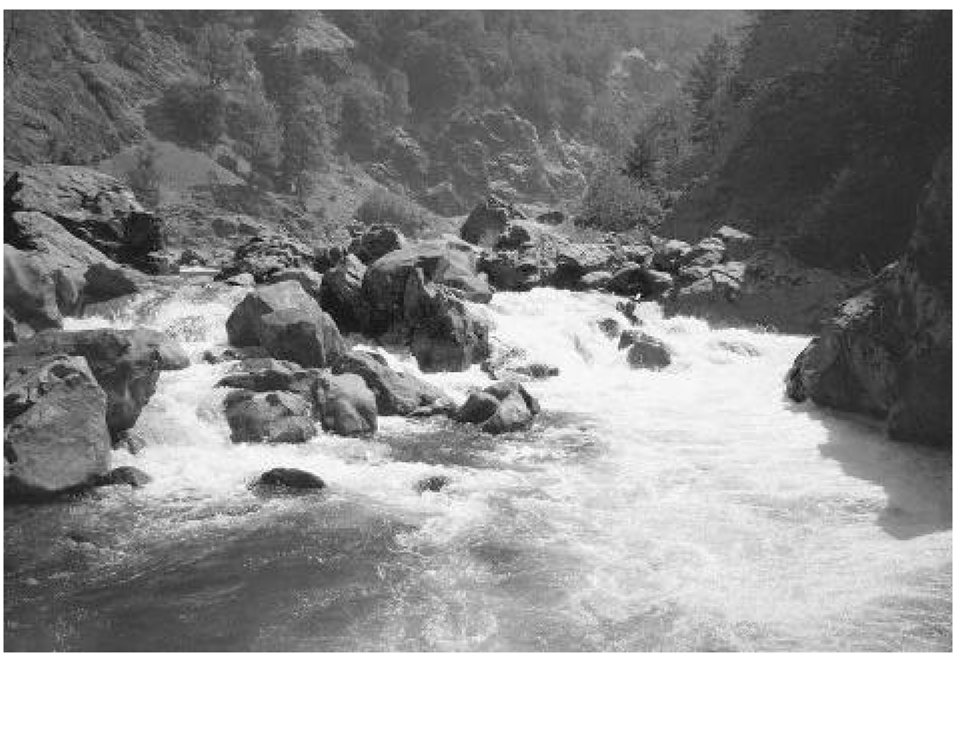
Mainstem Trinity Watershed Analysis

United States
Department of
Agriculture

Forest Service

Pacific
Southwest
Region

Six Rivers
National
Forest
May 2003



Mainstem Trinity Watershed Analysis

Prepared For:
U.S. Department of Agriculture
Forest Service
Pacific Southwest Region
Six Rivers National Forest
Lower Trinity Ranger District

Located within Humboldt and Trinity Counties, Klamath Province, CA
May 2003

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CHAPTER 1 CHARACTERIZATION OF THE WATERSHEDS

CHAPTER 3 REFERENCE & CURRENT CONDITIONS

INTRODUCTION

The Purpose of Watershed Analysis

Watershed analysis is a procedure used to characterize the human, aquatic, riparian, and terrestrial features, conditions, processes and interactions (collectively referred to as "ecosystem elements") within a watershed. It provides a systematic way to understand and organize ecosystem information. In doing so, watershed analysis enhances our ability to estimate direct, indirect, and cumulative effects of our management activities and guide the general type, location, and sequence of appropriate management activities within the watershed.

Watershed analysis is ecosystem analysis at the watershed scale that provides the watershed context for resource protection, restoration and enhancement efforts. The understanding gained through watershed analysis is critical to sustaining the health and productivity of natural resources. Healthy ecological functions are essential to maintain current and to create future social and economic opportunities.

Watershed analyses are conducted by a team of journey-level specialists who follow the six-step process outlined in *"Ecosystem Analysis at the Watershed Scale – Federal Guide for Watershed Analysis."* This process is issue driven. Rather than attempting to identify and address everything in the ecosystem, teams focus on core analysis topics along with watershed-specific problems or concerns. These problems or concerns may be known or suspected before undertaking the analysis or may be discovered during the analysis. The Analysis Team identifies and describes ecological processes of greatest concern, establishes how these processes are functioning, and determines the conditions under which management activities should and should not be taken.

Watershed analysis is not a decision-making process. Rather it is a stage-setting process. The results of watershed analysis establish the context for subsequent decision-making processes. The results of watershed analysis can be used to

- Assist in developing ecologically sustainable programs to produce water, timber, recreation, and other commodities
- Facilitate program and budget development by identifying and setting priorities for social, economic, and ecological needs within and among watersheds
- Establish consistent watershed context for project level National Environmental Policy Act (NEPA) analyses
- Establish a watershed context for evaluating management activity and project consistency given existing plan objectives
- Establish a consistent watershed context for implementing the Endangered Species Act
- Establish a consistent watershed context for local government water quality efforts and for protection of beneficial uses identified by the states and tribes in their water quality standards under the Federal Clean Water Act

Focus of This Watershed Analysis

The focus of this Watershed Analysis is to assess the effects of human activities including fuels reduction and timber harvesting on the physical, biological, and human processes within the Mainstem Trinity Watershed Analysis Area (MTWAA) encompassing mainly Willow, Campbell, Hawkins, Coon, and Sharber creeks. The MTWAA will provide information on the current condition in these watersheds as well as the desired condition based on the Land and Resource Management Plan (LRMP) and the Forest-wide Late-Successional Reserve Assessment (LSRA). It will also identify opportunities and possible management practices that could be implemented to meet the following objectives:

1. Watershed restoration in the MTWAA
2. Fuels management for the protection of community and natural resources, especially those within the Late Successional Reserve (LSR)
3. Long-term health and recovery of the LSR

This watershed analysis will focus primarily on the lands within these three watersheds that are administered by the Six Rivers National Forest (SRNF). Lands on the Hoopa Valley Indian Reservation and other private lands will be addressed when they influence the management of SRNF lands or to provide the context for analysis.

Previous Watershed Analyses

This is the first watershed analysis on National Forest System land for these watersheds. The Forest has completed watershed analyses for the surrounding watersheds including the Horse Linto, Mill and Tish Tang WA, and South Fork Trinity WA. The Hoopa Tribe has performed watershed analyses on both the Mill and Tish Tang Creek watersheds; these analyses focused on watershed management issues.

Public Participation

One important component of watershed analysis is public input. Although no public meetings were held for this particular MTWA, meetings have been held for other WAs in the vicinity of this MTWAA. These include the Horse Linto, Mill and Tish Tang WA, South Fork Trinity WA, and Lower-Middle Klamath WA. These meetings were well attended by individuals representing the full spectrum of interest groups. Valuable input about land management activities that may be appropriate for this MTWAA were gathered at the meetings and were instrumental in the development of the critical issues and questions for this analysis. Formal consultation with local tribal governments has also been conducted for this MTWA.

Format of the Document

Chapter 1 – Characterization of the Watershed: This chapter provides an overview of the dominant physical, biological, and human processes or features of the watershed that affect ecosystem functions or conditions. The relationships among these ecosystem elements and those occurring in the river basin or province are briefly described. The chapter also includes the most important land allocations, Forest Plan objectives and regulatory constraints that influence resource management in the watersheds. The watershed context is used to identify the primary ecosystem elements that will be analyzed in detail.

Chapter 2 – Issues and Key Questions: This chapter provides the key elements of the ecosystem that are most relevant to the management questions or objectives, human values, or resource conditions within the watersheds. These issues and key questions are developed by the team, considering input received from the public.

Chapter 3 – Current and Reference Conditions: This chapter addresses in detail the dominant physical, biological, and human processes or features of the watershed that affect ecosystem functions or conditions (more detailed than the characterization in chapter 1) relevant to the issues and key questions identified in Chapter 2. The current range, distribution, and condition of these ecosystem elements are documented. This chapter also explains how ecological conditions have changed over time because of human influence and natural disturbances. Reference conditions are developed for subsequent comparison with current conditions over the period that the system evolved and with key management plan objectives.

Chapter 4 – Synthesis and Interpretation: This chapter compares existing and reference conditions of specific ecosystem elements and explains significant differences, similarities, or trends and their causes. It also discusses the interrelationships among ecosystem components to ensure that management recommendations are based on interdisciplinary considerations. The capability of the system to achieve key management plan objectives is also provided.

Chapter 5 – Recommendations: This chapter brings the results to conclusion, focusing on management recommendations that are responsive to ecosystem processes identified in the preceding synthesis and interpretation. Specifically, it summarizes the opportunities to resolve issues and move from existing conditions to the desired conditions identified in the Forest Plan or LSRA. It also includes possible management practices that could be implemented to meet each opportunity.

CHAPTER 1
CHARACTERIZATION OF THE WATERSHEDS

Introduction

This chapter provides an overview of area that encompasses the mainstem Trinity River from Cow Creek, the most upstream tributary in the analysis area, to near Hawkins Bar, and to the downstream tributary of Hospital Creek which is within the Hoopa Tribe Reservation. The overview summarizes the dominant physical, biological and human processes and features of the watershed and their effect on ecosystem function or condition. It also relates these features and processes with those occurring in the river basin, and provides the watershed context for identifying elements that need to be addressed in this analysis. Willow Creek is the largest of the tributaries in the analysis area, and other main tributaries include Campbell Creek, Hawkins Creek, Coon Creek, and Sharber Creek.

Location

The MTWAA encompasses approximately 78,545 acres. There are approximately 31,142 acres in the "Upper Tributaries Lower Trinity River" watershed; 27,745 acres in the "Willow Creek" watershed; and 19,658 acres in "Hawkins-Sharber" watershed. The MTWAA is located in northeastern Humboldt County, California, primarily on the Lower Trinity Ranger District of the Six Rivers National Forest. The analysis area also contains blocks of private ownership including the town of Willow Creek, the communities of Salyer and Hawkins Bar, and a portion of the Hoopa Valley Indian Reservation. The Hoopa Valley Indian Reservation encompasses approximately 6,921 acres of the most northerly (and most downstream) portion of the analysis area, or 22 percent of the Upper Tributaries Lower Trinity River watershed unit (see Figure 1-1). Land in private ownership comprises 45 percent of the MTWAA with 55 percent in Six Rivers National Forest.

Land Allocations and Management Direction

Planning direction for SRNF is covered in the 1995 Six Rivers National Forest Land and Resource Management Plan (LRMP). The LRMP incorporated the direction in the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl, or ROD, as it is commonly known. Figure 1-2 shows the land allocations within the MTWAA. Table 1-1 shows the land allocations by watershed delineation.

Figure 1-1. Vicinity Map of Mainstem Trinity Watershed Analysis Area

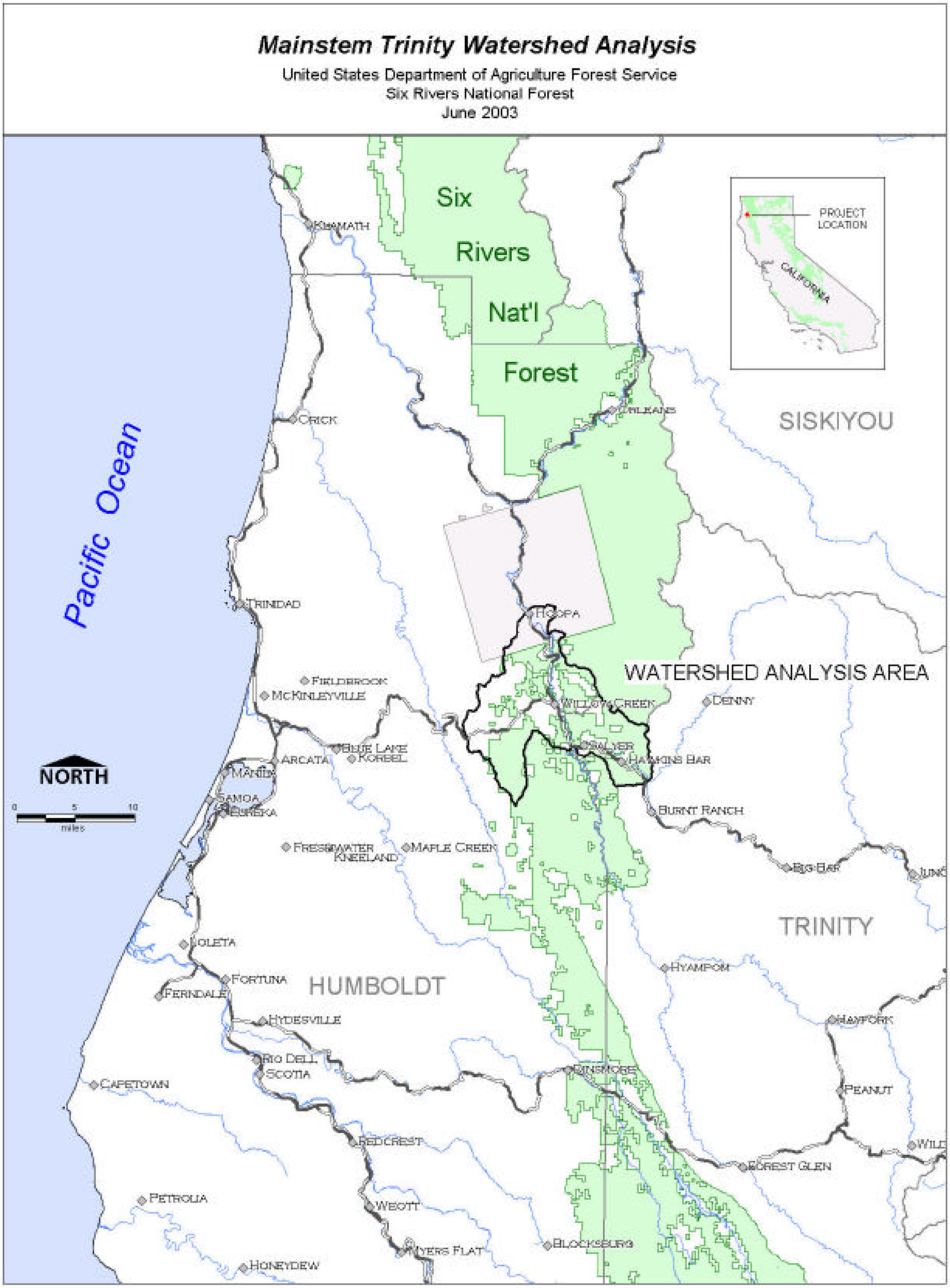


Figure 1-2. SRNF Management Area Designations Within the Mainstem Trinity Watershed Analysis Area

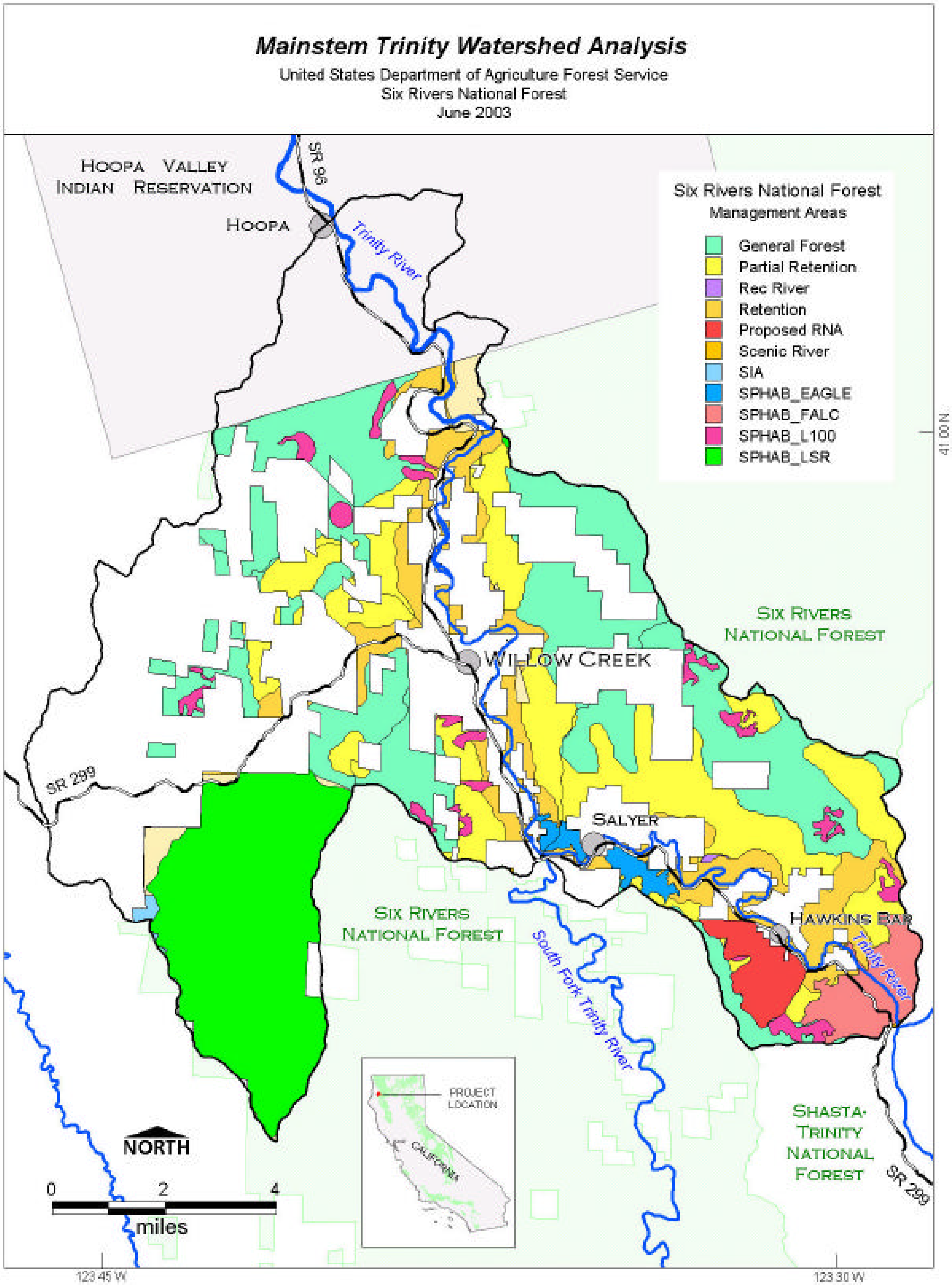


Table 1-1. Acres of Six Rivers National Forest System land allocations by watershed in the Mainstem Trinity Watershed Analysis Area.

Management Area	UTLTR	Willow Creek	H-S	Total
General Forest	6,626	2,249	4,372	13,247
Partial Retention	3,204	1,345	4,713	9,262
Retention	2,605	523	2,423	5,551
Special Habitat				
LSR	36	8,313	11	8,360
Eagle	97		487	584
Peregrine Falcon			1,625	1,625
L100	660	100	604	1,364
OG 12	478	368		846
Recreation River	2	0	30	32
Special Interest Area – Horse Mountain Botanical	0	1,000	0	1,000
Proposed Research Natural Area – Hennessey Ridge	0	0	1,154	1,154
Grand Total	**13,708**	**13,898**	**15,419**	**43,025**

Note the abbreviations for the Upper Tributaries Lower Trinity River (UTLTR) and Hawkins-Sharber (H-S) names. L100 is a designation for 100-acre late successional reserves. OG 12 is a designation for late successional and old-growth forests that are (1) most ecologically significant or (2) ecologically significant. Acres are approximate.

General Forest

Approximately 13,247 acres is within the general forest management area. This management area is part of the matrix and includes forested land programmed for commercial timber management. The primary goal for this area is to produce a sustained yield of timber, and silvicultural treatments are designed to help achieve the recommended management ranges identified in the Forest Plan for each vegetation series and seral stage.

Partial Retention

Approximately 9,262 acres of the MTWAA is classified as Partial Retention Visual Quality Objective management areas in the Forest Plan. These areas are typically middle-ground and background viewing areas as seen from highly sensitive viewing areas, or from moderately sensitive viewing locations such as county roads, streams, or trails. The goal for this management area is to maintain the area in a near-natural appearing condition, where management activities are visually subordinate to the character of the landscape. The partial retention management area is part of the matrix, and it is managed for a programmed, sustained harvest of forest products in areas that are suited for timber management.

Retention

Approximately 5,551 acres of the MTWAA have been classified as Retention Visual Quality Objective Management areas. These management areas are located within the matrix and primarily in the foreground of Highways 299 and 96. The goal of this classification is to maintain the area in a natural or near-natural appearing condition. Although a variety of management activities are allowed, they are subordinate to the characteristic landscape.

Special Habitat

There are approximately 13,677 acres classified as Special Habitat management areas within the MTWAA. This management area is intended to provide a core of relatively natural, undisturbed habitat for plants and animals associated with mature and old-growth forests. Characteristics of individual areas may vary somewhat according to the species for which they are managed. These management areas may require vegetative manipulation to enhance the value of the stands for wildlife or plant species. These management areas include Late Successional Reserves (LSR), old-growth (OG) forests, and eagle and peregrine falcon habitats.

Recreational River

Approximately 32 acres of the MTWAA are classified as Recreational River management areas. This management area included segments of the Trinity River and adjacent corridors of land. This area was classified as "recreational" by the national Wild and Scenic Rivers Act of 1968 and designated by the Secretary of the Interior on January 19, 1981. The goal of this designation is to protect the recreational rivers and their immediate environments for the benefit and enjoyment of present and future generations. This management classification provides for public recreational and resource uses that do not adversely impact or degrade those values.

Special Interest Area

Approximately 1,000 acres in the MTWAA are classified as Special Interest Areas. These areas are set aside to manage for their unique ecological values for public use, education, and enjoyment. The Horse Mountain Botanical Area is an example of this classification. The Forest's goals are to maintain the areas ecological processes and unique features as well as promote public use, education, and interpretation that is consistent with the values of the area.

Research Natural Area

Approximately 1,154 acres in the MTWAA are proposed as a Research Natural Area (RNA). This area is part of a national network of field ecological areas designated for non-manipulative research, observation, and to study and maintain biological diversity on National Forest System lands. The goals of the RNA are to maintain unmodified conditions and natural ecological processes as well as provide for the Forest's physical and biological diversity by acting as a gene pool for plant and animal species.

Wilderness

There are no designated wilderness areas in the MTWAA. The distance to the Trinity Alps and Marble Mountain Wildernesses is approximately 3.7 miles and 24.4 miles respectively.   Trinity Alps is a class II wilderness and Marble Mountain is a class I wilderness.

Riparian Reserves

Riparian Reserves are interspersed throughout the analysis area. Riparian Reserves are managed to provide benefits to riparian associated species, enhance habitat conservation for organisms that are dependent on the transition zone between upslope and riparian areas, improve travel and dispersal for many terrestrial animals and plants, and provide for habitat connectivity within the watershed. The Riparian Reserves also serve as corridors to connect Late Successional Reserves. Interim widths of the five categories of riparian reserves have been established in the LRMP. These interim widths are designed to provide a high level of fish habitat and riparian protection until watershed and site analysis can be completed. Riparian Reserves are intended to maintain and restore riparian structures and functions to five categories of water bodies: 1) fish-bearing streams, 2) permanently flowing non-fish-bearing streams, 3) constructed ponds and reservoirs, and wetlands greater than 1 acre, 4) lakes and natural ponds, and 5) seasonally flowing or intermittent streams, wetlands less than 1 acre, and unstable and potentially unstable areas.

Standards & Guidelines prohibit and regulate activities in Riparian Reserves that retard or prevent attainment of the Northwest Forest Plan Aquatic Conservation Strategy objectives. The Aquatic Conservation Strategy was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands. The strategy protects salmon and steelhead habitat on federal lands managed by the Forest Service and Bureau of Land Management within the range of northern spotted owl.

Roadless Areas

There are no Roadless Areas in the MTWAA. There were several potential roadless areas in the Cow Creek watershed, but they were dropped from consideration due to roads and/or development.

Hoopa Valley Indian Reservation Land Allocations

The Hoopa Valley Indian Reservation (HVIR) Forest Management Plan (1994) provides direction for the management of Tribal lands in these watersheds. There are a number of land allocations in these watersheds, each with its own Standards & Guidelines. There are cultural sites in the Supply and Campbell Creek watersheds directly north of lands managed by the Forest Service. The Campbell Creek watershed provides a significant portion of the domestic water for the western portion of the reservation and contains timberlands and noncommercial woodlands. Portions of both watersheds also contain geologically unstable and inaccessible lands, wildlife activity centers and wildlife travel corridors. A variety of land allocations guide management activities near the confluence of both creeks with the Trinity River, including valley viewshed, the Trinity Wild and Scenic River corridor (recreational designation), and urban use areas.

Physical Setting

Geology and Landforms

The analysis area is located along the western edge of the Klamath Mountains physiographic province. The Klamath Mountains province is a complex geologic region formed by the accretion of crustal material along the western edge of the North American continent during ancient subduction. The region is characterized by elongate, fault-bounded belts of rock (i.e., "terranes") representing individual accretion events. The belts are aligned in a concentric, crudely arcuate northwest-trending fashion, and they increase in age from southwest to northeast. Rocks in the province include greywacke sandstones, mudstones, greenstones, radiolarian cherts, and relatively minor limestone, as well as metamorphic equivalents of these rock types and abundant granitic and ultramafic intrusives (Irwin 1966).

Much of the analysis area is underlain by bedrock of the Jurassic age Galice formation (Young 1978; see Figure 3-1). The Galice formation is part of the Western Klamath Terrane and consists of mildly slatey to phyllitic argillite, greywacke, and stretched-pebble conglomerate (Irwin 1994). The Galice formation is extensively folded and structurally deformed, and it is mapped with fault boundaries along much of its extent (Young 1978). The Orleans Thrust Fault separates the Galice formation from the Ironside Mountain batholith (diorite) along the eastern margin of the analysis area. The Trinity River flows entirely within Galice formation through the analysis area. To the west, the Galice formation is overlain by a band of Jurassic age mélange of the Rattlesnake Creek terrane. This mélange consists of sheared and dislocated bodies of a wide variety of rock types. The Rattlesnake Creek mélange occupies upland areas west of Willow Creek in a fault relationship such that a band of Galice formation is present west of the mélange as well.

The western margin of the analysis area is coincident with the western edge of the Western Klamath Terrane, where it abuts the Franciscan Complex (Figure 3-1). Rocks along the western, fault-bounded edge of the Western Klamath Terrane include various ultramafic rocks and volcanics, the Friday Ridge gneiss, and the Ammon Ridge (diorite) pluton (Young 1978, Irwin 1994). The Western Klamath terrane is faulted against the Franciscan Complex along the Coast Range Thrust fault on the divide between the Trinity River and Redwood Creek watersheds. A small area of Franciscan Complex rocks is present along the western margin of the analysis area.

In general, northern California is a region of high seismicity. However, there are no known active faults in the assessment area, so the shaking potential appears to be a result of more distant sources. Numerous seismic sources are present in coastal Humboldt County to the west. The most significant is the Cascadia Subduction Zone, which dips to the east beneath the site. The leading edge of the subduction zone is offshore, but the subducting plate can be imaged beneath the continent to the Sacramento Valley. Melting of the subducting plate is responsible for volcanism at the southern end of the Cascade Range (e.g., Mt. Shasta and Mt. Lassen).

Seismicity associated with the subducting plate is concentrated near the continental margin and decreases inland. The assessment area appears to overlay the eastern edge of the seismogenic portion of the plate interface, although the zone appears to be 15 to 18 miles deep at this longitude (McPherson 1992). Additional potential seismic sources in the region include the Mad River fault zone, an active fold-and-thrust belt to the southwest, and the Grogan fault, a Quaternary active fault, which is roughly coincident with the axis of the Redwood Creek valley.

Much of the assessment area is characterized by steep topography. Streams and rivers in the region are confined within steep, deep canyons due primarily to the persistent geologic uplift of the regional landscape. Ancient and historic landslides are common on the steep valley walls, particularly within streamside inner gorges, which are prevalent in the assessment area. The abundance of mass wasting in the area is a result of the steep topography, high rainfall amounts, and weak earth materials. This has resulted in the delivery of large amounts of sediment to stream channels. This landscape has historically been sensitive to human disturbance such that many slope failures are attributable to management practices (timber harvest, road/highway building) and resource extraction (hydraulic mining, etc.).

Climate and Hydrology

The climate of the MTWAA is hot and dry in the summer with temperatures commonly above 100^{o}F and cold and wet in the winter with temperatures often below freezing. Snow frequently accumulates above 4,000 ft. elevation during the winter months. Elevations between 3,000 ft. and 4,000 ft. are frequently subjected to rain during snow events.

The maximum elevation in the analysis area is 5,282 ft. at the summit of the East Fork Willow Creek. The coastal divide on the west side of the analysis area has peaks of 4,952 ft. at Horse Mountain; 2,871 ft. at a bench mark near Berry Summit on Highway 299; 4,260 ft. into Three Creeks; 4,148 ft. into Campbell Creek; and 3,478 ft. in Hospital Creek. The east side of the analysis area is also steep but has generally slightly lower elevations, with a 3,300 ft. ridge summit in Coon Creek; 3,615 ft. peak in Sharber Creek; 3,689 ft. in Gray Creek; and peaking at approximately 4,440 ft. farthest east in Hawkins Creek. The benchmarks in the analysis area along the Trinity River are 578 ft. at an upstream location near Cow Creek down to 331 ft. at a downstream location in Hoopa.

Mean annual precipitation can reach 70 to 80 inches over the coastal ridges, diminishing with lowering elevations with averages of 40 to 60 inches for the rest of the analysis area. About 90 percent of the precipitation falls between October and April. However, snow usually remains at highest elevations through May or June.

Water Quality

The important water quality parameters that most influence the beneficial uses for the MTWAA are sediment and turbidity. Domestic water systems and the health of salmonid fisheries are significantly affected by these two criteria. There are 51 water system permits issued within the MTWAA. These systems are located throughout the MTWAA and vary from single domestic spring boxes to community water systems. Hoopa Valley Public Utilities manages a domestic water system on Campbell Creek, which serves about two-thirds of the Reservation's west-side water demand. The Hoopa Tribe has a

Water Quality Plan (1997) and water flowing from the MTWAA must meet those standards where they are more stringent than the State's. The community of Willow Creek draws its water from lower Willow Creek, east of Highway 96. The community of Hawkins Bar receives its water from Hawkins Creek.

The 1964 flood was a major regional event that, along with land management activities, affected each watershed in the area to varying degrees. Willow Creek and the Trinity River are both located in close proximity to Highways 299 and 96. These combined influences and activities have resulted in increased levels of sedimentation that impacted aquatic habitats. The Environmental Protection Agency (EPA) has listed the Trinity River as sediment impaired under the Clean Water Act section 303(d).

Biological Systems

Riparian and Aquatic Systems

Riparian Corridor Condition

The riparian corridors were greatly affected by natural and anthropogenic events. Prior to 1942 there was only limited logging within the MTWAA. Following World War II the housing boom created demand for wood products, and large-scale timber harvesting began mostly on private land with Forest Service activities beginning around 1960. The rains preceding the 1964 flood delivered massive amounts of sediment to stream channels that resulted in significant aggradation of stream channels and scouring of riparian vegetation. In addition, significant and permanent impact to riparian vegetation has occurred along Willow Creek as a result of the construction of Highway 299, which runs along most of the mainstem. Timber harvesting on a large percentage of private land and all federal MTWAA was greatly reduced throughout the 1990's. This helped foster recovery of riparian zones, although hardwoods now dominate canopy cover where it was once conifer. Riparian areas on National Forest System land in the MTWAA that were not harvested provide good connectivity for bryophytes, lichens, and vascular plants and for wildlife dispersal. SRNF databases report the MTWAA containing 415 acres of riparian vegetation series.

Riparian-Dependent Species

Foothill yellow-legged frogs and southern torrent salamanders are known to exist within the analysis area. Both species are in decline in parts of their range and are designated as Forest Service sensitive species.

Fish Species and Habitats

Figure 1-3 shows the known distribution of native resident and anadromous fish within the analysis area. The native fishes include anadromous fall chinook salmon (*Oncorhynchus tshawythcha*), coho salmon (*Oncorhynchus kisutch*), winter steelhead trout (*Oncorhynchus mykiss*), green sturgeon (*Acipenser medirostris*), white sturgeon (*Acipenser transmontanus*), Pacific lamprey (*Lampetra tridentata*), resident rainbow trout (*Oncorhynchus mykiss*), speckled dace (*Rhinichthys osculus*), three-spine stickleback (*Gasterosteus aculeatus*), Klamath small scale sucker (*Catostomus rimiculus*), prickly sculpin (*Cottus asper*), and riffle sculpin (*Cottus gulosus*). Non-native species include brook trout (*Salvelinus fontinalis*), American shad (*Alosa sapidissima*), brown bullhead (*Ameiurus nebulosus*), golden shiner (*Notemigonus crysoleucas*), and green sunfish (*Lepomis cyanellus*). Recreational fishing for resident fish is allowed within part of the analysis area. Although angling for salmon and steelhead is allowed within the mainstem Trinity River, no fishing for these species is allowed in the MTWAA drainages. This restriction is in place to protect spawning adult salmonids and rearing juveniles prior to their outmigration.

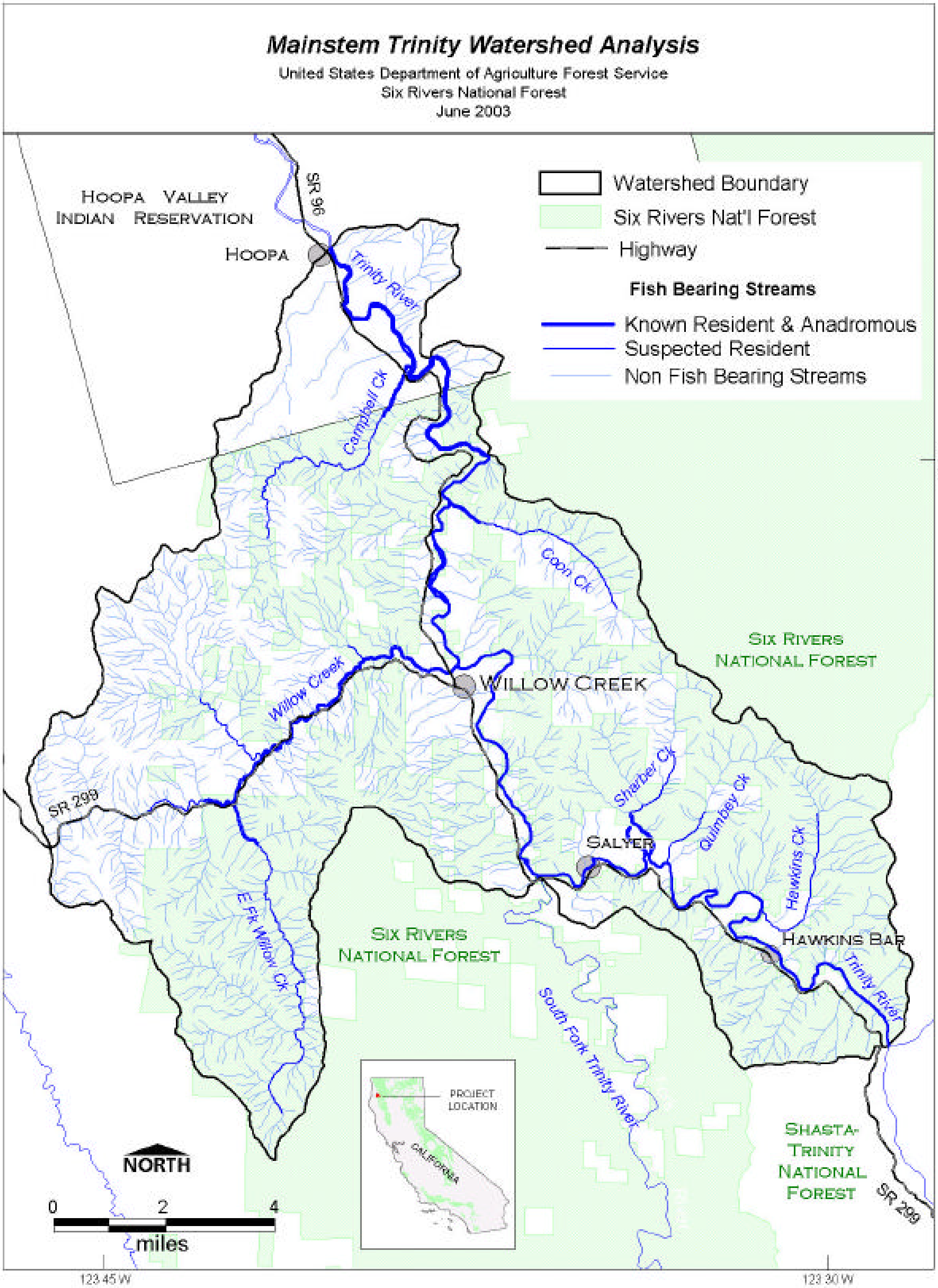
The 1964 flood and timber management activities greatly degraded fish habitat, especially anadromous habitat. These factors affected the MTWAA and most anadromous habitat in Northwestern California. Substantial habitat recovery has occurred since the 1964 flood, but wild anadromous fish populations have generally not recovered in the Klamath basin. The coho numbers in the MTWAA area are extremely low. Coho salmon and their habitat have been listed under the Endangered Species Act (ESA). The MTWAA contains designated critical habitat for the threatened Southern Oregon/Northern California Evolutionary Significant Unit (ESU) of coho salmon. Due to the long-term decline of chinook and steelhead runs in the Trinity sub-basin, the Pacific Southwest Region of the Forest Service has put these two species on a regional sensitive species list to help ensure that Forest Service activities do not result in a trend towards listing them under the ESA.

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act set forth some new mandates for NMFS, regional fishery management councils, and federal action agencies, such as the USFS, to identify and protect important marine and anadromous fish habitat. The councils, with assistance from NMFS, were required to delineate essential fish habitat (EFH) in fishery management plans or plan amendments for all managed species. Although the concept of EFH is similar to that of critical habitat under ESA, measures recommended to protect EFH are advisory, not prescriptive. The MTWAA contains EFH for coho and chinook salmon.

There are many causes for the general decline of anadromous salmonids in California, and scientists are not all in agreement as to which causes are most deleterious to the different fish stocks. Although it is recognized that many problems exist at larger scales than the analysis area, it is beyond the scope of this document to focus on fisheries problems outside the analysis area.

The Forest Service has tribal trust responsibility to protect anadromous fisheries from impacts that may result from management activities in the MTWAA.

Figure 1-3. Distribution of Anadromous and Resident Fish in the Mainstem Trinity Watershed Analysis Area.



Trinity River

The mainstem of the Trinity River flows through the MTWAA. Much of the management of Trinity River fisheries resources are largely influenced by decisions made off the Forest by the Bureau of Reclamation. The Bureau of Reclamation is responsible for management of the Trinity River Diversion (TRD) project that includes the Trinity and Lewiston Dams, which were completed in 1962. Streamflow in the river is regulated at Trinity Reservoir that has a storage capacity of 2.4 million acre-feet (McBain & Trush 1997). Immediately downstream of the Trinity Dam is Lewiston reservoir, a relatively small re-regulation impoundment that serves as the diversion point of Trinity River water to the Central Valley Project. Approximately 70 percent of the Trinity River flow is diverted out of the basin and sent to supply water for agricultural and urban users.

Following construction of the dams, a noticeable decrease in salmonid populations was observed (USFWS & HVT 1999). It was estimated that approximately 80 percent decline in chinook salmon populations and a 60 percent decrease in steelhead populations occurred by 1980 following the commencement of the diversion (USFWS & HVT 1999). In addition, the operation of the TRD altered the hydrologic regime which subsequently affected sediment transport, stream morphology, riparian vegetation, and salmonid habitat (McBain & Trush 1997).

Willow Creek

Willow Creek is contained within a 30,080-acre watershed. The legal location of its mouth is T7N, R5E, Section 29. The major tributaries are Brannan, Three Creeks, Gregg, East Fork, and Boise creeks. The watershed contains about 14 miles of anadromous fish habitat with an additional unknown amount of resident trout habitat. The salmonid fisheries in Willow Creek benefited from many instream restoration projects and several watershed restoration projects between 1989 and 2002. Highway 299 significantly affects Willow Creek, as it runs along much of the stream's mainstem length. This course reduced riparian function and increased sediment delivery. Two miles of stream are accessible to salmon, with an additional 12 miles of stream above a partial barrier utilized by steelhead.

Campbell Creek

Campbell Creek is contained within a 3,840-acre watershed. The legal location of its mouth is T7N, R5E, Section 6. It is not designated as a key watershed, but has important fisheries and community values to the Hoopa Valley Indian Tribe. The known anadromous habitat lies on the Hoopa Valley Indian Reservation. Anadromous fish are found only in the lower two miles of Campbell Creek. A set of bedrock falls is located approximately one mile upstream of the mouth that may be a partial barrier for anadromous migration. Resident trout are present upstream of the anadromous reach. The Hupa Tribe has installed several fish enhancement structures downstream of National Forest System land. The Hoopa community uses Campbell Creek as a domestic water source, which serves about two-thirds of Hoopa's west side water demand.

Coon Creek

Coon Creek is contained within a 3,400-acre watershed. The legal location of its mouth is T7N, R5E, Section 8. The mainstem of the stream is relatively steep with gradients ranging from 5-12% above the county road bridge. There is a low water barrier at the mouth of the creek, which limits anadromous salmonid access to periods of high water. LWD is a limiting factor in development of good habitat. Little is known about resident fish use in this creek, however the steep gradient would suggest limited utilization.

Sharber Creek

Sharber Creek is tributary to the Trinity River and is contained in a 2,050-acre watershed. The legal location of its mouth is T6N, R5E, Section 13. Sharber Creek supports both steelhead trout and chinook and coho salmon. There is approximately 6,300 feet of anadromous habitat. A waterfall blocks further upstream migration. A culvert fish passage restoration project currently in the planning stage will allow for improved access to the upper 5,800 feet of stream.

Hawkins Creek

Hawkins Creek is tributary to the Trinity River and its watershed encompasses about 2,600 acres. The legal location of its mouth is T6N, R6E, Section 20. The stream gradient averages 11 percent between the mouth and the Road 7N04 crossing. There is a sharp drop of 15 feet at the mouth, which is a barrier to anadromous migration until the river level rises. Another barrier to migration exists at the county Hawkins Bar Road culvert. The creek is considered anadromous only for the lower 600 feet, although its potential for steelhead could be improved. Hawkins Creek may be a significant source of domestic water for Hawkins Bar.

Vegetation

Vegetation Data

The vegetation data used in this analysis were provided by the Ecology Program of the Six Rivers National Forest. One of the main roles of the Ecology Program in Region 5 is the classification of potential natural plant communities. This classification is based on a hierarchical system that provides environmental variables as indicators of ecosystem process and function at each level. This hierarchy includes series, subseries and plant association. The vegetation series represent the dominant overstory and regenerating species in a stand. The subseries represents the sub-dominant tree species or the shrub species that reflect environmental relationships. The plant association is the lowest level of classification and represents the indicator species or the herb or shrub species that exist in a stand due to specific microenvironment conditions. Each level of the hierarchy is distinguished from the others by differences in species composition, soils, productivity, physiography, and expected response to management (Allen 1987).

Six seral stages, along with various modifiers, were used in this analysis. These seral stages are shrub/forb, pole, early mature, mid-mature, late mature, and old growth. Several modifiers were also used to define the land use or habitat potential associated with these seral stages. An ‘H' was added if a stand had been harvested, either clearcut or selection cut. An ‘A' was added if a stand had a pre-dominant overstory or a remnant stand of older trees that could be potential habitat for the marbled murrelet. A ‘B' was added if a stand with pre-dominant trees had been harvested.

During the development of the SRNF LRMP, the Forest identified the historic range of terrestrial vegetation variability (HRV) for the primary vegetation series to use as a basis in the development of an ecologically based management strategy. The management strategy is to mimic disturbance rates and patterns to achieve a range of vegetation types and seral stages that is within the HRV. The HRV represents a wide range of seral stage conditions including infrequent, high intensity, catastrophic disturbances. Since the Forest will naturally be subjected to catastrophic events, the Forest has developed a strategy to manage within a subset of the HRV that provides a buffer against catastrophic events. This subset is called the recommended management range (RMR).

Vegetation Series and Seral Stages

The MTWAA, like most of the area in the central part of the Forest, is dominated by mixed conifer/hardwood forests and conifer forests (Table 1-2). Approximately 88 percent of the National Forest System land in the watershed is composed of these general vegetation series. The remainder of the National Forest System land is composed of intermixed white oak, black oak and canyon live oak stands (5 percent), meadows/prairies (<1 percent), and non-vegetated or unknown types. The tanoak series is the dominant vegetation series, followed by the Douglas-fir series.

Table 1-2. Vegetation series in the Mainstem Trinity Watershed Analysis Area.

Series	Acres	Percent of Watershed
Tanoak	39,796	50.5
Douglas-fir	10,879	14
Jeffery pine	2,031	2.5
White fir	2,023	2.5
White oak	1,471	2
Canyon live oak	1,329	1.5
Grassland	550	<1
Black oak	506	<1
Sugar pine	490	<1
Riparian	415	<1
Port Orford-cedar	283	<1
Alder	62	<1
Gray pine	51	<1
Knobcone pine	43	<1
Ponderosa pine	18	<1
Non-vegetated/Unknown	3,247	4
Untyped private and Tribal land	15,350	20
Total	**78,545**	**100**

Disturbances are a significant factor in ecosystem function. Natural disturbances include fire, wind, floods, insects and disease, landslides, and earthquakes. Humans have introduced disturbances through fire suppression, intentionally and accidentally set fires, timber harvesting, mining and grazing, as well as introduction and spread of invasive plants. Although not currently found within the MTWAA, the introduction of diseases such as Port Orford cedar root fungus and sudden oak death (SOD) have been a major concern. The primary disturbance agents affecting vegetation structure and distribution in the MTWAA have been wildfire, wildfire suppression activities, logging, mining, and floods.

Currently, the early mature seral stage is most abundant in the MTWAA (27 percent). It is followed by the mid-mature (22 percent), pole (22 percent), old growth (10 percent), late mature (7 percent) and shrub/forb (7 percent) seral stages. The early and mid-mature seral stages appear to have resulted from stand-replacing fires that occurred throughout the area in the late 1860's and early 1910's. The majority of the shrub/forb and pole stands are the result of timber harvesting.

Fire and Fuels

Wildfires have been a critical component in the development and maintenance of western ecosystems, especially within the interior West (GAO/RCED-99-65, April 1999). Ecological processes, driven largely by climate and topography, have shaped the forests within the Six Rivers National Forest. Historically, wildfires with highly variable fire frequencies and intensities have played a major role in determining the structure, composition, and successional stage of forests in this region. Large scale stand-replacing fire events occurred infrequently, while lower intensity fires were more common.

As part of a dry, terrestrial physiographic province (FSEIS/ROD 1994) within the interior west, the MTWAA has experienced highly variable fire frequencies. Studies of pre-suppression fire frequency intervals conducted in the general vicinity of these watersheds showed an average interval of about 16 years in Douglas-fir dominated mixed evergreen forests (Adams & Sawyer 1980) and 35 years in white fir forests (Stuart & Salazar 2000). These pre-suppression fire return intervals are consistent with findings of other studies in the region indicating return intervals of 10 to 20 years in Douglas-fir dominated forests in Northwestern California (Atzet et al. 1988, Agee 1991, Wills 1991, Taylor & Skinner 1998).

Decades of successful fire suppression in the watersheds have significantly increased the return interval of wildfires, leading to significant increases in fuel loading. The most extensive and serious problem related to the health of national forests in the interior west, including the MTWAA, is the accumulation of dense vegetation, which has caused an increasing number of large, intense, uncontrollable, and catastrophically destructive wildfires (GAO/RCED-99-65 April 1999).

Human-related causes (arson, campfires, children, debris burning, equipment, smoking or other miscellaneous causes) are the predominant type of fire starts within the MTWAA, especially within the Trinity River corridor, on privately owned parcels and within the Hoopa Valley Indian Reservation. Lightning fire starts, although relatively infrequent when compared to human related starts, are a significant cause of wildfires along the upper slopes and ridges of the watersheds, with multiple wildfires sometimes generated from the same lightning storm.

The largest recorded wildfire to occur in the MTWAA was the 1999 Megram Fire, which started on the Shasta-Trinity National Forest. The Megram Fire was a lightning-generated wildfire that burned approximately 125,000 acres, the largest acreage on the Six Rivers National Forest since records began in 1910. The fire burned for over 70 days and severely degraded air quality within the MTWAA. Although the majority of the Megram Fire burned outside of the MTWAA, it did burn approximately 2,017 acres in the eastern portion of the MTWAA.

Factors within and adjacent to the MTWAA that present current and future challenges to fire and fuels management include successful fire suppression efforts leading to high fuel loading; significant areas of private lands adjacent and as inholdings to the MTWAA; a highway corridor along the Trinity River that includes a portion of the Hoopa Valley Reservation, several communities, and high levels of recreation use; limited access due to topography or intermixed ownership; and vegetation mortality and fuel accumulation in the area affected by the Megram Fire.

Horse Mountain Botanical Area

Most of Horse Mountain Botanical Area is within a Late Successional Reserve (LSR), and the remaining Area is designated as a Special Interest Area (SIA) in the Forest Plan. The Botanical Area (1,080 acres) lies mostly within the Willow Creek portion of the MTWAA at Horse Mountain (Figure 1-2) and is heavily dissected by the numerous drainages feeding Ruby, Horse, and Willow creeks within its boundaries. The SIA designation is to preserve and manage the distinctive serpentine vegetation and associated rare plants of the Area and the southern-most stands of Port Orford-cedar (*Chamaecyparis lawsoniana*, CHLA) within the natural range of this species.

The Special Interest Area Management Strategy (1998) specifies that the "management direction for Late-Successional Reserves is to protect and enhance conditions of late-successional and old-growth forest ecosystems which serve as habitat for late-successional and old-growth related species including the northern spotted owl. Timber management within the SIA is not permitted, but some stands could be treated to meet well-defined ecological objectives consistent with the values for which the area was designated." The primary goal of an SIA is "to protect unique ecological, botanical, cultural, and geologic features across the Forest and to promote public use, education, and enjoyment consistent with the values of each area." Consistent to these objectives, a Botanical Area is classified [36 CFR 294.1] for protection of unique botanical values, for educational purposes, and for recreational use compatible with these values. Management goals specified in the Forest Plan are "to maintain a full complement of species and plant communities as well as the natural process that supports these elements."

Proposed Research Natural Area (RNA)

RNAs are a part of a national network of ecological areas designated for non-manipulative research, observation, and to study and maintain biological diversity on National Forest System lands (USFS

1995). The objectives of establishing RNAs are (1) to preserve a wide spectrum of pristine, representative areas that typify target vegetation types and/or types considered of scientific interest; (2) to serve as control areas for comparing landscapes manipulated by humans; (3) to serve as baseline areas for measuring long-term ecological change; and (4) to preserve and maintain genetic diversity and to provide a laboratory for the study of ecological succession (USFS 1995).

The proposed Hennessey Ridge RNA is located in the southeastern portion of the MTWAA along Highway 299 at Hawkins Bar (Figure 1-2). This RNA would represent SAF type 229 Pacific Douglas-fir in the North Coast Province. Currently the proposed area is a single unit (approximately 90 acres) on the East Side of Hennessey Ridge primarily within the Icebox, Pony, and Gray Creek drainages (Hawkins-Sharber Watershed) which flow directly into the Trinity River. Part of a spotted owl management area lies within the northern portion of the proposed area.

Plant Species of Concern

The MTWAA area supports known locations of SRNF Forest Sensitive Species (FSS), SRNF Special Interest Species (SIS), Northwest Forest Plan Survey and Manage (SM) species, California State Listed (CR) species, and species considered rare by the California Native Plant Society (CNPS). Habitats for species of concern include late seral stage conifer forests, meadows, grasslands, wetlands, serpentine habitats, and rock outcrops. Suitable habitat for Federal Threatened and Endangered (TE) plant species is not present in the MTWAA.

