-4.0	459	39-2052

1/ Sample Size: 39
2/ Sample Size: 9

COVER IN POOL HABITATS BY TYPE 1/

Instream Cover Type	Percent Cover
Total Cover	49
Undercut Banks	0
Small Woody Material	11
Large Woody Material	9
Terrestrial Vegetation	10
Aquatic Vegetation	0
White Water	42
Boulders	19
Bedrock Ledges	9

Average Cover Complexity = 2.0 (Scale of 1 to 3; low to high complexity) = Moderate
1/ Sample Size: 39

MEAN STREAM WIDTH, DEPTH, VOLUME, & SHADE/CANOPY CLOSURE

Habitat Type	# of Samp's	Lngth (ft)	Width (ft)	Depth (ft)	Vol (ft3)	Shade (%)
Pool	8	21	10	0.9	271	67
Run	7	37	9	0.5	161	78
Riffle	8	44	7	0.3	110	69

Shade Sample Size: 1 Pool, 23 Run, 6 Riffle

COARSE WOODY MATERIAL TOTALS

Diameter	LENGTH IN FEET						
	3.3-6.6	**6.6-13**	**13.1-26.2**	**26.2-36.1**	**36.1-49.2**	**49.2-75.4**	**75.4-124.6 1/**
4"	67	63	64	75	47	11	2
18"	43	42	50	54	34	13	12
24"	42	25	18	17	7	6	1

-- LWM Recruitment: 67 recruits per 1,082' sampled; approximately 12% of survey length.
1/ No LWM was found above length shown.

PERCENT SUBSTRATE COMPOSITION

Habitat Type	Sample No.	Bedrock 1/	Boulder	Cobble	Gravel	Sand/ Fines
Pool 2/						
Run	2		67	19	11	3
Riffle	7		58	20	16	6

Substrate particle size breakdown: Boulder = >256mm, Cobble = 64-256mm, Gravel = 2-64mm, Fines = <2mm
1/ Bedrock included in Boulder count.
2/ No Data

PERCENT EMBEDDEDNESS

Habitat Type	Sample No.	Mean (%)
All	16	26
Pool	2	18
Run	5	29
Riffle	9	27

JUVENILE FISH DENSITY AND PROPORTION

Habitat Type	Sample No.	Sample Lngth	Density (fish/ft2)		Proportion (%)	
			0+ Steelhead	**1+ Steelhead**	**0+ Steelhead**	**1+ Steelhead**
Pool	9	184	.005938	.011875	46	68
Run	7	262	.00000	.000878	0	6
Riffle	8	351	.005374	.003455	54	26
Habitat Type	**Sample No.**	**Sample Lngth**	**Density (fish/ft2)**		**Proportion (%)**	
			0+ Brook	**1+ Brook**	**0+ Brook**	**1+ Brook**
Pool	9	184	.00000	.00000	0	0
Run	7	262	.004827	.002194	92	100
Riffle	8	351	.000384	.00000	8	0

JUSTIFICATION OF MATRIX OF FACTORS AND INDICATORS

MID-KLAMATH and LOWER SALMON RIVER TRIBUTARIES

Bark Shanty Gulch and Lightning/Beans Subwatershed

FACTORS	INDICATORS	JUSTIFICATION	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
		BARK SHANTY GULCH			
WATER QUALITY	Temperature	The average of 10 samples (5 noon, 5pm) is 56^0F	X		
	Turbidity	No Data	No Data		
	Chemical/Nutrient Contamination	No Data	No Data		
HABITAT ACCESS	Physical Barriers	There are no man-made barriers present.	X		
HABITAT ELEMENTS	Substrate	From 19 sets of grid tosses (12 pools and 17 low gradient riffles), 3.4% fines; 20 pebble counts (12 pools and 8 low gradient riffles), 9% fines; 20 embeddedness samples (12 pools and 8 low gradient riffles), 26% embedded.		X	
	Large Woody Material	Key large wood, 37 pieces/14,889' or 13 pieces/ mile; key large wood recruitment, 23 recruits/ 2,100' or 58 recruits/mile			X
	Pool Frequency	One pool every 9.3 bankfull widths; 27/47 pools (approximately 57%) have a maximum depth >=36"			X
	Off-Channel Habitat	Not applicable to this channel type.	N/A		
	Refugia	Composite of stream factors		X	
CHANNEL CONDITIONS AND DYNAMICS	Width/Depth Ratio	Designated Rosgen channel classes w/associated bankful width/depth ratios: B Type (36, 17, 20.4, 17, and 23.2) and A Type (10.86 and 9.5).	X		
	Streambank Condition	Slide length paralles to stream is 1.496' (out of 14,889' surveyed), approximately 10% unstable.		X	
	Floodplain Connectivity	Not applicable to this channel type.	N/A		
		LIGHTNING/BEANS SUBWATERSHED			
FLOW/ HYDROLOGY	Change in Peak/ Base Flow	No Data		No Data	
	Increase in Drainage Network	Ratio of miles of insloped road in subwatershed to miles of stream in watershed is 6.8/27.2 or 24.8%			X
WATERSHED CONDITIONS	Road Density and Location	There are 32.6 miles of road in 11 square miles of subwatershed, yielding a density of 2.9 miles of road/square mile of subwatershed.		X	
	Disturbance History	ECA is 19.9% based on the ERA value assigned to this subwatershed. There are 2,852 acres of late leral old-growth (LSOG) in the @ acre subwatershed; 40.4% is LSOG			X
	Riparian Reserves	Composite of subwatershed conditions, especially disturbances		X	

JUSTIFICATION OF MATRIX OF FACTORS AND INDICATORS

MID-KLAMATH and LOWER SALMON RIVER TRIBUTARIES

Beans Gulch and Lightning/Beans Subwatershed

FACTORS	INDICATORS	JUSTIFICATION	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
		BEANS GULCH			
WATER QUALITY	Temperature	The maximum temperature between 9/3 and 9/7/96 was 54.5⁰F	X		
	Turbidity	No Data	No Data		
	Chemical/Nutrient Contamination	No Data	No Data		
HABITAT ACCESS	Physical Barriers	There are no man-made barriers present.	X		
HABITAT ELEMENTS	Substrate	From 18 sets of grid tosses (11 pools and 7 low gradient riffles), 6.1% fines; 18 pebble counts (11 pools and 7 low gradient riffles), 11% fines; 20 embeddedness samples (11 pools and 7 low gradient riffles), 29% embedded		X	
	Large Woody Material	Key large wood, 39 pieces/11,382' or 18 pieces/ mile; key large wood recruitment, 97 recruits/ 1,200' or 427 recruits/mile		X	
	Pool Frequency	One pool every 9.3 bankfull widths; 20/41 pools (approximately 49%) have a maximum depth >=36"			X
	Off-Channel Habitat	Not applicable to this channel type.	N/A		
	Refugia	Composite of stream factors		X	
CHANNEL CONDITIONS AND DYNAMICS	Width/Depth Ratio	Four out of five bankfull widths/depths have a ratio >12 for all B type Rosgen channel designations		X	
	Streambank Condition	No Data	No Data		
	Floodplain Connectivity	Not applicable to this channel type.	N/A		
		LIGHTNING/BEANS SUBWATERSHED			
FLOW/ HYDROLOGY	Change in Peak/ Base Flow	No Data		No Data	
	Increase in Drainage Network	Ratio of miles of insloped road in the subwatershed to miles of stream in the watershed is 6.75/27.16 or 25%			X
WATERSHED CONDITIONS	Road Density and Location	There are 33 miles of road in 11 square miles of subwatershed, yielding a density of 3 miles of road/square mile of subwatershed.		X	
	Disturbance History	ECA is 19.9% based on the ERA value assigned to this subwatershed. There are 2,852 acres of late leral old-growth (LSOG) in the @ acre subwatershed; 40.4% is LSOG			X
	Riparian Reserves	Composite of subwatershed conditions, especially disturbances	X		

JUSTIFICATION OF MATRIX OF FACTORS AND INDICATORS
MID-KLAMATH and LOWER SALMON RIVER TRIBUTARIES

Coon Creek and Coon Creek Subwatershed

FACTORS	INDICATORS	JUSTIFICATION	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
		COON CREEK			
WATER QUALITY	Temperature	The maximum temperature recorded between 7/15 and 7/18/96 was 62.6^{0}F at 0805	X		
	Turbidity	No Data	No Data		
	Chemical/Nutrient Contamination	No Data	No Data		
HABITAT ACCESS	Physical Barriers	There is a fish ladder.	X		
HABITAT ELEMENTS	Substrate	From 9 sets of grid tosses (8 pools and 1 low gradient riffles), 18% fines; 10 pebble counts (8 pools and 2 low gradient riffles), 8% fines; 31 embeddedness samples (31 pools), 30% embedded		X	
	Large Woody Material	Key large wood, 22 pieces/10,370' or 11 pieces/ mile; key large wood recruitment not counted	Not Enough Data		
	Pool Frequency	One pool every 12.4 bankfull widths; 4/31 pools (approximately 13%) have maximum depth >=36"			X
	Off-Channel Habitat	Not applicable to this channel type.	N/A		
	Refugia	Composite of stream factors		X	
CHANNEL CONDITIONS AND DYNAMICS	Width/Depth Ratio	Here arre the designated Rosgen channel classes w/associated bankful width /depth ratios: B4, 21.5; A2, 25.7	No Data		
	Streambank Condition	No Data	No Data		
	Floodplain Connectivity	Not applicable to this channel type.	N/A		
		COON CREEK SUBWATERSHED			
FLOW/ HYDROLOGY	Change in Peak/ Base Flow	No Data	No Data		
	Increase in Drainage Network	Ratio of miles of insloped road i the subwatershed to miles of stream in the watershed is 2.9/18.6 or 15%		X	
WATERSHED CONDITIONS	Road Density and Location	There are 11.4 miles of road in 5.7 square miles of subwatershed, yielding a density of 2.0 miles or road/square mile of subwatershed.		X	
	Disturbance History	ECA is 17.3% based on the ERA value assigned to this subwatershed. There are 1,645 acres of late seral old-growth (LSOG) in the @ acre subwatershed; 45.5% is LSOG.		X	
	Riparian Reserves	Composite of subwatershed conditions, especially disturbances		X	

JUSTIFICATION OF MATRIX OF FACTORS AND INDICATORS

MID-KLAMATH and LOWER SALMON RIVER TRIBUTARIES

Flems Creek and Upper Ukonom Creek Subwatershed

FACTORS	INDICATORS	JUSTIFICATION	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
		FLEMS CREEK			
WATER QUALITY	Temperature	Maximum temperature during 7/18 and 7/19/94 is 61°F at 0745	X		
	Turbidity	No Data	No Data		
	Chemical/Nutrient Contamination	No Data	No Data		
HABITAT ACCESS	Physical Barriers	There are no man-made barriers present.	X		
HABITAT ELEMENTS	Substrate	From 6 sets of grid tosses (6 pools), 4% fines; 3 pebble counts taken in spawning habitat (3 pools), 3% fines; no embeddedness data	Not Enough Data		
	Large Woody Material	Key large wood, 12 pieces/11,152' or 6 pieces/ mile; key large wood recruitment, 48 recruits/ 1,027' or 247 recruits/mile		X	
	Pool Frequency	One pool every 10.7 bankfull widths; 6/55 pools (approximately 11%) have maximum depth >=36"			X
	Off-Channel Habitat	Not applicable to this channel type.	N/A		
	Refugia	No Data	No Data		
CHANNEL CONDITIONS AND DYNAMICS	Width/Depth Ratio	No Data	No Data		
	Streambank Condition	No Data	No Data		
	Floodplain Connectivity	Not applicable to this channel type.	N/A		
		UPPER UKONOM CREEK SUBWATERSHED			
FLOW/ HYDROLOGY	Change in Peak/ Base Flow	No Data	No Data		
	Increase in Drainage Network	Ratio of miles of insloped road in tn the subwatershed to miles of stream in the watershed is 0/25.7 or 0%.	X		
WATERSHED CONDITIONS	Road Density and Location	There are no roads.	X		
	Disturbance History	ECA is 25.6% based on the ERA value assigned to this subwatershed. There are 2,065 acres of late seral old-growth (LSOG) in the @ acre subwatershed; 36% is LSOG.			X
	Riparian Reserves	Composite of subwatershed conditions, especially disturbances	X		

JUSTIFICATION OF MATRIX OF FACTORS AND INDICATORS
MID-KLAMATH and LOWER SALMON RIVER TRIBUTARIES

Halverson Creek and Reynolds/Natuket Subwatershed

FACTORS	INDICATORS	JUSTIFICATION	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
		HALVERSON CREEK			
WATER QUALITY	**Temperature**	The maximum temperature recorded on 7/25/96 was 62.6°F at 1130	X		
	Turbidity	Low at most flows.	X		
	Chemical/Nutrient Contamination	No industry or agriculture in watershed.	X		
HABITAT ACCESS	**Physical Barriers**	There are no man-made barriers present.	X		
HABITAT ELEMENTS	**Substrate**	From 3 sets of grid tosses (3 pools), 25% fines; 3 pebble counts (3 pools), 15% fines; 12 embeddedness samples (12 pools), 27% embedded		X	
	Large Woody Material	Key large wood, 5 pieces/2,965' or 9 pieces/ mile; key large wood recruitment, 0 recruits/ 300' or 0 recruits/mile	Not Enough Data		
	Pool Frequency	One pool every 12.4 bankfull widths; 1/12 pools (approximately 8%) have maximum depth >=36"		X	
	Off-Channel Habitat	Not applicable to this channel type.	N/A		
	Refugia	Composite of stream factors		X	
CHANNEL CONDITIONS AND DYNAMICS	**Width/Depth Ratio**	Designated Rosgen channel class w/ associated bankfull width/depth ratio: A2, 10.6	No Data		
	Streambank Condition	No Data		No Data	
	Floodplain Connectivity	Not applicable to this channel type.	N/A		
		REYNOLDS / NATUKET SUBWATERSHED			
FLOW/ HYDROLOGY	**Change in Peak/ Base Flow**	No Data		No Data	
	Increase in Drainage Network	Ratio of miles of insloped road in the subwatershed to miles of stream in the watershed is 24.2/65/2 or 37.1%			X
WATERSHED CONDITIONS	**Road Density and Location**	There are 60.6 miles of road in 21.6 square miles of subwatershed, yielding a density of 2.8 miles of road/square mile of subwatershed		X	
	Disturbance History	ECA is 22.4% based on the ERA value assigned to this subwatershed. There are 2,649 acres of late seral old-growth (LSOG) in the @ acre subwatershed; 19.2% is LSOG.			X
	Riparian Reserves	Composite of subwatershed conditions, especially disturbances		X	

JUSTIFICATION OF MATRIX OF FACTORS AND INDICATORS

MID-KLAMATH and LOWER SALMON RIVER TRIBUTARIES

Irving Creek and Irving Creek Subwatershed

FACTORS	INDICATORS	JUSTIFICATION	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
		IRVING CREEK			
WATER QUALITY	**Temperature**	The maximum temperature recorded on 7/31/92 was 61^0F at 1425	X		
	Turbidity	Clears quickly after storms.	X		
	Chemical/Nutrient Contamination	No Data	No Data		
HABITAT ACCESS	**Physical Barriers**	There are no man-made barriers present.	X		
HABITAT ELEMENTS	**Substrate**	18 pebble counts in spawning habitat (15 pools and 3 low gradient riffles), 37% fines; 25 embeddedness samples (14 pools, 3 runs, and 8 low gradient riffles), 41% embedded			X
	Large Woody Material	Key large wood, 105 pieces/9,499' or 58 pieces/ mile; key large wood recruitment, 44 recruits/ 2031' or 114 recruits/mile		X	
	Pool Frequency	Bankfull widths not taken, so can't calculate # of pools necessary to fulfill NMFS requirement. 12/47 pools (approximately 26%) have a maximum depth >=36"; 6.7 pools (w/ maximum depths >=36")/mile and 26.1 pools/mile			X
	Off-Channel Habitat	Not applicable to this channel type.	N/A		
	Refugia	Composite of stream factors		X	
CHANNEL CONDITIONS AND DYNAMICS	**Width/Depth Ratio**	No Data	No Data		
	Streambank Condition	No Data		No Data	
	Floodplain Connectivity	Not applicable to this channel type.	N/A		
		IRVING CREEK SUBWATERSHED			
FLOW/ HYDROLOGY	**Change in Peak/ Base Flow**	No Data		No Data	
	Increase in Drainage Network	Ratio of miles of insloped road in the subwatershed to miles of stream in the watershed is 7/29.1 or 23.9%			X
WATERSHED CONDITIONS	**Road Density and Location**	There are 28.1 miles of road in 8.5 square miles of subwatershed, yielding a density of 3.3 miles of road/square mile of subwatershed			X
	Disturbance History	ECA is 21.9% based on the ERA value assigned to this subwatershed. There are 2,138 acres of late seral old-growth (LSOG) in the 5,423 acre subwatershed; 39.4% is LSOG.			X
	Riparian Reserves	Composite of subwatershed conditions, especially disturbances		X	

JUSTIFICATION OF MATRIX OF FACTORS AND INDICATORS

MID-KLAMATH and LOWER SALMON RIVER TRIBUTARIES

Lightning Gulch and Upper Rock Creek Subwatershed

FACTORS	INDICATORS	JUSTIFICATION	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
		LIGHTNING GULCH			
WATER QUALITY	Temperature	The average of 6 samples (2 from am, 2 from noon, 2 from pm) on 9/8 and 9/9/96 is 54°F	X		
	Turbidity	No Data	No Data		
	Chemical/Nutrient Contamination	No Data	No Data		
HABITAT ACCESS	Physical Barriers	There are no man-made barriers present.	X		
HABITAT ELEMENTS	Substrate	From 1 grid toss in 1 pool; 5% fines; 1 sample for substrate composition in 1 pool; 10% fines, 1 embeddedness sample from 1 pool; 40% embeddedness	Not Enough Data		
	Large Woody Material	Key large wood, 7 pieces/7,372' or 5 pieces/mile; key large wood recruitment, 12 recruits/600' or 106 recruits/mile			X
	Pool Frequency	One pool every 49 bankfull widths; 0/5 pools (approximately 0%) have a maximum depth >=36"			X
	Off-Channel Habitat	Not applicable to this channel type.	N/A		
	Refugia	Composite of stream factors		X	
CHANNEL CONDITIONS AND DYNAMICS	Width/Depth Ratio	Two bankfull width/depth ratios calculated. They were 9.7 and 9.9 for A type Rosgen channel classes.	X		
	Streambank Condition	One 200' long (parrallel to stream) slide was observed in the 7,323' surveyed in 1996; approxi-mately 3% bank instability	X		
	Floodplain Connectivity	Not applicable to this channel type.	N/A		
		UPPER ROCK CREEK SUBWATERSHED			
FLOW/ HYDROLOGY	Change in Peak/ Base Flow	No Data		No Data	
	Increase in Drainage Network	Ratio of miles of insloped road in the subwatershed to miles of stream in the watershed is 7.6/48.5 or 15.6%		X	
WATERSHED CONDITIONS	Road Density and Location	There are 42 miles of road in 18 square miles of subwatershed, yielding a density of 2.3 miles of road/square mile of subwatershed		X	
	Disturbance History	ECA is 19.9% based on the ERA value assigned to this subwatershed. There are 4,407 acres of late seral old-growth (LSOG) in the 11,499 acre subwatershed; 38.3% is LSOG.			X
	Riparian Reserves	Composite of subwatershed conditions, especially disturbances		X	

JUSTIFICATION OF MATRIX OF FACTORS AND INDICATORS

MID-KLAMATH and LOWER SALMON RIVER TRIBUTARIES

Lower Ukonom Creek and Panther/Lick, McCash/Cub, and Upper Ukonom Subwatersheds

FACTORS	INDICATORS	JUSTIFICATION	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
LOWER UKONOM CREEK					
WATER QUALITY	Temperature	The maximum during a year (July '90-June '91) long recording, using a Ryan Tempmentor was 66^{0}F	X		
	Turbidity	No Data	No Data		
	Chemical/Nutrient Contamination	No Data	No Data		
HABITAT ACCESS	Physical Barriers	There are no man-made barriers present. There is a natural barrier (falls) to anadromous fish one-half mile from the mouth.	X		
HABITAT ELEMENTS	Substrate	No grid toss data; 43 pebble counts (36 pools and 7 low gradient riffles), 27% fines; 117 embeddedness samples (35 pools, 37 runs, and 45 low gradient riffles), 14% embedded		X	
	Large Woody Material	Key large wood, 152 pieces/47,132' or 17 pieces/ mile; key large wood recruitment, 191 recruits/ 9,088' or 111 recruits/mile			X
	Pool Frequency	Bankfull widths not taken, so can't calculate # of pools necessary to fulfill NMFS requirement. 155/162 pools (approximately 96%) have a maximum depth >=36"	Not Enough Data		
	Off-Channel Habitat	Not applicable to this channel type.	N/A		
	Refugia	Composite of stream factors		X	
CHANNEL CONDITIONS AND DYNAMICS	Width/Depth Ratio	No Data	No Data		
	Streambank Condition	No Data	No Data		
	Floodplain Connectivity	Not applicable to this channel type.	N/A		
PANTHER/LICK, McCASH/CUB, AND UPPER UKONOM SUBWATERSHEDS					
FLOW/ HYDROLOGY	Change in Peak/ Base Flow	No Data	No Data		
	Increase in Drainage Network	Ratio of miles of insloped road in the subwatershed to miles of stream in the watershed is 2.2/101.6 or 2.2%	X		
WATERSHED CONDITIONS	Road Density and Location	There are 30.1 miles of road in 32.7 square miles of subwatershed, yielding a density of .9 miles of road/square mile of subwatershed	X		
	Disturbance History	ECA is 26.2% based on the ERA value assigned to this subwatershed. There are 7,716 acres of late seral old-growth (LSOG) in the 20,953 acre subwatershed; 36.8% is LSOG.			X
	Riparian Reserves	Composite of subwatershed conditions, especially disturbances	X		

JUSTIFICATION OF MATRIX OF FACTORS AND INDICATORS

MID-KLAMATH and LOWER SALMON RIVER TRIBUTARIES

McCash Creek and McCash/Cub Subwatershed

FACTORS	INDICATORS	JUSTIFICATION	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
		McCASH CREEK			
WATER QUALITY	**Temperature**	The maximum temperature between 7/13 and 7/16/94 was 58^{0}F on 7/13 at 1530	X		
	Turbidity	No Data	No Data		
	Chemical/Nutrient Contamination	No Data	No Data		
HABITAT ACCESS	**Physical Barriers**	There are no man-made barriers present.	X		
HABITAT ELEMENTS	**Substrate**	From 9 sets of grid tosses (9 pools), 18% fines; 11 pebble counts (9 pools and 2 glides), 15% fines; 22 embeddedness samples (10 pools, 6 runs, and 6 low gradient riffles), 31% embedded		X	
	Large Woody Material	Key large wood, 35 pieces/21,702' or 9 pieces/ mile; key large wood recruitment, 18 recruits/ 277' or 343 recruits/mile		X	
	Pool Frequency	One pool every 8.9 bankfull widths; 52/111 pools (approximately 49%) have maximum depth >=36"		X	
	Off-Channel Habitat	Not applicable to this channel type.	N/A		
	Refugia	Composite of stream factors		X	
CHANNEL CONDITIONS AND DYNAMICS	**Width/Depth Ratio**	No Data	No Data		
	Streambank Condition	1994 field crew noted '87 fire and fire sallvage logging. Comments indicated banks were unstable and consisted of decomposed granite as the main soil type. Heavy grazing was noted in Hell's meadows. Cross-section check list indicates bank instability at the cross-section.	No Data		
	Floodplain Connectivity	Not applicable to this channel type.	N/A		
		McCASH/CUB SUBWATERSHED			
FLOW/ HYDROLOGY	**Change in Peak/ Base Flow**	No Data	X		
	Increase in Drainage Network	Ratio of miles of insloped road in the subwatershed to miles of stream in the watershed is 0.46/41.47 or 1.11%	X		
WATERSHED CONDITIONS	**Road Density and Location**	There are 18.6 miles of road in 13.1 square miles of subwatershed, yielding a density of 1.4 miles of road/square mile of subwatershed	X		
	Disturbance History	ECA is 24.1% based on the ERA value assigned to this subwatershed. There are 3,675 acres of late seral old-growth (LSOG) in the 8,395 acre subwatershed; 43.8% is LSOG.			X
	Riparian Reserves	Composite of subwatershed conditions, especially disturbances	X		

JUSTIFICATION OF MATRIX OF FACTORS AND INDICATORS

MID-KLAMATH and LOWER SALMON RIVER TRIBUTARIES

Onemile Creek and Upper Ukonom Subwatershed

FACTORS	INDICATORS	JUSTIFICATION	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
		ONEMILE CREEK			
WATER QUALITY	Temperature	Maximum temperature during 8/24 and 8/25/94 survey was 51^0F, on 8/24 at 1745	X		
	Turbidity	No Data	No Data		
	Chemical/Nutrient Contamination	No Data	X		
HABITAT ACCESS	Physical Barriers	There are no man-made barriers present.	X		
HABITAT ELEMENTS	Substrate	From 3 sets of grid tosses (3 pools), 16% fines; 1 pebble count (1 pool), 10% fines; 4 embeddedness samples (3 pools and 1 low gradient riffle), 28% embedded	Not Enough Data		
	Large Woody Material	Key large wood, 69 pieces/14,067' or 26 pieces/ mile; key large wood recruitment, 98 recruits/1,553' or 333 recruits/mile	X		
	Pool Frequency	One pool every 2 bankfull widths; 2/29 pools (approximately 7%) have a maximum depth >=36"			X
	Off-Channel Habitat	Not applicable to this channel type.	N/A		
	Refugia	No Data	No Data		
CHANNEL CONDITIONS AND DYNAMICS	Width/Depth Ratio	Both cross-section bankfull width/depth ratios are <10 for the two A type Rosgen channels.	X		
	Streambank Condition	No Data	X		
	Floodplain Connectivity	Not applicable to this channel type.	N/A		
		UPPER UKONOM SUBWATERSHED			
FLOW/ HYDROLOGY	Change in Peak/ Base Flow	No Data	X		
	Increase in Drainage Network	Ratio of miles of insloped road in the subwatershed to miles of stream in the watershed is 0/25.7 or 0%	X		
WATERSHED CONDITIONS	Road Density and Location	There are 0 miles of road in 9 square miles of subwatershed, yielding a density of 0 miles of road/square mile of subwatershed	X		
	Disturbance History	ECA is 25.6% based on the ERA value assigned to this subwatershed. There are 2,065 acres of late seral old-growth (LSOG) in the 5,743 acre subwatershed; 35.9% is LSOG.			X
	Riparian Reserves	Composite of subwatershed conditions, especially disturbances	X		

JUSTIFICATION OF MATRIX OF FACTORS AND INDICATORS

MID-KLAMATH and LOWER SALMON RIVER TRIBUTARIES

Panther Creek and Panther/Lick Subwatersheds

FACTORS	INDICATORS	JUSTIFICATION	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
		PANTHER CREEK			
WATER QUALITY	**Temperature**	Maximum temperature between 8/29 and 9/1/94 was 59^{0}F, on 8/29 at 1640.	X		
	Turbidity	No Data	No Data		
	Chemical/Nutrient Contamination	No Data	No Data		
HABITAT ACCESS	**Physical Barriers**	There are no man-made barriers present.	X		
HABITAT ELEMENTS	**Substrate**	1 embeddedness sample (1 pool), 15% embedded	Not Enough Data		
	Large Woody Material	Key large wood, 3 pieces/3,295' or 5 pieces/ mile; key large wood recruitment, 16 recruits/199' or 425 recruits/mile		X	
	Pool Frequency	One pool every 23 bankfull widths; 1/12 pools (approximately 8%) have a maximum depth >=36"			X
	Off-Channel Habitat	Not applicable to this channel type.	N/A		
	Refugia	Composite of stream factors		X	
CHANNEL CONDITIONS AND DYNAMICS	**Width/Depth Ratio**	No Data	No Data		
	Streambank Condition	In 1973, WD Kesner comments on a landing that had given way, and "gutted" the stream channel. 1995 aerial photos observed by T McCulloch show "timber harvesting at the headwaters of Panther Creek, Road 14N01, and erosion adjacent ot the road at possibly 3 sites".	No Data		
	Floodplain Connectivity	Not applicable to this channel type.	N/A		
		PANTHER / LICK SUBWATERSHEDS			
FLOW/ HYDROLOGY	**Change in Peak/ Base Flow**	No Data	X		
	Increase in Drainage Network	Ratio of miles of insloped road in the subwatershed to miles of stream in the watershed is 1.75/34.42 or 5.1%	X		
WATERSHED CONDITIONS	**Road Density and Location**	There are 11.5 miles of road in 10.6 square miles of subwatershed, yielding a density of 1.1 miles of road/square mile of subwatershed	X		
	Disturbance History	ECA is 29.4% based on the ERA value assigned to this subwatershed. There are 1,976 acres of late seral old-growth (LSOG) in the 6,815 acre subwatershed; 29% is LSOG.			X
	Riparian Reserves	Composite of subwatershed conditions, especially disturbances		X	

JUSTIFICATION OF MATRIX OF FACTORS AND INDICATORS

MID-KLAMATH and LOWER SALMON RIVER TRIBUTARIES

Lower Rock Creek and Lower Rock Creek Subwatershed

FACTORS	INDICATORS	JUSTIFICATION	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
		LOWER ROCK CREEK			
WATER QUALITY	**Temperature**	The average of ten samples (5 noon, 5pm) was 59^{0}F	X		
	Turbidity	No Data	X		
	Chemical/Nutrient Contamination	No Data	X		
HABITAT ACCESS	**Physical Barriers**	There are no man-made barriers present.		X	
HABITAT ELEMENTS	**Substrate**	28 pebble counts (25 pools and 2 low gradient riffles and 1 glide), 18% fines; 56 embeddedness samples (25 pools, 19 runs, and 12 low gradient riffles), 25% embedded		X	
	Large Woody Material	No Data	No Data		
	Pool Frequency	Bankfull widths not taken, so can't calculate # of pools necessary to fulfill NMFS requirement. Since there are 96 pools/29,457 feet, would need a 43.8 bankfull width to meet 1 pool/7 bankfull width requirement. 69/96 pools (approx. 72%) have a maximum depth >=36". 12.4 pools (w/max. depths >=36")/mile & 17.2 pools/mile.		X	
	Off-Channel Habitat	Not applicable to this channel type.	X		
	Refugia	Composite of stream factors			
CHANNEL CONDITIONS AND DYNAMICS	**Width/Depth Ratio**	No Data	No Data		
	Streambank Condition		X		
	Floodplain Connectivity	Not applicable to this channel type.	X		
		LOWER ROCK CREEK SUBWATERSHED			
FLOW/ HYDROLOGY	**Change in Peak/ Base Flow**	No Data		X	
	Increase in Drainage Network	Ratio of miles of insloped road in the subwatershed to miles of stream in the watershed is 2.085/15.57 or 13.39%		X	
WATERSHED CONDITIONS	**Road Density and Location**	There are 10.6 miles of road in 4.3 square miles of subwatershed, yielding a density of 2.5 miles of road/square mile of subwatershed		X	
	Disturbance History	ECA is 17.5% based on the ERA value assigned to this subwatershed. There are 528.3 acres of late seral old-growth (LSOG) in the 2,764.7 acre subwatershed; 19.1% is LSOG.		X	
	Riparian Reserves	Composite of subwatershed conditions, especially disturbances	X		

JUSTIFICATION OF MATRIX OF FACTORS AND INDICATORS

MID-KLAMATH and LOWER SALMON RIVER TRIBUTARIES

Upper Rock Creek and Upper Rock Creek Subwatershed

FACTORS	INDICATORS	JUSTIFICATION	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
		UPPER ROCK CREEK			
WATER QUALITY	Temperature	Two samples, taken on August 28 and 29, 19c at 11:50 and 10:00 AM, were both 54^0F	X		
	Turbidity	No Data	X		
	Chemical/Nutrient Contamination	No Data	X		
HABITAT ACCESS	Physical Barriers	There are no man-made barriers present.	X		
HABITAT ELEMENTS	Substrate	From 16 sets of grid tosses in 16 different pools; 24% fines; 5 pebble counts in pools; 18% fines; 35 embeddedness samples (16 pools and 9 runs, and 10 low gradient riffles), 16% embedded		X	
	Large Woody Material	Key large wood, 8 pieces/19,533' or 2 pieces/ mile; key large wood recruitment, 158 recruits/186' or 448 recruits/mile		X	
	Pool Frequency	One pool every 4.8 bankfull widths; 13/155 pools (approximately 8%) have a maximum depth >=36"			X
	Off-Channel Habitat	Not applicable to this channel type.	N/A		
	Refugia	Composite of stream factors		X	
CHANNEL CONDITIONS AND DYNAMICS	Width/Depth Ratio	No Data	No Data		
	Streambank Condition	No Data	X		
	Floodplain Connectivity	Not applicable to this channel type.	N/A		
		UPPER ROCK CREEK SUBWATERSHED			
FLOW/ HYDROLOGY	Change in Peak/ Base Flow	No Data		X	
	Increase in Drainage Network	Ratio of miles of insloped road in the subwatershed to miles of stream in the watershed is 7.55/48.5 or 15.6%		X	
WATERSHED CONDITIONS	Road Density and Location	There are 42 miles of road in 18 square miles of subwatershed, yielding a density of 2.3 miles of road/square mile of subwatershed		X	
	Disturbance History	ECA is 20.2% based on the ERA value assigned to this subwatershed. There are 4407 acres of late seral old-growth (LSOG) in the 11,499 acre subwatershed; 38.3% is LSOG.			X
	Riparian Reserves	Composite of subwatershed conditions, especially disturbances	X		

JUSTIFICATION OF MATRIX OF FACTORS AND INDICATORS

MID-KLAMATH and LOWER SALMON RIVER TRIBUTARIES

Rogers Creek and Rogers Creek Subwatershed

FACTORS	INDICATORS	JUSTIFICATION	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
		ROGERS CREEK			
WATER QUALITY	**Temperature**	@^{0}F	X		
	Turbidity	No Data	X		
	Chemical/Nutrient Contamination	No Data	No Data		
HABITAT ACCESS	**Physical Barriers**	Culvert at mouth, a medium to high flow barrier.			X
HABITAT ELEMENTS	**Substrate**	From 15 sets of grid tosses (15 pools), 27% fines; 9 pebble counts in spawning habitat (6 pools and 3 low gradient riffles), 43% fines; 18 embeddedness samples (18 pools), 27% embedded			X
	Large Woody Material	Key large wood, 53 pieces/28,141' or 10 pieces/ mile; key large wood recruitment, 121 recruits/ 1,666' or 383 recruits/mile		X	
	Pool Frequency	One pool every 7.7 bankfull widths; 15/193 pools (approximately 8%) have a maximum depth >=36", there are 5.3 pools(w/max. depths >=36")/mile & 36.4 pools/mile			X
	Off-Channel Habitat	Not applicable to this channel type.	N/A		
	Refugia	Habitat is of moderate quality. At-risk becasue of fair quality habitat and migration barrier.		X	
CHANNEL CONDITIONS AND DYNAMICS	**Width/Depth Ratio**	No Data	No Data		
	Streambank Condition	1994 field crew comments on erosion between stream mile 3.09 and 4.2. 1995 aerial photos perused by T.McCulloch show timber harvested in this area.		X	
	Floodplain Connectivity	Not applicable to this channel type.	N/A		
		ROGERS CREEK SUBWATERSHED			
FLOW/ HYDROLOGY	**Change in Peak/ Base Flow**	No Data		X	
	Increase in Drainage Network	Ratio of miles of insloped road in the subwatershed to miles of stream in the watershed is 9.885/21.45 or 46.1%			X
WATERSHED CONDITIONS	**Road Density and Location**	There are 28.6 miles of road in 6.7 square miles of subwatershed, yielding a density of 4.3 miles of road/square mile of subwatershed			X
	Disturbance History	ECA is 43.4% based on the ERA value assigned to this subwatershed. There are 1,080.3 acres of late seral old-growth (LSOG) in the 4,291 acre subwatershed; 25.2% is LSOG.			X
	Riparian Reserves	Composite of subwatershed conditions, especially disturbances		X	

JUSTIFICATION OF MATRIX OF FACTORS AND INDICATORS

MID-KLAMATH and LOWER SALMON RIVER TRIBUTARIES

Salal Creek and Upper Rock Creek Subwatershed

FACTORS	INDICATORS	JUSTIFICATION	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
		SALAL CREEK			
WATER QUALITY	Temperature	Two mean of noon water timberatures is 55^{0}F	X		
	Turbidity	No Data	X		
	Chemical/Nutrient Contamination	No Data	X		
HABITAT ACCESS	Physical Barriers	There are no man-made barriers present.	X		
HABITAT ELEMENTS	Substrate	From 5 sets of grid tosses (5 pools), 15% fines; 6 pebble counts (5 pools and 1 glide), 16% fines; 5 embeddedness samples (5 pools), 46% embedded		X	
	Large Woody Material	Key large wood, 9 pieces/5,358' or 9 pieces/ mile; key large wood recruitment, 23 recruits/600' or 202 recruits/mile		X	
	Pool Frequency	One pool every 13.4 bankfull widths; 3/20 pools (approximately 15%) have a maximum depth >=36"			X
	Off-Channel Habitat	Not applicable to this channel type.	N/A		
	Refugia	Composite of stream factors		X	
CHANNEL CONDITIONS AND DYNAMICS	Width/Depth Ratio	Designated Rosgen channel classes w/associated bankfull width/depth ratios: A3, 9.57; A3, 14.55; and A3, 27.89		X	
	Streambank Condition	1996 field crew wrote "Mass Wasting; a few small new slides were observed with the largest being approximately 30'x15'."	X		
	Floodplain Connectivity	Not applicable to this channel type.	N/A		
		UPPER ROCK CREEK SUBWATERSHED			
FLOW/ HYDROLOGY	Change in Peak/ Base Flow	No Data	X		
	Increase in Drainage Network	Ratio of miles of insloped road in the subwatershed to miles of stream in the watershed is 7.55/48.5 or 15.6%		X	
WATERSHED CONDITIONS	Road Density and Location	There are 42 miles of road in 18 square miles of subwatershed, yielding a density of 2.3 miles of road/square mile of subwatershed		X	
	Disturbance History	ECA is 20.2% based on the ERA value assigned to this subwatershed. There are 4,407 acres of late seral old-growth (LSOG) in the 11,499 acre subwatershed; 38.3% is LSOG.			X
	Riparian Reserves	Composite of subwatershed conditions, especially disturbances	X		

JUSTIFICATION OF MATRIX OF FACTORS AND INDICATORS

MID-KLAMATH and LOWER SALMON RIVER TRIBUTARIES

Sandy Bar Creek and Sandy Bar/Stanshaw Subwatersheds

FACTORS	INDICATORS	JUSTIFICATION	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
		SANDY BAR CREEK			
WATER QUALITY	Temperature	The maximum temperature recorded between 8/1 and 8/6/96 was 66°F on 8/1/1996	X		
	Turbidity	No Data	No Data		
	Chemical/Nutrient Contamination	No Data	No Data		
HABITAT ACCESS	Physical Barriers	The field crew wrote in 1996, "The twin culvert is a probable fish barrier at this flow [summer low flow]..."		X	
HABITAT ELEMENTS	Substrate	From 8 sets of grid tosses (7 pools and 1 low gradient riffle), 25% fines; 11 pebble counts (9 pools and 2 low gradient riffles), 23% fines; 35 embeddedness samples (35 pools), 37% embedded			X
	Large Woody Material	Key large wood, 23 pieces/1.7 miles or 14 pieces/ mile; key large wood recruitment not counted	Not Enough Data		
	Pool Frequency	One pool every 11.8 bankfull widths; 9/35 pools (approximately 26%) have a maximum depth >=36"			X
	Off-Channel Habitat	Not applicable to this channel type.	N/A		
	Refugia	Composite of stream factors		X	
CHANNEL CONDITIONS AND DYNAMICS	Width/Depth Ratio	Designated Rosgen channel classes w/associated bankfull width/depth ratios: Ac,5.0 and G4, 6.52	X		
	Streambank Condition	Lots of harvest in Riparian Reserve, lots of stream crossings		X	
	Floodplain Connectivity	Not applicable to this channel type.	N/A		
		SANDY BAR/STANSHAW SUBWATERSHED			
FLOW/ HYDROLOGY	Change in Peak/ Base Flow	No Data		X	
	Increase in Drainage Network	Ratio of miles of insloped road in the subwatershed to miles of stream in the watershed is 20.6/57.4 or 35.9%			X
WATERSHED CONDITIONS	Road Density and Location	There are 64.2 miles of road in 17.3 square miles of subwatershed, yielding a density of 3.7 miles of road/square mile of subwatershed			X
	Disturbance History	ECA is 21.7% based on the ERA value assigned to this subwatershed. There are 2,602 acres of late seral old-growth (LSOG) in the 11,054 acre subwatershed; 23.5% is LSOG. Much old harvest in Riparian Reserves.			X
	Riparian Reserves	Lots of old harvest in Riparian Reserves, lots of stream crossings		X	

JUSTIFICATION OF MATRIX OF FACTORS AND INDICATORS

MID-KLAMATH and LOWER SALMON RIVER TRIBUTARIES

Stanshaw Creek and Sandy Bar/Stanshaw Subwatersheds

FACTORS	INDICATORS	JUSTIFICATION	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
		STANSHAW CREEK			
WATER QUALITY	Temperature	Maximum temperature recorded between 8/12 and 8/14/96 was 59^{0}F on 8/13/96 at 1430	X		
	Turbidity	No Data	No Data		
	Chemical/Nutrient Contamination	No industry or agriculture in watershed.	X		
HABITAT ACCESS	Physical Barriers	The field crew wrote in 1996, "Culvert under Highway fish barrier." [at low flow]		X	
HABITAT ELEMENTS	Substrate	From 13 sets of grid tosses (13 pools), 32% fines; 14 pebble counts (14 pools), 24% fines; 49 embedded-ness samples (49 pools), 41% embedded			X
	Large Woody Material	Key large wood, 47 pieces/14,006' or 18 pieces/ mile; key large wood recruitment, 6 recruits/300' or 106 recruits/mile			X
	Pool Frequency	One pool every 14.45 bankfull widths; 6/49 pools (approximately 12%) have a maximum depth >=36", there are 2.3 pools (w/max. depths >=36")/mile & 18.5 pools/mile			X
	Off-Channel Habitat	Not applicable to this channel type.	N/A		
	Refugia	Based on above factors, at-risk.		X	
CHANNEL CONDITIONS AND DYNAMICS	Width/Depth Ratio	Designated Rosgen channel classes w/associated bankfull width/depth ratios: G2, 6.9; Ac, 10.9; Ac, 8.9	X		
	Streambank Condition	No Data		X	
	Floodplain Connectivity	Good in low gradient upper reaches.	X		
		SANDY BAR/STANSHAW SUBWATERSHED			
FLOW/ HYDROLOGY	Change in Peak/ Base Flow	Based on indicators below, at-risk. LARGE WATER DIVERSION			X
	Increase in Drainage Network	Ratio of miles of insloped road in the subwatershed to miles of stream in the watershed is 20.6/57.4 or 35.9%			X
WATERSHED CONDITIONS	Road Density and Location	There are 64.2 miles of road in 17.3 square miles of subwatershed, yielding a density of 3.7 miles of road/square mile of subwatershed			X
	Disturbance History	ECA is 21.7% based on the ERA value assigned to this subwatershed. There are 2,602 acres of late-seral old-growth (LSOG) in the 11,054 acre subwater-shed; 23.5% is LSOG.			X
	Riparian Reserves	# stream crossings, # managed stands			X

DOESN'T MATCH SUBWATERSHED INFORMATION ON PREVIOUS PAGE...CHECK IT OUT...

JUSTIFICATION OF MATRIX OF FACTORS AND INDICATORS

MID-KLAMATH and LOWER SALMON RIVER TRIBUTARIES

Swillup Creek and Swillup Creek Subwatershed Subwatershed

FACTORS	INDICATORS	JUSTIFICATION	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
		SWILLUP CREEK			
WATER QUALITY	**Temperature**	The maximum temperature recorded between 7/8 and 7/15/96 was 63^0F, on 7/11/96.	X		
	Turbidity	No Data	X		
	Chemical/Nutrient Contamination	No Data	X		
HABITAT ACCESS	**Physical Barriers**	There are no man-made barriers present.	X		
HABITAT ELEMENTS	**Substrate**	From 7 sets of grid tosses (7 pools), 38% fines; 7 pebble counts in spawning habitat (7 pools), 16% fines; 20 embeddedness samples (20 pools), 28% embedded		X	
	Large Woody Material	Key large wood, 13 pieces/10,492' or 7 pieces/mile; recruitment not counted	Not Enough Data		
	Pool Frequency	One pool every 7.8 bankfull widths; 18/33 pools (approximately 55%) have a maximum depth >=36"		X	
	Off-Channel Habitat	Not applicable to this channel type.	N/A		
	Refugia	Composite of stream factors		X	
CHANNEL CONDITIONS AND DYNAMICS	**Width/Depth Ratio**	Here are the designated Rosgen channel classes w/ associated bankful width/depth ratios: B2, 9.72; B2, 9.09; and A2, 10.0	Not Enough Data		
	Streambank Condition	No Data	No Data		
	Floodplain Connectivity	Not applicable to this channel type.	N/A		
		SWILLUP CREEK SUBWATERSHED			
FLOW/ HYDROLOGY	**Change in Peak/ Base Flow**	No Data	X		
	Increase in Drainage Network	Ratio of miles of insloped road in the subwatershed to miles of stream in the watershed is 1.645/31.61 or 5.2%	X		
WATERSHED CONDITIONS	**Road Density and Location**	There are 13.7 miles of road in 8.7 square miles of subwatershed, yielding a density of 1.6 miles of road/square mile of subwatershed	X		
	Disturbance History	ECA is 13.2% based on the ERA value assigned to this subwatershed. There are 3,653.5 acres of late-seral old-growth (LSOG) in the 5,581.6 acre subwatershed; 65.5% is LSOG.	X		
	Riparian Reserves	Composite of subwatershed conditions, especially disturbances	X		

JUSTIFICATION OF MATRIX OF FACTORS AND INDICATORS

MID-KLAMATH and LOWER SALMON RIVER TRIBUTARIES

Ti Creek and Ti Creek Subwatershed

FACTORS	INDICATORS	JUSTIFICATION	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
		TI CREEK			
WATER QUALITY	Temperature	The average of 7 noon and 7 pm samples between 6/8/92 and 6/18/92 is 55^0F	X		
	Turbidity	No Data	No Data		
	Chemical/Nutrient Contamination	No Data	No Data		
HABITAT ACCESS	Physical Barriers	There are no man-made barriers present.	X		
HABITAT ELEMENTS	Substrate	31 pebble counts (30 pools and 1 low gradient riffle), 21% fines; 55 embeddedness samples (29 pools, 10 runs, and 16 low gradient riffles), 34% embedded			X
	Large Woody Material	Key large wood, 85 pieces/16,196' or 28 pieces/mile; key large wood recruitment, 43 recruits/ 2,921' or 78 recruits/mile		X	
	Pool Frequency	Bankfull widths not taken, so can't calculate # of pools necessary to fulfill NMFS requirement; 37/118 pools (approximately 31%) have a maximum depth >=36"			X
	Off-Channel Habitat	Not applicable to this channel type.	N/A		
	Refugia	Composite of stream factors		X	
CHANNEL CONDITIONS AND DYNAMICS	Width/Depth Ratio	No Data	No Data		
	Streambank Condition	No Data		No Data	
	Floodplain Connectivity	Not applicable to this channel type.	N/A		
		TI CREEK SUBWATERSHED			
FLOW/ HYDROLOGY	Change in Peak/ Base Flow	No Data		X	
	Increase in Drainage Network	Ratio of miles of insloped road in the subwatershed to miles of stream in the watershed is 14.4/31.7 or 37%			X
WATERSHED CONDITIONS	Road Density and Location	There are 40 miles of road in 9.5 square miles of sub-watershed, yielding a density of 4.2 miles of road/square mile of subwatershed			X
	Disturbance History	ECA is 33.5% based on the ERA value assigned to this subwatershed. There are 2,231 acres of late-seral old-growth (LSOG) in the 6,056 acre subwatershed; 36.8% is LSOG.			X
	Riparian Reserves	Composite of subwatershed conditions, especially disturbances		X	

JUSTIFICATION OF MATRIX OF FACTORS AND INDICATORS

MID-KLAMATH and LOWER SALMON RIVER TRIBUTARIES

Lick Creek and Panther/Lick Subwatershed

FACTORS	INDICATORS	JUSTIFICATION	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
		LICK CREEK			
WATER QUALITY	Temperature	The maximum temperature is 53⁰F on 8/23/97 at 0900.	X		
	Turbidity	No Data	X		
	Chemical/Nutrient Contamination	No Data	X		
HABITAT ACCESS	Physical Barriers	There are no man-made barriers present.	X		
HABITAT ELEMENTS	Substrate	From 1 grid toss (1 pool), 1% fines; 1 pebble count in spawning habitat (1 pool), 6% fines; 1 embeddedness sample (1 pool), 60% embedded	Not Enough Data		
	Large Woody Material	Key large wood, 1 piece/1,548' or 3 pieces/mile; key large wood recruitment, 24 recruits/ 211' or 601 recruits/mile		X	
	Pool Frequency	One pool every 18.9 bankfull widths; 0/9 pools (approximately %) have a maximum depth >=36"			X
	Off-Channel Habitat	Not applicable to this channel type.	N/A		
	Refugia	Composite of stream factors		X	
CHANNEL CONDITIONS AND DYNAMICS	Width/Depth Ratio	No Data	No Data		
	Streambank Condition		No Data		
	Floodplain Connectivity	Not applicable to this channel type.	N/A		
		PANTHER / LICK SUBWATERSHED			
FLOW/ HYDROLOGY	Change in Peak/ Base Flow	No Data	X		
	Increase in Drainage Network	Ratio of miles of insloped road in the subwatershed to miles of stream in the watershed is 1.76/34.4 or 5.1%	X		
WATERSHED CONDITIONS	Road Density and Location	There are 11.5 miles of road in 10.65 square miles of subwatershed, yielding a density of 1.1 miles of road/square mile of subwatershed	X		
	Disturbance History	ECA is 29.4% based on the ERA value assigned to this subwatershed. There are 1,975.7 acres of late-seral old-growth (LSOG) in the 6,814.7 acre subwatershed; 29% is LSOG.			X
	Riparian Reserves	Composite of subwatershed conditions, especially disturbances		X	

JUSTIFICATION OF MATRIX OF FACTORS AND INDICATORS

MID-KLAMATH and LOWER SALMON RIVER TRIBUTARIES

Upper Ukonom Creek and Upper Ukonom Subwatershed

FACTORS	INDICATORS	JUSTIFICATION	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
		UPPER UKONOM CREEK			
WATER QUALITY	**Temperature**	Three pm samples average 55^0F (the pm samples were the warmest recorded)	X		
	Turbidity	No Data	No Data		
	Chemical/Nutrient Contamination	No Data	X		
HABITAT ACCESS	**Physical Barriers**	There are no man-made barriers present.	X		
HABITAT ELEMENTS	**Substrate**	From 2 sets of grid tosses (2 pools), 25% fines; No pebble counts within spawning habitat; 16 embeddedness samples (2 pools, 5 runs, and 9 low gradient riffles), 26% embedded	Not Enough Data		
	Large Woody Material	Key large wood, 7 pieces/8,985' or 4 pieces/mile; key large wood recruitment, 67 recruits/ 1,082' or 327 recruits/mile		X	
	Pool Frequency	One pool every 9.1 bankfull widths; 4/39 pools (approximately 10%) have a maximum depth >=36"			X
	Off-Channel Habitat	Not applicable to this channel type.	N/A		
	Refugia	Composite of stream factors	No Data		
CHANNEL CONDITIONS AND DYNAMICS	**Width/Depth Ratio**	Both cross section bankfull width/depth ratios are <10 for the two A type Rosgen channels	X		
	Streambank Condition	182' (parallel to the streambank), consisting of 2 slides, recorded inthe 8,985' survey; about 2% instability	X		
	Floodplain Connectivity	Not applicable to this channel type.	N/A		
		UPPER UKONOM SUBWATERSHED			
FLOW/ HYDROLOGY	**Change in Peak/ Base Flow**	No Data	X		
	Increase in Drainage Network	Ratio of miles of insloped road in the subwatershed to miles of stream in the watershed is 0/25.7 or 0%	X		
WATERSHED CONDITIONS	**Road Density and Location**	There are 0 miles of road in 9 square miles of subwatershed, yielding a density of 0 miles of road/square mile of subwatershed	X		
	Disturbance History	ECA is 25.6% based on the ERA value assigned to this subwatershed. There are 2,064.6 acres of late seral old-growth (LSOG) in the 5,743.3 acre subwatershed; 36% is LSOG.			X
	Riparian Reserves	Composite of subwatershed conditions, especially disturbances	X		

AUBREY CREEK

Thomas/Aubrey Subwatershed

Aubrey Creek is a 2nd order stream (Strahler 1957) that drains southeasterly directly into the Klamath River. Fish populations and/or fish habitat conditions have been assessed in surveys conducted on June 27, 1961 by Dan Mongold and Tom Gaumer (from the mouth to approximately 1.5 miles upstream) and on June 12, 1974 by the United States Forest Service (from the Pony Peak road to 300 yards upstream on an unnamed tributary to Aubrey). No surveys have been done since then.

SPECIES ACCOUNT AND HABITAT STATUS

A. Species account - There are few fish in this stream. In fact, only a few small (an inch to an inch and a half fry) were observed by the 1961 field crew. No fish was seen in the unnamed tributary.

B. Habitat Status - The 1961 field crew wrote, "Though the stream is approximately 75 percent riffle, little of this area is suitable spawning area. Most of the riffle area flows quite rapidly and contains very large rock and debris. Shelter for this stream is overly abundant; brush and vines surround the stream and numerous trees have fallen across and into the stream making it seemingly impassable to migratory fish. Nursery area is also limited even though 25 percent of the stream is pools; these pools are placed intermittently among cascading water and are generally swift flowing." Additionally, the crew comments, "As may be guessed from its falling more than 3,000 feet in three miles [approximately a 19% slope] Aubrey Creek is generally quite steep. The stream is approximately 0.8 feet deep and 6 feet wide, at the time of the survey, it carried 2.2 cfs. (The stream cascades from pool to pool through much of its course; Intermingled with these cascades are stretches of swift flowing rapids.) The stream bed consists of boulders, fallen trees and debris cluttering the stream. Pool:riffle ratio was approximately 25:75."

WATER QUALITY

Temperature: The only temperature recorded in the Aubrey Creek watershed was 51 degrees Fahrenheit in the unnamed tributary at the Pony Peak road crossing on June 12, 1974 at 0920.

Turbidity: The only turbidity rating recorded in the Aubrey Creek watershed was "low turbidity" in the unnamed tributary at the Pony Peak road crossing on June 12, 1974 at 0920.

Chemical or Nutrient Contamination: No data available.

HABITAT ACCESS

In addition to the "seemingly impassable" vegetation mentioned above, there are three other sources that inhibit fish migration. The first is the Aubrey Creek culvert that is buried beneath Highway 96. The 1961 crew describes, "One culvert, about 200 yards upstream, located where the stream passes under Highway 96 created what was considered a partial barrier.

HABITAT ELEMENTS

Substrate: Boulders dominate the substrate in Aubrey Creek.

Large Woody Material: No quantitative data was recorded.

Pool Frequency: The pool:riffle ratio was approximately 25:75.

Off-Channel Habitat: Not applicable to this channel type.

Refugia: Aubrey Creek is not a prime fish bearing stream but it provides a wealth of various substrate for other organisms.

CHANNEL CONDITIONS AND DYNAMICS

Width/Depth Ratio: Aubrey Creek's channel has not been designated a certain Rosgen class. No data has been collected on bankfull width/depth ratio.

Stream Bank Conditions: No comments were made to evaluate streambank conditions.

Floodplain Connectivity: N/A to this channel type.

FLOW/HYDROLOGY

Changes In Peak/Base Flows: No gauges on stream.

Increase In Drainage Network: There are 4.1 miles of insloped road in the Thomas/Aubrey subwatershed for 31 miles of stream (stream miles include miles of intermittent, perennial, and the Klamath River that fall within Thomas/Aubrey subwatershed). That's 13.2 miles of insloped road for every 100 miles of stream.

WATERSHED CONDITIONS:

Road Density and Location: There are 13.1 miles of road and 9.3 square miles of land in the Thomas/Aubrey subwatershed. The road density is 1.4 miles of road/square mile of subwatershed.

Disturbance History: The subwatershed has a ECA of 9.3%. Five acres of what is now Riparian Reserve has been subjected to past timber harvest. There are 2906 acres of Late Seral Old Growth (LSOG) or 49% in the Thomas/Aubrey subwatershed.

Riparian Reserves: Probably in good shape because of low road density and high percentage LSOG.

CUB CREEK

Ukonom-McCash/Cub Subwatershed

Cub Creek is a first to second order stream (Strahler 1957) that drains northerly into Ukonom Creek. It originates from two springs above Long Meadow in the Marble Mountain Wilderness. The Forks of Cub Creek drain northerly in to Cub Creek. W.D. Kesner, USFS, surveyed roughly 1.5 miles of Cub Creek and Forks of Cub in 1973. Tony Hacking surveyed 2.5 miles of Cub Creek and Forks of Cub in 1986. No subsequent survey has been conducted.

SPECIES ACCOUNT AND HABITAT STATUS

Rainbow trout 1-6" in length were seen in Cub Creek by Tony Hacking and up to 200 yards above the culvert at the 15N17 road crossing by W.D. Kesner. No fish were seen at the Forks of Cub road crossings along the 15N17 road.

Hacking recorded 15 pools from the confluence of Ukonom Creek to the culvert on 15N17 road, and 2 pools on the Forks of Cub creek, 1/4 mile and 1/2 mile from the confluence of Cub Creek. Maximum depth for Cub Creek ranges from 1-4 feet and the average is 2.1 feet. Active channel widths range from 5-15 feet and the mean was 9 feet. Pools are formed by boulders, logs and falls. Hacking's survey ends at the culvert on Cub Creek. W.D. Kesner surveyed above and below the culvert with widths ranging from 2-10 feet and the mean at 6 feet. Depths ranged from 0.2 feet to 2 feet with a mean of 0.5 feet. Flow was estimated at 1 cfs in the area of 15N17 road and estimated at 10cfs below the confluence of Cub Creek and Forks of Cub. Cub Creek is described as having many rock falls 2-6' in height with a series of cascades and rapids.

WATER QUALITY:

Temperature: The water temperature average was 46 degrees Fahrenheit and air temperatures average 55 degrees Fahrenheit in September 1986.

Turbidity: The amount of turbidity in the stream was not noted, however road fill was noted as entering the stream below the culvert at the road crossing on Cub Creek, and at the Forks of Cub road crossing.

Chemical or Nutrient: "None" was recorded in the 1986 survey.

HABITAT ACCESS

Physical Barriers: Culverts are present on Cub Creek and Forks of Cub. No fish were seen at the Forks of Cub road crossings. W.D. Kesner noted rainbow trout 200 yards above the culvert on 15N17, but no farther. Above the culvert is a 4 foot cascading fall. A 10 foot waterfall and numerous cascades, one 230 feet long, were considered barriers by both Hacking and Kesner.

HABITAT ELEMENTS

Substrate: Hacking's survey included the substrate composition of pools and riffles. In all pools (17), there was 2.5% bedrock, 2.1% boulder & rocks (1-3 feet diameter), 19% large rubble (6"-1'), 25% small rubble (2"-6"), 19% gravel (1/4"-2"), and 30% fines (< 1/4"). In riffles there was 0.5% bedrock, 2.3% boulder, 16% boulder rocks, 32% large rubble, 23% small rubble, 13% gravel, and 3.5% fines. Embeddedness was not noted.

Large Woody Material: Photos from 1986 show woody material (>24" by >50') is present along Cub Creek and helps to form cover and habitat. There is not enough data to quantify large woody material in Cub Creek.

Pool Frequency: Bankfull measurement unavailable. Criteria for Hacking's survey recorded pools and riffles at every 1/4 mile location. Kesner described pools as abundant.

Off-Channel Habitat: Not applicable to this channel type.

Refugia: Stone flies and Caddis flies were present but considered few.

CHANNEL CONDITIONS AND DYNAMICS

Width/Depth Ratio: Cub Creek would probably range from an A2 to B2 and B3 Rosgen channel type. Kesner described stream channel as stable but sensitive to damage.

Floodplain Connectivity: Not applicable to this channel type.

FLOW/HYDROLOGY

Increase In Drainage Network: There is approximately 13.5 miles of natural stream courses, including intermittent stream courses, in Cub Creek and Forks of Cub combined. Seventeen miles of roadways are in the Cub Creek drainage area and the increase in the drainage network is about 2%.

FLOW/HYDROLOGY

Changes In Peak/Base Flows: No gauges on stream.

Increase In Drainage Network: There are 0.46 miles of insloped road in the McCash/Cub subwatershed for 41.5 miles of stream (stream miles include miles of intermittent, perennial, and the Klamath River that fall within McCash/Cub subwatershed). That's 1.1 miles of insloped road for every 100 miles of stream.

WATERSHED CONDITIONS:

Road Density and Location: There are 18.7 miles of road and 13.1 square miles of land in the

McCash/Cub subwatershed. The road density is 1.4 miles of road/square mile of subwatershed.

Disturbance History: The McCash/Cub subwatershed has a ECA of 24%. 147 acres of what is now Riparian reserve has been impacted by timber harvest. There are 3675 acres of Late Seral Old Growth (LSOG) or 44% in the McCash/Cub subwatershed.

Riparian Reserves: Probably in good shape because of low road density and high % LSOG.

ELLIOT CREEK
Thomas/Aubrey Subwatershed

Elliot Creek is a first to second order stream (Strahler 1957), that runs easterly to the Klamath River. Elliot Creek drains the east flank of Pony Peak. It originates at 4000 feet above sea level and empties into the Klamath at 800 feet above sea level. There is 4.8 miles of stream course. Elliot Creek runs through a mountainous canyon. The riparian vegetation consists of fir, pine, laurel, oak, and a variety of underbrush. W.D. Kesner, a United States Forest Service employee, surveyed from the mouth to approximately one half of a mile upstream on June 12, 1974. On June 26, 1961 Mike Kruse and Harley Reno also surveyed Elliot Creek (survey area is not recorded). No further surveys have been conducted since then.

SPECIES ACCOUNT AND HABITAT STATUS

A. Species account - Two trout were seen, they were 3-7 inches long. 2-3 fry were observed in a side pool.

B. Habitat Status - Elliot Creek is very steep. Many different sizes of waterfalls are present. The stream consists of rubble and boulders with little gravel and sand. The pool to riffle ratio is 9:1. The average depth of the stream is 8 inches, and the average width is 8 feet. There is very little spawning area due to the steep gradient. Boulders, pools, and brush serve as shelter. Many aquatic insects were observed. Elliot Creek is a small stream with an estimated flow of 2 cfs.

WATER QUALITY

Temperature: The only temperature recorded in Elliot Creek was 53 degrees Fahrenheit on November 14, 1967 at 1200.

Turbidity: The only turbidity rating recorded in Elliot Creek was "almost crystal clear" on November 14, 1967 at 1200.

Chemical or Nutrient Contamination: No data available.

HABITAT ACCESS

The mouth may serve as a barrier during low flows because the creek fans out on a bar. A half a mile from the mouth there is an eight foot cascade that is designated a barrier by Kesner in 1974. Additionally, the rough nature of the creek may prevent general use by salmon or steelhead. Kesner mentions that the box culvert under Highway 96 is passable and that there are no definite barriers to anadromous fish in the first one-half mile. (Elliott Creek mouth and culvert was found passable in 1997.)

HABITAT ELEMENTS

Substrate: Rubble is the dominant substrate type for the pools and riffles.

Large Woody Material: No quantitative data was recorded.

Pool Frequency: The pool:riffle ratio was 9:1 in 1961 (?).

Off-Channel Habitat: Not applicable to this channel type.

Refugia: The 1961 field crew describes, "The boulders, pools, and brush offer good shelter and a profuse amount of aquatic insects were observed in the stream that would be greatly beneficial for food."

CHANNEL CONDITIONS AND DYNAMICS

Width/Depth Ratio: Elliot Creek's channel has not been designated a certain Rosgen class and so no data has been collected on bankfull width/depth ratio.

Stream Bank Conditions: Kesner mentions, "Channel stabilizing after intense mining activity; soils and side slopes unstable."

Floodplain Connectivity: N/A to this channel type.

FLOW/HYDROLOGY

Changes In Peak/Base Flows: No gauges on stream.

Increase In Drainage Network: There are 4.1 miles of insloped road in the Thomas/Aubrey subwatershed for 31 miles of stream (stream miles include miles of intermittent, perennial, and the Klamath River that fall within Thomas/Aubrey subwatershed). That's 13.2 miles of insloped road for every 100 miles of stream.

WATERSHED CONDITIONS

Road Density and Location: There are 13.1 miles of road and 9.3 square miles of land in the Thomas/Aubrey subwatershed. The road density is 1.4 miles of road/square mile of subwatershed.

Disturbance History: The subwatershed has a ECA of 9.3%. Five acres of what is now Riparian Reserve has been subjected to past timber harvest. There are 2906 acres of Late Seral Old Growth (LSOG) or 49% in the Thomas/Aubrey subwatershed.

Riparian Reserves: Probably in good shape because of low road density and high percentage LSOG. Unknown whether mining impact noted by Kesner is recovered.

NATUKET CREEK

Reynolds/Natuket Subwatershed

Natuket Creek is a first to second order (Strahler 1957) stream, that drains easterly into the Klamath River. Fish populations and/or fish habitat conditions have been assessed by a 3 mile survey conducted by Humboldt State University students from a freshwater fisheries ecology class in October of 1978. A few notes were available from a 1975 California Department of Fish and Game (CDF&G) survey.

SPECIES ACCOUNT AND HABITAT STATUS

Species Account - (Steelhead Trout and Salmon): No fish species were observed in the 1978 survey, although it was noted in the (CDF&G) survey completed in 1975, that there were "reports" of a small rainbow trout population inhabiting the stream, however no fish were seen by the surveyors.

Habitat Status - The upper portions of Natuket Creek are high gradient and unsuitable for fish. Only the lowest 1/8th mile of the creek has potential for fish habitat. The surveyors in 1978 observed little spawning habitat in this lower portion due to heavy amounts of sediment and debris which they attributed to timber harvest practices; i.e., a clear-cut in the upper section of the creek, and run-off from the Teneyck mine. If these conditions have since changed it is not known.

WATER QUALITY

Temperature: In October when the 1978 survey was conducted the air temperature average was 57 degrees Fahrenheit and the water temperature average was 52 degrees Fahrenheit.

Turbidity: From the 1978 survey the amount of mud and silt was described as heavy and appeared related to several erosive slides, however, turbidity of the creek was described by the survey as "low".

Chemical or Nutrient: None was recorded. No current data.

HABITAT ACCESS

Physical Barriers: Although several culverts exist, these occur only in upper sections of the creek where there are no fish. A series of 2 foot to 6 foot waterfalls at the lower end of the creek were thought to be a fish barrier by the surveyors in 1978.

HABITAT ELEMENTS

Substrate: The percent fines (sand, silt and mud) was 22%. Embeddedness was not recorded.

Large Woody Material: From survey descriptions and photographs it appears that woody material forms an integral part of the creek drainage, and is responsible for several pools and waterfalls. Woody pieces were not quantified.

Pool Frequency: Lower portions are said to have a frequent pool occurrence, averaging 5 to 6 foot in diameter. No depths were taken at the time of the survey.

Off-Channel Habitat: Not applicable to this channel type.

Refugia: While surveyors described numerous insects, the lack of fish observed by the surveyors (juvenile or otherwise) leads one to assume that the creek was not an optimum habitat for spawning or rearing.

CHANNEL CONDITIONS AND DYNAMICS

Width/Depth Ratio: This channel is best described as a B4 stream type (Rosgen 1996). Natuket Creek flows through a steep narrow gorge, and has many pieces of woody material acting as a major component in stream formation. Banks were described as highly unstable and large amounts of fines and sediments were found in the pools.

Streambank Conditions: Natuket Creek, as previously explained is prone to erosion and mass wasting, along all but the last 1/8th mile of its channel. The stream bank soils are frequently described as being unstable.

Floodplain Connectivity: Not applicable to this channel type.

Flow/Hydrology: Changes in peak/base flows: No gauges on stream.

Increase In Drainage Network: There are approximately 6.5 miles of natural streamcourses in the Natuket creek drainage. Over 7.5 miles of established roads and spur roads traverse the drainage. Most of these roads were constructed to harvest timber. Clearcut and partial cut area in the drainage include skid trails and compacted tractor ground. Therefore, a 20% or larger increase in the extent of the drainage network related to timber and associated activities is possible.

WATERSHED CONDITIONS

Road Density and Location: The Natuket creek drainage is 1.9 square miles in size and has 7.5 miles of road. This is an average road density of 3.9 Mi/SqMi.

Disturbance History: Evidence of clear cut logging practices in the middle and upper portions of the creek are evident in 1995 aerial photographs. Descriptions of logging in the riparian areas were made by the 1978 surveyors.

Riparian Reserves: The predominate riparian species are Alders, low shrubs, and forbs, with very few conifers and almost no late seral stages present. Deforested voids along the riparian, and a massive slide near the mouth of the creek fragments the Riparian Reserves.

The following is a description of the Reynolds/Natuket subwatershed, not to be confused with the above information, that describes the Natuket Creek watershed.

FLOW/HYDROLOGY

Increase In Drainage Network: There are 24 miles of insloped road in the Reynolds/Natuket subwatershed for 65.2 miles of stream (stream miles include miles of intermittent, perennial, and the Klamath River that fall within Reynolds/Natuket subwatershed). That is 37.1 miles of insloped road for every 100 miles of stream.

WATERSHED CONDITIONS

Road Density and Location: There are 61 miles of road and 21 square miles of land in the Reynolds/Natuket subwatershed. The road density is 2.8 miles of road/square mile of subwatershed.

Disturbance History: The Reynolds/Natuket subwatershed has a ECA of 22%. 680 acres of what is now Riparian Reserves has been subjected to past timber harvest activities. There are 2649 acres of Late Seral Old Growth (LSOG) or 19% in the Reynolds/Natuket subwatershed.

Riparian Reserves: Riparian Reserves associated with streamcourses have been impacted by timber harvest.

REYNOLDS CREEK
Reynolds/Natuket Subwatershed

Lower Reynolds Creek is a high gradient stream having numerous long, high-gradient riffles and step-runs, and short cascades. Many of the cascades and high-gradient riffles have small plunge pools at their base. Current fish habitat conditions in lower Reynolds Creek can be best summarized as follows:

WATER QUALITY

Temperature: Lower Reynolds Creek (mouth to stream mile 1.0) is heavily shaded throughout by a dense canopy composed almost entirely of deciduous trees. Average canopy closure exceeds 95%. Although conifers are the dominant climax tree type that occurs along streams in this bio-region, the stream corridor of Reynolds Creek is dominated by deciduous trees because of incomplete recovery from the flood of 1964 which scoured the stream channel, destroying most of the riparian vegetation. Based on spot checks of water temperature taken during the hottest weather in summer 1994, it is assumed that water temperatures remain suitable (below 69 degrees) for rearing anadromous salmonids throughout each summer season.

Turbidity: No data available.

Chemical or Nutrient Contamination: No sources of contamination present.

HABITAT ACCESS

Physical Barriers: No man-made barriers present. Large debris jams which resulted from 1964 flood were apparently removed by stream managers in early 1970s.

HABITAT ELEMENTS

Substrate: Fines in stream areas that would typify salmon and trout spawning habitat (pool tail-outs) averages 20%. Dominate substrate is cobbles as determined by pebble count. Average embeddedness of cobbles in pool-tail out and riffles averaged 33% (range was 15-65%). Embeddedness in riffles averaged 30% (range was 10-65%).

Large Woody Material: There are very few pieces of large woody material in lower Reynolds Creek. Apparently much of the large woody material in Reynolds Creek was rendered hydrologically functionless prior to the 1975 survey when stream cleaning (the removal of large woody material from stream channels) was believed to benefit fish by improving access for migration. Stream surveyors in 1975 observed that "any logs that were in the streambed have been sectioned and stacked".

Pool Frequency: Pools are few and far between. Active channel width averages 24 feet across. There are an average of 20 pools per mile. Maximum pool depths average 1.8 feet. Average residual pool volume is 1.2 feet.

Off-Channel Habitat: Not applicable to this channel type.

Refugia: Lower Reynolds Creek provides some spawning and rearing areas suitable for steelhead, however this habitat is not of optimum quality due to low residual pool depth and excess fines.

CHANNEL CONDITION AND DYNAMICS

Width/Depth Ratio: The channel is best described as being an A3a+ stream type (Rosgen 1996). This stream type has a steep, deeply entrenched, and confined channel that is incised in course depositional soils, typically course textured colluvial deposits (mainly from debris slides in Reynolds Creek). Channel materials are unconsolidated, heterogeneous, non-cohesive materials, dominated by cobbles but also containing some boulders, gravels, and sand. Channel type is unlikely to have changed through recent times due to management activities.

Streambank Condition: Characteristic streambank erosional processes are fluvial entrainment, mass wasting, dry ravel, freeze/thaw, and debris flow scour. Natural debris slides and earthflows impinge upon Reynolds Creek in many places, resulting in unstable streambanks along 10-20% of the channel length.

Floodplain Connectivity: Not applicable to this channel type.

FLOW/HYDROLOGY

Changes In Peak/Base Flows: No gauges on stream.

Increase In Drainage Network: There are 24 miles of insloped road in the Reynolds/Natuket subwatershed for 65.2 miles of stream (perennial, intermittent, and portion of the Klamath river that flows through this subwatershed). That is 37.1 miles of insloped road for every 100 miles of streams.

WATERSHED CONDITIONS

Road Density and Location: There are 61 miles of road and 21 square miles of land in the Reynolds/Natuket subwatershed. The road density is 2.8 miles of road per square mile of subwatershed. There are 58 known road/stream crossings in this subwatershed for an average stream crossing density of 3.8 per square mile.

Disturbance History: The Reynolds/Natuket subwatershed has a ECA of 22%. 680 acres of what is now Riparian Reserve has been subject to past timber harvest activities. There are 2649 acres of Late Seral Old Growth (LSOG) or 19% in the subwatershed.

Riparian Reserves: Riparian Reserves associated with streamcourses have been impacted by timber harvest.

TENEYCK CREEK

Reynolds/Natuket Subwatershed

Teneyck Creek is a 2nd order stream (Strahler 1957) that drains easterly directly into the Klamath River. Fish populations and/or fish habitat conditions have been assessed in surveys conducted by CDF&G in 1975 (Culvert under USFS road 13N18 to approximately 300 yards downstream) and in 1979 by a Humboldt State University Freshwater Fisheries Ecology class (from culvert under USFS road 13N18 to the mouth, approximately 2 miles). No subsequent surveys have been conducted.

SPECIES ACCOUNT AND HABITAT STATUS

A. Species account - No fish species were observed by either group of surveyors.

B. Habitat Status - Teneyck creek has a relatively steep gradient (13-15%) near the mouth with numerous 6 foot cascades and falls. The surveyors in 1979 believed these falls might pose a potential barrier to anadromous fish.

WATER QUALITY

Temperature: The lower and middle portions of Teneyck creek are heavily shaded (80 to 90%) along the entire reach by a canopy of alder and other deciduous trees. Water temperature was recorded in a series of spot checks, as averaging 52 degrees Fahrenheit while the air temperature was 65 degrees Fahrenheit. Water flow was between 2.5 cfs to 3.5 cfs.

Turbidity: Pools are described as being full of sand and silt and canyon walls are descried as being unstable and prone to erosion, but no quantitative data is available on turbidity.

Chemical or Nutrient Contamination: No data available.

HABITAT ACCESS

A culvert photographed by the 1979 surveyors in the upper portion of Teneyck creek was thought to be a man made barrier, but the steep gradient (13-15%) and frequent series of falls 6 feet or more is thought to be a greater, natural obstacle for fish passage.

HABITAT ELEMENTS

Substrate: The substrate composition was evaluated in three nearly equally sized sections (lower, middle and upper) of the stream in 1979. Two miles was surveyed. The results rate the overall percentage of fines (sand, silt, and mud) to be approximately 23% of the substrate. The surveyors elaborate by describing the pools in the middle section of Teneyck. They write, "Many pools are formed by logs and the pools are largely full of sand and silt." Embeddedness was not recorded.

Large Woody Material: Again no quantitative data was recorded. However from descriptions and photographic representations one can ascertain the presence of extremely large amounts of woody material. Which seem to be performing its function of creating pools and filtering out silt.

Pool Frequency: Pools were described to be "common" in frequency and formed by boulders, logs, and rock falls. Pools were 3-4 feet average diameter, unfortunately, no pool depths were taken at the time of the survey.

Off-Channel Habitat: Not applicable to this channel type.

Refugia: It appears from the survey data collected in 1979 that Teneyck creek provides little if any spawning or rearing habitat for anadromous or resident fish. However many Siskiyou giant salamanders and aquatic invertebrates were seen by the surveyors. The shade canopy was described as dense (80 to 90%) along the entire stream.

CHANNEL CONDITIONS AND DYNAMICS

Width/Depth Ratio: The channel is best described as being a B4 stream (Rosgen 1996), although no designation was determined in the 1979 survey. Teneyck creek is a steep (8-15%), deeply entrenched channel characterized by unstable stream banks, frequent waterfalls, and debris created pools.

Stream Bank Conditions: "Severe cutting" and instability of the banks was observed in the steep upper and lower sections of the creek with only the middle section to the creek described as "moderately stable". The 1979 surveyors noted evidence of old mining operations in the creek and resulting erosion of stream bank walls.

Floodplain Connectivity: N/A to this channel type.

FLOW/HYDROLOGY

Changes In Peak Base Flows: No gauges on stream.

Increase In Drainage Network: There are approximately 14.5 miles of natural stream course in the Teneyck Creek drainage. Over 4.5 miles of established road and spur roads traverse the drainage. Most of these roads were constructed in order to harvest timber. Clearcut and partial cut areas in the drainage include skid trails and compacted tractor ground. Therefore, a 20% or larger increase in the extent of the drainage network related to timber and associated activities is possible.

WATERSHED CONDITIONS

Road Density and Location: The Teneyck creek drainage is approximately 1.65 square miles in size and has 4.5 miles of roads. There is at least one wet stream crossing having a culvert under fill.

Disturbance History: Significant timber harvest activity and associated road building has occurred in the Teneyck creek drainage, and evidence of clear cut logging near the riparian is noticeable from a 1995 aerial photograph of the drainage, in addition to reports of riparian disturbance observed in the 1979 Humboldt state survey.

Riparian Reserves: Fragmented at best, large areas especially in the upper and middle portions of the creek have been deforested dangerously close to the creek, and a large slide occurs in the lower portion.

The following is a description of the Reynolds/Natuket subwatershed, not to be confused with the above information, that describes only the Teneyck Creek watershed.

FLOW/HYDROLOGY

Increase In Drainage Network: There are 24 miles of insloped road in the Reynolds/Natuket subwatershed for 65 miles of stream (stream miles include miles of intermittent, perennial, and the Klamath River that fall within Reynolds/Natuket subwatershed). That's 37 miles of insloped road for every 100 miles of stream.

WATERSHED CONDITIONS

Road Density and Location: There are 61 miles of road and 22 square miles of land in the Reynolds/Natuket subwatershed. The road density is 2.8 miles of road/square mile of subwatershed.

Disturbance History: The Reynolds/Natuket subwatershed has an ECA of 22%. 680 acres of what is now Riparian Reserves has been subject to timber harvest activities. There are 2,649 acres of late-seral old-growth (LSOG) or 19% in the Reynolds/Natuket subwatershed.

Riparian Reserves: Riparian Reserves have been impacted by timber harvest and mining.

THREE CREEKS

Thomas/Aubrey Subwatershed

EXISTING ENVIRONMENT

Three Creeks is actually three small first order streams (Strahler 1957) that confluence together just above the creeks' confluence with the Klamath River and HWY 96. Fish populations and/or fish habitat conditions have been assessed in surveys conducted in the 1960s by the USFS (water temperatures taken at the mouths of each of the forks , flows were estimated, and water clarity described), in 1961 by Mike Kruse and Harley Reno, whom are thought to have been performing surveys for the California Department of Fish and Game (it is not clear what portion of the stream was actually surveyed on the ground), and in 1974 by the USFS (from the mouth to 100 yards upstream).

SPECIES ACCOUNT AND HABITAT STATUS

A. Species account - No fish were observed by any of the surveyors.

B. Habitat Status - Three Creeks has a very steep gradient, an average of 25% for the entire stream length (approximately 1.5 miles). On June 26, 1961, the surveyors wrote, "The average width was 2 feet, a depth of 2-3 inches and an estimated flow of less than

1 cfs." This is a very small, steep stream. In fact, the watershed is only about 700 surface acres.

WATER QUALITY

Temperature: Four temperatures were taken in Three Creeks, one in November and three in February. Two were taken at the mouth of the main stem and one each at the mouths of the western and eastern branch. The average of these is 47 degrees Fahrenheit, the range being 44- 55 degrees Fahrenheit.

Turbidity: Four "water clarity" observations were made along with the four temperatures taken at the above locations. The water clarity was described once as being "slightly turbid", once as being "almost crystal clear", and twice as "crystal clear."

Chemical or Nutrient Contamination: No data available.

HABITAT ACCESS

The stream report from 1974 reads, "The culvert under Highway 96 is a definite barrier to anadromous fish. It is on a steep gradient and has a falls at the lower end. However, approximately 100 yds. upstream from the pipe [the stream] cascades over boulders form[ing] a definite barrier to upstream migration."

HABITAT ELEMENTS

Substrate: The substrate is described as consisting "of rubble and small boulders." The actual sizes used to categorize these particles were not mentioned. A stream survey protocol used by the USFS at least as early as 1979 defined rubble to have a diameter between 2" and 1 foot. Also, "There is very little spawning area available because of the many waterfalls and steep gradient of the stream."

Large Woody Material: No data on the number and size of woody material was collected. Nevertheless, the absence of log jams was recorded.

Pool Frequency: "The pool-riffle ratio is 8:2." "The pools that were present were not wide or deep enough for larger fish but would probably be more beneficial as a nursery area for small fish."

Refugia: Three Creeks provides a diverse environment in which organisms can live but is not suitable for fish because of its' high gradient. The 1961 surveyors describe, "Near the mouth of the creek many aquatic insects and earth worms were found to inhabit the waters. The mouth itself was choked with aquatic plants which provided the habitat for the high productivity of the insects and worms."

CHANNEL CONDITIONS AND DYNAMICS

Width/Depth Ratio: Three Creeks' channel was never measured to determine channel type but probably would be classified as A(1-3). There is no bankfull width/depth ratio.

Streambank Condition: Three Creeks lies in a steep inland mountainous region. The vegetation consists of Douglas Fir, pine, oak, and thick underbrush and laurel trees grow with the former along the stream banks." This description by the 1961 surveyors paints a picture of a healthy and vegetated streambank. 1995 aerial photos perused by the Forest Service confirm that this vegetated state still exists. Additionally, the aerial photos show that Three Creeks has a very stable bank (indicated by lack of slides along the stream).

Floodplain Connectivity: Not applicable to this channel type.

FLOW/HYDROLOGY

Changes In Peak/Base Flows: No gauges on stream.

Increase In Drainage Network: There are 4.1 miles of insloped road in the Thomas/Aubrey subwatershed for 31.03 miles of stream (stream miles include miles of intermittent, perennial, and the Klamath River that fall within Thomas/Aubrey subwatershed). That's 13.20 miles of insloped road for every 100 miles of stream.

Watershed Conditions: (Thomas/Aubrey subwatershed)

Road Density and Location: There are 13.1 miles of road and 9.3 square miles of land in the Thomas/Aubrey subwatershed. The road density is 1.41 miles of road/square mile of subwatershed.

Disturbance History: The subwatershed has a ECA of 9.3%. Five acres of what is now Riparian Reserve has been subjected to past timber harvest. There are 2906 acres of Late Seral Old Growth (LSOG) or 49% in the Thomas/Aubrey subwatershed.

Riparian Reserves: Probably in good shape because of low road density and high percentage LSOG. No slides or erosion in RRs evident in aerial photos.

APPENDIX D - *EUI Defined*

INTRODUCTION

The Ecological Unit Inventory (EUI) used in the Ishi-Pishi/Ukonom Ecosystem Analysis provides information about the production capabilities, management opportunities, and limitations to land use. EUIs are developed by an interdisciplinary team and form the basis for land capability determinations for land management planning (*FSH 2090.11*, Ch. 3, p.2).

A primary function of EUI is to build a Forest-Wide GIS database that is compatible, coordinated, and ecological-based. A coordinated database is one where all data layers, i.e., bedrock geology, landform, soils, potential vegetation, and existing vegetation, use coincident lines. This is accomplished by an interdisciplinary team approach to mapping rather than each resource mapper working independently of each other and inputting into GIS their data layer separately. An ecological-based database consists of an integrated ecosystem classification system and mapping of ecological types that are nested within a National hierarchical framework of Ecological Units.

The EUI process is National in scope and directed by National guidelines. *Forest Service Handbook 2090.11*, Chapter 3, provides specific direction for conducting EUIs. This is Washington Office direction and must be used in conducting EUI by the Forest Service.