Forest Sensitive Species known to occur (historic and current) on the Forest are clustered lady's slipper (*Cypripedium fasciculatum*), mountain lady's slipper (*Cypripedium montanum*), Canyon Creek stonecrop (*Sedum paradisum*), and Howell's miner's lettuce (*Montia howellii*). The two lady's slippers (also listed as SM species) and the Sonoma manzanita (a proposed FSS plant species) also occur in the analysis area. The only Special Interest Species (proposed) in the area is Heckner's lewisia (*Lewisia cotyledon* ssp. *heckneri*). In addition to the known occurrences of these sensitive species and special interest species, potential habitat exists for other plant species of concern (Table 1-3) within the MTWAA.

In addition to the lady's slippers, there are a few SM species associated with late-seral-stage forest that are present in the habitat area, but are not known to occur within the MTWAA. These are Benson's saxifrage (*Bensoniella oregana*, BEOR); the bryophyte, Pacific fuzzwort (*Ptilidium californicum*, PTCA); and the lichens, *Bryoria tortuosa* (BRTO2) and *Leptogium cyanescens* (LECY60). *Bryoria tortuosa* grows in association with Ponderosa pine (*Pinus ponderosa*, PIPO), Jeffrey pine (*Pinus jeffreyi*, PIJE), and Douglas-fir (*Pseudotsuga menziesii*, PSME). *Leptogium cyanescens* grows in association with Douglas-fir (*Pseudotsuga menziesii*, PSME) and canyon live oak (*Quercus chrysolepis*, QUCH2) or with California black oak (*Quercus kelloggii*, QUKE).

Table 1-3. SRNF Forest Sensitive Species (FSS), Proposed Forest Sensitive Species (PFSS), Special Interest Species (SIS), Proposed Special Interest Species (PSIS), California State Listed - Rare (CR), and California Native Plant Society (CNPS) Listed plant species of suspected/known occurrence within the Mainstem Trinity Watershed Analysis Area. The bolded species are known to occur within the MTWAA.

Common Name	Scientific Name	Status
VASCULAR PLANTS		
Sonoma manzanita	***Arctostaphylos canescens* ssp. *sonomensis*, ARCAS3**	**PFSS, 1B[1]**
Bald Mountain milkvetch	*Astragalus umbraticus*, ASUM3	PSIS, 2[1]
Benson's saxifrage	*Bensoniella oregana*, BEOR	FSS, CR, 1B[1]
Vancouver groundcone	*Boschniakia hookeri*, BOHO	PSIS, 2[1]
Siskiyou sedge	*Carex gigas*, CAGI5	SIS, 4[1]
bristly stalked sedge	*Carex leptalea*, CALE10	SIS, 2[1]
meadow sedge	*Carex praticola*, CAPR7	SIS, 2[1]
clustered lady's slipper	***Cypripedium fasciculatum*, CYFA**	**FSS, 4[1]**
mountain lady's slipper	***Cypripedium montanum*, CYMO2**	**FSS, 4[1]**
Oregon bleeding heart	*Dicentra formosa* ssp. *oregana,* DIFOO	SIS, 4[1]
Siskiyou willowherb	*Epilobium siskiyouensis,* EPSI2	SIS, 1B[1]
rockloving erigeron	*Erigeron petrophilus* var. *viscidulus*, ERPEV	PSIS, 4[1]
Howell's fawnlily	*Erythronium howellii*, ERHO10	PSIS, 1B[1]
mahogany fawnlily	*Erythronium revolutum*, ERRE5	PSIS, 2[1]
bristly gentian	*Gentiana plurisetosa*, GEPL6	PSIS, 4[1]
California wild hollyhock	*Iliamna latibracteata*, ILLA2	PFSS, 4[1]
Heckner's lewisia	***Lewisia cotyledon* var. *heckneri,* LECOH2**	**SIS, 3[1]**
South Fork Mtn. lupine	*Lupinus elmeri,* LUEL2	FSS, 1B[1]
slightstemmed mitrewort	*Mitella caulescens*, MICA5	PSIS, 2[1]
Howell's miner's lettuce	***Montia howellii*, MOHO**	**FSS, 2[1]**
water bulrush	*Scirpus subterminalis*, SCSU	SIS, 2[1]
Cascade stonecrop	*Sedum divergens*, SEDI	SIS, 2[1]
coast checkerbloom	*Sidalcea oregana* ssp. *eximia*, SIORE	FSS, 1B[1]
Canyon Creek stonecrop	*Sedum paradisum* SEPA15	FSS, 1B[1]
Marble Mountain campion	*Silene marmorensis*, SIMA5	SIS, 1B[1]
English Peak greenbriar	*Smilax jamesii*, SMJA	FSS, 1B[1]
BRYOPHYTES		
Pacific fuzzwort	*Ptilidium californicum,* PTCA	SM(A)
LICHENS		
	Bryoria tortuosa, BRTO2	SM
	Leptogium cyanescens, LECY60	SM

[1] CNPS Lists: 1B = Rare, threatened, or endangered in California and elsewhere; 2 = Rare, threatened, and endangered in California, but more common elsewhere; 3 = More information is needed (Review List); and 4 = Limited distribution (Watch List).

Noxious Weeds

Weeds are undesirable and generally exotic or non-native plant species to an area. Invasive weeds generally first become well-established in disturbed areas and along roadsides, then spread to the adjacent forest area. Potential vectors for introduction and dispersal of weeds may include road maintenance (i.e., movement of infested fill material and rock), escape from home gardens and agricultural fields and orchards onto adjacent forest lands, movement of livestock from infested lands onto overgrazed or disturbed sites, and vehicular movement of infested mud and soil. When a species is aggressively invasive, poisonous, or presents other serious management problems, it is often designated as a noxious weed by the Secretary of Agriculture or by State Agencies. The noxious plants found on the Forest are mostly native to the Mediterranean or to Asia. Once introduced and established, many noxious weeds have the potential to displace native plant species and entire plant communities. Target species are drawn from State and County noxious weed lists. A proposed "Noxious and Invasive Weeds Program Strategy: Northern Province (Klamath, Mendocino, Six Rivers, and Shasta-Trinity National Forests)" is in preparation.

Initial surveys of the MTWAA have documented eight areas having yellow star thistle (*Centaurea solstitialis*) infestations, and five locations where Scotch broom (*Cytisus scoparius*) has become invasive, mostly in association with roads within the MTWAA. Additional noxious weeds that occur in significant numbers in the MTWAA are bull thistle (*Cirsium vulgare*), French broom (*Genista monspessulana*), klamathweed (*Hypericum perforatum*), and Himalayan blackberry (*Rubus discolor*).

Integrated Pest Management

Two forest plant pathogens of immediate concern to the MTWAA are *Phytophthora lateralis,* which causes root disease of Port Orford-cedar (POC) and *Phytophthora ramorum*, which causes sudden oak death disease (SOD) of coast live oak, California black oak, tanoak, and numerous other forest trees and shrubs. Both plant pathogens are regionally present, but neither is currently known to occur within the MTWAA. However, the presence of their respective host plant species within the MTWAA demands that every effort be made to prevent disease introduction. Both pathogens can be transported in infested wet soils or mud and through flowing water to non-infested areas. In addition, *P. ramorum* produces air-borne spores that are carried by wind-blown rain and fog.

Range Management

Suitable livestock grazing range is primarily found in grassland, oak woodland, browse, and transitory range (mostly associated with the timber management activities that open up the forest). Range management on the Forest involves limiting the number of grazing animals that have access to designated rangeland allotments seasonally (April through October) and physically distributing livestock (e.g., by using fencing and water developments) to minimize the impacts on other Forest resources.

The MTWAA currently has only portions of two range allotments. Approximately 1,790 acres of the 3,162-acre Grouse Mountain Grazing Allotment overlaps onto the southwestern corner of the MTWAA (southern portion of Enquist Creek watershed and the upper reaches of East Fork Willow Creek watershed). The entire Grouse Mountain allotment seasonally supports 32 cow/calf pairs. The 9,564-acre Groves Prairie Grazing Allotment abuts the north boundary of the Quinby-Sharber Slough and Hawkins

Creek watersheds of the MTWAA, and overlaps by only 12 acres. The entire Groves Prairie allotment seasonally supports 16 cow/calf pairs. Grazing impact to the MTWAA is currently minimal.

Wildlife Species and Habitat

Threatened and Endangered Species

As shown in Table 1-4, there are three federally threatened wildlife species that are known or suspected to occur within or near the MTWAA. (No species listed as federally endangered are known or suspected to occur in the MTWAA.) These include the bald eagle (*Haliaetus leucocephalus*), northern spotted owl (*Strix occidentalis caurina*), and marbled murrelet (*Brachyramphus marmoratus*). Designated Critical Habitat Units (CHU) for the northern spotted owl and marbled murrelet are located within and adjacent to the MTWAA within Late Successional Reserves (LSR) units #305 and #306, as well as twenty 100-acre LSRs.

A fraction of one designated bald eagle network territory, referred to as the "Todd Ranch/S. Fork Trinity River Territory," is located within the MTWAA. However, the actual nest site is located approximately 3.5 miles south of the MTWAA. Marbled murrelet zones 1 and 2 encompass approximately 66 percent and 32 percent of the MTWAA, respectively. Surveys were implemented in 1995 to determine presence/absence; however, no marbled murrelets were detected (Hunter et al. 1998). There are 26 northern spotted owl activity centers, consisting of 21 pairs and five territorial singles, on Forest Service lands and two activity centers, consisting of a pair and an unoccupied site, on Hoopa Valley Tribal lands within the MTWAA.

Table 1-4 provides a list of wildlife species of concern and known occurrences within the MTWAA. The list includes threatened, endangered, and candidate species as well as Forest Service sensitive species listed in the LRMP.

Forest Service Sensitive Species

As shown in Table 1-4, a number of Forest Service Sensitive Species are known to occur in the MTWAA. One historic peregrine falcon nest site and associated territory (Gray Creek territory) and a fraction of the "Horse Linto Creek" territory are located in the MTWAA. The portion of the Horse Linto Creek territory within the MTWAA contains only foraging habitat. There is one designated northern goshawk (*Accipiter gentilis*) territory within the MTWAA. This site is referred to as the "East Fork Willow Creek" territory that was last known to be occupied in 1987. In 1994 and 1995, a Forest-wide goshawk survey and habitat-use study was initiated in selected areas of the Forest. The only confirmed sightings from that study were on the Lower Trinity Ranger District but not within the MTWAA.

Table 1-4. Threatened, endangered, candidate, and Forest Service Sensitive (FSS) wildlife species known or suspected to occur within or near Mainstem Trinity Watershed Analysis Area.

Common Name	Scientific Name	Status	Status in MTWAA
Bald eagle	*Haliaetus leucocephalus*	Threatened	Present
Northern spotted owl	*Strix occidentalis caurina*	Threatened	Present
Marbled murrelet	*Brachyramphus marmoratus*	Threatened	No survey detections
American peregrine falcon	*Falco peregrinus anatum*	FSS	Present
Northern goshawk	*Accipiter gentilis*	FSS	Present
Great gray owl	*Strix nebulosa*	FSS	No recorded presence
Willow flycatcher	*Empidonax trailli*	FSS	No recorded presence
American marten	*Martes americana*	FSS	Present
Pacific fisher	*Martes pennanti*	FSS	Present
California wolverine	*Gulo gulo luscus*	FSS	No known records
Pacific western big-eared bat	*Plecotus townsendii townsendii*	FSS	No known records
Northwestern pond turtle	*Clemmys marmorata marmorata*	FSS	Present
Foothill yellow-legged frog	*Rana boylii*	FSS	Present
Northern red-legged frog	*Rana aurora aurora*	FSS	No known records
Southern torrent salamander	*Rhyacotriton variegatus*	FSS	Present

Numerous Pacific fisher and American martens have been observed within the MTWAA. Western pond turtles, foothill yellow-legged frogs, and southern torrent salamanders have also been observed in the MTWAA.

Survey and Manage Wildlife Species

A number of survey and manage or protection buffer wildlife species are known or suspected to occur in the MTWAA. Table 1-5 summarizes the Survey and Manage category and presence-absence of these species within the MTWAA.

Table 1-5. Survey & Manage (S&M) and Protection Buffer (PB) wildlife species known or suspected to occur within or near the Mainstem Trinity Watershed Analysis Area.

Common Name	Scientific Name	S&M Category	MTWAA
Hooded lancetooth	*Ancotrema voyanum*	E[3,4]	Present
Klamath shoulderband	*Helminthoglypta talmadgei*	D	Present
Chace or Siskiyou sideband snail	*Monadenia chaceana*	B[4]	No survey detections
Klamath sideband snail	*Monadenia fidelis klamathica*	B[3,4]	Present
Yellow-based sideband snail	*Monadenia fidelis ochromphalus*	B[3,4]	Present
Blue-gray tail dropper	*Prophysaon coeruleum*	A	No survey detections
Shasta chaparral	*Trilobopsis ropri*	A	No survey detections
Tehama chaparral	*Trilobopsis tehamana*	A	No survey detections

Common Name	Scientific Name	S&M Category	MTWAA
Pressley hesperian	*Vespericola pressleyi*	A	No survey detections
Long-eared myotis	*Myotis evotis*	PB	No known records
Fringed myotis	*Myotis thysanodes*	PB	No known records
Long-legged myotis	*Myotis volans*	PB	No known records
Silver-haired bat	*Lasionycteris noctivigans*	PB	No known records
Pallid bat	*Antrozous pallidus*	PB	No known records
Flammulated owl	*Otus flammeolus*	PB	Present
White-headed woodpecker	*Dendrocopos albolarvatus*	PB	Present

Notes: A = Rare, predisturbance surveys practical; B = Rare, predisturbance surveys not practical; D = Uncommon, predisturbance surveys not practical or not necessary; E = Rare, status undetermined.
[3] Conduct extensive surveys and manage sites. [4] Conduct general regional surveys.

Other Special Status Species

The Redwood Creek black-tailed deer herd utilizes habitat within the MTWAA. Although deer in this herd are primarily non-migratory, they will move down in elevation to avoid deep snow. Summer range is generally characterized by habitat in the upper elevations and winter habitat is generally associated with the lower elevations. The MTWAA encompasses a fraction of one key wintering area (Tish Tang Wintering Area) which lies just south of the Hoopa Valley Indian Reservation.

There have been several incidental sightings of Roosevelt elk in recent years. The analysis area is within close proximity to several established herds (the Marble Mountain Herd and the Trinity Alps Herd) and expansion of the herds within the area in the near future is probable.

Human Uses, Values, and Expectations

Communities

Humans have inhabited these watersheds for over 8,000 years. There are numerous prehistoric and historic sites documenting human use of the MTWAA. Most of the MTWAA population is located in the unincorporated communities of Willow Creek, Salyer, and Hawkins Bar, all located on Highway 299, and in the Hoopa Valley Indian Reservation, located north of Willow Creek on Highway 96. Historic economic activities occurring in the MTWAA over the past 150 years include mining (e.g., copper, gold), homesteading and ranching, logging (e.g., Douglas-fir, tanoak, etc.), and recreation-related tourism. The MTWAA provides diverse opportunities for outdoor enthusiasts and travelers, including fishing, hunting, hiking, rafting, and wildlife-viewing. Currently, the main industries are services, recreation-related tourism, agriculture, aggregate extraction, forest products, local branches of federal, state, and county government agencies, and the Hoopa tribal government.

The largest non-reservation community in the MTWAA, and in the entire SRNF, is Willow Creek, with a Census 2000 population totaling 1,743. Willow Creek has several small businesses, a major bank branch, service businesses, forest products industry, and government agencies. As the largest community in the area, Willow Creek serves to some extent as a regional trade and services center.

Salyer and Hawkins Bar are small communities located in Trinity County east of the South Fork Trinity River. This area's population is approximately 794. Key economic sectors include educational, health, and social services, and retail trade. The agriculture, forestry, fishing, hunting, and mining sectors are also important to the local economy.

The Hoopa Tribe is a federally recognized tribe, and as such, the federal government has trust responsibilities towards them. The southern portion of the Hoopa Valley Indian Reservation falls within the study area. The Trinity River flows through the center of the reservation. The population of the Hoopa Tribe, located on the Hoopa Valley Indian Reservation, numbered 2,633 in 2000. Most of the reservation's population is located in the portion of the 144-square-mile reservation north of the MTWAA boundary. Several small businesses, three of which are part of larger chain businesses, a major bank branch, a small cattle industry, and tribal government offices and enterprises, including a development corporation that runs tribal business enterprises, are located on the Hoopa Valley Indian Reservation. The Tribe manages its lands, administering timber, fisheries, wildlife, cultural plants and sites, and other natural resource-based programs. They have trust resources that are affected by off-reservation management, such as fish and water.

Water quality is a significant value held by all segments of the various communities. Improving water quality is viewed as an economic and environmental necessity that supports fisheries, fishing, and water-oriented recreational activities throughout the watershed. In addition, the growing agriculture industry relies upon consistent sources of high quality water.

Heritage Resources

Native American occupation and land-uses spanning millennia are evidenced by numerous prehistoric archaeological sites preserved across the study area and beyond. Also preserved are numerous historic archaeological sites, generally dating after sustained Euro-American contact ca. 1850. Historic sites are associated with post-contact Native Americans (including those descended from the indigenous peoples), Euro-Americans, Chinese, and other ethnic groups attracted to the region for its mineral or timber resources, or other reasons.

Early 20th century anthropologists documented that at historic contact, at least three distinct Native American groups occupied portions of the analysis area—the Hupa, the Tsnungwe, and the Chimariko. Living within the analysis area and beyond are people who trace their lineage back to these Native American groups, and many maintain heritage ties to the old ancestral lands, traditions and lifeways.

The discovery of gold in the Trinity River by Pearson B. Reading in 1848 precipitated Euro-American settlement of the basin. With the establishment of supply centers at Union (Arcata) and Trinidad, the lower Trinity was opened to California's 19th century Argonauts. New River Camp, China Flat, and the river bars and flats drew miners by the hundreds. Permanent settlement by families, who established farmsteads on the river flats at Burnt Ranch, Hawkins Bar, Salyer, China Flat, Willow Creek, and the Hoopa Valley following the initial push into the basin. They cultivated land, grew grains and hay, grazed stock, and established fruit orchards and vineyards. Descendants of these settlers continue to live and work within the MTWAA.

Tribal Trust Resources

In principle and through the application of treaties, statutes, and court cases, the Unites States government is required to interface with Indian Tribes on a government-to-government basis. In U.S. v. Mitchell (463 U.S. 206, 225 [1983]), the U.S. Supreme Court reaffirmed the principle of "the undisputed existence of a general trust relationship between the United States and the Indian people." The U.S. Forest Service is bound by this trust responsibility when it considers actions that may affect federally reserved tribal trust resources, interests, and concerns of tribal governments. Federal tribal trust responsibilities relating to the MTWAA extend to the federally recognized Hoopa Valley Indian Tribe. Tribal trust resources potentially affected by off-reservation management activities in the MTWAA include water quality and fisheries resources. The Forest Service must apply its trust responsibilities to the downstream Yurok Tribe who also hold federally reserved trust resource rights associated with water quality and fisheries in the Klamath-Trinity River Basin.

Land Ownership

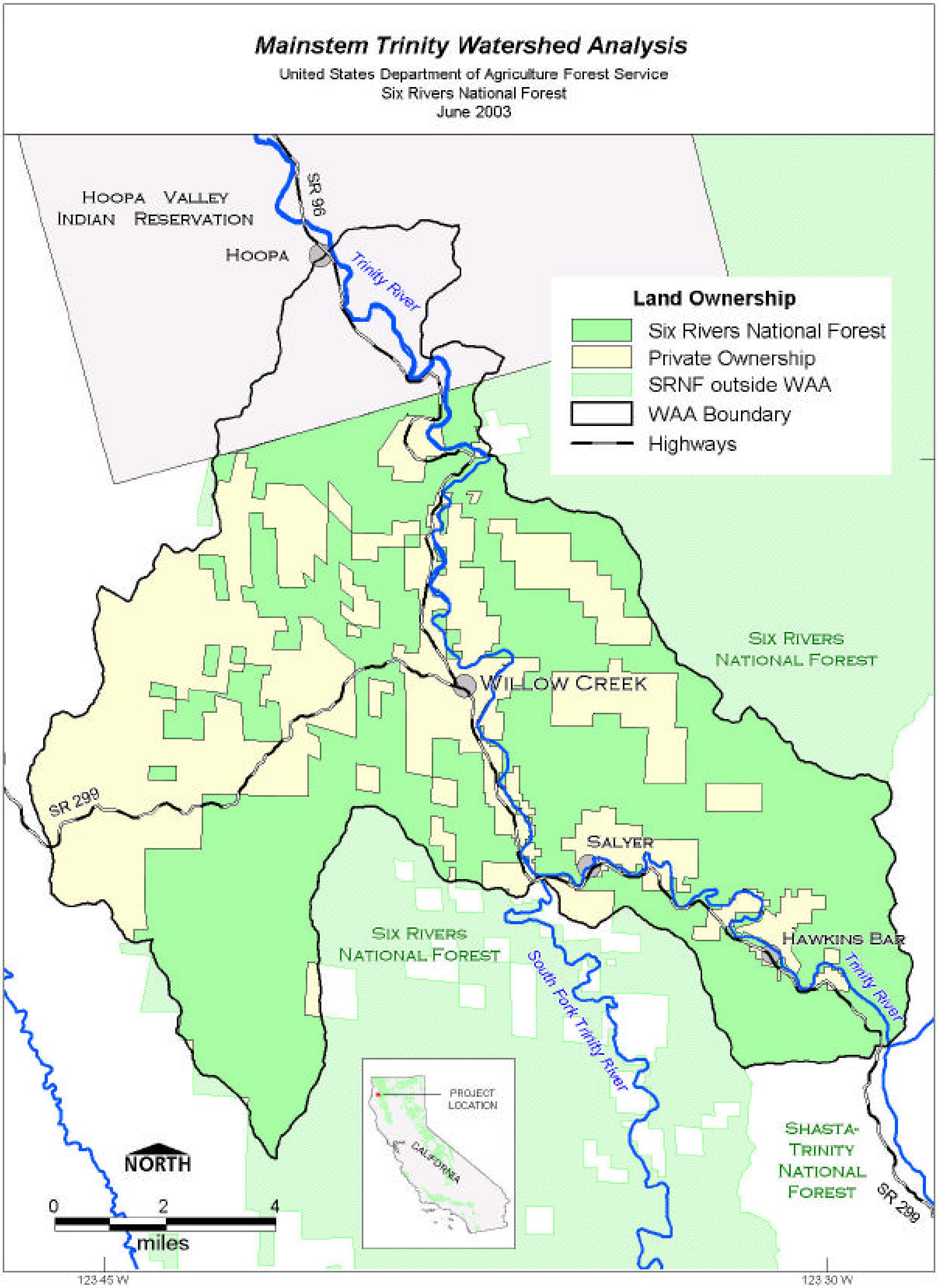
The MTWAA has approximately 55 percent of the ownership in public lands managed by the Six Rivers National Forest (Figure 1-4). Approximately nine percent (6,921 acres) is within the boundary of the Hoopa Valley Indian Reservation, and the other 36 percent (28,586 acres) is in private ownership (Table 1-6).

Table 1-6. Land ownership by watershed in the Mainstem Trinity Watershed Analysis Area.

Ownership	UTLTR	Willow Cr.	H-S	Total Acres
Six Rivers NF	13,706	13,885	15,447	43,038
Hoopa Valley Reservation	6,921	0	0	6,921
Other	10,515	13,860	4,211	28,586
Grand Total	**31,142**	**27,745**	**19,658**	**78,545**

Note: Acreages are approximate.

Figure 1-4. Land Ownership Within the Mainstem Trinity Watershed Analysis Area



Timber Production

The MTWAA includes general forest, or matrix, lands that are generally available for commercial timber production, which contributes to the Forest's overall timber products output. Additional commercial timber production may be possible from other land allocations as a byproduct of other vegetation management projects. For example, vegetation management projects with a primary goal of promoting the development of large diameter trees in a riparian zone may also generate small diameter sawlogs by understory thinning. Private timberlands within the MTWAA are primarily designated Timber Production Zone (TPZ), dedicated to timber production. The remaining private lands support rural residential uses. Hoopa Valley Tribal lands within the MTWAA are primarily classified as timberlands and managed for multiple uses including timber production.

On Forest Service lands within the MTWAA, silvicultural practices and timber harvesting have reduced the area occupied by mature and old growth seral stages and increased the area occupied by shrub/forb and pole stages. The current seral stage distribution of the primary vegetation series does not reflect the RMRs for the central zone. Vegetation management in the form of timber harvesting is one of the activities that can be used to promote the development of stands that more closely reflect the RMRs for the central zone.

Special Forest Products

Special Forest Products (SFP) are defined as non-timber, renewable plant materials that are collected for personal or commercial use. The most commonly collected products include firewood; holiday trees; a wide variety of floral products, medicinal plants, fungi, edible plants, nuts and berries; and plants used in Native American basket weaving and spiritual practices. The Lower Trinity Ranger District issues an average of 121 commercial, 2,389 personal, and 107 free-use SPF permits per year.

Recreation

Recreational uses in the MTWAA include day use, overnight, and special use (i.e., seasonal) activities. Most recreational activities center on the mainstem section of the Trinity River, from Cow Creek above Gray Falls to Supply Creek south of Hoopa. The MTWAA climate is characterized by hot dry summers and cold winters, resulting in seasonal variations in recreation activities. Water-oriented, hiking, and camping activities occur predominantly in the late spring, summer and fall; and snow play and cross-country skiing occur in the winter. Also, there are special events scheduled in the MTWAA communities of Willow Creek and Salyer, such as the annual Bigfoot Days held in Willow Creek each September. Recreational facilities in the MTWAA are provided by the federal government, the Hoopa Valley Tribe, local organizations and service districts, and private entities. Camping in the USFS East Fork Willow Creek and Boise Creek campgrounds is very popular.

River activities in the MTWAA occur mainly on the Trinity River, which is a designated Wild and Scenic River. While there are more than 20 tributaries in the MTWAA, most do not have sufficient flows to support water dependent activities. The majority of recreational use associated with the river consists of day use rather than extended overnight stays. River-oriented opportunities include rafting, kayaking, canoeing, inner-tubing, boating, sunbathing, swimming, fishing, gold-panning, and sight-seeing. There are nine river access sites within the MTWAA including trail access to water falls (Gray Falls) and vehicle access to water craft launch sites. The main travel corridors in the MTWAA, Highway 299 and Highway 96, are designated scenic routes and offer sightseeing opportunities.

Mountainous areas include Horse Mountain, Titlow Hill, Telescope Peak, Snow Mountain, Brannan Mountain, Three Creeks Summit, Brush Mountain Lookout, and Zeigler Point. Mountain-oriented activities include camping (including designated, wheel-chair accessible, and primitive/dispersed sites), hiking, backpacking, horse-back riding, mountain biking, picnicking, hunting, scenic driving (such as Bigfoot Scenic Byway—Hwy 96, Trinity Scenic Byway—Hwy 299, and Titlow Hill Road to Horse Mountain on Forest Route 1), off-highway vehicles (OHV), wildlife observation, wildflower viewing, fishing provided by commercial outfitter guides, hunting, jeep-touring, and wilderness pack trips. Winter-oriented activities include snow play, snow-mobiling, and cross-country skiing, which take place primarily on Horse Mountain.

A significant portion of the MTWAA is privately owned, and there are privately offered recreational facilities and activities that occur on both private and public lands. Recreational facilities offered by the Forest Service have decreased in the last decade, primarily due to the closing of Gray Falls campground and the transfer of Tish Tang recreation area to the Hoopa Valley Tribe ownership. Some river access points on private property have also been closed due to trespassing and property damage.

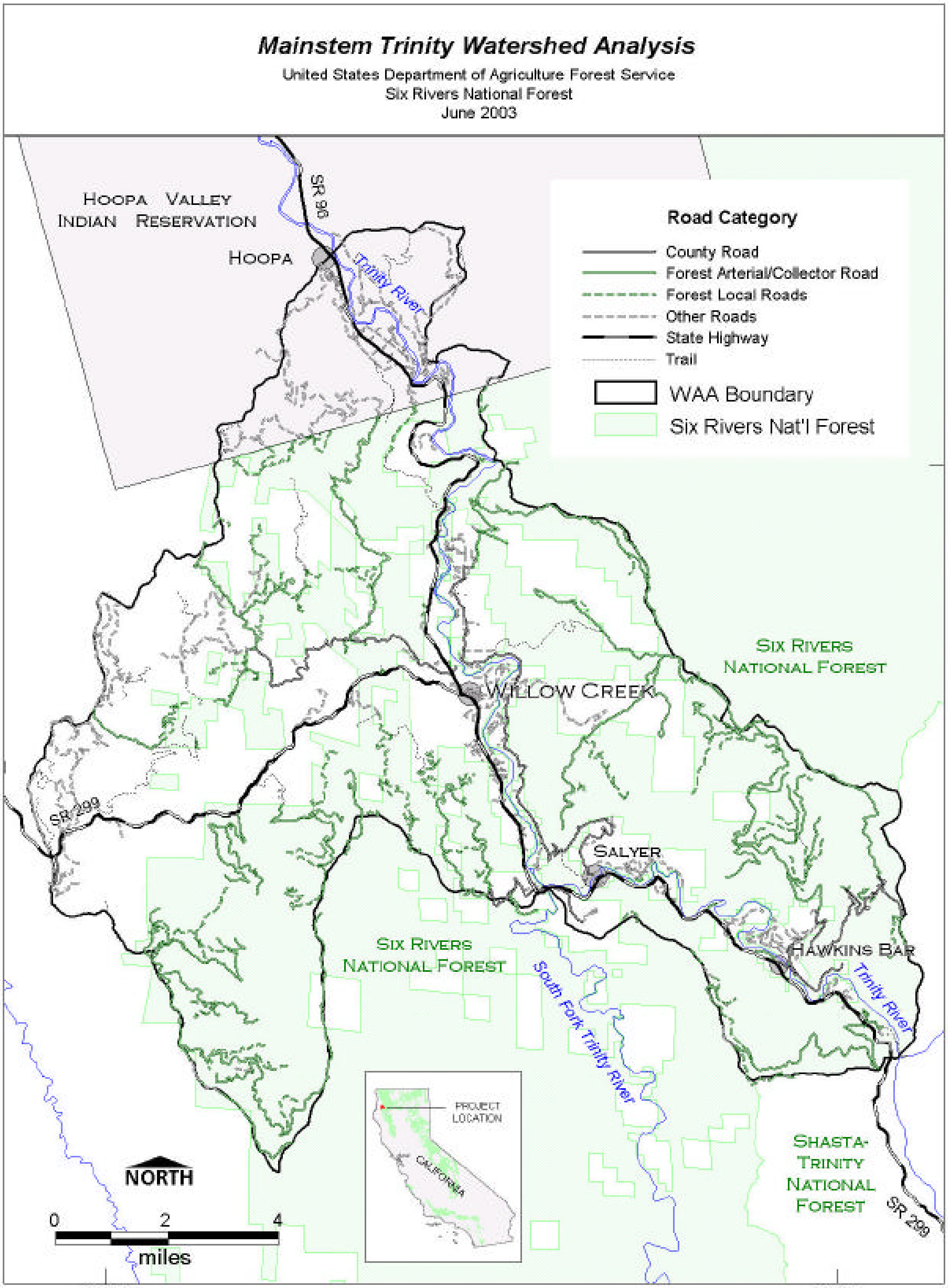
Transportation System

The transportation system in the analysis area is made up of roads and trails that provide access for motorized and non-motorized vehicles, livestock, and foot traffic. Since most trails are typically used for recreational purposes, trails are described under the *Recreation* sections throughout this document (except for a segment on historical, pre-road system trails discussed in the *Transportation System – Reference Conditions* section); roads are discussed in the *Transportation System* sections.

The road system in these three watersheds consists of two arterial routes, several collector routes, and a series of local spur roads. The major routes (arterial and collectors) are part of the transportation network that link the analysis area to State Highway 96 and State Highway 299. In general, these roads extend from the lower reaches of the drainages to the higher elevations by following major ridge systems. Most of the stream crossings occur at tributaries to the main drainages in the middle to upper reaches of these watersheds. Shorter local roads spur off the major routes, providing access to specific sites or limited land areas. The arterial and collector roads generally offer improved surfaces and can accommodate passenger vehicles. The local spur roads tend to be low standard and typically were designed and maintained only for high-clearance vehicles.

Road densities are variable within the analysis area. Much of the analysis area is in private ownership and has a fair amount of residential and urban road uses. The analysis area has no designated roadless areas or wilderness areas. Figure 1-5 shows existing roads within the MTWAA, as well as some of the adjacent arterial and collector routes.

Figure 1-5. Existing Roads Within and Adjacent to the Mainstem Trinity Watershed Analysis Area



CHAPTER 2
ISSUES AND KEY QUESTIONS

The purpose of this chapter is to focus the analysis on the key elements of the ecosystem that are most relevant to the management questions, human values, and resource conditions in the watersheds. Major issues are identified and framed, and key questions are developed to evaluate the resource conditions and to identify future management opportunities and priorities. Watershed issues are identified using various sources. These sources include the following: Ecosystem Analysis at the Watershed Scale, Federal Guide for Watershed Analysis, version 2.2 (August 1995); Northwest Forest Plan and Aquatic Conservation Strategy objectives; best professional judgment regarding landscape-scale resource conditions and management direction; and public involvement regarding watershed concerns.

Physical System

Issue 1 - Erosion Process and Water Quality

Aquatic ecosystems in the Pacific Northwest have adapted to disturbances that impact water quality, aquatic species, and habitat in the short term but rejuvenate the aquatic ecosystem in the long term. During the past 40 years, parts of the Mainstem Trinity Analysis Area have experienced timber harvest and road building. Due to the inherent instability and erodibility of this landscape, human-caused disturbance may have compounded the impacts associated with natural disturbances. The degree to which erosion rates, riparian areas, water quality, instream habitat, and aquatic populations have been altered from historic or reference conditions and the reasons for these changes are of key concern.

Key Questions:

1. How have the distribution or intensity of hillslope processes changed over time in the analysis area?
2. What effects have natural and human-caused disturbances (including storm/flood events, landslides, wild and prescribed fire, logging, road construction or maintenance, and mining) had on mass wasting and erosion processes within the analysis area?
3. To what degree and where have management activities affected mass wasting or erosion processes?
4. To what extent have flow characteristics of the watersheds been altered, and what effects has this had on key dependent aquatic species?
5. What water quality parameters within the watersheds may be detrimental to native aquatic organisms?
6. Where are domestic water sources located and how vulnerable are they to sedimentation from natural or human-caused landscape disturbances?
7. Where beneficial uses have been impacted, when will they be considered "recovered"?

8. Where within the watersheds have management activities tended to produce adverse effects on beneficial uses (water quality and instream habitat), either directly or indirectly?
9. How do water quality parameters and erosion processes within the watersheds compare to the entire Trinity basin?

Issue 2 - Soil Productivity and Protection

Soils are a fundamental resource on which most other ecosystem values are based. Many of the soils in the Mainstem Trinity Analysis Area are vulnerable to impacts from management, depending in large measure on the particular location and type of management involved. Erosion hazard is high or extreme in some areas due to steep slopes that are inherently unstable. Some soils with already low organic matter are very susceptible to damage from high intensity wild or prescribed fire, while other soils are subject to loss of porosity when compacted under moist or wet conditions. Maintaining the soil profile in a near-natural condition throughout most of this Analysis Area (with the exception of permanent roads or facilities) must be a primary goal to sustain other ecosystem functions.

Key Questions:

1. What soil types occur in the watersheds that are especially sensitive to natural or management disturbance (such as logging, mining, fire or fuel treatments), and in what locations are special mitigations warranted?
2. What are the key factors for protection of the various soils in this Analysis Area when conducting treatments to preserve other ecosystem values (such as fuels reduction)?
3. How should the relative risks and benefits to long-term soil productivity of actively managing vs. not managing be evaluated when planning or executing projects?
4. What are the major uncertainties in protecting soil productivity within this Analysis Area while conducting management activities?

Biological System

Issue 3 - Riparian Areas

Riparian and aquatic systems often reflect the ecological condition of an entire watershed. Riparian areas are important links between terrestrial and aquatic ecosystems, and they provide important habitat for numerous species. Riparian Reserves are a National Forest land allocation intended to protect riparian areas. Riparian areas within the Mainstem Trinity Analysis Area have been subjected to both natural and human-caused disturbances, which may have diminished their function or value to dependent biotic communities.

Key Questions:

1. How have vegetative conditions of riparian areas changed over the past century within the analysis area, and what have been the causes of those changes?

2. What are the principal beneficial uses associated with riparian areas and water bodies within the analysis area, and how functional are riparian areas in meeting those uses?
3. Given the historic and recent impacts of natural and human-caused disturbances, what is the potential and what are the principal mechanisms for large woody debris recruitment within riparian areas?
4. What effects have natural and human-caused disturbances (including logging, mining, fire, and fuel treatments) had on riparian areas throughout the analysis area during the past century?
5. What riparian dependant species of concern exist in the analysis area?
6. How have the abundance and distribution of riparian species of concern and their habitats changed as a result of natural and human caused disturbances?
7. What criteria should be used to establish appropriate riparian reserve widths or to guide management adjacent to or within riparian areas, in order to protect and restore beneficial uses?
8. What cooperative efforts with private landowners and other groups might be used to restore riparian vegetation and reduce erosion and sedimentation while maintaining "fire safe" defensible spaces on the wildland/urban interface?

Issue 4 - Aquatic Species and Habitat

The Analysis Area contains a significant portion of the Mainstem Trinity River and surrounding tributaries that provide essential habitat for anadromous fish and other aquatic species. Several species are considered at-risk and are listed as a Federal Endangered Species or Forest Service Sensitive Species.

Key Questions:

1. What were the historic distribution, relative abundance, and habitat conditions of fish known to occupy the analysis area?
2. Which fish species have been identified as being at-risk, and what are their current trends?
3. Which subwatersheds in the analysis area are critical for the maintenance, protection, and restoration of at-risk species?
4. What physical and environmental factors have the most influence on the quality and distribution of essential fish habitat for species at risk? What enhancement projects or changes in management would benefit anadromous fish and other aquatic species in this watershed?
5. What have been the natural and human causes of change between the historic distribution and abundance of at-risk species and their current distribution and abundance in the analysis area?
6. How have exotic and hatchery-raised fish affected native fish populations in this part of the Trinity River?

Issue 5 - Vegetation

Vegetation management is based on the seral stage distribution within the primary vegetation series on the Forest (tanoak, Douglas-fir, white fir and red fir). A historic range of variability (HRV) and recommended management range (RMR) has been developed for each of these series and seral stages within each of the three zones on the Forest. The HRV and RMR are based on disturbance regimes that have created a mosaic of seral stages throughout the landscape. These watersheds lie within the central zone and contribute to the RMRs for that zone.

Disturbance agents such as fire, timber harvesting, road building, and fire suppression have altered the seral stage distribution in this landscape. In addition, diseases such as Port-Orford cedar root disease and sudden oak death disease have the potential to alter plant community species composition. Through these agents, the resilience of some plant communities to catastrophic or larger scale disturbance may have been altered.

Key Questions:

1. What is the potential impact of Port-Orford-cedar root disease (*Phytopthora lateralis*) and sudden oak death disease (*Phytopthora ramorum*) on plant community composition and function?
2. Using the year 2000 revised seral stage distribution, what management opportunities exist within the watershed to bring the existing conditions more "in line" with the recommended management ranges (RMRs) for the Central Zone?
3. Are there opportunities for vegetation management that would increase resilience to catastrophic disturbance such as fire?

Issue 6 - Fire

The Mainstem Trinity WA area includes the largest population centers on the Six Rivers NF, including eight Federally listed communities at risk from wildfires. Recent wildfire events show the extensive and severe potential threats to these communities and the natural resources of the area. The virtual elimination of fire from this area for over 60 to 80 years has resulted in vegetation patterns and structure which present severe challenges when trying to implement fuel treatments within and adjacent to the wildland/urban intermix and across the landscape. Given the extensive private property within this watershed, a return to a pre-European fire regime may not be possible.

Key Questions:

1. What was the pre-European fire regime?
2. What is the trend of the wildfire risk (lightning vs. human-caused)?
3. What is the fire hazard and what are the potential effects of wildfires to the communities and resources within this area?
4. What are the impacts on air quality and visibility from wildfires compared to prescribed burns within and adjacent to the analysis area?
5. Is returning to a pre-European fire regime achievable and sustainable?
6. What efforts can help to minimize risk of wildfire, especially the human-caused risk?

7. What combination of fuel treatments (e.g., prescribed fire, fuelbreaks, thinning, mechanical treatments) could help to reduce the fire hazard and where are the priority areas to treat?

Issue 7 - Botanical Area

The Horse Mountain Botanical Area is managed for the protection of unique botanical values (distinctive serpentine vegetation and rare plants), for educational purposes, and for recreational use compatible with these values. Universities and colleges use the area as an outdoor classroom. In addition, public uses such as wildflower viewing, hiking, dispersed camping, wintertime snow-play, and hunting are popular in the area. Target shooting has also traditionally occurred here. There is a certain level of littering associated with recreational activities and unlawful dumping within the botanical area. Past mineral mining has left mining roads, trails, and tailing piles. Special uses in the area include an electronic communications site. A Special Interest Area Management Strategy was developed in 1998 and identified specific issues related to Horse Mountain. The key questions below attempt to address these issues.

Key Questions:

1. What are the distinctive elements of the botanical area and how do these elements compare to the rest of the analysis area?
2. What are the potential impacts to botanical area values (i.e. plant communities, including Port Orford cedar, rare plants) from past mining?
3. To what degree are current uses in the area incompatible with botanical area values?
4. What are the trends for this area related to use, private-public land interface, and botanical area stewardship?
5. What opportunities exist to curtail resource impacts and increase public enjoyment of the area?

Issue 8 - Noxious Weeds

Noxious weeds are present in the MTWAA, some as localized populations. The dominance and persistence of noxious weeds displaces native species (flora and fauna) and alters various ecosystem processes. Noxious weeds also reduce property values, the quality of pastureland and quality of riverside recreation. Potential exists for these species to spread into currently uninfested areas by such vectors as roads and equipment relocation. Opportunities exist to manage localized and leading edge populations.

Key Questions:

1. What priority invasive plant species are in the analysis area?
2. What management activities exacerbate the introduction, spread and ability to manage invasive plant species?
3. What are the trends for weed further introduction and spread in the analysis area?

4. What invasive plant management opportunities are available and applicable to the analysis area?

Issue 9 - Wildlife Species and Habitat

The Mainstem Trinity Analysis Area provides habitat for many wildlife species. There are concerns about the viability of some of the species. These include federal listed Threatened species, Region 5 Forest Service Sensitive species, and Survey and Manage and Protection Buffer species from the Forest Plan.

Key Questions:

1. What are the types and distribution of habitats and, where known, populations of these wildlife species within the analysis area, and what are the trends for those populations?
2. What is the current distribution of late-seral stage and old-growth habitat within the watershed?
3. What is the habitat and population status for the northern spotted within LSR 306? What is the relationship of LSR 306 to other adjacent LSRs and what actions are needed, if any, to improve habitat conditions and connectivity for late-seral stage dependent species?
4. How has the Megram Fire altered conditions for TES and special status species within the watershed?
5. What possible management practices are needed to facilitate recovery of special status species habitats lost due to the effects of the Megram Fire?
6. What possible management practices are needed to maintain and improve habitats for special status species within the watershed?

Social System

Issue 10 - Socio-Economic

This watershed has a large private property aspect to it, including portions of the Hoopa Valley Indian Reservation. This large population of residents has many uses for the resources within the watershed and various values associated with these uses. Management of National Forest System lands and resources affects daily life styles, recreation uses, and economic stability. The communities, Tribal governments, and people are concerned about the management practices that the Six Rivers National Forest may implement, particularly as the practices relate to access via roads and trails, potential catastrophic fires, quality of their lives and experiences, and local community economics and infrastructures.

Key questions:

1. What does this watershed contribute to the economies of local communities? What management practices can assist in sustaining or improving the economies?
2. What are the subsistence activities of plant gathering, hunting, and fishing by local communities? What management practices will be supportive of these activities?

3. How does quality of life relate to the watershed? What are the contemporary spiritual and traditional activities of the Hoopa and Tsnungwe tribes within the watershed? What management practices might contribute quality of life and cultural traditional activities?
4. What opportunities exist for developing cooperative partnerships with the communities, organizations, tribal governments, and others to increase the health and function of the resources and communities of the Mainstem Trinity River?

Issue 11 - Heritage Resources

For hundreds or perhaps thousands of years, the landscape and environment of the Mainstem Trinity Analysis Area has been shaped and influenced by the prehistoric and historic activities of its human inhabitants. This Analysis Area contains many archaeological sites as well a ceremonial villages, ceremonial areas, and culturally important plants.

Key Questions:

1. What were the prehistoric land uses and practices?
2. What were the historic land uses and practices?
3. What heritage resources exist?
4. How has land management after the 1850's affected heritage resources?
5. What effect has fire suppression had on culturally important plants and cultural settings?
6. What types of activities have the highest potential to affect heritage resources?

Issue 12 - Tribal Trust Resources

A portion of the Hoopa Valley Indian Reservation is included in the analysis area. NFS lands are adjacent to the Hoopa Valley Indian Reservation and their trust properties and resources. The Hoopa and Yurok Tribes have Federally Reserved trust rights associated with anadromous fish and water. The Forest has a trust responsibility to manage its activities and policies so that its off-reservation activities do not adversely affect on-reservation trust resources or rights, including those rights associated with the anadromous fishery and water quality and quantity.

Key Questions:

1. What are the federally reserved trust resources and responsibilities within the analysis area?
2. What cooperative governmental opportunities are there to enhance trust resources?

Issue 13 - Timber Production

The Forest Plan establishes a sustainable level of timber production that could be provided from general forest (matrix) lands. This watershed contains productive matrix lands and valuable tree species than can help meet a portion of society's demand for wood products. Public opinion, locally and nationally, varies on whether federal lands should be managed to provide timber outputs. The Six Rivers National Forest is responsible for monitoring implementation of the Forest Plan and validating the assumptions used in it.

Key Questions:

1. What portion of the Forest Plan timber outputs, i.e. Allowable Sale Quantity, is expected from this watershed?
2. In light of existing (year 2000) seral stage distributions in the central zone, and given all other Forest Plan Standards & Guidelines, is the answer to question #1 realistic to achieve?
3. Are there opportunities for timber harvesting to occur outside of general forest (matrix) while still meeting the goals, standards, and guidelines of the Forest Plan?

Issue 14 - Special Forest Products

Special Forest Products (SFP) are defined as non-timber, renewable plant materials that are collected for personal or commercial use. The list of potentially available SFP is quite large. The most commonly collected products include firewood; holiday trees; a wide variety of floral products, medicinal plants, fungi, edible plants, nuts and berries; and plants used in Native American basket weaving and spiritual practices.

Due to the close proximity to prehistoric village sites, the town of Willow Creek, and State Highway 299, many Special Forest Products have been harvested from this watershed over time. Native Americans cultured and utilized many of these products for thousands of years. In recent years, demand has increased for commercial utilization of some SFP. General personal use of some SFP has also increased. Uncertainties exist about the ecological roles and sustainable levels of harvest for many of these species and products, especially in light of exotic diseases such as POC root disease and sudden oak death.

Key Questions:

1. What are the levels of historic and prehistoric utilization of SFP?
2. What are the projected commercial and personal use demands for SFP over the next decade?
3. What opportunities exist to provide increased quantities and/or improved quality of SFP for all uses?
4. What are the opportunities to manage a commercial harvest program that is supportive of community subsistence and cultural traditional uses of plants?
5. What effects will State and Federal quarantines relating to sudden oak death (SOD) have on the opportunities for SFP utilization?

Issue 15 - Recreation

Recreation use in the Mainstem Trinity Analysis Area is primarily focused along the designated Wild and Scenic Trinity River and in the Horse Mountain area of South Fork Mountain. The majority of recreational use is associated with the river and consists of day use rather than extended overnight stays. A significant portion of the use is derived from coastal communities as well as area residents. Fishing, rafting, and boating draw many people to the watershed. Access to the river is an issue. Increasing recreation use occurring in the mountains, primarily by hikers, Off Highway Vehicle (OHV) users, mountain bikers, snow-players, cross-country skiers, dispersed campers, and target shooters is resulting in conflicts and resource damage.

Key Questions:

1. What types and levels of recreation use are now occurring in the analysis area?
2. What are the issues concerning river access and other key activities?
3. How can recreation be developed and managed to be responsive to culturally significant locations and protect heritage resources as well as other sensitive resources?
4. What opportunities exist for increasing river access and enhancing existing ones through partnerships?

Issue 16 - Transportation System

Access to the Forest for management of its resources and for its use and enjoyment by the public is dependent on state and county roads and Forest Service system roads and trails. Most activities on the Forest, including camping, hunting, fishing, motorized recreation, hiking, enjoying rivers and streams, suction dredge mining, gathering fuel-wood, and accessing other forest products are available because a Forest road or trail provides access to them. Driving for pleasure and viewing scenery is a popular recreational activity on the Forest.

There is an extensive road system located in this analysis area. The transportation system was developed over an extended time frame largely for the purpose of resource extraction. Some road development predates Forest Service management activities.

In the past when timber hauling was the primary road use, road maintenance was accomplished primarily with timber sale contracts where the private contractor provided maintenance during harvest operations. Currently, the Forest administers road maintenance contracts to maintain roads within available funding for vehicular safety concerns.

Reduced funding levels have created a situation in which it is not feasible to fully maintain the existing road system at the operational maintenance levels. The current road system is maintained based upon available funding which generally consists of appropriated funds. If maintenance activities and funding continue to decline, the potential will exist for unsafe conditions for vehicles and for road-related resource damage.

Key Questions:

1. Which roads pose the greatest risk for erosion or prism failure if inadequately maintained?
2. What road maintenance is needed for each road to minimize future road deterioration and provide for safe vehicle access?
3. What factors should be considered for maintaining roads to meet user access needs?
4. What factors should be considered for maintaining roads to protect forest resources?

CHAPTER 3
REFERENCE & CURRENT CONDITIONS

Introduction

The purpose of this section is to develop both a reference condition, which will enable comparisons of how ecological conditions have changed over time as the result of human influences and natural disturbances, and a current condition. This discussion will allow further analysis about how reference and current conditions interface with key management plan objectives that are outlined in the Six Rivers National Forest (SRNF) Land and Resource Management Plan (LRMP). This discussion will also develop information relevant to the issues and key questions presented in the last chapter.

Current conditions are generally derived from existing data and published reports. For this analysis, professional judgment has been used to apply knowledge gained from data collected outside the analysis area where specific data is lacking from within this area.

Reference conditions are primarily built from a multitude of sources ranging from anecdotal information and knowledge of ecosystem processes and functions to data extrapolations based on old aerial photographs. Therefore, reference conditions are both quantitative and qualitative and are influenced by professional judgment.

Physical Setting

Erosion Process and Water Quality

Erosion Process – Reference Conditions

Because of the steep terrain, locally weak earth materials, frequent seismicity, and high levels of precipitation, many hillslopes within the MTWAA are susceptible to high levels of mass wasting and surface erosion. As such, the Trinity River and its tributaries are subject to high sediment loads. The presence of long-term high sediment loading within the Trinity River system is demonstrated by the presence of large, extensive, alluvial deposits (terraces, fans, etc.) throughout the area. Peak winter storm flows are typically associated with high levels of turbidity resulting from the large suspended sediment load.