In January of 1992, Forest Service Region 5 developed a Draft Supplement to *FSH 2090.11* providing specific direction on mapping procedures, processes, and format. This direction was taken from the Natural Resources Conservation Service's *National Soils Handbook* and was formatted to fit the EUI concept of lithology, geomorphology, soil, and potential natural community, rather than just soils.

KNF PROCESS

The following description is for the basic mapping process currently occurring on the Klamath National Forest. This process has evolved since 1992 due to changing technology, Forest needs, and budgets.

The first step is to take existing Forest bedrock and geomorphology layers and coordinate them with the existing Order 3 soils layer; using paper maps. This final product now uses the computer's capability to display these layers on the monitor's screen and changes are made directly in GIS using ARC-INFO, thus eliminating numerous chances for line error.

The next step is for the vegetation mapper to take this information into the field and describe/map potential and existing vegetation. During this mapping process, changes to soil, bedrock geology, and landform can be made. The soil scientist also makes changes to the soil, bedrock geology, and landform boundaries. Currently, we do not have a geologist available to assist in this mapping process.

When the field mapping process is completed, the vegetation mapper and soil scientist agree on the final location of polygon boundaries and ecological types. The boundaries are finalized on 1:16,000 photos and transferred directly into GIS by digitizing the lines over digital orthophotos displayed on the computer screen.

A database is constructed that connects polygons to each of the mapped data elements, such as soils, bedrock, landform, potential vegetation, and existing vegetation.

Currently, the Forest's EUI program is mapping at Order 3 intensity using a 1:24,000 scale map base. The minimum ecological map unit polygon size is approximately twenty acres. Data analysis of four completed EUI mapping projects; Main Salmon, Lower South Fork, Callahan, and Ishi Pishi/Ukonom, show 71% of the coordinated EUI polygons were 100 acres or less in size and 29% were 101-500 acres.

To date, 460,000 acres have been mapped at the Order 3 intensity.

EUI existing vegetation mapping for the northwest portion of the Ishi-Pishi/Ukonom watershed on the Happy Camp Ranger District was performed in the following way: Vegetation polygons from the 1992 Browns/Aubrey mapping project were attributed with additional information (i.e., series, subseries, % hardwood canopy closure, hardwood size class, previous logging, etc.) that was not captured in the original mapping. The methods used to incorporate the additional information included aerial photo interpretation, ground knowledge recollection, stand record card analysis, and ground verification. In cases where more than one category of a new attribute existed in one polygon, the polygon was split into two or more polygons to accurately map the attribute.

INDIVIDUAL EUI DATA ELEMENTS

The following discussion will provide more information for each data layer of the EUI process:

Bedrock Geology - EUI uses the recently updated (1996) Forest bedrock geology database in GIS. Major lithologic boundaries are field verified when encountered and corrections made. Lithologic units less than twenty acres are not recognized unless they are strongly contrasting or are important for management interpretation.

Geomorphology - EUI uses a combination of the draft *A Classification System for Geomorphology* (March 1996) which is the Forest Service's standard, in conjunction with the Forest geomorphic type coding system. The EUI currently recognizes 17 geomorphic types.

Soil - The soil survey portion of the EUI process is guided by direction from the *National Soil Survey Handbook* (1996), *Soil Survey Manual* (1993), *Forest Service Handbook 2090.11* and numerous technical guidelines and support from the Natural Resources Conservation Service.

The EUI uses the existing Order 3 Soil Survey which was completed in the early 1980s and published in 1994. This survey was mapped at 1:60,000 and enlarged to 1:24,000 in GIS. During the EUI mapping process, soils are examined more closely in the field and refined where needed.

Comparing the existing soil survey and the EUI soil survey shows that the existing soil survey used 74 soil map units to describe the soils on the west side of the Forest (west of I-5). Currently, the updated EUI soil survey uses 378 soil map units to describe soils.

Comparing the polygon size frequency distribution, shows that the existing soil survey has 37% of its polygons between 0-100 acres compared to 60% for the EUI soil survey. Also, the existing soil survey has 19% of its polygons between 501 and >2,000 acres compared to less than seven percent for the EUI soil survey. This comparison clearly shows that the EUI soil survey is much more detailed and descriptive than the existing soil survey.

Potential Vegetation - Direction and guidance for the potential vegetation (PV) component of the EUI is provided by *Forest Service Manual 2060, Ecosystem Classification, Interpretation, and Application* (1991), *Forest Service Handbook 2090.11, Ecological Classification and Inventory Handbook* (1991), *Forest Inventory and Analysis User's Guide* (1997), and numerous plant association field guides as well as draft plant association guides.

The EUI process at the Order 3 mapping intensity maps potential vegetation to the subseries level, which is appropriate for the mapping scale currently used.

The polygon size frequency distribution shows 71% of the PV polygons are 100 acres or less in size, 17% are 101-200 acres, and 10% are 201-500 acres in size; mean polygon size is 104 acres.

Existing Vegetation - Direction and guidance for the existing vegetation component is provided by the R5 Supplement to *Forest Service Handbook 2090.11*. The existing vegetation component of the EUI was not an original part of the EUI process but was added when the users of EUI indicated that it was the most useful component of vegetation in making interpretations. The existing vegetation polygons are nested within the coordinated EUI polygons.

Comparing the EUI existing vegetation to the existing timber type existing vegetation shows that the timber type has three data identifiers; conifer/hardwood species, size class, and density class, while the EUI existing vegetation uses nine data identifiers; seral stage, conifer size class, hardwood size class, percent total vegetation cover, percent total tree cover, percent conifer cover, percent hardwood cover, primary species, and secondary species. *In addition, there are designators for the presence of pre-dominant conifers (>36" dbh), and vegetative disturbance; any type of harvest, fire + salvage or fire + no salvage, included in the seral stage coding.*

Comparing the polygon size frequency distribution shows 49% of the EUI existing vegetation polygons are 1-15 acres in size while 29% of the timber type polygons are 1-15 acres in size. Also, 81% of the EUI existing vegetation polygons are 1-40 acres in size, while 72% of the timber type polygons are 1-40 acres in size.

The mean polygon size for the timber type is 37 acres, and 26 acres for the EUI existing vegetation.

PEER REVIEW

The Forest's EUI Program was reviewed in 1995 as part of the Regional Office's quality control program. In attendance were Paul Johnson (acting Director for Minerals and Watershed Management), Rob Griffith (Regional Soil Scientist), Scott Miles (North Zone Soil Scientist), numerous ecologists, geologists, botanists, and other soil scientists from the Six Rivers, Shasta-Trinity, Mendocino, and Klamath National Forests.

The purpose of this Klamath Administrative Province Review was for the province EUI Teams to meet and share techniques, successes, and enhance the consistency and quality of EUI methods and products across the Province and Region.

WORK PLAN

Currently, the Klamath National Forest's EUI Program is operating under the guidance of a 1995 Landtype Ecological Unit Survey Work Plan for the Klamath National Forest Area.

Submitted: September 1997; TOM LAURENT, Soil Scientist, EUI Program Leader

Updated 5/98 by FEAT

APPENDIX E - *Fire and Fuels*

The following is a description of the components and the process involved in determining fire behavior potential and risk for the Ishi Pishi/Ukonom watershed analysis.

FUEL MODEL DEFINITIONS

The prediction of fire behavior is 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, shrubs, timber,** and **slash.** The differences in these groups are related to the fuel load and distribution of fuel among size classes. Size classes are: 0-1/4" (1 hour fuels), 1/4-1" (10 hour fuels), 1-3" (100 hour fuels), and 3" and greater (1,000 hour fuels).

A description of fuel models used in fire behavior as documented by Albini (1976) is in the following table:

FUEL MODEL Typical Fuel Complex	FUEL LOADING tons/acre				FUEL BED DEPTH in ft.
	1 Hr	10 Hr.	100 Hr.	Live	
GRASS AND GRASS-DOMINATED					
1-Short Grass (1 ft.)	0.74	0.00	0.00	0.00	1.0
2-Timber (Grass and Understory)	2.00	1.00	0.50	0.50	1.0
3-Tall Grass (2.5 ft.)	3.01	0.00	0.00	0.00	-
CHAPARRAL AND SHRUB FIELDS					
4-Chaparral (6 ft.)	5.01	4.01	2.00	5.01	6.0
5-Brush (2 ft.)	1.00	0.50	0.00	2.00	2.0
6-Dormant Shrub & Hdwd. Slash	1.50	2.50	2.00	0.00	2.5
7-Southern Rough	1.13	1.87	1.50	0.37	2.5
TIMBER LITTER					
8-Closed Timber Litter	1.50	1.00	2.50	0.00	0.2
9-Hardwood Litter	2.92	0.41	0.15	0.00	0.2
10-Timber (Litter and Understory)	3.01	2.00	5.01	2.00	1.0
SLASH					
11-Light Logging Slash	1.50	4.51	5.51	0.00	1.0
12-Medium Logging Slash	4.01	14.03	16.53	0.00	2.3
13-Heavy Logging Slash	7.01	23.04	28.05	0.00	3.0

The criteria for choosing a fuel model (Anderson 1982) includes the fact that fire burns in the fuel stratum best conditioned to support 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. Thirteen fire behavior predictive fuel models are used during the severe period of fire season when wildfire pose greater control problems and impacts on land resources.

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 continuous 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 eight miles 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.

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 three inches 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 three 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.

Fuel models identified and used in this analysis are in the following table:

ISHI PISHI/UKONOM FUEL MODELS

VEGETATION TYPE	SERAL STAGE 1/	FM@≤ 25% CROWN CLOSURE	FM@ 25-50% CROWN CLO-SURE	FM@>50-% CROWN CLO-SURE	BURNED & UNSAL-VAGED
Sub-alpine conifer	M/L/O1/	NON2/	8	10	N/A
Sub-alpine conifer	E/S/P1/	NON	14	5	N/A
True fir	M/L/O	5	8	10	12
True fir	E/S/P	5	5	6	6
Douplas fir/while fir	M/L/O	5	6	10	12
Douglas fir/while fir	E/S/P	5	6	6	6
While fir/hardwood	M/L/O	2	2	10	N/A
While fir/hardwood	E/S/P	2	5	6	N/A
Douglas fir	M/L/O	2	2	10	N/A
Douglas fir	E/S/P	5	6	6	N/A
Douglas fir/lanoak	M/L/O	6	6	10	12
Douglas fir/lanoak	E/S/P	5	6	6	6
Douglas lir/lanoak/live oak	M/L/O	5	6	10	N/A
Douglas fir/lanoak/live oak	E/S/P	5	5	6	N/A
Douglas fir/live oak	M/L/O	2	2	8	N/A
Douglas fir/live oak	E/S/P	5	5	6 on S&W Aspects, 5 on N&E Aspects	N/A
Jeffery pine	M/L/O	2	5	9	N/A
Jeffery pine	E/S/P	2	5	6	N/A
Meadow/Lake	E/S/P/M	14	N/A	N/A	N/A
Meadow/Lake	LAKE	NON	N/A	N/A	N/A
Riparian	M/L/O	14	8	10	N/A
Riparian	E/S/P	14	N/A	N/A	N/A

1/ E/S/P = Early/Sapling/Pole M/L/O = Mid/Late/Old-Growth
2/ NON = Nonflammable N/A=Not Applied

Fire Behavior Fuel Model 14 is virtually non-flammable due to wet conditions.

The percent of each fuel model identified in the watershed is shown in the following table:

FUEL MODEL	ACRES	PERCENT
2	1,476	1%
5	8,269	8%
6	23,901	23%
8	9,523	9%
9	186	<1%
10	55,798	53%
12	2,095	2%
14	3,431	3%
Nonflammable	469	<1%

WEATHER DATA

The following weather parameters were taken from the data collected from the Somes Bar weather station from 1973 through 1992. These parameters are representative of 90th percentile weather conditions.

FUEL MOISTURE	PERCENT

1 Hour	3
10 Hour	5
100 Hour	9
1000 Hour	11
Live Woody	80
Herbaceous	30
20 Foot Wind Speed = 10 MPH	

FIRE BEHAVIOR POTENTIAL

To determine Fire Behavior Potential Classes, 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 representative weather station was used to model late summer afternoons, typical of late July through early September.

Three slope classes are used, consistent with the slope classes used in the LMP geologic hazard classification (0-34%, 35-65%, and >65%). All fuel models were run through each of the three 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.

Fire behavior potential modeling is done in order to estimate the severity and resistance to control that can be expected, when a fire occurs during what is considered the worst case weather conditions. Late summer weather conditions are referred to as the 90th percentile weather data, which is a standard used when calculating fire behavior (90th percentile weather is defined as the severest 10% of the historical fire weather, i.e., hot, dry, windy conditions occurring on mid afternoons during the fire season). The modeling incorporates fuel condition, slope class, and 90th percentile weather conditions in calculating projections on flame lengths and rates of spread. A **low** rating indicates that fires can be attacked and controlled directly by ground crews building fireline and will be limited to burning in understory vegetation. A **moderate** rating indicates that hand built firelines alone would not be sufficient in controlling fires and that heavy equipment and retardant drops would be more effective. Areas rated as **high** represent the most hazardous conditions in which serious control problems would occur i.e., torching, crowning, and spotting, control lines are established well in advance of flaming fronts with heavy equipment and backfiring may be necessary to widen control lines.

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, typical response times, terrain, fuels, and available forces, a Low rating had to have a ROS <30 chains per hour, for containment to be accomplished during initial attack.

FIRE BEHAVIOR POTENTIAL CLASSES

Low- Flame lengths <4' and ROS <30chs/hr
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 retardant 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.

FUEL MODEL DATA TABLE

Fuel Model	Aspect	1 HR	Wind	R25	R55	R75	F25	F55	F75	H@25	H@55	H@75
2	S&W	2	4	50	74	100	8	10	11	High	High	High
2	E	3	4	45	66	90	8	9	10	High	High	High
2	N	4	4	*41	60	82	7	8	10	High	High	High
5	S&W	2	4	30	42	56	7	9	10	Mod	High	High
5	E	3	4	28	40	53	7	8	9	Mod	High	High
5	N	4	4	27	38	51	7	8	9	Mod	High	High
6	S&W	2	4	43	61	81	8	9	10	High	High	High
6	E	3	4	*39	55	72	7	8	9	High	High	High
6	N	4	4	*35	49	65	7	8	9	High	High	High
8	S&W	2	3	2	3	4	1	1	2	Low	Low	Low
8	E	3	3	2	3	4	1	1	2	Low	Low	Low
8	N	4	3	2	3	4	1	1	1	Low	Low	Low
9	S&W	2	3	8	13	18	3	4	5	Low	Mod	Mod
9	E	3	3	7	11	16	3	4	4	Low	Mod	Mod
9	N	4	3	6	10	14	3	3	4	Low	Low	Mod
10	S&W	2	2	5	10	16	5	6	7	Mod	Mod	**High
10	E	3	2	5	10	15	4	6	7	Mod	Mod	**High

Fuel Model	Aspect	1 HR	Wind	R25	R55	R75	F25	F55	F75	H@25	H@55	H@75
10	N	5	2	5	9	13	4	5	6	Mod	Mod	**High
12	S&W	2	4	17	25	33	10	12	14	High	High	High
12	E	3	4	16	23	30	9	11	13	High	High	High
12	N	4	4	14	21	28	9	10	12	High	High	High
14	S&W	10	3	3	N/A	N/A		N/A	N/A	Low	Low	Low
14	E	12	3	3	N/A	N/A		N/A	N/A	Low	Low	Low
14	N	14	3	3	N/A	N/A		N/A	N/A	Low	Low	Low

* Fire behavior potential is based on rate of spread rather than flame length.
** Enhanced fire behavior potential (slope >60% and crown closure >70%).

INITIAL ATTACK ACCESS
Another consideration when determining fire behavior potential is the ability of initial attack fire suppression forces to successfully contain a fire that can be quickly accessed.

The initial attack fire suppression forces used for this analysis were:

Two Model 42 Engines/Crew
One 5-Person Handcrew
One Type 3 Helicopter/Bucket
One Type 1 Airtanker

Based on the flame lengths and rates of spread modeled at the 90th percentile weather and the line building capabilities of the initial attack fire suppression forces, it was determined that fires with <8' flame length and a rate of spread <30 chains per hour could be contained, if they originated within 1/4 mile of a road.

This is the crosswalk from fuel models to fire behavior potential taking into account initial attack fire suppression capabilities. Within 1/4 mile from a road, fire suppression will be credited for lowering fire behavior potential from a moderate rating to a low rating. In areas where fuels and topography indicate a high rating, the rating will stay as high. Areas identified as low will stay low. The only areas that will change are those with moderate fire behavior potential where the rate of spread is lower than the line building capabilities of the initial attack forces and are within 1/4 mile of a road.

FUEL MODEL	FIRE BEHAVIOR POTENTIAL	FIRE BEHAVIOR POTENTIAL WITHIN 1/4 MILE OF A ROAD
2	High	
5	Mod on Slopes ≤ 35%	Low on Slopes ≤ 35%
5	High on Slopes > 35%	
6	High	
8	Low	
9	Mod on S,W&E Aspects, with >65% Slope	Low on S,W&E Aspects, with >65% Slope
9	Low on S,W&E Aspects , with <65% Slope	
9	Low on N Aspects	
10	High on S&W Aspects with >65% Slope	Low on all Aspects with <65% Slope and <70% Crown Closure
10	High on N&E Aspects with >65% Slope and >70% Crown Closure	
10	Mod on all Aspects with <65% Slope	
10	Mod on N&E Aspects with <65% Slope and <70% Crown Closure	
12	High	
14	Low	

Using this crosswalk, the fire behavior potential ratings have been changed. These are the new acres associated with each Fire Behavior Potential class in the watershed, taking into account fire suppression capabilities.

High- 41,698 acres (40% of the analysis area)
Moderate- 48,013 acres (45% of the analysis area)
Low- 15,439 acres (15% of the analysis area)

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 the watershed. Many year-round residences, industrial endeavors, many dispersed camp sites, recreational use, and travel corridors all contribute to the possibility of a wildfire occurrence from human causes.

The greatest risk of fire starts is from the occurrence of lightning. Thunder storms are common throughout the summer months in and near the watershed. Lightning, erratic winds and usually precipitation accompany these storms, the latter which limits the actual number of ignitions.

The Klamath National Forest fire history data base indicates that within the watershed boundary 501 fire starts have occurred during the period from 1922-1994. 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 mathematical 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 (501).
y = Period of time covered by the data base (for this analysis, 72 years).
z = Number of acres analyzed (displayed in thousands 105,000 = 105.0).

$\{(x/y)10\}/z$ = Risk rating

$\{(501/72)10\}/105 = 0.66$

The value derived corresponds to a likelihood of fire starts per 1,000 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 rating of 0.66 falls into a moderate risk. This rating indicates that the average number of fire starts for this watershed are .66 per 1,000 acres per decade, or 69 fires per decade, or an average of seven fires per year.

APPENDIX F - *Endangered Species Act and Other Species Considerations Questions and Answers*

As requested by the U. S. Fish and Wildlife service, 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.

Northern Spotted Owl

1. Are spotted owl activity centers located within the watershed? Yes; 28 activity centers.

1a. If so, how many and in what ROD land allocations are they located? Of the 28 activity centers, 19 are located in LSRs, 2 are located in the Katimin cultural area, 4 are located in riparian reserves, 1 in partial retention and 2 in general forest.

1b. Which of these are currently above take thresholds and which are below? Activity centers KL-58, KL-61, KL-82, KL-230, KL-305, KL-307, KL-308, KL-1072, KL-4059, KL-4060, and KL-4080 are below the take threshold.

1c. When were the activity centers located? Refer to table below under the "History" column.

1d. Describe the reproductive history.

Activity Center	Acres in 0.7 Mile Circle	Acres in 1.3 Mile Circle	History (Since 1980; # of years surveyed varies) P=Presence (1 adult)/O=Pair Status/ R=Reproduct
			Information unavailable at time of printing.
KL-58*	368	1,053	"
KL-61	241	743	"
KL-79*	526	1,795	"
KL-82*	349	1,012	"
KL-230*	545	1,279	"
KL-305	379	1,270	"
KL-307	256	880	"
KL-308	125	833	"
KL-1070	815	2,723	"
KL-1071	544	1,897	"
KL-1072	625	1,269	"
KL-1073	479	1,745	"
KL-1074	439	1,382	"
KL-1075	378	1,620	"
KL-1076	446	1,640	"
KL-1077	405	1,448	"
KL-1088	351	1,537	"
KL-1089	461	1,413	"
KL-1250	527	1,589	"
KL-1260	656	1,866	"
KL-1264*	459	1,579	"
KL-4059*	324	1,220	"
KL-4060*	357	943	"
KL-4062*	498	1,723	"
KL-4063	515	1,766	"
KL-4078	428	1,560	Information unavailable at time of printing.
KL-4080*	404	1,118	"
KL-4224*	706	1,713	"

* indicates a spotted owl activity center with a portion of the area outside of the analysis area. Acreage figures are for the portion of the activity center within the analysis area only.

2. Has a 100 acre core area seen designation around each activity center located in matrix lands? Yes.

3. How many acres of nesting, roosting, and foraging (NRF) habitat are there in the watershed? There are 46,632 acres of nesting/roosting habitat and 29,723 acres of foraging habitat in the watershed.

3a. What percentage of the watershed is this? Nesting/roosting = 44%; Foraging = 28%

3b. Which of these stands have been surveyed to protocol (two years)? 3c. Which were not? Information unavailable at time of printing.

4. What is the amount of NRF habitat in each ROD land allocation within the watershed? See Table 5-5-15 and 5-16, Spotted Owl Habitat Acreage, for each respective District, contained in Step 5 of this document.

5. Does any portion of the watershed contain LSRs? Yes, it contains a portion of the Ten Bear LSR, the Flint Valley LSR, and the Dillon LSR.

5a. What percent of the total watershed is this? It is 43,421 acres which is 41% of the watershed.

5b. What are the current totals of NRF habitat and capable habitat in the LSR?

LSR	
Nesting/Roosting	23,342 Ac.
Foraging	8,486 Ac.
Capable	37,979 Ac.

6. What is the amount of dispersal habitat (11-40 and above) in each ROD land allocation within the watershed? See Tables 5-15 and 5-16, Spotted Owl Habitat Acreage, for each respective District, contained in Step 5 of this document.

7. Is distance between LSRs (those over 10,000 acres) greater than four miles?
7a. If so, then what is the amount of dispersal habitat on Federal lands for all 1/4 townships between the LSRs?
7b. What % of the total Federal lands in these 1/4 townships is this?
7c. 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?
7d. Is this total greater than 50%?
7e. Describe, if present, the natural barriers to dispersal.
7f. Is connectivity, or dispersal habitat, sufficient to allow movement? **See the late-successional habitat and connectivity section of the document for a discussion of dispersal habitat and connectivity for spotted owls.**

8. How much critical habitat has been designated within the watershed? 33,170 acres.

8a. How much of this total overlaps with LSRs? 28,700 acres.

8b. For areas that do not overlap, how much is currently NRF habitat? And how much is capable? Nesting/roosting = <> acres, foraging = <> acres, and capable = <> acres. (Information unavailable at time of printing.)

8c. How many activity centers are located in this non-overlap area of CHU? <> Information unavailable at time of printing.

8d. How many are currently above take? How many below (use acres established by FWS for .7 and 1.3 mile radius)? Information unavailable at time of printing.

8e. What role does this non-overlap critical habitat play in this watershed in relation to the reasons for the designation of the CHU? Information unavailable at time of printing.

Bald Eagle

For a discussion of bald eagle use of the watershed, see the Terrestrial Wildlife section of the document.

1. Are occupied bald eagle activity areas (nesting, foraging, winter roosts, or concentration areas) located within the watershed?
1a. If so, what type?
1b. How many?
1c. What ROD land allocations are they located?
1d. Describe reproductive history based on monitoring data.
1e. Has a final site-specific protection/management assessment been developed for each site?
1f. 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?
2a. If so, what type?
2b. How many?
2c. What ROD land allocations are they located?
2d. 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)?
4a. Does the watershed and the surrounding area meet objectives of the Recovery Plan?
4b. If not, then are there capable eagle activity areas located within the watershed?
4c. If capable activity areas are present, what type are they? 1). How many? 2). What ROD land allocations are they located?
4d. 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? Yes, Del Norte salamanders were surveyed for.

1a. What species does the literature suggest may be present in the watershed? Rough-skinned newt, long-toed salamander, Pacific giant salamander, black salamander, ensatina, Del Norte salamander, Siskiyou Mountain salamander, tailed frog, foothill yellow-legged frog, Cascades frog, western toad, and Pacific tree frog.

2. Are sensitive species and ROD Table C-3 species present or possibly occur? Del Norte salamander and possibly Siskiyou Mountain salamander.

3. Have intensive or extensive inventories been conducted in adjoining drainages/sub-watersheds?

3a. If so, can those inventories be extrapolated to this watershed? Del Nortes have also been found in 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)? Bullfrogs.

Peregrine Falcon

1. Are any cliffs located within the watershed (rock wall >50 feet)? Yes.

2. Are any cliffs present that are historic (pre-1975) or traditional (post-1975) peregrine eyries? Traditional - Somes Bar and Rock Creek

3. For past projects near historic cliffs, have mitigation measures for habitat been considered?

3a. At these historic cliffs, have surveys to protocol (Pagel 1992) been accomplished for at least two years prior to the activities? N/A

4. For traditional cliffs, have surveys/monitoring been conducted to determine nest site occupancy and reproductive status? Yes.

4a. Has a draft or final site management plan been created? 1). 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 unrated, have surveys been accomplished to protocol? No.

7. Describe site habitat variables within a three mile radius of historic and traditional nest sites (cliff parent material, distance to water/riparian, vegetative habitat, seral stages, human activities).

Marbled Murrelet (Zone 1 & 2)

The Ishi-Pishi/Ukonom Analysis Area is bisected by the line between Marbled Murrelet Zones 1 and 2.

1. Are occupied sites within the watershed? None have been identified to date.

2. Has a 0.5 mile radius management area been delineated for each site? N/A

3. Within this management area, what stands are currently murrelet habitat? Late-seral and old-growth stands with 40% conifer cover and primary conifer species of Douglas-fir or ponderosa pine.

3a. What stands are recruitment habitat (capable of becoming suitable within 25 years; see ROD description)? Mid-mature stands with 40% conifer cover and primary conifer species of Douglas-fir or ponderosa pine.

3b. What stands are non-habitat? True fir stands at any seral stage, all other stands in shrub, pole, early-mature, and mid-mature seral stages.

4. Do stands of potential habitat exist in the watershed? Yes.

3a. Describe habitat (acres, quality, quantity, spatial relationship to nearby habitat).
See the Marbled Murrelet discussion and habitat maps in the document.

3b. Describe past surveys.

3c. What stands of habitat have not been surveyed? N/A

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? There is recruitment habitat in the analysis area in all seral stages. Based on historic amounts of old-growth and LMP land designations the amount of suitable habitat should range from 45-60% of the watershed.

APPENDIX G - *Numerical Listing of Roads and Their Status*

Forest Road	Name	Length (mi.)	Mtc. Level	Lanes	Surface Class	Template	Closure	Average Daily Traffic	Highway Safety	Primary User	Existing Mgmt. Strategy
11N01	NATUKET	0.40	2	S	NAT	O	N	H	N	T	A
11N01A	NATUKET	1.20	2	S	NAT	O	N	H	N	T	A
12N02	WOOLEY VIEW	1.70	2	S	PITRUN	O	Y	L	N	T	P
12N03	STATE SPUR	0.60	I	S	NAT	O	Y	L	N	T	P
12N03	STATE SPUR	0.80	I	S	AGG	O	Y	L	N	T	P
12N04	GO REY	1.00	1	S	NAT	O	Y	L	N	T	P
12N05	HAYPRESS	3.30	1	S	NAT	O	Y	L	N	T	P
12N06	OLD SHANTY	2.80	2	S	NAT	O	N	H	N	T	A
12N07	MERRILL CREEK	4.10	2	S	NAT	O	Y	H	N	T	P
12N08	IRVING GATES CREEK	4.30	1	S	AGG	O	Y	L	N	T	P
12N08A	IRVING GATES CREEK	0.90	1	S	AGG	O	Y	L	N	T	P
12N08B	IRVING GATES CREEK	0.30	1	S	AGG	O	Y	L	N	T	P
12N09	MERRILL MOUNTAIN	4.10	2	S	NAT	O	Y	H	N	T	A
12N09A	MERRILL MOUNTAIN	0.80	2	S	NAT	O	Y	H	N	T	A
12N11	UKONOM ADMIN SITE	1.00	4	S	PAV	C	N	VH	Y	T	E
12N12	BULL	1.60	2	S	PITRUN	O	N	H	N	T	A
12N12K	BULL	0.40	2	S	NAT	O	N	H	N	T	A
12N13	BULL PINE	3.10	2	S	NAT	O	Y	L	N	T	P
12N13	BULL PINE	3.60	2	S	PITRUN	O	N	H	N	T	A
12N13	BULL PINE	3.60	2	S	PITRUN	O	N	H	N	T	A
12N13N	BULL PINE	0.20	1	S	NAT	O	Y	L	N	T	P
12N13Y	EAST BULL PINE	0.50	1	S	NAT	O	Y	L	N	T	P
12N14	LEACH	0.50	2	S	NAT	O	N	H	N	T	A
12N15	BARKSHANTY GULCH	2.20	2	S	NAT	O	S	H	N	T	A
12N16	SIX PACK	0.40	1	S	PITRUN	O	Y	L	N	T	P
12N16A	SIX PACK	0.20	1	S	PITRUN	O	Y	L	N	T	P
12N17	GREEN BEAN	6.70	2	S	PITRUN	O	S	H	N	T	A
12N17C	GREEN BEAN	1.30	1	S	NAT	O	Y	L	N	T	P
12N17D	GREEN BEAN	0.60	2	S	NAT	O	S	H	N	T	A
12N18	HOMESTEAD	0.70	2	S	NAT	O	N	H	N	T	A
12N19	REYNOLDS	7.70	1	S	NAT	O	Y	L	N	T	P
12N19E	REYNOLDS	0.70	1	S	NAT	O	Y	L	N	T	P
12N19F	REYNOLDS	0.60	1	S	NAT	O	Y	L	N	T	P
12N20	OFFIELD L.O.	0.50	1	S	NAT	O	Y	L	N	T	P
12N20	OFFIELD L.O.	0.50	1	S	NAT	O	Y	L	N	T	P
12N21	OFFIELD LOOP	0.70	1	S	NAT	O	Y	L	N	T	P
12N22	BEANS CAMP	3.00	2	S	NAT	O	N	H	N	T	A
12N22A	BEANS CAMP	1.00	2	S	NAT	O	N	H	N	T	A
12N22B	BEANS CAMP	0.40	2	S	NAT	O	N	L	N	T	A
12N23	CORRAL	1.00	2	S	NAT	O	N	H	N	T	A
12N24	CAMP OUT	1.00	1	S	PITRUN	O	N	L	N	T	D
12N24A	CAMP OUT	0.30	1	S	PITRUN	O	N	L	N	T	D
12N25	BEANY	0.70	2	S	NAT	O	S	H	N	T	A
12N25A	BEANY	0.00		S	NAT	O	S	H	N	T	
12N26	FLATLANDER	0.40	1	S	NAT	O	Y	H	N	T	P
12N26A	FLATLANDER	0.50	1	S	NAT	O	Y	H	N	T	P
12N27	AZALEA BEANS	0.80	2	S	NAT	O	N	H	N	T	A
12N29	BALD BUTTE	3.90	1	S	PITRUN	O	Y	L	N	T	P
12N29A	BALD BUTTE	1.30	1	S	AGG	O	Y	L	N	T	P
12N30	LITTLE BULL	1.00	2	S	PITRUN	O	N	H	N	T	A
12N30A	LITTLE BULL	0.40	1	S	NAT	O	N	L	N	T	A
12N31	BARK	0.30	2	S	NAT	O	S	H	N	T	A
12N31A	BARK	0.30	2	S	NAT	O	S	H	N	T	A
12N32	WEST CAMP THREE	0.50	1	S	NAT	O	N	L	N	T	A
12N32A	WEST CAMP THREE	0.20	1	S	NAT	O	N	L	N	T	A
12N33	BULLSHIP	1.10	1	S	NAT	O	Y	L	N	T	P
12N33B	BULLSHIP	0.20	1	S	NAT	O	Y	L	N	T	P
12N34	GREEN RIFFLE R.A.	0.40	3	S	PITRUN	I	N	H	Y	R	E
12N36	SHANTY	0.00		S	NAT	O	Y	L	N	T	P
12N39	MAPLE BEANS	0.70	2	S	NAT	O	N	H	N	T	A
12N39A	MAPLE BEANS	0.20	2	S	NAT	O	N	H	N	T	A
12N40	LITE	0.30	2	S	NAT	O	N	H	N	T	A

Forest Road	Name	Length (mi.)	Mtc. Level	Lanes	Surface Class	Template	Closure	Average Daily Traffic	Highway Safety	Primary User	Existing Mgmt. Strategy
12N41	MERRILL MTN LOOP	1.00	2	S	NAT	O	Y	H	N	T	P
12N43	VIEW-IT	1.10	1	S	NAT	O	Y	L	N	T	P
12N44	ROGER DAVIS	0.80	1	S	NAT	O	Y	L	N	T	P
12N46	MERRILL OFF	1.30	2	S	PITRUN	O	N	H	N	T	A
12N47	GATES CREEK	1.10	1	S	PITRUN	O	Y	L	N	T	P
12N47A	GATES CREEK	1.50	1	S	PITRUN	O	Y	L	N	T	P
12N48	DURAL	3.12	1	S	PITRUN	O	Y	L	N	T	P
12N52	ROGERS CREEK	6.20	3	S	PITRUN	I	N	VH	Y	T	E
12N53	REYNOLDS RIDGE	3.40	1	S	NAT	O	Y	L	N	T	P
12N53A	REYNOLDS RIDGE	0.40	1	S	NAT	O	Y	L	N	T	P
12N53B	REYNOLDS RIDGE	0.60	1	S	NAT	O	Y	L	N	T	P
12N53D	REYNOLDS RIDGE	1.00	1	S	NAT	O	Y	L	N	T	P
12N54	BARK SHANTY CAMPTIE	1.00	1	S	NAT	O	Y	L	N	T	P
12N55	BARK SHANTY RIDGE	1.70	2	S	PITRUN	I	S	H	Y	T	E
12N55	BARK SHANTY RIDGE	2.50	2	S	NAT	I	S	H	Y	T	E
12N55A	BARK SHANTY RIDGE	0.90	2	S	NAT	O	S	H	N	T	A
12N55C	BARK SHANTY RIDGE	0.60	2	S	NAT	O	S	H	N	T	A
12N56	GO LOOP	1.10	2	S	NAT	O	N	H	N	T	A
13N01	UPPER CUB	1.10	2	S	PITRUN	O	S	H	N	T	A
13N02	LOOKOUT	11.70	2	S	NAT	O	S	H	N	T	A
13N03	CAMP FOUR	2.00	1	S	NAT	O	Y	L	N	T	P
13N03	CAMP FOUR	3.10	1	S	NAT	O	Y	L	N	T	P
13N03A	CAMP FOUR	0.70	1	S	NAT	O	Y	L	N	T	P
13N05	HELLS MEADOW	4.10	1	S	AGG	O	Y	L	N	T	P
13N05A	HELLS MEADOW	0.40	1	S	NAT	O	Y	L	N	T	P
13N06	TI CREEK	6.00	1	S	NAT	O	Y	L	N	T	P
13N06A	TI CREEK	1.30	1	S	NAT	O	Y	L	N	T	P
13N06B	TI CREEK	0.50	1	S	NAT	O	Y	L	N	T	P
13N06E	TI CREEK	1.20	1	S	NAT	O	Y	L	N	T	P
13N06Y	NORTH TI CREEK	2.50	1	S	NAT	O	Y	L	N	T	P
13N07	KAROO	2.10	1	S	PITRUN	O	Y	L	N	T	P
1333N07A	KAROO	0.70	1	S	NAT	O	Y	L	N	T	P
13N08	UKONOM MOUNTAIN	4.40	3	S	NAT	I	S	H	Y	T	P
13N08A	UKONOM MOUNTAIN	0.20	1	S	NAT	O	Y	L	N	T	P
13N08B	UKONOM MOUNTAIN	0.50	1	S	NAT	O	Y	L	N	T	P
13N08C	UKONOM MOUNTAIN	0.20	1	S	NAT	O	Y	L	N	T	P
13N08D	UKONOM MOUNTAIN	0.30	1	S	NAT	O	Y	L	N	T	P
13N08E	UKONOM MOUNTAIN	0.40	1	S	NAT	O	Y	L	N	T	P
13N08G	UKONOM MOUNTAIN	0.30	1	S	NAT	O	Y	L	N	T	P
13N08H	UKONOM MOUNTAIN	0.30	1	S	NAT	O	Y	L	N	T	P
13N09	MIDDLE TI	4.00	1	S	PITRUN	O	Y	L	N	T	P
13N09A	MIDDLE TI	0.30	1	S	PITRUN	O	Y	L	N	T	P
13N10	SANDY BAR LOOP	4.20	1	S	PITRUN	O	Y	L	N	T	P
13N11	SANDY BAR	3.90	4	S	CHP	C	N	VH	Y	T	E
13N11	SANDY BAR	12.50	3	S	AGG	I	N	H	Y	T	E
13N11B	SANDY BAR	0.70	1	S	NAT	O	Y	L	N	T	P
13N11D	SANDY BAR	0.40	1	S	NAT	O	S	L	N	T	P
13N11F	SANDY BAR	0.30	1	S	NAT	O	S	L	N	T	P
13N11J	SANDY BAR	0.40	1	S	NAT	O	S	L	N	T	P
13N12	STANSHAW	3.20	3	S	AGG	I	N	VH	Y	T	E
13N12	STANSHAW	4.10	2	S	NAT	O	S	H	Y	T	A
13N12	STANSHAW	4.10	2	S	NAT	O	S	H	Y	T	A
13N12A	STANSHAW	1.10	1	S	NAT	O	Y	L	N	T	P
13N12B	STANSHAW	0.90	1	S	AGG	O	N	L	N	T	A
13N12D	STANSHAW	0.60	1	S	NAT	O	Y	L	N	T	P
13N12E	STANSHAW	0.50	1	S	NAT	O	Y	L	N	T	P
13N13	ROCK SHANTY	0.40	4	S	PAV	I	N	H	Y	T	E
13N13	ROCK SHANTY	14.80	3	S	NAT	I	N	H	Y	T	E
13N13A	ROCK SHANTY	1.50	1	S	NAT	O	Y	L	N	T	P
13N14	TENEYEK	5.20	2	S	PITRUN	O	N	H	N	T	A
13N14A	TENEYEK	0.40	1	S	NAT	O	Y	L	N	T	A
13N14A	TENEYEK	0.80	1	S	PITRUN	O	Y	L	N	T	A
13N14B	TENEYEK	0.50	1	S	NAT	O	N	L	N	T	A
13N14D	TENEYEK	0.50	1	S	NAT	O	N	L	N	T	A
13N14Y	TENWART	1.80	1	S	NAT	O	Y	L	N	T	P
13N14YA	TENWART	0.70	1	S	NAT	O	Y	L	N	T	P
13N15	LOWER TEN BEAR	2.80	1	S	NAT	O	Y	L	N	T	P
13N15A	LOWER TEN BEAR	0.30	1	S	NAT	O	Y	L	N	T	P
13N16	CEDAR RIDGE	3.00	2	S	NAT	O	S	H	N	T	A
13N18	OOGAROMTOK	1.70	3	S	PITRUN	I	N	H	Y	T	E