A number of bedrock and soil types are present throughout the MTWAA. Some of these are particularly susceptible to erosion and mass wasting. As would be anticipated, these susceptible rock and soil types are sensitive to human disturbance, and in many instances, human activities in the watershed have resulted in significant increases in erosion and subsequent sedimentation.

Earth Materials

As discussed in Chapter 1, the MTWAA is located in a complex geologic region underlain by a wide variety of earth materials, much of which has been tectonically deformed and metamorphosed to varying degrees. In order to evaluate the susceptibility of this variety of earth materials to mass wasting, seven primary rock units were established based on similarities in lithology, age, and/or degree of metamorphism. These seven units were distilled from the complex geologic mapping in Figure 3-1 in order to simplify the landslide analysis described below.

Galice Formation (Jg). Metasedimentary rocks of the Galice Formation underlie 60 percent of the analysis area. This unit is part of the Western Klamath terrane (Irwin 1994). The Galice Formation consists of mildly slatey to phyllitic argillite, greywacke, and stretched pebble conglomerate. These slopes contain many large, ancient, deep-seated landslide deposits and are moderately susceptible to debris slides, debris flows, and accelerated gully erosion. For the purposes of landslide analysis, the Galice Formation includes map units Jgs, Jwk_ms, and Jwk_tm (Figure 3-1).

Rattlesnake Creek mélange (rcm). Mélange associated with the Rattlesnake Creek terrane underlies 15 percent of the analysis area. This mélange consists of sheared and dislocated bodies of serpentinized peridotite, pillow basalt, and other mafic volcanic flows and tuffs, thin-bedded chert, argillite, intermediate-composition to silicic volcanic rocks, and fine to medium-grained greywacke. Published geologic maps (Young 1978, Irwin 1994) typically identify discrete ultramafic lenses and limestone outcrops within the mélange, although those are not distinguished herein. Ancient landslide deposits are common, and slopes exhibit a wide range of mass wasting characteristics due to the varying lithologies. The Rattlesnake Creek mélange is shown on Figure 3-1 as PMrc_u.

Mesozoic intrusives. Intrusive igneous rock bodies underlie about seven percent of the analysis area. These igneous bodies are distinguished here due to their unique weathering and mass wasting characteristics (e.g., grusification, decomposed granite, etc.). Intrusives are shown on Figure 3-1 as units Jwk_gn-fc, MZpl_d-ar, MZpl_g-wc, and MZpl_d-im.

Ultramafics. Two distinct belts of serpentinite and other related ultramafic rocks are present within the analysis area. One is located in the Rattlesnake Creek terrane, the other in the Western Klamath terrane. These areas are distinguished here due to their unique lithologies, textures, and susceptibility to mass wasting. Ultramafic belts are most common along major tectonic boundaries (i.e., along the thrust faults that separate the terranes). Ultramafic rocks underlie about six percent of the analysis area, and are shown on Figure 3-1 as units Jwk_um and PMrc_um.

Metavolcanics. Metavolcanic rocks of the Western Klamath terrane underlie about five percent of the analysis area. These areas consist of resistant and fairly competent greenstone and greenstone breccia that form steep slopes with fewer ancient landslides than other areas of the Western Klamath terrane. Young (1978) maps these areas as the Rogue Formation. Metavolcanics are shown on Figure 3-1 as Jwk_rv.

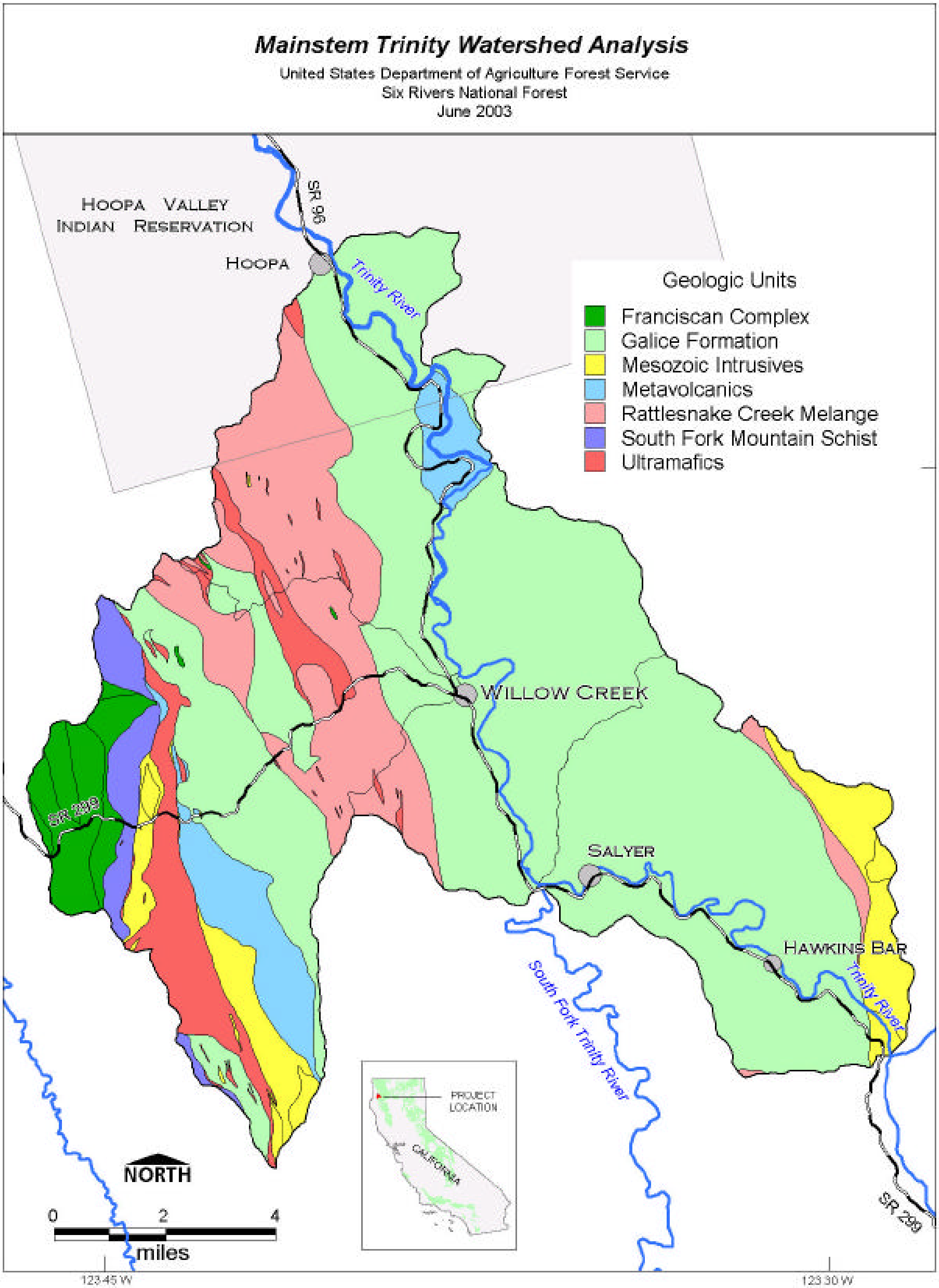
Franciscan Complex (KJf). A small area of the Franciscan Complex is present along the western watershed divide of the analysis area. These materials are associated with the Eastern belt of the

Franciscan Complex. The Eastern belt of the Franciscan Complex is subdivided into the Yolla Bolly and Pickett Peak terranes. Franciscan Complex rocks are shown on Figure 3-1 as units Kjfe_bf, Kjfe_gw, and Kjyb_crm, and they underlie about three percent of the analysis area.

South Fork Mountain Schist (KJsf). The South Fork Mountain Schist is part of the Franciscan Complex, but is subdivided here due to its distinct metasedimentary texture. The unit consists of quartz-albite-muscovite-chlorite schist and semischist. This unit underlies three percent of the analysis area, and is characterized by an abundance of large, ancient deep-seated landslides. These earth materials are moderately susceptible to debris slides, debris flows, and accelerated gully erosion. The South Fork Mountain Schist is shown on Figure 3-1 as unit KJppsm.

	CRETACEOUS
KJfe_bf	Eastern Belt Franciscan Complex Broken Formation; sandstone
KJfe_gw	Eastern Belt Franciscan Complex Yolla Bolly Terrane undivided; greywacke, conglomerate, chert, argillite
KJyb_crm	Eastern Belt Franciscan Complex Yolla Bolly Terrane undivided; mélange to broken formation
KJppsm	Eastern Belt Franciscan Complex Pickett Peak Terrane; quartz mica schist
	JURASSIC
Jgs	Galice Formation; phyllite
Jwk_tm	Western Klamath Terrane Galice Formation; phyllite
Jwk_ms	Western Klamath Terrane metasediments Galice Formation; phyllite
Jwk_gn-fc	Western Klamath Terrane Friday Camp gneiss
Jwk_rv	Western Klamath Terrane Rogue Formation; greenstone
Jwk_um	Western Klamath Terrane ultramafics; serpentinite locally with mafic rocks
	MESOZOIC
MZpl_d-ar	Mesozoic pluton Ammon Ridge Pluton; diorite, tonalite, quartz diorite, gabbro
MZpl_d-im	Mesozoic pluton Ironside Mountain Batholith; diorite, tonalite, quartz diorite, gabbro
MZpl_g-wc	Mesozoic pluton Willow Creek Pluton; granite and diorite
	PALEOZOIC / MESOZOIC
PMrc_ib	Paleozoic/Mesozoic intrusive blocks; dikes and sills, granitic blocks
PMrc_ls	Paleozoic/Mesozoic limestone
PMrc_um	Paleozoic/Mesozoic ultramafic
PMrc_u	Paleozoic/Mesozoic mélange

Figure 3-1. Geologic Units Within the Mainstem Trinity Watershed Analysis Area.



Landscape Evolution and Disturbance Regimes

- *How have the distribution or intensity of hillslope processes changed over time in the analysis area?*
- *What effects have natural and human-caused disturbances (including storm/flood events, landslides, wild and prescribed fire, logging, road construction or maintenance, and mining) had on mass wasting and erosion processes within the analysis area?*
- *To what degree and where have management activities affected mass wasting or erosion processes?*

The landscape of the analysis area is typical of the Klamath Mountains Province. The geomorphic evolution of the region has been influenced by the complex geology, regional tectonic uplift, high levels of precipitation, and frequent seismicity. These processes have resulted in a landscape characterized by deep, steep-sided canyons, relatively high-gradient, high-energy streams that are burdened with a high sediment load, and widespread mass wasting. The region has evolved over millions of years, during which it has experienced catastrophic changes with long intervening periods (hundreds of years) of relative stability. Both large- and small-scale physical disturbances have been an integral part of this evolution, and the various flora and fauna have adapted to these fluctuating conditions. Large-scale disturbances that have affected the WAA include long-term climatic fluctuations (i.e., glacial/interglacial epochs, etc.) and large seismic events (particularly those associated with great earthquakes on the Cascadia Subduction Zone).

Within the short historical record, the principal natural disturbances that have impacted the area are associated with catastrophic flood events. Three such events are known to have occurred in 1861, 1955, and 1964. These floods resulted in widespread landsliding and subsequent peak sediment inputs into the region's watercourses. Previous, larger floods are likely to have occurred in prehistoric times; such extreme events are thought to have occurred in 1750 and 1600. Clearly the reference condition for the MTWAA is characterized by dynamic geomorphic conditions that include periodic catastrophic events and subsequent increases in mass wasting and sedimentation. These periods undoubtedly caused significant changes in riparian and aquatic ecosystems.

Intervening periods between catastrophic landscape-altering events in the MTWAA were likely associated with quiescent periods where geomorphic conditions were relatively stable. During these periods, landsliding and erosion rates are diminished, and the subsequent sedimentation rate is reduced. These conditions would allow aquatic and riparian conditions to stabilize and recover. These episodes of disturbance and recovery were probably distributed randomly through time. In addition, disturbances may have affected specific areas within the MTWAA or affected specific areas at different rates or magnitudes. As such, different locales within the analysis area have probably been at different stages of disturbance, recovery, or stability at any one time.

Surface erosion rates vary greatly across this landscape because of variations in soil type and parent material, slope steepness and aspect, and vegetative cover. Over millennia, soil formation in most places outpaces erosion so that soils accumulate, becoming deeper and presumably more fertile. In a geologically active area such as the WAA, however, soil formation may only barely outpace erosion, resulting in thin, immature soil veneers. Where mass wasting occurs, short-term erosion processes may increase, resulting in complete removal of accumulated soils. Low gradient alluvial terraces and ancient landslide benches provide two of the few topographically favorable locales where soils may accumulate and are protected from erosion. Wildfires are naturally occurring phenomena that have affected soil formation and preservation throughout the WAA. Fires reduce the level of vegetative cover resulting in increased erosion potential, and if intense enough, can alter the physical properties of the soil.

Pre-management Mass Wasting Conditions

Interpretation of pre-management mass wasting conditions is based on historical records and accounts, familiarity with non-managed wilderness areas in similar terrain, and evaluation of early historical aerial photographs. Prior to human influences, the geomorphic evolution of the landscape within the analysis area was primarily influenced by major climatic, seismic, and wildfire events. The potential magnitude of these natural events in this topographic and geologic setting suggests that the analysis area was subject to significant disturbance, even under natural conditions.

The earliest human influences were associated with Native American cultures. The impacts associated with these early cultures were probably fairly minor as their activities were subsistence-based. The most significant impact on mass wasting associated with early Native American cultures was probably burning. Native cultures frequently initiated fires to facilitate growth and establishment of specific plant species that were important for ceremonial and subsistence purposes. These burns likely increased erosion and mass wasting potential through the reduction of canopy and overall organic cover.

Impacts associated with early European settlers were more severe. The earliest settlers within the WAA were mid 19th- and early 20th-century miners and homesteaders. Historical records indicate that mining activity had substantial impacts on mass wasting processes and sediment delivery along the mainstem Trinity River and some tributaries. These impacts were especially severe upstream of the analysis area. Hydraulic mining, which occurred locally within the WAA in the late 1800's and early 1900's, had a particularly profound impact. Near-stream terrace deposits were processed using a variety of placer mining techniques, and spoils were typically disposed of into the Trinity River. Since many of the placer deposits mined were very old, elevated terraces that would have included substantial older landslide debris intermixed with younger stream deposits likely included a large fraction of older soils mixed with alluvial sand, gravel, and boulders. These older soils would have contained a higher concentration of fine particles. Most of the mining typically occurred during the wet season, when tributary flows were substantial enough to process the placer ore. As such, a significant amount of the fines in the spoils would have been transported downstream. There is no way to reliably estimate how much sediment was contributed to the Trinity River system by early mining (hydraulic or otherwise). Although mining activity probably fluctuated considerably during its peak period, it is likely that several million cubic yards of sediment were delivered during most years.

Interpretation of early aerial photographs provides insight into the patterns and impacts associated with 20th century development of the watershed. The earliest available aerial photographs are circa 1941 and 1944. These early photographs show relatively undisturbed hillslope conditions; most development at that time was concentrated on alluvial terraces along the mainstem Trinity River. Agricultural cultivation of the terraces is the most significant development visible in the early photographs, as evidenced by relatively large, well-established orchards. Highways 299 and 96 are present, but few upland roads are apparent. Forest Service road building did not begin until the late 1950's.

The primary visual evidence of mass wasting processes on the 1944 aerial photographs consists of recently active landslide scars and recent alluvial deposits. A total of 133 active landslides were present, of which 56 percent were smaller than one acre and 14 percent were larger than three acres. Active landslides were estimated to cover 222 acres, or 0.3 percent, of the MTWAA. About 74 percent of the failures were natural features, while the rest were associated with county roads or old mining areas. Nearly all of the slides appeared to have delivered at least 20 percent of their volume directly to streams (the average delivery was 71 percent, accounting for nearly four million tons reaching watercourses). Many of these slides also appeared to be ongoing sources of sedimentation from surface erosion, but this was probably only a small fraction of the sediment delivered by the original slope failure.

Most of the active landslides visible in 1944 (71 percent) were interpreted to be shallow debris slides, flows, or avalanches. About 14 percent of the active slides appeared to be deep-seated; 13 percent were rockslides. The various types of landslides have different short-term and long-term sedimentation impacts. Shallow slides are generally smaller in volume, but deliver a large fraction of that volume, as well as much large organic debris, directly to stream channels. Shallow slides tend to be single-event failures, although the bare slide scar may be subject to erosion for many years before revegetating. In contrast, deep-seated slides usually involve much larger volumes, but occur less frequently and deliver only a small fraction of their volume to stream channels during the initial failure. However, some types of deep-seated slides may continue to move on a seasonal basis, or the depositional area of the deep-seated slide may be a chronic source of smaller secondary failures. Deep-seated slides may also have profound effects on slope and channel morphology because of their size. Rockslides tend to deliver relatively coarse material on an infrequent, sporadic basis as exposed bedrock weathers and becomes increasingly weak.

The aerial photograph-based interpretation of mass wasting conditions may underestimate the number of shallow landslides because they are often obscured by forest canopy and can heal relatively quickly. If the intervals between successive sets of aerial photographs are long enough (i.e., greater than about five years), a small, shallow slide can occur and heal sufficiently within the interval such that it is not visible on either photo set. Field studies also generally indicate that shallow slope failures have been a more extensive erosion process than is indicated by aerial photograph inventories, in terms of the interpretation of both recent and older (dormant) features. Over long time frames, deep-seated landsliding probably has a more profound effect on the overall evolution of a landscape, while shallow landsliding is a more significant source of sediment delivery.

Erosion Process – Current Conditions

The MTWAA is characterized by a wide variety of topographic and geologic conditions. Therefore, erosion rates are quite variable across the landscape. Total erosion rates are a combination of surface erosion and mass wasting (i.e., landsliding) processes. Based on previous erosion studies in northwestern

California, it is likely that mass wasting processes have been far more significant in terms of sediment delivery than surface erosion. However, surface erosion generally delivers a higher percentage of fine-grained sediment to streams, while landslides may deliver both fine- and coarse-grained material as well as boulders and large woody debris, which are important for proper stream function.

Surface erosion rates were not quantified in this analysis. However, based on experience in these areas, surface erosion rates are probably highest in areas underlain by (1) ultramafic rocks, which are typically sparsely vegetated and can be particularly susceptible where subject to concentrated runoff (e.g., culverts, etc.); (2) in mélange and schist, which are subject to gullying; and (3) in areas where igneous rocks are decomposed or deeply weathered. In addition, bare soil areas resulting from recent landslides, intense wildfires, or in some cases, clearcutting, can be associated with short-term high surface erosion rates. The following section on Soil Productivity and Protection presents further discussion regarding surface erosion potential.

Landslide Inventory and Analysis

An inventory of historically active landslides was prepared by Forest Service analysts for this Watershed Analysis to estimate the distribution of slides, their failure mechanisms, inferred cause, size, and the percentage of sediment delivery. The development of individual slides was analyzed through time by interpreting aerial photographs from 1944, 1960, 1975, 1990, and 1998. The following attributes were recorded for each landslide identified on aerial photographs:

- Estimated size (in acres)
- Landslide type (shallow slide, debris flow, rockslide, avalanche, or deep-seated)
- Management influence (Highways 96 and 299, Forest or County road, harvest, mining, natural)
- Hillslope position
- Estimated percent sediment delivery to stream
- Growth from previous aerial photograph series

Below we discuss general landslide trends, the impacts of various management influences on landslide occurrence, and the variation in landslide concentration relative to the subwatersheds and geologic units.

General Landslide Trends

In 1944, aerial photograph interpretation identified 133 active landslides within the analysis area. By 1998, 1,240 additional landslides had occurred, all but 20 of which had appeared by 1975 (Table 3-1). The absence of interpreted landslides in the period since 1975 is the most significant trend of the Mainstem Trinity data set. Of the 1,373 total landslides observed, approximately 192 had experienced detectable enlargement, while 681 others had remained essentially static scars that probably continued to deliver some sediment without lateral expansion. The spatial distribution of currently active landslides is shown on Figure 3-2.

Table 3-1. Summary of landslide trends and estimated sediment mobilized (yd^3) in the Mainstem Trinity Watershed Analysis Area (1944-1998).

	Present in 1944		Appeared or Enlarged 1944-1960		Appeared or Enlarged 1960-1975		Appeared or Enlarged 1975-1990		Appeared or Enlarged 1990-1998	
	Count	Est. Vol.	Count	Est. Vol.	Count	Est. Vol.	Count	Est. Vol.	Count	Est. Vol.
Active	133	2,753,800	343	2,474,800	877	6,615,500	17	185,500	3	9,200
Enlarged	0	0	26	154,500	138	1,297,500	22	97,300	6	29,700
Total	133	2,753,800	369	2,629,300	1,015	7,913,000	39	282,800	9	38,900
Percent	8.5	20.2	23.6	19.3	64.9	58.1	2.5	2.1	0.6	0.3
Static	0	0	89	0	251	0	231	0	110	0
Recovering	0	0	18	0	86	0	437	0	280	0
Healed	0	0	0	0	1	0	663	0	974	0
Grand Total = 13,617,800 yd^3										

Landslide volumes were estimated based on application of previously derived relationships between photo-interpreted landslide area and field measurements of slide volume. These relationship data were developed for a sediment budget analysis of the Grouse Creek area (Raines & Kelsey 1991). A percentage of the overall volume that was delivered to a stream was estimated from the aerial photographs (Table 3-2) and converted to tons delivered using a density conversion factor of 1.5 tons per cubic yard (Table 3-3). Volumes and tons delivered include small increments for shallow slides that appeared static for a particular time interval but are inferred to have been on-going sediment sources. However, static slides are not counted as "enlarged" in Tables 3-1, 3-2, or 3-3. The estimates of sediment delivery, especially when summed for the various categories discussed below, are considered accurate to about 30 percent.

An estimated 14.8 million tons of sediment were delivered from all 1,373 landslides for the period of record (see Table 3-3 below). That material represents 72.3 percent of the total amount of material mobilized. Over half of that sediment (8.6 million tons) was delivered during the 1960-1975 interval. This interval includes the 1964 flood, which is the most significant geomorphic event during the time recorded on aerial photographs. Significant volumes were also delivered during the earlier photo intervals (pre-1944 and 1944-1960), the majority of which was derived from new slides. The data suggest that sediment delivery diminished significantly in the more recent photo intervals (1975-1990 and 1990-1998). These intervals were interpreted to have delivered just under 0.4 million tons of sediment, a relatively small amount compared with the earlier periods. The cumulative amount of sediment delivery through the air photo period is shown in Figure 3-3. That graph demonstrates the large contribution in the 1960-1975 interval as well as the relatively small increase in interpreted inputs since 1975.

Figure 3-2. Current Active Landslides Within the Mainstem Trinity Watershed Analysis Area.

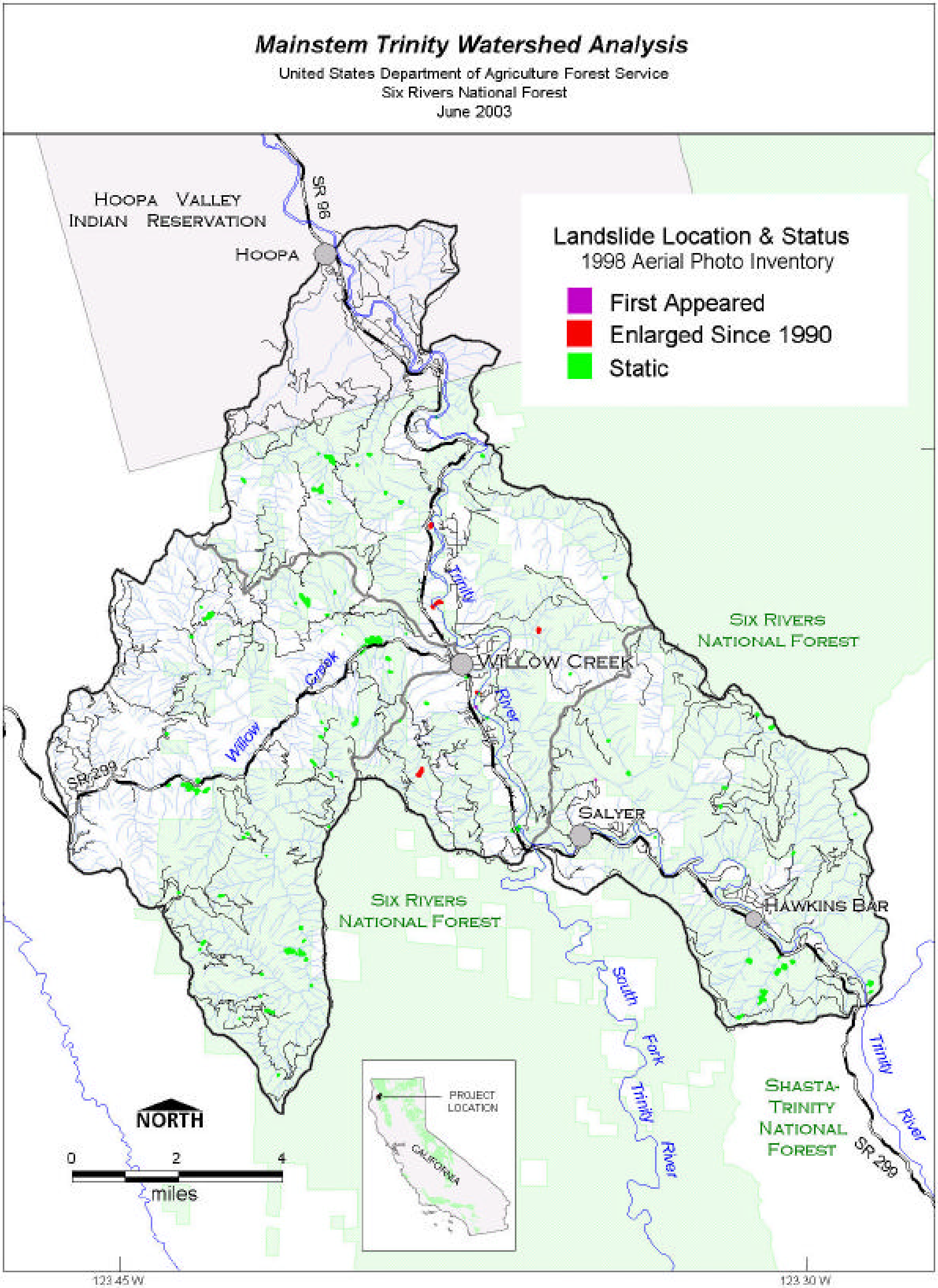


Table 3-2. Summary of landslide trends and estimated sediment delivery (yd^3) in the Mainstem Trinity Watershed Analysis Area (1944-1998).

	Present in 1944		Appeared or Enlarged 1944-1960		Appeared or Enlarged 1960-1975		Appeared or Enlarged 1975-1990		Appeared or Enlarged 1990-1998	
	Count	Est. Vol.	Count	Est. Vol.	Count	Est. Vol.	Count	Est. Vol.	Count	Est. Vol.
Active	133	2,058,300	343	1,679,200	877	4,904,000	17	141,900	3	8,300
Enlarged	0	0	26	119,700	138	834,800	22	77,100	6	24,400
Total	133	2,058,300	369	1,798,900	1,015	5,738,800	39	219,000	9	32,700
Percent	8.5	20.9	23.6	18.3	64.9	58.3	2.5	2.2	0.6	0.3
Grand Total = 9,847,700 yd^3										

Table 3-3. Summary of landslide trends and estimated sediment delivery (tons) in the Mainstem Trinity Watershed Analysis Area (1944-1998).

	Present in 1944		Appeared or Enlarged 1944-1960		Appeared or Enlarged 1960-1975		Appeared or Enlarged 1975-1990		Appeared or Enlarged 1990-1998	
	Count	Est. Tons.	Count	Est. Tons.	Count	Est. Tons.	Count	Est. Tons.	Count	Est. Tons.
Active	133	3,087,400	343	2,518,800	877	7,356,000	17	212,900	3	12,400
Enlarged	0	0	26	179,500	138	1,252,200	22	115,600	6	36,600
Total	133	3,087,400	369	2,698,300	1,015	8,608,200	39	328,500	9	49,000
Percent	8.5	20.9	23.6	18.3	64.9	58.3	2.5	2.2	0.6	0.3
Grand Total = 14,771,400 tons										

Management Influence on Landslides

Nearly half of the landslides in the WAA are interpreted to be related to management activities, based on visual proximity to management disturbance; 51.5 percent of the landslides are interpreted as natural failures that are unrelated to management activities (Tables 3-4 and 3-5; Figure 3-4). In 1944, the largest contributors of sediment were landslides associated with mining. This was the only period in which non-natural landslides were interpreted to contribute more than natural slides (Tables 3-4 and 3-5; Figure 3-5). Coincident with the decrease in mining operations in the WAA, post-1944 contributions related to mining diminished drastically in later photo intervals. Natural landsliding is dominant in the 1960-1975 interval, which reflects the impacts of the 1964 flood (Figure 3-5). The other major contributor in the 1960-1975 interval is timber harvest-related landsliding, which is interpreted to be associated with 14.5 percent of the sediment delivery. The 1960-1975 interval represents a period of increased logging in the WAA, an era most notable for the intensive use of tractor-based yarding. Prior to the inception of the Forest Practice Rules in the early 1970's, tractor logging was relatively unregulated, resulting in frequent utilization on steep slopes and near (or in some cases within) watercourses. The percentage of annual sediment delivery to streams relative to management influence through the analysis period is shown in Figure 3-6. That graph shows clearly the relative significance of the major contributing management influences, mining and timber harvest, and the steady increase in the relative significance of natural landsliding.

Figure 3-3. Cumulative amount of sediment delivery (tons) within the Mainstem Trinity Watershed Analysis Area (1944-1998).

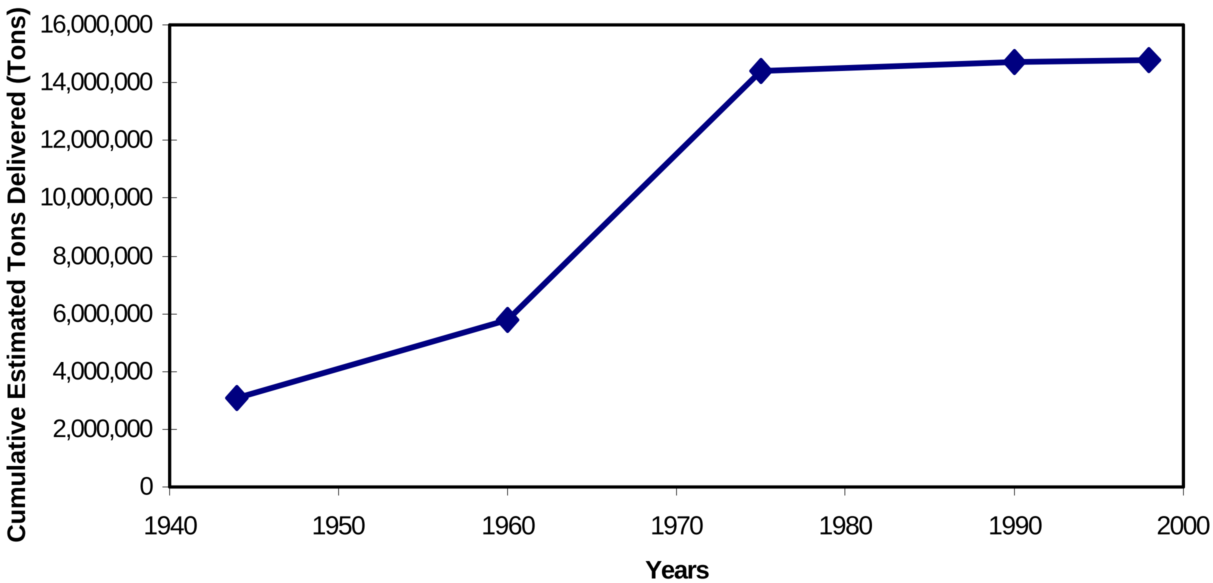


Table 3-4. Landslide incidence and estimated sediment delivered to streams (tons) relative to management influence within the Mainstem Trinity Watershed Analysis Area (1944-1998).

Influence / Percent of Total	1944	1944-1960	1960-1975	1975-1990	1990-1998	Total
Natural / 51.5	1,218,900	1,038,600	5,109,900	218,800	41,700	**7,627,900**
Harvest-related / 14.5	24,900	653,200	1,429,300	26,400	0	**2,133,800**
Mining-related / 13.3	1,684,300	217,700	0	51,200	0	**1,953,200**
Harvest road-related / 9.5	42,100	521,600	830,900	1,600	1,400	**1,397,600**
Road-related / 6.5	51,400	155,200	736,200	21,300	4,000	**968,100**
Hwy 299-related / 2.3	37,300	55,800	239,000	8,300	0	**340,400**
County road-related / 1.8	3,700	28,600	226,000	900	0	**259,200**
Hwy 96-related / 0.6	24,800	27,600	36,900	0	1,900	**91,200**
Total	**3,087,400**	**2,698,300**	**8,608,200**	**328,500**	**49,000**	**14,771,400**

Table 3-5. Landslide incidence and estimated sediment delivered to streams (yd^3) relative to management influence within the Mainstem Trinity Watershed Analysis Area (1944-1998).

Influence / Percent of Total	1944	1944-1960	1960-1975	1975-1990	1990-1998	Total
Natural / 51.5	812,600	692,400	3,406,600	145,900	27,800	**5,085,300**
Harvest-related / 14.5	16,600	435,500	952,900	17,600	0	**1,422,600**
Mining-related / 13.3	1,122,900	145,200	0	34,100	0	**1,302,200**
Harvest road-related / 9.5	28,100	347,700	553,900	1,100	900	**931,700**
Road-related / 6.5	34,200	103,400	490,800	14,200	2,700	**645,300**

Influence / Percent of Total	1944	1944-1960	1960-1975	1975-1990	1990-1998	Total
Hwy 299-related / 2.3	24,900	37,200	159,300	5,500	0	**226,900**
County road-related / 1.8	2,400	19,100	150,700	600	0	**172,800**
Hwy 96-related / 0.6	16,600	18,400	24,600	0	1,300	**60,900**
Total	**2,058,300**	**1,798,900**	**5,738,800**	**219,000**	**32,700**	**9,847,700**

Landslide Variation Among Subwatersheds

Landslide occurrence was evaluated on a subwatershed basis (subwatersheds are delineated on Figure 3-2) to identify high and low susceptibility portions of the overall analysis area (Table 3-6). Between 1944 and 1960, the Hawkins-Sharber and Willow Creek subwatersheds contributed more sediment than the Upper Tributaries subwatershed, despite being smaller. The sediment peak between 1960 and 1975 was fairly evenly distributed among the three subwatersheds. Landslide activity was again highest in the Hawkins-Sharber subwatershed in the 1975-1990 interval, although mass wasting in the WAA was much reduced. Mass wasting was low throughout all subwatersheds between 1990 and 1998. Table 3-6 also shows the relative impacts of the various management influences within the subwatersheds.

On an individual subwatershed basis, several creeks in the WAA have developed a high concentration of landslides, usually along the streamside inner gorge slopes. These include the mainstem Trinity itself, Willow Creek, East Fork Willow Creek, Cedar Creek, Gregg Creek, Victor Creek, Campbell Creek, Coon Creek, Bremer Creek, Sharber Creek, Quinby Creek, and Gray Creek.

Figure 3-4. Landslide incidence and percent of estimated sediment volume (tons) delivered to streams relative to management influence within the Mainstem Trinity Watershed Analysis Area (1944-1998).

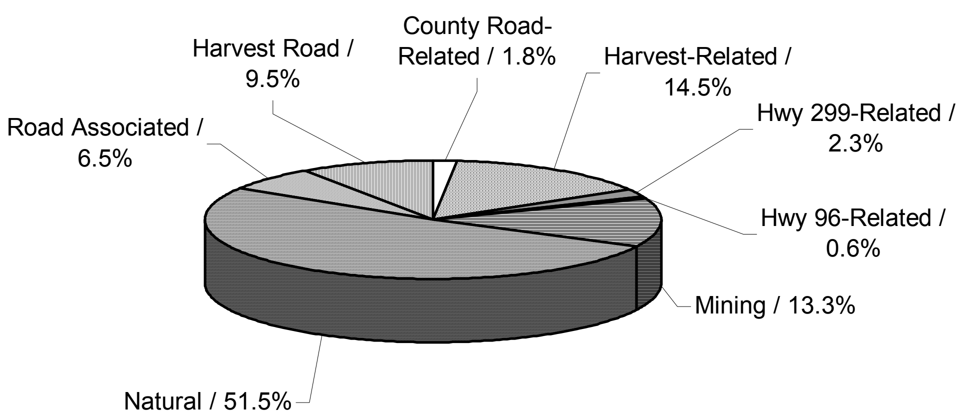


Figure 3-5. Landslide incidence and estimated sediment delivered to streams (tons) relative to management influence within the Mainstem Trinity Watershed Analysis Area (1944-1998).

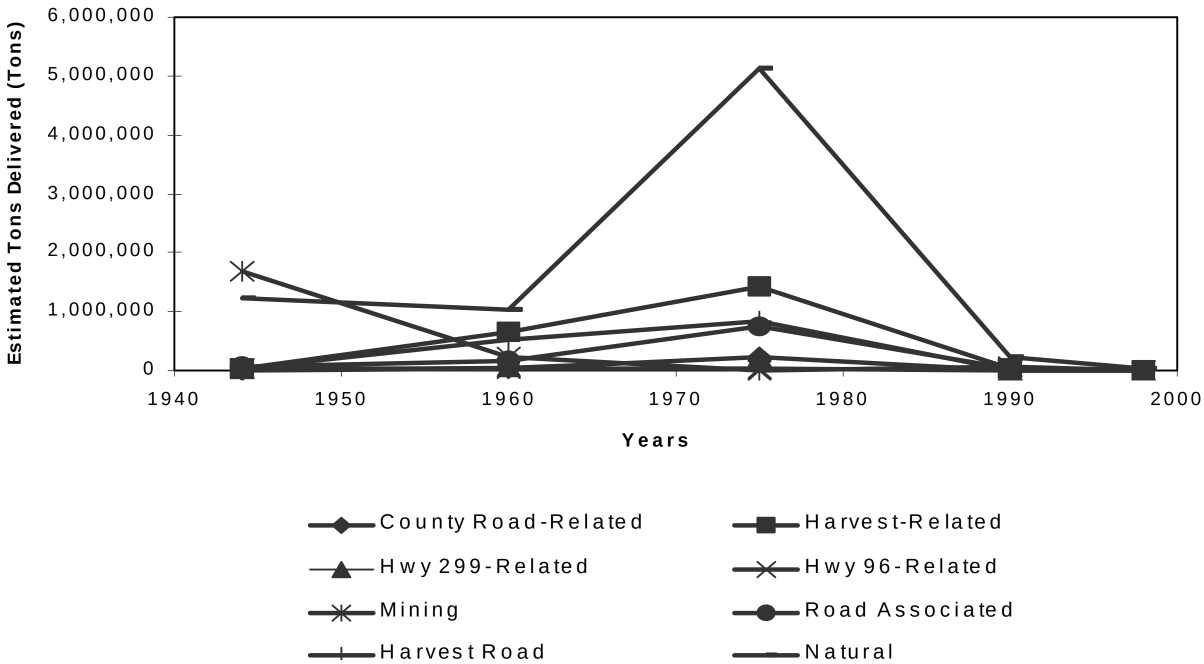


Figure 3-6. Landslide incidence and percent of sediment delivered to streams relative to time and management influence within the Mainstem Trinity Watershed Analysis Area (1944-1998). For legend key, see Figure 3-5 (above).

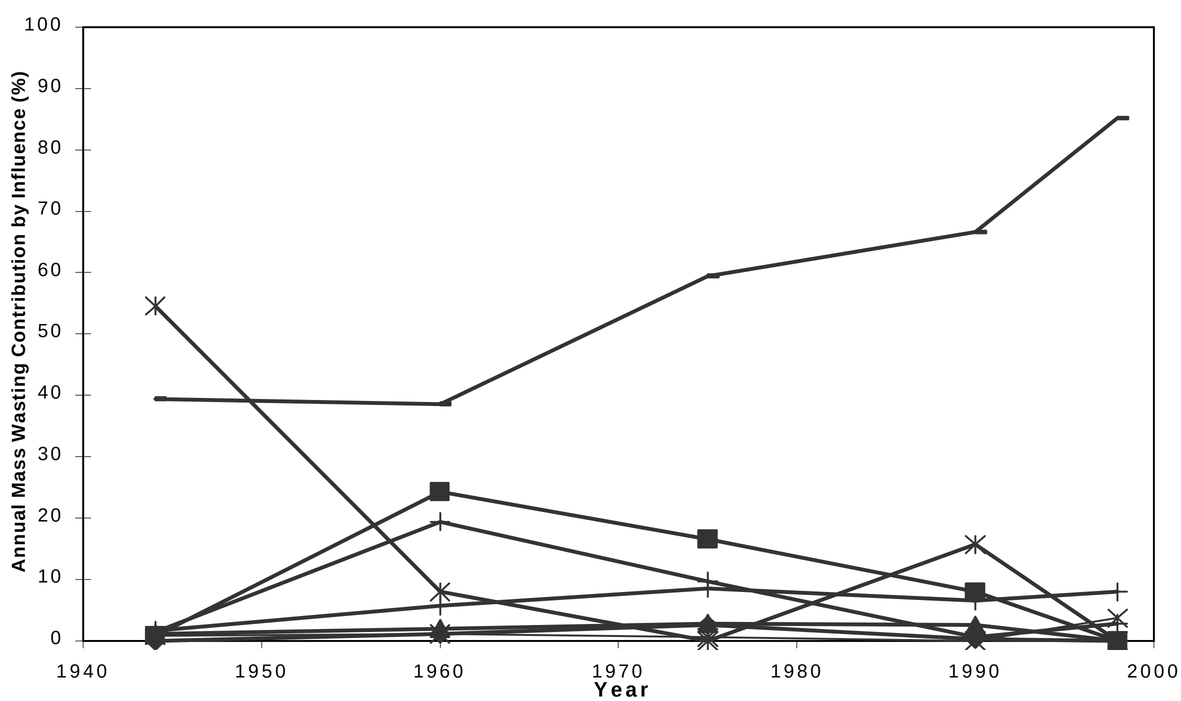


Table 3-6. Percentage of mass wasting sediment delivery by subwatershed, time interval, and management influence. UTLTR = Upper tributaries of the Lower Trinity River.

			Management Influence (%)							
	Acres	**Tons Delivered**	**Natural**	**Mining Related**	**Harvest Related**	**Harvest Road Related**	**Road Related**	**County Road Related**	**Hwy 299 Related**	**Hwy 96 Related**
Hawkins-Sharber	**19,658**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Pre-1944	--	--	24.3	75.5	--	--	--	0.2	--	--
1944-1960	--	952,200	21.5	22.9	20.3	34.2	0.2	0.1	0.8	--
1960-1975	--	2,720,100	77.0		8.4	7.6	1.6	0.2	5.3	--
1975-1990	--	263,500	76.2	19.4	1.6	--	1.4	--	1.4	--
1990-1998	--	4,000	--	--	--	--	100.0	--	--	--
UTLTR	**31,142**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Pre-1944	--	--	76.4	--	--	12.0	3.6	--	0.4	7.5
1944-1960	--	683,500	48.1	--	22.3	15.7	6.3	3.7	--	4.0
1960-1975	--	4,941,200	60.6	--	11.0	10.4	11.5	5.5	--	1.0
1975-1990	--	22,400	78.3	--		7.3	10.5	3.9	--	
1990-1998	--	45,000	92.7	--	--	3.1	--	--	--	4.2
Willow Creek	**27,745**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Pre-1944	--	--	80.5	--	4.7	0.5	7.5	--	6.8	--
1944-1960	--	1,062,600	47.5	--	28.9	8.4	10.4	0.2	4.5	--
1960-1975	--	4,208,300	42.2	--	32.0	10.4	10.3	0.5	4.7	--
1975-1990	--	42,700	1.5	--	51.7	--	35.8	--	11.0	--
1990-1998	--	0	--	--	--	--	--	--	--	--

Landslide Variation Among Geologic Units

Landslide frequencies and sediment production vary considerably among the different geologic units in the MTWAA (Table 3-7). The Galice Formation, which covers about 60 percent of the MTWAA, accounts for the largest number of slides, the largest volume of sediment delivery, and the highest rate of sediment delivery per acre per year. The large number of slides and the large volume of sediment generated in areas underlain by the Galice Formation can be explained by the large aerial extent of the unit within the MTWAA; however, the high rate of sediment delivery per acre is a normalized value that reflects the apparent susceptibility of this bedrock type to landsliding. Landslide rates were also relatively high in the Rattlesnake Creek mélange. Other geologic units were associated with lower rates of landslide incidence.

Table 3-7. Landslide incidence and estimated sediment delivery relative to geologic units within the Mainstem Trinity Watershed Analysis Area (1944-1998).

Geology	Acres	Number of active and enlarged slides	Tons Delivered	Tons per acre	Tons per acre per year
Franciscan Complex	3,141	55	168,900	54	1.0
Galice formation	47,576	908	8,929,000	188	3.5
Mesozoic intrusives	5,082	76	356,900	70	1.3
Metavolcanics	4,182	65	223,000	53	1.0
Rattlesnake Creek mélange	11,817	225	1,548,000	131	2.4
South Fork Mountain schist	1,996	14	53,700	27	0.5
Ultramafics	4,739	71	351,700	74	1.4

Hydrologic Regimes – Reference Conditions

1. *To what extent have flow characteristics of the watersheds been altered, and what effects has this had on key dependent aquatic species?*

Mainstem Trinity River

The hydrologic regime of the mainstem of the Trinity River in the MTWAA varies with the annual and spatial distribution of precipitation. An analysis of annual precipitation at Hoopa from 1948 to 1983 shows that annual precipitation ranged from a low of 25.39 inches in 1976 to a high of 96.01 inches in 1983. Most of the annual precipitation falls in the winter (Dec-Feb), averaging 29.85 inches, while the summer (Jun-Aug) is generally dry, with 1.15 inches of rainfall primarily from short-duration, high-intensity thunderstorms. The maximum daily rainfall of 8.64 inches occurred in December 1964. Annual snowfall averaged 2.7 inches with a high of 15.7 inches in 1972.

Annual peak flows at USGS Gaging Station #1153000 at Hoopa from 1912 to 2001 range from a low of 13,200 cfs (in 1944 and 2001) to a high of 231,000 cfs (in 1965). Peak flows were analyzed using the USGS Annual Peak Flow Frequency Analysis following the Bulletin 17-B guidelines (USGS 2000). All annual recorded peaks were used in the analysis, including peaks associated with the known regulation effects of Trinity River Diversion operations. The results of the analysis are presented in Table 3-8.

Table 3-8. Peak flows at USGS Gaging Station #1153000 at Hoopa, CA.

1.25 year Peak Discharge (cfs)	2 year Peak Discharge (cfs)	5 year Peak Discharge (cfs)	10 year Peak Discharge (cfs)	25 year Peak Discharge (cfs)	50 year Peak Discharge (cfs)	100 year Peak Discharge (cfs)
30,933	53,703	89,892	116,044	150,658	177,357	204,614

Tributaries of the Trinity River

A limited amount of streamflow data are available for the main tributary stream channels in the analysis area. The USGS operated gaging stations on Willow Creek (Station #1152980) from 1959 to 1974 and

Supply Creek (Station #11530020) from 1981 to 1987. An analysis of the Supply Creek record was not performed because of the relatively short period of flow records (six years). An analysis of the Willow Creek record was performed using USGS Annual Peak Flow Frequency Analysis following the Bulletin 17-B guidelines (USGS 2000). The results are presented in Table 3-9.

Table 3-9. Peak flows at USGS Gaging Station #1152980 Willow Creek at Willow Creek, CA.

1.25 year Peak Discharge (cfs)	2 year Peak Discharge (cfs)	5 year Peak Discharge (cfs)	10 year Peak Discharge (cfs)	25 year Peak Discharge (cfs)	50 year Peak Discharge (cfs)	100 year Peak Discharge (cfs)
2,149	3,732	6,575	8,891	12,231	15,249	18,503

Peak flows were estimated for tributary watersheds using the methods described for gaged vs. ungaged relationship for the North Coast Region in USGS Water Resources Investigation 77-21, Magnitude and Frequency of Floods in California (Wannenen & Crippen 1977). Peak flows from the Willow Creek analysis were used for the gaged site, and the watersheds for the gage sites were derived from a SRNF watershed layer. The results of the peak flow estimation are presented in Table 3-10.

Table 3-10. Estimated peak flows for tributary watersheds. PD = peak discharge

Watershed	Acres	2 year PD (cfs)	5 year PD (cfs)	10 year PD (cfs)	25 year PD (cfs)	50 year PD (cfs)	100 year PD (cfs)
Supply Creek	440	56	98	132	179	223	271
Hospital Creek	9,832	1,262	2,198	2,939	3,997	4,983	6,047
Lower Cedar Creek	1,749	224	391	523	711	887	1,076
Coon Creek	4,523	580	1,011	1,352	1,839	2,293	2,782
Brimer Creek	9,020	1,157	2,016	2,696	3,667	4,572	5,547
Summit Creek	6,474	831	1,447	1,935	2,632	3,281	3,981
Brannan Creek	6,197	795	1,385	1,852	2,519	3,141	3,811
Sharber Ck	5,862	752	1,311	1,752	2,383	2,971	3,605
China Creek	5,714	733	1,277	1,708	2,323	2,896	3,514
Quinby Creek	3,226	414	721	964	1,312	1,635	1,984
Ruby Creek	6,644	853	1,485	1,986	2,701	3,368	4,086
Hawkins Creek	10,450	1,341	2,336	3,123	4,248	5,296	6,426
East Fork Willow Ck	8,189	1,051	1,831	2,448	3,329	4,150	5,036

Hydrologic Regimes – Current Conditions

<u>Mainstem Trinity River</u>

Completion of Lewiston Dam in 1962 initiated biological, physical, and geomorphic changes in the Trinity River below Lewiston. From 1962 to 1979, Central Valley Project (CVP) diversions delivered nearly 90 percent of the Trinity River annual water yield above Lewiston into the Sacramento River for urban and agricultural use. After 1979, river releases were increased from 110,000 acre-feet (af) to 340,000 af such that the diversion percentage was reduced to roughly 70 percent (McBain & Trush 1997).

Accretion of unregulated flows and sediment from the North Fork Trinity River and South Fork Trinity River tends to mitigate the impacts from Trinity River Diversion (TRD) operations downstream from their confluences with the mainstem of Trinity River. McBain & Trush (1997) found that the impacts to high flow magnitudes decrease substantially downstream as unregulated tributaries contribute to flooding. The study conducted by McBain & Trush analyzed streamflow records from USGS gaging stations at Lewiston, near Burnt Ranch, and at Hoopa before and after the TRD. The pre-TRD period is defined as Water Year (WY) 1912 to WY 1960, and the post-TRD period is WY1961 to WY 1995. Consistent trends were observable at all three locations: (1) higher flows, those exceeded less than 50 percent of the year, decreased as a result of TRD operations; (2) low flows, those exceeded over 85 percent of the year, increased; and (3) annual flow variability was reduced.

The U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, and the Hoopa Valley Tribe conducted an assessment of Trinity River flows in 1999. The resulting report, Trinity River Flow Evaluation, found that "disruption of the annual pre-TRD flow regimes with diverse hydrograph components and the loss of coarse sediment supply responsible for creating and sustaining the Trinity River ecosystem caused substantial habitat degradation. Downstream tributaries partially offset the TRD effects by contributing flow and sediment to the mainstem, but downstream tributaries cannot mitigate the lost snowmelt hydrograph components once generated above Lewiston" (USFWS & Hoopa Valley Tribe 1999). The report also concluded that present snowmelt runoff tends to end earlier than pre-TRD snowmelt runoff.