Forest Road	Name	Length (mi.)	Mtc. Level	Lanes	Surface Class	Template	Closure	Average Daily Traffic	Highway Safety	Primary User	Existing Mgmt. Strategy
13N18	OOGAROMTOK	10.40	3	S	NAT	I	N	H	Y	T	E
13N18	OOGAROMTOK	10.40	3	S	NAT	I	N	H	Y	T	E
13N18A	OOGAROMTOK	0.40	1	S	NAT	O	Y	L	N	T	P
13N18C	OOGAROMTOK	2.00	1	S	NAT	O	Y	L	N	T	P
13N19	BALDWIN PARK	3.50	2	S	NAT	O	S	H	N	T	A
13N19A	BALDWIN PARK	0.10	1	S	NAT	O	S	L	N	T	A
13N20	JEEP RIDGE	2.90	1	S	NAT	O	Y	L	N	T	P
13N20A	JEEP RIDGE	0.20	1	S	NAT	O	Y	L	N	T	P
13N20A	JEEP RIDGE	0.20	1	S	PITRUN	O	Y	L	N	T	P
13N20C	JEEP RIDGE	0.40	1	S	PITRUN	O	Y	L	N	T	P
13N20C	JEEP RIDGE	0.60	1	S	NAT	O	Y	L	N	T	P
13N21	AZALEA DRIVE	1.20	1	S	NAT	O	Y	L	N	T	P
13N22	POO BEAR	1.00	1	S	AGG	O	Y	L	N	T	P
13N22	HELLS BELLS	2.60	1	S	PITRUN	O	Y	L	N	T	P
13N24	NORTH ROCK CREEK	2.50	2	S	PITRUN	O	S	H	N	T	A
13N25	TI TIE	1.00	1	S	NAT	O	Y	L	N	T	P
13N26	LIGHTNING RIDGE	3.66	1	S	NAT	O	Y	L	N	T	P
13N26A	LIGHTNING RIDGE	2.60	1	S	NAT	O	Y	L	N	T	P
13N27	EYESE SANDY	0.30	2	S	AGG	O	N	H	N	T	A
13N27A	EYESE SANDY	0.20	2	S	AGG	O	N	H	N	T	A
13N28	STONER	0.40	2	S	NAT	O	N	H	N	T	A
13N29	OLD TI BAR GS	0.30	2	S	AGG	O	N	H	N	T	A
13N30	PERSIDO BAR R. A.	0.30	3	S	NAT	I	N	H	Y	T	E
13N32	IRVING CREEK	4.10	1	S	AGG	O	Y	L	N	T	P
13N32A	IRVING CREEK	0.40	1	S	AGG	O	Y	L	N	T	P
13N33	CABBAGE HEAD	1.50	1	S	NAT	O	Y	L	N	T	P
13N34	SOUTH FROGGER	1.20	1	S	NAT	O	N	L	N	T	A
13N34Y	LITE BEANS	0.00		S	NAT	O	N	L	N	T	D
13N35	SOLDIER	6.40	3	S	PITRUN	I	N	H	Y	T	E
13N35C	SOLDIER	060	2	S	NAT	O	N	H	N	T	A
13N37	DILLON MILL	2.80	1	S	NAT	O	S	L	N	T	A
13N39	EYESE BAR	1.80	1	S	NAT	O	Y	L	N	T	P
13N40	TI POT	0.80	2	S	PITRUN	O	Y	H	N	T	D
13N40	TI POT	1.50	2	S	NAT	O	Y	H	N	T	D
13N43	TI LOOP	1.10	1	S	NAT	O	Y	L	N	T	P
13N44	EYESE	4.10	2	S	PITRUN	O	N	VH	N	T	A
13N44	EYESE	4.10	2	S	PITRUN	O	N	VH	N	T	A
13N44E	EYESE	0.50	1	S	NAT	O	Y	L	N	T	P
13N45	TEN BEAR TRAIL	0.80	2	S	NAT	O	S	H	N	T	A
13N45A	TEN BEAR TRAIL	0.50	2	S	NAT	O	S	H	N	T	A
13N47	BALDWIN ROCK	1.90	2	S	NAT	O	S	H	N	T	A
13N48	REROCK	3.50	2	S	NAT	O	N	H	N	T	A
13N51	SALAL	3.80	1	S	NAT	O	Y	L	N	T	P
13N51A	SALAL	0.60	1	S	NAT	O	Y	L	N	T	P
13N51B	SALAL	0.40	1	S	NAT	O	Y	L	N	T	P
13N51C	SALAL	0.50	1	S	NAT	O	Y	L	N	T	P
13N51D	SALAL	0.90	1	S	NAT	O	Y	L	N	T	P
13N51Y	SANDYSHAW	1.10	1	S	NAT	O	Y	L	N	T	P
13N52	POTSE	0.40	1	S	PITRUN	O	Y	L	N	T	P
13N53	EAST DILLON	0.52	2	S	NAT	O	S	H	N	T	A
13N54	ROCKER	1.70	2	S	NAT	O	N	H	N	T	A
13N54A	ROCKER	0.70	1	S	NAT	O	N	L	N	T	A
13N54B	ROCKER	1.20	1	S	NAT	O	N	L	N	T	A
14N01	TEN BEAR	10.20	4	S	PAV	C	N	VH	Y	T	E
14N01A	TEN BEAR	0.50	1	S	PITRUN	O	Y	L	N	T	P
14N01B	TEN BEAR	0.70	1	S	PITRUN	O	Y	L	N	T	P
14N01C	TEN BEAR	0.40	1	S	NAT	O	Y	L	N	T	P
14N01E	TEN BEAR	0.70	1	S	NAT	O	Y	L	N	T	P
14N01F	TEN BEAR	0.80	1	S	NAT	O	N	L	N	T	A
14N01G	TEN BEAR	0.40	1	S	NAT	O	Y	L	N	T	P
14N05	KINGS RIDGE	3.50	2	S	NAT	O	S	H	N	T	A
14NO8	KENNEDY FLATS	1.60	2	S	PITRUN	O	N	H	N	T	A
14N08A	KENNEDY FLATS	0.80	2	S	NAT	O	N	H	N	T	A
14N11	ALPHUS	0.00	2	S	NAT	O	N	H	N	T	A
14N12	CUB CREEK	1.20	1	S	PITRUN	O	Y	L	N	T	P
14N14	CARTER	3.20	2	S	PITRUN	O	N	H	N	T	A
14N15	DELAHAYE	0.50	1	S	PITRUN	O	Y	L	N	T	P
14N15A	DELAHAYE	0.20	1	S	NAT	O	Y	L	N	T	P
14N16	BURNS	1.10	1	S	NAT	O	Y	L	N	T	P
14N17	CEDAR CAMP	3.95	2	S	PITRUN	O	S	L	N	T	A

Forest Road	Name	Length (mi.)	Mtc. Level	Lanes	Surface Class	Template	Closure	Average Daily Traffic	Highway Safety	Primary User	Existing Mgmt. Strategy
14N21	DILLON	2.50	1	S	PRIM	O	N	L	N	T	A
14N21	DILLON	5.30	3	S	PITRUN	O	S	VH	N	T	E
14N21	DILLON	8 80	2	S	NAT	O	N	H	Y	T	A
14N21D	DILLON	0.80	2	S	NAT	O	S	H	N	T	A
14N21E	DILLON	1.10	1	S	NAT	O	Y	L	N	T	P
14N22	GRAND SLAM	1.60	2	S	NAT	O	S	H	N	T	A
14N27	COON LOOP	2.40	2	S	NAT	O	S	H	N	T	A
14N39	PONY PEAK	1.50	2	S	PITRUN	O	Y	L	N	T	P
14N39	PONY PEAK	7.80	2	S	NAT	O	Y	L	N	T	P
14N63	CUB POO	0.30	1	S	PITRUN	O	Y	L	N	T	P
14N63A	CUB POO	0.30	1	S	NAT	O	Y	L	N	T	P
14N69	SIDEWINDER	1.90	4	S	PAV	C	S	VH	Y	T	E
15N17	CAMP THREE	0.50	3	S	CHP	C	N	VH	Y	T	E
15N17	CAMP THREE	5.70	2	S	NAT	O	N	H	N	T	A
15N17	CAMP THREE	6.90	4	S	PAV	C	N	VH	Y	T	E
15N17	CAMP THREE	13.10	3	S	AGG	I	N	VH	Y	T	E
15N17C	CAMP THREE	0.80	2	S	PITRUN	O	N	H	N	T	A
15N17D	CAMP THREE	0.90	1	S	NAT	O	Y	L	N	T	P
15N17E	CAMP THREE	1.60	2	S	NAT	O	N	H	Y	T	A
15N17G	CAMP THREE	0.20	2	S	NAT	O	N	H	N	T	A
15N17H	CAMP THREE	0.90	1	S	PITRUN	O	Y	L	N	T	P
15N19	BEAR PEAK	13.40	3	S	PITRUN	I	N	VH	Y	T	E
15N20	COON CREEK	4.20	2	S	NAT	O	S	H	N	T	A
15N20A	COON CREEK	0.60	2	S	NAT	O	S	H	N	T	A
15N20B	COON CREEK	0.60	1	S	NAT	O	S	L	N	T	A
15N20C	COON CREEK	1.60	2	S	NAT	O	S	H	N	T	A
15N28	DRY LAKE	0.70	2	S	NAT	O	S	H	N	T	A
15N28	DRY LAKE	4.80	2	S	PITRUN	O	S	H	N	T	A
15N28B	DRY LAKE	0.60	1	S	NAT	O	Y	L	N	T	P
15N28C	DRY LAKE	1.00	1	S	NAT	O	S	L	N	T	A
15N30	PONY PEAK RIDGE	3.90	2	S	NAT	O	N	H	N	T	A
15N42	YOGI BEAR	0.80	2	S	NAT	O	N	H	N	T	A
15N55	RACOON	2.00	2	S	AGG	O	S	H	N	T	A
15N93	COON FLATS	1.40	2	S	NAT	O	S	H	N	T	A

DEFINITION OF TERMS

NOTE: (Source TIS & RMO Report 3/18/95)

MAINTENANCE LEVELS:

1 = Assigned to intermittent service roads during the time they are closed to vehicular traffic.
2 = Assigned to roads open for use by high clearance vehicles.
3 = Assigned to roads open and maintained for travel by a prudent driver in a standard passenger car.
4 = Assigned to roads that provide a moderate degree of user comfort and convenience at moderate speeds.
5 = Assigned to roads that provide a high degree of user comfort and convenience; normally paved roads. Aggregate roads would be treated for dust abatement.

SURFACING:

NAT = Existing Material AGG = Gravel Surface PAV = Pavement CHP = Chip Seal
PRIM = Primitive

TEMPLATE:

O = Outslope, assumes no ditch, or outside berm unless needed for short stretches.
I = Inslope, assumes inboard ditch, with no outside berm unless needed for short stretches.
C = Crown, assumes inboard ditch, with no outside berm unless needed for short stretches.

ROAD CLOSURES:

Y = Yearlong for the following reason(s); Road Maintenance, Wildlife, and Sensitive Soils
N = Road Open Year-round
S = Seasonal Closure/Open (minimize resource/use conflicts such as wildlife, sensitive soils, public safety, or road maintenance, normally during winter conditions).

ADT (Average Daily Traffic):

Low (L) = 0 to 1 Moderate (M) = 2 to 4 High (H) = 5 to 15 Very High (VH) = 16+

HSA (Highway Safety Act):
If road is passable by passenger car, then HSA applies; normally applies to Maintenance Level 3, 4, & 5 roads).
Y = Yes N = No

PRIMARY USER:
P = Private Land Access Use R = Recreation Use T = Timber Use H = Human Development/Administration
GP = General Public Use (public highway, open to all users)

EXISTING MGMT. STRATEGY:
A = Accept E = Encourage L = Eliminate P = Prohibit (road closure order applies)
N/A = Not Applicable for County roads; ***Note:*** Will be expanded when opportunity warrants.
D = Decommission (close system, seed roadway, pull drainages, ripping road bed).

APPENDIX H - *Results of Roads Analyses*

This appendix lists the analysis results from two completed documents: *Westside Roads Analysis* (1997) and the *Ukonom Travel and Access Management Plan* (1996). Additional analysis information from the Happy Camp/Ukonom Zone Engineering Road Manager is also provided. The intent of this information is to compile it into one document, and assist in the development of opportunities for road improvements, maintenance planning, and decommissioning. It should be pointed out that this information is a **coarse filter** for opportunities and **not a decision**. The NEPA process must be used to assess alternatives, identify environmental affects, and document any decision related to road decommissioning.

The column in the table **Consistent WRA & UTP** identifies where both analysis documents basically agree with one another and are listed with a YES. These would be a good starting point for further evaluation in the NEPA process. In the other cases where they are not consistent, the underlying assumptions from the original analysis should be reviewed to determine the nature of the discrepancy, refined based on more site specific information, and documented in NEPA process.

The column **Decommissioning Potential** lists those roads that have been identified by the Road Manager strictly from a **road management perspective**. The reasons include: reoccurring high maintenance problem(s), road receives little or no use, road is located in a high road density area, or permanently closed. This information would be useful during the NEPA process.

Forest Road #	Total Miles	Human Rating 1/	Resource Rating 2/	Westside Roads Strategy 3/	Ukonom Travel & Access Mgmt Plan	Consistent WRA&UTP 4/	Decom. Potential
CANDIDATES FOR DECOMMISSIONING							
11N01	0.3	L	L	LT Closure	N/A		YES
11N01A	0.4	L	L	LT Closure	N/A		YES
12N02	1.9	L	M	Decommission	N/A		N/A
12N03--1	0.9	M	M	Improve	N/A		YES
12N03--2	0.6	M	M	Improve	N/A		YES
12N04	1	M	L	Maintain	N/A		N/A
12N05	2.5	L	M	Decommission	WS Rest	YES	N/A
12N06	2.4	L	M	Decommission	N/A		N/A
12N07	3.1	M	M	Improve	N/A		YES
12N08	4.4	M	M	Improve	N/A		N/A
12N08A	0.6	L	M	Decommission	N/A		YES
12N08B	0.5	L	M	Decommission	N/A		YES
12N09	3.6	M	M	Improve	N/A		N/A
12N09A	0.8	L	M	Decommission	N/A		N/A
12N11	0.2	H	M	Improve	N/A		N/A
12N12	1.7	L	M	Decommission	N/A		N/A
12N12K	0.4	L	M	Decommission	N/A		N/A
12N13--1	3.3	H	M	Improve	WS Rest	YES	N/A
12N13--2	2.8	M	M	Improve	WS Rest	YES	YES
12N13N	0.1	L	M	Decommission	N/A		YES
12N13Y	0.7	M	M	Improve	Decomiss		YES
12N14	0.5	L	M	Decommission	N/A		YES
12N15	2.2	L	M	Decommission	N/A		YES
12N16	0.3	L	M	Decommission	N/A		YES
12N16A	0.2	L	L	LT Closure	N/A		YES
12N17	6.6	H	M	Improve	N/A		N/A
12N17C	1.2	L	M	Decommission	N/A		YES
12N17D	0.6	L	M	Decommission	N/A		YES
12N18	0.7	H	M	Improve	N/A		N/A
12N19	6.5	M	M	Improve	N/A		N/A
12N19E	0.7	L	M	Decommission	N/A		YES
12N19F	0.6	L	M	Decommission	N/A		YES
12N20	1.6	M	M	Improve	N/A		N/A
12N21	0.8	L	M	Decommission	N/A		N/A
12N22	3.3	M	M	Improve	WS Rest	YES	N/A

Forest Road #	Total Miles	Human Rating 1/	Resource Rating 2/	Westside Roads Strategy 3/	Ukonom Travel & Access Mgmt Plan	Consistent WRA&UTP 4/	Decom. Potential
CANDIDATES FOR DECOMMISSIONING							
12N22A	1	L	M	Decommission	N/A		YES
12N22B	0.4	L	M	Decommission	N/A		YES
12N23	1.3	H	H	Improve	N/A		N/A
12N24	0.7	L	M	Decommission	WS Rest or Decom	YES	YES
12N24A	0.3	L	M	Decommission	WS Rest or Decom	YES	YES
12N25	0.6	L	M	Decommission	N/A		YES
12N25A	0.2	L	M	Decommission	N/A		YES
12N26	0.6	L	M	Decommission	WS Rest or Decom	YES	YES
12N26A	0.5	L	M	Decommission	WS Rest or Decom	YES	YES
12N26B	0.2	L	M	Decommission	WS Rest or Decom	YES	N/A
12N27	0.7	L	M	Decommission	N/A		YES
12N29	3.8	M	M	Improve	WS Rest	YES	N/A
12N29A	1.1	L	M	Decommission	WS Rest or Decom	YES	YES
12N30	1	L	M	Decommission	N/A		YES
12N30A	0.3	L	M	Decommission	N/A	YES	YES
12N31	0.3	L	M	Decommission	N/A		YES
12N31A	0.2	L	M	Decommission	N/A		N/A
12N31B	0	L	L	LT Closure	N/A		N/A
12N32	0.7	L	M	Decommission	WS Rest or Decom	YES	YES
12N32A	0.1	L	M	Decommission	WS Rest or Decom	YES	YES
12N33	1.2	M	M	Improve	WS Rest	YES	YES
12N33B	0.3	L	M	Decommission	WS Rest or Decom	YES	YES
12N39	0.9	L	M	Decommission	N/A		YES
12N39A	0.3	L	M	Decommission	N/A		YES
12N40	0.3	L	L	LT Closure	N/A		N/A
12N41	0.8	L	M	Decommission	N/A		YES
12N43	1.5	L	M	Decommission	N/A		YES
12N44	0.9	L	M	Decommission	N/A		N/A
12N46	1.3	H	M	Improve	N/A		YES
12N47	1.2	L	M	Decommission	N/A		YES
12N47A	1.4	L	M	Decommission	N/A		YES
12N48	2.8	M	M	Improve	N/A		YES
12N52	5.9	H	M	Improve	N/A		N/A
12N53	3.2	H	M	Improve	WS Rest	YES	N/A
12N53A	0.2	L	L	LT Closure	N/A		YES
12N53B	0.9	L	L	LT Closure	N/A		YES
12N53D	0.8	L	M	Decommission	N/A		YES
12N54	0.9	L	M	Decommission	N/A		YES
12N55--1	1.7	M	H	Improve	N/A		N/A
12N55--2	2.4	M	M	Improve	N/A		N/A
12N55A	0.8	L	H	Decommision	N/A		YES
12N55C	0.6	M	M	Improve	N/A		YES
12N56	1.4	M	L	Maintain	N/A		YES
12N56A	0.2	M	L	Maintain	Decomiss		N/A
13N01	1	H	M	Improve	WS Rest	YES	N/A
13N02	10.5	H	M	Improve	WS Rest	YES	N/A
13N03--1	3.2	M	M	Improve	WS Rest	YES	YES
13N03--2	2.7	L	M	Decommission	WS Rest	YES	YES
13N03A	0.6	L	M	Decommission	WS Rest	YES	YES
13N05	3.7	M	M	Improve	N/A		N/A
13N05A	0.3	L	M	Decommission	N/A		YES
13N06	5.5	M	M	Improve	WS Rest	YES	N/A
13N06A	1.2	L	M	Decommission	WS Rest	YES	YES
13N06B	0.6	L	M	Decommission	WS Rest	YES	YES
13N06E	1	L	M	Decommission	WS Rest	YES	YES
13N06Y	2.2	M	M	Improve	WS Rest	YES	N/A
13N07	1.9	M	M	Improve	WS Rest	YES	N/A
13N07A	0.3	L	M	Decommission	WS Rest	YES	YES
13N08	3.9	H	L	Maintain	N/A		N/A
13N08A	<>	N/A	N/A	N/A	Decomiss		YES
13N08B	0.6	L	M	Decommission	Decomiss	YES	YES
13N08C	0.1	L	L	LT Closure	Decomiss	YES	YES

Forest Road #	Total Miles	Human Rating 1/	Resource Rating 2/	Westside Roads Strategy 3/	Ukonom Travel & Access Mgmt Plan	Consistent WRA&UTP 4/	Decom. Potential
CANDIDATES FOR DECOMMISSIONING							
13N08D	0.3	L	M	Decommission	Decomiss	YES	YES
13N08E	0.3	L	M	Decommission	Decomiss	YES	YES
13N08F	<>	N/A	N/A	N/A	Decomiss		N/A
13N08G	0.3	L	M	Decommission	Decomiss	YES	YES
13N08H	0.3	L	L	LT Closure	Decomiss	YES	YES
13N09	3.8	M	H	Improve	WS Rest	YES	N/A
13N09A	0.5	L	M	Decommission	WS Rest	YES	YES
13N10	3.8	M	M	Improve	WS Rest	YES	N/A
13N11--1	3.8	H	H	Improve	N/A		N/A
13N11--2	11.7	H	M	Improve	WS Rest	YES	N/A
13N11B	1.2	M	M	Improve	N/A		YES
13N11D	0.2	L	H	Decommission	Decomiss	YES	YES
13N11F	0.4	L	M	Decommission	Decomiss	YES	YES
13N11J	0.3	L	M	Decommission	WS Rest or Decom	YES	YES
13N12	7	H	M	Improve	N/A		N/A
13N12A	0.9	M	M	Improve	N/A		YES
13N12B	0.8	M	M	Improve	N/A		N/A
13N12D	0.6	L	M	Decommission	Decomiss	YES	YES
13N12E	0.5	L	M	Decommission	Decomiss	YES	YES
13N13--1	0.6	H	M	Improve	WS Rest	YES	N/A
13N13--2	13.6	H	H	Improve	WS Rest	YES	N/A
13N13A	1.4	M	M	Improve	N/A		N/A
13N14	5.1	H	M	Improve	WS Rest	YES	N/A
13N14A--1	0.8	H	M	Improve	N/A		N/A
13N14A--2	0.4	L	M	Decommission	N/A		N/A
13N14B	0.7	L	L	LT Closure	Decomiss	YES	YES
13N14C	0.2	L	L	LT Closure	Decomiss	YES	
13N14D	0.5	L	L	LT Closure	Decomiss	YES	YES
13N14Y	2	M	M	Improve	N/A		YES
13N14YA	0.7	M	H	Improve	N/A		N/A
13N15	2.2	L	M	Decommission	WS Rest	YES	YES
13N15A	0.5	L	M	Decommission	WS Rest	YES	YES
13N16	2.9	M	M	Improve	Decomiss		N/A
13N18--1	12.2	H	M	Improve	N/A		N/A
13N18A	0.3	L	M	Decommission	Decomiss	YES	YES
13N18B	<>	N/A	N/A	N/A	Decomiss		N/A
13N18C	1.9	L	M	Decommission	N/A		N/A
13N19	3	M	M	Improve	WS Rest	YES	N/A
13N19A	0.1	L	M	Decommission	Decomiss	YES	N/A
13N20	3.6	H	M	Improve	WS Rest	YES	N/A
13N20A--1	0.2	L	M	Decommission	N/A		YES
13N20A--2	0.2	L	M	Decommission	N/A		YES
13N20C--1	0.6	L	M	Decommission	N/A		YES
13N20C--2	0.4	L	M	Decommission	N/A		YES
13N21	0.9	L	M	Decommission	WS Rest or Decom	YES	YES
13N22	1.1	L	M	Decommission	WS Rest	YES	YES
13N23	2.7	M	M	Improve	N/A		N/A
13N24	2.3	M	M	Improve	WS Rest	YES	YES
13N25	0.9	L	M	Decommission	WS Rest	YES	YES
13N26	3.4	M	M	Improve	N/A		N/A
13N26A	0.9	M	L	Maintain	Decomiss		YES
13N27	0.3	H	M	Improve	N/A		N/A
13N27A	0.4	H	M	Improve	N/A		N/A
13N28	0.4	L	L	LT Closure	N/A		YES
13N29	0.6	H	H	Improve	N/A		N/A
13N30	0.2	H	H	Improve	N/A		N/A
13N32	4.5	M	M	Improve	N/A		N/A
13N32A	0.4	M	M	Improve	N/A		N/A
13N32B	0.6	M	M	Improve	N/A		N/A
13N33	1.7	L	M	Decommission	Decomiss	YES	YES
13N34	1.1	M	M	Improve	N/A		YES
13N34Y	0.7	L	M	Decommission	Decomiss	YES	YES

Forest Road #	Total Miles	Human Rating 1/	Resource Rating 2/	Westside Roads Strategy 3/	Ukonom Travel & Access Mgmt Plan	Consistent WRA&UTP 4/	Decom. Potential
CANDIDATES FOR DECOMMISSIONING							
13N35	6.6	H	M	Improve	N/A		N/A
13N35C	0.6	L	M	Decommission	N/A		N/A
13N37	2.7	M	L	Maintain	N/A		N/A
13N39	1.4	M	M	Improve	N/A		YES
13N40	1.2	H	M	Improve	N/A		N/A
13N43	0.9	L	M	Decommission	WS Rest or Decom	YES	YES
13N44	3.9	H	M	Improve	N/A		N/A
13N44E	0.4	L	M	Decommission	Decomiss	YES	YES
13N45	0.7	H	M	Improve	N/A		N/A
13N45A	0.5	L	M	Decommission	N/A		N/A
13N47	1.9	M	L	Maintain	N/A		YES
13N48	4.5	M	M	Improve	N/A		N/A
13N51	3.3	M	L	Maintain	N/A		N/A
13N51A	0.5	L	L	LT Closure	N/A		YES
13N51B	0.4	L	M	Decommission	N/A		YES
13N51C	0.8	M	L	Maintain	N/A		N/A
13N51C	<>	M	L	Maintain	N/A		YES
13N51D	0.8	M	M	Improve	N/A		YES
13N51Y	0.9	L	M	Decommission	Decomiss	YES	YES
13N52	0.1	L	M	Decommission	Decomiss	YES	YES
13N53	0.8	L	M	Decommission	WS Rest or Decom	YES	N/A
13N54	1.7	M	L	Maintain	N/A		N/A
13N54A	0.8	L	L	LT Closure	N/A		YES
13N54B	1.1	M	L	Maintain	N/A		YES
14N01	10	H	M	Improve	N/A		N/A
14N01A	0.6	L	L	LT Closure	N/A		N/A
14N01B	0.7	M	L	Maintain	N/A		N/A
14N01C	0.3	L	M	Decommission	WS Rest or Decom	YES	YES
14N01D	0.4	L	M	Decommission	N/A		N/A
14N01E	0.9	L	M	Decommission	Decomiss	YES	YES
14N01F	0.6	L	M	Decommission	WS Rest or Decom	YES	N/A
14N01G	0.5	L	M	Decommission	WS Rest or Decom	YES	YES
14N05	3.3	M	L	Maintain	N/A		N/A
14N08	1.5	M	M	Improve	WS Rest	YES	N/A
14N08A	0.8	L	M	Decommission	WS Rest	YES	N/A
14N11	0.5	M	M	Improve	N/A		N/A
14N12	1	M	M	Improve	N/A		N/A
14N14	3.2	H	M	Improve	N/A		N/A
14N15	0.5	M	M	Improve	Decomiss		N/A
14N15A	0.2	L	M	Decommission	Decomiss	YES	N/A
14N16	1.4	M	M	Improve	N/A		N/A
14N17--1	3.7	H	M	Improve	N/A		N/A
14N21--1	2.3	L	H	Decommission	N/A		N/A
14N21--2	8.9	H	M	Improve	N/A		N/A
14N21--3	3.8	H	M	Improve	N/A		N/A
14N21D	0.8	M	L	Maintain	N/A		N/A
14N21E	1.1	M	M	Improve	N/A		YES
14N22	1.4	M	L	Maintain	WS Rest	YES	N/A
14N27	3.3	M	M	Improve	N/A		N/A
14N39--1	1.4	H	M	Improve	N/A		N/A
14N39--2	7.4	H	M	Improve	N/A		N/A
14N50	0.1	M	H	Improve	N/A		N/A
14N63	0.3	L	M	Decommission	WS Rest	YES	YES
14N63A	0.3	L	M	Decommission	WS Rest	YES	YES
14N69	1.9	H	M	Improve	N/A		N/A
15N17--1	6.5	H	M	Improve	N/A		N/A
15N17--2	12.5	H	M	Improve	N/A		N/A
15N17--3	0.4	H	M	Improve	N/A		N/A
15N17--4	5.7	H	M	Improve	N/A		N/A
15N17C	0.9	L	L	LT Closure	N/A		N/A
15N17C	<>	L	L	LT CLosure	N/A		YES
15N17D	0.7	L	M	Decommission	WS Rest or Decom	YES	YES

Forest Road #	Total Miles	Human Rating 1/	Resource Rating 2/	Westside Roads Strategy 3/	Ukonom Travel & Access Mgmt Plan	Consistent WRA&UTP 4/	Decom. Potential
CANDIDATES FOR DECOMMISSIONING							
15N17E	1.5	M	M	Improve	N/A		N/A
15N17F	0.2	H	M	Improve	WS Rest or Decom	YES	N/A
15N17G	0.2	L	M	Decommission	WS Rest or Decom	YES	N/A
15N17H	0.8	L	M	Decommission	N/A		N/A
15N19--2	10.2	H	M	Improve	N/A		N/A
15N20	4.3	M	M	Improve	N/A		N/A
15N20A	0.5	L	L	LT Closure	N/A		N/A
15N20B	0.4	L	L	LT Closure	N/A		N/A
15N20C	1.6	M	M	Improve	N/A		N/A
15N28--1	1.2	M	M	Improve	N/A		N/A
15N28B	0.6	L	M	Decommission	N/A		N/A
15N28C	1	M	L	Maintain	N/A		N/A
15N30	3.7	M	L	Maintain	N/A		N/A
15N42	0.7	M	M	Improve	N/A		N/A
15N55	2.1	M	M	Improve	N/A		N/A
15N93	1.4	M	M	Improve	N/A		N/A

1/ The Human rating represents the need for human access as defined and identified in the Westside Roads Analysis, KNF, 1997.

2/ The Resource Rating represents the overall potential for resource impacts based on the process/ criteria found in the Westside Roads Analysis, KNF, 1997.

3/ The strategy identified (i.e., decommission, maintain, etc.) utilizes the recommendations taken from the "Road Planning Strategy Recommendations" table (page 8, Westside Roads Analysis, Klamath NF, 1997) and applies those concepts to the human and resource ratings for each road found in the analysis area.

4/ Consistent analysis results between the Westside Roads Analysis and the Ukonom Travel and Access Management Plan.

N/A = Not Applicable. The road was either not identified in the roads data base and consequently not evaluated in the Westside Roads Analysis; or was not identified as a either a decommissioning or watershed restoration opportunity in the Ukonom Transportation Access and Management Plan; or did not meet any one of the four criteria (listed above) used by the road manager.

APPENDIX I - *Mining*

Prepared by: ***Polly Haessig***, Geologist
Version 3-18-98

Overview of Mineral Deposits and Mining Activity
Mineral deposits known to occur in the analysis area include placer gold and platinum, and surface and underground lode gold. The important placer mining areas were all along the Klamath River at river level and on elevated terraces, and along or at the mouths of tributary streams to the Klamath such as: Coon, Aubrey, Thomas, Carter, Sandy Bar, and Teneyck Creeks. The area of surface and underground mining of gold in vein porphyry was along Prospect Ridge. Mining activity along the Klamath River corridor in this area seems to have occurred well after the early part of the gold rush. Most of the placer mine sites appear to have been claimed and located in late 1880s and 1890s, with work continuing through the early 1920s in some areas. There has been little recent placer mining activity except at the Ten Eych Mine and associated with suction dredging in the Klamath River.

Significant Mines in the Analysis Area
Mines described here are ones where there is some description of their history from literature. Many named mines and unnamed mine locations are also known but not written about in any detail. See Figure 4-1 Historic Mines and Dumps, contained in the Map Packet located at the end of this document, for approximate locations of known mine areas in the analysis area. The mines located on the map are from the U. S. Bureau of Mines Minerals Availability System/ Mineral Industry Location System (MAS/MILS) database compiled for the Klamath Forest in 1993.

Placer and Hydraulic Mines
Pond Water: Owner H. H. Albars of Blue Nose (Logan 1925; Averill 1935).

Stenshaw, Stangbau, and Sandy Bar Placer and Hydraulic: These mine areas are along the Klamath River and upper benches between Stenshaw and Sandy Bar Creek. The Stenshaw claims in 1890s covered 160 acres. Sam Stenshaw of Cottage Grove was the owner. The property consisted of three benches of gravel averaging ten feet in thickness with 40' of overburden. The area was farmed as well as mined during the winter when water was available. In 1937, the operator was Charles P. Franchot of New York and the Klamath Gold Mining Corporation. Water was obtained from both Sandy Bar and Stenshaw Creeks. Gold bearing gravel was 25' deep over slate bedrock. They used No. 3 and No. 4 giants with 4.5 and 5" nozzles and they had 500' of sluice boxes. The gravel averaged 25¢ per cubic yard and the operation employed eight men that year (Crawford 1896, Logan 1925, O'Brien 1947).
Russel Hydraulic Mine is above Sandy Bar Creek and was hydraulic mined when water was available by George Russell of Blue Nose (Logan 1925).

Milligan's Bar Hydraulic Mine is located up Coon Creek. It was worked by B. Goodwin of Happy Camp (Crawford, 12th Report, 1894).

Elliott Diggings Hydraulic Mine is on the Klamath River 1.5 miles upstream of Cottage Grove. It was worked in 1890s by the Elliott Brothers of Cottage Grove. Twenty-five feet of gravel were washed from a bench above the Klamath. The Elliott Brothers appear to have worked another placer mine up Aubrey Creek (Crawford, 12th Report, 1894 and 13th Report, 1896).

Nolans Bar Hydraulic Mine is located about a half mile downstream from Cottage Grove and was about 80 acres. Water was delivered from a ditch more than a mile long. William Thomas of Cottage Grove was the owner (Crawford, 12th Report, 1894, and 13th Report, 1896).

Auberry Hydraulic Mine was across from Cottage Grove on the north side of the Klamath River. It was worked in the 1890s by Roland Auberry of Cottage Grove. The bank was 40' high with 15' thickness of gravel (Crawford, 13th Report, 1896).

Thomas Hydraulic Mine was near Thomas Creek on the north side of the Klamath River across from Cottage Grove. It was worked by the Thomas Brothers of Blue Nose. Two benches were worked above the Klamath River (Logan 1925).

Carter Hydraulic Mine is on the south side of the river across from Blue Nose. Water was taken from several small creeks and collected in a reservoir. The bank cut was 50' high and showed 15' of gravel. Norman Carter of Cottage Grove was the owner (Crawford, 1896, 13th Report).

The Blue Nose hydraulic mine was owned by the Blue Nose Mining Company and consisted of five claims. Four benches were mined below 40' overburden and landslide material. The claims were located in the 1890s by Norman Carter but little work was done. Water was used from Carter Creek, and later by ditch from Ti Bar. Operations were mainly around 1919 (Logan 1925).

The Mann and Ross Drift Mine produced gold and some platinum and was located at the mouth of Reynolds Creek on the Klamath River. It consisted of five placer claims owned by Ed Mann and Nelson Ross of Orleans. The ground drifted was the first bench about 20' above the Klamath River. The exposed bedrock at the river is slate but further upslope it is serpentinite and landslide materials. The gravel is loose and consists of slate, amphibolite schist and granodiorite. The owners first attempted to hydraulic the deposit, but the slopes were steep and the serpentinite and loose rocks slid into the workings making progress difficult. Drifting into the gravels worked better than hydraulicking (Logan 1925).

Ten Eych Placer Mine consisted of 80 acres on the west side of the Klamath River between Teneych and Natuket Creeks. The mine area is within a large landslide complex. The mine produced platinum as well as gold. It appears to have been worked from the 1890s through the 1920s. It was a good producer over 25 years or so and its yearly production in 1916 was said to be $20,000. The deposits consisted of three benches, with the lowest one about 50' above the Klamath River. The second bench was 300' higher. This was worked in 1909 but the main activity seems to have been around 1916. The gravels were mainly hydraulicked. To the west of the gravel benches, small pockets of gold were found in serpentinite that occurs with diorite and mafic dikes. The large boulders of the gravel deposit were removed by a large derrick and the piles are easily seen today. The area was recently mined in the 1990s (Logan 1925; Brown, 14th Report, 1916).

The Hickox Hydraulic Mine is in the same general location as the Ten Eych, and was worked by Charles Hickox of Cottage Grove. Crawford, 13th Report, 1896.

The Dunnigan Placer appears to be located on old benches up a tributary to Reynolds Creek. Claims comprise 160 acres. It was worked in 1890s and may have been worked again later around 1913 (Brown, 14th Report, 1916).

<u>Surface and Underground Gold Mines and Prospects</u>
Prospect Hill Mine & Prospect Hill #2; several mine locations are known along the NNW trending Prospect Hill ridgeline. Adits were developed and a three stamp mill was reported to have existed (Logan 1925, Siskiyou County Report 1961).

Mountain King is located somewhere on Prospect Hill, and consisted of three claims. It was located in 1918 (Logan 1925).

Rough and Frye, and Twan and Hannum are two separate mines located in the Teneyck Creek area below Prospect Hill. Their exact locations are not known. The Rough and Fry consisted of 40 acres of claims located in 1913. A 175' adit was dug as well as open surface cuts. The lode vein was 11' wide, with some ore running $15 a ton. The Twan and Hannum mine is similarly described consisting of 400' adit cross-cutting the ledge which was four feet wide at the surface. The ore was crushed and treated in a cyanide mill at the Champion Mine (Brown, 14th Report, 1916).

The Champion Mine was located in 1899 but its exact location is not well known. It is said to be on the east slope of Prospect Hill. The claim is said to join the Twan and Hannum Prospect. It was owned by J. A. and W. F. Hunter of Orleans, and comprised 180 acres; nine claims. Gold ore occurred in two veins in porphyry. At least two adits were dug, and dwellings and a stamp mill were constructed. The adits were 110 and 335' long. A two-ton-a-day cyanide plant was also used to extract gold. Water to run the stamp mill came by ditch from Ten Eych Creek. The vein was three feet wide or more. The ore was estimated at 14,000 tons of $15 a ton rock. Three men were employed. The Champion was worked from 1909-1917 (Brown 1916, Logan 1925).

Mine Inventory and Assessment

There are more than 1,300 placer and lode mine locations in the Klamath National Forest. The Klamath Forest Abandoned/Inactive Mine Inventory concentrated on investigating and visiting mine locations that had a known development and production history, known adits, waste dumps, tailings, mill sites or workings, and whose ore deposit type could have a potential for generating acid discharges. Because of this, very few placer mines were visited in the field.

The Ten Eych Placer Mine was the only mine site visited in the analysis area as part of the mine inventory in 1996. The mine was last worked in 1991. The mine area was revegetated and seeded with grass in 1995. Abandoned mine junk was removed; roads were grass seeded and water-barred, and shallow settling basins were constructed. These are filling with sediment and need no further maintenance. The revegetation efforts appear to have been successful.

Opportunities

The literature review conducted as part of the analysis uncovered several mine locations that need to be located precisely in the field and more fully assessed. The mines that need to be field verified include the following six lode underground and surface mines in the Prospect Hill area: Prospect Hill Mine, Prospect Hill #2; Mountain King, Champion, Twan and Hannan, and Rough and Frye. Review of 1944 and 1995 air photos of this area indicated that these prospects either are too small to be readily identifiable, or they are on what is now private lands. Assessment of these mine prospects would be conducted to evaluate the safety and condition of mine adit openings, potential for bat use, and abandoned mine reclamation needs.

ISHI-PISHI MINE LOCATIONS						
Compiled from the Bureau of Mines MAS/MILS Database, 1993						
Location Number	Mine Name	Mine Type	Production Status	Commodity Minerals	Mine Workings/Site Disturbance	Inventory Status
60230169	Prospect Hill Mine	Prospect	Past Producer	Gold	Adits, Mill?	Not Visited
60930035	Unidentified Location	Placer	Unknown	Gold	Unknown	Not Visited
60930036	Unnamed Location	Placer	Unknown	Gold	Unknown	Not Visited
60930037	Unidentified Working	Placer	Unknown	Gold	Unknown	Not Visited
60930038	Pond Water	Placer	Unknown	Gold	Unknown	Private
60930039	Stangbau	Placer	Past Producer	Gold	Unknown	Not Visited
60930040	Russell	Placer	Unknown	Gold	Unknown	Not Visited
60930041	Roosevelt Mine	Mineral Loc	Unknown	Gold	Unknown	Not Visited
60930042	Unidentified Mines	Placer	Unknown	Gold	Unknown	Not Visited
60930043	Milligans Bar Mine	Placer	Unknown	Gold	Unknown	Not Visited
60930044	Black Hawk	Mineral Loc	Unknown	Gold	Unknown	Not Visited
60930045	Elliot Diggings # 2	Mineral Loc	Unknown	Gold	Unknown	Private?
60930046	Unnamed Location	Placer	Unknown	Gold	Unknown	Not Visited
60930047	Elliott Bros	Placer	Unknown	Gold	Unknown	Not Visited
60930048	Nolans Bar Mine	Mineral Loc	Unknown	Gold	Unknown	Private
60930049	Auberry Hydraulic Mine	Mineral Loc	Past Producer	Gold	Unknown	Not Visited
60930050	Unnamed Location	Mineral Loc	Unknown	Gold	Unknown	Not Visited
60930052	Thomas	Placer	Producer	Gold	Unknown	Private?
60930055	Carter Hydraulic Mine	Mineral Loc	Unknown	Gold	Unknown	Not Visited
60930056	Blue Nose Mine	Mineral Loc	Past Producer	Gold	Unknown	Not Visited
60930068	Rough and Frye	Mineral Loc	Unknown	Gold	Adits, Open Cuts?	Not Visited
60930182	Mann and Ross Drift Mine	Surface	Unknown	Gold, Platinum	Unknown	Private
60930241	Hickox Hydraulic Mine	Surface	Unknown	Gold	Recently Active	Visited & Reclaimed
60930893	Dunnigan Placer	Placer	Past Producer	Gold	Unknown	Not Visited
60930906	Halverson Mine	Placer	Unknown	Gold	Unknown	Not Visited
60931105	Ten Eych Placer Mines	Surface	Surface	Gold, Platinum	Recently Active	Visited & Reclaimed
60931155	Mountain King	Prospect	Unknown	Gold	Unknown	Not Visited
60931168	Unnamed Locations	Mineral Loc	Unknown	Gold	Unknown	Not Visited
60931172	Prospect Hill No. 2	Prospect	Raw Prospect	Gold	Unknown	Not Visited
60931173	Twan and Hannan Mine	Surface	Unknown	Gold	Adit?	Not Visited
60931174	Champion	Underground	Unknown	Gold	Adits, Stamp Mill, Cyanide Plant	Not Visited
60931175	Presidio Bar Mine	Placer	Unknown	Gold	Unknown	Not Visited
60931690	Kookaburra	Placer	Past Producer	Gold	Unknown	Not Visited
60931764	Reynolds Creek	Placer	Past Producer	Gold	Unknown	Not Visited
60931777	Sandy Bar Point	Placer	Past Producer	Gold	Unknown	Not Visited
60931790	Stenshaw-On-Klamath	Placer	Past Producer	Gold	Unknown	Private?

NOTES:
Location Number corresponds to the MAS/MILS Sequence Number in the database.
Mine Name is that used in literature references or from Bureau of Mines Records.
Mine Type: A Mineral Loc is a mineral prospect or claim described in the literature or other records production status in unknown.
Site Disturbance: Working listed from literature references or from site visits.