In December 2000, the Department of Interior issued a Record of Decision (ROD) for the Trinity River Mainstem Fishery Restoration Final Environmental Impact Statement/Final Environmental Impact Report (Trinity River ROD 2000). The key element of the Trinity River ROD was the recommendation to vary annual instream flows for the Trinity River from the TRD based on forecasted hydrology for the Trinity River Basin as of April 1st of each year, ranging from 369,000 af in critically dry years to 815,000 af in extremely wet years.

The primary effects of the changes in hydrology resulting from TRD operations on the key dependent aquatic species within the MTWAA are a degradation of fish habitat by a reduction of gravel necessary for spawning habitat and the inability of reduced and less variable flows to flush fine sediments from the existing gravels. TRD operations have eliminated a defined snowmelt peak and recession period (McBain & Trush 1997). Water temperatures have also increased due to the lack of snowmelt runoff that typically occurred during the spring/summer period (USBR 1979 *in* Zedonis & Newcomb 1997).

Several researchers have found that increased flows result in reduced travel times of smolts (as cited in Zedonis and Newcomb 1997). The results of the studies generally indicate that migration rates are positively correlated with river flow. While there are no known studies of investigating the effect of flow levels on the travel rates of natural outmigrating smolts in the Trinity River, it is likely that smolts in the Trinity River would respond to changes in flow levels similar to the results reported in the studies cited in Zedonis and Newcomb (1997). Current migration rates would be less than migration rates of pre-TRD operations.

Tributaries of the Trinity River

The timing of flows in the main tributaries to the Trinity River has been altered by the changes in hydrologic processes resulting from roads. Roads have three primary effects on hydrologic processes: (1) they intercept rainfall directly on the road surface and road cutbanks and affect subsurface water moving down the hillslope; (2) they concentrate flow, either on the surface or in an adjacent ditch or channel; and (3) they divert or reroute water from paths it would otherwise take were the road not present (Gucinski et al. 2001). The effect of roads on peak streamflow depends upon the size of the watershed; for example, capturing and rerouting water can remove water from one ephemeral channel and cause major channel adjustments in another ephemeral channel receiving the water (Gucinski et al. 2001). In larger watersheds, roads constitute a small portion of the total area and have relatively insignificant effects on peak flow.

At the landscape scale, correlative evidence suggests that roads are likely to influence the frequency, timing, and magnitude of disturbance to aquatic habitats (Gucinski et al. 2001). Roads can act as barriers to migration, lead to water temperature changes, and alter flow regimes (Gucinski et al. 2001).

Less frequent fire in tributary watersheds has reduced or eliminated peak flow responses to the removal of duff, understory vegetation, and overstory vegetation by fire. As a result, the frequency of inputs of coarse sediments and flushing of fine sediments associated with peak flow in response to fires has been reduced in tributary channels.

Water Quality – Reference Conditions

The earliest water quality information collected for the parameters of concern in the analysis area – sediment, temperature, and dissolved oxygen – was found in the Environmental Protection Agencies STORET Database. The Forest Service collected periodic grab samples of sediment concentrations at sampling locations on the following tributaries to the mainstem of the Trinity River from 1972-1980: Hawkins Creek, Coon Creek, Quinby Creek, Sharber Creek, South Fork Trinity River, Ruby Creek, and Willow Creek. The California State Water Resources Control Board began monitoring water quality parameters on the mainstem of the Trinity River in 1958. Because there is a lack of quantitative water quality data from the reference period, reference conditions are inferred from other data sources.

Mainstem Trinity River

Sedimentation rates of the mainstem Trinity River within the analysis area were most likely high given that after a major flood there would be numerous fresh inner gorge landslides adjacent to the channel and sediment produced by hydraulic mining. Shade-producing riparian vegetation as shown on the 1944 aerial photos was lacking adjacent to Trinity River. Therefore, water temperatures were linked to changes in seasonal flow volumes and diurnal and seasonal heating of the water by solar radiation and air temperature. Summer base flows were lower because the Trinity River was not regulated, and as a result, summer maximum temperatures may have been higher. Because dissolved oxygen (DO) levels are inversely proportional to temperature, if all other variables affecting DO are held constant (e.g., use of DO by aquatic organisms in the respiration process), DO levels may at times have been lowered due to increased water temperatures. Lowered DO levels would have been localized. Although some fish mortality may have been experienced, lowered levels most likely would not have significantly affected fish populations.

<u>Tributaries of the Trinity River</u>

In the 1944 aerial photos there were very few landslides within the tributary watersheds, and nearly all were attributable to natural causes. As a result, sediment delivered to channels from landslides was relatively low. Riparian vegetation was moderate to dense in the 1944 aerial photos, and most channels were not directly visible. Thus, it can be inferred that diurnal and seasonal temperatures were moderated by this shade-producing vegetation. Summer water temperatures were probably at the low end of their historic range, presumably below 65° F.

Given that fires may have been more frequent and their spatial extent was generally localized, chronic fine and coarse sediment sources due to fires were more prevalent. Periods of increased summer base flows likely resulted from fires due to increased mortality of transpiring vegetation. The loss of this transpiring vegetation would have increased recharge of shallow and deep groundwater aquifers. Groundwater would have been released to the tributary channels during the summer months as stream levels dropped. The increased groundwater flows most likely would have produced more frequent cold water summer refugia for fish populations. Periodic and localized decreases in DO would have resulted from the elevated nutrient concentrations and organic decay in post-fire watercourses. DO levels could have been low enough to create localized fish kills.

Water Quality – Current Conditions

- *What water quality parameters within the watersheds may be detrimental to native aquatic organisms?*

Water quality of the Trinity River is listed as impaired for sediment throughout its length by California State Water Resources Control Board under Section 303 (d) of the Federal Clean Water Act. A sediment impairment determination is based on non-attainment of water quality objectives and threat to designated beneficial uses. With respect to cold freshwater habitat, the beneficial use may be threatened due to conditions either in the water column (e.g., suspended sediment and turbidity) or on the stream bed (e.g., settleable material), or both. Other water quality parameters of concern that may affect native aquatic organisms include water temperature and DO.

<u>Water Temperature in the Mainstem Trinity River</u>

Water temperature affects every aspect of the life of fish, including incubation, growth, maturation, competition, migration, spawning, and resistance to parasites, diseases, and pollutants (Armour 1991 *in* USFWS & Hoopa Valley Tribe 1999). The timing and duration of flows in the mainstem Trinity River have been altered, and as a result, seasonal temperature regimes have changed (USFWS & Hoopa Valley Tribe 1999). The storage of snowmelt runoff from the watershed above the dams has resulted in warmer springtime temperatures in the mainstem Trinity River compared to pre-dam water temperatures (TRBFWTF 1977 *in* USFWS & Hoopa Valley Tribe 1999).

Parr-smolt transformation (smoltification) during the spring involves changes in the behavior and physiology of juvenile anadromous salmonids that prepare them for survival in salt water (Folmar & Dickhoof 1980, Wedemeyer et al. 1980 *in* USFWS & Hoopa Valley Tribe 1999). Studies suggest that water temperature alone is the primary influence on the timing and duration of emigration and smoltification of chinook salmon. When water is slow to warm in the spring, smolts emigrate over a longer period of time (Hoar 1988 *in* USFWS & Hoopa Valley Tribe 1999). The extended migration periods associated with gradual warming may result in increased growth, which is a benefit because larger smolts have higher survival rates in seawater (Hoar 1988). Zaugg & Wagner (1973 *in* USFWS & Hoopa Valley Tribe 1999) conclude that water temperatures greater than 55.4°F may interfere with steelhead parr-smolt transformation. Coho salmon smolts also require cool water temperatures to smolt. Clarke (1992 *in* USFWS & Hoopa Valley Tribe 1999) recommended rearing coho salmon at temperatures between 50°F and 59°F and reported that water temperatures below 62.6 °F are required for survival in seawater. In the Trinity River, chinook salmon smolts emigrate later in the spring than do either coho salmon or steelhead smolts and typically encounter the warmest water temperatures (USFWS 1998 *in* USFWS & Hoopa Valley Tribe 1999). In hatchery experiments, water temperatures between 51.8°F and 53.6°F were shown to support chinook salmon smoltification. From 1992 to 1995, at least 80 percent of steelhead, coho salmon, and chinook salmon smolts passed the Trinity River trap site near Willow Creek by May 22, June 4, and July 9 respectively (USFWS 1998 *in* USFWS & Hoopa Valley Tribe 1999). In 1992 and 1994, years when water temperatures were warmer, chinook salmon appeared to migrate past the trap 1 to 2 weeks earlier (USFWS & Hoopa Valley Tribe 1999).

During the spring, summer, and fall, adult chinook salmon and steelhead emigrate into the mainstem Trinity River within the MTWAA and hold until the onset of spawning. Boles (1988 *in* USFWS & Hoopa Valley Tribe 1999) concluded that water temperatures between 38°F and 60°F were adequate for protection of holding adults; at water temperatures above 60°F, pre-spawning mortality and temperature-mediated diseases or reduced egg or sperm viability can occur. During spawning, a water temperature of 56°F or less is recommended to decrease the prevalence of infectious diseases and fungi (Ordal & Pacha 1963 *in* Boles 1988).

Salmonid growth is influenced by water temperature and food availability. At extremely low water temperatures, fish exhibit little or no growth. As water temperature increases, digestive enzyme efficiency increases, and depending on food abundance and quality, growth rates increase (Rich 1987 *in* USFWS & Hoopa Valley Tribe 1999). At very high temperatures, excessive metabolic activity and the synergistic effects of additional stresses (e.g., low DO) can result in little or no growth, disease, or death (DEQ 1995 *in* USFWS & Hoopa Valley Tribe 1999).

The optimal temperatures for migration, spawning and incubation vary by species. The optimal rearing temperature range for steelhead is 45.0-58.1 °F with an upper lethal limit of 75 °F (Barnhart 1986). The optimal rearing temperature for coho salmon is 53.2-58.3 °F with an upper lethal limit of 78.4 °F. Table 3-11 shows optimal temperature ranges as recommended by Bell (1986).

Table 3-11. Optimal salmonid temperature ranges (Bell 1986)

Species	Migration °F	Spawning °F	Incubation °F
Fall Chinook	51.1-66.9	42.1-57.0	41.0-57.9
Spring Chinook	37.9-55.9	42.1-57.0	41.0-57.9
Coho	45.0-60.1	39.9-48.9	39.9-55.9
Steelhead		39.9-48.9	

The 1964-1983 Trinity River temperatures at Hoopa exceeded many of the temperature ranges and thresholds discussed above (Table 3-12, Figures 3.7 and 3.8). The highest temperatures recorded at Hoopa were from June through October, a period that includes most of the life stages of salmonids. The USGS data in Table 3-12 and Figure 3.7 must be analyzed with caution because temperature was not continuously recorded. However, water temperatures appear to be affecting salmonid spawning, growth, development, resistance to disease and outmigration.

Table 3-12. Average daily maximum water temperature of the Trinity River at Hoopa by month from 1964-1983 (Hydrosphere 1997).

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
°C	6.7	7.6	8.7	11.0	15.1	19.2	22.9	23.0	20.2	14.9	9.8	7.4	13.9
°F	44.0	45.6	47.7	51.7	59.3	66.6	73.2	73.3	68.4	58.8	49.7	45.3	57.0

1964-1983 (Hydrosphere 1997).

A spring chinook fish kill was recently documented on the Trinity River which began in late June and extended into early July of 2002 (Cyr 2002). A total of 23 dead chinook salmon were discovered in a survey conducted by the Lower Trinity River Ranger District between the confluence of the South Fork Trinity River and the mainstem downstream to the Big Rock river access point off of Highway 96 at Willow Creek (Andazola 2002). The Hoopa Tribal Fisheries, Yurok Tribal Fisheries, and California Department of Fish and Game also conducted surveys of the Trinity River in July 2002 (USFWS 2002). Gill and vent tissue samples were collected from 11 fish and analyzed by the USFWS. Both *Ceratomyxa shasta* (Ceratamyxosis) and *Flavobacterium columnare* (Columnaris) were detected in these fish and may have contributed to pre-spawning mortality (USFWS 2002). Ceratamyxosis is temperature dependent and mortality increases for fish exposed at greater than 50 °F. Mortality due to Columnaris is low at temperatures < 59 °F with increasing mortality at 68 °F. The Lower Trinity River Ranger District recorded temperatures of 72 °F during their survey (Cyr 2002).

Figure 3-7. Average daily maximum water temperature of the Trinity River at Hoopa June through October from 1964 - 1983 (Hydrosphere 1997).

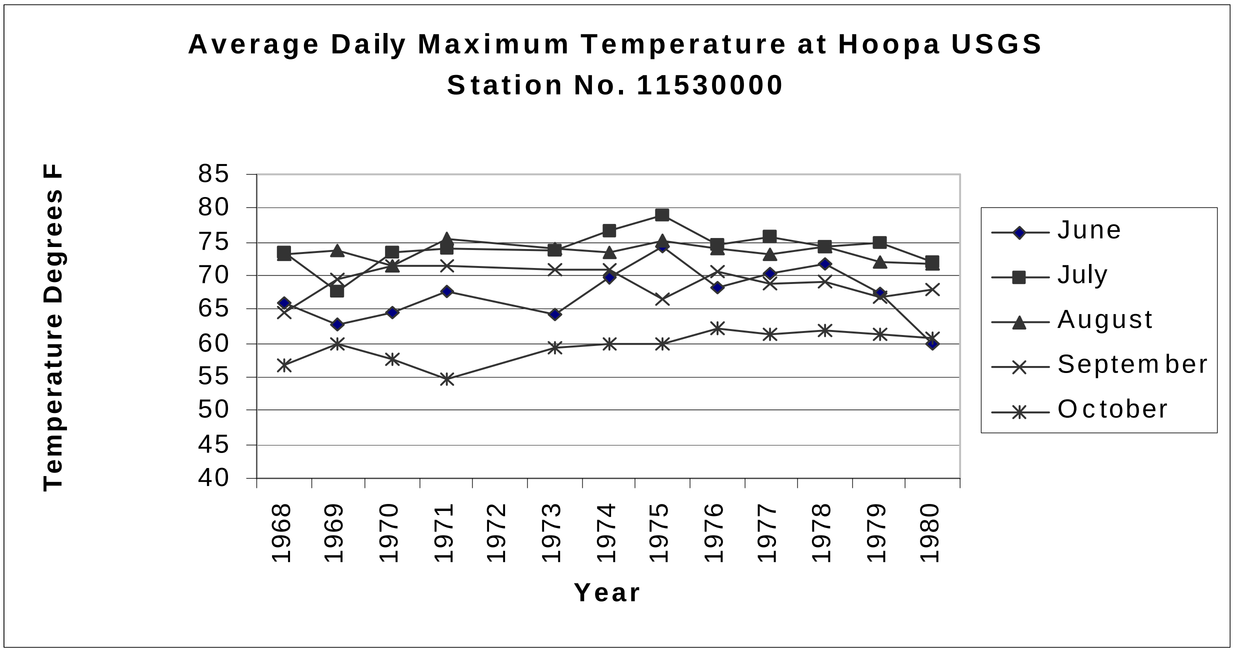
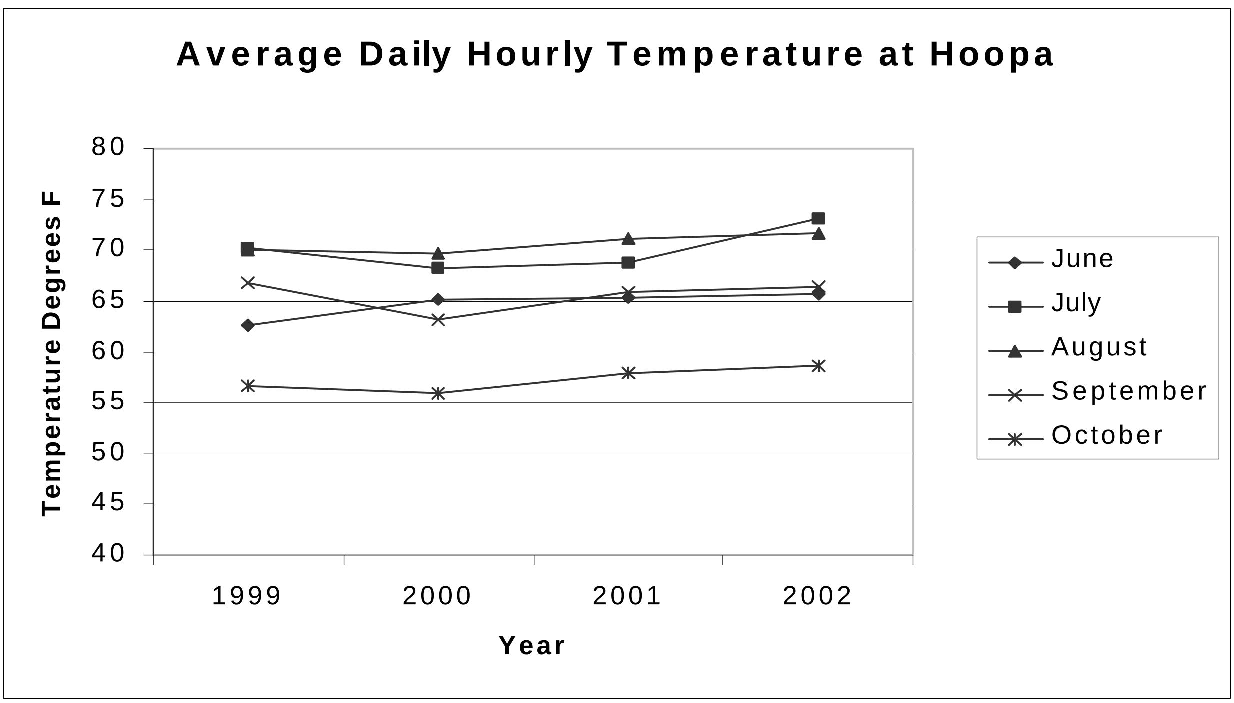


Figure 3-8. Average daily hourly water temperature of the Trinity River at Hoopa June through October from 1998 - 2002 (CDEC 2003).



Water Temperature in the Tributaries of the Trinity River

Coldwater discharges from tributary channels are a key component of the thermal regime of the mainstem of the Trinity River. Localized coldwater refugia are often found where tributary flows enter the Trinity River.

Based on aerial photo interpretation, it is possible that water temperatures are slightly elevated in the tributaries due to the changes in channel morphology and riparian vegetation caused by the 1964 flood. The tributary channel riparian vegetation has gradually recovered from 1964 flood, and stream channels are now shaded by alders and conifers. Summer water temperatures have been continuously recorded by the Six Rivers National Forest on the East Fork of Willow Creek above the mouth (1997-2001), Willow Creek just below the East Fork (1995-2001), Willow Creek just above the East Fork (1999-2001), Willow Creek at the downstream migrant trap (1995-2001), and Sharber Creek (1997-1998). During the summer of 2001 the following maximum temperatures were recorded:

- East Fork of Willow Creek above the mouth - 61 °F
- Willow Creek just below the East Fork - 62.2 °F
- Willow Creek at the downstream migrant trap - 68.9°F
- Willow Creek just above the East Fork of - 62.2 °F

The 2001 summer water temperatures exceed the maximum optimal temperature for steelhead and coho salmon rearing and the maximum optimal temperature for spring chinook and coho salmon migration.

Sediment and DO in the Mainstem Trinity River

The USGS monitored sediment concentrations and discharges at the Hoopa gaging station from 1959-1979 (Table 3-13). The highest sediment discharges are associated with winter storms (December-March), with December the highest month. The December discharge is influenced by the flood of 1964, which produced the highest recorded discharge - 8,900,000 tons/day.

Table 3-13. Sediment discharges (tons/day) for the Trinity River at Hoopa 1959-1979 (Hydrosphere 1997).

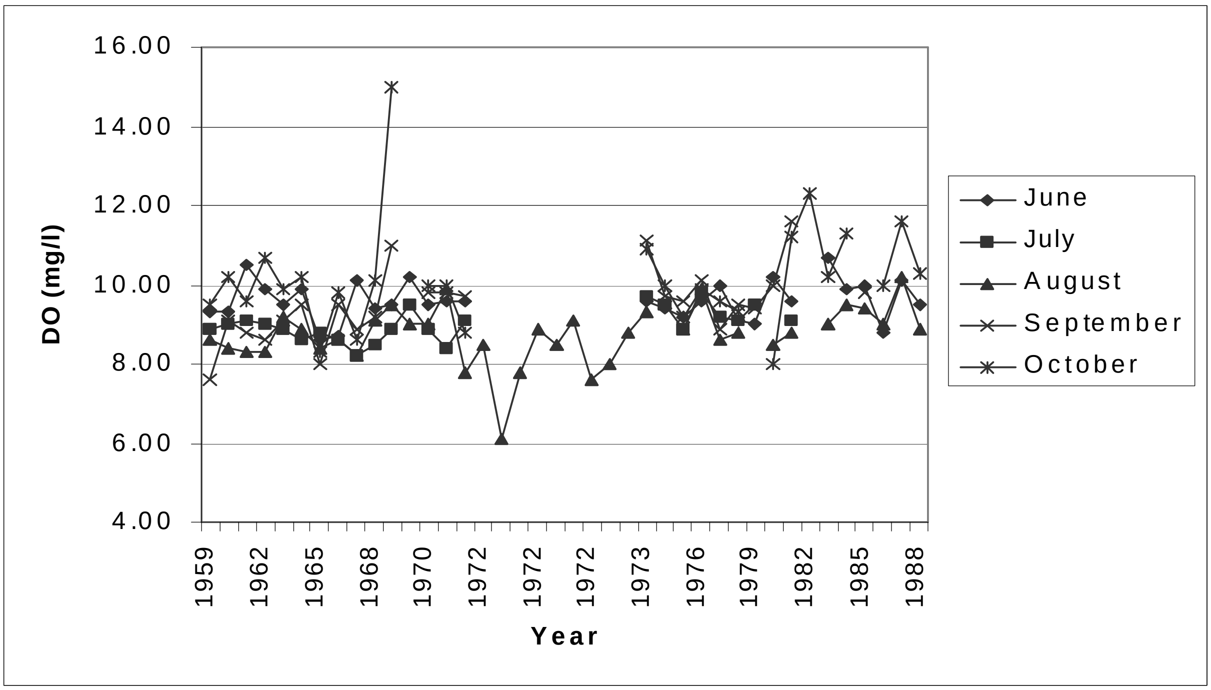
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
#Days	615	547	620	600	620	600	620	620	600	620	600	620	7,282
AvgDay	53,624	19,444	19,099	7,857	2,351	528	45	10	12	302	3,328	56,274	13,603
MaxDay	1,450,000	540,000	813,000	265,000	37,000	11,800	556	148	579	55,600	182,000	8,900,000	8,900,000
MinDay	2	3.2	12	11	8.3	3	0.76	1.0	0.81	0.83	1.0	1.4	0.76

Most of the energy used by salmonids to swim, locate food, grow, and reproduce is provided through metabolic processes that require oxygen. Environmental conditions influence the oxygen demands of fish, the amount of oxygen present on the water, and the ability of fish to take up oxygen. In general, the oxygen demand increases with increasing temperature, although oxygen consumption may decrease as temperatures approach lethal levels. Bjornn and Reiser (1991) found that adult and juvenile coho swimming performance declined sharply after DO fell to 6.5-7.0 mg/l, and adult migration ceased when

DO fell below 4.5 mg/l and didn't resume until it exceeded 5.0 mg/l. Generally, rearing salmonids function without impairment when DO is ≥7.75 mg/l with percent saturation at the following temperatures: 32 °F-76%, 41 °F-76%, 50 °F-76%, 59 °F-76%, 68 °F-85%, and 77 °F-93% (Bjornn and Reiser 1991).

The California State Water Resources Control Board monitored DO at Hoopa from 1958 to 1988. The data were analyzed to determine the trend of DO concentrations for months of June though October (Figure 3.9). In some years August DO concentrations fell below the salmonid function impairment threshold of ≥7.75 mg/l, but for the majority of the time they were above this level.

Figure 3-9. June-October Dissolved Oxygen Concentrations Trinity River at Hoopa.



<u>Sediment and DO in the Tributaries of the Trinity River</u>

The USGS and Forest Service have monitored sediment concentrations and sediment discharges at the following locations:

<u>Forest Service</u>: Hawkins Creek, Coon Creek, Quinby Creek, Sharber Creek, South Fork Trinity River, Ruby Creek, and Willow Creek (1972 - 1980). (Note: These data include both grab and automatic sampling of suspended sediment. There are approximately 2,000-3,000 samples for each site. These data have not yet been analyzed.)

<u>USGS</u>: Supply Creek near Hoopa, Station No. 1153000 1959 –1979 (Table 3-14)

Similar to the mainstem Trinity River, the highest sediment discharges in Supply Creek are associated with winter storms, with December being the highest month. The December discharge is influenced by the flood of 1964 which produced the highest recorded discharge – 9,950 tons/day.

Table 3-14. Sediment discharges (tons/day) for Supply Creek at Hoopa 1959-1979 (Hydrosphere 1997).

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
#Days	155	113	124	120	62	30	54	56	53	62	90	124	1,043
AvgDay	15	65	23	23	0	0	0	0	0	1	48	223	45
MaxDay	1,020	1,800	942	837	0.99	0	0	0	0	72	707	9,950	9,950
MinDay	0.15	0.09	0.28	0.26	0	0	0	0	0	0	0	0.33	0

Dissolved oxygen has not been monitored in the tributary channels, but the annual patterns of DO concentrations should be similar to the mainstem Trinity River DO concentrations. However, summer DO concentrations would be higher because tributary water temperatures are generally lower than the mainstem water temperatures.

Domestic Water Sources in the MTWAA

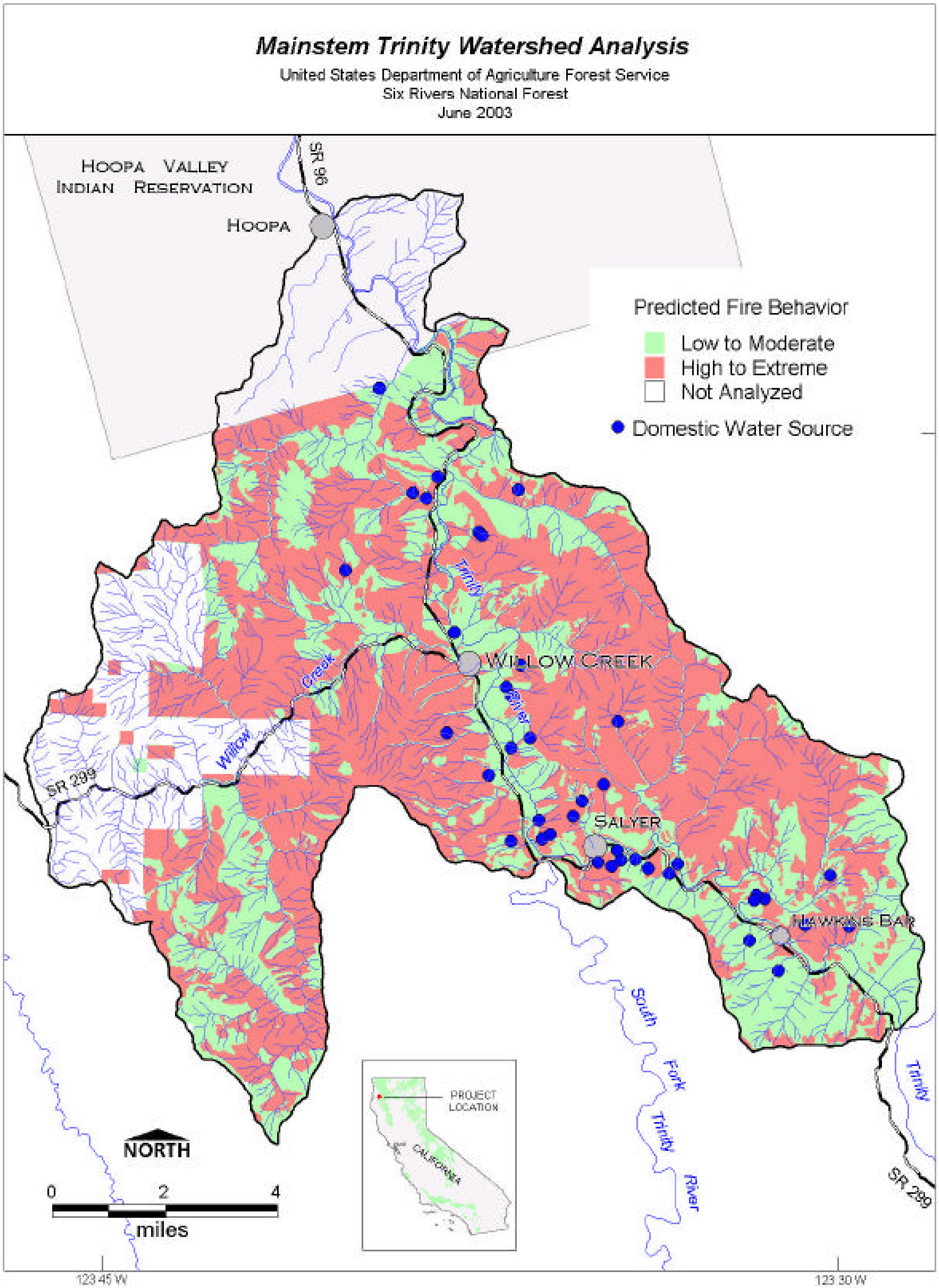
- *Where are domestic water sources located and how vulnerable are they to sedimentation from natural or human-caused landscape disturbances?*

There are 43 permitted and approximately 25-40 non-permitted domestic water sources within the analysis area (Frey pers. comm. 2002). Most of these water sources have surface or subsurface intakes that are dependent upon surface water quality. The known locations of the permitted water sources are illustrated in Figure 3-10.

The mainstem Trinity River and the following tributaries supply water for the permitted and non-permitted uses: Campbell Creek, Kirkham Creek, Coon Creek, Hudson Creek, Fourmile Creek, Sharber Creek, Icebox Creek, Pony Creek, Cow Creek, Willow Creek, and Hawkins Creek. The Hoopa Valley Tribe receives approximately 70 percent of its west-side domestic water that serves 300 people from a surface water withdrawal on Campbell Creek. The Salyer Heights water system services about 40 people. The Trinity Village withdrawal on Hawkins Creek (non-permitted) services 150 or more users. The Willow Creek Community Services District (WCCSD) services approximately 1700 users. The WCCSD intake is located on the Trinity River near Willow Creek and during the peak summer months withdraws 1.5 million gallons per day.

Figure 3-10 shows the location of permitted water sources and the predicted fire behavior of the water-source watersheds. Many of the domestic water sources are within or downstream of areas with high to extreme predicted fire behavior. If fires do occur in these areas, post-fire ash, sediment, and nutrient discharges could have short-term water quality impacts that could make the water unusable for domestic purposes without treatment. In addition, several of these water sources are downstream of active landslide areas that are chronically producing sediment. Sediment concentrations for water sources that are downstream of landslide source areas are most likely elevated and possibly make the water unusable without treatment after significant precipitation events that activate landslide erosion.

Figure 3-10. Known Locations of Permitted Water Sources and the Predicted Fire Behavior of the Water Source Watersheds Within the Mainstem Trinity Watershed Analysis Area.



Soil Productivity and Protection

- *What soil types occur in the analysis area that are especially sensitive to natural or management disturbances (such as wildfire, fuel treatments or logging), and in what locations are special mitigations warranted?*

Soils are a dynamic resource that support many physical, biological, and ecological functions in the environment. Soils consist of mineral particles, organic matter, and numerous organisms. Therefore, soils have biological, chemical, and physical properties that can change in response to management disturbances. Soils vary with geologic parent material, topography, biological processes and age. The different soils have variable textures and other characteristics that make them more or less sensitive to disturbances such as wildfire and to land management activities such as timber harvesting, road building, and fuel reduction projects.

Wildfires can negatively impact soils, particularly if the fires are intense and long duration. With intense wildfires, soils may become hydrophobic (water-repellent), thereby reducing infiltration rates and increasing surface runoff and surface erosion through rilling and gullying. In addition, organic matter in the duff layer and possibly the A-horizon can be consumed during severe wildfires. The loss of organic soil cover may increase surface erosion and reduce long-term soil productivity. Wildfire suppression activities may cause an indirect impact on soils. Heavy equipment use may result in soil compaction, and fire line construction results in the removal of organic matter and soil surface cover. Sensitivity to burn damage relates to the potential for substantial reduction in soil organic matter that would lower soil productivity. Some soils have textures and sufficient organic matter that will accommodate partial loss of organic matter without reduced productivity better than other soils. These characteristics are used to rate different soils for their sensitivity to damage from burning.

The soil Erosion Hazard Rating (EHR) indicates how susceptible the soil surface is to sheet and rill erosion after the soil has been disturbed. Management activities that remove surface cover, expose subsoil, result in soil compaction, or concentrate surface runoff have the potential to increase soil erosion above natural erosion rates. Potential consequences of accelerated erosion include reduced productive capacity of the site and adverse effects on water quality. Maximum EHR ratings are based on little or no vegetation cover present during the average long-term occurrence of two-year, six-hour storm events. When such a rainstorm occurs, accelerated erosion could result in most years on some of these soils and generate unacceptable resource impacts.

Soil compaction susceptibility characterizes the potential for heavy equipment use to result in soil compaction. Soil compaction typically occurs when moist or wet soils are compressed and the pore space between soil particles is reduced. Soil compaction and reduced soil porosity are directly linked. Compaction changes soil structure, reduces the size and continuity of pores, and increases soil bulk density. Soils can become compacted from vehicular use (timber harvest operations and roads) and repeated passes from large animals (cattle and horses) or people. Compaction becomes a problem when porosity is reduced to the point that water infiltration, percolation, and moisture storage within the soil column are insufficient to support natural levels of plant growth and nutrient cycling. The potential of soils to become compacted is primarily a function of soil texture (i.e., proportions of gravel, sand, silt, clay and organics in a given soil type) and soil moisture levels. The SRNF Soil Survey contains soil texture descriptions that were used to estimate potential risk of soil compaction. Table 3-15 and Figure 3-11 show the dominant soil families for the MTWAA. Table 3-15 also indicates the compaction risk for each soil family. Approximately 19,921 acres (26 percent) of the MTWAA have a high compaction risk.

Susceptibility to burn damage, average EHR, and compaction risk are listed for the soils in the SRNF Order 3 Soils Survey (1993). Given the level of generalization in the Order 3 Soils Survey, these characteristics should be sampled and verified in the field to guide project implementation or mitigation. Table 3-15 lists the dominant soil family with a generalized rating of sensitivity to these three environmental factors within the MTWAA.

Table 3-15. Dominant soils with environmental susceptibility characteristics in the Mainstem Trinity Watershed Analysis Area. Abbreviations are as follows: EHR = soil erosion hazard rating; L = Low; M = Moderate; H = High.

Dominant Soil Family	Total Soil Family Acres	% Analysis Area	Susceptibility to Burn Damage	Average EHR	Average Compaction Risk
CLALLAM (Deep Dry, Deep, Mod. Deep)	25,925	33	M & **H**	M	M
SKALAN (Deep, Deep Dry)	14,587	19	M	M & **H**	M & **H**
MAYMEN	4,463	6	M & **H**	M	M
TYPIC XEROFLUVENTS	4,374	6	L	L	M
HUNGRY (Deep)	2,836	4	M	M	**H**
HUGO (Deep)	2,674	3	M	M	M
GOLDRIDGE (Deep)	1,381	2	L	**H**	M
HOLLAND (Deep)	1,635	2	L	M	**H**
CHAIX (Mod. Deep)	1,087	1	**H**	**H**	M
DEADMAN (Deep)	1,145	1	M	M	M
DEADWOOD	1,033	1	M & L	L	M
HULLT (Deep, Deep Dry)	673	1	M	M	M
MADDEN (Mod. Deep)	863	1	**H**	M	**H**
Untyped Soils in MTWAA	15,782	20			

The areas occupied by soils with high burn damage susceptibility and high erosion hazard ratings are areas at high risk for impacts to long-term soil productivity. The soils with high burn damage susceptibility and high EHR were isolated and acres summed for the subwatersheds in the MTWAA (Table 3-16). Only the Chaix soil family, located in the Hawkins-Sharber subwatershed, has both a high burn damage susceptibility and a high EHR.

Table 3-16. Soils with high burn damage susceptibility and/or high Erosion Hazard Rating (EHR) with acres in the subwatersheds of the Mainstem Trinity Watershed Analysis Area.

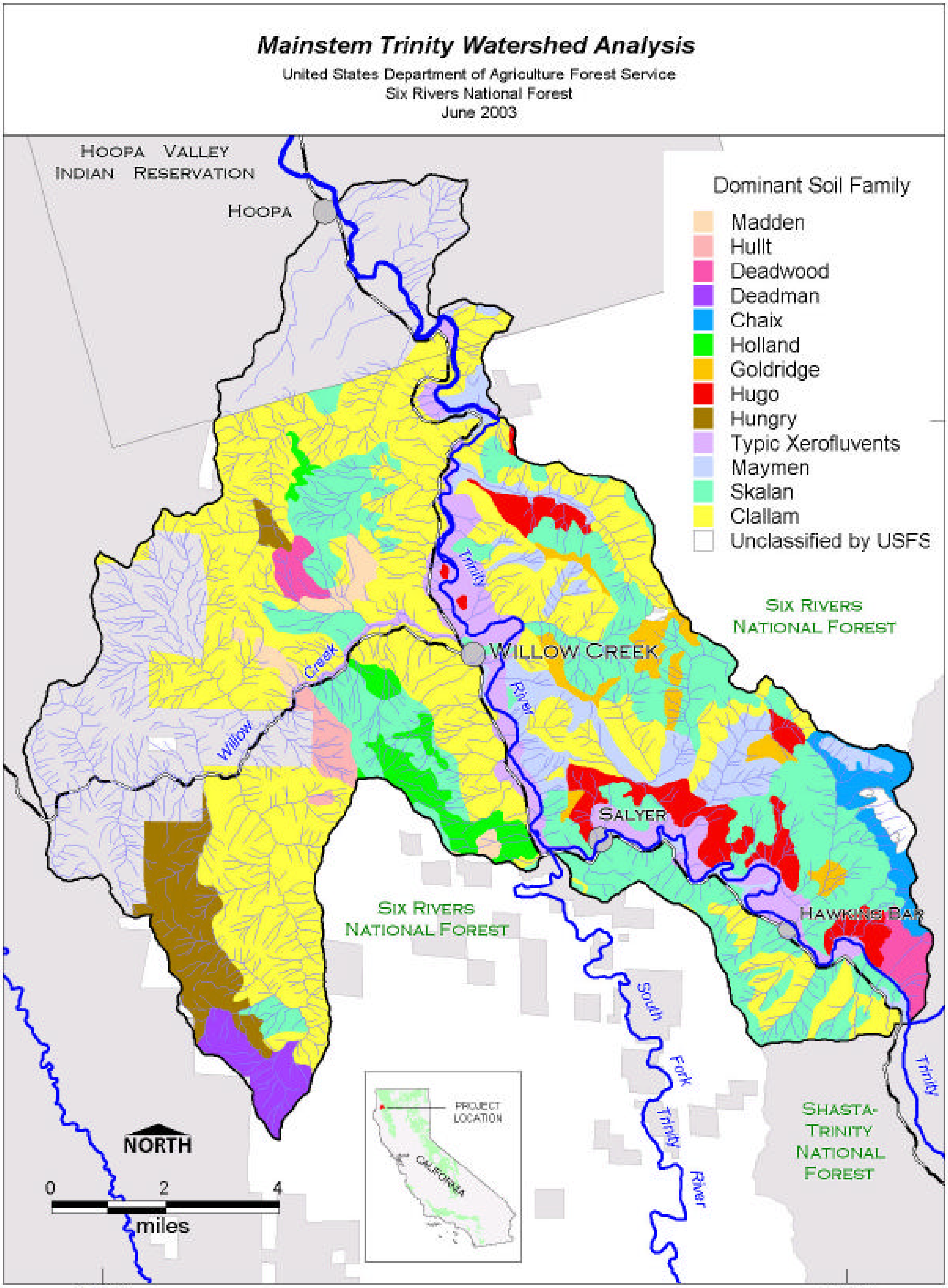
Dominant Soil Family (Burn/EHR Susceptibility)	Total Acres in High Burn Damage Susceptibility and/or High EHR	Hawkins-Sharber	Upper Tributaries Lower Trinity	Willow Creek
CHAIX (Burn & EHR)	1,087	1,087		
CLALLAM (Burn)	11,678	1,459	4,226	5,994
MADDEN (Burn)	863		255	608
MAYMEN (Burn)	237	237	0	
GOLDRIDGE (EHR)	1,381	849	532	
SKALAN (EHR)	6,649	4,568	2,075	7
Total acres	**21,897**	**8,200**	**7,088**	**6,609**
Percent of MTWAA or Sub-MTWAA	**35**	**42**	**29**	**36**

The areas occupied by soils with high sensitivity to burn damage that are also classified as areas of high to extreme predicted fire behavior are areas at high risk for soil damage from uncontrolled wildfire. These areas are summarized in Table 3-17. Areas of concern are located in all of the subwatersheds, but the Willow Creek subwatershed has the highest percentage of area occupied by soils with high burn damage susceptibility and high to extreme predicted fire behavior.

Table 3-17. Soils with high burn damage susceptibility and high to extreme predicted fire behavior with acres in the subwatersheds of the Mainstem Trinity Watershed Analysis Area.

Dominant Soil Families with High Burn Susceptibility	Total Acres of Soils with High Burn Susceptibility and High to Extreme Predicted Fire Behavior	Hawkins-Sharber	Upper Tributaries Lower Trinity	Willow Creek
CHAIX	478	478		
CLALLAM	6,569	246	2,243	4,081
MADDEN	523		144	379
MAYMEN	87	87	0	
Total acres	**7,657**	**811**	**2,387**	**4,460**
Sub-MTWAA %	**12**	**4**	**10**	**24**

Figure 3-11. Dominant Soil Families Within the Mainstem Trinity Watershed Analysis Area.



Biological System

Riparian Areas

Riparian Corridors and Stream Channels – Reference Conditions

The condition of riparian and aquatic habitats in the MTWAA has varied through time, primarily as a result of channel changes caused by mass wasting and sedimentation resulting from sporadic floods of extreme magnitude. In the first few decades after a major flood, there would likely be numerous fresh landslides adjacent to channels, sizeable secondary erosion from landslide scars, prevalent accumulation of sediment and debris in most stream channels, and decreased channel shading due to loss of riparian vegetation. These types of impacts facilitate elevated water temperatures, reduced aquatic habitat quality, and reduced stream productivity for salmonids. Longer and more stable intervals between severe floods facilitates a period of channel recovery. These recovery periods see riparian growth, often resulting in riparian stands with large trees that provide dense shade and the occasional input of large woody debris (LWD) to the channel. As deleterious channel impacts of a flood lessen over time, aquatic habitats are likely to improve and increase for salmonids with cool water temperatures and complex instream structure. Eventually, erosion, sediment delivery, and sediment transport roughly become in balance in the watershed, providing abundant clean substrate for spawning and rearing of salmonids.

Little direct information exists regarding prehistoric conditions, processes, and functions under which the riparian and aquatic ecosystems of the analysis area evolved. However, useful inferences can be drawn from historical records and aerial photographs taken in 1944. The aerial photos reveal extensive riparian cover, much of it old-growth conifer. The exception to this is a general lack of riparian vegetation along the Trinity River. The flood of 1861 reportedly had widespread impacts in the region, but the effects are not noticeable on these older aerial photos and probably have been erased or concealed in the intervening 83 years. Historical records indicate that Port Orford-cedar logging commenced with the completion of the Trinity Highway (Hwy 299) in 1923. Logging activities prior to 1944 were primarily limited to the ridge top areas in the Low Gap and Three Creeks area and would not have had a significant effect on riparian vegetation structure and diversity throughout the MTWAA.

Inferences about other riparian and aquatic processes and functions can be drawn from the extent and density of this historic riparian cover. Stream temperatures were probably low where there was substantial shading along most tributary streams. It is also reasonable to infer from the few active landslides and other sediment sources visible in 1944 that aggradation and channel widening were fairly minimal in the tributary stream channels. Although extensive sedimentation was not apparent in 1944, considerable sediment could have been stored in these channels that is not visible on the aerial photos. Much of that sediment may have been fairly well stabilized by vegetation and channel structure (such as boulders and logs). Hence, it is possible that less sediment was available for transport during high flows compared to the present, resulting in more optimal riparian and aquatic conditions.

Mainstem Trinity River

Between the New River and Hoopa, the Trinity River is a transport-dominated, bedrock-controlled channel. A review of the 1944 through 1998 aerial photographs shows large gravel point bars and elevated stream terraces in reaches that are not highly confined between steep canyon walls. Alternate bars are present in the steep canyon areas. There are extensive sections, mostly upstream of the South Fork Trinity River, with steep canyon walls that may provide some topographic channel shading. However, the riparian canopy does not, and probably never did, provide much shading of the channel. The mainstem channel has likely had an open riparian canopy for centuries due to its width, the scouring action of floods, shallow soils over a cobble and gravel base, and canyon walls. In addition, LWD would not have had much influence on instream habitat development due to high flows flushing wood from the system.

Sediment levels in the mainstem have varied in response to disturbance events such as floods and episodes of widespread landsliding. Most of the sediment has probably originated from unstable terrain along the mainstem corridor, hydraulic mining activities, and areas upstream of the MTWAA. The relatively small tributaries that enter the MTWAA, with the exception of the South Fork Trinity River, have probably tended to be of secondary importance as far as sediment input.

Tributaries of the Trinity River

In the 1944 aerial photos, riparian areas along main tributary streams in the MTWAA contained moderate to dense, old-growth conifer riparian stands. The slope between Willow Creek and Highway 299 also contained relatively undisturbed stands that provided a high level of cover over the creek. Most tributary channels were not directly visible, although small openings were evident next to scattered inner gorge landslides. There were very few landslides within tributary watersheds, and nearly all were attributable to natural causes. The tributaries appeared pristine with little or no land management activity. Ridge-top roads existed in some parts of the Three Creeks and Low Gap Creek subwatersheds and were used to access the early timber harvest areas. A large flood that occurred in 1861 reportedly had a large impact on many Trinity River tributaries and likely affected those in the MTWAA as well. Effects of this flood on the tributaries flowing into the MTWAA were not very evident on the 1944 aerial photos, although some older, dormant debris slides are visible that could have resulted from 19^{th} century floods. Given the extent of the riparian conifer cover visible in 1944 and the time that it takes for the conifers to mature (75-120 years), it is reasonable to conclude that these tributaries had not experienced a major disturbance capable of altering sediment routing and LWD recruitment for many decades, or perhaps since the 1861 flood.

Riparian Corridors and Stream Channels – Current Conditions

- *How have vegetative conditions of riparian areas changed over the past century within the analysis area, and what have been the causes of those changes?*

Current conditions of riparian areas in the MTWAA have been shaped to a large extent by human disturbance of the landscape through extensive logging and road building as well as recent natural events like the 1964 flood. Landsliding and hillslope erosion triggered by floods and exacerbated by land use activities in the 1960's and 1970's resulted in substantial changes to riparian areas in the main tributaries. However, since the mainstem Trinity River already contained relatively sparse riparian vegetation, the flood effects were more muted and mostly limited to channel aggradation.

Mainstem Trinity River

As described above under Reference Conditions, the mainstem Trinity within the MTWAA does not have extensive shade-producing riparian cover. The predominant riparian vegetation along the mainstem corridor consists of willow and alder. The 1997 storm event uprooted some of the riparian vegetation along the river banks. It was unclear if the reach experienced significant deposition and erosion of bars and terraces since the river discharge during the 1998 aerial photograph date was about three times higher than that on the 1990 photos. The sequential aerial photo study revealed relatively few channel changes within the main river over the past 50 years.

Tributaries of the Trinity River

Examination of sequential aerial photos from 1944 through 1998 reveals extensive riparian corridor and stream channel changes in tributary drainages. In 1944, there were only a few inner gorge landslides scattered among the main tributary drainages that created riparian canopy openings and downstream aggradation. The riparian vegetation at that time was primarily late-successional/old-growth conifers. Riparian vegetation in Willow Creek along Highway 299 was largely intact. Channel adjustments appeared to be fairly minor and did not appear to have had significant riparian or aquatic impacts. Logging was occurring on private land within the Willow Creek drainage but had not had a significant impact to riparian vegetation.

The most dramatic change in riparian canopy and stream channel condition was visible in the 1960 aerial photos of Willow Creek. Large-scale timber harvesting was occurring on private land that primarily utilized tractor yarding. Much of the yarding was downslope into the creek beds, which were used as skid roads and landing locations. The landings were located in the Willow Creek channel and adjacent terraces, presumably to facilitate truck hauling on the nearby Highway 299. Nearly all of the late-successional/old-growth riparian vegetation was removed along Highway 299 where it ran through private land. Forest Service land remained largely undisturbed. Willow Creek and its tributary channels experienced severe impacts to form and function due to channel widening and aggradation. As the channel was highly impacted by the timber practices of the day, it is difficult to assess what the impacts of the 1955 flood were in the watershed.

Channel and riparian disturbance also occurred on private land in Sharber Creek from tractor logging during the interval between the 1944 and 1960 air photos. As per the practices of the day, yarding and road building also occurred in its streambeds. It appeared from the air photos that the Sharber harvesting began a few years prior to 1960 due to the "freshness" of the disturbed ground, lack of "green-up," and little evidence of landslides. Hawkins Creek also experienced some logging on Forest Service land during this period, but riparian buffers were established that included some green tree retention.

The 1975 photos show much reduced logging activity on private ground with increased operations on Forest Service land throughout the MTWAA. Willow Creek showed extensive channel widening due to the 1960's yarding practices and riparian harvesting, which was then exacerbated by the intensity of the 1964 flood. Riparian regeneration was underway on private land in Sharber Creek. However, a western tributary to this creek that passes through uncut Forest Service land showed numerous streambank landslides and channel widening. The mainstem of Sharber that flowed through the cutover private land appeared to have a stable channel with an extensive young riparian canopy. The logging on Forest Service land was conducted primarily by clear cutting with cable yarding that included riparian buffers and streamside tree retention.

The most recent aerial photos show that much of the coniferous riparian canopy disrupted by floods and logging between 1960 and 1975 has been replaced by dense deciduous vegetation. Little timber harvesting has occurred on Forest Service land since 1990. While the long-term woody debris recruitment potential may have been set back, the shade component has been re-established through encroachment of alders and other riparian vegetation. Channel openings remain along most tributaries (particularly Willow Creek), but overall, riparian canopy closure conditions have substantially recovered since 1975. Canopy closure throughout much of the MTWAA is dense, with the exception of reaches along the mainstem Trinity where the width of the channel reduces closure. A comparison of 1990 and 1998 aerial photos reveals little new disturbance of riparian corridors as a result of the 1997 storm throughout the MTWAA.