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APPENDIX J - *Vegetation*

The current seral stage distributions and stand densities are listed below by vegetation community in:

Acreage and Percentage Seral Stage and Stand Density by Vegetation Type

VEGETATION COMMUNITY --Seral Stage	Density	Acres	Percent of the Community
SUB-ALPINE CONIFER			
--Shrub/Forb	0-20	60	4
--Pole	0	0	0
--Early-Mature	0-20	128	9
	21-40	69	5
	41-60	195	14
--Mid-Mature	0-20	142	10
	21-40	122	9
	41-60	4	<1
	61-80	298	22
	81-100	0	0
--Late-Mature/Old-Growth	0-20	0	0
	21-40	26	2
	41-60	155	11
	61-80	159	12
	81-100	0	0
TOTAL		1,359	
TRUE FIR			
--Shrub/Forb	0-20	491	8
	21-40	0	0
	41-60	12	<1
--Pole	0	0	0
--Early-Mature	0-20	47	1
	21-40	265	4
	41-60	66	1
	61-80	80	1
	81-100	0	0
--Mid-Mature	0-20	303	5
	21-40	681	10
	41-60	842	13
	61-80	733	11
	81-100	128	2
Late-Mature/Old-Growth	0-20	0	0
	21-40	169	3
	41-60	306	5
	61-80	2,419	37
	81-100	0	0
TOTAL		6,542	
DOUGLAS-FIR/WHITE FIR			
--Shrub/Forb	0-20	805	6
	21-40	160	1
	41-60	69	<1
	61-80	55	<1
	81-100	14	<1
--Pole	0-20	52	<1
	21-40	316	2
	41-60	148	1
	61-80	321	3
	81-100	107	1

VEGETATION COMMUNITY --Seral Stage	Density	Acres	Percent of the Community
DOUGLAS-FIR/WHITE FIR (cont.)			
--Early-Mature	0-20	183	1
	21-40	127	1
	41-60	56	<1
	61-80	272	2
	81-100	238	2
--Mid-Mature	0-20	218	2
	21-40	633	5
	41-60	495	4
	61-80	531	4
	81-100	929	7
Late-Mature/Old-Growth	0-20	48	<1
	21-40	491	4
	41-60	892	7
	61-80	2,687	22
	81-100	2,570	21
TOTAL		12,420	
WHITE FIR/HARDWOOD			
--Shrub/Forb	0-20	273	8
	21-40	245	7
	41-60	105	3
	61-80	108	3
	81-100	55	2
--Pole	0-20	0	0
	21-40	182	5
	41-60	306	9
	61-80	160	5
	81-100	200	6
--Early-Mature	0-20	61	2
	21-40	7	<1
	41-60	19	<1
	61-80	20	<1
	81-100	79	2
--Mid-Mature	0-20	16	<1
	21-40	36	1
	41-60	0	0
	61-80	19	<1
	81-100	166	5
Late-Mature/Old-Growth	0-20	0	0
	21-40	0	0
	41-60	30	1
	61-80	138	4
	81-100	1,147	34
TOTAL		3,372	
DOUGLAS-FIR			
--Shrub/Forb	0-20	206	6
	21-40	186	5
	41-60	36	1
	61-80	12	<1
	81-100	0	0
--Pole	0-20	51	1
	21-40	3	<1
	41-60	12	<1
	61-80	82	2
	81-100	17	1

VEGETATION COMMUNITY --Seral Stage	Density	Acres	Percent of the Community
DOUGLAS-FIR (cont.)			
--Early-Mature	0-20	44	1
	21-40	49	1
	41-60	135	4
	61-80	175	5
	81-100	174	5
--Mid-Mature	0-20	55	2
	21-40	48	1
	41-60	85	2
	61-80	607	18
	81-100	434	13
Late-Mature/Old-Growth	0-20	12	<1
	21-40	0	0
	41-60	78	2
	61-80	513	15
	81-100	396	12
TOTAL		3,409	
DOUGLAS-FIR/TANOAK			
--Shrub/Forb	0-20	1,368	3
	21-40	1,829	4
	41-60	794	2
	61-80	908	2
	81-100	188	<1
--Pole	0-20	5	<1
	21-40	264	1
	41-60	751	2
	61-80	2,288	5
	81-100	2,696	6
--Early-Mature	0-20	125	<1
	21-40.	139	<1
	41-60	272	1
	61-80	988	2
	81-100	1,531	4
--Mid-Mature	0-20	21	<1
	21-40	160	<1
	41-60	276	1
	61-80	3,001	7
	81-100	7,865	19
Late-Mature/Old-Growth	0-20	3	<1
	21-40	0	0
	41-60	88	<1
	61-80	1,087	3
	81-100	15,148	36
TOTAL		41,794	
DOUGLAS-FIR/TANOAK/LIVE OAK			
--Shrub/Forb	0-20	377	2
	21-40	508	2
	41-60	166	1
	61-80	67	<1
	81-100	17	<1
--Pole	0-20	47	<1
	21-40	65	<1
	41-60	246	1
	61-80	143	1
	81-100	218	1
--Early-Mature	0-20	72	<1
	21-40	136	1
	41-60	197	1
	61-80	743	3
	81-100	1,755	8
--Mid-Mature	0-20	324	2
	21-40	161	1
	41-60	400	2
	61-80	2,219	10
	81-100	7,888	37

VEGETATION COMMUNITY --Seral Stage	Density	Acres	Percent of the Community
DOUGLAS-FIR/TANOAK/LIVE OAK (cont.)			
Late-Mature/Old-Growth	0-20	20	<1
	21-40	63	<1
	41-60	333	2
	61-80	1,252	6
	81-100	3,821	37
TOTAL		21,234	
DOUGLAS-FIR/LIVE OAK			
--Shrub/Forb	0-20	220	2
	21-40	243	2
	41-60	60	1
	61-80	17	<1
	81-100	0	0
--Pole	0-20	39	<1
	21-40	24	<1
	41-60	52	<1
	61-80	118	1
	81-100	55	1
--Early-Mature	0-20	59	1
	21-40	174	2
	41-60	279	3
	61-80	1,206	11
	81-100	1,244	11
--Mid-Mature	0-20	40	<1
	21-40	85	1
	41-60	919	8
	61-80	1,833	17
	81-100	2,149	20
Late-Mature/Old-Growth	0-20	0	0
	21-40	0	0
	41-60	123	1
	61-80	665	6
	81-100	1,218	11
TOTAL		10,819	
ULTRAMAFIC MIXED CONIFER			
--Shrub/Forb	0-20	140	13
	21-40	0	0
	41-60	0	0
	61-80	0	0
	81-100	0	0
--Pole	0	0	0
--Early-Mature	0-20	212	19
	21-40	80	7
	41-60	94	8
	61-80	81	7
	81-100	64	6
--Mid-Mature	0-20	111	10
	21-40	65	6
	41-60	62	6
	61-80	14	1
	81-100	0	1
Late-Mature/Old-Growth	0-20	22	2
	21-40	41	4
	41-60	56	5
	61-80	54	5
	81-100	13	1
TOTAL		1,106	
MONTANE MEADOW/LAKE			
--Shrub/Forb		486	
--Lake		116	
TOTAL		602	

VEGETATION COMMUNITY --Seral Stage	Density	Acres	Percent of the Community
RIPARIAN			
--Shrub/Forb	0-20	1,220	43
	21-40	23	1
	41-60	0	0
	61-80	0	0
	81-100	0	0
--Pole	0-20	5	<1
	21-40	15	1
	41-60	14	<1
	61-80	41	1
	81-100	26	1
--Early-Mature	0-20	7	<1
	21-40	35	1
	41-60	361	13
	61-80	853	30
	81-100	98	3
--Mid-Mature	0-20	36	1
	21-40	25	1
	41-60	0	0
	61-80	46	2
	81-100	33	1
Late-Mature/Old-Growth	0-20	0	0
	21-40	0	0
	41-60	0	0
	61-80	5	<1
	81-100	3	<1
TOTAL		2,847	

Seral stages are determined by the dominate overstory layer in a stand. The dominate tree layer must occupy at least ten percent of the stand area; it cannot consist of scattered predominate trees. Seral stage is primarily by size class, with some modification for site capability. For example, a stand that fits the size class for early/mature-seral stage, but has slow growing trees because of site limitations, may be classified as mid/mature. The following table, Seral Stage Classification, shows size classes for each seral stage.

Seral Stage Classification

Seral Stage	Description
Shrub	Trees (if present) <5" DBH or trees not present
Pole	Trees from 5-11" DBH
Early-Mature	Trees from 11-21" DBH
Mid-Mature	Trees from 21-36" DBH
Late-Mature/Old-Growth	Trees >36" DBH

Acres of Planation by Vegetation Community

Vegetation Community	Acres of planation in the Community	Percentage of Community	Percentage of plantations Non-stocked
Sub-Alpine Conifer	0	0	0
True Fir	207	3	0
Douglas-Fir/White Fir	1,982	16	2
White Fir/Hardwood	1,513	45	<1
Douglas-Fir	458	13	4
Douglas-Fir/Tanoak	9,892	24	4
Douglas-Fir/Tanoak/Live Oak	1,787	8	4
Douglas Fir/Live Oak	592	6	5
Ultramafic Mixed Conifer	13	1	0
Montane Meadow/Lake	2	<1	0
Riparian	31	1	0

Old-growth is distinguished from late/mature in the EUI database by characteristics of structural diversity; holes in the canopy, high number of down logs, and snags, etc. But for most purposes, the late/mature and old-growth seral stages are collectively referred to as old-growth.

The late/mature old-growth type (LM/OG) is of particular importance for planning. The *Northwest Forest Plan ROD* standards and guidelines "specify retention of old-growth fragments in fifth field watersheds containing less than 15% of such stands." Ishi-Pishi/Ukonom, a fifth field watershed, currently contains 35,655 acres of the LM/OG seral stages, or 34% of the 105,500 acre watershed. The distribution of LM/OG stands in Ishi-Pishi/Ukonom is displayed in Figure 3-12 Late/Mature and Old-Growth Stands, contained in the Map Packet located at the end of this document, and management implications are discussed in Step 5.

Acres of Old-growth

Vegetation Community	Acres of Old-Growth	Percentage of Community
Sub-Alpine Conifer	341	25
True Fir	2,724	42
Douglas-Fir/White Fir	6,464	52
White Fir/Hardwood	1,316	39
Douglas-Fir	1,032	30
Douglas-Fir/Tanoak	16,855	40
Douglas-Fir/Tanoak/Live Oak	5,005	24
Douglas-Fir/Live Oak	1,795	17
Ultramafic Mixed Conifer	136	12
Riparian Shrub	8	<1

APPENDIX K - *Timber Management Options*

HARVEST COST ANALYSIS & ASSUMPTIONS

(May 1, 1998)

The objective of this analysis is to provide planners with a tool to utilize timber harvest as a means of achieving watershed objectives, while reducing probability of developing timber sale packages with minimal economic viability. The analysis is intended to provide a **coarse filter evaluation of economic viability** at the initial stages of project development. If it is planned to develop nonessential KV opportunities within sale areas, consideration needs to be given to developing packages that exceed the minimum levels defined in this analysis.

The summary of this analysis defines mbf/acre value threshold needed for individual stands to meet minimum levels of economic viability. This value defines the volumes necessary for cost/benefit to equal zero. This does not preclude treatment of stands that cannot meet the minimum mbf/acre values. By displaying the potential, it should allow for development of sale packages that mix higher value economic opportunity with lower value stands in order to accomplish needed work. Additionally, cost assumptions should be evaluated and refined for each stand under consideration. Opportunities may exist to meet resource objectives and reduce costs outlined in the basic assumptions.

This documents the cost and value assumptions associated with various timber harvest activities on National Forest lands. There are certain cost factors that cannot be accurately determined, therefore no attempt was made to develop them for the analysis. General statements about these cost differences are made, in order to provide a sense of additional costs that may be associated with treatment of certain types of stands.

Stumpage value estimates are based on the January 1 through June 30, 1998, Harvest Value Schedules provided by the California Franchise Tax Board. These values are the basis for the Transaction Evidence Appraisal (TEA) system used in establishing timber sale stumpage values. Another source of value estimates was provided by Jeff Bryant, IFPA California Representative. This analysis provided a cost basis for multi-product timber sales. It was developed with ground based harvesters and biomass chipping operations in mind.

Fuel treatment and reforestation costs were derived from recent BD and KV plans. Logging costs were based on the TEA system and cost estimates provided by IFPA.

STUMPAGE VALUE ESTIMATES

TEA System Value for miscellaneous small sawlogs (average net volume per 16' log <65 board feet) is $160 per mbf. This includes logs up to 22" dbh. This is generally consistent with information provided by IFPA. A difference is that the Forest Service has determined 8" dbh as a minimum merchantable tree and the TEA system doesn't establish a minimum diameter limit for this category. The IFPA analysis indicates stumpage values of 10-14" dbh as zero (cost of removal, transport etc. equal value at mill). When considering treatment of stands with high proportion of small diameter material, the amount of material <16" may significantly alter viability. For example a stand with 10 mbf/acre removed in the 10-22" dbh class, with 50% of the volume between 10-16", could have a per acre value of ranging from $800 to $1600 per acre (depending upon whether a value was attributed to 10-16" range). This difference should provide an alert when developing packages with a high proportion of small diameter material included. If all volume is attributed to the $160/mbf value, it may be an over estimate of economic potential, while attributing no value to the lower diameter range may be underestimating potential cost/benefit.

The TEA System Value for young growth (<150 years) Douglas-fir logs in this area is $360/mbf. The value for old growth logs ranged between $380-600/mbf depending upon grade. The document provided by IFPA valued trees 24-39" dbh at $300/mbf. For the purpose of this analysis, the $380/mbf value was used.

FUEL TREATMENT COSTS

The following assumptions were used to determine probable fuel treatment costs associated with various logging systems. When developing project proposals and treatment options during the IDT process, these assumptions need to be revisited. For example the decision to handpile a tractor unit, would significantly increase costs associated with the treatment. Conversely treatment of a cable unit within a larger underburn unit could reduce costs associated with handline construction.

The decision to be made at the project level is whether the work can best be accomplished as Purchaser Responsibility or collection of BD funds. Regardless of the implementation choice, these are costs associated with treatment of stands.

Tractor	
$/Acre	Description
25	Fell Damaged Residual
285	Tractor Pile
150	Burn Piles
$460/acre + OH factor @ 43% = $660/acre	

Cable	
$/Acre	Description
75	Fell Unmerchantable Material
240	Handline Construction *
250	Burn
$565/acre + OH factor @ 43% = $810/acre	

* Handline construction assumption average unit size of 10 acres w/40 chains of line @ $60/chain

Helicopter	
$/Acre	Description
170	Fell unmerchantable materia l (increased cost due to inaccessibility)
100	Handline Construction
250	Burn
$520/acre + OH factor @ 43% = $745/acre	

Unit costs for fuel treatment are lower than for conventional system based on the assumption that fuel reduction within harvest units would occur as part of a larger natural fuel reduction project. If harvest units are not part of a larger underburn, then costs will likely be higher than established for cable units. Handline construction costs are based an average unit size of 50 acres. Anticipate further reduction in costs associated with use of natural features and/or larger underburn areas. The ratio of line construction per acre treated is reduced. Total per acre cost is projected for harvest unit acres only. As a comparison in the Outside Heli Fire Salvage Timber Sale, fuel treatments in helicopter harvest units that were part of larger underburn areas were projected to cost between $230 and $720 per acre (BD including overhead). The average cost was about $560/acre. It appears that under this assumption, fuels treatment can be far less expensive. Actual implementation costs should be evaluated to refine the assumptions.

YUM - Assumed to be $10/mbf for both tractor and cable systems. YUM costs are estimated to be double for helicopter units. YUM costs are dependent upon proportion of YUM to merchantable material removed. Anticipate yarding costs associated with stands of low conifer density and high hardwood density to be much higher than displayed in analysis. Example - Pot Cabbage timber sale made hardwoods included timber to accomplish removal objectives. In addition to logging costs associated with removal, BD costs of roughly $25/mbf were charged for hardwood volume.

REGENERATION COSTS

Assumed reforestation and one release for survival for all regeneration harvest units at a cost of $930/acre (includes OH assessment). An additional $95/acre was considered for increased costs associated with helicopter units. It is also assumed that 50% of the stands in the mid and lower site classes (FSSC3 and lower) would require a second release for survival if preharvest hardwood basal area exceeds conifer basal area. Both of these are untested assumptions, that need refinement of actual costs. It is a high probability that reforestation costs will be higher than average when access is limited and/or hardwood competition is vigorous.

$930/acre	Standard cost in conventional units
$1025/acre	Reflects higher costs associated with helicopter
$1180/acre	Reflects higher costs associated with additional release efforts (primarily Group 1*)
$1275/acre	Combination of helicopter and hardwood competition factors.
*Group 1 generally consists of those subseries with low to moderate productivity and high proportion of hardwoods to conifers (refer to Subseries Definitions, Assumptions and Conclusions appendix).	

LOGGING COSTS

The TEA system establishes cable yarding costs @ $30/mbf above tractor costs. It is anticipated that low volume, small diameter stands likely exceed this estimate (possibly as high as $100/mbf). Without substantiated cost differences, the TEA value was used. Helicopter costs are factored @ $140/mbf above tractor costs. The values defined assume tractor yarding systems and a deduction is made accordingly for cable or helicopter units. An additional unique cost for the Ukonom district is $5/mbf for haul costs.

The IFPA analysis identified differing costs per acre dependent upon unit size and length of operating season. The unit size influences the set up costs associated with treatment units. Costs increase with numerous small units. The values provided in the IFPA analysis assumed feller bunchers, chippers, etc. associated with multi-product sales. While it is certain there is an increase in cost for more conventional systems, a specific value wasn't derived for this analysis. Actual costs would depend upon proximity to adjacent units, volume removed per unit, and other factors that cannot be readily addressed in this analysis.

Another consideration of IFPA document that was used was length of operating season. It was presumed that limiting operations to 66% of normal operating period increased costs by $75/acre. That correlates roughly with impacts of Northern Spotted Owl Limited Operating Periods (LOP). If operations were limited to 33% of normal operating period, costs were estimated to increase by $200/acre. This correlates roughly with addition of Marbled Murrelet LOP to normal operating period. In conversation with Jeff Bryant, it was recognized that IFPA analysis was developed for different equipment and small diameter material with high market fluctuations. But it is understood that there are increased operating costs associated with limited periods of operations. Insurance, equipment and employee costs, as well as market values are all factors that increase costs when limiting operations to short periods of time. These values were used only as a sensitivity analysis tool. They should not be considered absolutes, but as an indicator of the affect a LOP may have on project viability. This is an area where further refinement of actual costs would be useful.

It was presumed that projects would be developed as tree measurement sales, therefore no additional costs associated with accountability would be incurred by the purchaser. If sales are prepared for contract scaling, and additional $15/mbf cost is associated with those packages.

It should be noted that profit and risk were not calculated in this analysis. The IFPA analysis considered an additional 11% of anticipated costs as part of the total cost of operation. Under the old Forest Service appraisal system, 15% was the standard value used. If project proposals are being consider with an economic offering near zero, they may not be viable, as they do not consider standard operating profit and risk factors.

SUMMARY OF COST/ACRE VARIABLES BY HARVEST METHOD AND LOGGING SYSTEM

Intermediate Treatment			
Logging System	No LOP	Owl LOP	MAMU LOP
Tractor	$660	$735	$860
Cable	$810	$885	$1010
Helicopter	$745	$820	$945
These costs consider fuels treatment only, with potential influence of LOP			

Regeneration Treatment			
Logging System	No LOP	Owl LOP	MAMU LOP
Tractor	$1590	$1665	$1790
Cable	$1745	$1815	$1940
Helicopter	$1770	$1845	$1970
These costs include regeneration costs to the fuels treatment costs.			

Regeneration Treatment in Hardwood Dominated Stands			
Logging System	No LOP	Owl LOP	MAMU LOP
Tractor	$1840	$1905	$2040
Cable	$1990	$2065	$2190
Helicopter	$2020	$2095	$2245

These costs include assume additional release needs in addition to standard regeneration and fuel treatment costs

MBF Value Assumptions				
Size Class	Stumpage Value	Tractor Costs	Cable Costs	Helicopter Costs
8-14"	$80	$65	$35	($75)
16-22"	$160	$145	$115	($5)
24"+	$380	$365	$335	$215

Tractor costs subtract YUM and haul costs from base value. Cable subtracts additional $30/mbf and helicopter $140/mbf (per TEA). For sensitivity analysis all material 8-14" is valued at $80/mbf (assuming there is some range between IFPA and TEA estimates which reflect actual value). Note that helicopter yarding costs exceed stumpage value in smaller diameter range.

Minimum MBF/Acre For Economic Offering To Be Zero --(cost/acre/value/MBF)

The following tables summarize all information in the analysis that influence economic viability. These values are not intended as absolutes, but as **a coarse filter** to be used in development of projects, or for evaluation of specific stands that may be in question.

When considering treatments in stands, with high degree of variability in diameter distribution, the proportion of volume in various diameter classes should be considered. For example in mid-mature stands, with standard thin from below prescriptions it is assumed that the volume removed will be primarily in the <22" dbh range (in some subseries the majority is <16" dbh). If the stand is understocked and a regeneration prescription is implemented, it is assumed that a portion of the larger diameter trees would be removed (after GTR standards are met), increasing the volume/acre and value of material.

Minimum mbf/acre estimates were not calculated for the 8-14" class. It would require a minimum of 10 mbf/acre in this size class to have a cost/benefit of zero in intermediate tractor units. It is unrealistic to expect high volume/acre outputs in this diameter range. The projected mbf/acre in this diameter class should be considered when evaluating individual stands.

See further below for discussion of subseries groups, which summarizes diameter distribution, conifer and hardwood densities, probability of treatment options, etc.

Intermediate Treatment 16 - 22" Dbh			
Logging System	No LOP	Owl lop	MAMU LOP
Tractor	4.6	5.1	5.9
Cable	7.0	7.7	8.8
Helicopter	Costs Exceed Value		
Intermediate Treatment 24" + Dbh			
Logging System	No LOP	Owl LOP	MAMU LOP
Tractor	1.8	2.0	2.4
Cable	2.4	2.6	3.0
Helicopter	3.5	3.8	4.4

MBF/acre values seem low for the 24"+ category, particularly for cable and helicopter systems. This does not consider issues such as skyline corridor volume or payload for efficient helicopter turns. If the mbf/acre is evenly distributed throughout a stand, these issues will seriously affect economics. If distribution is clumpy, then these values may be reasonable. The proportion of YUM to merchantable material will also significantly influence value.

Regeneration Treatment 16 - 22" Dbh			
Logging System	No LOP	Owl lop	MAMU LOP
Tractor	11.0	11.5	12.3
Cable	15.2	15.8	16.9
Helicopter	Costs Exceed Value		

Intermediate Treatment 24" + Dbh			
Logging System	No LOP	Owl LOP	MAMU LOP
Tractor	4.4	4.6	4.9
Cable	5.2	5.4	5.8
Helicopter	9.4	9.7	10.4
Intermediate Treatment 16 - 22" Dbh in Hardwood Dominated Stands			
Logging System	No LOP	Owl lop	MAMU LOP
Tractor	12.7	13.1	14.1
Cable	17.3	18.0	19.0
Helicopter	Costs Exceed Value		
Intermediate Treatment 24" + Dbh in Hardwood Dominated Stands			
Logging System	No LOP	Owl LOP	MAMU LOP
Tractor	5.0	5.2	5.6
Cable	5.9	6.2	6.5
Helicopter	9.4	9.7	10.4

As previously stated this does not consider profit and risk. Development of a package with many of the stands meeting minimum mbf/acre values will have low probability of economic viability, particularly if any of the cost assumptions have been under estimated (i.e. YUM in high density hardwood stands, increased yarding costs associated with cable systems).

SUBSERIES DEFINITIONS, ASSUMPTIONS, AND CONCLUSIONS

The general stand descriptions and initial identification of economic potential are based on the Vegetation Productivity and Subseries Analysis (Jimerson and Jones). This analysis is part of the Large Scale Vegetation Analysis for the Six Rivers National Forest and was developed to be used in development of project proposals using timber harvest as a tool to achieve resource objectives within the watershed.

The Klamath EUI mapping product for the analysis area incorporates canopy closure for softwoods and hardwoods. The subseries groups defined in this analysis will be displayed by seral stage and conifer cover. It is assumed that stands with greater amounts of overstory conifer cover correlate with greater standing volume per acre. It is anticipated that this may display the likelihood of treatment opportunity for various subseries and seral stages. This assumption needs to be validated through subsequent field review and project development

It also is expected that refinement of minimum economic thresholds can be developed with consideration of choice of logging systems and associated stand treatment costs. It is anticipated that the end result is a comparison of logging system cost benefits for various silvicultural treatments. As an example, a set of stand conditions may provide a high degree of economic benefit (and flexibility) if treated with ground based systems, but cost benefit factors may be greatly reduced for cable systems and may be negative if helicopter options are chosen.

The final product will use a combination of:

- Slope class and proximity to road to determine probable logging systems
- Assessment of existing stand conditions to determine probability of per acre economic potential
- Prioritization of treatment options based on productivity and seral stage

This analysis is based on the primary assumption that timber harvest projects are used as a tool to achieve ecosystem management objectives. It presumes that a watershed analysis has been performed, desired conditions are developed and management opportunities to achieve the desired conditions have been developed. When timber harvest is identified as the appropriate tool to achieve those desired conditions, economic feasibility should be considered. The step by step process for determining feasibility and development of viable project proposals is expected to work somewhat as follows:

- Watershed scale resource objectives are established
- Potential treatment areas are identified to meet the resource objectives
- Initial logging system options are determined
- Plant subseries, seral stage and conifer cover are evaluated to establish preliminary treatment units
- Actual stand conditions are evaluated through field review
- Feasible treatments that can achieve the resource objectives are identified

Implementing this step in project development should provide greater specificity to the proposed action. Identification of factors affecting unit cost will enable the ID to determine specific factors that can be adjusted to improve the value. This should streamline the environmental analysis phase of timber sale planning and preparation. Areas consisting of primarily of stand types with low opportunity values may require more field review prior to development of a project proposal.

SUBSERIES SUMMARY DISCUSSION

The forty subseries within matrix lands in the Ishi Pishi analysis area were grouped into three separate categories. This grouping is based on existing stand conditions and site productivity. A map and data table have been developed which correlate directly with the subseries groups described below. These subseries groups are further defined by seral stage and overstory conifer cover. The map provides a visual display of "opportunity" discussed within each subseries group. The table provides the same information in tabular form.

GROUP 1 Summary - Includes subseries which include at least 10% canyon live oak in the overstory (5% for LIDE2-QUCH), with successful regeneration of live oak in the understory. This group also includes subseries that are influenced to varying degrees by serpentine parent material. These subseries are generally considered to provide lower economic opportunity, with low to moderate productivity. The abundance of conifers or canyon live oak in the overstory should be good indicators of potential.

EARLY MATURE
Average net volume is 15.6 mbf/acre with a range of 9.5 to 18.9 mbf/acre

41-57% of the merchantable trees were <18" dbh
17-29% were 18-25" dbh
27-29% were >25' dbh

MID-MATURE
Average net volume is 17.9 mbf/acre with a range of 12.2 to 24.1 mbf/acre

29-39% of the merchantable trees were <18" dbh
27-54% were 18-25" dbh
18-40% were >25' dbh

LATE MATURE
Average net volume is 23.8 mbf/acre with a range of 13.5 to 31.8 mbf/acre

26-32% of the merchantable trees were <18" dbh
21-47% were 18-25" dbh
38-53% were >25' dbh

General trend within this group is small mbf/acre returns for all seral stages, with much of the stumpage in lower value class. The early mature stands have a low likelihood of providing economically viable thinning options. The densest mid-mature stands may provide thinning options with conventional logging systems. Understocked mid-mature may be viable with tractor systems, cable yarding costs may exceed value in these stands. Late mature stands appear to be viable options with all systems, although low density stands which incur high treatment costs are likely to be marginal.

GROUP 2 Summary
- Moderate opportunity, moderate to high productivity group. This group consists primarily of plant associations with a tanoak component. Canyon live oak may be present, but comprise <10% of the overstory. The PSME-QUKE and PSME-CACH2 subseries are similar in productivity and potential economic viability. Due to the absence of tanoak in these subseries, there may be reduced costs associated with regeneration harvest activities. Stands within this group with low mbf/acre removal and high hardwood YUM costs will be significantly reduced in viability than displayed in visual analysis.

EARLY MATURE
Average net volume is 20.4 mbf/acre with a range of 9.8 to 33.1 mbf/acre

26-64% of the merchantable trees were <18" dbh
9-45% were 18-25" dbh
31-45% were >25' dbh

MID-MATURE
Average net volume is 32.0 mbf/acre with a range of 11.6 to 46.1 mbf/acre

27-50% of the merchantable trees were <18" dbh
10-29% were 18-25" dbh
36-54% were >25' dbh

LATE MATURE
Average net volume is 45.3 mbf/acre with a range of 16.2 to 53.9 mbf/acre

16-44% of the merchantable trees were <18" dbh
8-25% were 18-25" dbh
31-79% were >25' dbh

General trend within this group is low probability of economically viable intermediate treatment options in most early mature stands. A moderate probability that thinning options in mid-mature stands are economically feasible. A high probability that mid-mature can be economically regenerated with conventional logging systems It is possible that low density late mature stands may provide viable treatment options with all logging systems.

GROUP 3 SUMMARY - High probability of opportunity. Moderate to high productivity. Primarily includes subseries with a white fir component. Understory regeneration is mainly conifer species. Hardwoods are present in low numbers in these subseries, with few concerns about hardwood release in intermediate treatments and reduced costs associated with regeneration harvest activities.

EARLY MATURE
Average net volume is 32.4 mbf/acre with a range of 18.8 to 55.7 mbf/acre

38-67% of the merchantable trees were <18" dbh
21-38% were 18-25" dbh
8-28% were >25' dbh

MID-MATURE
Average net volume is 50.0 mbf/acre with a range of 29.6 to 70.9 mbf/acre

24-51% of the merchantable trees were <18" dbh
15-28% were 18-25" dbh
28-48% were >25' dbh

LATE MATURE
Average net volume is 70.0 mbf/acre with a range of 23.4 to 146.0 mbf/acre

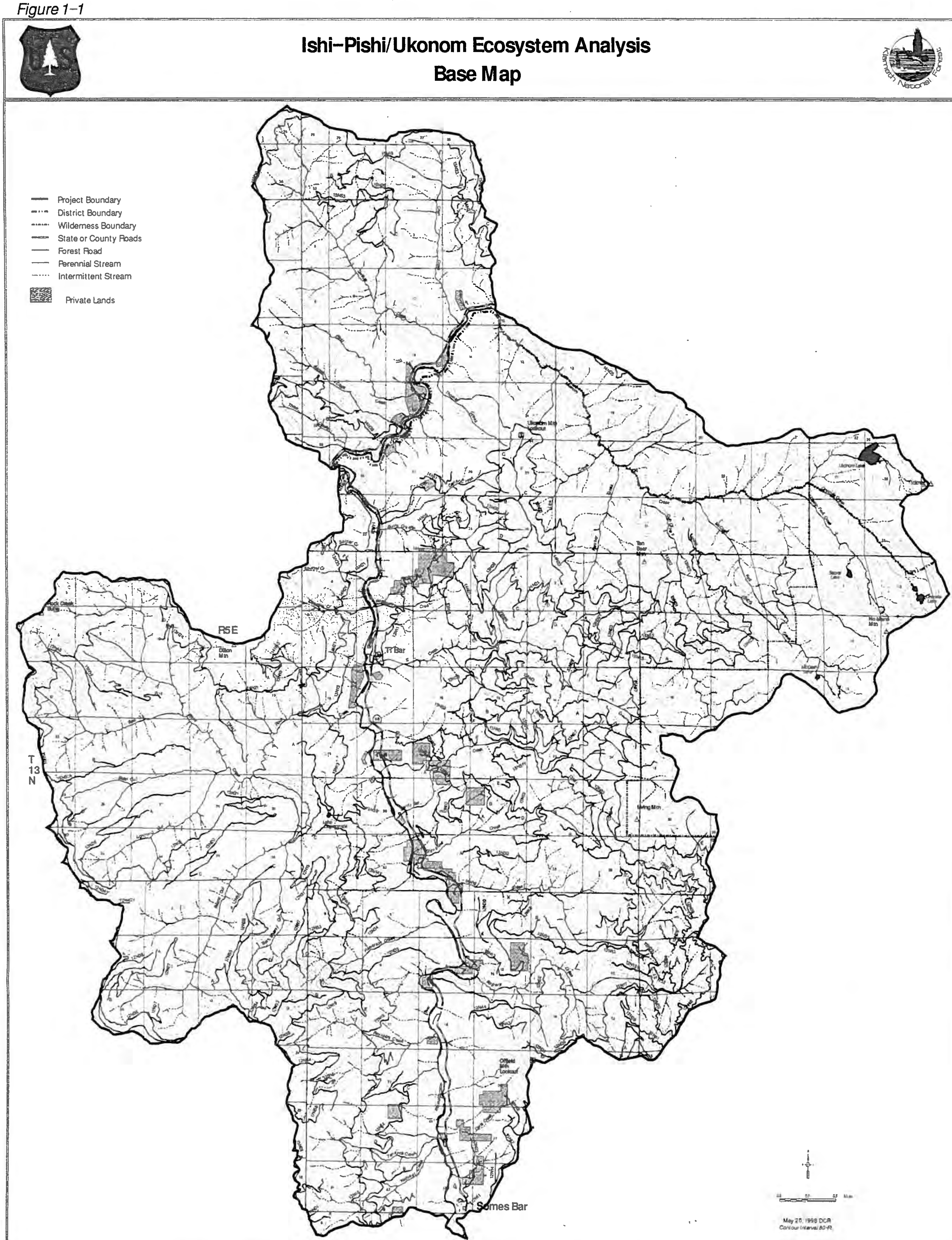
29-41% of the merchantable trees were <18" dbh
18-28% were 18-25" dbh
41-49% were >25' dbh

General trend within this group is high probability of economically viable intermediate treatment options in most early and mid-mature stands using conventional logging systems. A high probability that mid-mature can be economically regenerated with conventional logging systems It is possible that low density late mature stands may provide viable treatment options with all logging systems.

QUCH2 Series - Canyon live oak - Not part of the capable land base. No distinction between seral stages within this group Conifer density should always show up as <30% cover.

MAP PACKET

Figure 1–1



Ishi–Pishi/Ukonom Ecosystem Analysis
Base Map
Klamath National Forest
Project Boundary
District Boundary
Wilderness Boundary
State or County Roads
Forest Road
Perennial Stream
Intermittent Stream
Private Lands
R5E
Ti Bar
T
13
N
Somes Bar

Figure 1-2

Ishi-Pishi/Ukonom Ecosystem Analysis
Forest Plan Management Areas Updated During This Analysis

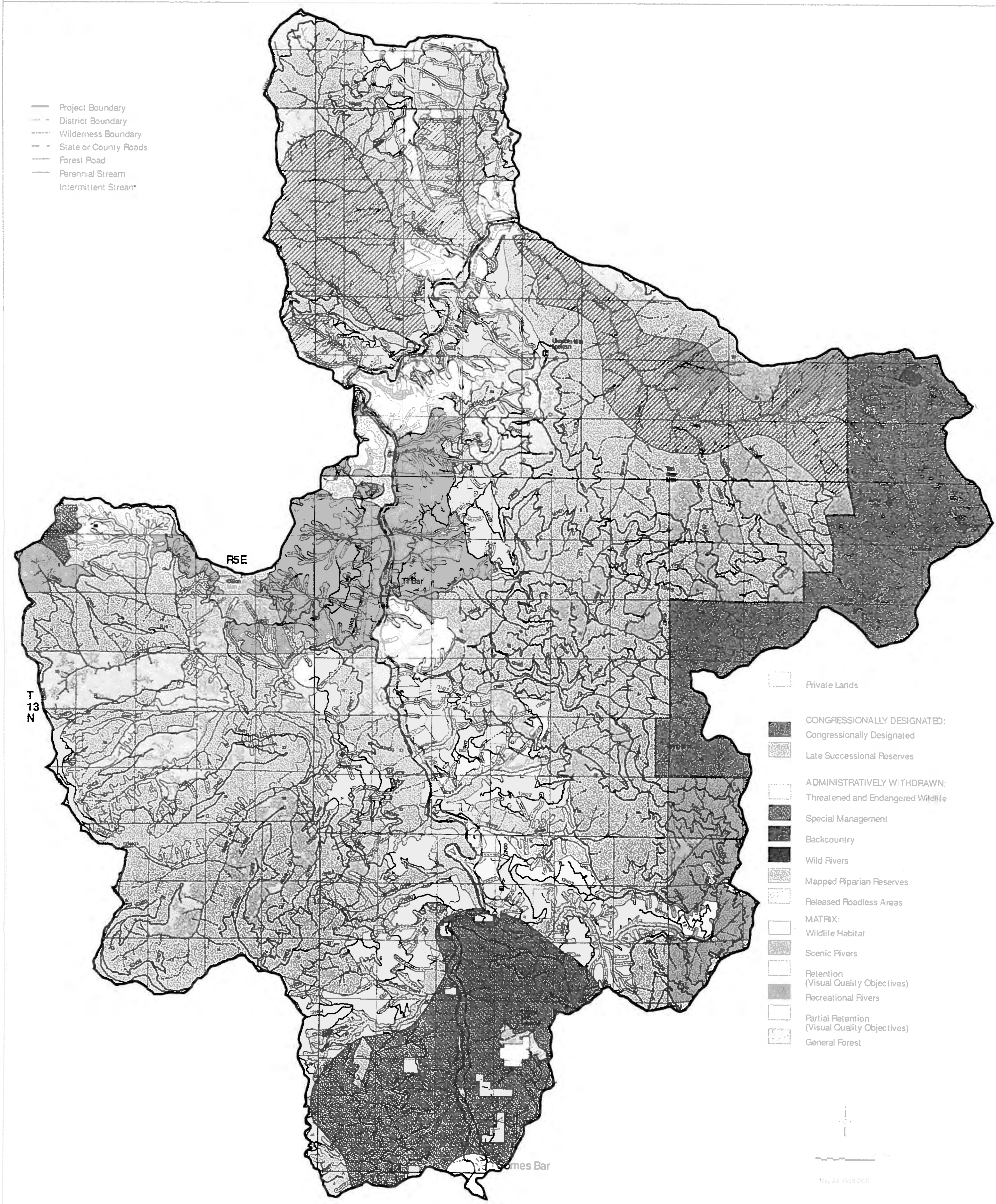


Figure 3-1

Ishi-Pishi/Ukonom Ecosystem Analysis
Simplified Lithology

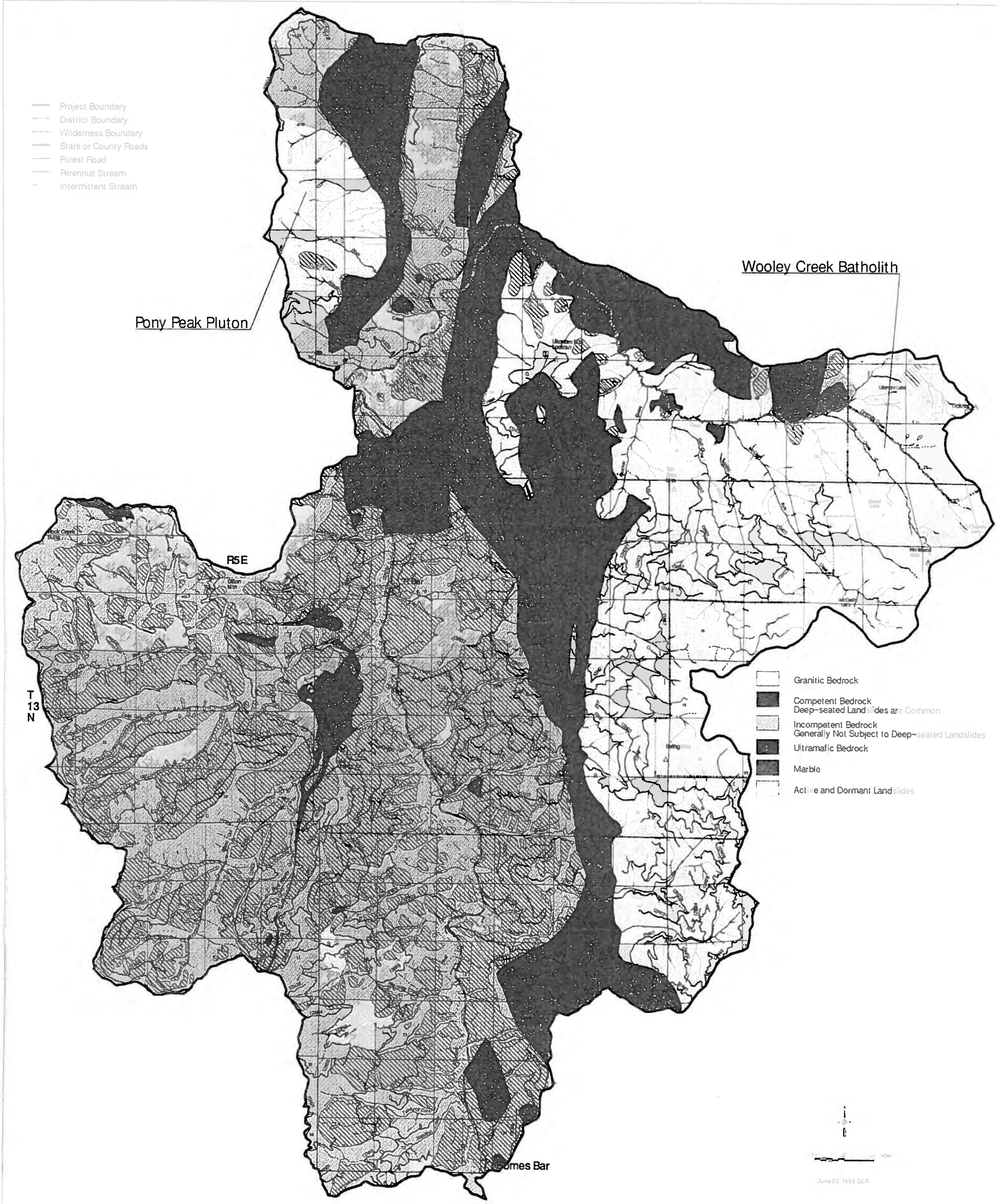


Figure 3-2

Ishi-Pishi/Ukonom Ecosystem Analysis
Subwatersheds and Forest Plan Areas with Watershed Concerns