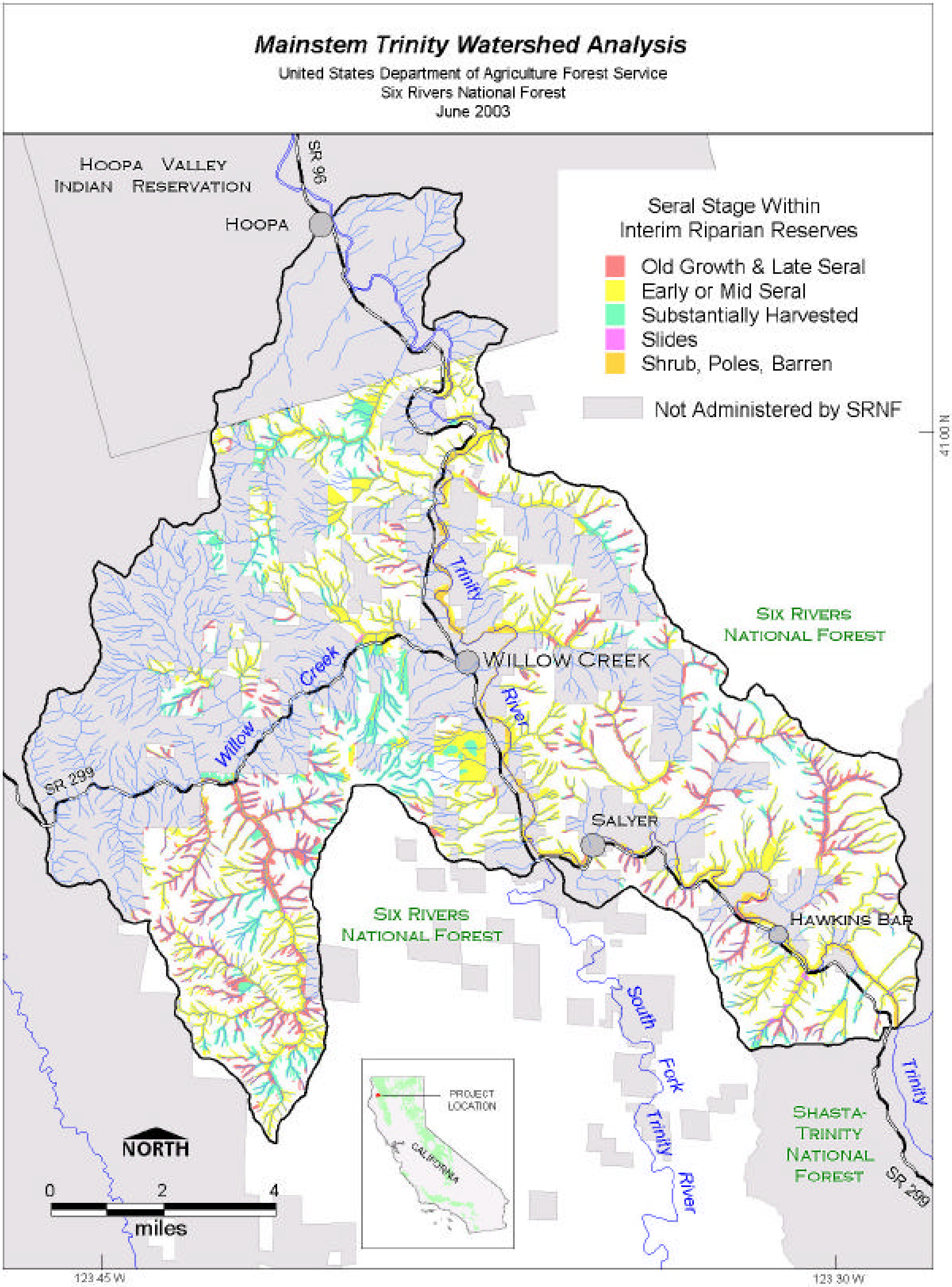
Interim Riparian Reserves (IRR) are areas along streams, within Federal ownership, that are intended to protect beneficial uses and the processes and functions inherent to riparian areas when management activities are proposed within or adjacent to them. IRRs apply to unstable areas, perennial streams, and intermittent/ephemeral streams with evidence of annual scour. Figure 3-12 shows the IRR and vegetation seral stages within the MTWAA. The present condition of the IRRs varies among tributary watersheds as described above. Landslides associated with past storm events and management activities have left a legacy that is still visible in the 1998 aerial photos. In addition to active landslides associated with storm events, past timber harvesting and wildfires have also had an impact on seral stages within IRRs. Table 3-18 shows the number of currently active landslides, seral stages, and high to extreme fire behavior within the IRRs for each of the three major watersheds.

Table 3-18. Current conditions within Interim Riparian Reserves (IRR) of the three subwatersheds of the Mainstem Trinity Watershed Analysis Area. Abbreviations are as follows: UTLTR = Upper Tributaries Lower Trinity River; H-S = Hawkins-Sharber.

Watershed	IRR acres	Acres of active slides in IRRs	Acres substantially harvested	Acres in late succession or Old-Growth	Acres in early- or mid-mature	Acres in Shrub/ Pole/ Barren	Acres of high to extreme fire behavior
UTLTR	5,535	62	1,010	423	3,457	582	2,918
Willow Ck.	5,380	86	1,319	1,670	2,109	196	3,161
H-S	4,519	137	426	1,362	2,325	269	1,904

Note: IRR occur only on Forest Service land. Acreage of currently active slides in the IRRs are derived from slides located on the lower portion of the slope, which are either fully contained within or originating outside and passing through the IRR.

Figure 3-12. Current Vegetation Seral Stages within Riparian Zones Within the Mainstem Trinity Watershed Analysis Area.



A query of active slide data from aerial photographic estimates and GIS data (in part derived from air photos) showed between 845 and 1,196 acres of active slides within the MTWAA from 1944 through 1998. There are currently about 285 acres of active slides in the analysis area. These acreages should be considered a minimum amount of what may actually be on the ground. This is because aerial photographic analysis alone is not sufficient to identify all areas of mass wasting in the IRR. For example, slides under tree canopy, toe zones of older deep seated landslides, and small shallow slides may not be identified and mapped on aerial photographs. A thorough field review will be needed to fully identify landslides during the planning and environmental analysis portion of any proposed project.

- *What are the principal beneficial uses associated with riparian areas and water bodies within the analysis area, and how functional are riparian areas in meeting those uses?*
- *Given the historic and recent impacts of natural and human-caused disturbances, what is the potential and what are the principal mechanisms for large woody debris (LWD) recruitment within riparian areas?*
- *What effects have natural and human caused disturbances (including logging, mining, fire, and fuel treatments) had on riparian areas throughout the analysis area during the past century?*

The principal beneficial uses associated with riparian areas and water bodies within the MTWAA include

- Shade provision over watercourses to help moderate increases in water temperatures
- Deposition of organic matter that helps drive primary productivity and aquatic macroinvertebrate production
- Contribution of LWD that helps store and route sediment as well as forms or enhances aquatic and terrestrial species habitats
- Stabilization of streambanks and near-slope areas
- Sediment filtration from upslope disturbances

As watershed and stream size increases in a downstream direction, the functional values of the riparian areas change, and some of the above beneficial uses are not as applicable. For example, small trees and brush in headwaters can effectively shade the stream; farther downstream, even large trees may not provide effective shade (Murphy & Meehan 1991). In addition, small streams receive more of their organic matter from local riparian vegetation than do larger streams. The role of LWD also changes with stream size. In small streams, LWD generally stays where it falls and influences most of the stream channel. In large systems, large trees may be carried away by high flows and deposited into log jams or on terraces.

The principal mechanism for large woody debris recruitment involves trees falling into riparian areas through either natural mortality, landslide movement, wildfire, or windthrow. In steep tributary channels, which are characteristic of most stream channels within the MTWAA, woody debris recruitment is an important function providing in-channel structure, sediment routing, and wildlife habitat. In the uppermost reaches of tributaries where stream power is limited and wood cannot be readily transported by the stream, woody debris serves mostly as a nutrient source and wildlife habitat.

Conditions within riparian reserves, as shown in Table 3-18 (above), agree with observations made from aerial photo trend analysis. Many of the riparian areas on private land have been disturbed historically through timber harvesting, natural storm events, landslides, and wildfires. There appeared to be relatively little timber harvesting on private land during the 1990's. Most of the recent private harvesting was primarily located around ridgetop areas running between Coon, Brewer, and Sharber creeks. Some of the private harvesting did involve timber removal from intermittent or ephemeral drainages. Most of the harvesting on Forest Service land prior to the introduction of the Northwest Forest Plan retained riparian buffers, although they were narrower than IRRs and likely experienced some level of harvesting. The more recent Forest Service harvesting incorporated IRRs to help protect beneficial uses of riparian areas. The stream channels on public and private property were affected to some degree by indirect effects of timber harvesting and road construction. These indirect effects were related to landslides and sediment delivery and were generally triggered by storm events. The riparian zone along Willow Creek is still being significantly affected by Highway 299 and the chronic sediment delivery from it.

The effects of public and private timber harvesting on LWD recruitment processes can be seen in two ways. Harvesting resulted in changes in both tree species composition and size. Tree species composition in riparian areas has shifted from being conifer-dominated prior to the 1940's to one that is predominantly deciduous, especially in Willow Creek. Although the deciduous vegetation may generally be in a mature state (being relatively short-lived) and contribute LWD, their size and decay rate result in relatively low instream persistence and functionality. For those areas that have had conifer regeneration, the trees are relatively small, which limits instream functionality and makes them more prone to being flushed through the system. The reduction in instream LWD likely decreased rearing habitat complexity for salmonids and reduced the ability of the streams to route and sort sediment and create pools.

The vegetative composition of riparian reserves has been altered substantially as a result of past timber harvest. The UTLTR, Willow Creek, and Hawkins-Sharber watersheds have 47.6 percent, 31 percent, and 30.1 percent late-mature or old-growth vegetation remaining in their respective IRRs. These seral stages are the likely current sources of large wood for these streams due to decadence or windthrow. The aerial photographs show that a significant portion of the main tributary stream channels are lined with a closed canopy of deciduous vegetation. Development of conifers is limited under these conditions. The development of deciduous stands along the watercourses may have increased the seasonal inputs of organic materials and improved primary productivity to some degree.

The three watersheds have a substantial component of early to mid-mature vegetation. These seral stages may not provide much large wood currently except as shallow landslides occur, but they are likely to be primary sources for recruitment several decades in the future. The 1998 aerial photos show that many of these riparian areas currently have a large component of deciduous riparian vegetation (probably willows and alders) compared to the 1944 photos in which most riparian areas were dominated by old-growth conifer cover. These observations suggest that the intermediate-term recruitment potential for LWD has been reduced from recent historic levels. It is probable that sub-areas with relatively low percentages of late mature and old-growth in riparian areas have a potential longstanding deficit in LWD recruitment.

It is important to note that despite the massive disturbance of the 1964 and later floods to riparian areas, large flood events are a natural process. The 1964 flood generated many landslides and delivered much sediment and woody debris. Even though many of the riparian areas now have a smaller conifer vegetation component than before 1964 and may have a lower LWD recruitment potential in some areas, LWD delivered during the 1964 flood still remains an important part of current channel function.

Historic mining activities likely had some effect on riparian areas that varied with the type of mining technique employed. Hydraulic mining washed away entire hillsides, obliterated creeks and drainage patterns, and deposited massive amounts of sediment in stream channels. Small scale placer mining occurred in the Willow Creek and Three Creeks drainages. These small operations likely harvested local timber near the creeks to build cabins, dams, sluices, and other objects necessary for their endeavors. Even though there were many of these claims, their size and short time of operations would have limited the amount of damage to riparian areas. The 1944 aerial photographs appear to indicate that the riparian vegetation was fully recovered from the placer mining era.

Wildfires have occurred historically throughout the analysis area. The most recent was the Megram Fire, which originated outside the MTWAA. Since records started in 1910, approximately 752 fires have started within the MTWAA with only six burning more than 100 acres. Of these 752 fires, 90 percent were started by humans and burned approximately 2,545 acres. The other fire starts resulted from lightning and burned 141 acres. These records suggest that post-1910 wildfires have not played much of a role in the development or recruitment of LWD in the analysis area. However, the 1944 aerial photographs appear to show relatively uniform seral stage development within the analysis area. This may indicate that large stand-replacing fires occurred prior to record keeping. These fires would have had a significant impact on development and recruitment of LWD (e.g., short-term pulse in recruitment with a long-term deficit).

It is difficult to determine what this past legacy of wildfires means in terms of current potential for wildfire within riparian areas. The extent of high to extreme fire behavior within riparian areas (shown in Table 3-18 above) varies for each subwatershed between approximately 42 percent (for Hawkins-Sharber) and 59 percent (for Willow Creek) across the landscape. Given the fact that much of the analysis area has already had a reduction in late-mature and old-growth riparian vegetation from past harvesting, roading, floods, and landslides, a high risk of stand-replacing fire in a substantial portion of the riparian reserves could pose a significant concern for beneficial uses and riparian dependent species. Figures 3-21, 3-22, and 3-23 (in the *Fire and Fuels – Current Conditions* section) illustrate that high to extreme fire behavior is predicted throughout much of the MTWAA, including the IRRs. Many of the riparian reserves at high risk from wildfire are located along Highway 299 and Highway 96 or near residential areas where most of the fire starts have occurred.

With the exception of shading and perhaps organic inputs, riparian areas within the MTWAA appear to have lost some functionality. The ability of the riparian areas to contribute functional LWD has diminished due to the shift from large conifers to smaller deciduous vegetation. Streambank stability was reduced by historic harvest activities that introduced large amounts of sediment into the system and flood events that widened channels and destabilized the toe of slopes. Sediment filtration has been reduced, especially along Highway 299 where slides are common. The ability of riparian areas to serve as travel corridors for wildlife species may have been affected to some unknown degree by development within the MTWAA. The MTWAA is heavily wooded, and in general, wildlife species are not restricted to travel solely within riparian areas.

Riparian Species of Concern

- *What riparian-dependent species of concern exist in the analysis area?*

<u>Riparian-Dependent Plant Species</u>

One botanical riparian-dependent plant species of concern, *Bensoniella oregana*, occurs just south of the MTWAA. This species has not been observed within the MTWAA, though potential habitat is present in wet meadows along Route 1.

<u>Riparian-Dependent Wildlife Species</u>

Of the wildlife species of concern (Endangered, Threatened, Sensitive, or Survey and Manage), there are several that depend on riparian areas for some stage of their life history. These species are listed here, and a further description of how they occur within the MTWAA can be found in the Wildlife section.

Bald eagles (Threatened) generally nest where they can overlook a large body of water, and they generally do most of their foraging in proximity to water. They depend on the Trinity River, but not directly on the minor tributaries within the MTWAA. However, factors throughout the MTWAA that affect the availability of fish and waterfowl can also affect bald eagles. Four bald eagles were observed downstream of Willow Creek within the MTWAA during the fall of 2002 (D. Halligan pers. comm.).

Willow flycatchers (FS Sensitive) have been observed within the MTWAA, primarily along the Trinity River, during their fall migration. They may be using the MTWAA as a forage area to build the fat reserves necessary for their migration to the tropics (bulking). They prefer wet meadows or relatively stable willow/alder dominated riparian zones near slow moving waters for nesting, but no nests (or nesting activity) have been found within what are rather sub-optimal habitats occurring in the MTWAA.

Northwestern pond turtles (FS Sensitive) live and forage in ponds and slow moving reaches or side-channels of the Trinity River. They have been reported from a general location approximately two miles up Brannan Mountain Road. A pond turtle was observed in the Trinity River downstream of the mouth of Willow Creek in 1996 (Halligan 1997). Outside the MTWAA, they are known to occur along the South Fork Trinity River. Nesting, hibernation, and migration occur on land, generally within 1 km of water.

Southern torrent salamanders (FS Sensitive) find ideal habitat in proximity to cold clear streams, seepages, or waterfalls. Southern torrent salamanders have been found in or near Boise Creek, Brannan Creek, and an unnamed tributary of Quinby Creek; between 0.5 to 1.0 miles east of Salyer near the

Trinity River; on Brush Mountain, just south of Brannan Mountain; and on Indian Butte (CNDDB 2002). The SRNF wildlife database shows an additional three records for this species.

Foothill yellow-legged frogs (FS Sensitive) utilize the margins and near-shores of relatively low gradient waters within the MTWAA. Their egg and larval stages are entirely aquatic. Adults often bask on exposed rock surfaces near streams. Foothill yellow-legged frogs have been observed along Coon Creek. This species has been observed along the Trinity River within the MTWAA (Halligan 1997, 1998, 1999).

- *How have the abundance and distribution of riparian species of concern and their habitats changed as a result of natural and human caused disturbances?*

Abundance and Distribution of Riparian Plant Species and Habitat

One botanical riparian plant species of concern, *Bensoniella oregana*, occurs just south of the MTWAA. This species has not been observed within the MTWAA, though potential habitat is present in wet meadows along Route 1. Understanding changes in the abundance and distribution of bensoniella is difficult given the total lack of information regarding presence of this species in the analysis area. However, if this species were present the historic and current cattle grazing and trampling in wet meadow areas could have affected seed production and ultimately bensoniella abundance and distribution.

Port Orford cedar (POC) tends to concentrate in riparian areas, although it is also present in upland areas. Historic and recent timber harvesting activities in the analysis area either targeted POC or took this species incidentally. Although the distribution of POC has probably not changed, its abundance has likely been diminished.

Abundance and Distribution of Riparian Wildlife Species and Habitat

Comparisons of current and baseline data on the abundance and distribution of populations of riparian-associated wildlife species of concern is generally lacking, making the understanding of how populations have changed over time elusive. There are no current or historic accounts of bald eagles nesting in the MTWAA. However, in the last ten years there has been an increase in eagle activity within the Klamath River Basin, which may be tied to an increase in spring and summer anadromous fish runs (USFS 2002a). According to the California Department of Fish and Game, bald eagle populations were increasing in California as of 1997 (CDFG 2001).

As stated above, land use activities, landsliding, and hillslope erosion triggered by the 1964 flood resulted in substantial changes to the channels and riparian vegetation in all main tributaries. This may have negatively affected the abundance and distribution of willow flycatchers (which may have nested in the MTWAA at one time). Historic population levels of northwestern pond turtles in the tributaries were likely very low since the riparian zones had a closed conifer canopy. Northwestern pond turtles prefer relatively open areas with slow water and basking sites, which tend not to be available in closed-canopy, confined channels. Foothill yellow-legged frogs also prefer more open riparian areas that closed conifer canopies cannot provide. It is possible that yellow-legged frogs have responded positively to the change from closed conifer to more open deciduous canopies along the tributaries. These frogs are commonly observed along the Trinity River. Southern torrent salamander populations appear to be in decline, especially in the warmer, interior portions of their range (USFS 2002a). Negative effects to southern torrent salamander populations as a result of natural- and human-caused disturbances may have occurred as a result of high intensity fire, logging, road building, and erosion in proximity to headwater areas if they resulted in elevated water temperatures, decreases in dissolved oxygen (DO), or increases in siltation.

The function of riparian areas as wildlife travel corridors within the MTWAA is not well understood but probably varies with the physical size and habits of the various species. Fishers have been found to use riparian areas disproportionately for travel and escape (Buck et al. 1983). Larger species with larger home-ranges travel more and seek out less steep travel-ways. The concept of riparian areas as wildlife travel corridors probably has greater utility in arid and semi-arid areas where vegetative cover is more or less restricted to the riparian areas, or in areas heavily developed for agriculture. The MTWAA is heavily wooded, and in general, wildlife species are not restricted to travel solely within riparian areas.

Aquatic Species and Habitat

Aquatic Species – Reference Conditions

- *What were the historic distribution, relative abundance, and habitat conditions of fish known to occupy the analysis area?*

Historic Fish Distribution and Abundance

Approximately 30 miles of the mainstem Trinity River lie between Hoopa and the New River within the MTWAA. This large riverine system provides fish passage, holding, and spawning areas for adults; facilitates movement of juveniles into and between tributaries; provides rearing habitat for fry and juveniles produced in tributaries; and provides habitat for smolts as they emigrate from tributaries and migrate to sea.

Historically, anadromous fish populations such as chinook, coho, steelhead, lamprey, and, to a lesser extent, green sturgeon inhabited the Trinity River. With the exception of the green sturgeon, the tributaries within the MTWAA supported one or more of these species. Species distribution was dependent on access, stream gradient, substrate, and other instream habitat conditions. Green sturgeon also migrated up the Trinity River and other large tributaries, like the South Fork Trinity, to spawn.

The historical (pre-development) distribution of anadromous species within the Trinity River extended above the North Fork and Lewiston. One of the most immediate limitations on the distribution of coho, chinook, and steelhead within the Trinity River resulted from construction of the Trinity River Diversion in 1962. For at least 40 years, salmon and steelhead have been blocked from their important historic spawning grounds in the upper Trinity River above Lewiston Dam. It was estimated that the dam blocked access to 59 miles of chinook habitat, 109 miles of steelhead habitat, and an undetermined amount of coho salmon habitat (USFWS 1983). Furthermore, elimination of the upstream reaches, which were dominated by snowmelt and were hydrologically different from the river habitats downstream of

Lewiston, greatly reduced the diversity of the entire river system, thereby reducing habitat choices for salmonids (USFWS 1983).

Salmonid run sizes prior to the 1900's are difficult to determine. However, native fish populations in the Klamath River Basin sustained themselves in numbers sufficient to provide for lucrative fishing enterprises in the mid-1800's to early 1900's (URS 2000). It was estimated that 141,000 chinook salmon were caught and canned in the Klamath River during 1912 (Snyder 1933). Therefore, the total run size, which includes escapement, was significantly larger. That run was said to be the greatest ever witnessed by non-Indians.

Declining fish populations were noted on the Trinity River as early as 1890. On February 8, 1890, the Arcata Union reported the following:

> *"It will be a matter of news to people in this section to learn that a fish hatchery has been established at Camp Gaston (Hoopa Valley) and is now in operation... The hatchery has a capacity to hatch out and put in the streams from two to three million young salmon yearly. Aside from the great benefit to resident whites and Indians of this great increase, the canneries will be benefited and to supply their drain, a hatchery is absolutely necessary, otherwise there will be no fish."*

It appeared from this article that in-river commercial fishing contributed to a decline in salmonid population. In addition, mining sedimentation was also linked to decreasing fish populations. An observer in Hoopa Valley noted in 1865 that the Klamath and Trinity Rivers were very muddy and almost deserted by salmon (Klamath River Basin Fisheries Task Force 1991). Snyder (1931) reported commercial catches of chinook salmon in the Klamath River between 1913 and 1926 ranged from 7,200 to 72,400 fish annually. Snyder (1931) also reported that by 1931 the spring run of chinook salmon was so depleted as to be scarcely evident and catches of silvers and fall chinook could only be maintained with greatly increased fishing effort.

Aquatic Species – Current Conditions

Multiple Fishery of Today

Today, the fishery resources of the Trinity River continue to be an important social and economic aspect of northwestern California. The Trinity River salmon resources contribute to different types of fishing opportunities including an active tribal fishery, in-river sport fishery, an ocean recreational fishery, and limited ocean commercial fishery. Two Native American tribes continue to fish within the Trinity River: the Yurok and Hoopa. To this day, these Tribes located within and downstream of the MTWAA largely depend on chinook, coho, steelhead, green sturgeon, and Pacific lamprey for subsistence and ceremonial purposes. Yurok tribal members have the opportunity to operate a commercial fishery further downstream along the Klamath River within the Yurok Indian Reservation.

In the ocean, commercial trolling and recreational fishing for chinook salmon occurs within the Klamath Management Zone north of Fort Bragg, California to Cape Blanco, Oregon. Under the management of the Pacific Fishery Management Council, seasons and quota limits are set annually. The commercial fishery is a shadow of its former self with no allowable take of coho salmon and a very small chinook harvest level of around 2,000 to 3,000 fish.

In-river recreational fishing on the Klamath River Basin likely began in the late 1800's, and continues for chinook salmon and steelhead today. Since 1986, the river recreational fishery has been regulated by a quota system based on predicted population returns. Recreational fishing within the MTWAA continues to provide an economic return to the communities on a seasonal basis, especially when large annual returns are expected and angler quotas are raised. Several commercial fishing guides are known to operate on the Trinity River.

Opportunities for recreational fishing for resident trout species is limited in the MTWAA. Earlier resident trout fisheries targeted a large number of juvenile salmon and steelhead. This fishery has been restricted in recent years to help facilitate the rebuilding of the anadromous salmonid populations.

Distribution of Fish Species

Anadromous and resident fish species are distributed throughout the MTWAA in the mainstem Trinity River and tributaries (Figure 1-4). Fish are found in most of the MTWAA tributaries, except where limited by stream gradient and natural or man-made barriers. Mixed anadromous-resident fish assemblages exist in the mainstem and most lower reaches of tributaries while a resident rainbow trout assemblage is typically found in upper reaches of tributaries. In Willow Creek, a natural barrier allows steelhead access upstream but represents the upstream end of anadromy for salmon. Sharber Creek formerly followed the course shown on the 1979 USGS Salyer CA 7.5' topographic quadrangle. Since that time, it has captured another small channel in the south half of Section 12, T6N, R5E and the majority of its flow follows this course. Anadromous fish are found in both of the channels.

The MTWAA provides approximately 57.3 miles of anadromous fish habitat (40 miles of the Trinity River and 17.3 miles of adjoining tributaries). Chinook, coho, lamprey, green sturgeon, and steelhead inhabit some of this mixed anadromous and resident fish habitat. All of these fish species utilize the Trinity River at some point in their life cycle. Each of these fish has various habitat preferences for spawning and rearing. Based on available data, spring-run chinook, summer-run steelhead, and green sturgeon occupy the Trinity River portion of the MTWAA primarily as a migration corridor. Fall-run chinook and coho salmon, steelhead trout, and Pacific lamprey occupy the mainstem and tributary streams where suitable habitat is available. There are also an estimated 18.6 additional miles of suitable resident trout fish habitat upstream of anadromous reaches within the analysis area.

Relative Abundance

There is a lack of information regarding relative abundance of salmonid populations in the MTWAA prior to 1977. In addition, there are few data available regarding relative abundance for many of the MTWAA tributaries, with Willow and Sharber creeks being the exception. However, mainstem Trinity River run size and spawner escapement estimates are available for fall- and spring-run chinook salmon, coho salmon, and steelhead trout from data collected between 1977 and 2000 at the weir located approximately

5.3 miles upstream of the town of Willow Creek. The weir typically operates from August to late November to coincide with the salmon migration and prior to the onset of heavy fall rains. It must be noted that although the Willow Creek weir counts are currently the best available population data, they are more indicative of the success of the hatchery program than of the ability of the watershed to naturally produce salmonids.

Fall-run chinook run sizes upstream of Willow Creek between the years 1977 and 2000 were estimated to range from 9,207 and 147,888 fish (CDFG 2002a). An estimated 2,381 to 62,692 spring chinook passed the Junction City Weir during that time frame. Approximately 852 to 59,079 coho salmon, and 3,046 to 37,276 steelhead passed the Willow Creek weir during the same period (Figure 3-13). The spring-run chinook estimate is only for those fish entering the upper Trinity River basin above Junction City since the Willow Creek weir was installed after the run passed. The estimates of coho and steelhead run sizes were based on data collected from August through mid-November. The coho and steelhead estimates reported above should be considered conservative since these species continue their spawning migration runs well past the closing of the weir.

The hatchery component of the 2000-2001 Trinity River salmonid runs was also estimated by CDFG (2002a) from returns of weir-marked and coded-wire tagged fish to the Trinity River Hatchery (TRH). The CDFG (2002a) estimated that 75.6 percent of the spring chinook above the Junction City weir and 70.1 percent of the fall chinook above the Willow Creek weir were TRH fish. Of the 26,083 spring chinook that were estimated to have passed the Junction City weir during the 2000-2001 season, approximately 4,522 contained coded-wire tags. Of these, an estimated 1,870 (41.4 percent) spring-run chinook were thought to have spawned naturally. Of the 55,473 fall-run chinook that were estimated to have passed the Willow Creek weir during the 2000-2001 season, approximately 9,168 contained coded-wire tags. Of these, an estimated 3,040 (33.2 percent) spring-run chinook were thought to have spawned naturally.

An estimated 14,993 (96.5 percent) of the 15,532 coho that passed the Willow Creek weir during 2000-2001 were TRH-produced (CDFG 2002a). Of these, an estimated 10,670 (71.2 percent) were believed to have spawned naturally. Of the 539 naturally-produced coho, 64 entered the TRH.

Information available for the upper Trinity River from 1944 through 1994 shows a decline in salmonid populations following the construction of the Lewiston dam in 1962. Pre-dam chinook salmon spawning escapement, including grilse, above the North Fork ranged from 19,000 to 67,115 with a mean of 38,154 individuals (CH2MHill 1995). Approximately 50 percent of these were believed to spawn above Lewiston. Post-dam chinook escapement was estimated to range from 5,249 to 113,007 with a mean of 27,650 fish. When adjusted for the hatchery component of in-river spawners, the numbers range from 2,551 to 54,921 with a mean of 13,465 fish (CH2MHill 1995). It appears that post-dam natural spawners declined approximately 68 percent from pre-dam levels during that period.

Chinook typically spawn in mainstem rivers and larger tributaries within the MTWAA. Halligan (1997) observed six redds and two spawned-out female chinook salmon in the mainstem Trinity River at the Big

Rock Recreation Area in 1996. In addition, redds were observed near the Willow Creek airport and Salyer during the fall of 2002 (D. Halligan pers. comm.).

Adult chinook surveys in Willow Creek begin every fall (usually in late October) and continue into early January or until flows limit surveyor access. Based on Forest Service surveys since 1991, redd counts from 1991 through 2001 ranged from 17 to 142 (Table 3-19). This would equate to an adult spawning population of 38 to 320 fish when the CDFG 2.25 fish per redd expansion factor is used. During this same period, 29 to 215 live fish and eight to 53 carcasses were observed. No coho were observed in Willow Creek during the 1991 to 2000 spawning surveys. However, a few individuals are known to spawn in the creek due to the low numbers of juveniles captured in downstream migrant traps.

Table 3-19. Spawning survey totals from 1991-2001 for Willow Creek (McSweeney 2001).

Year	# of Survey Days	Live Fish	Carcasses	Redds		Total Redds
				Natural	Artificial	
1991	4	57	29	37	21	58
1992	5	100	13	68	27	95
1993	9	74	17	15	19	34
1994	6	81	8	28	9	37
1995	5	112	13	35	21	56
1996	5	215	53	59	83	142
1997	7	138	43	71	23	94
1998	8	29	18	14	3	17
1999	9	65	31	19	11	30
2000	14	135	31	77	47	131
2001	5	180	28	34	44	78

Note: Redds found in an artificially influenced site were recorded as artificial. An artificially influenced site is one where fish habitat has been augmented to mimic natural spawning habitat (McSweeney 2001).

A downstream migrant trap has operated on lower Willow Creek, below the Highway 96 bridge, from 1991 to 1993 and again between 1995 and 2001. The first three years of operations were conducted with a pipe trap to little effect (McSweeney 2001). Beginning in 1995, a rotary screw trap was used and found to be successful (Table 3-20). In 2001, the trap was installed in late March and run through July of the year to capture both the beginning and end of the downstream migration. However, in some years a late-March installation may miss a significant portion of the run.

Figure 3-13. Fall chinook, coho, and steelhead run-sizes for the Trinity River upstream of the Willow Creek weir from 1977-2000. Spring chinook run-sizes for the Trinity River upstream of the Junction City weir from 1977-2000 (CDFG 2002a).

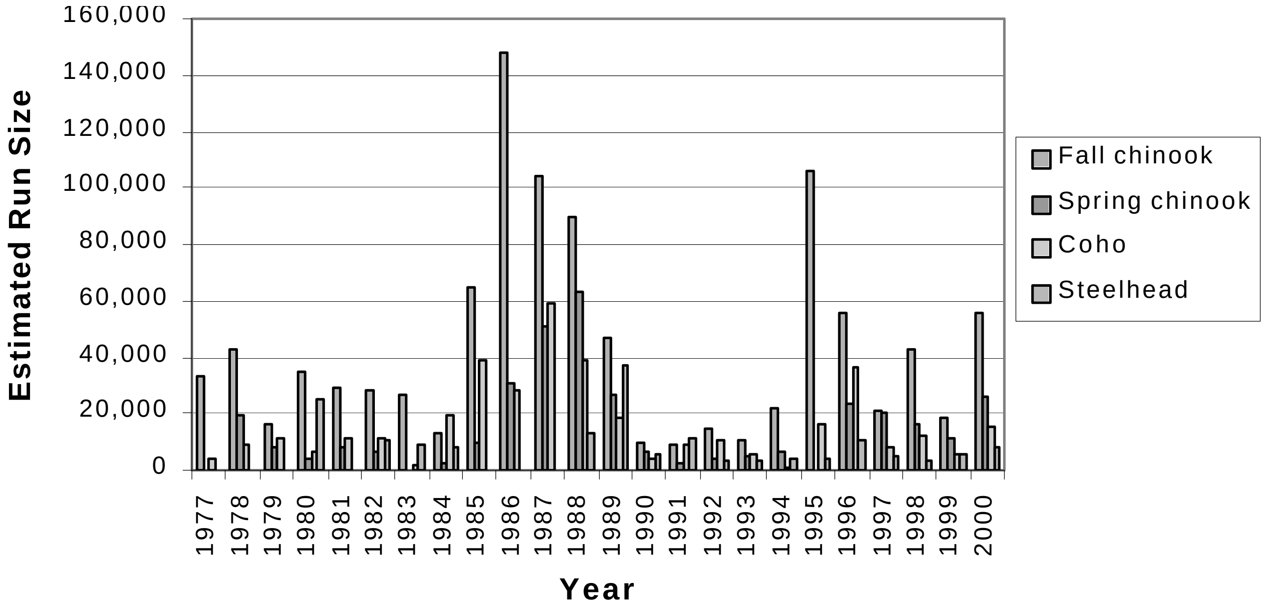


Table 3-20. Willow Creek downstream migrant trap totals (McSweeney 2001).

Species	1995	1996	1997	1998	1999	2000	2001	2002*
Caught								
Chinook	113	1,511	1,245	2,905	5,149	5,125	44,915	22,192
Mean Efficiency					28.87%	38.98%	53.78%	49.3%
Steelhead All	1,606	2,415	1,853	2,977	8,485	5,259	9,120	17,083
Age 1+ Steelhead	66	298	289	600	450	1,724	3,016	644
1+ mean efficiency						25.36%	28.06%	
Coho	12	5	0	0	4	0	57	114
Expanded								
Chinook		5,780		10,236	18,468	13,147	83,516	45,015
Age 1+ Steelhead						8,289	10,748	

* Trap was closed for 12 days. Preliminary data. Blank cells indicate no data available.

Sharber Creek is also known to have a significant salmonid population. Indeed, the Sharber Creek is unique on the Lower Trinity Ranger District in that coho are found in much greater abundance (McSweeney & Walters 2002). An instream restoration project in 2001 downstream of a private road crossing allowed greater access to upstream spawning areas by migrating adults. The survey season in the creek generally begins in December and runs through February to document the coho runs. The creek is usually inaccessible to spawning salmonids prior to the onset of winter rains. Surveys recorded between 0 and 67 redds since surveys commenced in 1996 (Table 3-21). The majority of spawning activity in the creek is believed to be by coho salmon (McSweeney & Walters 2002).

Table 3-21. Spawning survey totals from 1996-2001 for Sharber Creek (McSweeney & Walters 2002).

Year	Survey Days	Live Fish Coho	Carcasses Coho	Redds		Total Redds
				Natural	Artificial	
1996	3	52	30	39	0	39
1997	8	11	9	10	0	10
1998	11	60+1*	23+6*	44	0	44+1*
1999	6	0	0	0	0	0
2000	7	2	1	0	0	0**
2001	8	100	48	67	0	67

*Chinook ** One redd located below the survey reach, below the culvert on private land.

The CDFG conducted an electrofishing survey in three index reaches on Sharber Creek in September of 1998. Reach 1 was approximately 115 feet long and located downstream of the road culvert. Reach 2 was 107 feet long and located approximately 3,300 feet upstream of the mouth. Reach 3 was 155 feet long and located approximately 4,600 feet upstream of the confluence with the Trinity River. The survey was used to generate population estimates for juvenile coho and steelhead (Table 3-22).

Table 3-22. Catch and population estimates (95 percent confidence interval) for all Index Reaches, Sharber Creek, 1998 (CDFG 1998).

Species	Pass					Population Estimate
Index Reach 1	1	2	3	4	Total	
Coho	8	7	4	0	**19**	2 ± 1
Steelhead	29	14	7	4	**54**	44 ± 14
Index Reach 2						
Coho	62	3	NA	NA	**65**	63 ± 0.8
Steelhead	8	5	NA	NA	**13**	21 ± 31.4
Index Reach 3						
Steelhead	2	1	NA	NA	**3**	4 ± 6.8

Tributary streams that are not accessible to anadromous species, or do not provide suitable habitat, are also critical to salmonid survival. Many of these streams are small, well-shaded, and provide high quality, cool water to the Trinity River. Juvenile chinook, steelhead, coho, and many other species are often found holding in the lower reaches and/or at the confluence of these tributaries, especially from July through September.

Other fish species, such as green sturgeon and Pacific lamprey, continue to be part of the local tribal fishery. The largest spawning population of green sturgeon in California is thought to be in the Klamath River (Moyle et al. 1995). Spawning migrants penetrate the Trinity River up to about Gray Falls and larvae and juveniles have been caught in the Willow Creek trap. Adults are caught in the salmon gill net fisheries by Hupa and Yurok Tribal members. Because of its limited distribution along the west coast and our limited knowledge about this species, it is difficult to assess the population dynamics of green sturgeon found in the Trinity and Klamath Rivers. The NMFS recently completed a status review of the green sturgeon and found that listing under the ESA was not warranted; however, the USFS manages these species with extra care to prevent their becoming listed.

The population dynamics and distribution of Pacific lamprey are also poorly understood. They are known to occupy the MTWAA in both the mainstem Trinity River and its tributaries. However, there is little information regarding their relative abundance.

Natural resource development and periodic natural events have reduced some of these fish populations throughout the MTWAA and Trinity River basin. During the past 150 years, varied human impacts have lowered the capacity of many rivers like the Trinity to support anadromous salmonids. These fisheries have remained culturally important to the Hoopa and Yurok Tribes and other Tribes within the Klamath basin. These fish have made a substantial contribution to subsistence, sport, and commercial fisheries. Recently, much attention has been focused on these species declines as further described below.

- *Which fish species have been identified as being at-risk, and what are their current trends?*

Coho salmon, spring-run chinook, summer-run steelhead, and green sturgeon appear to be the species most at risk within the MTWAA. Fall chinook salmon and winter steelhead also inhabit the MTWAA and underwent status reviews by the NMFS. The NMFS determined that chinook salmon and steelhead trout in the upper Klamath Basin, including the Trinity River, did not warrant listing under the ESA. NMFS also determined that the two distinct population segments (DPS) of green sturgeon did not warrant listing as a threatened or endangered species at this time.

Coho Salmon

At present, coho salmon populations are substantially lower than historical population levels evident at the turn of the century. The southernmost populations of coho salmon occur in California where native coho stocks have declined dramatically. The severity of the decline and number of extirpated populations increases as one moves closer to the historical southern limit of the coho salmon range, indicating that freshwater habitat in these marginal environments is less able to support coho populations than in the past.

On May 6, 1997, the NMFS announced its determination to list the Southern Oregon/Northern California (SONC) coho salmon ESU as "threatened" under the ESA (62 FR 24588). The SONC coho salmon ESU occurs between Cape Blanco, Oregon and Punta Gorda, California, which includes the MTWAA. SONC coho critical habitat was designated by the NMFS on May 5, 1999.

Coho populations were historically much smaller than chinook salmon in the Trinity River (USFWS et al. 1999). Holmberg (1972 *in* USFWS et al. 1999) reported that the estimated number of coho salmon in the Trinity Basin was approximately 8,000. An average annual pre-dam spawner escapement of approximately 5,000 adult coho above Lewiston was cited by CDFG and USFWS (1956 *in* USFWS et al. 1999). After construction of the Lewiston Dam, coho in-river escapement estimates below Lewiston ranged from 460-2,100 from 1969 through 1971 (USFWS et al. 1999). Approximately 15,532 coho passed the Willow Creek weir during 2000-2001. However, 14,993 (96.5 percent) of these were TRH-produced (CDFG 2002a). Of these, an estimated 10,670 (71.2 percent) were believed to have spawned naturally. Therefore, there were only 539 naturally-produced coho upstream of the Willow Creek weir. The Willow Creek weir counts are more indicative of the success of the hatchery program than of the ability of the watershed to produce coho.

Within the MTWAA, the Forest Service has been operating a downstream juvenile migrant trap on Willow Creek from 1995 to 2002. However, the relatively short-term trapping record does not provide a very accurate trend record of coho in Willow Creek, but it does indicate the presence of coho at different life stages during certain times of the year. The trap caught an average of only 24 smolts from 1995-2002 (see Table 3-20 above).

Recovery planning efforts are underway for the SONC coho salmon ESU. A technical recovery team for coho salmon was created in October 2001. Its goal is to develop an area-based recovery plan that contains measurable criteria for determining when delisting is warranted, establish a comprehensive list of site-specific management actions necessary to achieve the plan's goal for recovery of the species, and estimate the cost and time required to carry out those actions.

Spring-run Chinook Salmon

The spring-run chinook salmon was once the most abundant race of salmon in California. By 1931, the Klamath River spring chinook population seemed to have almost disappeared, and the depletion of other salmon runs was progressing at an alarming rate (Snyder 1931). The number of spring-run chinook passing the Junction City weir between 1978 and 2000 ranged from 2,381 to 62,692 fish. However, the majority of these fish were of hatchery origin. Escapement estimates for the years 1982 through 1997 (excluding 1983 and 1995) indicated that an average of 65 percent of the in-river spawner escapement of Trinity River spring chinook salmon were hatchery-produced (USFWS et al. 1999). Approximately 76.6 percent of the spring chinook produced by the TRH spawned naturally during the 2000-2001 season (CDFG 2002a). The goal of the Trinity River Restoration Program is to have 6,000 naturally produced spring chinook. Between 1982 and 1997 only about 40 percent of that goal was achieved (USFWS et al. 1999). In the 2000-2001 season the goal was exceeded when an estimated 6,352 naturally produced spring chinook reached the spawning grounds. Many of these naturally spawning chinook were likely prodigy of hatchery strays and not necessarily native "wild" fish. In 1990, spring-run chinook salmon were designated a "sensitive species" by the Forest Service due to significant declines in escapement over the long-term. Spring chinook are not known to occupy the MTWAA except during upstream and downstream migration runs.

Summer-run Steelhead Trout

At present, the summer-run steelhead population appears on the decline. Prior to the construction of the Trinity River Diversion (TRD) project, summer steelhead populations upstream of Lewiston were estimated to average 8,000 adults (USFWS et al. 1999). In recent years, the CDFG, Forest Service, Hoopa Valley Tribe, and USFWS have conducted surveys in the Trinity River basin. Population estimates have ranged from a low of 20 fish in the South Fork to a high of 1,037 adults in the North Fork Trinity River (USFWS et al. 1999). The New River, which is at the upper end of the MTWAA, has averaged 404 adults from between 1980 and 1996. On March 16, 1995, NMFS published a proposed rule to list Klamath Mountain Province steelhead as threatened (60 FR 14253). This proposal included all steelhead populations occurring in coastal streams between Cape Blanco, Oregon and the Klamath River Basin in Oregon and California. However, NMFS determined that listing was not warranted for this ESU on April 4, 2001. The summer steelhead was listed as a "sensitive species" by the Forest Service. This species is not known to occupy the MTWAA except during upstream and downstream migration runs.

Green Sturgeon

Little is known about the North American green sturgeon. This species is thought to be one of the largest freshwater fish in the world. The ecology and life history of green sturgeon has received little study. This species spends much of its life in the marine or estuarine environment, coming into rivers mainly to spawn. They are taken incidentally in the Indian salmon gillnet fishery as they migrate upstream to spawn in the spring and again when they are returning to seaward during the summer. Green sturgeon are only known to use the Klamath-Trinity, Sacramento, and Rogue River systems as principal spawning areas. These rivers are thought to be the only spawning locations for this species in North America (Moyle 1995). However, green sturgeon have been observed for several years in the mainstem Eel River in the vicinity of Fort Seward during the summer (D. Halligan, pers comm.). They typically spawn in deep, swift waters like those found in the Trinity mainstem within the analysis area.

Catch and Catch Per Unit Effort (CPUE) data are available for the Yurok Tribal fishery for the years 1984-2001. A qualitative examination of the data suggest that catch has increased slightly overtime while CPUE has been stable or decreased slightly (NMFS 2003). However, these data are not statistically significant. The length-frequency data of harvested green sturgeon were also examined to determine if there was any evidence that harvest was affecting the size structure of the population. Although the sample size was small, there was no evidence of any trend in the available data suggesting that larger fish were being removed from the population or that the size structure of the population was being altered by this or any other fishery (NMFS 2003).

North American green sturgeon has been listed as a Forest Service sensitive species for the Klamath River Basin since 1998. On June 12, 2001, NMFS received a petition to list this species as threatened or endangered and to designate critical habitat under ESA. NMFS found that the petition presents substantial scientific information indicating that the petition was warranted and initiated a status review. As a result of the status review, NMFS, on January 23, 2003, determined that the two distinct population segments (DPS) of green sturgeon did not warrant listing as a threatened or endangered species at this time. Because of remaining uncertainties about their population structure and status, NMFS is adding both DPS to the agency's list of candidate species and will reevaluate their status in five years, provided that sufficient new information becomes available indicating that a status review update is warranted.

In 2002, the USFWS, in cooperation with the CDFG, and the Yurok, Hoopa, and Karuk Tribes began a green sturgeon research project on the Klamath River and associated tributaries (T. Shaw, pers. comm.). The overall objective of the study is to learn more about green sturgeon habitat use so that survival and spawning success can be better described. Final results of the study are expected to be available in 2004.

Pacific Lamprey

The population dynamics and distribution of Pacific lamprey are poorly understood. They are known to occupy the MTWAA in both the mainstem Trinity River and its tributaries. However, there is little information regarding its relative abundance. Adult lamprey are relatively strong swimmers and are able to surmount obstacles such as cascades and small dams by incrementally using their suctoral disk. Spawning adults dig a shallow nest of 21-23 inches (533-584 mm) in diameter with body movements and by moving stones with the suctoral disc. The female attaches to a rock and orients across the nest; the male carries out a type of prespawning courting called "gliding-feeling" by moving or rubbing along the body of the female posterior to anterior with slight contact of the disc. When the male reaches the head of the female he attaches to it, coils around the female, eggs and sperm are emitted together, and the fertilized eggs fall to the nest. The eggs are adhesive for 2 hours and cling to stones in the nest. The adults do not migrate downstream and usually die 1-14 days after spawning (Scott and Crossman 1973).

On January 28, 2003, a petition to list this species was filed with the USFWS by 11 conservation organizations. The petition lists a number of causes including dam construction, water diversions, habitat degradation, channelization, and streambed scour.

- *Which subwatersheds in the analysis area are critical for the maintenance, protection and restoration of at-risk species?*

In addition to the mainstem Trinity River, it appears that just about every perennial stream that flows into the Trinity River is critical for the maintenance, protection, and restoration of at-risk species. However, only two subwatersheds, Willow Creek and Sharber Creek, contain significant populations of anadromous salmonids. Willow Creek has approximately 14 miles of anadromous habitat and produces a significant number of juvenile chinook and steelhead. Sharber Creek has only 1.2 miles of anadromous habitat, but it contains the largest spawning population of coho salmon in the MTWAA. Due to the severe decline in coho population throughout the ESU, any watercourse that is capable of sustaining its coho population is critical to the maintenance, protection, and restoration of the species. In addition, the non-fishbearing perennial watercourses provide cool water refugia at their mouths that may become critical for juvenile salmonids and holding adults as mainstem water temperatures rise. These smaller tributaries may also contribute coarse or fine particulate organic matter, which helps aquatic macroinvertebrate production and ultimately food availability for fish.

Factors Influencing Essential Fish Habitat

- *What physical and environmental factors have the most influence on the quality and distribution of essential fish habitat for species-at-risk?*
- *What have been the natural and human causes of change between the historic distribution and abundance of at-risk species and their current distribution and abundance in the analysis area?*

Essential Fish Habitat (EFH) for coho and chinook salmon was designated by the NMFS under the Magnuson-Stevens Act. EFH means those waters and substrate *necessary* to fish for spawning, breeding, feeding, or growth to maturity (Magnuson-Stevens Act, 16 U.S.C. 1801 et seq). "Necessary" means the habitat required to support a sustainable fishery and the managed-species contribution to a healthy ecosystem (EFH Interim Final Rule, 62 FR 66531). The Forest Service must consult with the NMFS on projects that may affect EFH. EFH has not been designated for summer steelhead and green sturgeon, although they are considered species-at-risk. This section is organized to provide important information on the main factors that influence EFH and subsequently affect fish populations and their distribution.

Despite hatchery programs, habitat restoration efforts, and increasingly restrictive fishing regulations, salmon and steelhead populations have suffered a general decline in the last few decades. The causes of fish declines in the Trinity Basin are complex and probably interactive. The decline of these fish species can be attributed to a variety of factors including dam construction, intensive timber harvest, road construction, mining, and stream habitat alterations. Other important but often overlooked factors include climatic change, large flood events, droughts, El Niño, fires, changes in water quality and temperature, introduced species, reduced genetic integrity from hatchery production, predation, disease, and poaching.

Some of the most significant factors affecting the quality and distribution of EFH within the MTWAA are attributed to logging, road construction, the TRD, mining, and natural events such as the 1964 flood. These activities and events have also significantly altered riparian areas throughout the MTWAA, which also affects instream habitat (See *Riparian* Section).

Logging

Over the years, many publications have been produced that have documented the effects of logging practices on fisheries habitat (Ziemer 1998, Meehan 1991, Bisson et al. 1987, Burns 1972). Although any harvesting system may have some negative habitat impact, the extent to which each type of harvest affects fisheries habitat depends considerably on the choice of equipment, layout of the harvest unit, and mode of operation. Harvest systems include tractor, high-lead cable, skyline, and helicopters. Roads can account for a sizeable portion of erosion and resource damage as previously described. Past harvesting in riparian areas also contributed to sediment delivery and reduction in the amount of large woody debris in some stream channels. Laws currently regulate timber harvest activities on Federal lands and many policies have changed over the past 45 years to protect aquatic resources. See the *Vegetation* section for a discussion of harvest histories and affected acreages.

Juvenile and adult salmonids can be adversely affected by forest management activities through a variety of ways. Although direct effects on fish populations are uncommon, indirect effects on aquatic habitat can still occur. Indirect effects may include, but are not limited to, changes in water temperature resulting from reductions in stream shading; increased sedimentation resulting from increased erosion; reduced recruitment of LWD; alteration of flow patterns resulting from changes in runoff characteristics; and changes in stream channel geomorphology. These inputs significantly affect water quality, spawning and rearing habitat quantity and quality, over-winter survival and high flow refugia, cover from predators, and habitat formation and stability.

The Forest Service has designated IRR on Forest System lands that are adjacent to streams as well as in unstable or potentially unstable areas, where special standards and guidelines direct land use. According to the Aquatic Conservation Strategy of the Northwest Forest Plan, management activities within riparian areas that do not maintain the existing condition or lead to improved conditions in the long term are not implemented. Riparian reserve boundaries are based on site-specific review and analysis by an interdisciplinary resource team. Riparian buffers on private land are based on slope and stream classification characteristics as described in the California Forest Practice Rules.

Roads

The MTWAA has an extensive forest road network of approximately 342 miles, of which 166 are on Forest Service land (See *Transportation System* section). An Access and Travel Management Plan (ATM) was developed for lands on the Lower Trinity River Ranger District in 1998 that included implementation plans for road restoration and upgrading. Extensive road inventories on Forest Service land were conducted throughout the analysis area to address the current conditions of the transportation system and determine what opportunities existed for road restoration and upgrading.

Approximately 112 miles of Forest Service roads within the analysis area are classified as Maintenance Level 1 and 2. Maintenance Level 1 roads are typically closed to vehicular traffic but remain on the Forest transportation system for possible future use. These roads are generally hydrologically maintenance free with pipes removed and outsloped. Maintenance Level 2 roads are open for use by high clearance vehicles. With the reduction in timber harvest, road maintenance activities, especially on Maintenance Level 2 roads, have declined dramatically. Minimal maintenance is done to protect the road investment and minimize damage to adjacent land and resources. As maintenance activities continue to decline, the potential for erosion, sediment delivery to streams, and road-related resource damage will likely increase. Approximately 134 miles of road in the MTWAA are on private land and the Hoopa Valley Indian Reservation. It is likely that these private and Tribal roads have variable maintenance activities and some are contributing sediment to area watercourses.

Highway 299 runs along most of Willow Creek's mainstem. This highway is a significant contributor of road-related sediment to the creek. Landslides are present in several areas above and below the road. Inboard ditches direct sediment-laden water during runoff events from the toe of the cutbanks into cross-drains that empty onto the highway fillslope prior to entering the creek. Some of the cutbanks experience sheet erosion during rainstorms due to a lack of vegetation on their surfaces. Inputs of these sediments (mostly fine sediment) adversely affect spawning habitat quality. The highway also contributes to stream heating due to the relatively low amount of vegetation along its right-of-way where it crosses tributary streams and comes close to Willow Creek. Large amounts of vegetation along this corridor were removed or severely altered prior to 1960 and during upgrade construction, which has had lasting effects on existing riparian stands.

Poor road design, location, construction, and maintenance can cause mass soil movement, surface erosion, gullies, and stream bank erosion. Sediment from these processes can, and does, enter area watercourses and adversely affect essential fish habitat. In the absence of timely road maintenance, minor road problems can become more damaging and may persist for decades. Roads in certain areas may have a higher priority for treatment, and ongoing analysis is needed to determine the extent of actual effects. Road maintenance and restoration projects to treat these problems need to continue to focus on watersheds with valuable fisheries resources.

Trinity River Diversion and Lewiston Dam (TRD)

Much of the management of Trinity River fisheries resources are largely influenced by decisions made off the Forest by the Bureau of Reclamation, the agency that is responsible for management of the TRD project that includes the Trinity and Lewiston Dams. Streamflow in the river is regulated at Trinity Reservoir that has a storage capacity of 2.4 million acre-feet (McBain & Trush 1997). Immediately downstream of the Trinity Dam is Lewiston reservoir, a relatively small re-regulation impoundment that serves as the diversion point of Trinity River water to the Central Valley Project. Approximately 70 percent of the Trinity River flow is diverted out of the basin and sent to supply water for agricultural and urban users.

The uppermost section of the mainstem Trinity River in the MTWAA, near river mile 43, lies approximately 69 miles below Lewiston Dam, near river mile (RM) 112 from the confluence of the Trinity River with the Klamath River, which was constructed in 1960. In this MTWAA, the section from RM 43 down to RM 31, where the South Fork Trinity River (an approximate 1,000 square mile drainage area) enters the mainstem, is the most affected by the flow regulation from Lewiston Dam. Table 3-23 below shows the differences in mainstem Trinity River flow between the USGS Burnt Ranch gage (#11527000), approximately eight river miles upstream of the MTWAA boundary, and the USGS Hoopa gage (#11530000), at the downstream end of the MTWAA, which also includes the South Fork Trinity flow contribution. For a short period (1961-1974), Willow Creek had a USGS gage (#11539800). The data for that gage are also included in Table 3-23.

Dam regulation changes the natural flow regime of rivers both in terms of timing of flows and volume of flows. Additionally, dams can affect the temperature regimes on a river depending on where the release from the reservoir is drawn. Lewiston Dam regulation reduces the highest peak-flows seen on the Trinity River and generally increases the lowest summer and fall flows that would have occurred under a natural condition.

Table 3-23. Gage data for the Mainstem Trinity Watershed Analysis Area (from U.S. Geological Survey data).

Gage (approximate drainage area above gage)	Number of Records	Highest Peak-flow (year)	Approximate 2-year Peak-flow
Burnt Ranch pre-1960 (1,439 sq. mi)	13	172,000 cfs (1955)	31,000 cfs
Burnt Ranch post-1960 (1,439 sq. mi)	42	78,100 cfs (1964)	15,000 cfs
Hoopa pre-1960 (2,853 sq. mi)	33	190,000 cfs (1955)	63,000 cfs
Hoopa post-1960 (2,853 sq. mi)	42	231,000 cfs (1964)	49,000 cfs
Willow Creek (41 sq. mi)	15	17,000 cfs (1964)	4,000 cfs

Following construction of the dams, a noticeable decrease in salmonid populations was observed (USFWS & HVT 1999). It was estimated that an approximately 80 percent decline in chinook salmon populations and a 60 percent decrease in steelhead populations occurred by 1980 following the commencement of the diversion (USFWS and HVT 1999). In addition, the operation of the TRD altered the hydrologic regime, which subsequently affected sediment transport, stream morphology, riparian vegetation, and salmonid habitat (McBain & Trush 1997). The TRD affected essential fish habitat in the Trinity River by eliminating bedload transport from 719 square miles upstream of Lewiston Dam (blocking access to more than 100 miles of spawning and rearing grounds) and diverting flow to the Sacramento River Basin (USFWS and HVT 1999). A hatchery was built at Lewiston to mitigate for loss of anadromous salmonid habitat upstream due to dam construction. The hatchery produces spring and fall chinook, coho, and steelhead. However, a significant portion of the hatchery-produced fish stray and spawn with the naturally-produced fish in the river and tributaries below the dam. These hatchery-produced fish compete with the natural fish for the available spawning and rearing habitat.

It appears that some of the effects of the TRD on essential fish habitat in the MTWAA may be ameliorated somewhat by the unregulated contributions of the North and South Forks of the Trinity River, New River, and other tributaries downstream of the Lewiston Dam. For example, the pre- and post-TRD flood magnitudes at the Hoopa gaging station show little difference. The 1.5-year flood discharge prior to and following completion of the TRD was 39,000 cfs and 42,000 cfs respectively. The 10-year flood discharge was 118,000 cfs prior to the TRD and 114,000 cfs after completion of the dam (USFWS & HVT 1999). High flows are necessary for creation and maintenance of fish habitat in the bedrock-controlled mainstem Trinity River within the MTWAA. Average summer low flows at Hoopa in August have increased from a pre-dam discharge of 653 to 739 cfs following completion and 512 to 646 cfs in September (Table 3-24). However, post-TRD April through June flows decreased by 35 to 45 percent from the pre-project levels (Table 3-24). High spring flows assist in the downstream smolting migration of juvenile salmonids. Reduced flows during this period may slow the migration, delay their entry into the estuary, and subject the smolts to higher water temperatures in the early summer.

Table 3-24. Average monthly flows at the Hoopa gaging station prior to and following completion of the Trinity River Diversion (TRD). Period of Record: 1911-2001.

Month	Pre-TRD (cfs)	Post-TRD (cfs)	Month	Pre-TRD (cfs)	Post-TRD (cfs)
January	10,105	9,942	July	1,674	1,227
February	12,344	10,251	August	657	739
March	10,766	9,998	September	485	646
April	10,564	6,901	October	988	894
May	8,634	4,777	November	2,683	2,979
June	4,756	2,829	December	7,107	6,848

Water Quantity and Quality

The Forest Service has issued 43 water withdrawal permits within the MTWAA. In addition, there are at least 25 other non-permitted water systems within the MTWAA (See *Water Quality* section). The amount of impact to EFH is dependent on the amount and location of the withdrawal. For example, a small collection box and storage system on an upslope spring would have little or no impact on EFH in the anadromous tributaries or mainstem Trinity. By contrast, the Campbell Creek diversion, which supplies much of the west-side Hoopa Valley water, can significantly affect EFH when surface flows are decreased by the withdrawal. The reduction in surface and subsurface flow in tributaries can reduce the amount of cool water refugia at their confluence with the Trinity River. The effects on EFH can increase during dry water years.

Mining

Many of the communities in the Trinity River Basin owe their origin to the gold mining boom of the middle 1800's. The towns of Junction City and Weaverville were located near the largest gold mining sites of the period. Gold was first discovered in 1848 at Redding Bar near Douglas City. With the establishment of supply centers at Union (Arcata) and Trinidad, the lower Trinity was opened to California's 19^{th} century argonauts. New River Camp, China Flat, and the river bars and flats drew miners by the hundreds. The first watershed impacts resulted from mining activities, including diversion of streams, sedimentation, dewatering of the riverbed, and rearrangement of banks and channels from hydraulic operations.

Hydraulic mining of terrace gravel occurred at the confluence of the South Fork and mainstem Trinity River between 1930 and 1941, closed during World War II, and reopened for a year in 1948. Hydraulic mines were also located at Sugar Bowl and Clover Flat during the late 1890's and early 1900's. Numerous small placer operations were located along the mainstem Willow Creek and Three Creeks in the late 1880's. Copper mining did take place at the Horse Mountain mine during the late 1950's and early 1960's but did not prove profitable. Erosion from this mine has been a problem, but steps were taken to stabilize areas both upslope and downslope of the mine site. See the *Heritage Resources* section for additional information on historic mining activity.

Today, gold mining activities are conducted on a much smaller scale in the Trinity River basin. The primary extraction method has now become small, portable suction dredges. Water and gravel are sucked up from the bottom and fed over a baffled sluice box where the gold is deposited. The gravel tailings are deposited back onto the bottom downstream of the dredge. The dredging activity results in an increase in turbidity, siltation of downstream gravel beds, and destabilization of the worked substrate. Suction dredge permits are issued by the CDFG. On federal lands, the Forest Service requires each suction dredger to obtain a CDFG permit and file a "notice of intent" and "plan of operation." A maximum of six plans of operation can be approved in the MTWAA with no more than one dredge per 1/3 mile. The designated suction mining reach is between the South Fork Trinity River and the New River.

Instream gravel extraction operations are present within the MTWAA in the vicinity of Willow Creek and on the Hoopa Valley Indian Reservation. Extraction occurs by skimming dry gravel bars and trench excavation during the summer low flow season. Elevational, edge of water, and riparian and streambank buffers are maintained to avoid or minimize impacts to the low flow channel, riparian vegetation, and bar stability. Extraction volumes and plans are based on the amount of gravel recruited during the previous winter flows. All extraction activities on private land are permitted by the Army Corps of Engineers (ACOE) following consultation with the NMFS, CDFG, Regional Water Quality Control Board, and County of Humboldt. Extraction activities on federal or Tribal land are permitted by the ACOE and Forest Service (if applicable), with consultation by NMFS. Channel and habitat monitoring is conducted based on protocols described in the permit conditions.

Between 1997-2001 the number of acres subject to gravel extraction operations have been as follows: 9.5 acres in 1997; 7.3 acres in 1998; 5 acres in 1999; and 4.2 acres in 2000. The operation also includes a processing plant adjacent to the Trinity River. The total maximum annual permitted volume is 40,000 cubic yards (y^3) of sand and gravel. However, between 1998 and 2000 an annual average of 27,961 y^3 were extracted. Lehre (1993) estimated a range of mean annual recruitment of 250,000-400,000 y^3, with 400,000 y^3 being a ceiling. The Federal Emergency Management Agency (FEMA) conducted a flood insurance study for Humboldt County in 1982. Part of this study included a longitudinal profile and cross-sections taken at the Willow Creek site. The FEMA information was compared to Mercer-Fraser monitoring cross-sections taken from 1993-1998, as well as a longitudinal profile conducted in 1996, and results showed that the bed of the Trinity River at the points surveyed in 1980 had aggraded an average of 10 feet in the 18-year period of time (Mercer-Fraser 1999).

The mainstem Trinity River within the MTWAA is contained within a stable channel that is hydraulically controlled by bedrock. In addition, gravel bars in the mainstem are scoured on an annual, or more frequent basis, by high flows that result in little vegetation being established (See *Riparian* section). The low level of extraction volume as compared to bedload volume, established mitigation measures, season of extraction restrictions, lack of natural vegetation, and bedrock-controlled channel minimize the amount of impact these operations may have on the low flow channel. However, it is likely that there is a loss of high flow habitat during the winter period on the extraction surface due to the removal of cobble armor that may provide velocity refugia and edgewater habitat.

Natural Events

The 1964 flood was probably the most significant event to affect EFH in the MTWAA in the last 100 years. The rain-on-snow storm that occurred in late-December 1964 unleashed a 100-year flood event that widened and aggraded stream channels, triggered landslides, and destroyed riparian vegetation. The effects of the flood can still be seen today along many of the MTWAA watercourses where the toes of slopes were destabilized, triggering landslides. Large woody debris recruitment potential was severely reduced by timber harvesting on private land that removed most of the standing conifers in plan areas, including those along creeks and on unstable slopes. Therefore, landslides that were triggered by the floods probably did not deliver much LWD to the stream channels. The reduction in LWD contributed to a decrease in salmonid rearing habitat complexity, sediment storage, and routing.

A number of large natural landslides are present along many of the area watercourses, including Willow Creek. These landslides are a chronic source of fine sediment that adversely affects spawning habitat quality. The unstable nature of the slides prevents significant riparian vegetation development. The low level of riparian vegetation in these locations along with the sediment input results in elevated water temperatures that can affect rearing habitat quality.

Aquatic Habitat – Reference and Current Conditions

The distribution and relative abundance of these at-risk fish species were previously described above in the *Fisheries – Current Conditions* section. This section will primarily focus on describing historic and current habitat conditions within the mainstem of the Trinity River and other small tributary watersheds in the MTWAA. Historical data are limited, and some inferences are made based on current information.

Trinity River Mainstem

The Trinity River mainstem provides approximately 30 miles of anadromous fish habitat within the analysis area between Hoopa and the New River. Spring-run chinook, coho, green sturgeon, and summer-run steelhead are all considered to be species-at-risk that inhabit some of this mixed anadromous habitat. The quality and quantity of this mainstem fisheries habitat is one of the most important factors affecting these species-at-risk.

Only generalizations can be made regarding what fish habitat conditions were like within the Trinity River prior to the 1800's. The Trinity River was still wild, and its flow was uncontrolled. The annual hydrograph likely peaked during the winter months due to storm runoff and during the spring due to snowmelt. High flows likely scoured the channel and floodplain, preventing establishment of large areas of mature riparian vegetation. Willows were predominant near the channel. Large woody debris was not abundant in the river system. Seasonal floods mobilized the channel bottom and maintained pools and large alternate river bars that were used by local Native Americans. The Hupa and Yurok people inhabited villages along the mainstem, and seasonal burning occurred to aid with production of food crops and resources from surrounding areas. Riparian vegetation in certain areas along the river corridor was more open and dominated by hardwood stands. Steeper slopes were well vegetated.

Large floods were documented in 1861-1862 in the Trinity River sub-basin. Flood events were also recorded in 1890, 1915, 1955, 1964, and 1974. Some of these natural events triggered widespread landslide episodes that were exacerbated by the land management and mining practices of the time. Large amounts of sediment were transported during some of these floods, especially during the mining period. Dramatic changes to the riparian corridor and river channel occurred.

Floods and low flows generally had beneficial effects on fisheries. Floods helped maintain habitat diversity, while low flows allowed for recolonization by macroinvertebrates. Adult migration and juvenile outmigration were triggered by changes in flows along with other seasonal fluctuations.

Recent fisheries habitat data were collected within the MTWAA on the mainstem Trinity River by Halligan (2000). Approximately 2,250 feet of main channel, about 1.5 miles downstream of the South Fork Trinity River in the vicinity of the McKnight Bar, was habitat-mapped on August 28, 2000. The habitat units within this reach consisted of two corner pools, a bedrock scour pool, two low gradient riffles, a high gradient riffle, a run, and a glide.

The primary habitat units within the survey reach were pools, which made up 1,300 feet (58 percent) of the total length. Small cobble was the dominant substrate with lesser amounts of cobble and sand present. The mean and maximum depths averaged 8 ft and 15+ ft respectively. Depth at pooltail crest ranged from 2.5 ft to 3 ft. The mean lengths and widths of these units were 433 ft and 78 ft, respectively. There was a total of 11,900 ft^2 of structural complexity area within these units. The majority of the complexity came from substrate (bedrock ledges and boulders) and bubble curtains. Substrate embeddedness averaged less than 25 percent and appeared suitable for spawning. The left bank (looking downstream) was made up primarily of very sparsely vegetated sand and gravel. The right bank composition was made up of bedrock or boulders and was moderately (20-60 percent) vegetated with brush.

Low and high gradient riffles were the second most common habitat type present in the survey reach, making up 620 feet (27.5 percent) of the reach length. Large cobble was the dominant substrate with small cobble being subdominant. The mean and maximum depths averaged 1 ft and 2 ft, respectively. The mean lengths and widths of these units were 207 ft and 80 ft, respectively. Other than the cobble substrate, there was no measurable structural complexity within these units. However, there was a total of 18,576 ft^2 of instream cover. The majority of the cover came from bubble curtains. The left bank was made up primarily of sand and gravel with little or no vegetation. The right bank composition was made up of lightly vegetated sand and gravel.

Flatwaters (run and glide) made up 330 ft (14.5 percent) of the reach length. The substrate varied from large cobble to gravel in these units. The mean and maximum depths were 2.5 ft and 4.5 ft, respectively. The mean lengths and widths of these units were 165 ft and 80 ft, respectively. There was a total of 3,520 ft^2 of structural complexity area within these units. The complexity came primarily from boulders. The left bank was made up primarily of sand and gravel with little or no vegetation. The right bank composition was made up of bedrock or boulders and was lightly (15-20 percent) vegetated with brush.

Jensen (2000) mapped a total of 6,550 feet of main channel and 2,250 feet of side channel habitat within and downstream of the Big Rock Recreational Area at Willow Creek during the summer of 1999. The habitat units within this reach consisted of one flatwater, two side channels, two lateral scour pools, one corner pool, and four turbulent riffles.

Pools were the most common habitat type present in the survey reach, making up 39 percent of the monitoring reach length, not counting side channel and edgewater lengths, for a total length of 2,525 feet. Cobble was the dominant substrate with lesser amounts of gravel and sand present. The mean and maximum depths were 8.6 ft and >20 ft, respectively. The mean lengths and widths of these units were 841 ft and 136 ft, respectively. There was a total of 15,325 ft^2 of structural complexity area within these units. The complexity came from a variety of structure types including depth, large woody debris, and boulders. Substrate embeddedness ranged from 50-75 percent, and spawning habitat for anadromous salmonids was present.

Runs made up 38 percent of the monitoring reach length, not counting side channel and edgewater lengths, for a total length of 2,500 feet. Cobble is the dominant substrate with lesser amounts of boulders and gravel present. The mean and maximum depths are 4 ft and 7 ft, respectively. The mean lengths and widths of these units are 2,500 ft and 200 ft, respectively. There was no measurable structural complexity area within this unit.

Riffles made up 23 percent of the monitoring reach length, not counting side channel and edgewater lengths, for a total of 1,525 feet. Cobble was the dominant substrate with lesser amounts of gravel and sand present. The mean and maximum depths were 2.5 ft and 6 ft, respectively. The mean lengths and widths of these units were 381 ft and 162 ft, respectively. There was no measurable structural complexity within these units.

There were two side channels, which had a total length of 2,250 ft, making up 26 percent of the entire survey reach length. The dominant substrate was cobble with a lesser amount of gravel. Edgewater habitat was present along the stream margins throughout the survey reach and supplied rearing habitat for herpetiles and juvenile fish species.

Side channels and marginal slack water are extremely important for coho during early stages of their development. For example, coho fry and juveniles rear in the Trinity River from March to June. Fry usually swim close to the edge or hold in side channels to seek cover. Marginal slack waters are particularly important since the weak swimming abilities for young-of-year coho make prey items in the midstream taxing to obtain. As these fish continue to develop, they tend to move out into higher velocity water. Coho typically rear in this riverine environment for one year before emigrating to the ocean.

Spring-run chinook generally enter the Trinity River around March. Migrating adults tend to hold in deeper pools as they migrate upriver into the South Fork Trinity and New River before spawning in the early fall. Pools that are greater than 10 feet deep provide essential habitat. Green sturgeon also utilize deep pool habitat for holding and spawning.

Tributaries to the Mainstem

Approximately 16.3 miles are considered suitable by chinook, coho, and steelhead for spawning and rearing. The majority of the anadromous habitat (14 miles) is found in Willow Creek, with Sharber Creek (1.2 miles), Campbell Creek (1 mile), and Hawkins Creek (0.1 mile) containing the remainder. Anadromous fish habitat is limited within the smaller tributaries of the MTWAA.

Willow Creek and Tributaries

There are no historical stream or watershed surveys for the Willow Creek drainage prior to 1973 when the East Fork was surveyed for the first time. Therefore, information on historic conditions was based on aerial photographs. The 1942 aerial photos of the Willow Creek drainage revealed dense riparian cover on Forest Service land with limited harvest activities occurring on private land. A few roads were present, but no erosional impacts associated with these roads were evident. Many large conifers were noticeable along the channels. The extent and density of riparian cover and the absence of management suggest that ambient conditions in riparian areas probably helped provide good habitat for aquatic species. Likewise, summer stream temperatures were probably at the low end of their historic range.

The current condition of riparian and aquatic habitats in the Willow Creek watershed has varied greatly since 1942, primarily as a result of channel changes caused by mass wasting and sedimentation during major flood but also by human disturbance of the landscape.

Sequential aerial photos (1960, 1975, 1998) reveal extensive riparian corridor and stream channel changes. By 1960, extensive private land logging was underway that extended down to the creeks and used primarily tractor yarding. Logging on Forest Service land commenced between 1960 and 1975 using primarily clear-cut silviculture and cable yarding with riparian buffers. By 1975, the effects of the 1964 flood were still evident. Substantial channel widening and opening of riparian canopies had occurred, and much of the mainstem had become aggraded by landslide debris. For example, the lower East Fork exhibited channel widening and a significant loss of conifers along the watercourse. In the mainstem, downstream of the East Fork, substantial aggradation was visible. By 1998, riparian canopy had returned but was dominated by hardwood trees. Conifers had yet to become established.

A mainstem Willow Creek general descriptive survey was conducted in 1981 (Kaufman 1981). The upstream-most reach of the stream was confined in a steep canyon with 100 percent side slopes, 10 percent average gradient, boulder roughs, and 90 percent canopy closure. The mid-reach, which included the mouth of the East Fork, was confined between 2-5 percent gradient, was riffle dominated, and had about 60 percent canopy closure and good fish habitat. The third reach contained boulder roughs with side slopes of 60-100 percent, a 6 percent gradient, and 30 percent canopy closure. The lowest reach flows through a broad sloping plain with an average gradient of 1 percent and low canopy closure (15-20 percent). The lowest reach contains habitat for coho, chinook, and steelhead.

The first habitat inventory was conducted in Willow Creek in 1987 by the Forest Service. Approximately 6.7 miles of stream was surveyed. The dominant habitat types as expressed by percentage of total length were as follows: low gradient riffles – 28 percent; high gradient riffles – 15 percent; cascades – 12 percent; mid-channel pools – 11 percent; various other scour pools – 10 percent; and runs – 16 percent. The findings suggested that pool and edgewater habitat for chinook and coho salmon may have been a limiting factor (Dale & LeBlanc 1992).

Another habitat survey was conducted in 1991 between the mouth of Willow Creek and the East Fork using the McCain et al. (1990) methodology. The dominant habitat types as expressed by percentage of total length were as follows: low gradient riffles – 16 percent; high gradient riffles – 18 percent; cascades – 4.5 percent; mid-channel pools – 10 percent; various other scour pools – 19 percent; runs and step runs – 28 percent; glides – 3.5 percent; and others – 0.5 percent. The conclusions were that Willow Creek was a high gradient, riffle/run dominated watercourse dominated by boulders; cover and shade were limiting factors for salmonid production with only 21 percent of the stream area providing adequate cover; and less than 40 percent of the habitat was shaded by riparian vegetation (Dale & LeBlanc 1992).

The Forest Service has been conducting barrier modification, habitat enhancement, and slide stabilization projects in the Willow Creek drainage since 1985. Between 1985 and 1989, nine barrier sites were blasted between Boise and Brannan Creeks to improve steelhead access to 12 miles of anadromous habitat upstream. Between 1986 and 2001, approximately 19 large woody debris and 28 boulder structures were placed in the creek to improve spawning and rearing habitat. Approximately 45 acres of erosive surfaces and slides were revegetated between 1989 and 1999.

An instream habitat inventory was conducted in 1989 on the East Fork Willow Creek from its mouth to the confluence with Horse Mountain Creek. The major findings of this survey were as follows: 1) the creek is dominated by riffle and run habitat – approximately 80 percent of the habitats fall into these groupings; 2) the substrate was dominated by boulders and cobbles – over 70 percent of the substrate fell into these groupings; and 3) mid-channel pools were the most common pool type comprising about half of the pools surveyed and 10 percent of the total survey length (Dale & LeBlanc 1992).

The lower 2.4 miles of Three Creeks was last surveyed in 1978. The reach of Three Creeks between Summit Creek and 0.6 miles downstream was characterized by broad slow runs and deeper pools (no depth given). The average stream depth was about 1 foot. Riparian vegetation was patchy in places with about 40 percent closure overall. Bank instability was noted. The gravel was pea-sized and substantial sand was present in the slower water areas. The lower section that extended to the mouth was characterized by shallow pools, a gradual gradient resulting in slow flow, and broad, shallow runs. Riparian vegetation cover was moderate to dense, and shade canopy was estimated to be 40 percent. The streambank was stable with one large slide contributing sand and silt to the creek. The stream bottom composition was largely rubble, gravel, and sand. No barriers were observed. Water temperature was 54°F at 1600 hours. Overall fish habitat was rated as fair, and production was limited by the lack of instream cover and good gravel (Moreau & Dickson 1978).

Campbell Creek

Hoopa Tribal Fisheries Department (1994) conducted an assessment of four reaches in Campbell Creek. The survey length that corresponded with the anadromous zone was approximately 1 mile. The Hoopa Tribe has installed several fish enhancement structures downstream of Forest Service lands.

Reach 1 started at the mouth of the creek and extended approximately 1,490 feet upstream. The channel was moderately entrenched and generally unconfined with an average gradient of 2 percent. Dominant substrates were gravel and sand. The riparian vegetation was well established with an overstory canopy closure of 99 percent. The presence of large woody debris was relatively low. Habitat types were typically pocket waters and step runs. Deep pools were relatively rare. This was a formerly bedrock-influenced channel that aggraded with sand and gravel. The lower portion of the reach was an alluvial fan that impeded escapement from the river into the stream.

Reach 2 was approximately 800 ft long. The channel was fairly well entrenched and unconfined with an average gradient of 4 percent. Dominant substrates were cobble and boulder. The riparian vegetation was fairly well established with an overstory canopy closure of 70 percent. Large wood was relatively common. The habitat types were generally runs and pocketwaters. Deep pools were relatively rare. Shallow pool depths provide little rearing habitat.

Reach 3 was about 1,085 ft long with an average gradient of 1 percent. The channel was not well entrenched or confined. Dominant substrates were cobble and boulder. The riparian vegetation was well established with an overstory canopy closure of 100 percent. Large wood was relatively high. The habitat types were generally runs and low gradient riffles. Deep pools were relatively rare. The channel was highly aggraded with flood terraces and center bars of mainly gravel, sand, and fines.

Reach 4 was about 1,105 feet long with an average gradient of 6 percent. The channel was moderately entrenched and well confined. Dominant substrates were cobble and boulder. The riparian vegetation was well established with an overstory canopy closure of 100 percent. Large wood was relatively low.

The habitat types were generally cascades and plunge pools. Deep pools were relatively numerous. A set of bedrock falls is located at the upper end of this reach and represents the end of anadromy. Resident trout only are present for about three miles upstream of the anadromous barrier.

Sharber Creek

The CDFG conducted an electrofishing survey in three index reaches on Sharber Creek in September of 1998. Reach 1 was approximately 115 feet long and located downstream of the road culvert. Reach 2 was 107 feet long and located approximately 3,300 feet upstream of the mouth. Reach 3 was 155 feet long and located approximately 4,600 feet upstream of the confluence with the Trinity River. During the course of the survey, general habitat data were collected and summarized (Table 3-25).

Table 3-25. Physical habitat characteristics of Sharber Creek index reaches, 1998 (CDFG 1998).

	Percent Composition for Level II Habitat Types		
	Riffles	Flatwaters	Pools
Index Reach 1			
Surface Area	28.8	16	55
Instream Cover	20	13	13
Shade Canopy	75	63	55
Index Reach 2			
Surface Area	14.5	29.5	56
Instream Cover	20	40	23
Shade Canopy	80	70	87
Index Reach 3			
Surface Area	67	NA	32.9
Instream Cover	10	NA	12
Shade Canopy	90	NA	92

A culvert located on private land, approximately 450 feet upstream of the mouth of the creek, has been variably passable for salmonids due to shallow pool depth, high jump-height from pool to culvert mouth, and high water velocities through the culvert (McSweeney & Walters 2002). In 2001, the Forest Service installed a series of three back flood weirs that deepened the jump pool and lowered the jump height to facilitate salmonid passage through the culvert.

Hawkins Creek

Hawkins Creek was last surveyed by the Forest Service in 1978. At that time only the lower 600 feet of stream was considered accessible to anadromous salmonids due to the Hawkins Bar Road double culvert, located on private land. The culverts are 4 feet in diameter and have 6-foot drops into a 3-foot deep pool. The reach of creek downstream of the culverts had a moderate to steep gradient and rapid flow from one shallow pool to the next. A number of cascades were observed. The bottom composition was primarily rubble and rocks. Concrete was used to fortify a streambank about 100 feet upstream of the mouth, creating a 3-foot wide chute that may be a velocity barrier at higher flows. The lowest 50 feet was considered a barrier to anadromous salmonids until the Trinity River rose 15 feet (Moreau 1978).

Upstream of the Hawkins Bar Road the creek flowed through a narrow, wooded "V" shaped valley with moderate gradient. Step pools typified the reach. Bottom composition consisted of loose gravel. Shade canopy was dense and provided by alders.

Other Subwatersheds

A number of other small tributaries are found within the analysis area. Most of these streams such as Coon, Bremmer, China, and Kirkham Creeks do not provide much, if any, suitable anadromous habitat, but they are generally well-shaded and provide high quality water to the Trinity River. Juvenile and adult salmonids are likely to hold in the Trinity River near the confluence of these tributaries and/or, when accessible, in the lower reaches of the tributaries during mid- to late summer. The stressful stream temperatures in July, August, and September within the mainstem underscore the importance of maintaining these cool water tributaries for these species.

Influence of Exotic and Hatchery Fish

- *How have exotic and hatchery fish affected native fish populations in this part of the Trinity River?*

Exotic Fish

Thirteen native fish species and at least six exotic species are known to occupy the MTWAA. Some of these introduced species are golden shiner (*Notemigonus crysoleucas*), brown bullhead (*Ameirus nebulosus*), brown trout (*Salmo trutta*), brook trout (*Salvelinus fontinalis*), and green sunfish (*Lepomis cyanellus*). Striped bass (*Morone saxatilis*) have only recently been reported in the Klamath and Trinity River basins, but reports are rare.

Although the abundance of these species is unknown, they do not appear to have significantly changed the ecology in this part of the Trinity River. However, some possible adverse interactions that may occur between exotic fish species and native fish include the following:

- Competition between two species for a resource (usually food or space) in limited supply, which can result in one species being eliminated
- Predation by exotic species on native fish which can severely impact a localized population
- Habitat Interference, which occurs when an exotic species changes habitat characteristics by its activities and the change forces native species to leave or suffer reductions
- Disease, which is a poorly understood mechanism by which one species can replace another (e.g., some exotic fish can bring disease and parasites which can affect native fish).

Hatchery Fish

Hatcheries have been one of the mainstays of California's salmonid management efforts. A hatchery was built at Lewiston to mitigate for loss of upstream anadromous salmonid habitat due to dam construction. The hatchery produces fall and spring chinook, coho, and steelhead. Because salmon and steelhead populations in the state have collapsed despite the presence of hatcheries, their value has been questioned. In fact, there is a growing recognition that the decline of wild stocks of salmon and steelhead, or their failure to recover from declines, may be partially due to the negative effects of hatchery-reared fish. Some of the main problems and benefits of hatchery-reared fish are discussed below.

One of the main concerns of hatcheries involves genetic risk. Human intervention with rearing fish may cause genetic change. These genetic changes can impact fish species diversity (e.g., inbreeding) and the health of the population. Hatchery programs vary and therefore the risks vary by hatchery. Hatchery-produced fish often differ from wild fish in their behavior, appearance, and/or physiology. Hatchery environments are quite different from stream environments. Consequently, hatchery fish tend to have different foraging, social, and predator-avoidance behavior. Hatcheries can also have disease outbreaks. Once fish are released, these fish can quickly transmit disease to wild fish. Some ecological risks of hatchery fish are similar to those impacts that may occur between native fish and exotic fish species as previously described.

Straying and natural spawning by large numbers of hatchery fish result in competition with wild populations for suitable territory and mates. In addition, the cross breeding of hatchery and wild fish reduces the genetic integrity of wild populations, which can lead to loss of fitness in local populations and loss of diversity among populations (Weitkamp et al. 1995). Even if they are unlikely to survive to breed, large numbers of juvenile prodigy of hatchery fish compete with wild juveniles for food and space and may adversely affect survival of the natural populations.

Although the spring and fall chinook spawning periods overlap, their spawning habitats were historically different, providing spatial separation for the different populations (CDFG & NMFS 2001). The spring run accessed higher streams and the fall run utilized the lower mainstem and tributaries. Because the historical spawning habitat of the spring run is no longer accessible, the potential for interbreeding of the two races is high. The Joint Hatchery Review Committee recognizes and supports continued efforts to maintain a separation between spring and fall runs of chinook at the TRH. Hatchery personnel report that run timing and phenotypic characteristics appear to provide good separation between fall and spring runs. There is currently a 2 week gap between spring and fall collection during which fish cannot enter the hatchery. There is some concern regarding the potential for cross-breeding of spring- and fall-run chinook salmon in the hatchery (CDFG & NMFS 2001).

The transmission of disease from hatchery to wild stocks is of increasing concern. Under normal conditions many fish harbor parasites and pathogens but do not suffer from outbreaks unless environmental conditions degrade (e.g., higher water temperatures, lower dissolved oxygen) to the point where individual resistance is lowered. Because of the crowded conditions within hatchery rearing trays and raceways, epidemics of disease are more likely to occur in hatcheries than in the wild. Importing eggs or fish to a hatchery from other river basins increases the risk of introducing diseases to which local fish have little resistance (PNFHPC 1989).

According to Krisweb (2003) the most common and virulent fish pathogens in northern California are

- ***Ceratomyxa Shasta*** – A protozoan that is pervasive in the Klamath River system which sometimes causes widespread mortality in hatchery and wild populations (Foote 1995). As the disease organism reproduces within the fish, the fish shows a distended stomach and protruding eyes just prior to mortality. All native salmon and steelhead populations in the Klamath River have developed some immunity to this organism (Buchanan 1989).

- **Columnaris disease** – This is a skin and gill infection caused by the bacteria *Flexibacter columnaris*. It is common in hatcheries but is usually treatable unless warm water temperatures or other stressors are present.
- **Infectious hematopoietic necrosis (IHN)** – The virus known as IHN attacks the liver of salmon or steelhead. The fish are more susceptible to IHN when water temperatures are cold. The disease is "vertically transmitted," which means that it can be passed from fluids within the gut of female fish to eggs of the next generation. Chen (1984) suggested that various strains of IHN exist, and if salmonids evolve with a specific strain, they will develop resistance to it. He suggested that if IHN were transferred from one basin to another, its virulence could be substantially increased. Juvenile salmonid mortality at large northern California hatcheries has been very high due to IHN outbreaks (Kier Assoc. 1991).
- **Bacterial kidney disease (BKD)** – BKD results from infection by the bacteria *Renibacterium salmonarium*, which attacks the kidney of salmonids. This disease can be transmitted "horizontally," from fish to fish through fecal material, as well as vertically from one generation to the next. BKD, like IHN, is more pathogenic in very cold water conditions. Steelhead are more resistant to BKD than are other salmon species, although Foote (1992) did find high incidence of BKD in wild steelhead populations in the Trinity River. This disease is subtle because juvenile salmon or steelhead may survive well in their journey downstream but may be unable to make appropriate changes in kidney function for a successful transition to seawater (Foote 1992). Stress during migration may also cause this disease to "flare up" (Schreck, 1987).

The Trinity River Salmon and Steelhead Hatchery (TRSSH) fingerling and yearling production of chinook and coho salmon for the years 1995-1998 is summarized in Table 3-26 (CDFG 2002). Hatchery operations, including the magnitude and timing of hatchery releases and the subsequent return of adult fish, can directly affect the behavior, growth, survival, and ultimate success of naturally-produced salmon and steelhead (USFWS et al. 1999). Factors such as competition, predation, and diseased organisms transmitted by hatchery-produced fish may adversely affect naturally-produced anadromous salmonids within the Trinity River basin (USFWS et al. 1999). It is also likely that the coho within the MTWAA have some amount of hatchery stock in their genetic makeup. In 1981, approximately 280,000 juvenile coho from the Lewiston fish hatchery were released in Willow Creek and another 2,500 in Sharber Creek (USFS 1984).

Of the 15,532 upstream migrating adult coho captured at the Willow Creek weir (in the Trinity River) in the 2000-2001 return year, only 539 were naturally-produced (CDFG 2002a). Of this total number of adults, 4,704 returned to the hatchery, with the remaining assumed to have strayed and naturally spawned in tributary streams. In addition, over half of the coho carcasses recovered by the Lower Trinity Ranger District in 1998-1999, in a condition allowing verification, showed a maxillary clip denoting that they were from the Lewiston hatchery (SRNF 1999c). One coho stray from the Rock Creek hatchery on the North Umpqua River in Oregon was found in Horse Linto Creek (adjacent to the MTWAA) during the 2001-2002 spawning season (McSweeney 2002).

Table 3-26. Release data for Trinity River salmon and steelhead hatchery salmon, 1995-1998.

Year	Species	Number
1995	Spring chinook salmon	298,145
	Fall chinook salmon	110,327
	Coho salmon	No data
1996	Spring chinook salmon	329,211
	Fall chinook salmon	327,850
	Coho salmon	No data
1997	Spring chinook salmon	356,662
	Fall chinook salmon	529,852
	Coho salmon	517,196
1998	Spring chinook salmon	314,570
	Fall chinook salmon	536,180
	Coho salmon	493,233

The hatchery component of the 2000-2001 Trinity River salmonid runs was estimated by CDFG (2002a) from returns of weir-marked and coded-wire-tagged fish to the Trinity River Hatchery (TRH). The CDFG (2002a) estimated that 75.6 percent of the spring chinook above the Junction City weir and 70.1 percent of the fall chinook above the Willow Creek weir were TRH fish. Of the 26,083 spring chinook that were estimated to have passed the Junction City weir during the 2000-2001 season, approximately 4,522 contained coded-wire tags. Of these, an estimated 1,870 (41.4 percent) spring-run chinook were thought to have spawned naturally. Of the 55,473 fall-run chinook that were estimated to have passed the Willow Creek weir during the 2000-2001 season, approximately 9,168 contained coded-wire tags. Of these, an estimated 3,040 (33.2 percent) spring-run chinook were thought to have spawned naturally.

Hatcheries can also benefit wild populations. Hatchery operations can help maintain a population at a safe level until factors for decline, such as habitat degradation and loss, can be addressed. They can also "jump start" recovery by providing a boost to an existing population or reintroducing fish into vacant habitat. By collecting broodstock from the wild, a successful hatchery can produce more returning adults than would have occurred in the wild. All released juveniles should have some identifying mark so they are not retained and bred after being captured as returning adults. Only unmarked wild fish should be retained for breeding, with the returning hatchery-produced adults allowed to spawn naturally. Hatcheries of this type are typically small and limited to a single subwatershed. Small-scale hatcheries that have successfully enhanced wild populations include the one at Horse Linto Creek (now closed) and at Freshwater Creek (tributary to Humboldt Bay), both of which are outside of the MTWAA.

In summary, exotic species may be causing some impact to native fish populations within the MTWAA. Some of these possible impacts from competition, predation, habitat interference, and disease are not well understood and are very difficult to demonstrate. Hatcheries are not a substitute for addressing the root causes of salmon and steelhead decline. While it is hard to identify risks that hatcheries pose for wild fish populations, it is not easy to predict whether damaging effects may occur to the Klamath/Trinity Basin as well. The TRSSH is currently operated in a manner to minimize impacts on naturally spawning fish and is using very strict production constraints to avoid exceeding their mitigation goals.

Vegetation

Vegetation – Reference Conditions

The vegetation composition of a region may shift over tens of thousands of years due to climate changes. In this context, the general vegetation composition in the MTWAA and surrounding region has been relatively consistent for the past few thousand years. Pollen analysis completed in the Pilot Ridge area located approximate 20 miles southwest of the center of the MTWAA provides some insight into the nature of vegetation composition change in the region. The pollen analysis indicates that the current composition of the mixed evergreen forest (Douglas-fir – tanoak and Douglas-fir – true oak) has been established for more than 2,000 years. Tanoak and chinquapin appeared in the pollen record about 2,300 years ago.

In contrast to long term vegetation composition, changes in vegetation structure occur over shorter periods. Data from California tree ring analysis indicate that there have been periods of water scarcity and abundance over the period of 1600-1960 (Fritts & Gordon 1980). A long, severe drought occurred from about 1865 to 1885, followed by a wet period from 1885 to 1915. The drought period likely resulted in widespread tree mortality and high fuel accumulations. The accumulated dead fuels likely contributed to subsequent large scale, stand-replacing fires. The following wet period likely promoted vegetation growth, contributing high fuel accumulations of live material. These high fuel loads (both living and dead), combined with the typical dry Mediterranean summers, probably resulted in additional large, stand-replacing fire events.

A developing understanding of the interrelated historic weather patterns and fire events leads to a hypothesis that these widespread fire events have shaped much of the present vegetation seral stage distribution on the SRNF. Potential evidence of these stand-replacing fires is currently available in the SRNF vegetation seral stage maps. Stand ages of mid-mature and early-mature conifer stands demonstrate the intensity and extent of these stand replacing fire events. These even-aged stands are approximately 135 and 90 years old respectively. Their ages roughly correspond to the 1865-1885 and post 1915 periods and point to the occurrence of large scale stand-replacing disturbance such as severe wildfire. Preliminary reconstruction of these two fire periods shows a mosaic pattern of fires that burned across the landscape, encompassing large areas of the SRNF and the MTWAA.

Historical Range of Variability

Past disturbance patterns are difficult to assess, yet the frequency and pattern of these events can be inferred from the distribution of seral stages across the landscape. An analysis of the seral stage distribution of SRNF was done in 1995 and reanalyzed in 1997 upon completion of the Forest vegetation map (Jimerson et al. 1997). This analysis modeled the past distribution of seral stages for different vegetation series. To determine the past distribution, stands were projected backward in time over 250 years at 50-year intervals. The past seral stage distribution was compared to the present to develop a Historical Range of Variability (HRV), which is identified for seral stages in the primary vegetation series on the forest. These series are the tanoak, Douglas-fir, white fir, and red fir series. The HRV percentages are relevant for analysis at the scale of the Forest zones. The Forest zones are three areas (north, central, and south) of the Forest that are distinguished by species composition and seral stage distribution. These differences in vegetation are a reflection of the different disturbance patterns, geologic material, and climate conditions of these three zones.

The MTWAA is part of the Central Zone. The HRVs and Recommended Management Ranges (RMR) for the Central Zone are referenced in Table 3-27. Although HRV values are specific to the Zone, they can be compared to percentages in watersheds within the Zone. These comparisons can show how the watersheds reflect the HRV percentages of the Zone. For example, within the Central Zone, late seral is within the HRV for the tanoak, Douglas-fir, and white fir series (Table 3-27); old-growth in the tanoak series is within the HRV; and old-growth in the Douglas-fir and white fir series are below the HRV. However, within the MTWAA, only the tanoak series is within the HRV for late seral, while all three vegetation series are significantly below the HRV for old-growth.

HRV/RMR Comparison

The Forest utilized the HRV to develop RMR for seral stages in the primary vegetation types (tanoak, Douglas-fir, white fir, and red fir). The RMRs are a subset of the HRV designed to maintain vegetation types and seral stages in an ecologically balanced manner by mimicking past seral distribution. The RMRs provide a buffer against unpredictable large scale stand-replacing events. The RMRs are used as guidelines in assessing all proposed vegetation management treatments.

A comparison of the HRV/RMR for the Central Zone to the Zone's existing condition gives an indication of how vegetation seral stages have changed over time (Table 3-27).

Table 3-27. The Historic Range of Variability (HRV) and Recommended Management Ranges (RMR) for seral stages within the tanoak, Douglas-fir, and white Fir series in the Central Zone of Six Rivers National Forest. These percentages are compared to the existing percentage of each series in the Central Zone and the existing percentages in the MTWAA.

	Central Zone HRV %	Central Zone RMR %	Central Zone Existing %	Analysis Area Existing %
Tanoak				
shrub/forb	-	-	-	9
pole	-	-	-	21
early mature	11-18	11-14	21	15
mid mature	11-19	12-17	17	25
late mature	9-19	14-19	18	14
old-growth	22-50	36-50	24	16
Douglas-fir				
shrub/forb	-	-	-	5
pole	-	-	-	2
early mature	13-23	13-18	28	49
mid-mature	10-27	12-20	36	41
late mature	9-14	12-14	12	3
old-growth	22-34	28-34	15	4

	Central Zone HRV %	Central Zone RMR %	Central Zone Existing %	Analysis Area Existing %
White fir				
shrub/forb	-	-	-	9
pole	-	-	-	24
early mature	15-23	15-19	10	24
mid mature	11-20	14-18	21	26
late mature	8-16	12-16	13	6
old-growth	30-41	35-40	26	11

Plantations

The acreage of lands occupied by plantations was estimated using the Forest vegetation mapping data. The mapping data provides vegetation seral stage by stand and information on whether a stand was harvested. The shrub/forb and pole stands identified as harvested were used to estimate plantation acres. It is assumed that these young stands are the product of past clearcut or regeneration harvesting.

There are 8,971 acres of plantations on National Forest System land within the three analysis area watersheds. The plantations vary in age from 10 to 70 years, with the majority being 20-40 years old. The primary conifer species present are Douglas-fir and ponderosa pine.

Vegetation – Current Conditions

Vegetation Type

The ecology and mapping program at SRNF has identified and mapped Forest-wide potential natural vegetation types. Information from this classification and mapping effort was used for this analysis. Potential Natural Vegetation is the vegetation that would exist on the landscape due to specific biotic and abiotic factors and without human influence. The classification of these vegetation types is based on a hierarchical system. This system begins with the vegetation series, which represents the dominant overstory and regenerating species in a stand. The next level of the classification is the subseries. The subseries is the subdominant tree species or the shrub species that have indicator value across multiple plant associations. The plant association is the lowest level of the classification. It represents a potential natural community of definite floristic composition and uniform appearance that repeats itself across the landscape.

Vegetation Series

The MTWAA is approximately 78,545 acres, including about 43,025 SRNF lands, 6,921 acres of Hoopa Reservation lands and 28,599 acres of private lands. Within the MTWAA, approximately 60,000 acres have been classified by vegetation series as discussed above. Classified lands include all of the SRNF lands, all of the Hoopa Reservation lands, and the major private inholdings within the SRNF lands. The large block of contiguous private land in the northwest portion of the Willow Creek watershed has not been classified.

The Central Zone is dominated by the tanoak, white fir, and Douglas-fir series, followed by the canyon live oak, white oak, and grassland series. The MTWAA is dominated by the tanoak and Douglas-fir series, with tanoak accounting for approximately 27,366 acres (64 percent) and Douglas-fir with 7,295 acres (17 percent). Other significant series in the analysis area include Jeffery pine with 1,821 acres (4 percent), white fir with 1,646 acres (4 percent), and canyon live oak with 1,220 acres (3 percent). Figure 3-14 displays the vegetation series classifications for the SRNF portion of the MTWAA (refer also to Table 1-2, chapter 1).

Vegetation Subseries

The subseries in the analysis area (Table 3-28) indicate the environmental conditions present. They display a moisture gradient from moderately dry in the tanoak-canyon live oak subseries to moist in the white fir-Douglas-fir subseries. They also reflect micro-site conditions. The steep, highly dissected terrain is usually dominated by canyon live oak, while the more gentle slopes contain white fir and Douglas-fir.

Table 3-28. The distribution of vegetation subseries in the Six Rivers National Forest portion of the Mainstem Trinity Watershed Analysis Area.

Subseries	Acres	Percent
Tanoak - canyon live oak	5,778	13
Tanoak - chinquapin	990	2
Tanoak - maple	2,169	5
Tanoak - evergreen huckleberry	1,499	3
Tanoak - salal	437	1
Tanoak - moist shrub	758	2
Tanoak - dry shrub	12,247	28
Tanoak - Port Orford-cedar	4	-
Tanoak - LIDE 3	12	-
Tanoak - black oak	3,370	8
Tanoak - California bay	101	-
Port Orford-cedar - white fir	181	-
Port Orford-cedar - Port Orford-cedar	59	-
Port Orford-cedar - LIDE 3	27	-
Port Orford-cedar - western white pine	78	-
White fir - tanoak	586	1
White fir - LIDE 3	445	1
White fir - Douglas-fir	377	1
White fir - Ponderosa pine	13	-
White fir - canyon live oak	12	-
White fir - chinquapin	212	-
Jeffery pine - Douglas-fir	19	-
Jeffery pine - LIDE 3	1,802	4
Douglas-fir - maple	62	-
Douglas-fir - tanoak	135	-
Douglas-fir - Ponderosa pine	2	-

Subseries	Acres	Percent
Douglas-fir - white oak	1,259	3
Douglas-fir - black oak	4,036	9
Douglas-fir - LIDE 3	12	-
Douglas-fir - canyon live oak	1,703	4
Douglas-fir - Jeffery pine	86	-
Sugar pine - western white pine	508	1
Alder	22	-
Grassland	73	-
White oak - canyon live oak	465	1
White oak - Douglas-fir	124	-
White oak - black oak	293	-
Black oak - Douglas-fir	202	-
Black oak - canyon live oak	48	-
Black oak - white oak	69	-
Canyon live oak - Douglas-fir	950	2
Canyon live oak - canyon live oak	270	-
Gray pine - Jeffery pine	15	-
Gray pine - canyon live oak	12	-
Knobcone pine	43	-
Riparian	157	-
Non-veg./unknown	1,271	3
Grand Total	**42,993**	

Vegetation Seral Stages

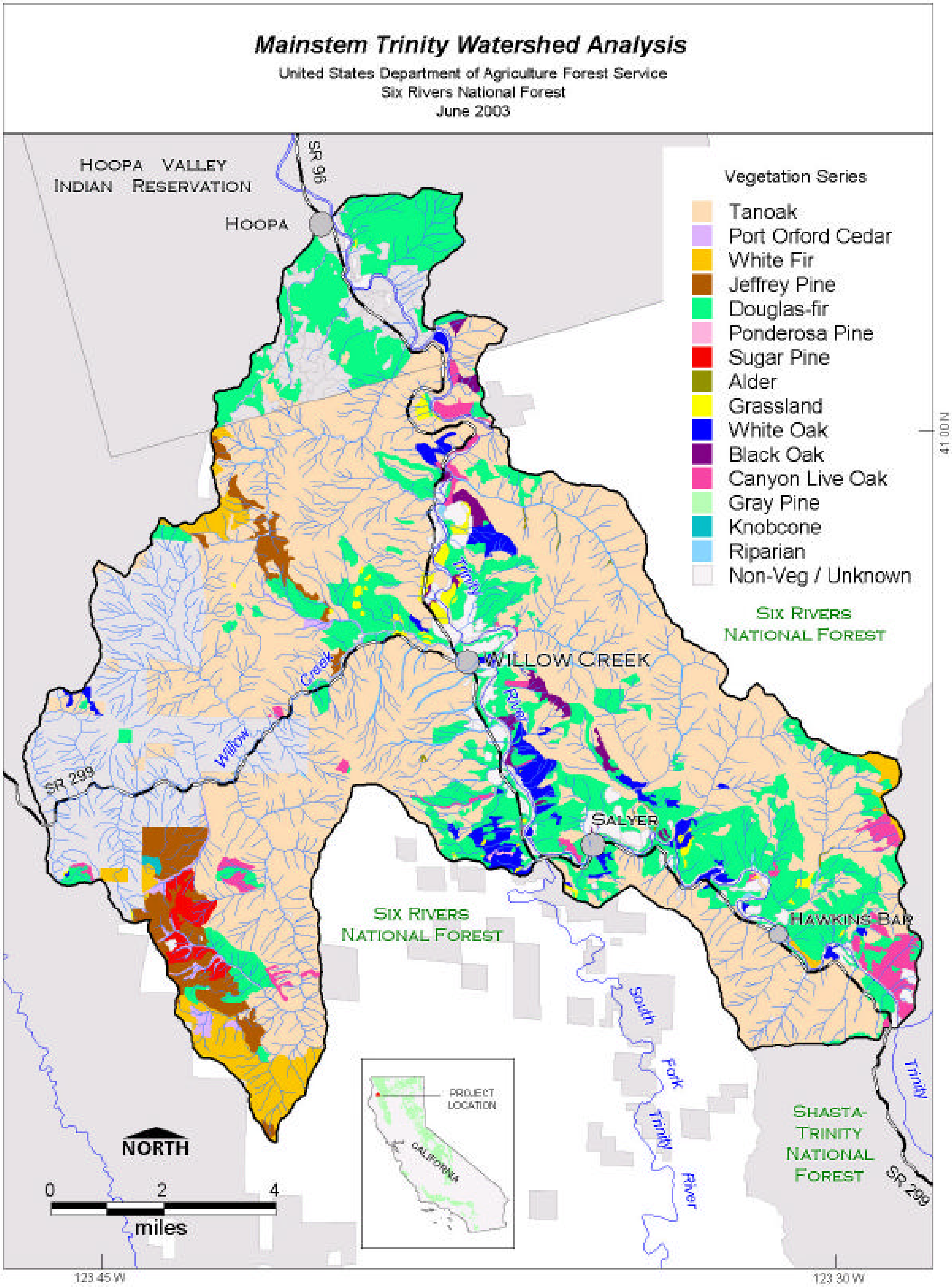
MTWAA Seral Stages

Table 3-29 displays the acres and percentage of seral stages for the MTWAA. Fifty-three percent of the MTWAA is occupied by early and mid-mature seral stages. Late mature and old-growth account for 24 percent, with the remaining 23 percent made up of shrub/forb and pole seral stages.