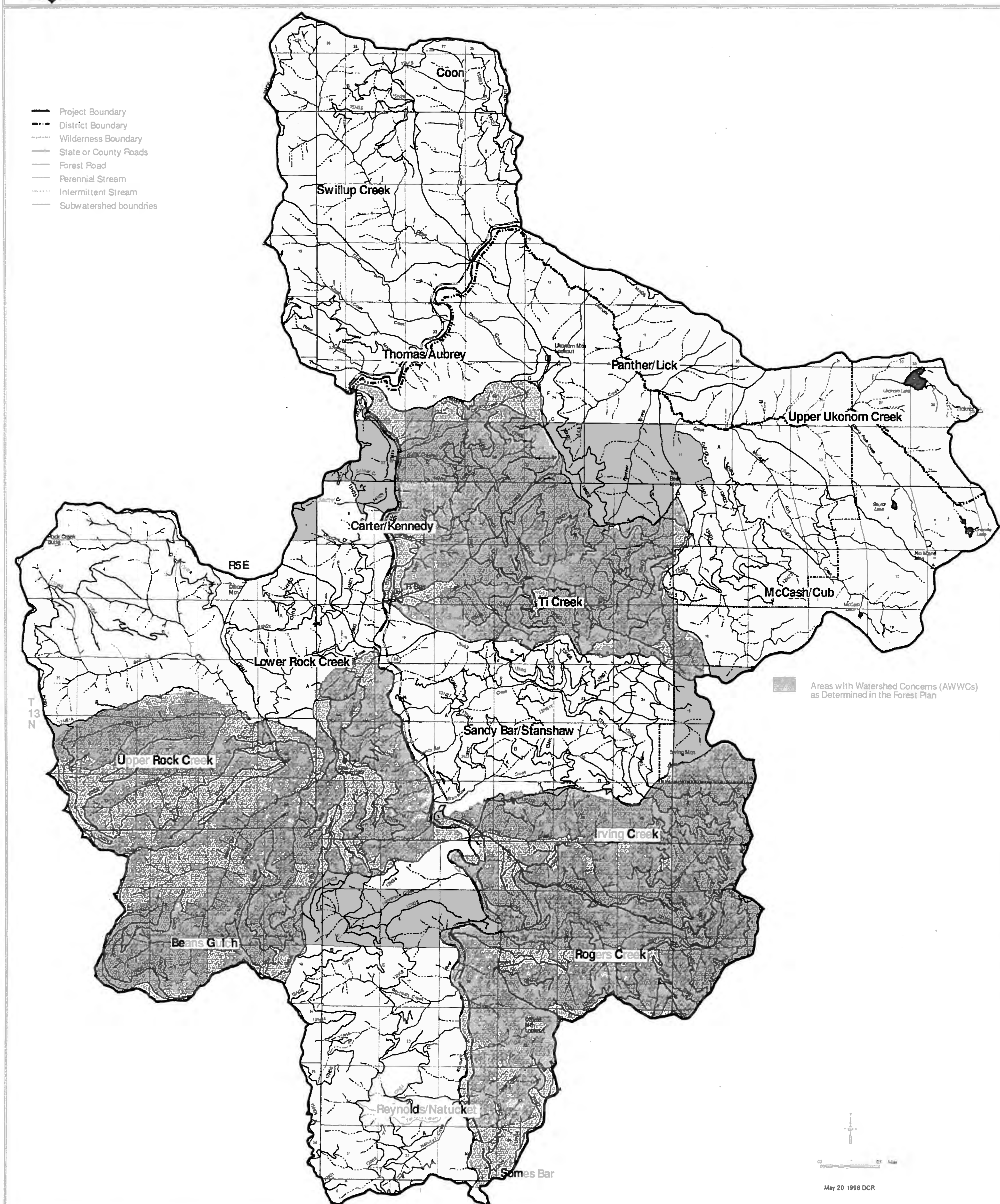


Figure 3-3

Ishi-Pishi/Ukonom Ecosystem Analysis
Geomorphic Terranes

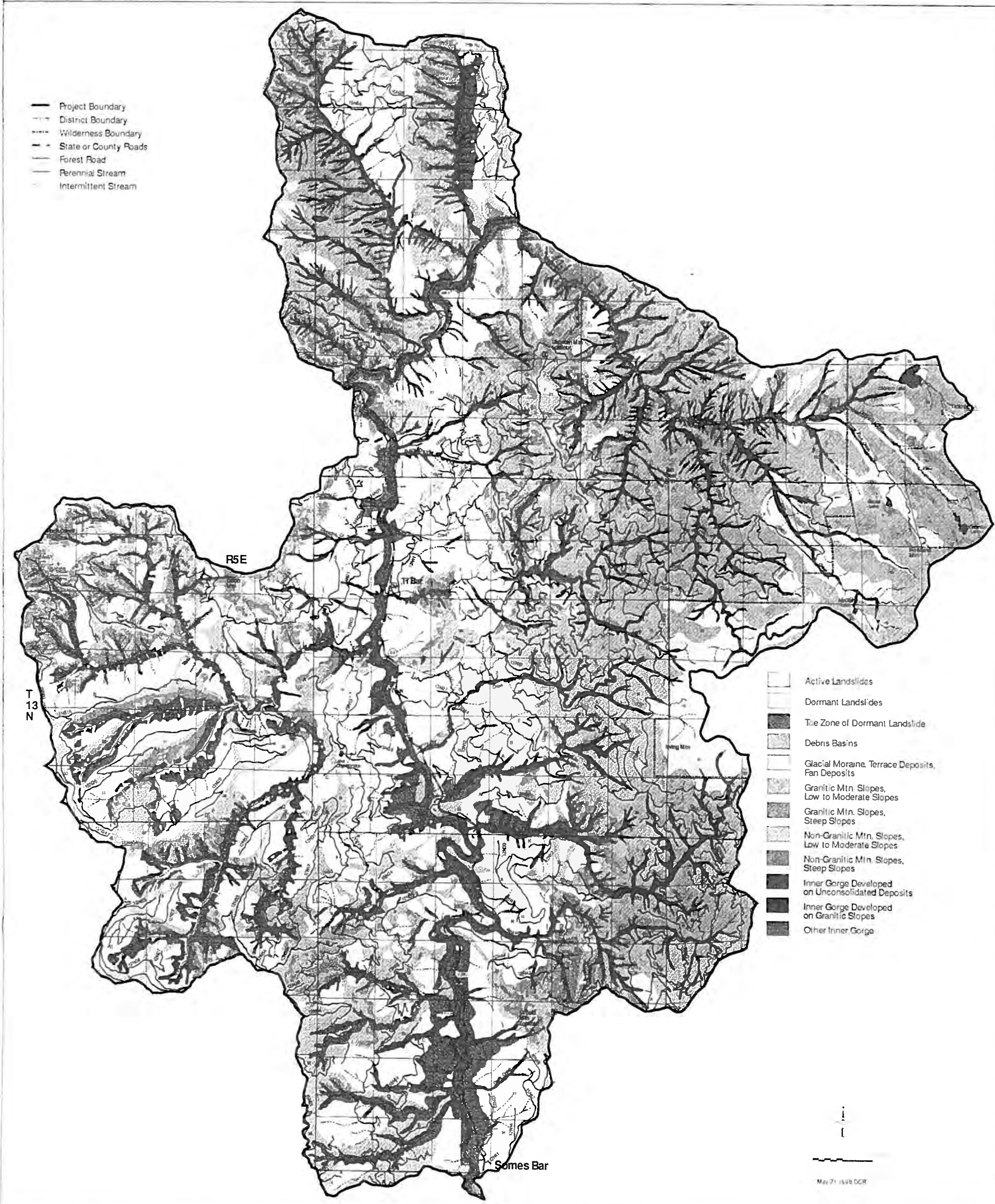


Figure 3-4

Ishi-Pishi/Ukonom Analysis Ongoing 1997 Flood Damage Study

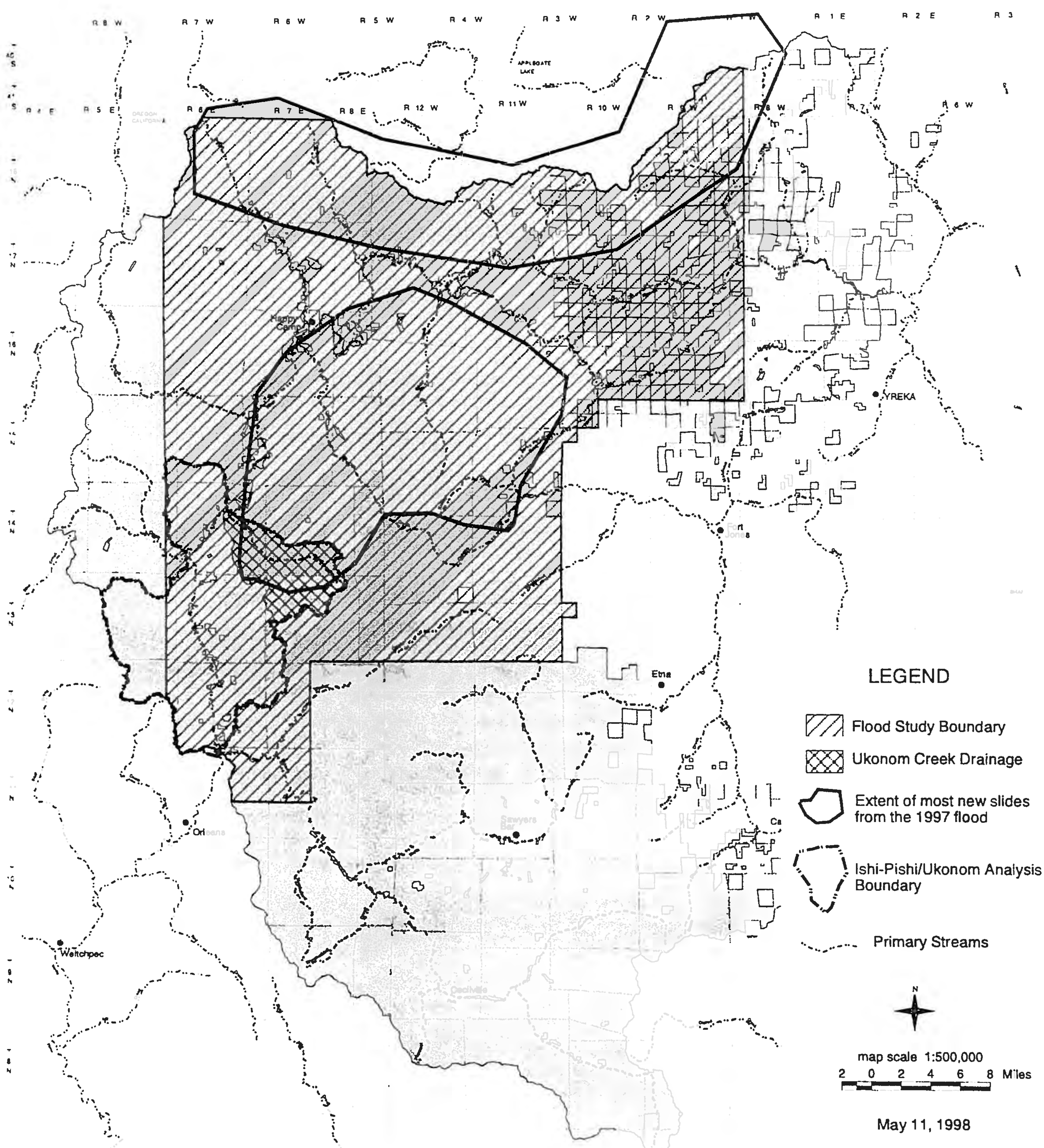


Figure 3–5

Ishi–Pishi/Ukonom Ecosystem Analysis
1997 Flood Damage and Flood Related Landslides

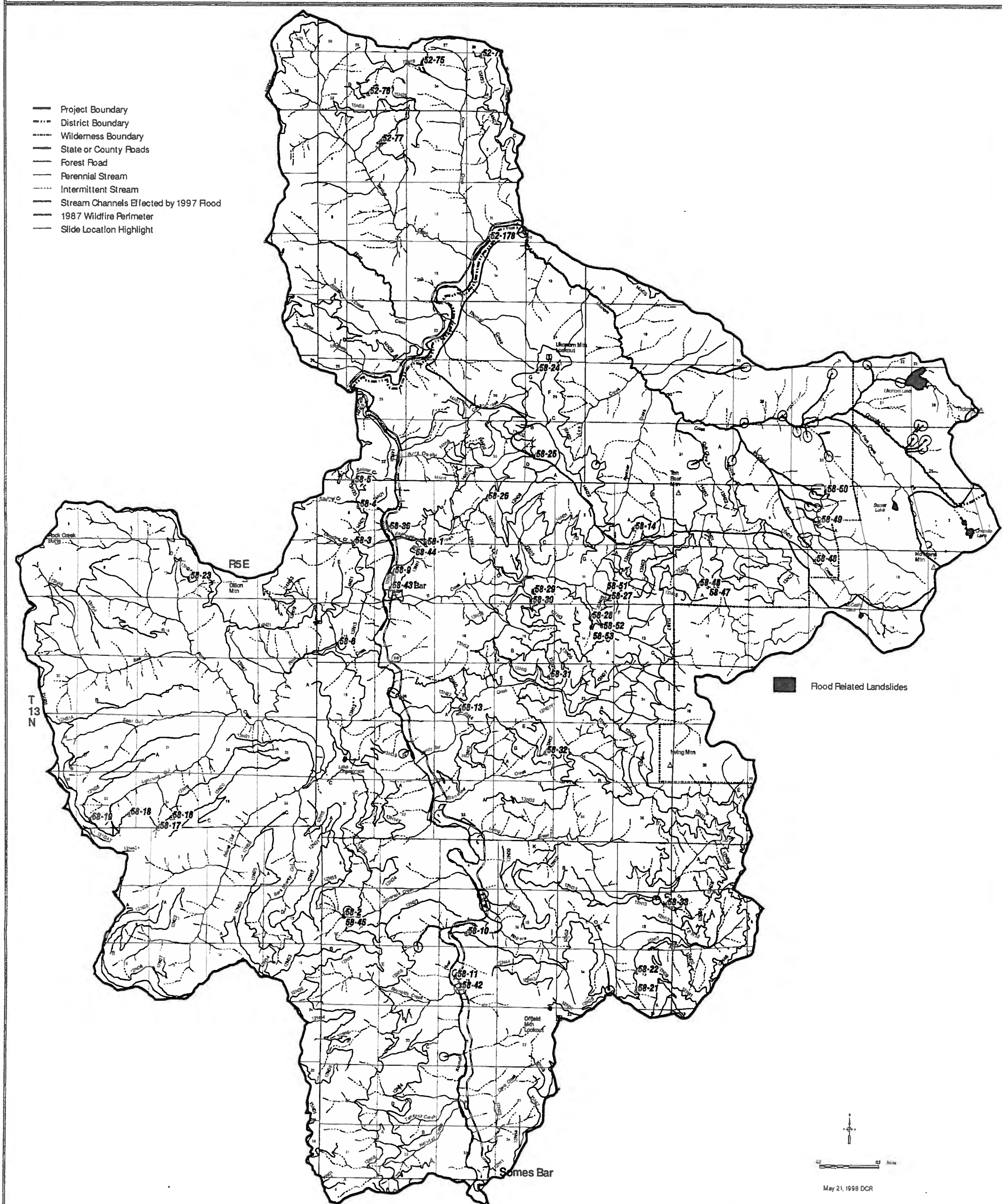


Figure 3-6

Ishi-Pishi/Ukonom Ecosystem Analysis
Watershed Disturbances

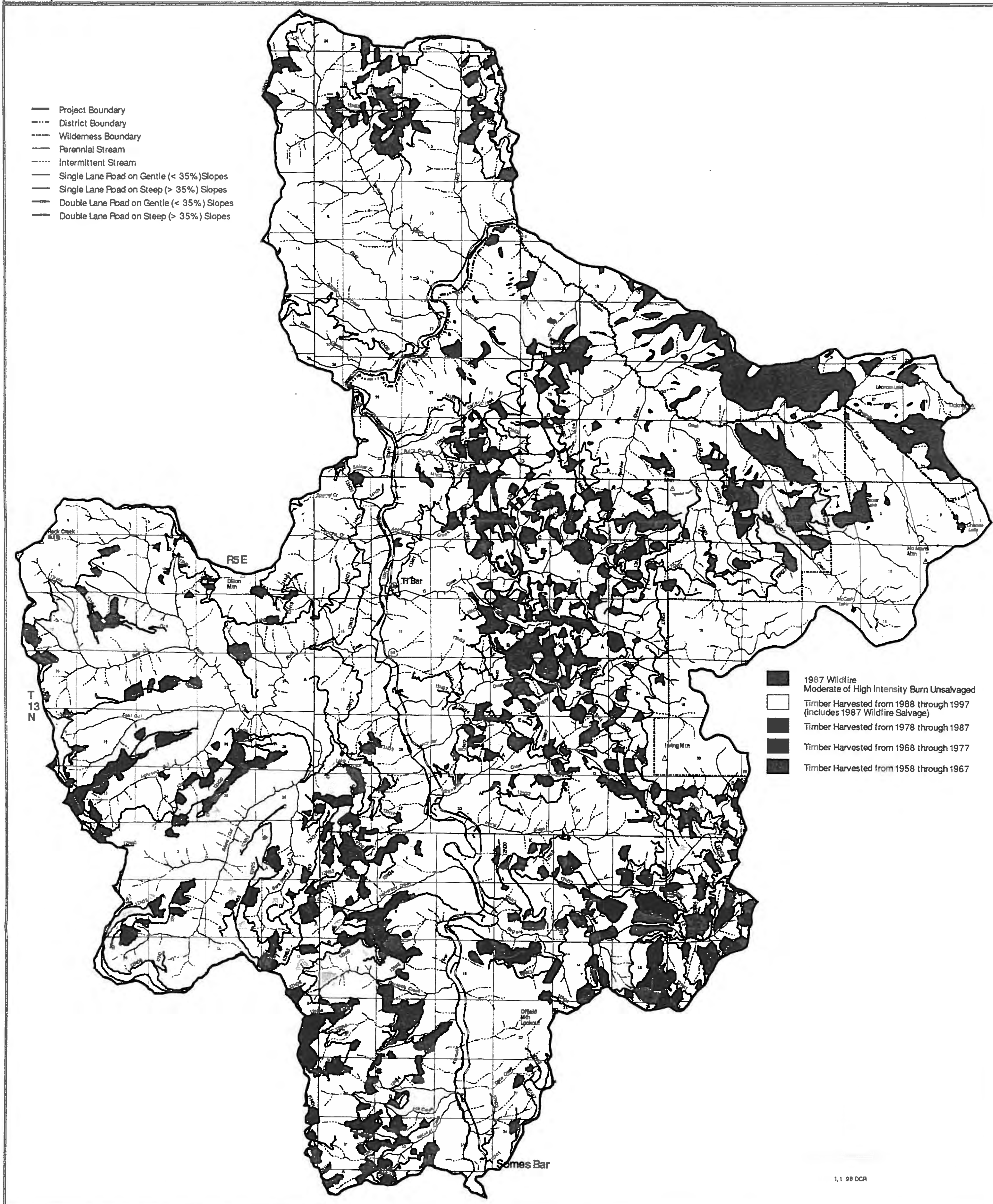


Figure 3-7

Ishi-Pishi/Ukonom Ecosystem Analysis
Pre-Analysis Riparian Reserve Components

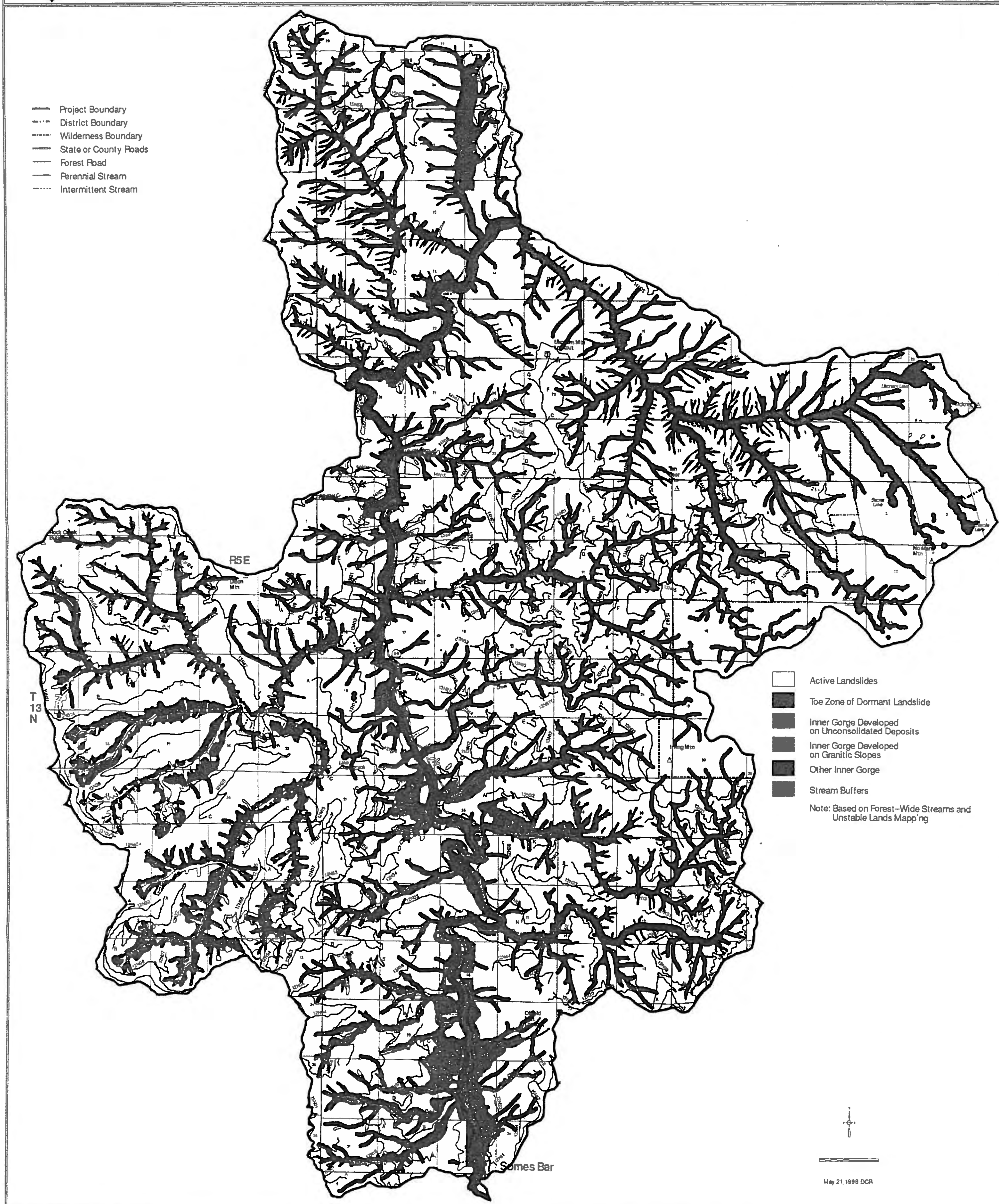


Figure 3-8

Ishi-Pishi/Ukonom Ecosystem Analysis
Riparian Reserve Vegetation (Using Pre-Analysis Riparian Reserve Boundary)

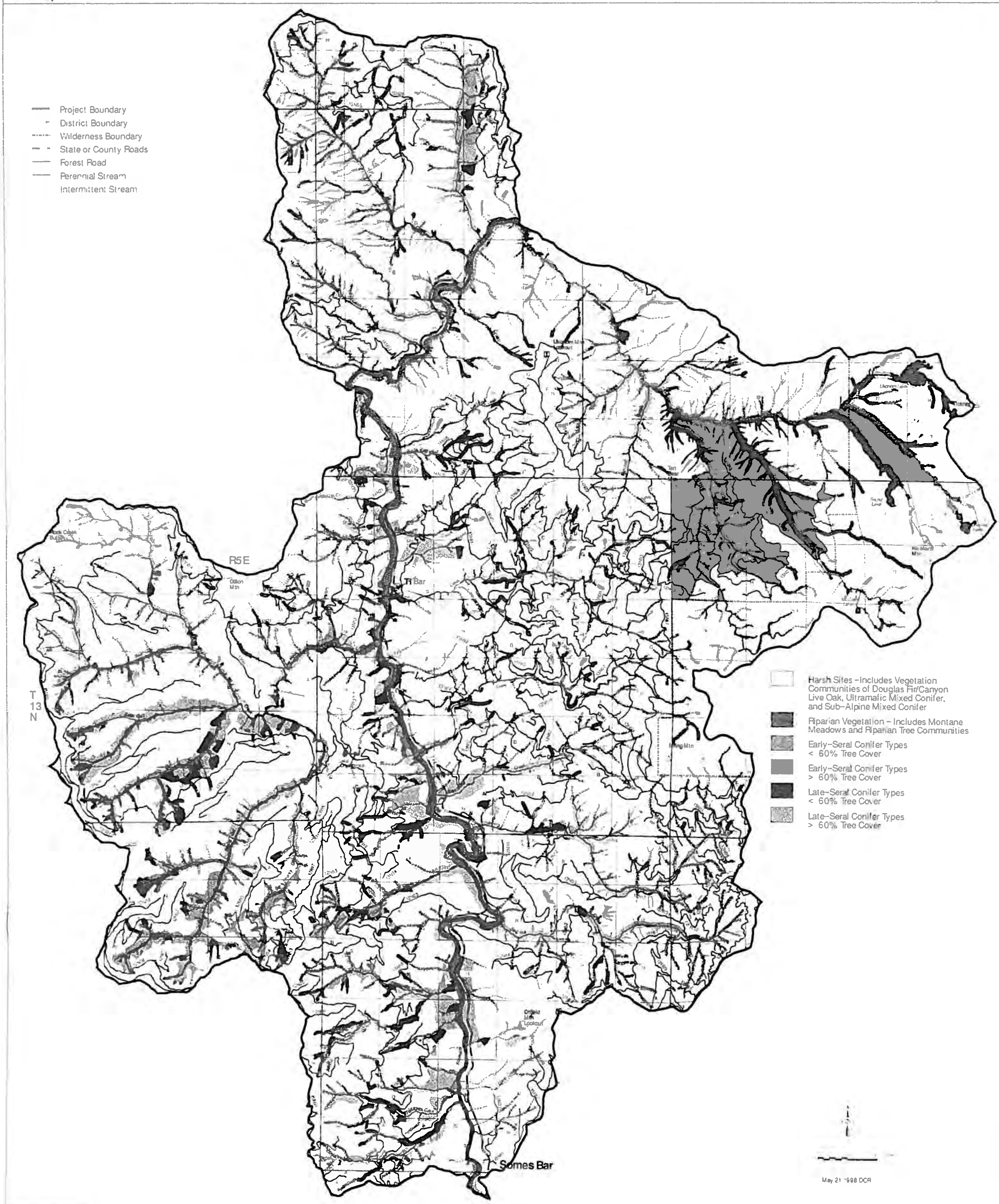


Figure 3–9

Ishi-Pishi/Ukonom Ecosystem Analysis
Habitat Inventory Reaches

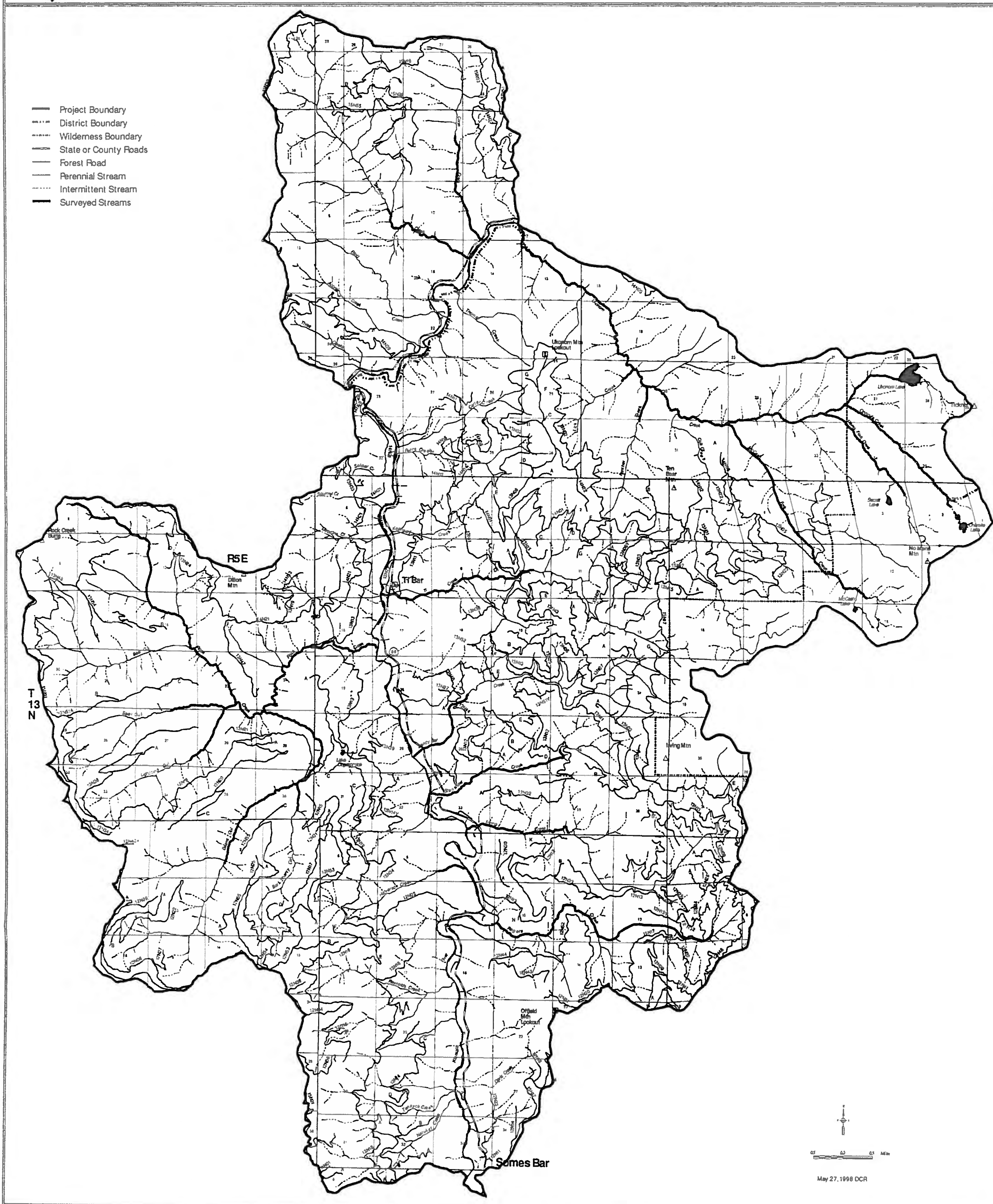


Figure 3-10

Ishi-Pishi/Ukonom Ecosystem Analysis
Fish Species Range

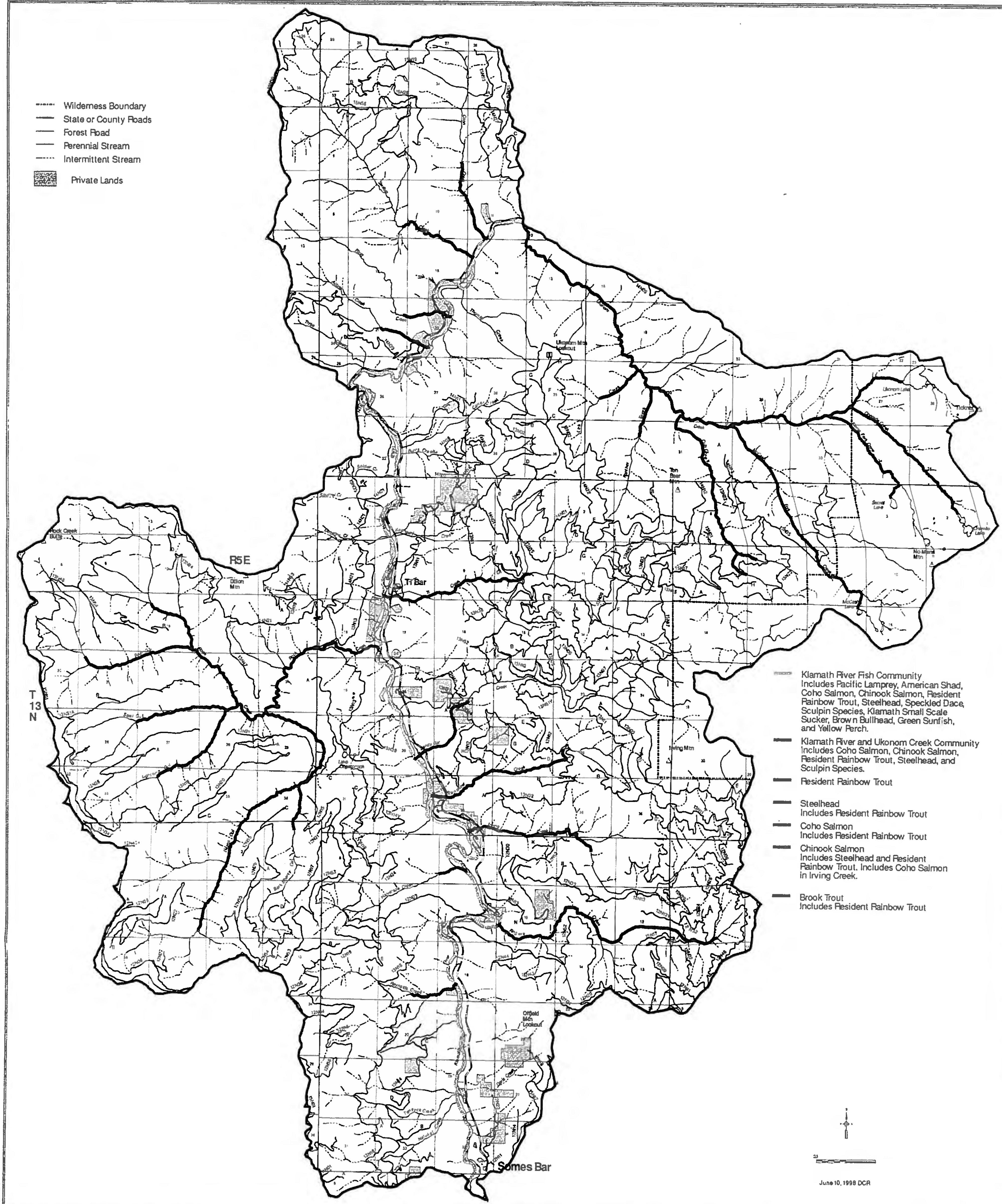


Figure 3-11

Ishi-Pishi/Ukonom Ecosystem Analysis
Existing Vegetation Based on EUI

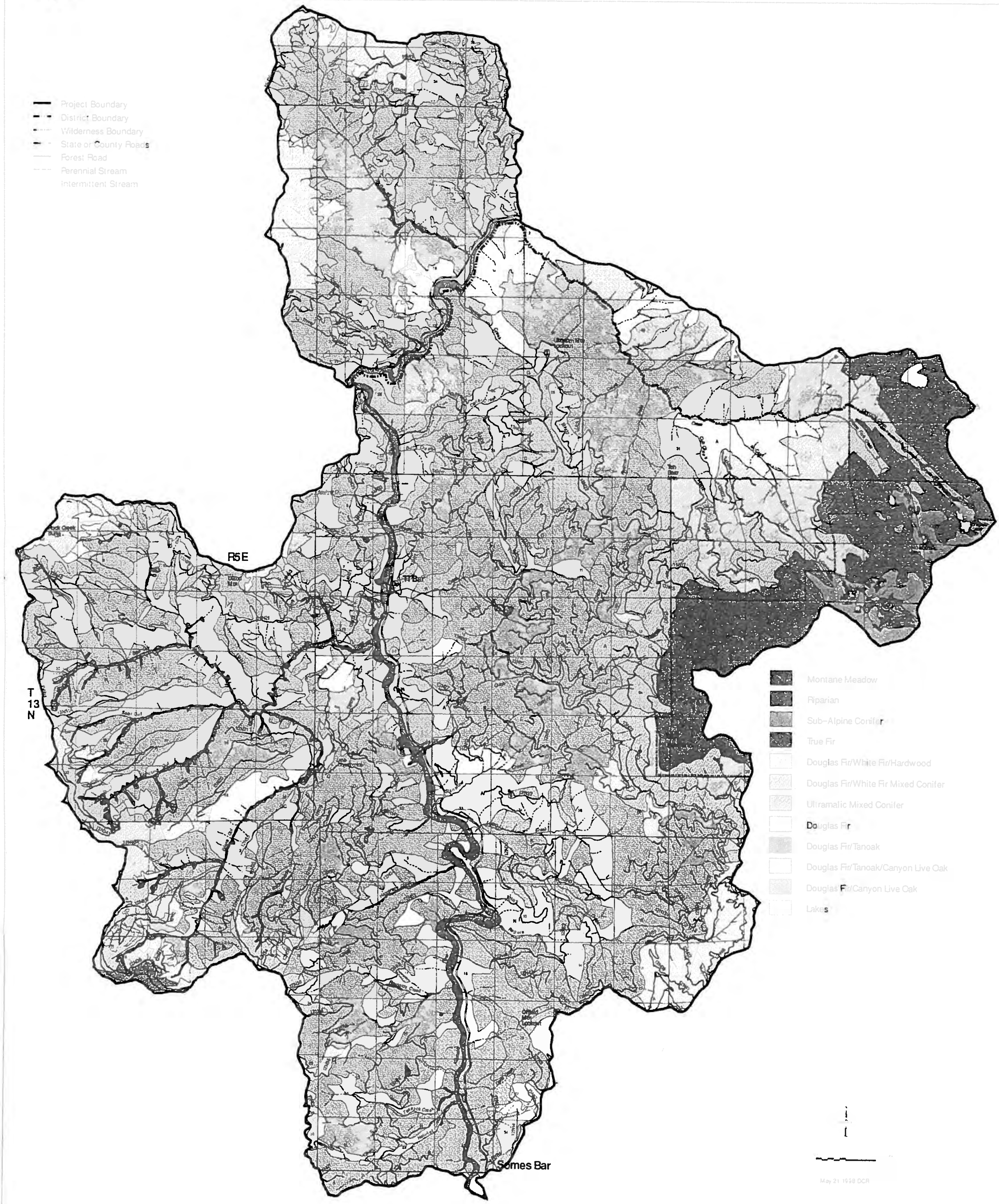


Figure 3-12

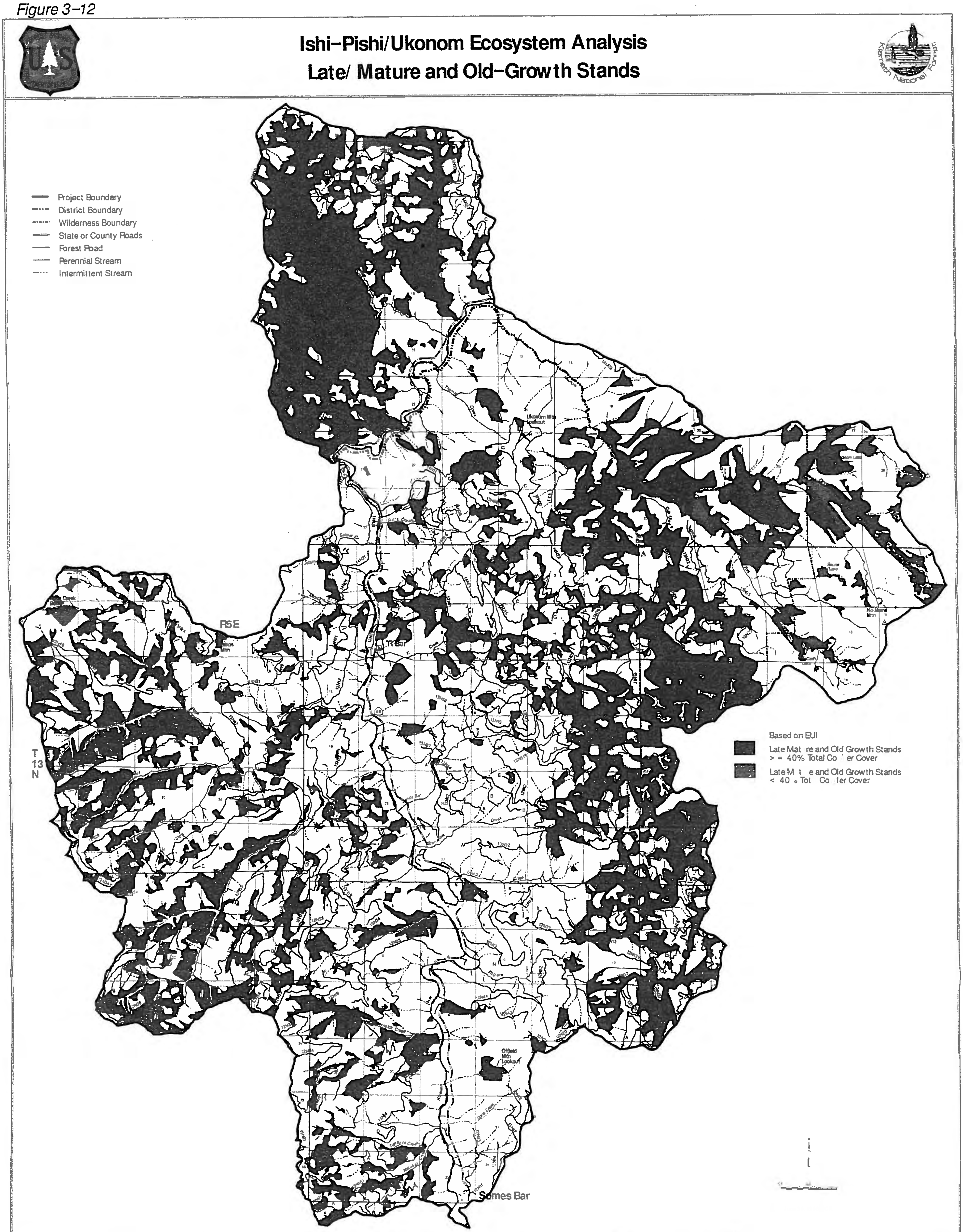

Ishi-Pishi/Ukonom Ecosystem Analysis
Late/ Mature and Old-Growth Stands
Project Boundary
District Boundary
Wilderness Boundary
State or County Roads
Forest Road
Perennial Stream
Intermittent Stream
R5E
T
13
N
Somes Bar
Based on EUI