Table 3-29. Vegetation seral stage distribution for the Six Rivers National Forest portion of the Mainstem Trinity Watershed Analysis Area.

Seral Stage	Acres	Percent
shrub/forb	2,983	7
pole	6,533	16
early mature	10,909	26
mid mature	11,330	27
late mature	4,092	10
old-growth	5,825	14
Total	**41,672**	**100**

Figure 3-14. Current Vegetation Series Classification Within the Mainstem Trinity Watershed Analysis Area.



The analysis area contains 1,149 acres of early mature and 103 acres of mid mature stands that contain predominant trees. These large overstory trees are the remnants (legacy) of the previous stand and provide late seral characteristics to early and mid mature stands. Figure 3-15 displays the distribution of the seral stages in the MTWAA.

Seral Stages by Vegetation Series

Most of the vegetation in the analysis area is included in the tanoak, Douglas-fir, white fir, Jeffery pine, and canyon live oak series. Table 3-30 presents the distribution of seral stages by the major vegetation types in the MTWAA.

Table 3-30. Seral stage distribution for the five vegetation series that account for 94% of the vegetation series in the Six Rivers National Forest portion of the Mainstem Trinity Watershed Analysis Area.

	Tanoak		Douglas-fir		White fir		Jeffery Pine		Canyon Live Oak	
Seral Stage	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**
shrub/forb	2,396	9	88	1	141	9	236	13	25	2
pole	5,783	21	155	2	402	24	134	7	53	4
early mature	4,141	15	3,601	50	403	24	448	25	814	67
mid mature	6,940	25	2,918	40	427	26	363	20	329	27
late mature	3,699	14	235	3	98	6	22	1	0	-
old-growth	4,407	16	299	4	175	11	618	34	0	-
Total	**27,366**	**100**	**7,295**	**100**	**1,646**	**100**	**1,821**	**100**	**1,220**	**100**

Harvested Areas and Current Seral Stages

The Forest vegetation mapping process identified stands that have been previously harvested. Harvested stands were differentiated from natural stands for each seral stage. For example, shrub/forb natural stands were differentiated from the shrub/forb harvested stands, and pole-harvested stands were differentiated from pole-natural stands. This same differentiation process was completed for all the seral stages. Natural stands include stands that originated from natural events and have not had apparent harvest activity. Harvested stands include stands that originated from regeneration harvesting or have been partially harvested.

The past harvesting activities included regeneration harvests and a range of partial harvesting treatments including thinning and selection. In terms of seral stage classification, harvested areas that were regenerated were assumed to "start over" at the shrub/forb seral stage and then progress through the seral stages. If the regeneration harvest occurred 40 to 50 years ago, the current seral stage classification of the stand would likely be the pole stage. Therefore, a stand that is identified as a pole-harvested stand identifies a stand that is currently at the pole seral stage that was originated from past harvesting, as compared to a pole-natural stand where the origination was from natural events. Partial harvesting in mature and old-growth seral stages did not change the seral stage classification of the stand.

Figure 3-15. Current Seral Stages of Vegetation Within the Mainstem Trinity Watershed Analysis Area.

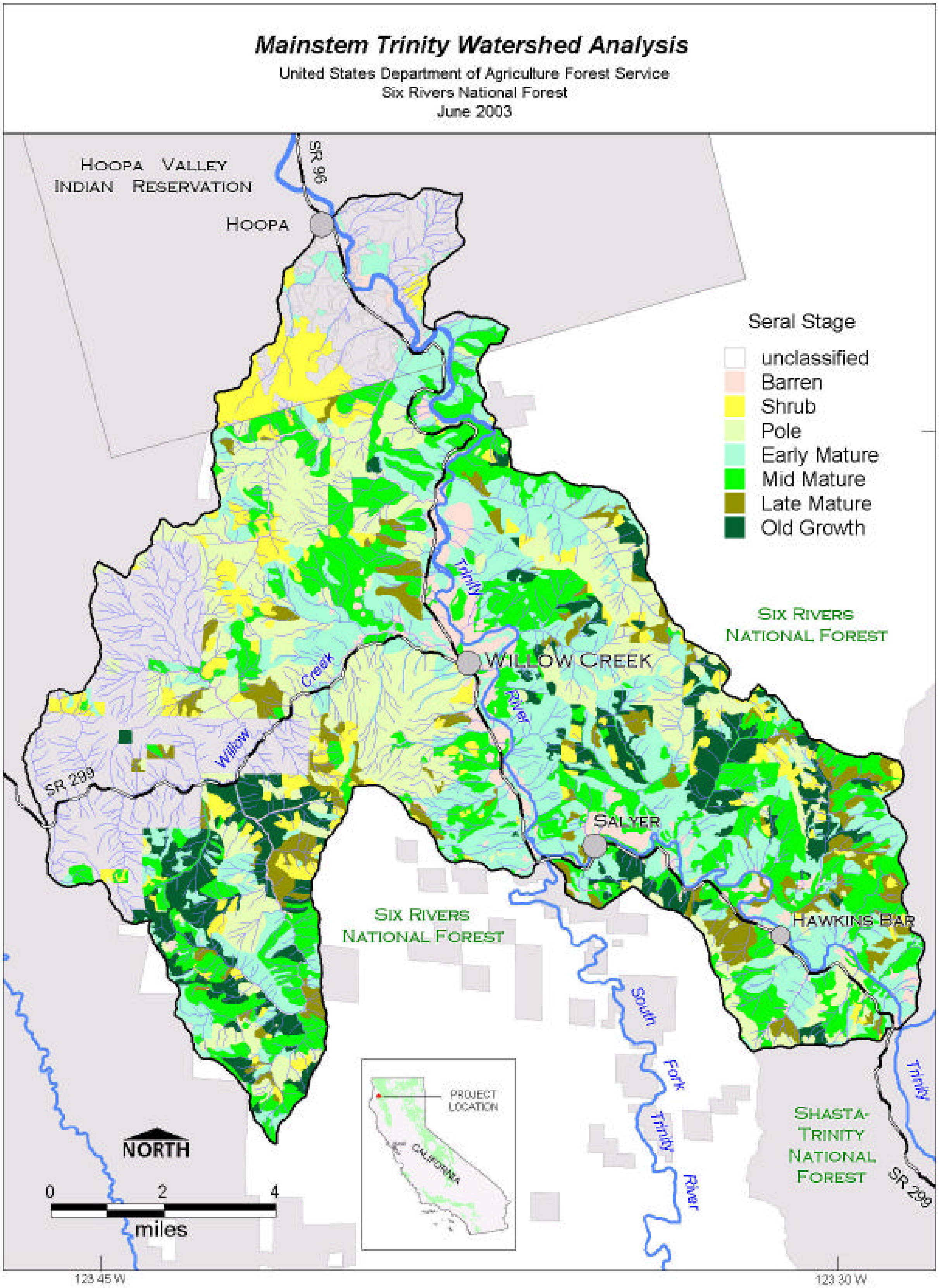
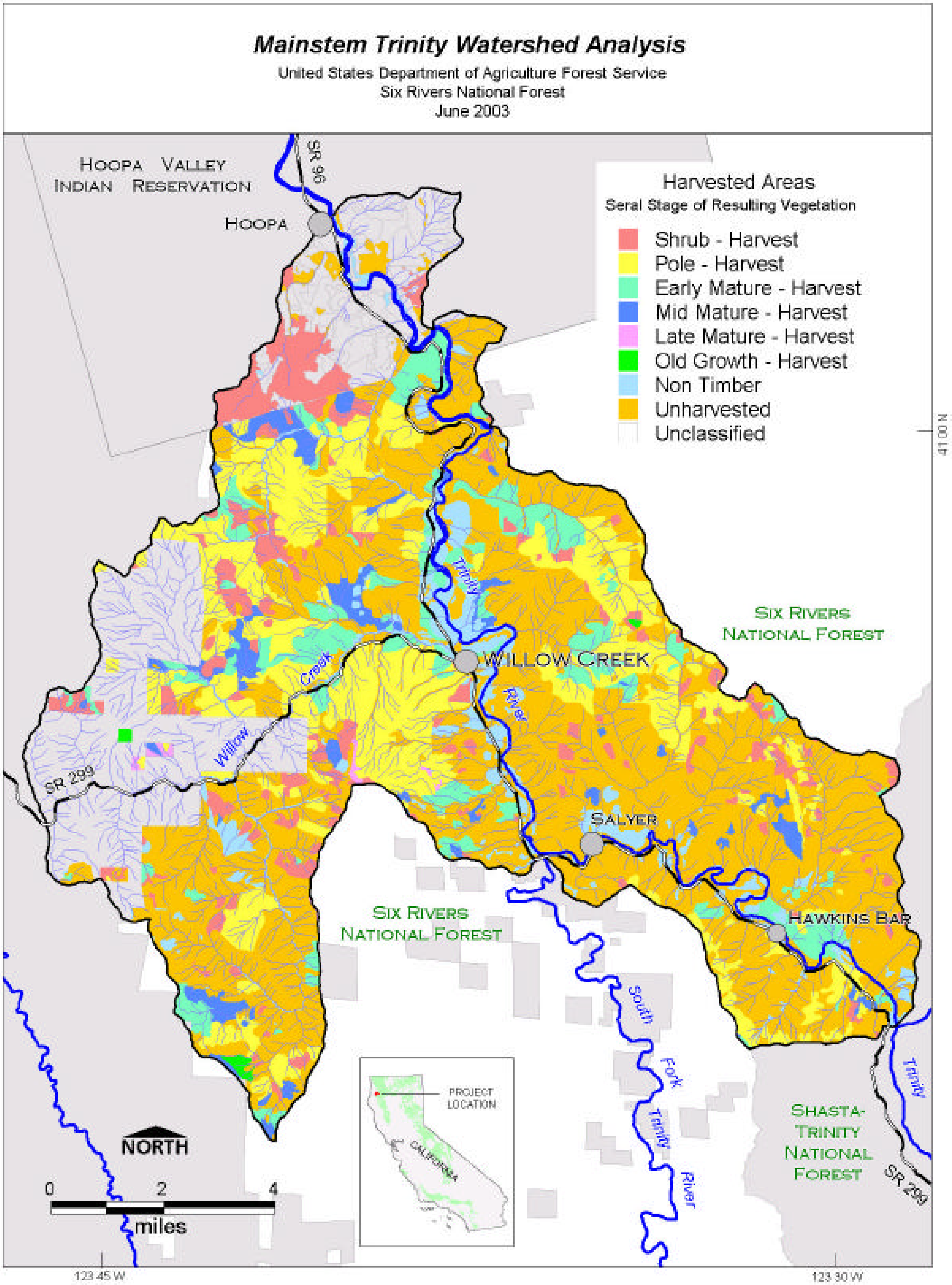


Figure 3-16. Harvested Areas and Resulting Vegetation Seral Stages Within the Mainstem Trinity Watershed Analysis Area.



The shrub/forb and pole stands identified as "harvested" in Table 3-31 (below) are the regenerated stands that developed following regeneration harvest. Early mature, mid mature, late mature, and old-growth stands identified as harvested were harvested under a partial harvest treatment that did not alter their seral stage classification.

Most of the harvesting has taken place in the tanoak and Douglas-fir series. Approximately 10,008 acres (37 percent) of the tanoak series and 1,314 acres (18 percent) of the Douglas-fir series have had regeneration or selective harvesting (Table 3-31). Figure 3-16 shows harvested areas with resulting seral stages.

Table 3-31. Current seral stages resulting from, or affected by, past harvest treatments within the classified vegetation series in the Mainstem Trinity Watershed Analysis Area.

Seral Stage	Tanoak	Douglas-fir	White fir	Jeffery pine
shrub/forb harvest	2,392	88	141	236
pole harvest	5,526	94	402	88
early mature harvest	966	689	214	81
mid-mature harvest	990	443	141	180
late mature harvest	119	-	-	-
old growth harvest	15	-	87	-
Total harvest	**10,008**	**1,314**	**985**	**585**
Percent of Series Harvested	**37**	**18**	**60**	**32**

Size Class and Canopy Closure

Vegetation polygons within the MTWAA have been attributed a size class based on average tree diameter (DBH). The following vegetation size classes are used:

Size Class	DBH Range
0	Non-timber
1	0 - 5.9 inches
2	6 - 10.9 inches
3	11 - 20.9 inches
4	21 - 35.9 inches
5	> 36 inches

A majority of the Six Rivers National Forest portion of the analysis area is classified as having size class 2, 3 and 4 trees (both hardwoods and conifers) (Table 3-32). Canopy closure is high overall in this analysis area (Table 3-33). Eighty-eight percent of the area has a canopy closure between 60 and 100 percent.

Table 3-32. The distribution of size classes for tanoak and Douglas-fir series relative to the total for all vegetation series within the Six Rivers National Forest portion of the Mainstem Trinity Watershed Analysis Area.

	Tanoak		Douglas-fir		Total for all Vegetation Series	
Size Class	**Acres**	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**
0 (none)					1,248	3
1 (0-5.9 inches)	2,396	9	88	1	3,034	7
2 (6-10.9 inches)	5,850	21	189	3	8,281	19
3 (11-20.9 inches)	4,114	15	3,601	49	9,912	23
4 (21-35.9 inches)	8,622	32	3,130	43	13,593	32
5 (>36 inches)	6,384	23	288	4	6,925	16
Total	**27,366**	**100**	**7,296**	**100**	**42,993**	**100**

Table 3-33. Total tree canopy closure classes for all vegetation series within the Six Rivers National Forest portion of the Mainstem Trinity Watershed Analysis Area. Abbreviations are as follows: N = none; S = sparse; P = open; M = moderate; D = dense.

Total Canopy Closure	Acres	Percent
N (0-9%)	2,008	5
S (10-20%)	660	2
P (21-39%)	616	1
M (40-59%)	1,874	4
D (60-100%)	37,841	88
Total	**42,999**	**100**

Figure 3-17 shows the distribution of tree size classes for the vegetation series within SRNF portion of the MTWAA. Figure 3-18 shows the total tree canopy closure classes for the vegetation series within the SRNF portion of the MTWAA.

Snags and Logs

The importance of snags and logs in late seral stands has been documented throughout the literature. In an effort to understand the relationship of snag and log densities to vegetation type and seral stage, over 1,200 plots were sampled across the Forest. These plots were used to generate the background levels of snags and logs displayed in Table IV-8 of the LRMP.

The desired range of densities for snags and logs by vegetation type and seral stage is displayed in Table 3-34. These levels are 80 to 100% of the average numbers contained in LRMP Table IV-8 (Mean Snag and Log Densities). As stated in the LRMP, these numbers may be revised as more data is collected. Where vegetation treatments occur, the actual number of snags and logs will vary depending on wildlife habitat needs, fire hazard, and public safety. However, the LRMP Standard is that the 80-100% objective shall be met over any contiguous 40-acre area.

Figure 3-17. Distribution of Tree Size Classes Within the Mainstem Trinity Watershed Analysis Area.

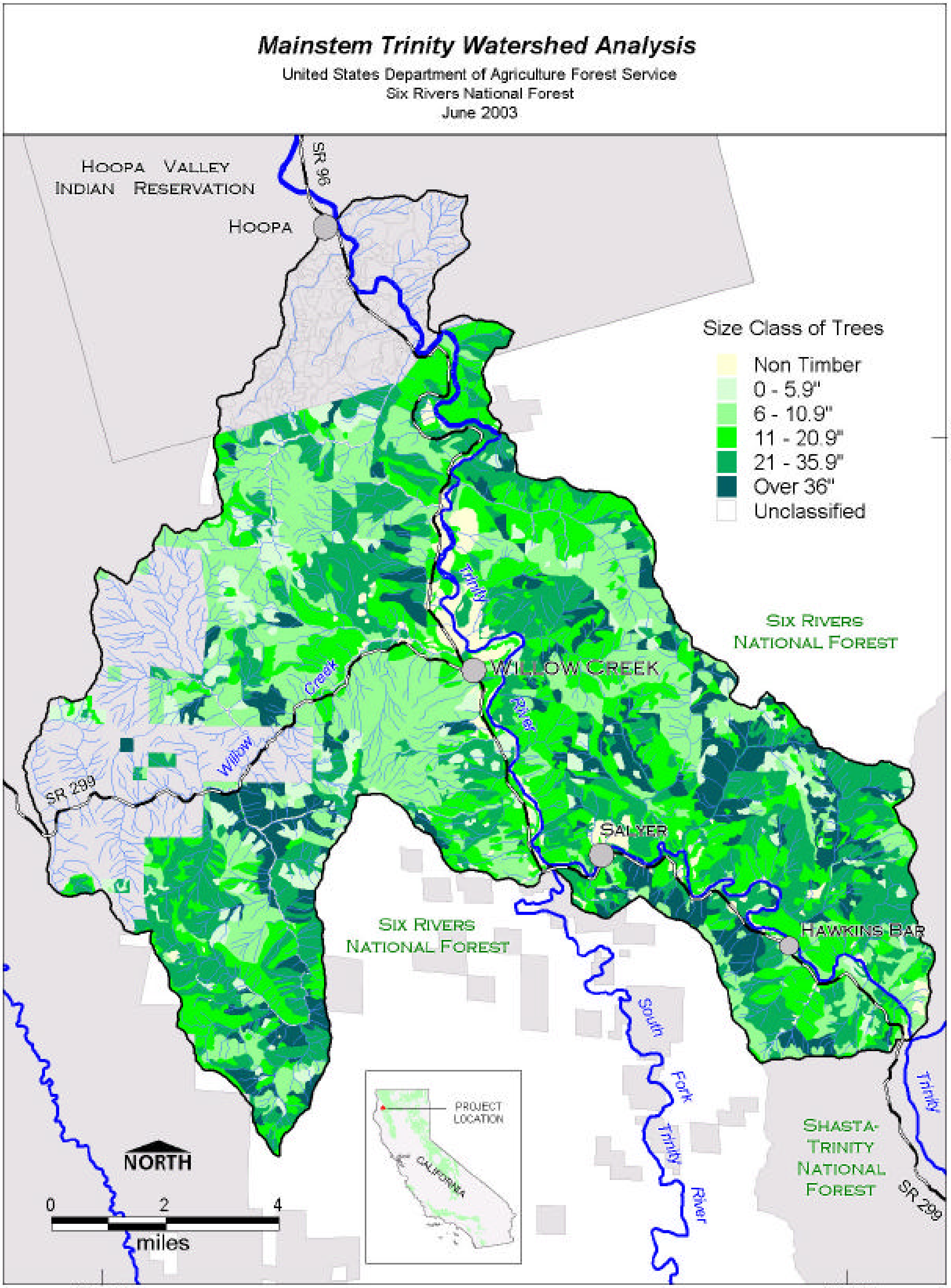


Figure 3-18. Distribution of Tree Canopy Closure Classes Within the Mainstem Trinity Watershed Analysis Area.

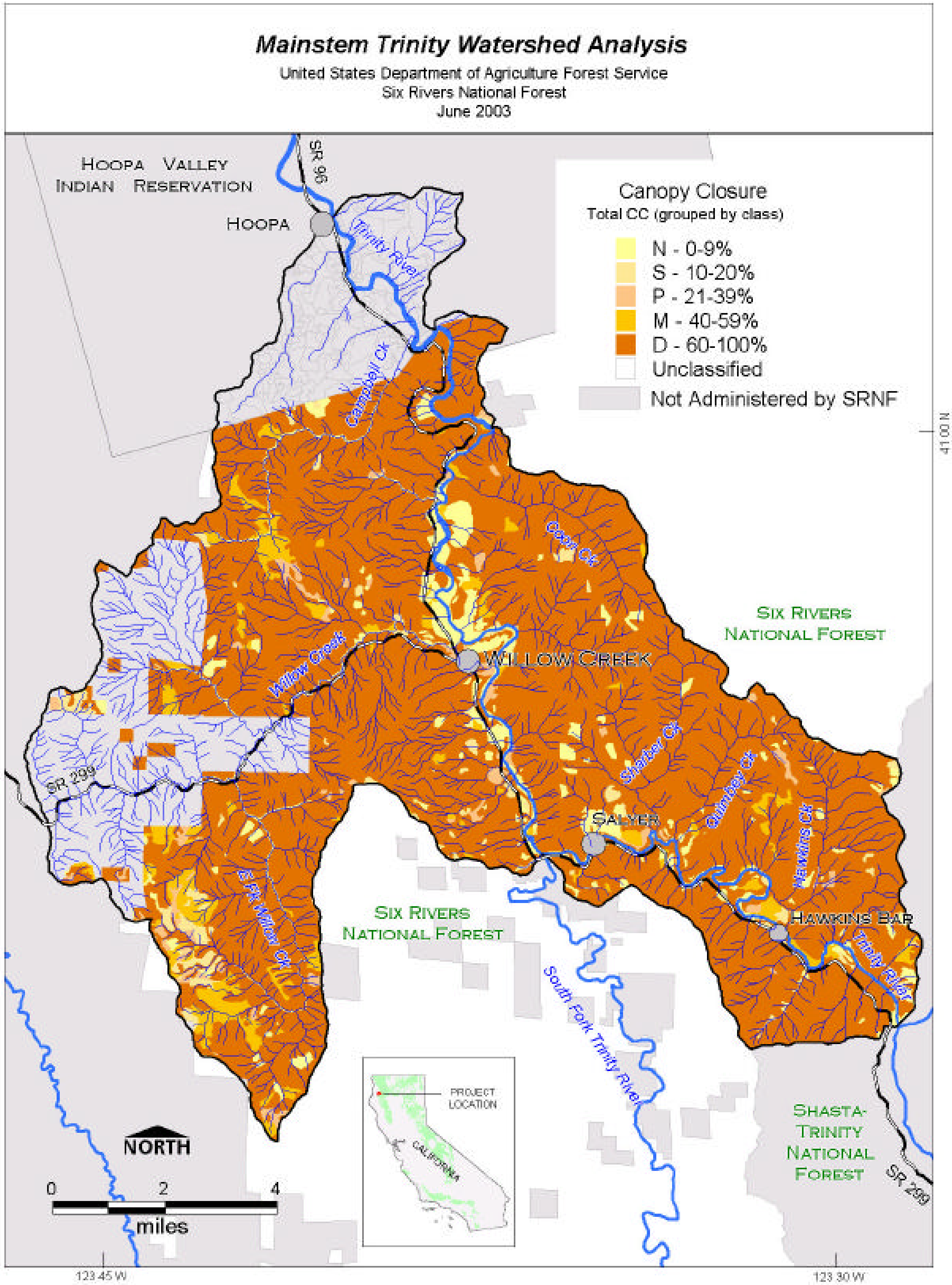


Table 3-34. Desired ranges of snags and logs per acre by vegetation type and seral stage.

Vegetation Series and Seral Stages	Snag Range per Acre	Log Range per Acre
Tanoak		
early mature	2.6 - 3.2	6.6 - 8.2
mid mature	2.8 - 3.6	3.8 - 4.7
late mature	1.0 - 1.8	1.4 - 1.8
old-growth	3.4 - 4.3	7.4 - 9.2
White Fir		
early mature	1.4 - 1.7	3.8 - 4.0
mid mature	4.2 - 5.2	4.2 - 5.3
late mature	6.1 - 7.6	8.8 - 11.0
old-growth	4.7 - 5.9	10.8 - 13.5
Douglas-fir		
early mature	3.0 - 3.7	12.8 - 16.0
mid mature	1.0 - 1.2	4.3 - 5.4
late mature	0.7 - 0.9	5.0 - 6.3
old-growth	2.4 - 3.9	7.0 - 8.7

Larger diameter downed logs are preferable, as they are expected to last longer over time. The numbers of snags and downed logs may vary on any particular acre, depending on site-specific conditions and objectives. For instance, snag and log densities may be very low in fuel breaks but be high in windthrow areas. Aggregations of snags and logs are also important for providing ecological functions in both terrestrial and riparian habitats.

Fire Effects on Vegetation

Individual tree damage within stands following fire is generally categorized using two characteristics: crown scorch (or crown loss) and cambium damage (Wagener 1961, Weatherspoon 1988, Reinhardt & Ryan 1988). Individual species vary greatly in their susceptibility to fire, as do trees of different heights and diameters. Comparatively, pines have thicker bark and larger buds than the firs. These characteristics provide greater protection to cambium and next year's production of replacement foliage (needles) (Wagener 1961). True firs (*Abies* sp., e.g., white and red fir) and Douglas-fir have thin bark on younger trees and on mid and upper boles. Buds are smaller and less resistant to heat damage. These species cannot withstand as much cambium damage and crown loss as the pines. Generally for firs, crown losses greater than 65 percent of pre-fire crown volume or cambium damage between 25 and 40 percent of the bole circumference will result in death (Wagener 1961, Weatherspoon 1988). Insects will likely attack surviving trees that are near the upper limit of these damage thresholds.

Late season (fall) high intensity fires can also kill fine roots within a few inches of the soil surface and cambium on larger roots near the surface (Weatherspoon 1987). The amount of damage is difficult to predict due to factors such as species differences, soil moisture, duff layer depth, and fire duration. Significant root loss can result in mortality or predisposition to insect attack.

Tanoak is a fire-sensitive species. Aboveground portions are extremely susceptible to fire mortality (Van Dersal 1938, Veirs 1982). The thin bark provides little insulation from radiant heat, which usually kills the cambium around the base of the stem (McDonald et al. 1983). As a result, low intensity ground fires readily top-kill tanoak seedlings and sapling-sized stems (Atzet 1979, Tappeiner et al. 1984a, Tappeiner et al. 1984b). Larger, thicker barked trees occasionally survive light under-burning (Roy 1957). Bark thickness of mature trees may range from 1 to 3 inches, sometimes reaching 4 to 5 inches. Bole injuries usually result following ground fires, and vertical wounds 4 to 10 feet long are common (McDonald 1987, Roy 1957). Many older tanoak trees may initially survive light burns, but bole wounds facilitate the entry of insects and disease, and most injured trees eventually die (Roy 1957).

Long-term survival is most likely in young, vigorous trees where bole wounds tend to heal rapidly (Roy 1957). In virgin redwood stands in Redwood National Park, Veirs (1982) found the oldest tanoak trees occupying sites where frequent under-burning by indigenous peoples reduced fuel loadings to the point where only light-intensity ground fires occurred. Crown fires kill the aerial portions of all tanoak, regardless of age or size (Plumb and McDonald 1981, Roy 1957).

After a fire, tanoak resprouts from adventitious buds located on a burl. Most buds are located at or beneath the ground surface (Roy 1957). Unless fires are particularly severe, nearly all tanoak resprout to some extent during the first postburn growing season (McDonald and Tappeiner 1987). Tanoak initiates a rapid postburn recovery and is an aggressive competitor during the early stages of postburn succession. Postburn sprouting potential of tanoak is strongly correlated with size and vigor of the parent tree (Roy 1957, Tappeiner 1984a and b). Since burl size increases as tanoaks grow, larger stemmed tanoak usually possess larger burls with increased numbers of dormant buds. Trees greater than 12 inches DBH typically support abundant resprouts (Tappeiner 1984b).

Forest Pathogen Effects on Vegetation

- *What is the potential impact of Port Orford-cedar root disease (Phytopthora lateralis) and sudden oak death disease (Phytopthora ramorum) on plant community composition and function?*

Port Orford-cedar Root Disease

In addition to being the southern-most stand of Port Orford-cedar (POC) within its natural range, the POC on Horse Mountain are at the uppermost reaches of the Trinity River Watershed. This is the single remaining uninfested watershed within the range of the species. If the pathogen is introduced here, it will quickly move downstream and throughout all downslope reaches of the watershed.

The potential impacts of this fatal disease on POC communities are immense. Port Orford-cedar is the primary shade tolerant conifer species found along the streams of the Horse Mountain Botanical Area. It regenerates naturally under its own canopy, providing stream shading and habitat for a variety of wildlife species. In addition, POC is known to have the highest species richness of the primary vegetation series found in Northwest California (Jimerson & Daniel 1994). Due to POC's resistance to decay, its snags and logs are long-lived components of wildlife habitat and also provide in-stream structure as well as organic input to streams containing anadromous fish (Jimerson & Daniel 1994).

Until the early 1950's, natural stands of POC had few serious pests (Roth et al. 1987 *in* Jimerson & Jones 2002). At that time, the pathogen causing Port Orford-cedar root disease (*Phytophthora lateralis*) was introduced by humans and has continued to spread throughout much of the natural range of the POC. On the Six Rivers National Forest the disease has killed at least one-tenth of these trees. Currently, the Trinity River watershed continues to be free of this pathogen, however the POC of the Horse Mountain Botanical Area are considered at risk for infection (Jimerson et al. in prep.).

The pathogen spreads by motile aquatic zoospores, non-motile soil-borne chlamydospores, and root grafting. The disease is dispersed through water, through root-grafted trees, and through the movement of earth containing the pathogen. The disease spreads from infested to uninfested areas by the transport of its spores trapped in the mud on the bottom of vehicles and equipment. Infested soil often is attached to construction equipment used in road maintenance and logging operations. Cattle and wildlife also can transport the pathogen into previously uninfested areas by carrying the infested soil on their hoofs and fur. Hikers, bicyclists,and off-highway vehicle users may carrying infested mud on their boots or tires into an uninfested area. The application of water drawn from an infested watershed onto roads in uninfested areas has also introducted the disease to previously healthy watersheds. Once introduced into a drainage, the disease can spread rapidly downstream in the water and kill entire stands of POC.

The understory plants in a plant community are reliant on the specific conditions provided by the presence of the particular overstory species and are directly impacted by the loss of the POC. Many of the low elevation examples of these communities have already been infested, resulting in replacement of this shade-tolerant species by less shade-tolerant species such as Douglas-fir (*Pseudotsuga menziesii*) and alder (*Alnus* sp.). Infestation has also resulted in a change in the plant species composition of the previously rich, diverse communities.

The results of a recent Landscape Level Roads Risk Assessment on POC Plant Associations on the Six Rivers National Forest indicates that the majority of roads in or near the Horse Mountain Botanical Area are classified as "high" or "moderate" in risk for the introduction of POC root disease to the area (Jimerson & Jones 2002). Because the primary vector for POC root disease is the road systems, this information is being seriously considered in current and future management decisions for the area. An additional Risk Assessment of POC Plant Associations on Federal and State Lands in California is currently in preparation and will offer further management guidelines (Jimerson et al., in prep.).

Strict road closures and access restrictions to at-risk POC areas are well-enforced on the forest. An effort to minimize the risk of further spread of the disease is through public awareness. Informational signage is placed at gated road closures and other access routes into these areas. The multi-agency informational brochure "Why are Port-Orford-cedars dying?" is available free of charge to the public and is widely distributed by the Forest Service (USFS 1997).

Sudden Oak Death Disease

Sudden Oak Death (SOD) is currently not known to occur on the Six Rivers National Forest, and it is not known if the pathogen, *Phytophthora ramorum*, is capable of causing disease as far inland as the

MTWAA. The nearest confirmed occurrence of SOD is at Redway, California (foliar infection on California bay laurel) in an old-growth redwood grove.

Over the course of the last seven years, this disease has spread through coastal oak forests over 185 miles of the California central coast (Garbelotto et al. 2003). Nearly all of the main tree species in mixed-evergreen and redwood-tanoak forest types may be hosts to *P. ramorum*. However, it appears that the oaks in the subgenus *Quercus* (the white oaks) are unaffected by the pathogen. In addition, numerous understory shrubs are also hosts to *P. ramorum* (Garbelotto et al. 2003).

The plant species that are known hosts of *P. ramorum* are categorized as having either non-lethal foliar and twig infections or lethal branch or stem infections. The hosts having bark cankers become infected on the trunks; the cankers often lead to the tree's mortality. Tanoak (*Lithocarpus densiflorus* var. *densiflorus*), black oak (*Quercus kelloggii*), canyon live oak (*Quercus chrysolepis*), coast live oak (*Quercus agrifolia*), and Shreve's oak (*Quercus parvula* var. *shrevei*) are all known bark canker hosts of *P. ramorum*. This pathogen is capable of killing mature healthy trees. Both the black oak (*Quercus kelloggii*) and the canyon live oak (*Quercus chrysolepis*) are widespread within the MTWAA and are major components of their associated plant communities.

Though *P. ramorum* is deadly on certain oaks and tanoak, the extent of the damage caused on individual non-oak hosts is not yet well characterized (Garbelotto et al. 2003). On several plant species in the Ericaceae family, *P. ramorum* causes significant foliar and branch dieback. Pacific madrone (*Arbutus menziesii*) saplings have been killed within a few months, and it is suspected that the disease is capable of killing mature madrone trees. The death of mature rhododendrons (*Rhododendron macrophyllum*) by SOD has also been observed (Garbelotto et al. 2003).

In the case of most foliar hosts, however, the disease is restricted to foliage, twigs, and small branches (Garbelotto et al. 2003). The hosts with non-lethal foliar infections express SOD in a range of symptoms, from necrotic leaf spots to twig and small branch dieback to, in severe infections, plant mortality. The ever-expanding list of known native foliar hosts (Frankel & Stanley 2002) includes a number of species found within the MTWAA:

- California bay laurel, *Umbellularia californica*
- bigleaf maple, *Acer macrophyllum*
- California coffeeberry, *Rhamnus californica* var. *californica*
- evergreen huckleberry, *Vaccinium ovatum*
- honeysuckle, *Lonicera hispidula*
- toyon, *Heteromeles arbutifolia*
- common manzanita, *Arctostaphylos manzanita*
- cascara, *Rhamnus purshiana*
- salmonberry, *Rubus spectabilis*
- Douglas-fir, *Pseudotsuga menziesii*
- western star flower, *Trientalis latifolia*
- poison oak, *Toxicodendron diversilobum*

In the case of Douglas-fir, only seedlings and small saplings have been observed with the disease and only at a single site in Big Sur, California. It is yet unknown whether SOD will present a serious decline for Douglas-fir stands by affecting the process of regeneration. Also, it is not yet known if different environmental conditions could cause widespread damage to Douglas-fir.

SOD presence in foliar hosts is not likely to directly affect plant community composition. However, under suitable environmental conditions, the pathogen sporulates heavily on foliar lesions. These vast quantities of air-borne spores are dispersed throughout the surrounding area where they may infect additional foliar hosts as well as previously uninfected bark canker hosts (particularly the tanoak and canyon live oak), thus indirectly causing stand mortality.

SOD tree decline and mortality of both tanoak and canyon live oak across the MTWAA would have a potentially significant effect upon their respective associated plant communities. Both of these trees are a major component of the Forest, and their widespread loss would permanently alter the habitat for all plant and wildlife species within the affected areas.

Humans are the primary vectors of the SOD pathogen through transport of infested plant materials and soils into previously uninfested areas. The Forest Service is currently developing a science-based management policy to prevent possible introduction of SOD onto National Forest and surrounding lands.

Fire

Fire and Fuels – Reference Conditions

- *What was the pre-European fire regime?*

Note: In addition to the discussion below, more details on the history of fire in the watershed and surrounding region are provided in the *Historical Resources, Historic Period Land Uses and Practices* section in this chapter as well as Appendix B.

Fire Occurrence

Fire has been one of the major forces shaping the vegetation in the MTWAA on a landscape level. Historically, the two general causes of fire ignition were human and lightning. The dry summer weather patterns of the region combined with regular lightning activity, Native American burning practices, and steep terrain led to the development of a fire-adapted ecosystem. Barrett (1935) summarized historical California wildfires during the days of the early explorers and states the following: "Great conflagrations occurred in California during the early days. Records from both the northern and southern part of the state prove that these fires often burned from four to six months and frequently swept over more than 100,000 acres of forest and major watersheds before being extinguished by rain."

Although lightning is the primary natural source of forest fires in the world, and 37 percent of all ignitions in the Pacific States are from lightning (Taylor 1974), only about 10 percent of the MTWAA fire starts are from lightning. Lightning starts vary by elevation, aspect, and fuel type and contribute to landscape change within the watershed. While human-caused ignitions contribute to the largest number of starts, the less frequent lightning ignitions often contribute to the occurrence of large fires. The reasons for this are complex and include the tendency for lightning starts to occur along higher elevation ridgelines that tend to be among the more remote locations of the MTWAA. These particular starts often occur with multiple starts that affect the initial attach resources and may reduce overall fire suppression effectiveness. Although only about 10 percent of the fires that have started in the MTWAA area are from lightning, a majority of the MTWAA burned within the area is related to lightning fires. The largest area burned is a portion of the Megram Fire, a lightning fire that started outside of the MTWAA.

Data from California tree ring analysis indicate that there have been periods of water scarcity and abundance over the period of 1600-1960 (Fritts and Gordon 1980). A long, severe drought occurred from about 1865 to 1885, followed by a wet period from 1885 to 1915. The drought period likely resulted in widespread tree mortality and high fuel accumulations. The accumulated dead fuels likely contributed to subsequent large scale, stand-replacing fires. The following wet period likely promoted vegetation growth, contributing high fuel accumulations of live material. These high fuel loads (both living and dead), combined with the typical dry Mediterranean summers, probably resulted in additional large, stand-replacing fire events. Preliminary reconstruction of this fire period shows a mosaic pattern of fires that burned across the landscape, encompassing large areas of the SRNF and the MTWAA.

The San Francisco Chronicle (August 10, 1887) mentions a fire on Trinity Mountain that had been "raging so fiercely throughout the country for the last month and has destroyed so much timber and property." R.T. Fischer's report of September 1901 on the proposed Trinity Forest Reserve mentions fire conditions in the South Fork Mountain area. "The entire tract has been much burned. In the dense Fir Type along South Fork Mountain there are a score or more of fire glades, 50 to 100 acres in extent. In the opener Pine fire has seldom cleared the ground, but has scarred or burned down many trees, killed the reproduction, and brought in brush. In the scrub, fires had burned large areas. Six fires were seen during this reconnaissance, three of which had been set to clear trails, and the rest left by campers." The Blue Lake Advocate refers to fires and smoke as a regular and expected occurrence around Willow Creek in the fall. Fires started in the late summer or fall were expected to burn until the winter rains. The *Heritage Resources* Section of this chapter (above) includes a detailed discussion of fires as reported in the local papers.

Keter (1993 and 1995) found that Native American burning was a widespread component of the regional landscape. The long-term existence of Native American tribes in this area and use of fire to enhance the production of traditional cultural materials affected historical fire occurrence. Considering the importance of tanoak acorns to many aboriginal people, these hardwood stands were likely burned to facilitate the collection of this important food source.

Ranching became an important land use activity following 1850, with grassland and timberland throughout Humboldt County utilized for grazing cattle. Livestock grazing also promoted burning of large areas to provide forage for livestock. Periodic burning by both aboriginal people and early ranchers contributed to maintaining the diversity and size of grasslands on the landscape. Timbered areas were also burned regularly, either in an attempt to convert timberland to grassland or to develop and maintain an open timber stand with forage in the understory to support livestock.

The first California State Fire Law was enacted in 1872 to prevent the destruction of forests by fire on public lands. Fines not exceeding one thousand dollars, imprisonment not exceeding one year, or both, were established for fires caused by arson or carelessness which affected "any wooded country or forest belonging to this State, or the United States, within this State, or to any place from which fire shall be communicated to any such wooded country or forest" (Barrett 1935). The creation of National Forests and Forest Reserves increased aggressive fire prevention efforts to eliminate wildfires caused by settlers, ranchers, miners, and Native Americans. Barrett (1935) went on to say "No such conflagrations as these [the large 100,000 acre fires] have destroyed the timber wealth of the state since fire prevention measures have been put into effect by the Forest Service."

Fire Hazard

Fire hazard pertains to projected fire behavior and subsequent suppression effectiveness once a fire starts. Historic fire hazard conditions can be inferred from several studies and personal accounts. Barrett (1935) refers to the diary entry of Jedediah Smith from May 10, 1828 near the junction of the South Fork and Main Trinity Rivers: "The traveling was very bad, several very steep, rocky and brushy points of mountains to go up and down with our horses,…we lost 15 on the way in the brush – 2 with loads." Four days later when the party was down in what is now the Hoopa Indian Reservation, the diary says, "The traveling amazingly bad; we descended one point of brushy and rocky mountain, where it took us about six hours to get the horses down." Barrett (1935) also cites that the 1873 fire that "raged in the Trinity Mountains" had burned for more than a week, creating "dense smoke all over the country, making the atmosphere oppressive and hot." Another fire on Trinity Mountain in 1887 "raged so fiercely throughout the country for the last month." These historic accounts relate conditions of steep terrain, heavy vegetation cover, and wildfires burning for long periods of time.

Accounts from early fire reports from the region, as shown below, indicate fire behavior that could be considered severe:

- "The fires burned rapidly into one big crown fire which swept to the top of the ridge before night. It was impossible for two or three men to do anything on the fire under the conditions. They could not hold the fire on the ridge; they could not go to the creek and work up the side as the fire had not yet reached the creek, nor could they build line on the slope and hold it. The fire was too big and burning too fast." (1928)
- "The fire was set at three known places spaced several hundred yards apart, in exceedingly thick brush at the bottom of a steep side-hill. Low humidity and high winds were the cause of its rapid spread, the day following its start." (1926)
- "The fire was set in a thicket of heavy brush and at a time of high wind which caused such a rapid spread." (1925)
- "The fire was scattered over such a wide country that the crowning flames had a good headway before nightfall." (1925)

Following the California State Fire Law enacted in 1872, fire prevention and suppression programs began, eventually resulting in stands that were more dense with a greater ladder fuel component (GAO/RCED-99-65, 1999). This trend may have been recognized as early as 1918 when Orleans District Ranger Harley commented on the effects of fire suppression, describing the "thick underbrush, windfalls, and general humus" that now covered the forest. Within the MTWAA and the Forest in general, effective fire suppression efforts were not in place until around the 1940's. With the introduction of aerial suppression efforts in the 1950's, fire suppression effectiveness dramatically improved. The data for the watershed reflect that the 1950's were a pivotal period when the number of fires per decade generally increased, and the average acreage burned per fire generally decreased. The acreage that did burn tended to burn as large fires with a higher potential to result in stand replacing events.

Historic fire severity is difficult to assess without extensive analysis of vegetation succession and fire scarring, with only moderate to high intensity wildfires creating effects that would be discernable (e.g., mortality). Taylor & Skinner (1998) looked at patterns of past fire severity, interpreted from age-class structures in the Seiad LSR in the Klamath National Forest. They found fire severity to be related to relative topographic position and slope orientation. Patterns of past fire severity, inferred from age-classes and patch size patterns, indicate that upper slopes, ridgetops, and south- and west-facing slopes experienced more severe fires than lower slopes or east- and north-facing slopes.

Fire and Fuels – Current Conditions

Fire Risk and Hazard

- *What is the trend of the wildfire risk (lightning vs. human-caused)?*
- *What is the fire hazard and what are the potential effects of wildfires to the communities and resources within this area?*

Fire risk pertains to the occurrence and cause of a fire, such as a natural cause like lightning, or human caused, which can include a variety of causes such as children playing with matches, equipment, power-lines, campfires, escaped debris burning, and other causes. Fire hazard pertains to projected fire behavior and subsequent suppression effectiveness once a fire starts. Higher hazard ratings indicate the potential for extreme fire behavior, difficulties in suppression, and increased mortality.

Fire Risk

SRNF fire occurrence data for this MTWAA are available from 1911 to 2001 (Figure 3-19). The SRNF data include information on fires that have started on Forest Service and adjacent private lands within the MTWAA, with limited coverage of the adjacent Hoopa Reservation area. Additional fire occurrence data are available for the Hoopa Reservation from 1986 to 1998. The SRNF fire data include information such as location, fire name, date of occurrence, acres burned, and fire cause. The Hoopa fire data include information on fire location only. The SRNF fire data indicate that approximately 829 fires have occurred within the MTWAA between 1911 and 2001. The Hoopa data indicate that 403 additional fires have occurred in the portion of the Hoopa reservation within the MTWAA between 1986 and 1998. Table 3-35 provides a summary of numbers and acres of fires by cause based on the SRNF fire data.

Table 3-35. Six Rivers National Forest data indicating number and acres of fires started in the Mainstem Trinity Watershed Analysis Area by cause.

Year	Number of Human Caused	%	Number of Lightning Caused	%	Total #	Year	Acres of Human Caused	%	Acres of Lightning Caused	%	Total Acres
1911-19	14	88	2	12	16	1911-19	123	96	5	4	128
1920-29	9	100	0	0	9	1920-29	85	100	0	0	85
1930-39	56	81	13	13	69	1930-39	718	86	115	14	833
1940-49	40	87	6	13	46	1940-49	35	95	2	5	37
1950-59	90	89	11	11	101	1950-59	1258	99	2	1	1,260
1960-69	118	91	12	9	130	1960-69	186	98	4	2	190
1970-79	161	93	13	7	174	1970-79	65	88	9	12	74
1980-89	86	97	3	3	89	1980-89	27	96	1	4	28
1990-2001	181	93	14	7	195	1990-2001	120	98	3	2	123
Total	**755**	**91**	**74**	**9**	**829**	**Total**	**2,617**	**95**	**141**	**5**	**2,758**

Human activities caused the majority of the recorded fires started in the MTWAA between 1911 and 2001. The majority of these fires were small fires that burned limited acreage, however the six largest recorded fires that started in the MTWAA were human caused, burning 1,834 acres. There were two fires in 1955 that burned a total of 1,152 acres; both had human causes. The majority of the human-caused fires within the MTWAA are located near areas of concentrated human activity such as communities, roads, and highways. The largest lightning-caused fire that started in the MTWAA was the Three Creeks fire that started in 1938 and burned 80 acres. Lightning fire starts are generally located in more remote locations. Multiple lightning fire starts generally originate from July to October, and are generally clustered along ridges.

During the recent period of 1997 to 2001, there were 77 fires, with one lightning-caused fire and 76 human-caused fires (Figure 3-20). The breakdown of the human causes is as follows: incendiary (8), campfire (24), children (1), debris burning (16), equipment use (6), smoking (1), and unspecified miscellaneous (20). The majority of the human-caused fires occurred from July through October, which tend to be high-use months.

In addition to the fires that started in the MTWAA, a portion of the Megram Fire burned in the watershed. The Megram Fire was a lightning fire that started outside the MTWAA; however, it resulted in the largest recorded burned area within the MTWAA. Records indicate that 2,017 acres burned southwest of Waterman Ridge.

Figure 3-19. Fire Start Locations for the Period 1911 - 2001 Within the Mainstem Trinity Watershed Analysis Area.