Figure 3–13

Ishi-Pishi/Ukonom Ecosystem Analysis
Suitable Northern Spotted Owl Habitat

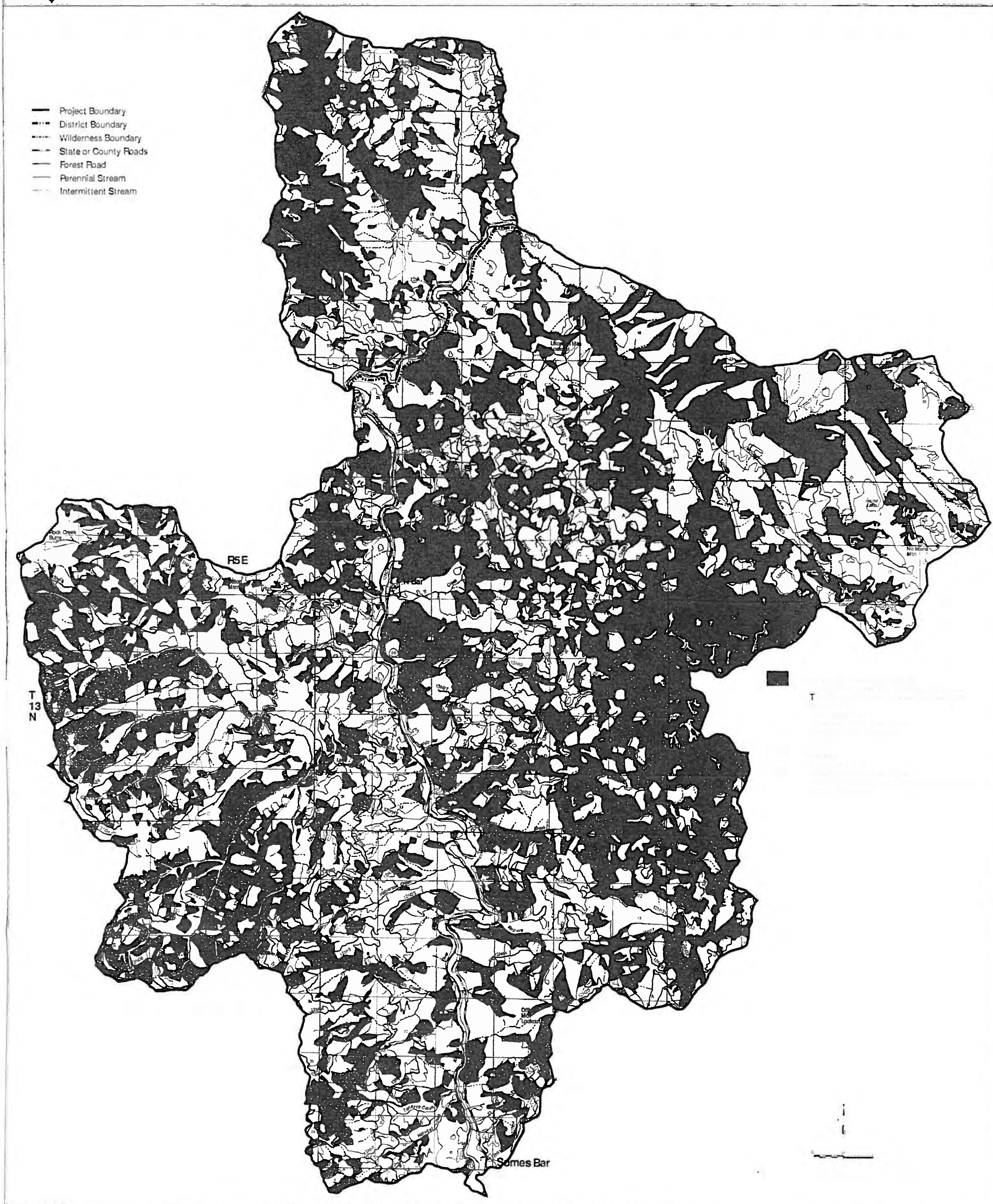


Figure 3–14

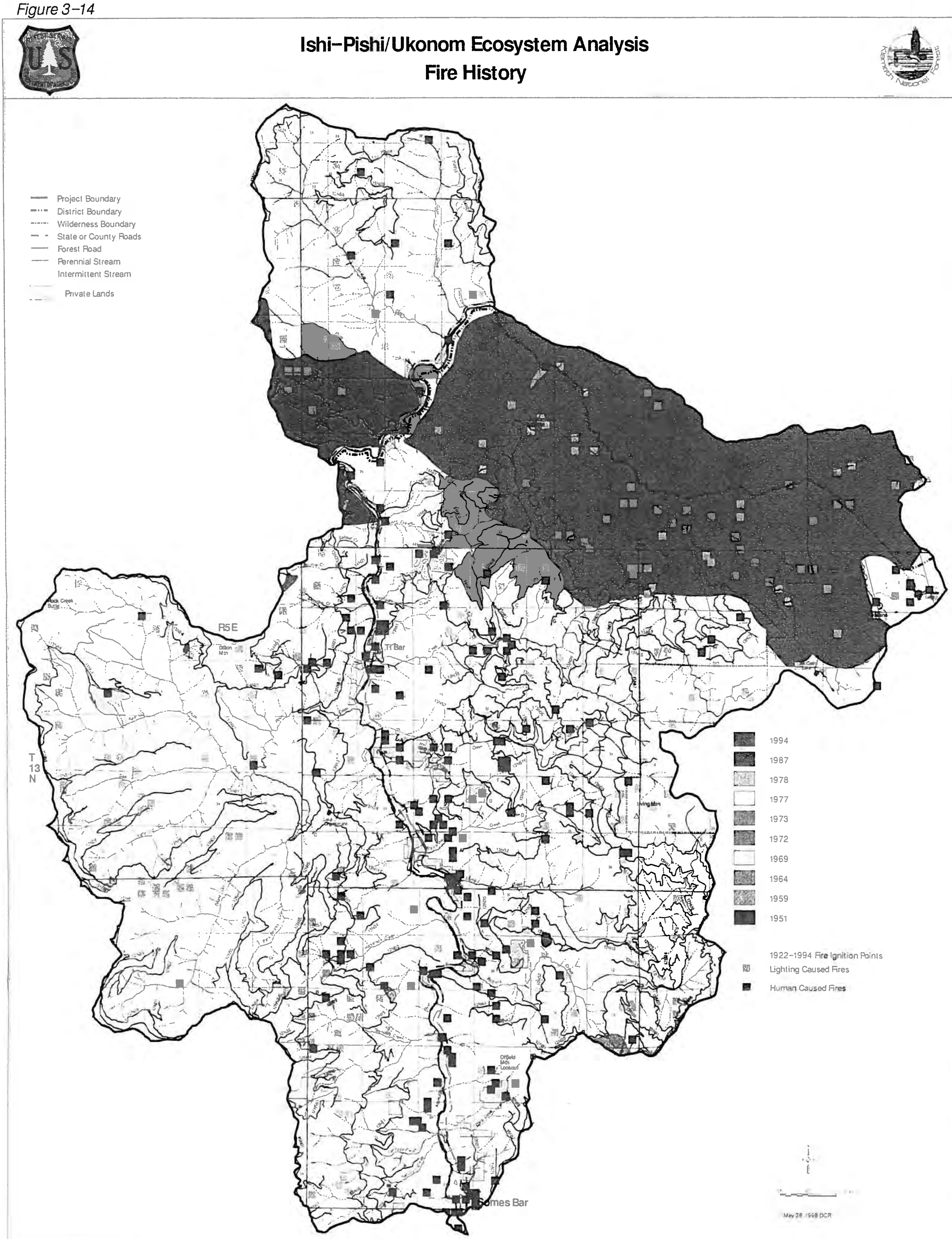

Ishi-Pishi/Ukonom Ecosystem Analysis
Fire History
Klamath National Forest
Project Boundary
District Boundary
Wilderness Boundary
State or County Roads
Forest Road
Perennial Stream
Intermittent Stream
Private Lands
1994
1987
1978
1977
1973
1972
1969
1964
1959
1951
1922-1994 Fire Ignition Points
Lighting Caused Fires
Human Caused Fires
R5E
T 13 N
Ti Bar
Somes Bar
Offield Mtn Lookout

Figure 3–15

Ishi–Pishi/Ukonom Ecosystem Analysis
Fuel Models

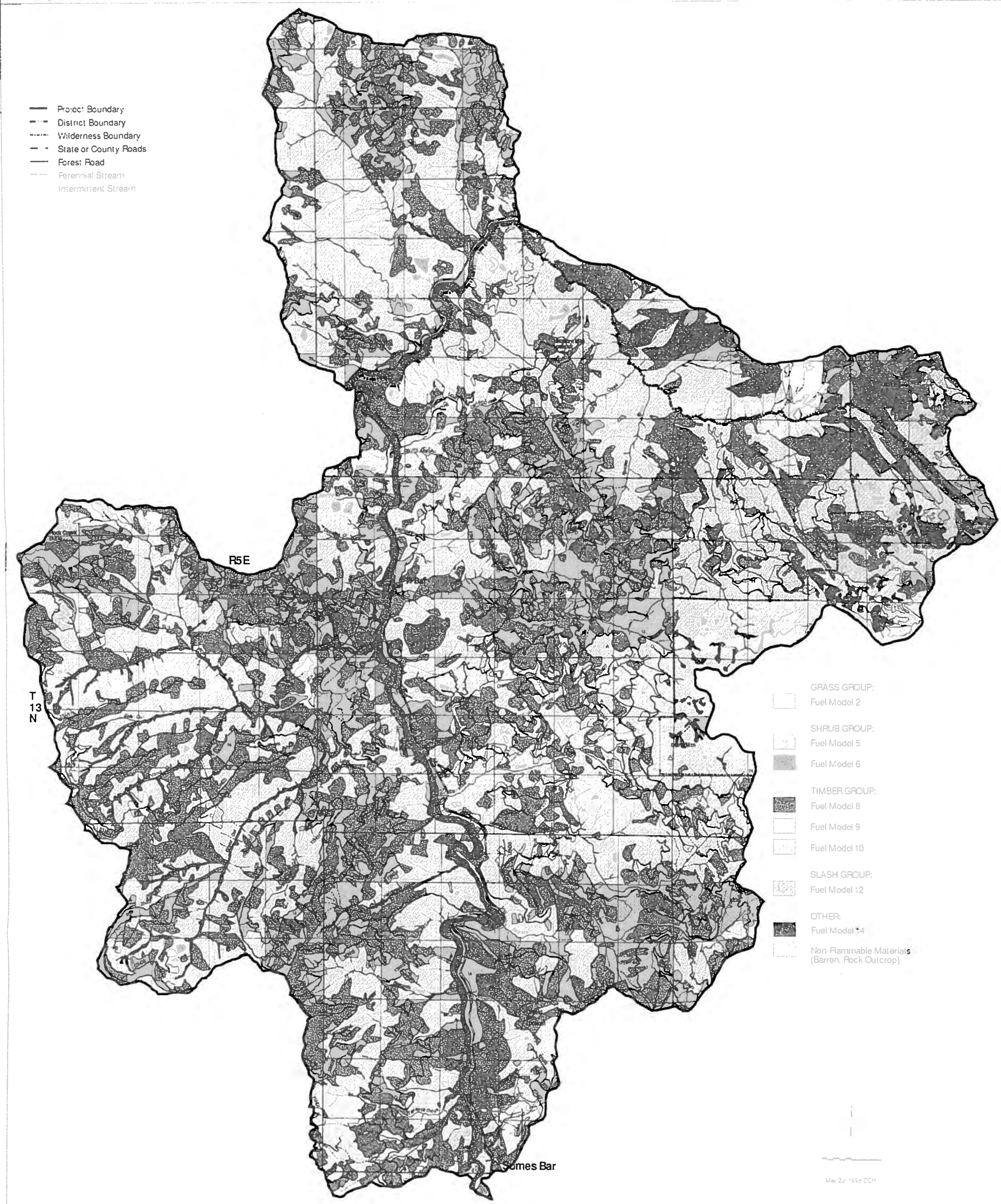


Figure 3-16

Ishi-Pishi/Ukonom Ecosystem Analysis
Fire Behavior Potential

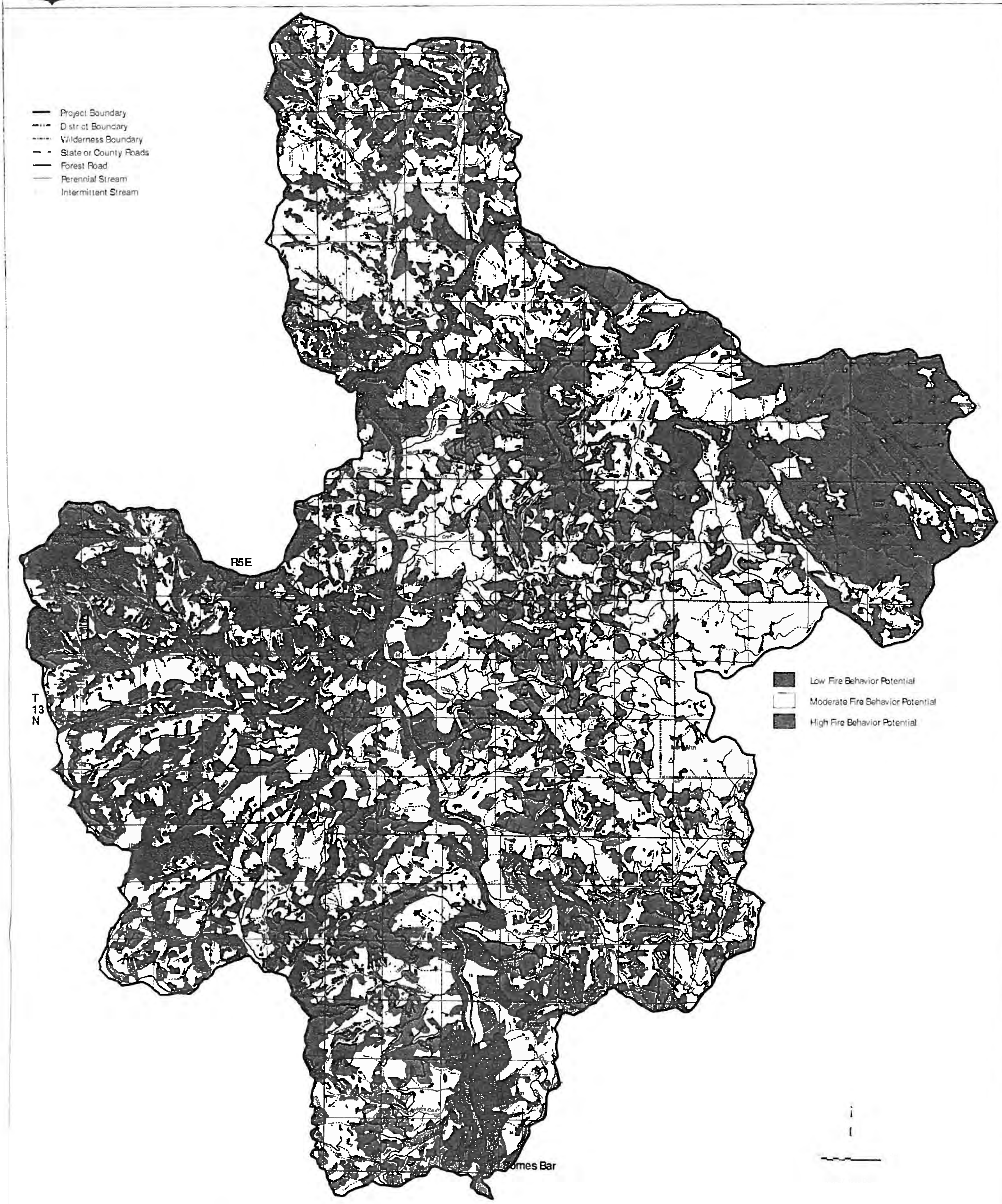


Figure 3-17

Ishi-Pishi/Ukonom Ecosystem Analysis
Suitable Nesting Habitat for Marbled Murrelet

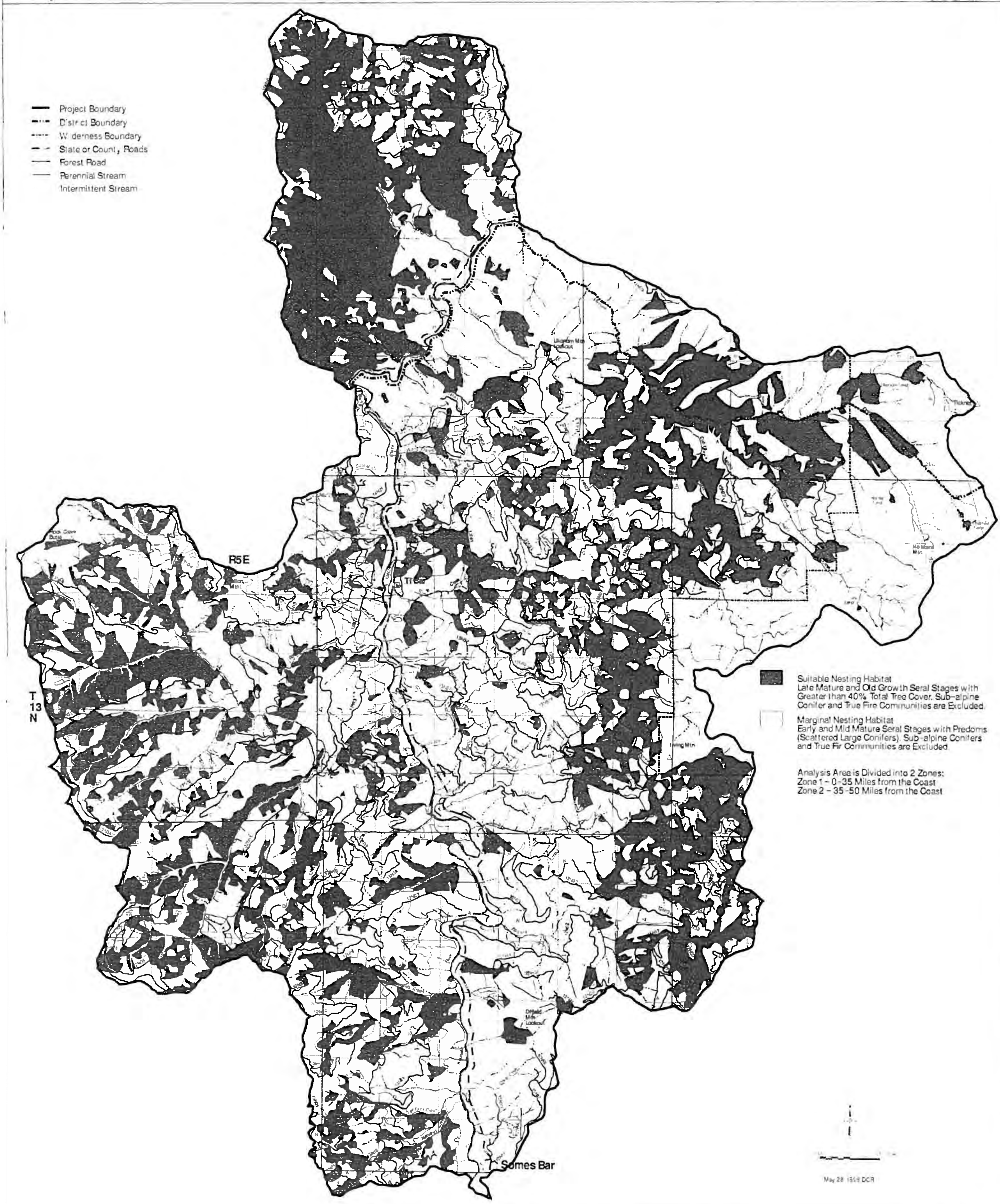


Figure 3-18

Ishi-Pishi/Ukonom Ecosystem Analysis
Suitable Habitat for American Marten and Pacific Fisher

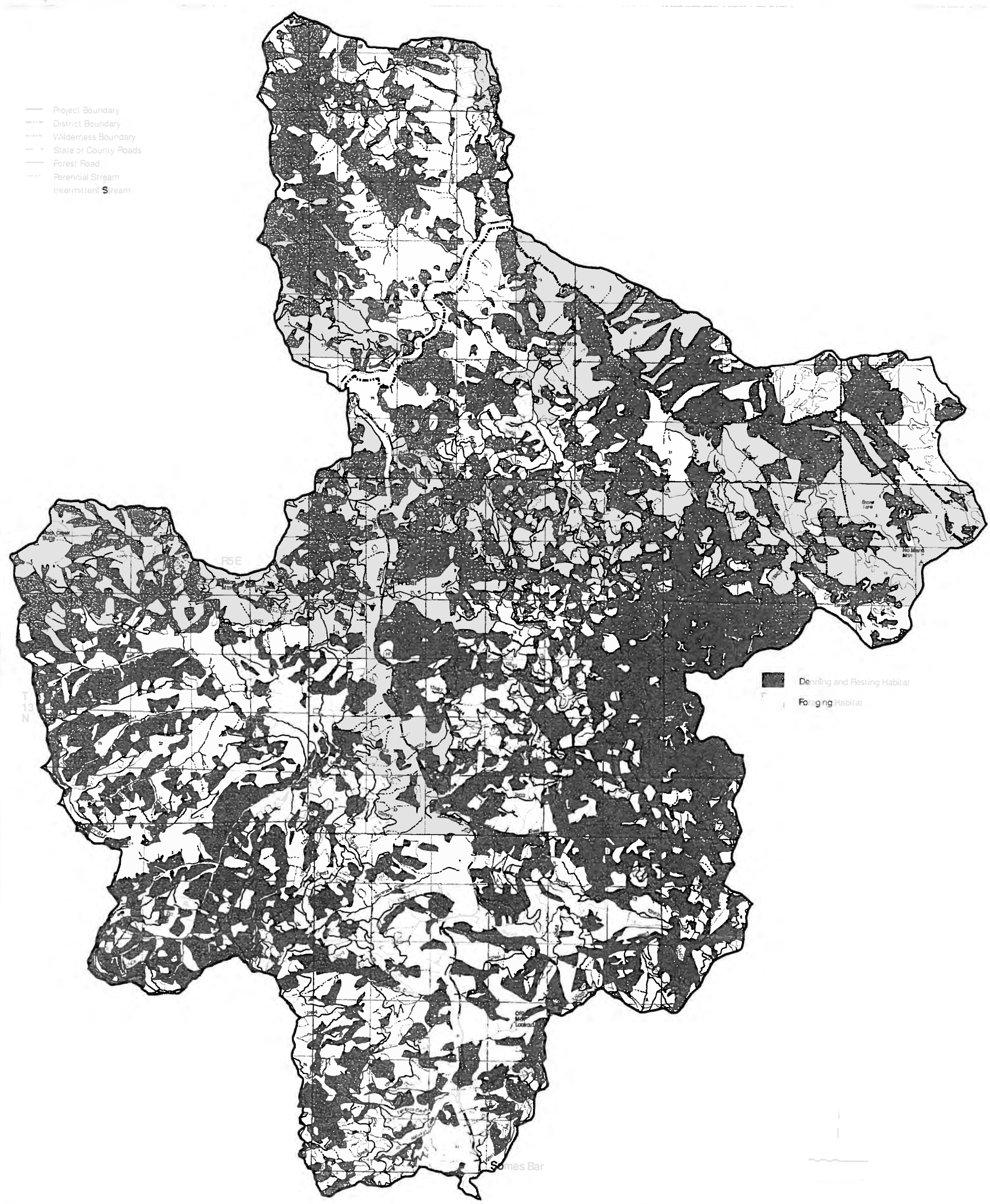


Figure 3-19

Ishi-Pishi/Ukonom Ecosystem Analysis
Current Transportation System

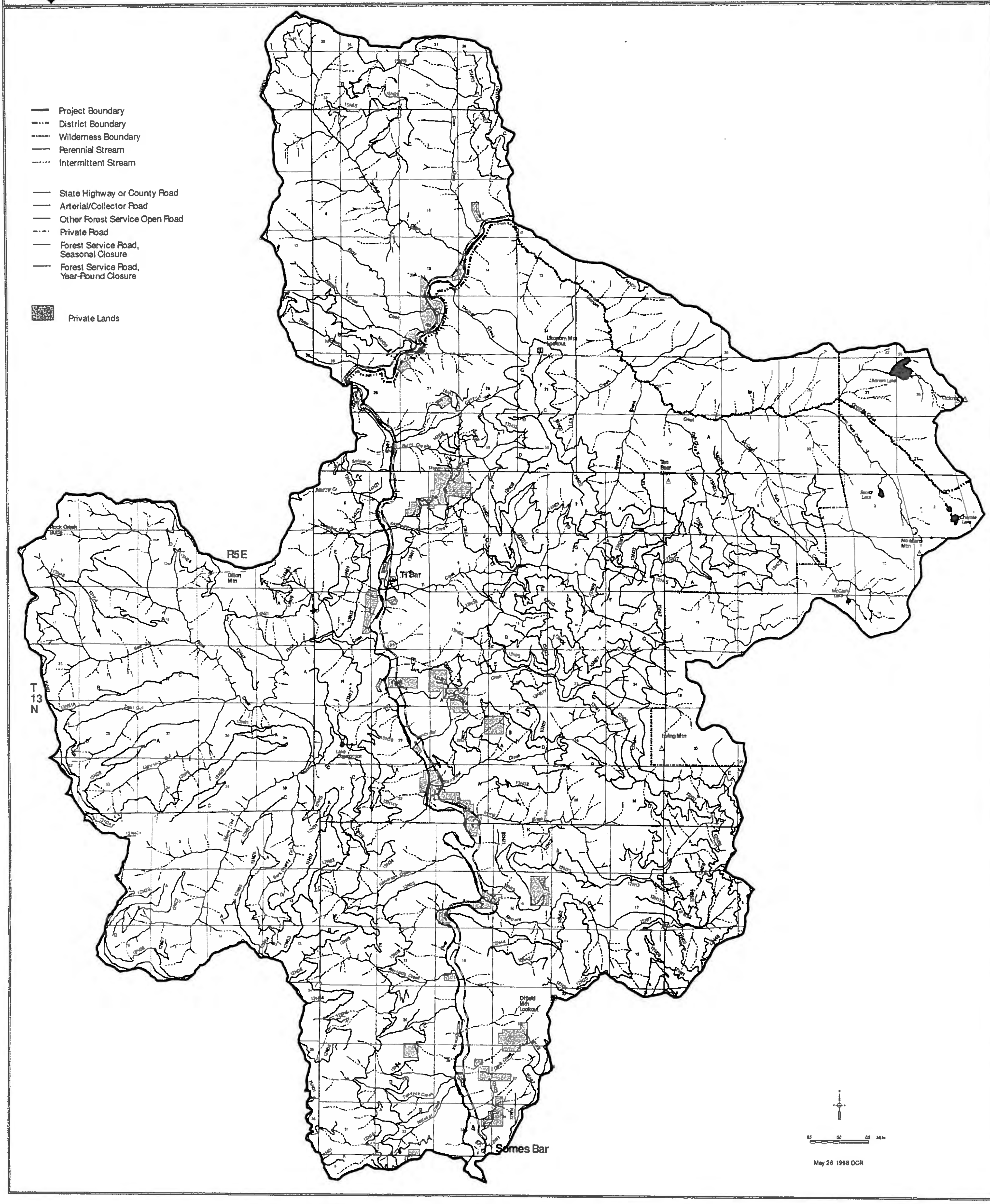


Figure 3–20

Ishi-Pishi/Ukonom Ecosystem Analysis
Road Density

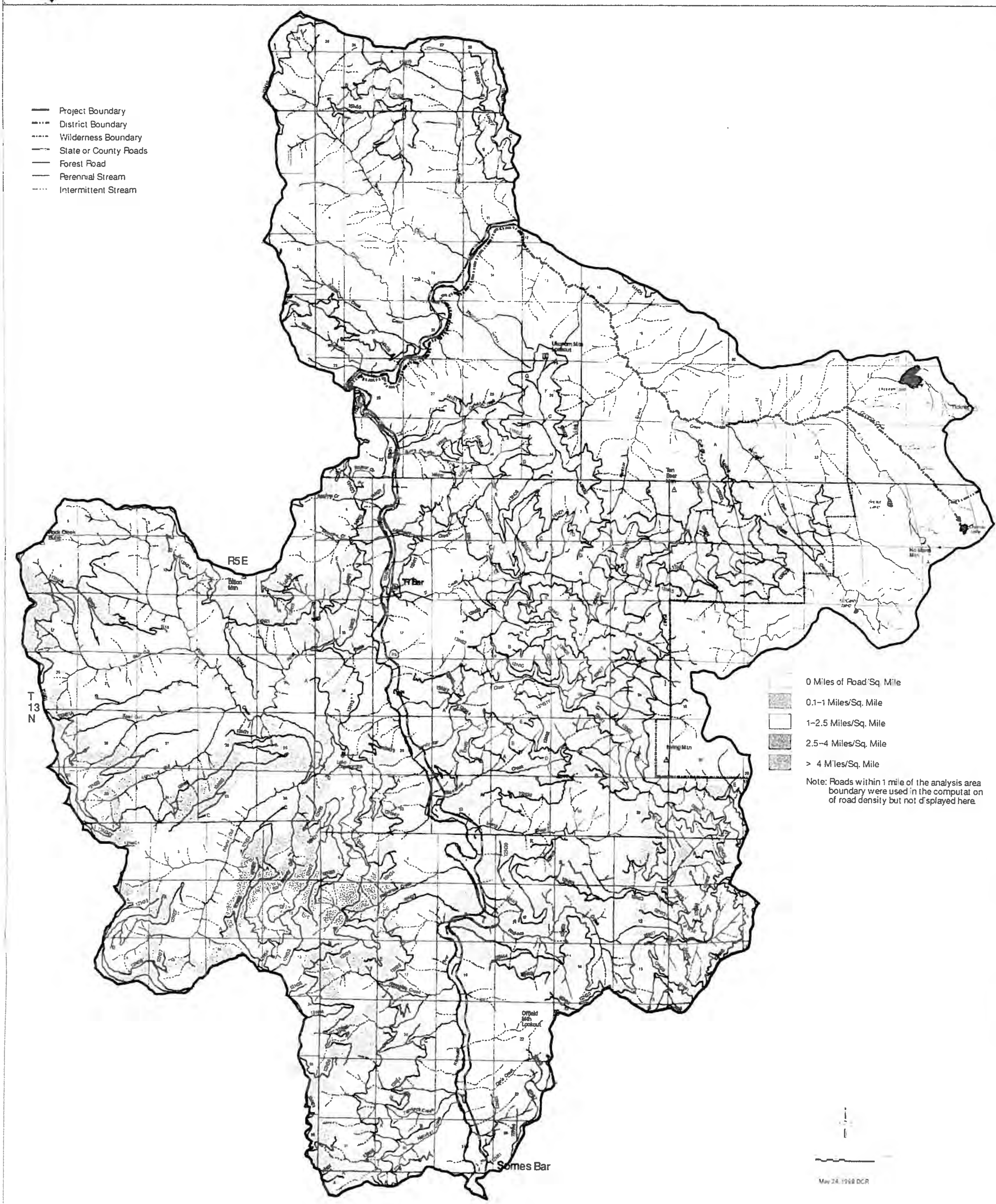


Figure 3-21

Ishi-Pishi/Ukonom Ecosystem Analysis
Existing Visual Condition

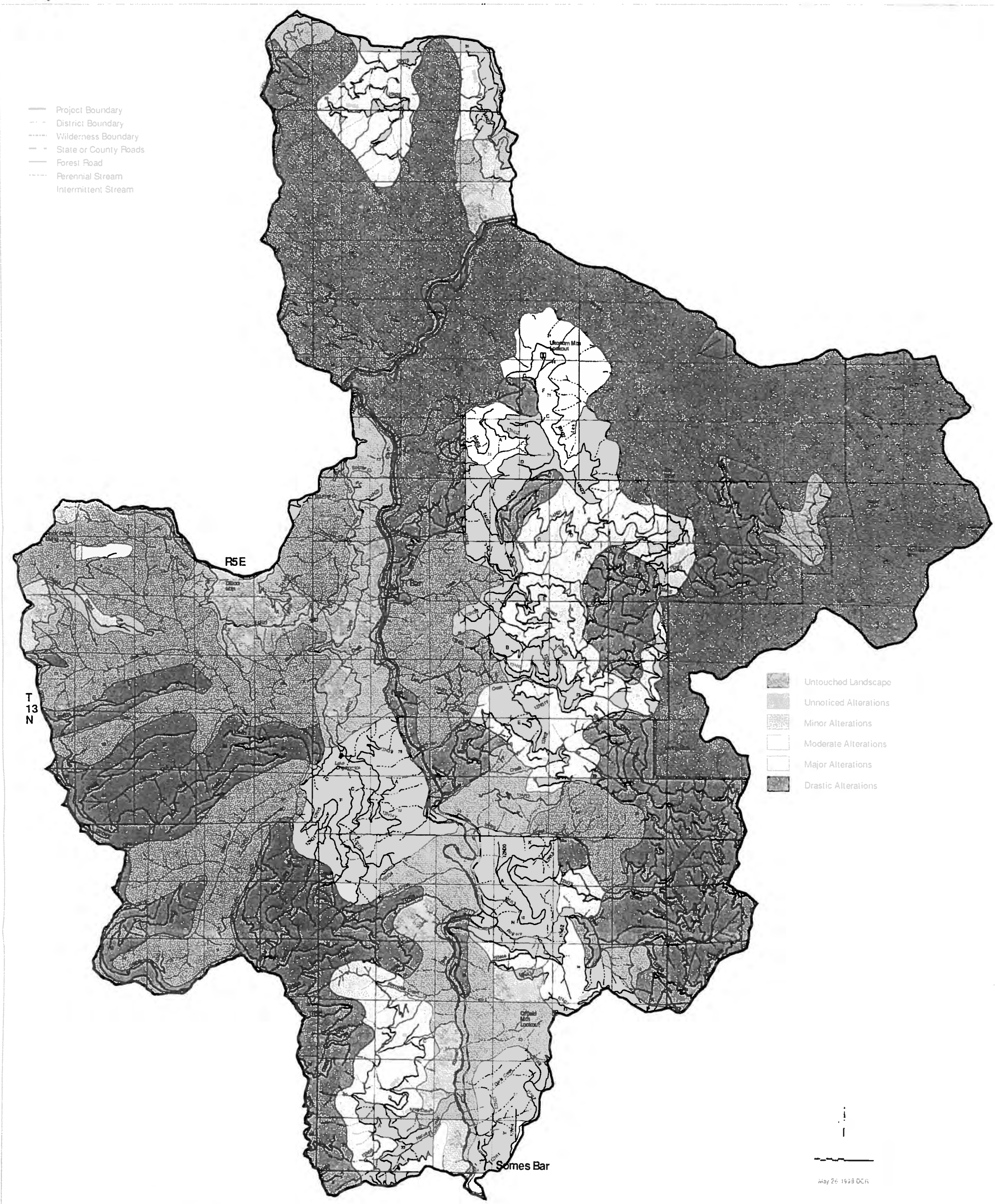


Figure 3-22

Ishi-Pishi/Ukonom Ecosystem Analysis
Recreation Features and Existing Private Land Uses

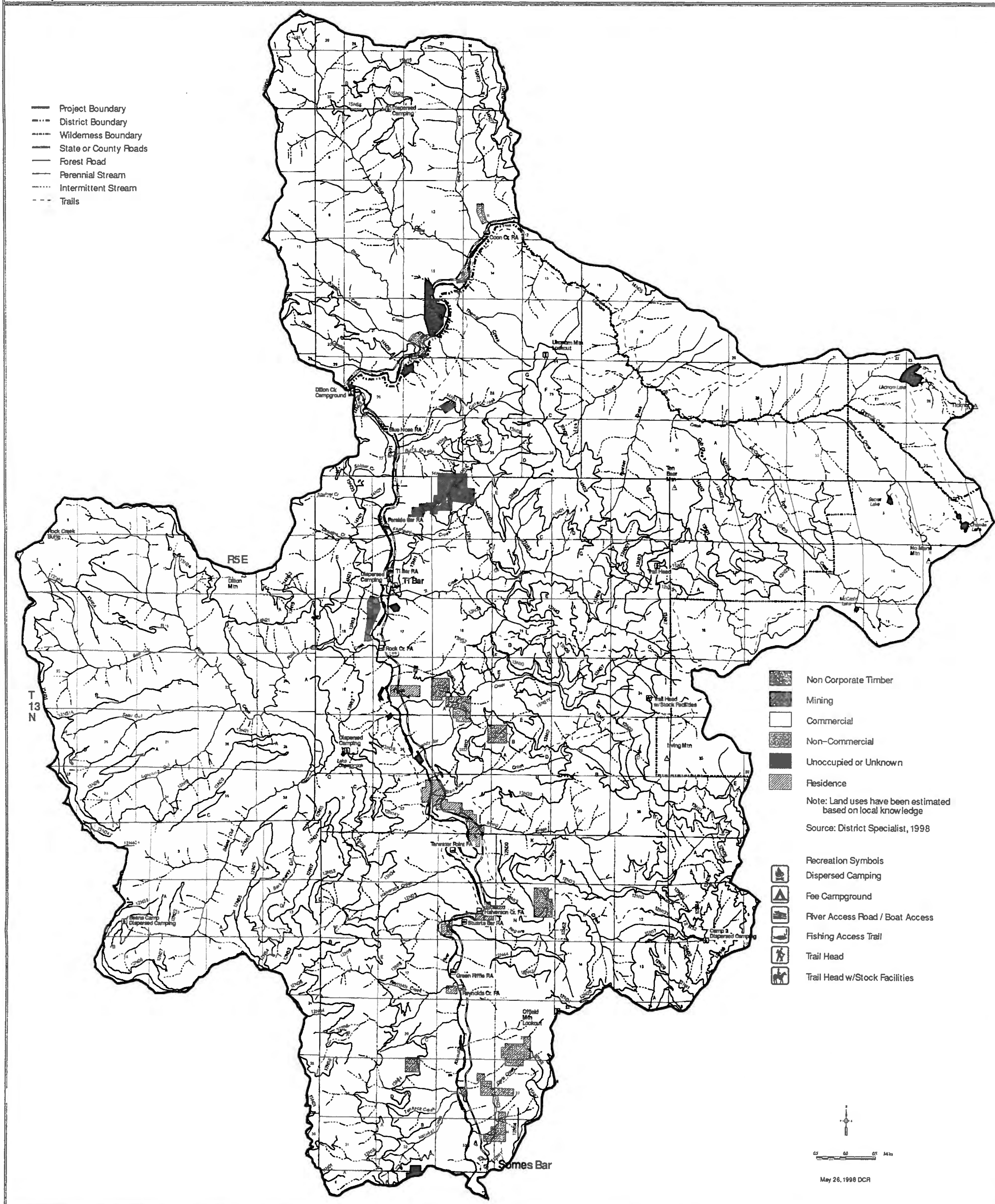


Figure 4-1

Ishi-Pishi/Ukonom Ecosystem Analysis
Historic Mines and Dumps

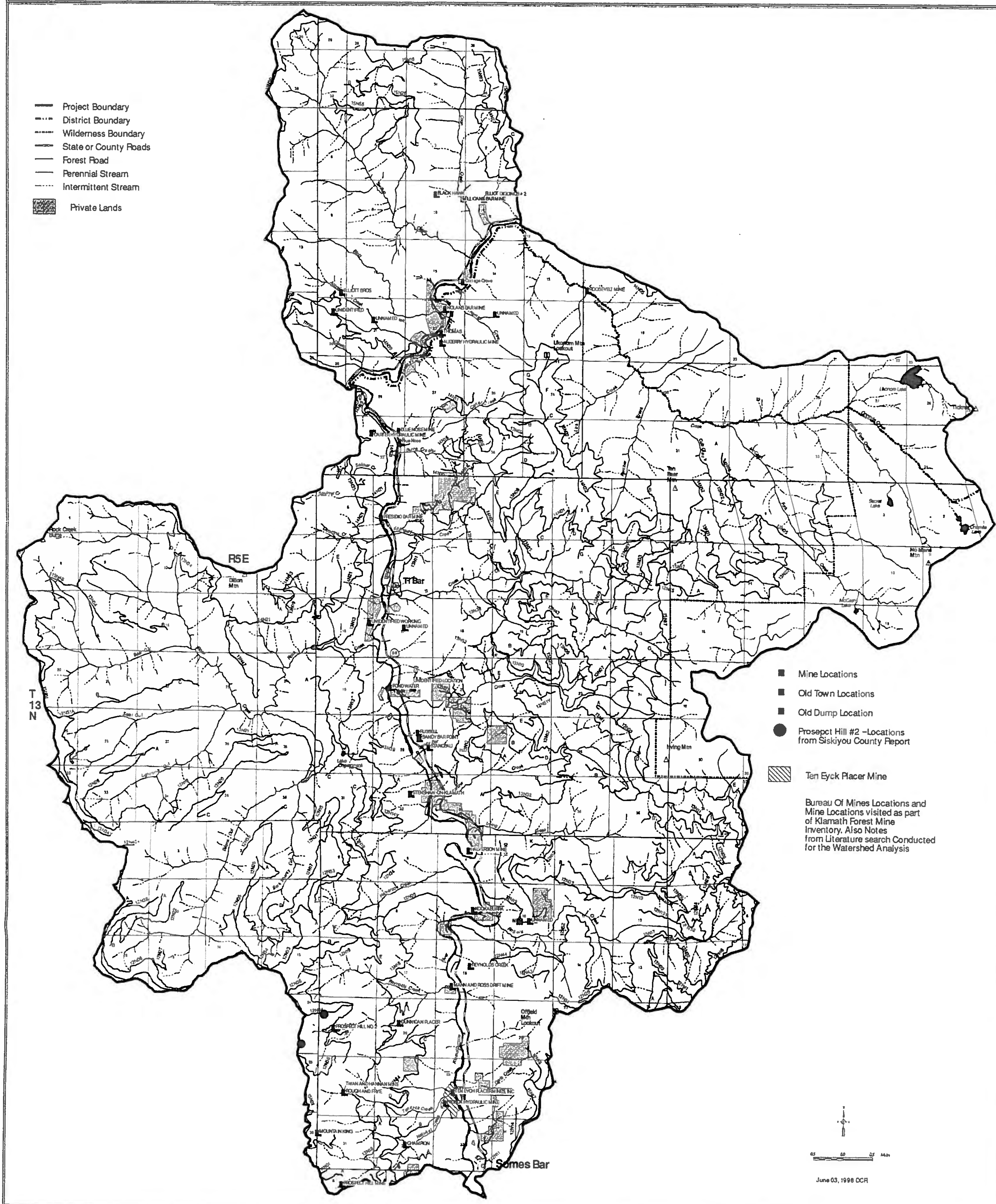


Figure 4-2

Ishi-Pishi/Ukonom Ecosystem Analysis
Road System Development

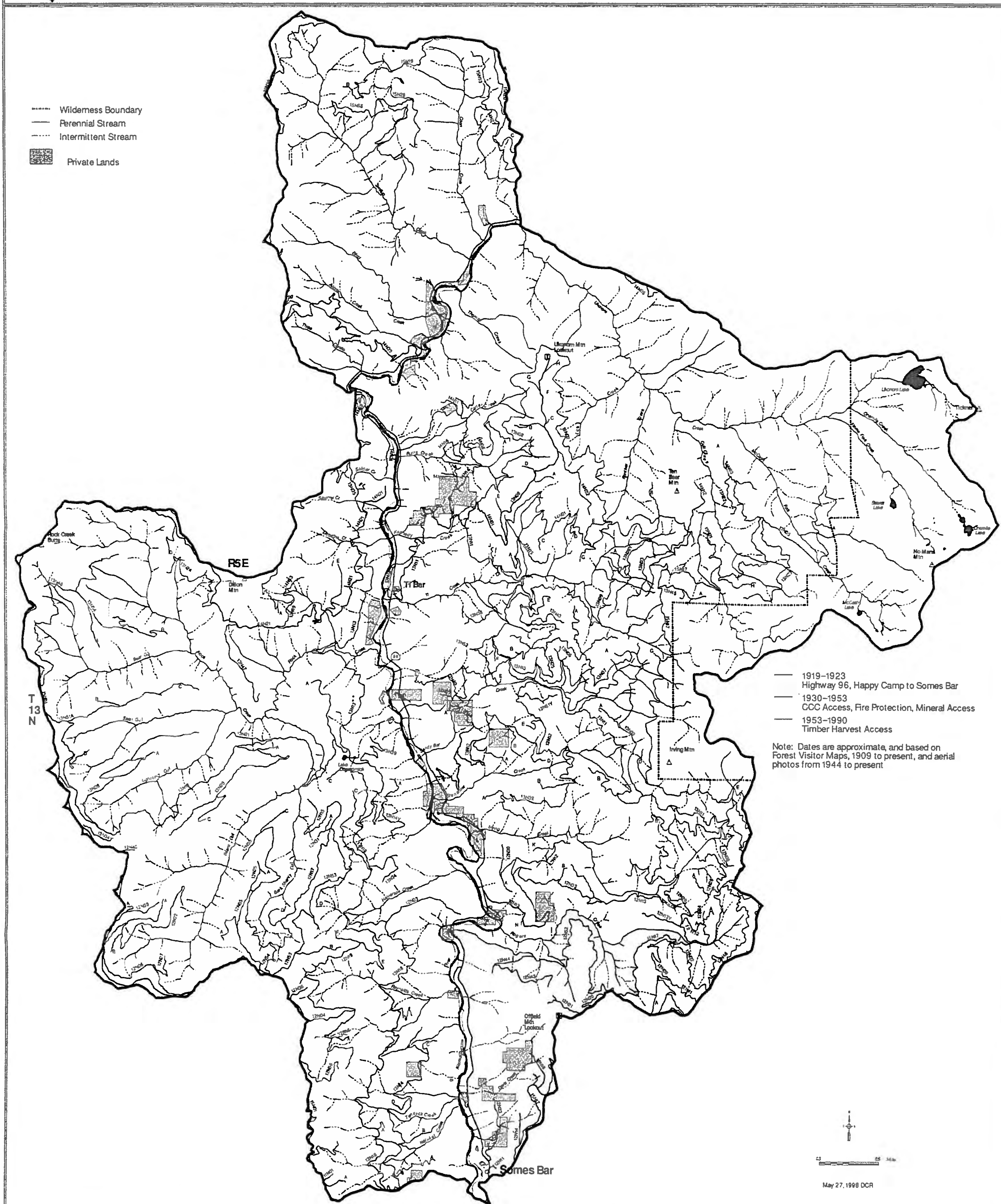


Figure 4-3

Ishi-Pishi/Ukonom Ecosystem Analysis
Historical Logging

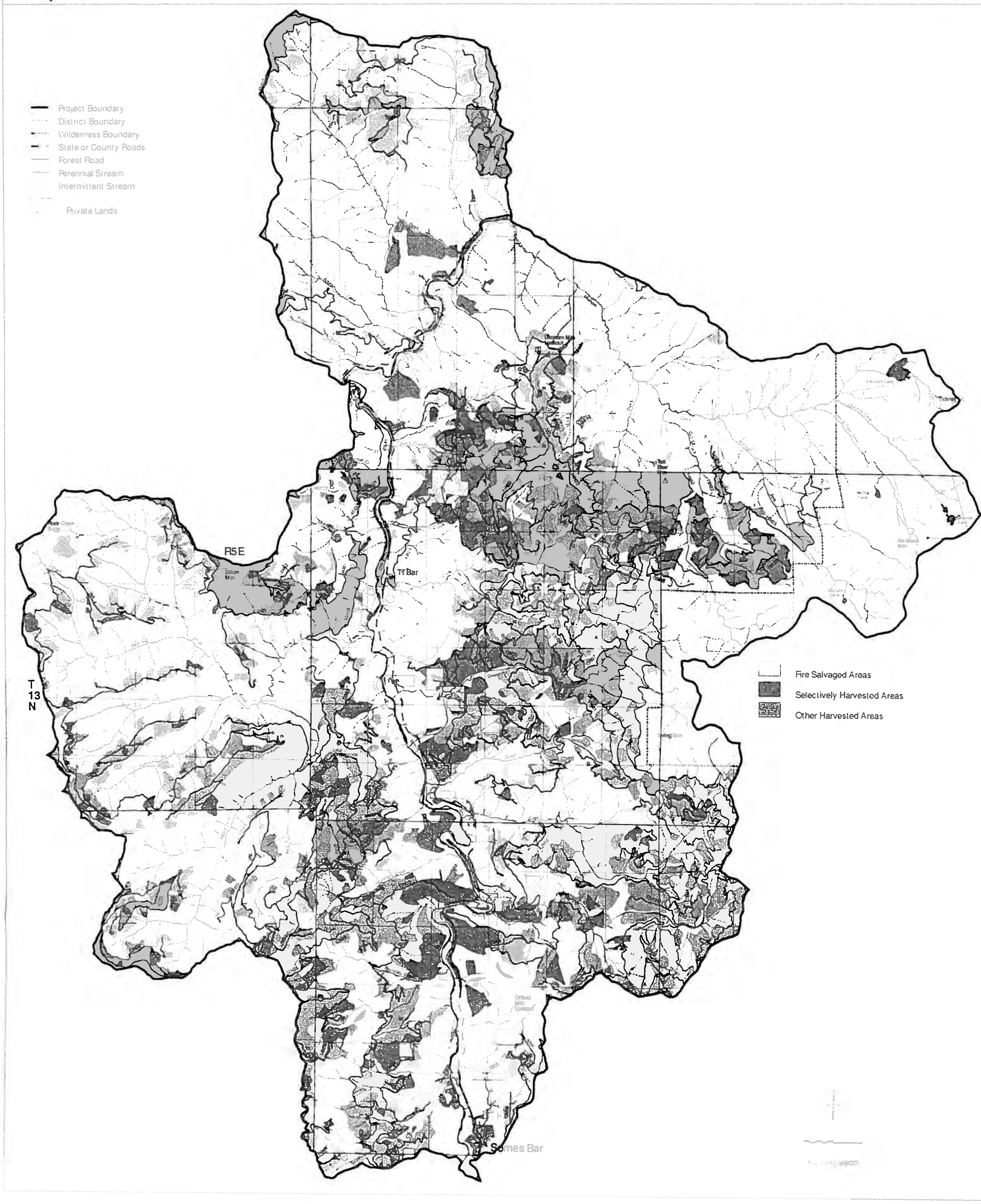


Figure 5–1

Ishi–Pishi/Ukonom Ecosystem Analysis
Impaired Watersheds

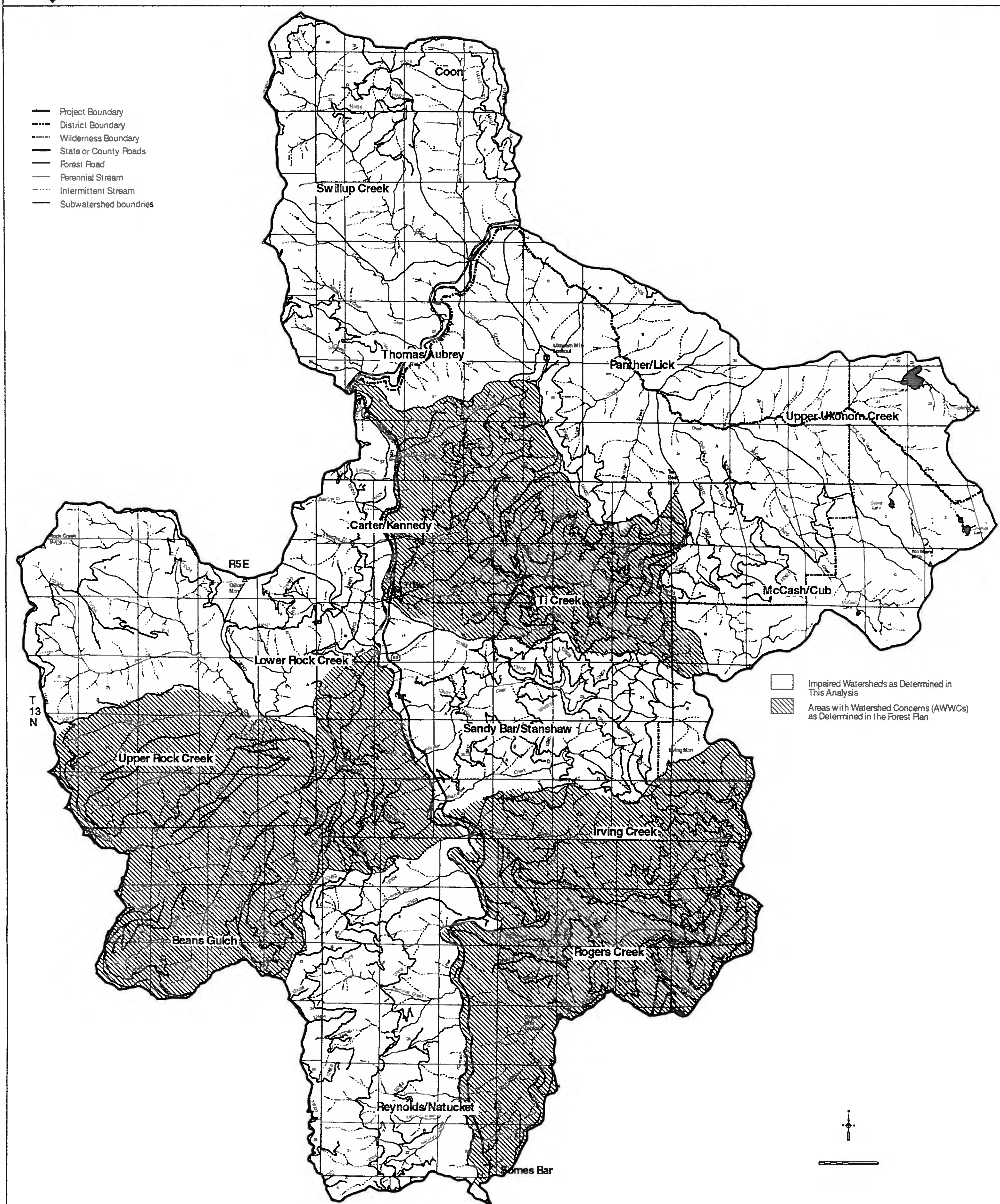


Figure 5-2

Ishi-Pishi/Ukonom Ecosystem Analysis
Post-Analysis Riparian Reserve Components

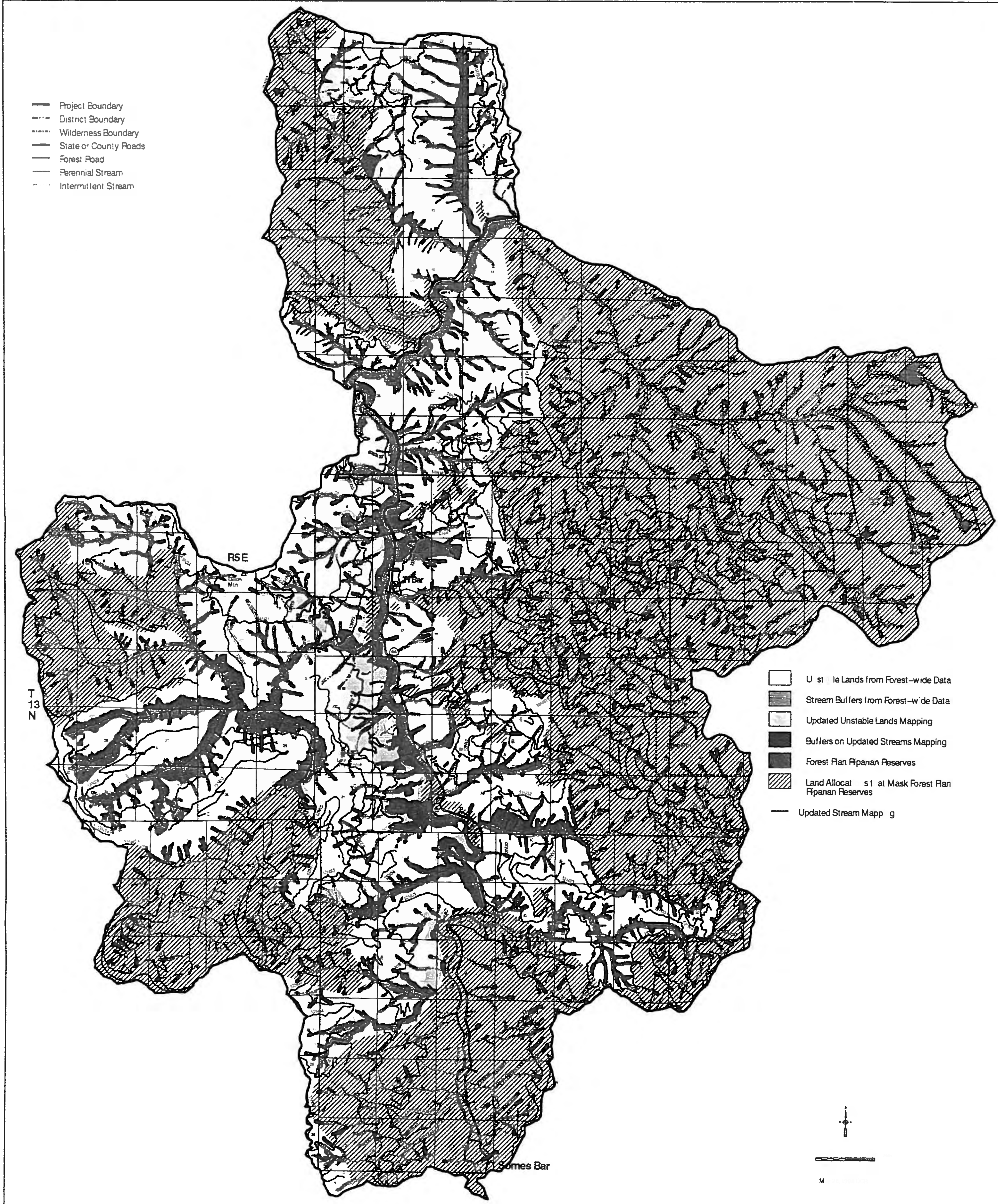


Figure 5-3

Ishi-Pishi/Ukonom Ecosystem Analysis
Fuels Treatment and Fire Management Considerations

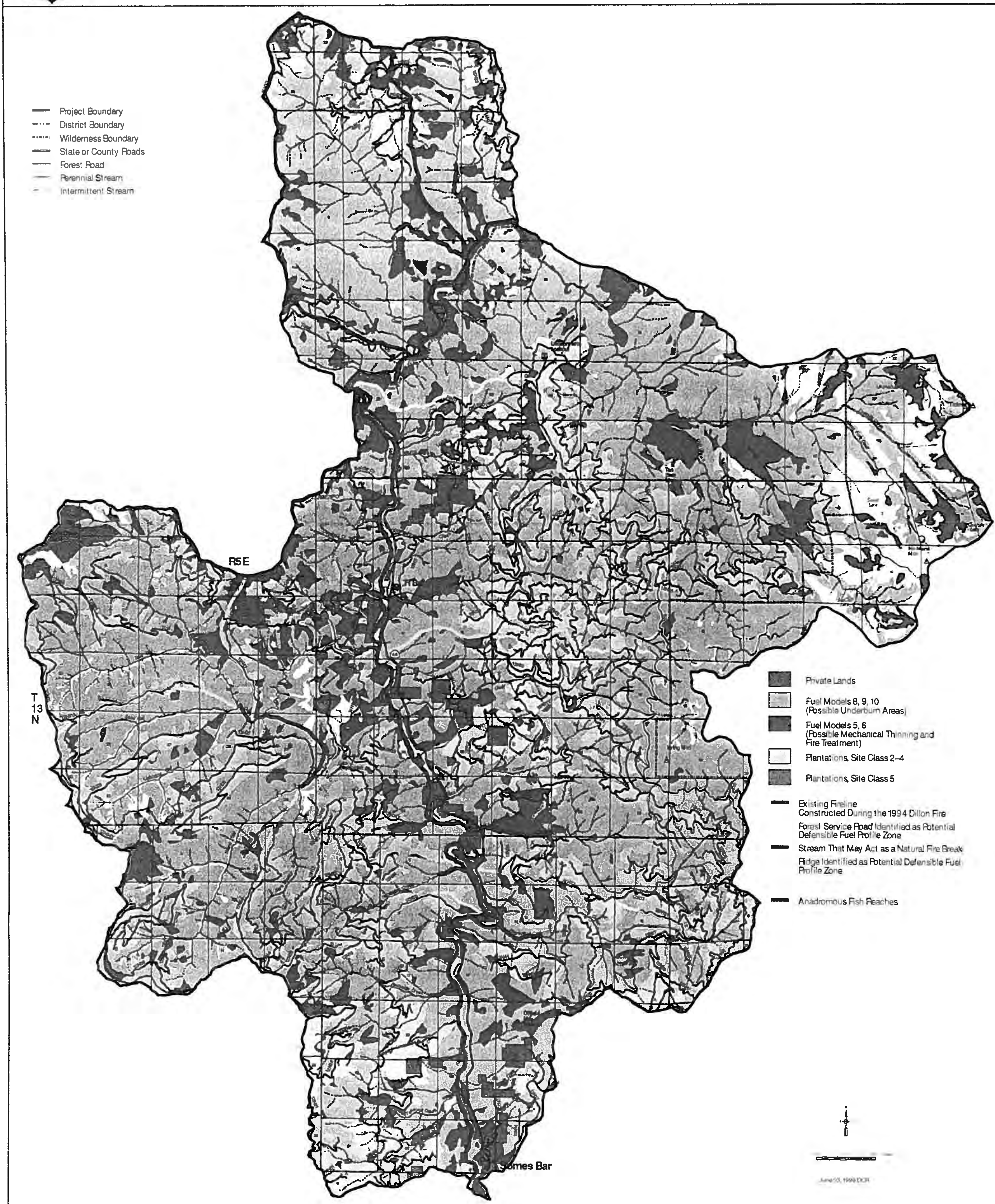


Figure 5–4

Ishi-Pishi/Ukonom Ecosystem Analysis
Roads Analysis Results

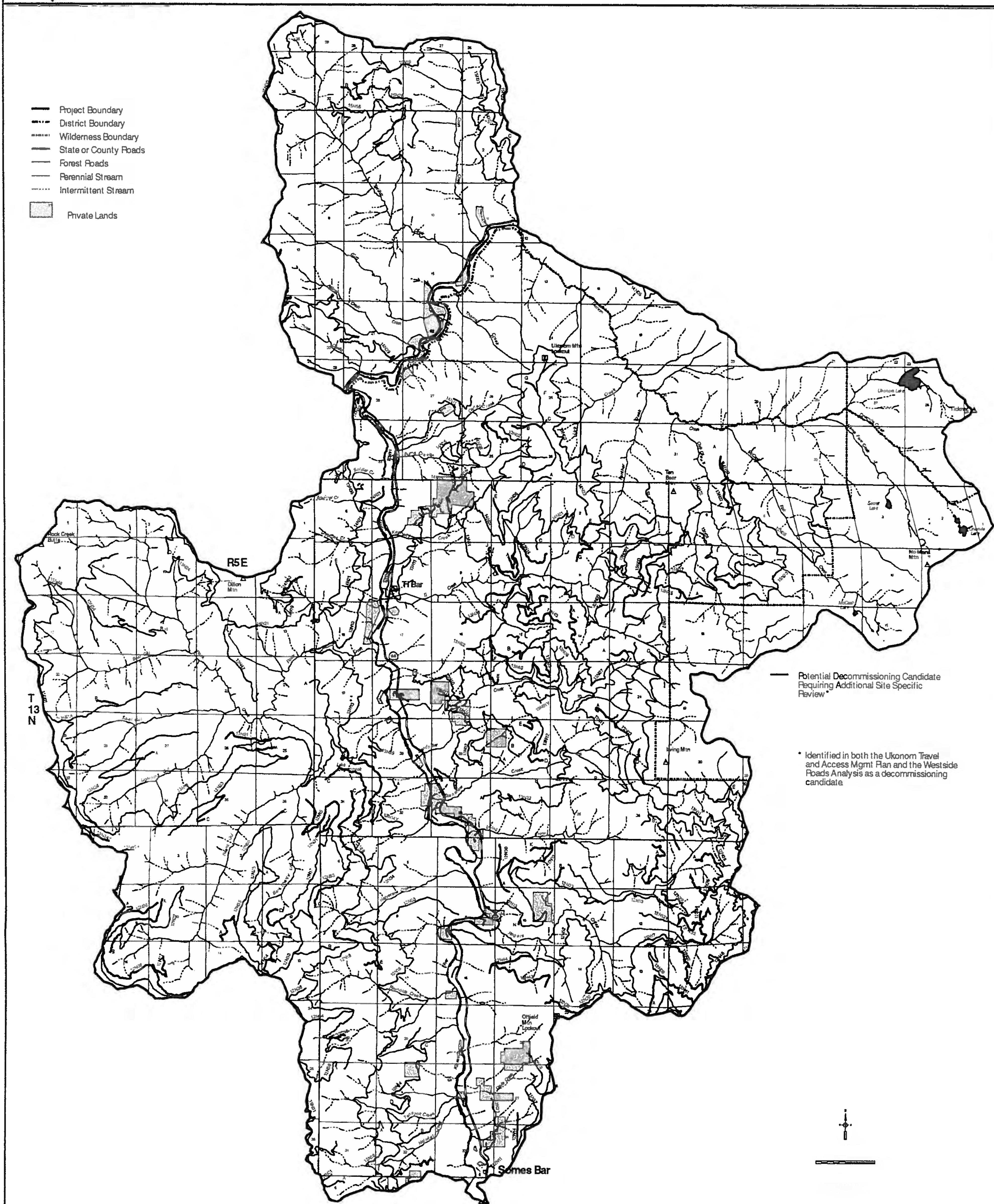


Figure 5–5

Ishi–Pishi/Ukonom Ecosystem Analysis
Lands Available for Scheduled Timber Harvest

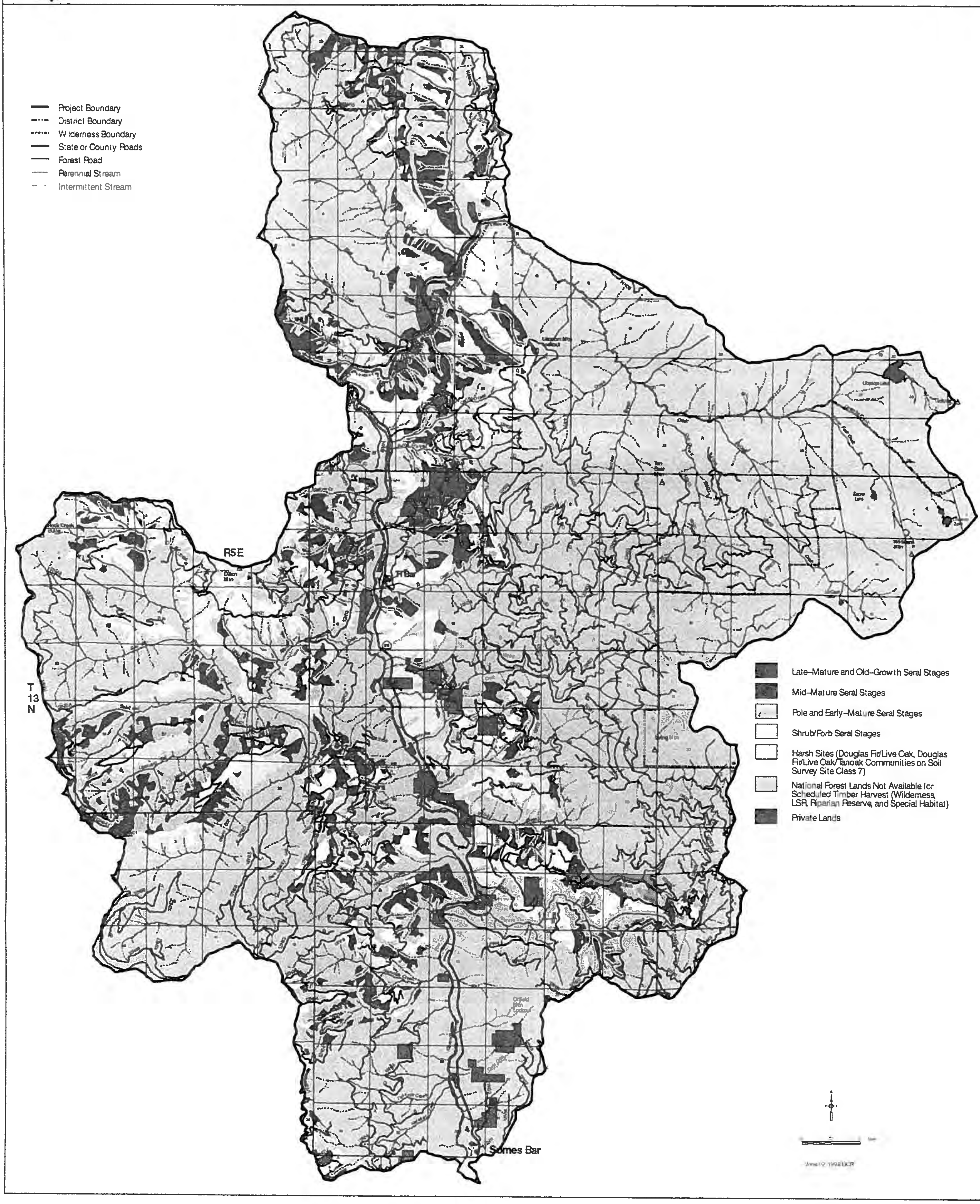


Figure 5-6

Ishi-Pishi/Ukonom Ecosystem Analysis
Timber Management Options

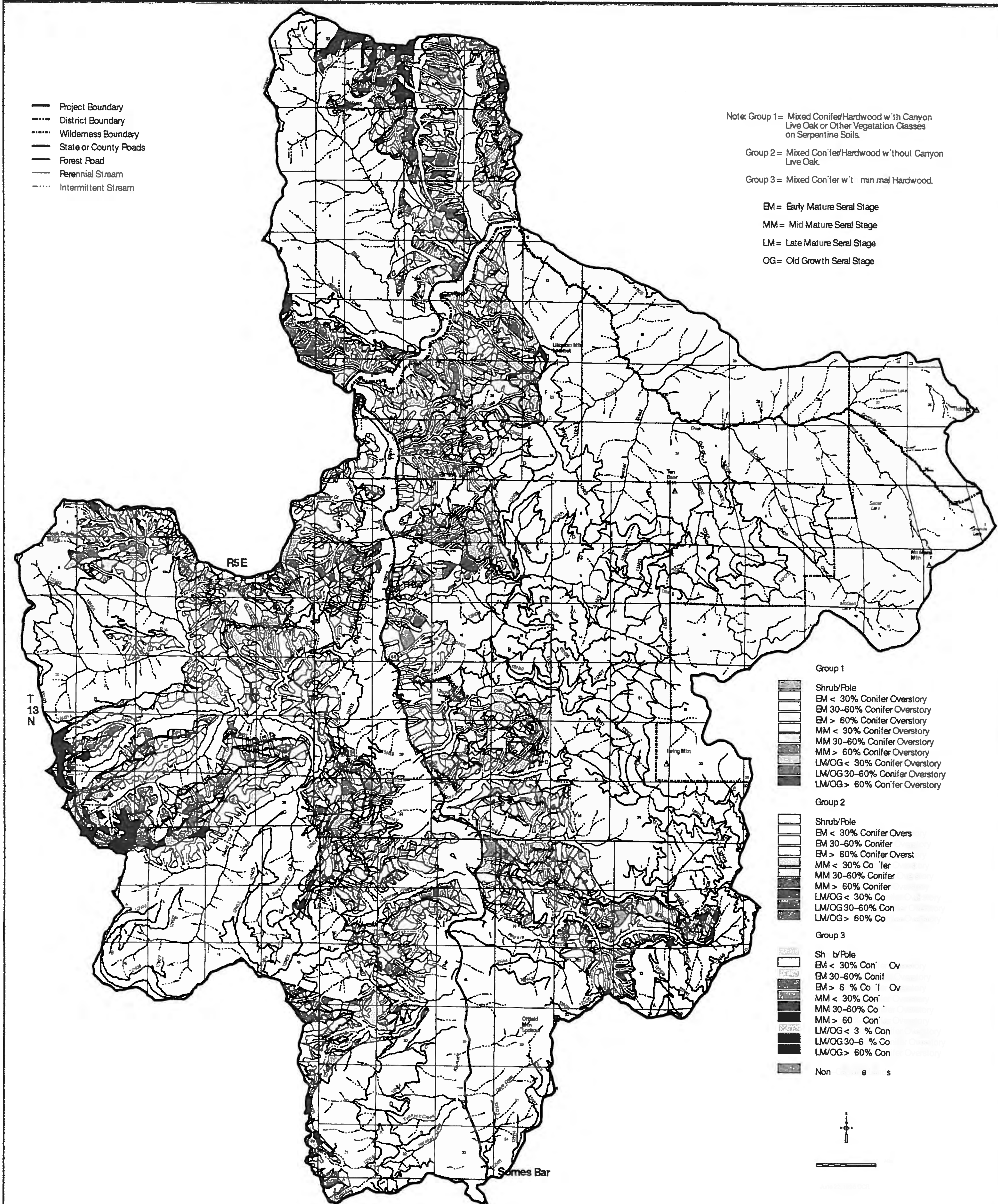


Figure 5–7

Ishi–Pishi/Ukonom Ecosystem Analysis
Visual Quality Objectives

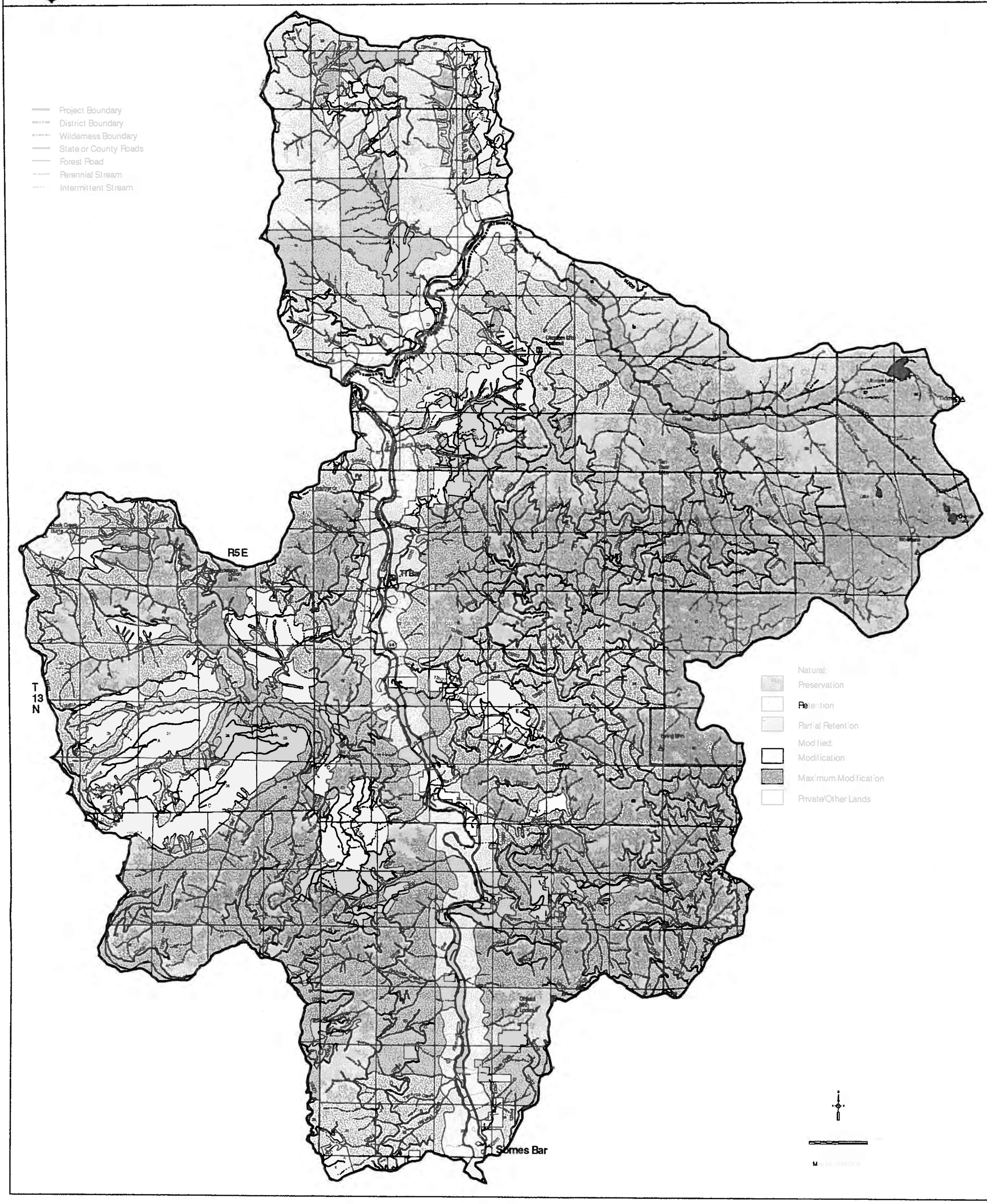


Figure 6–1

Ishi–Pishi/Ukonom Ecosystem Analysis
Management Opportunities (1 of 4)

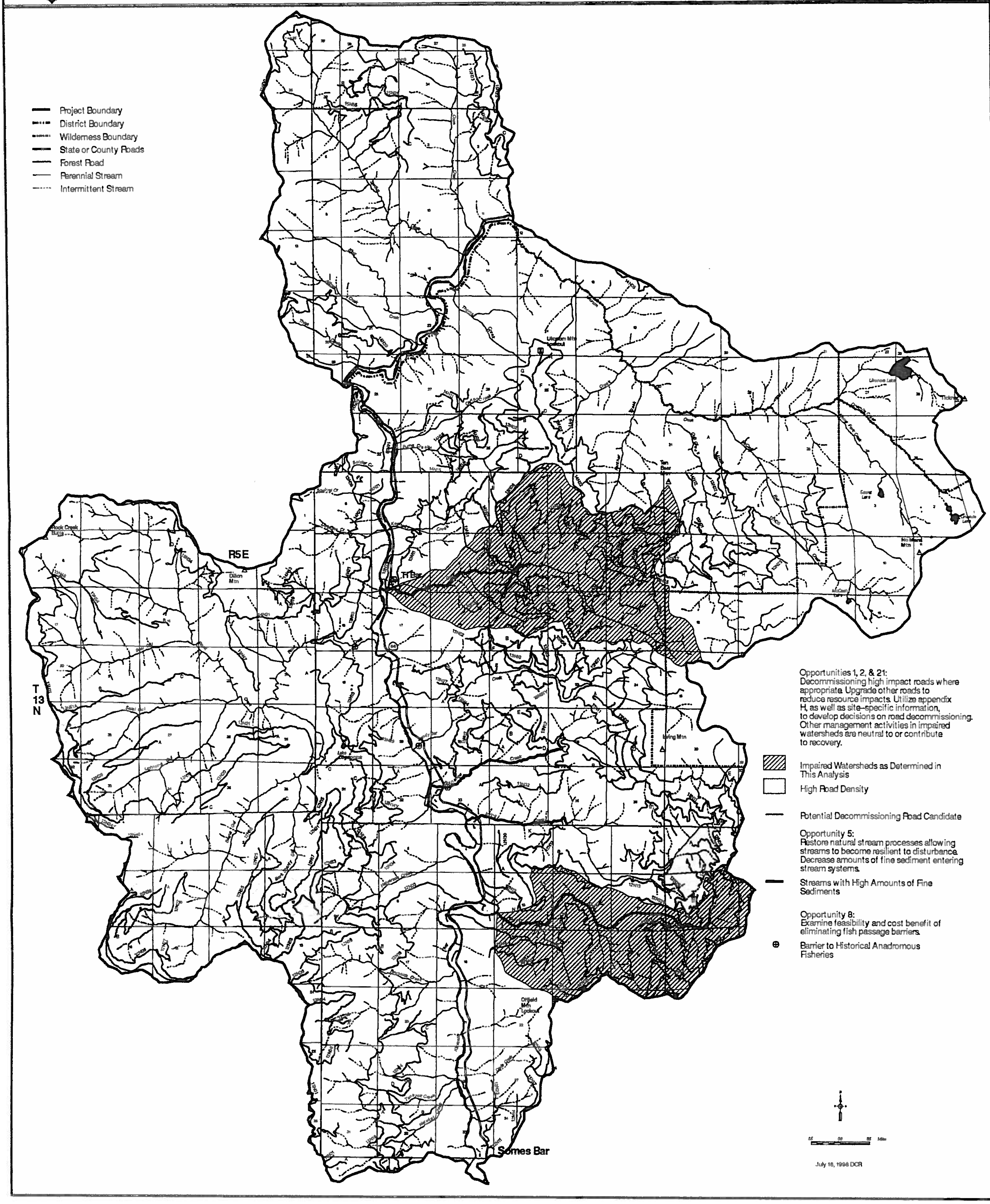


Figure 6–2

Ishi–Pishi/Ukonom Ecosystem Analysis
Management Opportunities (2 of 4)

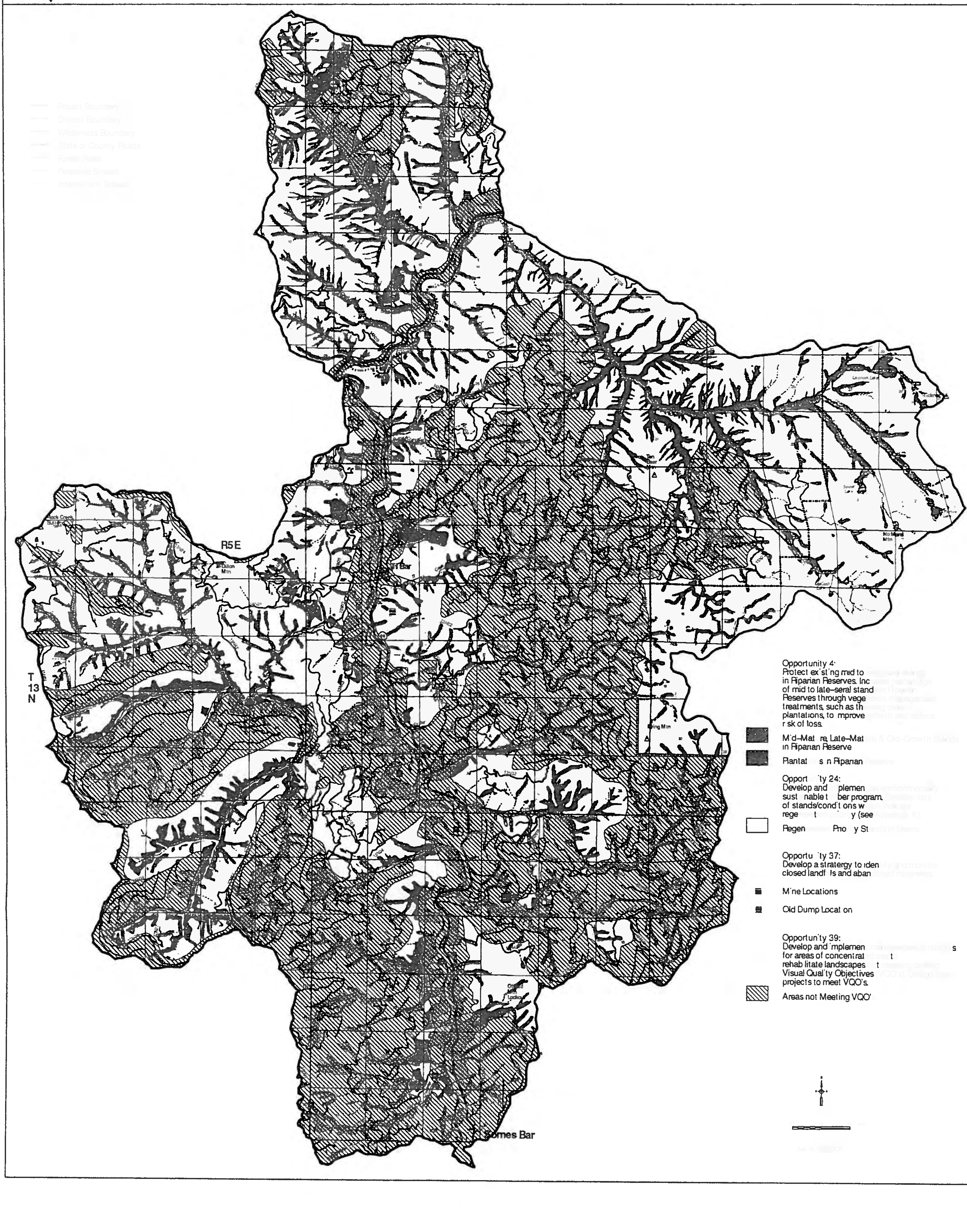


Figure 6–3

Ishi–Pishi/Ukonom Ecosystem Analysis
Management Opportunities (3 of 4)

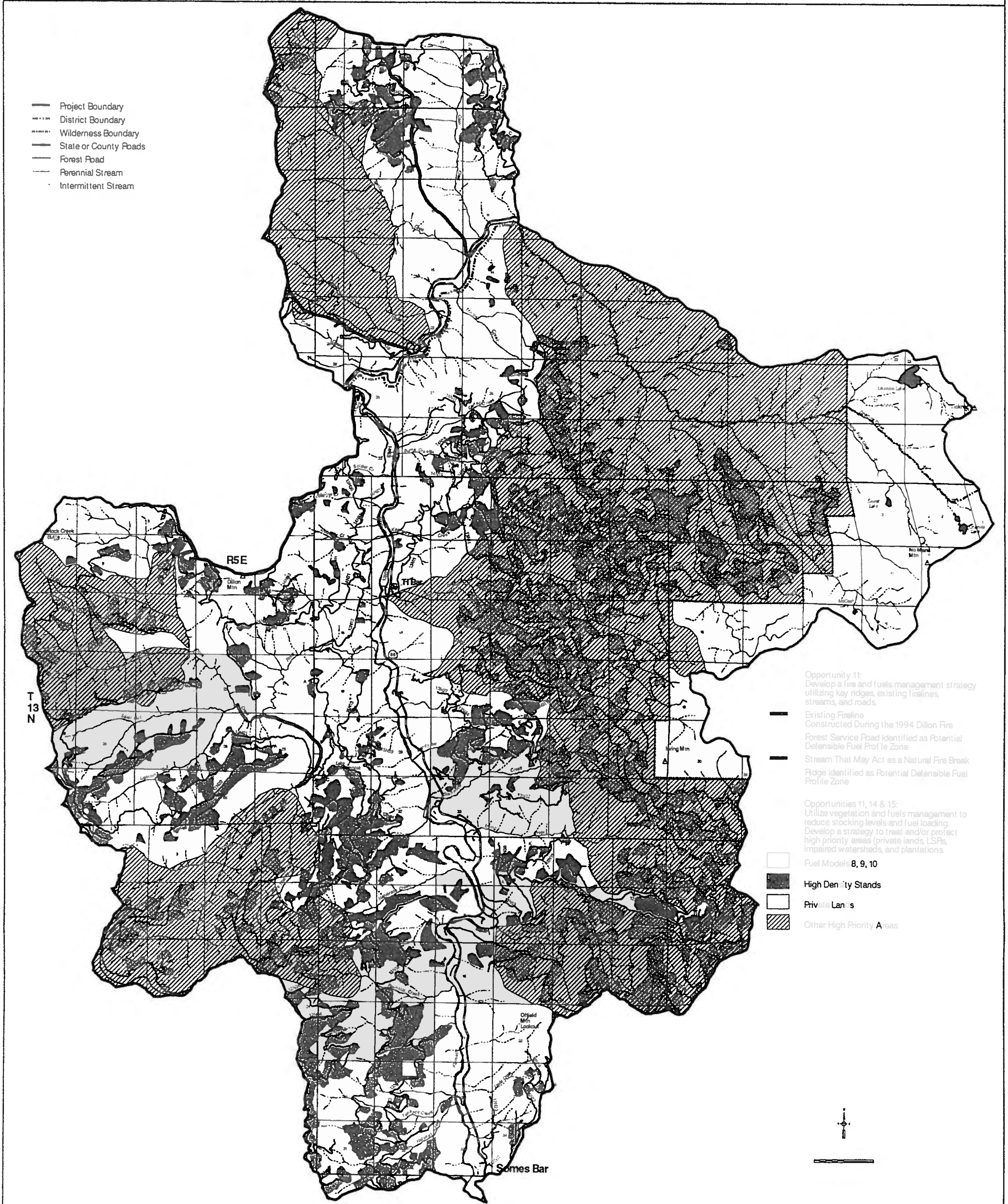


Figure 6–4

Ishi–Pishi/Ukonom Ecosystem Analysis
Management Opportunities (4 of 4)