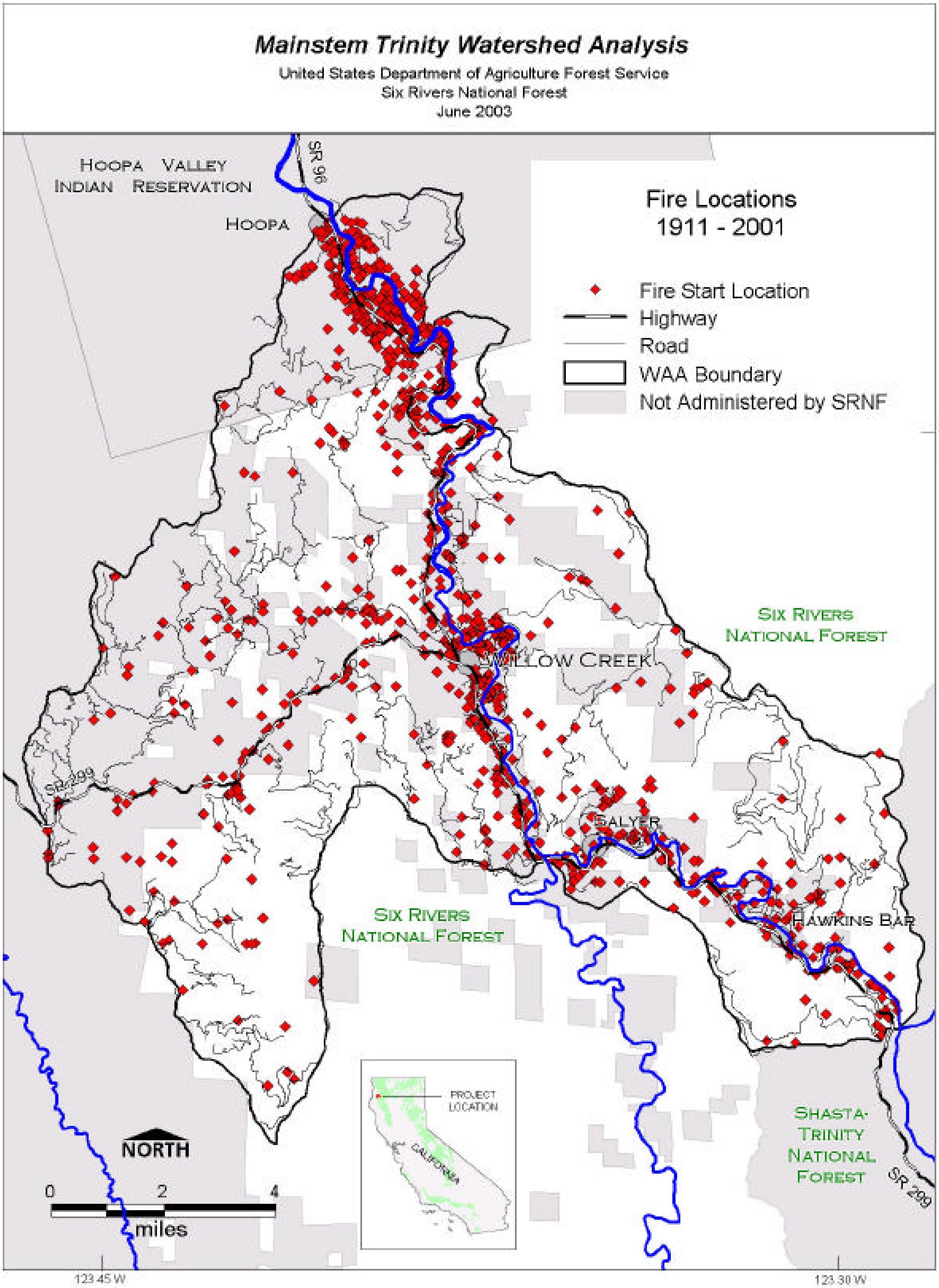
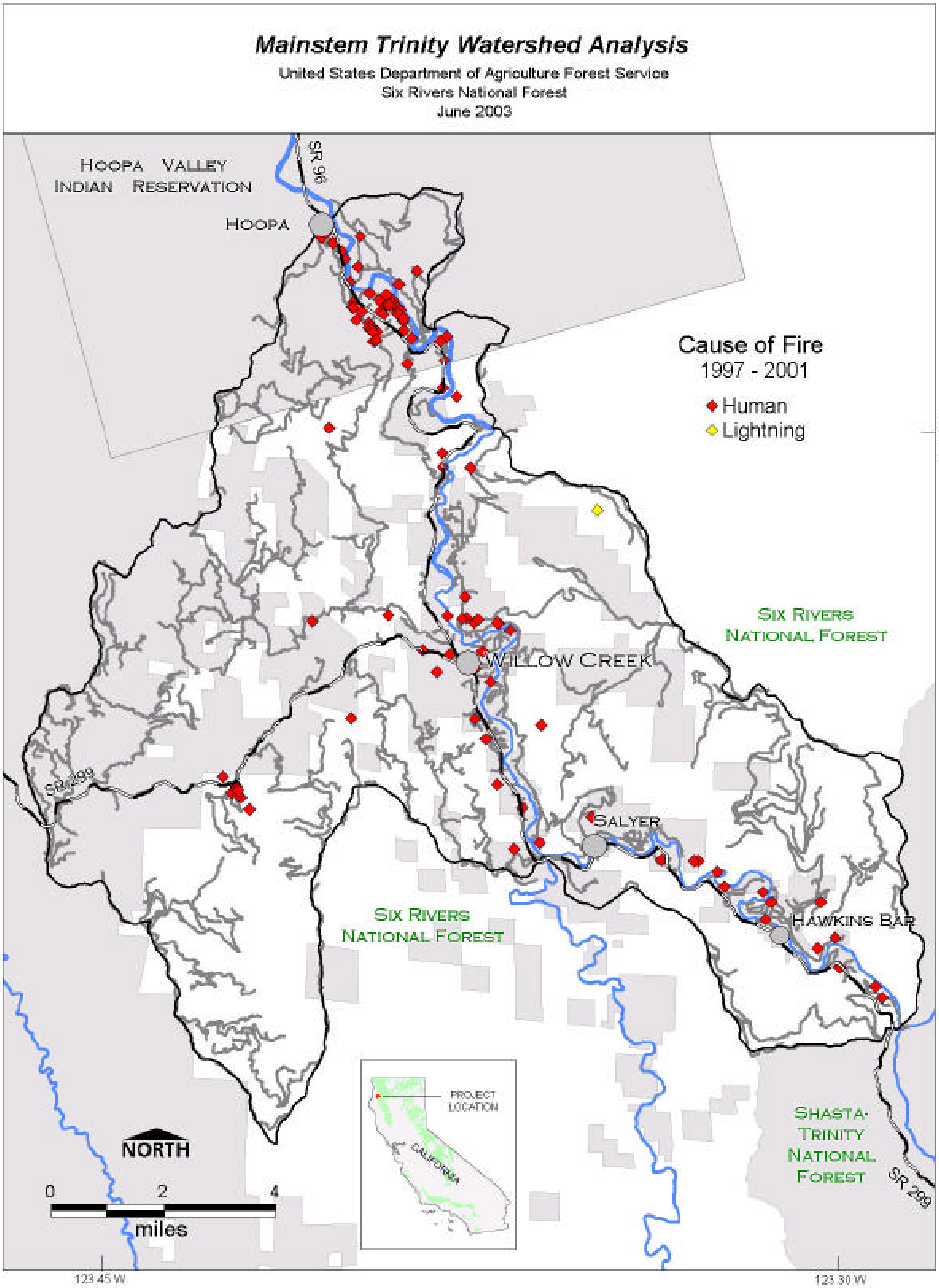


Figure 3-20. Fire Causes for the Period 1997- 2001 Within the Mainstem Trinity Watershed Analysis Area.



Fire Risk Rating

The occurrence and distribution of fire since 1911 within the MTWAA was analyzed to develop overall fire risk categories for the MTWAA. To assess past fire occurrence trends and expected future fire occurrence, a risk rating is calculated using a standard formula. This standard risk formula is based on the number of fire starts, the number of years of historical information, and the number of acres involved. Risk ratings and ranges of values used in this assessment are shown in Table 3-36.

Table 3-36. Fire risk ratings and values.*

Risk	Values	Interpretation
Low	0 - 0.49	At least one fire expected every 20 or more years per thousand acres
Moderate	0.5 - 0.99	At least one fire expected in 11-20 years per thousand acres
High	> 1.0	At least one fire expected in 0-10 years per thousand acres

* Risk rating = [(x/y)*10]/z
x = number of starts recorded for the chosen area
y = number of years the records cover
z = number of acres analyzed, displayed in thousands (e.g., the 78,545 acre MTWAA would be expressed as 78.545)

Risk values and ratings are presented in two ways for the MTWAA. First, Table 3-37 shows the risk values and ratings for the entire MTWAA, based on the SRNF fire data, to indicate the trend in fire risk by decade and other time groupings for the time period between 1911 and 2001. The risk ratings were developed using the standard fire risk formula. Table 3-38 shows the risk values and ratings for the Hoopa Reservation portion of the MTWAA based on the Hoopa fire data for comparison and the standard fire risk formula.

In addition to the overall MTWAA fire risk analysis, a secondary risk analysis was conducted at the subwatershed scale using the fire start date from 1980 to 2001. The watershed scale analysis indicates that there are low, moderate, and high fire risk areas within the MTWAA. Table 3-39 and Figure 3-21 show the risk ratings by subwatershed. The risk ratings by subwatershed were developed using the standard fire risk formula. As indicated on Figure 3-21, subwatersheds associated with the Trinity River corridor have a high risk of fire ignition.

Table 3-37. Risk values and ratings for all lands within the 78,545 acre Mainstem Trinity Watershed Analysis Area by period. For definition of risk rating, see Table 3-36.

Period	Number of Fires	Number Of Years	Risk Value	Risk Rating
1911-1919	16	9	0.2	Low
1920-1929	9	10	0.1	Low
1930-1939	69	10	0.8	Moderate
1940-1949	46	10	0.6	Moderate
1950-1959	101	10	1.3	High
1960-1969	130	10	1.7	High
1970-1979	174	10	2.2	High
1980-1989	89	10	1.1	High

Period	Number of Fires	Number Of Years	Risk Value	Risk Rating
1990-2001	195	12	2.1	High
1911-2001	829	91	1.2	High
1911-1949	140	39	0.46	Low
1950-2001	689	52	1.7	High

Table 3-38. Risk values and ratings for the Hoopa Reservation lands (6,921 acres) within the Mainstem Trinity Watershed Analysis Area. For definition of risk rating, see Table 3-36.

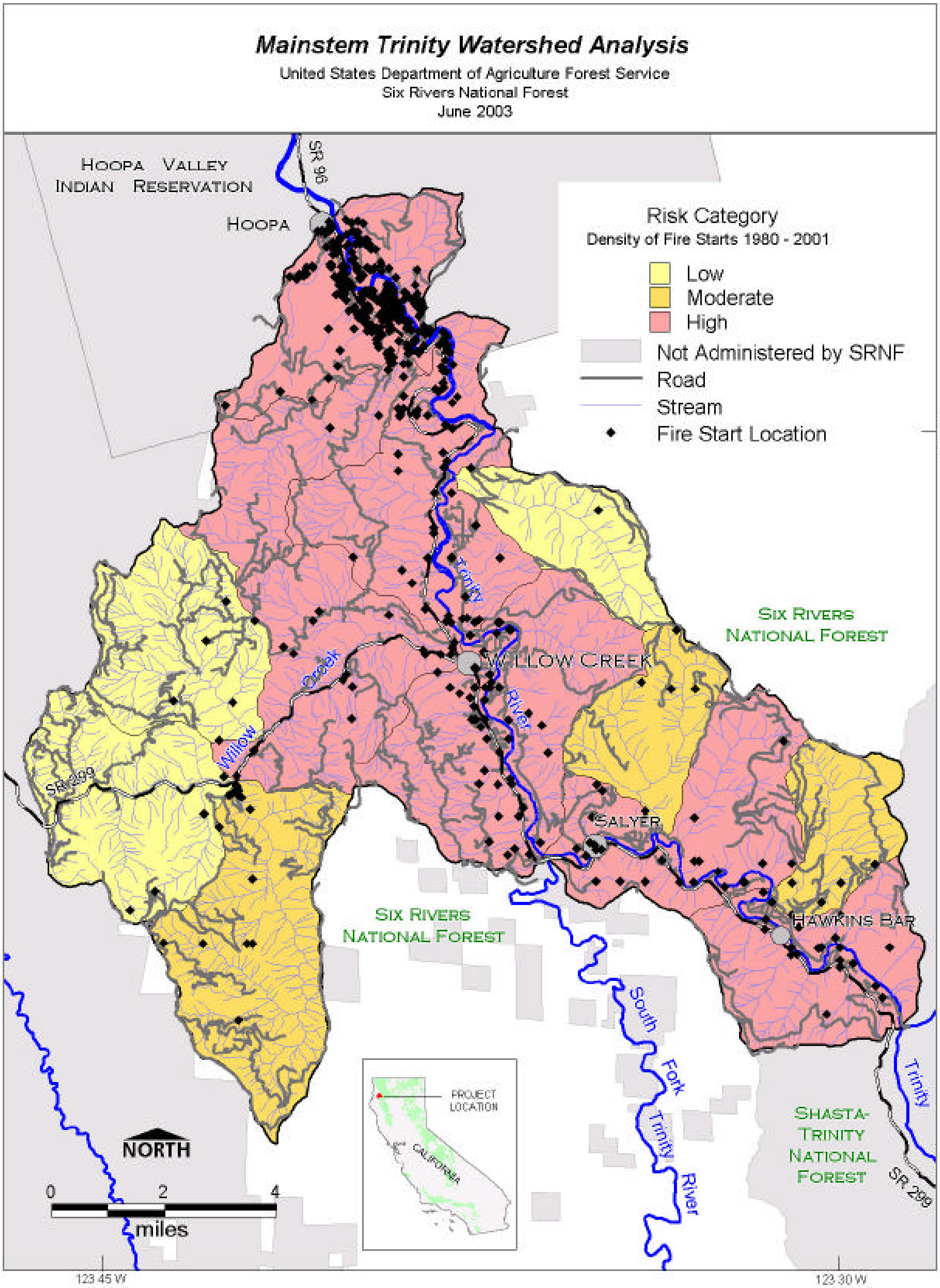
Period	Number of Fires	Number Of Years	Risk Value	Risk Rating
1986-1998	403	13	44.8	High

Table 3-39. Risk ratings for all lands within the Mainstem Trinity Watershed Analysis Area by subwatershed. For definition of risk rating, see Table 3-36.

Risk Rating	Acres	Percent of MTWAA	Number of starts / 1000 acres per decade
High	47,556	61%	>1.0
Moderate	15,071	19%	0.5 - 0.9
Low	15,918	20%	< 0.5

The overall high risk rating (i.e., 1.7 fires expected per 10 years per thousand acres) since 1950 and the high percentage of human-caused fires indicate that human-caused risk is a significant concern in the MTWAA. Incendiary and miscellaneous are the recorded causes for about 69 percent of the fires from 1980-1996 and 37 percent from 1997-2001, indicating a definite challenge for prevention efforts. The areas with the highest risk of ignition are generally along highways, major rural roads, and the Trinity River corridor. Increasing recreation activity levels on the SRNF and increasing rural residential development adjacent to SRNF contribute to this risk. The very high risk rating of fire occurrence on the Hoopa Valley Indian Reservation would also be a concern for management on nearby SRNF lands. The more remote areas tend to have lower risk of fire ignition. Given these factors, overall, the MTWAA is expected to continue to experience a high risk rating in the future, (i.e., at least one fire per 10 years per thousand acres), with the highest risk in areas that are most accessible to the public. This risk-potential, in combination with the state of the fuels within and adjacent to these watersheds, could present a substantial threat to local communities.

Figure 3-21. Fire Risk Within the Mainstem Trinity Watershed Analysis Area.



The majority of the recorded fires in the MTWAA have been small, with only six recorded fires of 100 acres and greater. The largest recorded fire in the watershed area is the portion of the Megram fire that burned into the watershed. Approximately 2,017 acres of the Megram Fire burned in the MTWAA. Of the 10 next largest fires in the MTWAA, all were less than 800 acres, ranging from about 50 to 780 acres. Approximately 4,775 acres, or about 6 to 7 percent of the MTWAA occupied by forest or related vegetation types, has burned in the 91 years of record.

Fire Hazard

An assessment of current wildfire hazard includes projected fire behavior (given current fuel conditions) and associated suppression effectiveness (given available suppression forces). For this hazard assessment, hazard was modeled in terms of rates of spread (ROS) and flame length (FL), which are calculated based on inputs from fuel models (SRNF fuel models were derived from subseries and seral stage), slope class, and weather (Andrews 1986). Calculated values and maps of ROS and FL were only possible for the SRNF portion of the MTWAA.

These two critical fire behavior factors, ROS and FL, also affect resistance to control, which must be considered in the assessment of fire hazard for an area the size of a watershed. Implications of fire effects to resources can be made based on flame lengths and the amount of time it takes for a fire to spread over an area. Flame lengths are also related to suppression effectiveness, in terms of whether hand crews, equipment, or aerial attack can successfully suppress a wildfire. Fires that require aerial attack are associated with the greatest potential for larger, more destructive wildfires with extensive crown fires and higher tree mortality.

The analysis process involved fire behavior models and mortality assessments. Fuel models were assigned to all mapped subseries and seral stages on the Forest. Fire behavior fuel models (Anderson 1982) were used with a two fuel model concept (Andrews 1986) to reflect understory conditions. These fuel models were geographically overlaid with standard National Fire Danger Rating slope classes (Deeming & others 1977) and assigned typical June and August weather for input into the BEHAVE fire model (Andrews 1986), which calculated ROS and FL.

Separate ROS and FLs were calculated for each individual fuel model and fuel model combination. For the two fuel model combination, ROS values were weighted by percent cover. Flame lengths were assigned based on the fuel model with the greatest assigned percentage. Table 3-40 displays the June and August weather inputs to typify average (50^{th} percentile) and more severe (90^{th} percentile) summer time conditions. Depending on the year's weather, the more severe 90^{th} percentile values and even more extreme values could still exist well beyond August into September and October. ROS and FL values were grouped as shown in Table 3-41. Table 3-41 also shows the suppression effectiveness assessments to corresponding ROS and FL values.

Table 3-40. June and August fuel conditions.

Weather Parameter	June	August
Midflame wind speed (mi/hr)	5	7
1-hr time-lag fuel moisture	6	2
10-hr time-lag fuel moisture	8	4
100-hr time-lag fuel moisture	14	8
live herbaceous fuel moisture	133	75
live woody fuel moisture	143	100

Note: Fuel moistures are designated by "hour" time-lag categories, which correspond to diameter size classes: 1-hour - 0.0 to 0.25 inches; 10-hour - 0.26 to 1.0 inch; 100-hour - 1.1 to 3.0 inches.

Table 3-41. Rate of spread (ROS) and flame length (FL) groupings with suppression effectiveness assessments.

Value	ROS (ft/min)	FL (ft)	Suppression Effectiveness
Low	0-5	0-2	3-person hand crew or engine
Moderate	5.1-11	2.1-4	5-person hand crew or engine
High	11.1-22	4.1-6	engines/hand crews/water tender plus aerial attack
Very High	22.1-33	6.1-8	all above plus tractor/aerial support
Extreme	33.1+	8.1+	beyond initial attack, into extended attack

Table 3-42 shows distributions of calculated ROS and FLs for the June and August weather scenarios for the SRNF portion of the MTWAA. For mapping purposes, the high, very high, and extreme August ROS and FLs were grouped and are depicted on Figure 3-22. The coincidence of high to extreme August ROS with high to extreme August FLs covers 60 percent of the MTWAA.

Table 3-42. Percent of the Mainstem Trinity Watershed Analysis Area occupied by various June and August rate of spread (ROS) and flame length (FL) values.

Value	ROS (June)	ROS (Aug)	FL (June)	FL (Aug)
Low	35	-	45	40
Moderate	29	35	42	-
High	30	4	11	40
Very High	2	37	2	1
Extreme	4	24	-	19

The communities of Willow Creek, Salyer, Hawkins Bar, Oden Flat, Suzy Q Ranch, Gray Ranch, Hoopa and the Hoopa Indian Reservation were listed in the Federal Register (August 17, 2001, v 66: n 160) as communities at high risk from the threat of wildfires. Figure 3-22 shows the location of the high fire hazard areas relative to these communities.

Fire Hazard-Risk Analysis

The fire risk analysis and fire hazard analysis described above were combined to indicate where high to extreme hazard areas overlapped areas of moderate to high risk. Figure 3-23 shows the high to extreme hazard ratings overlaid with the low, moderate, and high risk ratings. The areas of highest risk and highest hazard are of primary concern. These areas are where historical ignition data indicate probable future ignition, and fire behavior models indicate probable extreme fire behavior and difficulty in suppression.

Fire Hazard in the Horse Mountain Botanical Area

The Horse Mountain Botanical Area is included in the mixed severity, short interval fire regime typical of the MTWAA. This type of regime is the result of the complex mix of vegetation types, slope, and aspect present within the Area. Fire risk is moderate (between 0.5 and 0.9 starts/1000 acres/decade) for the Area, with fire cause divided between lighting and human causes. Fire hazard (predicted fire behavior) is high to extreme for about half of the Area, primarily along the upper slopes and ridges. The lower slopes tend to have low to moderate fire hazard ratings.

As would be expected in an area with this type of fire regime, stand-replacing events appear to be a minor component of recent fires in the Area. This may also be a result of effective fire suppression program in place for the past 50 years. Evidence of past fires with moderate intensity is present in the vegetation, with some live trees scorched to heights of 25 feet (USFS 1998).

The overall area has a moderate to high susceptibility to burning damage that is typically associated with steep slopes and shallow soils. This indicates that high intensity wildfires could result in soils concerns (USFS 1998).

Fire Regime

The combination and interaction of fire extent, frequency, and severity that occur in an ecosystem are known as a fire regime. Fire regimes range from low severity, short interval (stand maintenance) to high severity, long interval (stand replacing). Various human activities (e.g., fire suppression) and natural events (e.g., droughts, windthrow) can affect individual components of an area's fire regime, and the interpretation of changes or trends must assess all of these factors. Vegetation type and distribution and fire history studies indicate that the MTWAA falls within a mixed severity, short interval fire regime (Agee 1993, Brown & Smith 2000, Frost & Sweeney 2000).

Fire Extent

The spatial extent of fires refers to the size of the area affected by a fire and the landscape patterns that result. Once started, fires in Douglas-fir forests can continue to burn until autumn rains come, allowing fires to cover large areas (Agee 1993). Taylor & Skinner (1998) conducted a fire history study in an LSR in the Klamath Mountains that included an analysis of fire extent. The study analyzed tree species composition, structure (diameter, age), and fire scars from 75 upland plots distributed across approximately 4,000 acres. The average fire size from 1627 to 1987 was approximately 900 acres, with 16 fires having burned more than a third of the study area. The majority of the fires recorded in the MTWAA since 1911 were small fires that burned limited acreage, with the six largest recorded fires started in the watershed burning 1,834 acres.

Figure 3-22. High Fire Hazard Areas Within the Mainstem Trinity Watershed Analysis Area.

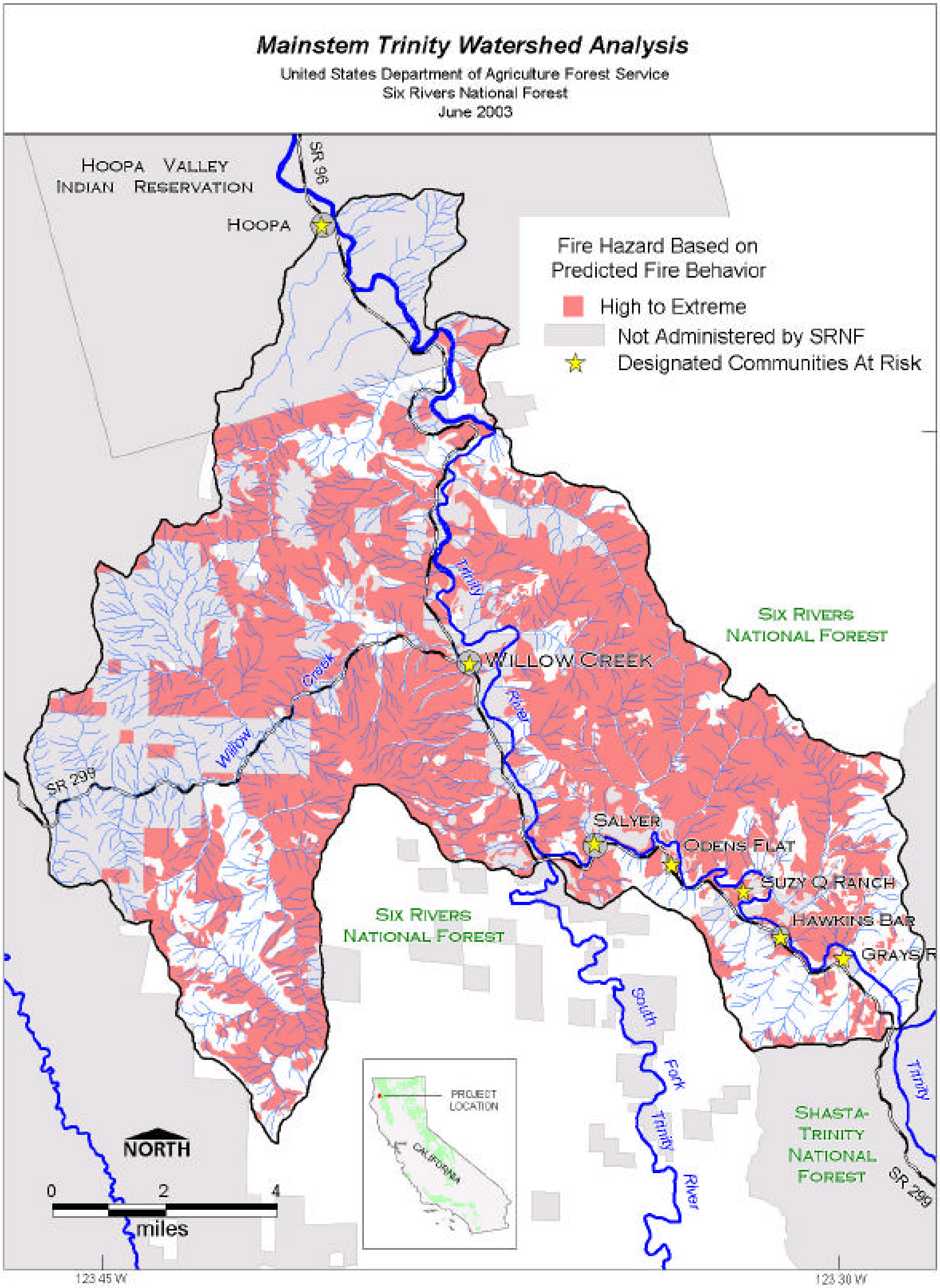
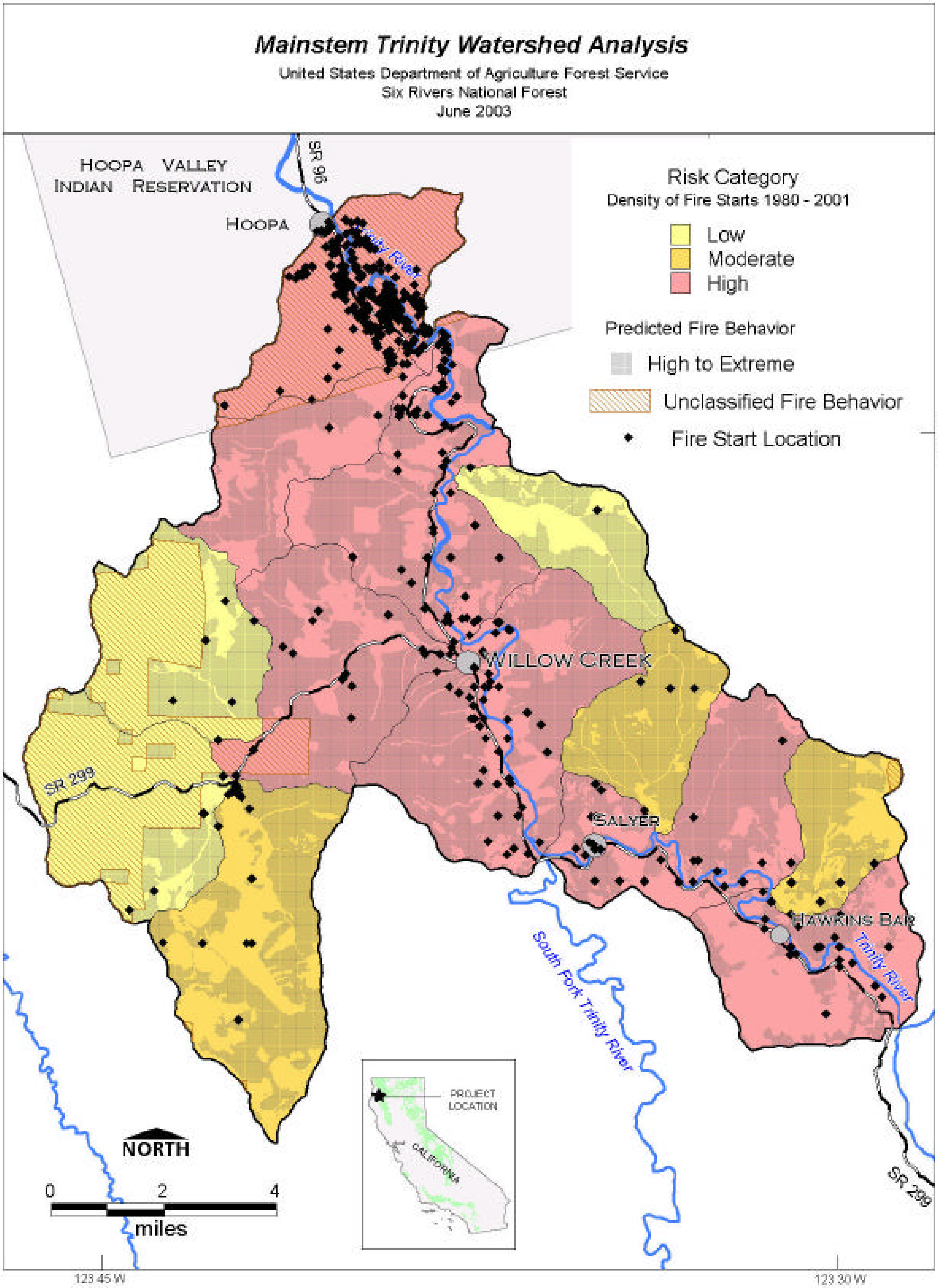


Figure 3-23. Fire Risk Rating Overlaid with Areas of High to Extreme Hazard Rating Within the Mainstem Trinity Watershed Analysis Area.



Review of the existing data on fire occurrence and fire size (previous Table 3-42) shows that after the 1950's, average fire size decreased. One factor that may have contributed to this trend is the effectiveness of aggressive fire suppression.

Fire Frequency or Fire Return Interval

A fire frequency, or fire return interval, describes the period of time between fires for a given location. Fire frequencies can be determined using fire slabs from trees that were several hundred years old when cut down. Fire return intervals taken from several sample points within a stand or type are normally presented as the median return interval for the stand or vegetation type. Frost & Sweeney (2000) completed a summary of fire history studies that included timber types common to northwestern California and presented a number of fire return intervals for various timber types. For the Douglas-fir and white fir types, there is a wide range of median fire return intervals reported from the various studies. The median fire return intervals for Douglas-fir and Douglas-fir/tanoak stands ranged from a low of 12 years to a high of more than 100 years, while the median fire return interval for white fir ranged from about 25 to 65 years. Most of the studies indicate that a narrower fire return interval range of about 15 to 20 years for Douglas-fir/tanoak stands and about 25 to 40 years for white fir stands would be applicable to the MTWAA.

Specific studies by Adams & Sawyer (1980) found fire return intervals in Douglas-fir dominated, mixed evergreen forests to be 16.2 years for the Lower Trinity Ranger District. They concluded that the all-aged nature of these stands, infrequent scarring of trees, and frequency of fires strongly suggest that ground fires, as opposed to crown fires, were the common mode of burning. A white fir fire history study, using plots within the Orleans Ranger District, showed mean fire return intervals of 36.7 years, with a range of 20 to 52 years (Stuart and Salazar 2000). In Douglas-fir forests, frequencies averaging 20 years have been found in the eastern Siskiyou Mountains (Atzet et al. 1988), and Agee (1991) has documented a similar fire return interval in the eastern Siskiyou Mountains between 1740 and 1860, before significant European settlement. In the Salmon River watershed on the Klamath National Forest, Wills (1991) found pre-settlement mean fire return intervals of 10 to 15 years for Douglas-fir/hardwood forests. Within a Douglas-fir dominated landscape in a late-successional forest reserve in the Klamath Mountains, Taylor & Skinner (1998) found median fire return intervals of 14.5 years for the pre-settlement period (1626 to 1849), 12.5 for the settlement period (1850-1904), and 21.5 for the suppression period (1905 to 1992).

Fire Severity

Fire severity describes the effects of fire on an ecosystem and is related to fire intensity. In this section, stand mortality is used as an indicator of general fire severity. Severity is largely dependent on the quantity, type, and distribution of available fuels and the rate at which that fuel burns. There is a tendency for fire severity to be inversely related to fire frequency (i.e., the more frequent an area burns, the less severe the effects). Numerous studies throughout the western United States have indicated that aggressive fire suppression and prevention in the 20th century has reduced fire frequency and resulted in stands that are more dense with a greater ladder component. It would follow that the less frequent fires would be likely to burn with more intensity and severity.

Regionally, fire intensity outside the MTWAA has been highly variable depending on site specific conditions during the fire. However, the fire intensity of regionally significant past wildfires gives insight into the potential fire severity within the region and this watershed. The 1987 Hog Fire and the 1987 Off Fire, both on the Klamath National Forest, grew to 80,000 acres and 9,000 acres, respectively. In both cases, a mosaic of fire severity resulted, with less than half of the areas burned with high intensity, with the remainder burning at moderate and low intensity.

Fire severities were mapped for the SRNF portion of the 1999 Megram Fire. Approximately 30 percent of the Megram Fire had greater than 70 percent mortality (as mapped one year after the fire). Several areas have 3-5 miles of continuous complete stand mortality within the burned perimeter. The recent Windy Fire (70 acres burned in 2000) resulted in mixed severity and mainly burned at night. Alternatively, the Dance Fire (30 acres burned in 2001) resulted in approximately 70-80 percent high severity and was wind-driven during the afternoon.

A potentially significant problem is the possibility of the occurrence of sudden oak death (SOD) within the MTWAA. Considering the prevalence of tanoak and other oaks within this MTWAA which could be affected by this disease, there is a need for great concern. The onset of this disease could drastically affect the extent and severity of future wildfires, with marked effects on fire and fuels management strategies, efficiencies, and effectiveness.

Fire regimes have been, and continue to be, highly variable in terms of frequency, extent, and intensity. However, fire regimes have changed over time due to settlement and fire suppression activities. Using elevation to stratify the watershed and identifying pre-settlement, settlement, and post-settlement/suppression time periods allows for some generalizations (Table 3-43). In general, during the pre-settlement period, the low to mid elevations likely had a fire regime of relatively frequent, low to moderate intensity surface fires, while the higher elevations likely had less frequent, moderate to high intensity fires with greater potential for stand-replacing events. During the settlement period, fire frequency at all elevations likely increased due to more human activity and actively set fires for clearing land, while intensity remained relatively unchanged. The suppression period resulted in a transition to a condition where there is a high frequency of fires that are effectively suppressed with infrequent large fires that escape suppression.

Table 3-43. Generalized fire regimes stratified by elevation and periods.

	Pre-Settlement	Settlement	Post Settlement / Suppression
High Elevation	Infrequent, Low to high intensity High potential for stand-replacing fires	Increased frequency Relatively consistent intensity and potential for stand-replacing fires	Frequent fires Effective suppression with infrequent larger fires that have high potential for stand-replacing events
Low Elevation	Frequent, Low to moderate intensity Primarily surface fires	Increased frequency Relatively consistent intensity and surface fires	Frequent fires Effective suppression with infrequent larger fires that have high potential for stand-replacing events

Without fire suppression, fires occurred more frequently, reducing fuels loads on a regular basis. The more frequent pre-suppression fires probably would have been less intense due to the reduced fuel loads but could have covered significant areas. Therefore, rates-of-spread may have still been high under late summer conditions, but flame lengths would probably have been much less severe, except during stand-replacing fire events (i.e., under severe weather and/or extreme fuel conditions).

Condition Class

Condition classes (Schmidt et al. 2002) also can provide information related to changes in historical fire regimes. Condition Classes were derived for SRNF based on vegetation series and seral stage (USFS 2001). Condition Classes are a function of the degree of departure from historical fire regimes resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, and canopy closure. These alterations within Condition Class 2 and 3 can result in moderate to dramatic changes to fire size, frequency, intensity, severity, or landscape patterns. In turn, the effects of insects, disease, or the eventual fire may cause an increased threat (Condition Class 2) or a significant or complete loss (Condition Class 3) of one or more defining ecosystem components.

Table 3-44 and Figure 3-24 show the MTWAA Condition Class distribution, which indicates a high risk of losing key ecosystem components throughout the watershed.

Table 3-44. Condition Classes for the Mainstem Trinity Watershed Analysis Area (MTWAA) compared to the entire Six Rivers National Forest (SRNF).

	MTWAA		SRNF
Condition Class	**Acres**	**Percent**	**Percent**
Not Mapped	15,286	-	-
1	14,522	23	22
2	15,422	24	19
3	33,244	53	60
Totals	**63,259**	**100**	**100**

The condition class distribution for the MTWAA is similar to the overall distribution for the entire Forest. The widespread occurrence of Condition Class 2 and 3 in and around Willow Creek, Salyer, Hawkins Bar, and the Hoopa Valley Indian Reservation shows the potential wildfire threat to these communities. Also, with the typical ingrowth patterns of brush and small to medium size trees, Condition Class 1 areas are transitioning into Condition Class 2, and Condition Class 2 areas are advancing into Condition Class 3.

Fire Effects on Stand Development

The Old-Growth Definition Task Group (1986) found that the Klamath subregion contains some of the driest forest types in which Douglas-fir is dominant and where this species old-growth is recognized. According to Agee & Edmonds (1992), when fire return intervals are reduced to 50 years or less in these drier and warmer environments, a certain pattern of succession after wildfires occurs. Following a stand-replacement fire, Douglas-fir regenerates the site. A portion of the Douglas-fir regenerating the site ("resisters") may survive several low to moderate severity fires that remove the understory white or grand fir ("avoiders"), and top-kill the associated hardwoods such as madrone, oaks, and tanoak ("endurers"). Several recurrences of such fires will create a stand with several age classes of Douglas-fir and hardwoods, representing regeneration after the last disturbance. Not every fire will result in Douglas-fir regeneration, suggesting many fires had little effect on the overstory canopy (Thornburgh 1982, Wills 1991). Understory-tolerant conifers of other species may be represented in post-fire regeneration. Such stands usually will be intermixed with others that have experienced a stand-replacement event during one of the intermediate fires, resulting in a landscape that is more patchy than in wetter Douglas-fir forests.

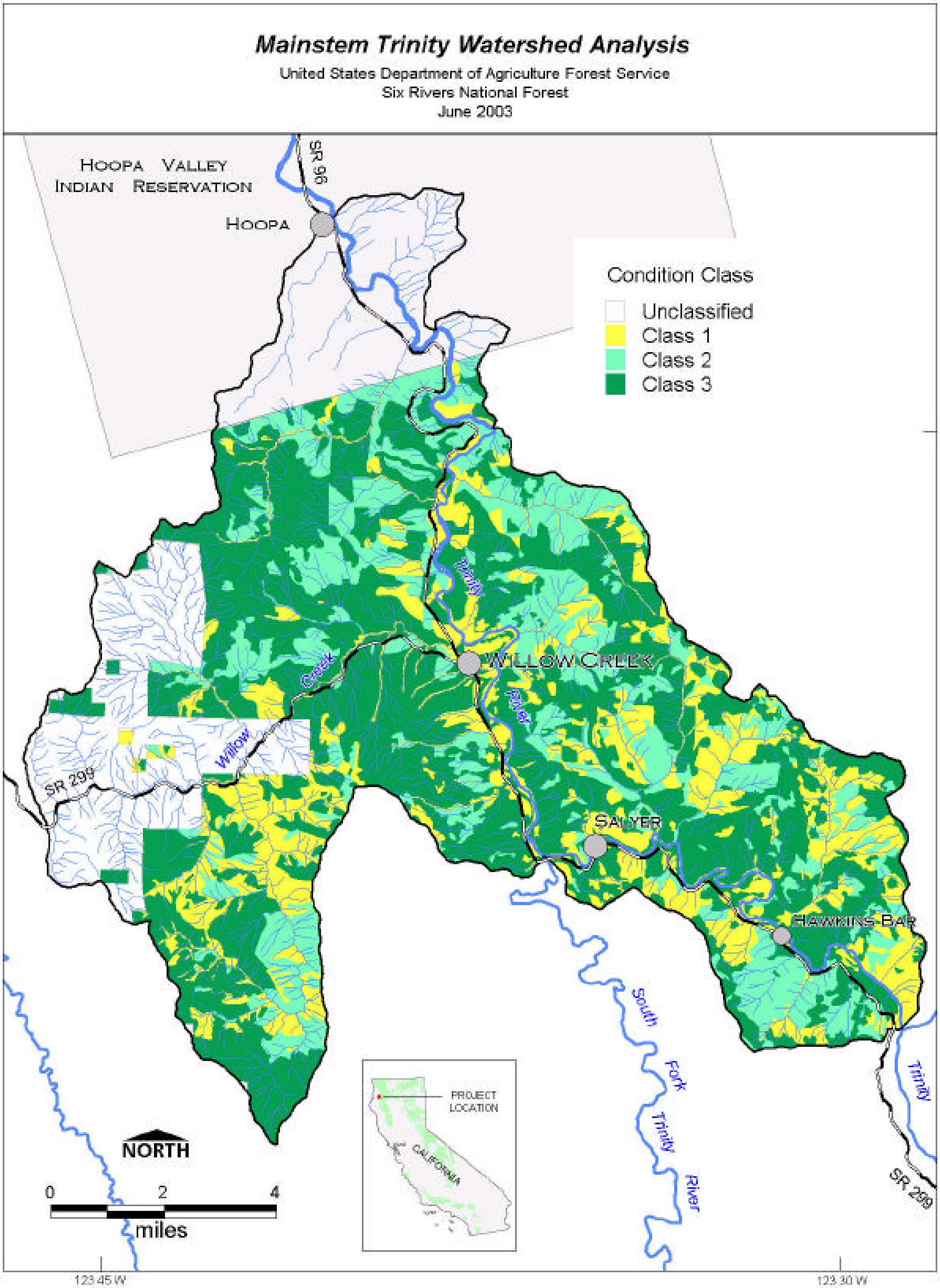
The MTWAA, as part of the Klamath subregion (as defined in the Recovery plan for the northern spotted owl), has a high potential for habitat loss through wildfire (Agee 1993) due to high fuel loads and more uniform multi-layered canopies. This area is also defined as part of an intermediate physiographic province (USFS & USDI BLM FSEIS ROD 1994), which has highly variable fire return interval and fire severity. Wildfires play an important role in stand dynamics, altering age-class distributions with stand regeneration following wildfires. Wildfires do not always result in complete stand mortality or fuel consumption, with surviving trees, snags, and coarse woody debris becoming part of the post-fire stand.

Fuel Treatments and Suppression Effectiveness

There are unique examples of how fuel treatments can affect fire behavior and suppression effectiveness in the adjacent Horse Linto-Mill Creek-Tish Tang watersheds. There were two groups of fuel treatments that affected or had the potential to affect suppression effectiveness during the Megram Fire. The first group was a cluster of understory burns treating 400 to 600 acres that were completed in the late 1980's as part of the Point timber sale (approximately one mile north of Hawkins Bar). Fire suppression tactics for the Megram fire included use of this treated area by placing a fireline along the eastern boundary of the treated area. This afforded the firefighters the tactical advantage of an open forest floor to their backs and the potential for reduced intensities if a spot fire had occurred within the treated area. The open areas also allowed for greater mobility for fire fighting crews.

The second group of fuel treatments was a series of shaded fuelbreaks that were undertaken in 1999 within the blowdown area along roads and ridges. A wide variety of fuel treatment prescriptions were undertaken within these units, including large woody debris removal, piling and burning, jackpot burning, and understory burning. A small number of units were completed all the way to understory burning, while many more were only partially implemented. This group of fuelbreaks fit the standard definition of "a strategically located wide block, or strip, on which a cover of dense, heavy, or flammable vegetation has been permanently changed to one of lower fuel volume or reduced flammability" (Green 1977). Shaded fuelbreaks are created by altering surface fuels, increasing the height to the base of the live crown, and opening the canopy by removing trees (Agee et al. 1998).

Figure 3-24. Condition Class Distribution Within the Mainstem Trinity Watershed Analysis Area.



A total of 1,615 acres had some phase of fuel treatment completed, and essentially all of them were within the Megram Fire boundary, including some spot fires. By overlaying the fuel treatment coverage with the burn severity coverage, an overview of fuelbreak effectiveness can be assessed. Due to the extreme fire behavior exhibited while the fire was burning through this area, firefighters were not dispatched to this area, but the fire effects were very indicative of potential suppression effectiveness. Fuelbreaks are not designed to stop fires; they allow suppression forces a higher probability of successfully attacking a wildland fire (Agee et al., 2000). Overall, about one-third of the treated acres had less than 40 percent mortality with no fire suppression assistance compared to nearly 100 percent mortality in the adjacent stands. The best results within these fuel treatment areas were in the units that had large woody debris removed along with understory burning and the areas that had the fuels piled with no other treatment.

In their Final Report to the Joint Fire Science Program on Effects of Fuels Treatment on Wildfire Severity, Omi & Martinson (2002) concluded that fuel treatments moderate fire behavior within treated areas where fire return intervals are short. The fuel treatment areas burned in the Megram Fire were one of four study sites sampled for the Report. In summary, they found that treating the fuel profile in its entirety was critically important for maximum effectiveness of fuels treatments. Crown bulk density, height to live crown, stand density, basal area, surface fuel conditions, and other factors all need to be considered when designing fuels treatments. Treating single elements will be substantially less effective than an integrated treatment strategy.

Suppression Availability

Of equal importance to a hazard assessment and suppression effectiveness is the determination of suppression availability once a fire starts. Suppressing fires while they are still small requires a mix of initial attack resources that are mobile and quickly available. The current organization for the Forest Service and CDF emphasizes ground attack as the primary initial attack resource, with support from aerial forces for extended attack. The MTWAA falls within the Lower Trinity Ranger District, which has two engines available, with three engines also available from the Hoopa Valley Tribe. CDF would supply crews from High Rock, Alderpoint (one engine), Trinidad (one engine), Fortuna (dozer), Thorn, and the Mendocino Ranger Unit. The watershed would also typically receive resources from the Shasta-Trinity National Forest. Local air support would include Kneeland and/or Scott Valley helicopters and air tankers out of Rohnerville, Redding, and Medford. Numerous volunteer fire departments would also respond.

The portion of the MTWAA adjacent to the community of Willow Creek and along the Trinity River corridor includes the highest population density within the SRNF. This area represents the largest and most complicated wildland interface within the Forest. However, the majority of the MTWAA is sparsely populated. Fires that start in the less densely populated portions of the area may have a lower priority for response when compared to more populated wildland interfaces and intermixes found in the MTWAA and throughout the state. This could be a significant factor when forces are drawn down past effective levels, possibly resulting in significantly larger and more destructive wildfires. For example, the extremely busy fire seasons of 1987, 1996, 1999, 2000, and 2002 resulted in standard resource orders being delayed for two to three days.

Once crews do arrive, the significant factors that would affect suppression effectiveness within the MTWAA are excessive fuel accumulations and steep topography. According to Biswell (1989), a fire burning on nearly level ground doubles in ROS when it goes up a 25 percent slope, and doubles again when the slope is 40 percent. Given that 19 percent of the MTWAA is between 25 and 40 percent slopes, and 62 percent has greater than 40 percent slopes, ground forces would likely be hampered, and aerial attack would be needed for the majority of wildfires within the MTWAA.

Air Quality

- *What are the impacts on air quality and visibility from wildfires compared to prescribed burns within and adjacent to the analysis area?*

The MTWAA falls within the North Coast Air Quality Management District (AQMD). Air quality in this air basin is generally considered good, with all Federal standards consistently achieved (including those for ozone, carbon monoxide, particulate matter, and nitrogen dioxide). The overall area is considered to be in "attainment" by Federal standards, i.e., it has previously and currently meets ambient air quality standards. California state standards for PM10 (particulate matter smaller than 10 microns) have not been met for the AQMD due, at least in part, to the location of the monitoring stations in urban areas (i.e., Eureka and Weaverville). These monitoring stations show that PM10 standards are exceeded during winter months, primarily due to wood stoves for home heating and automobile emissions.

Smoke from wildfires and prescribed burns can be a major contributor of PM10 levels. Smoke from recent wildfires was quite extensive, lasting for several weeks. The Megram Fire resulted in extensive periods of heavy smoke that produced both a State and Federal state of emergency due to air pollution from smoke. Most recently, the fire season of 2002 has resulted in extensive smoke impacts in this area due to wildfires on the Hoopa Reservation, the Klamath National Forest, the Smith River National Recreation Area, and southern Oregon.

The MTWAA lies approximately 24.4 miles away from the Marble Mountain Wilderness (a Class I Wilderness) and about 3.7 miles from the Trinity Alps Wilderness (a Class II Wilderness). The Clean Air Act, as amended in 1977, declared as a national goal the "prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Class I Federal areas in which impairment results from man-made air pollution." The Clean Air Act further states that visibility will be an Air Quality Related Value for Class I Areas. The objective for Class II airsheds is to keep air pollution below federal air standards, which are designated for a moderate degree of protection from future air quality degradation.

Effective smoke management means maintaining desired air quality by avoiding unacceptable combinations of concentration, duration, and dispersal of smoke. The central principle of smoke management is to promote dispersion of smoke that has the potential to cause health and visibility impacts. This is especially the case in the vicinity of communities, major highways, and wilderness areas where the best available predictive models and strategies would need to be used to minimize the negative impacts on the local residents and visitors.

Botanical Area

The primary goal of the Horse Mountain Botanical Area (1,080 ac or 437 ha) is to preserve and manage for the unique botanical values on Horse Mountain, which include Jeffrey pine woodland, serpentine barren, and Port Orford-cedar communities. The full complement of species and plant communities as well as the natural processes that support these elements are protected. The majority of the acreage making up the Horse Mountain Botanical Area (HMBA) is protected as Late Successional Reserve (978 ac or 400 ha) under the Northwest Forest Plan (NWFP). Because LSR management has precedence over all other land management policy under the NWFP, only the remaining 102 acres (41ha) of the HMBA are protected under a Special Interest Area (SIA) designation (USFS 1998). Botanical Special Interest Areas (SIAs) include some of the best examples of indigenous and sensitive plant concentrations, sensitive plant habitat, conifer diversity, and unique plant communities on the Forest (USFS 1995).

- *What are the distinctive elements of the botanical area and how do these elements compare to the rest of the analysis area?*

The HMBA was established due to the presence of distinctive serpentine vegetation and associated rare plants found on Horse Mountain that are not found elsewhere on the Forest. This Botanical Area includes the southern portion of the CDFG's Indian Butte Significant Natural Area. The Horse Mountain communications site occupies a portion of the Botanical Area. Remnants of mining activity are present in the area. The Botanical Area ranges from 2,800 feet (853 m) elevation along Ruby Creek to 4,960 feet (1,512 m) at Horse Mountain. The landscape is highly dissected by numerous drainages emptying into Ruby and Horse Mountain Creeks (tributaries to Willow Creek and thence the Trinity River). The rugged topography—a series of ridges and draws—enhances the influence of aspect on the vegetation. Mean annual precipitation is 65 inches (165 cm) per year according to a 1990 USDA Soil Survey of the SRNF (USFS 1998), with a snow pack on the north-facing slopes extending into May (USFS 1998).

The parent material of Horse Mountain is primarily of ultramafic origin. Ultramafic soils are exclusionary to most plant species. This is due to myriad factors, including a soil chemistry characterized by a high magnesium-to-calcium ratio, high concentration of heavy metals, and low levels of essential nutrients such as nitrogen. However these soils tend to support an extraordinary number of rare and endemic plant species. Serpentine and peridotite are two types of ultramafic rock types that appear in the Horse Mountain Area as local outcrops surrounded by metasedimentary parent material of the Franciscan formation. These outcrops along the North Coast Range of California are commonly aligned with northwest-oriented faults that result from tectonic movement along the border of the oceanic and continental plate (Kruckeberg 1984 *in* USFS 1998).

A vascular plant species list for the HMBA is presented in Appendix A. The distribution of the various vegetation types and seral stages represented in the Horse Mountain Botanical Area are listed below in Tables 3-45 and 3-46, respectively.

Table 3-45. Distribution of the various vegetation types represented in the Horse Mountain Botanical Area.[1]

Subseries	Acres	Percent of Total Area
Tanoak – Chinquapin	4	0.4
Tanoak/Dry shrub	12	1.1
Port Orford-cedar – Port Orford-cedar	42	3.8
Port Orford-cedar – White fir	3	0.2
Port Orford-cedar – Western white pine	32	2.9
White fir – Tanoak	13	1.9
Jeffrey pine – Incense cedar	535	48.2
Douglas-fir – Oregon white oak	29	2.7
Sugar-pine – Western white pine	402	36.2
Grassland	14	1.3
Non-veg.	23	2.1

[1] Table from USDA-Forest Service, Six Rivers National Forest Special Interest Area Management Strategy, Version 1.0 , 1998 (page 112).

Table 3-46. Distribution of seral stages represented in the Horse Mountain Botanical Area.[1]

Seral Stage	Acres	Percent of Total Area
Shrub Harvest	28	2.5
Shrub Natural	19	1.7
Pole Natural	33	3.0
Early Harvest	34	3.1
Early Mature	97	8.8
Mid Mature	255	23.0
Late Mature	24	2.2
Old-growth	597	53.8
Landslide	2	0.2
Quarry	21	1.9

[1] Table from USDA-Forest Service, Six Rivers National Forest Special Interest Area Management Strategy, Version 1.0 , 1998 (page 112).

The vegetation at HMBA is characterized primarily by an open canopy of Jeffrey pine (*Pinus jeffreyi*) associated with incense cedar (*Calocedrus decurrens*), a patchy shrub cover, and scattered distribution of herbs and grasses. Huckleberry oak (*Quercus vaccinifolia*) is the most abundant shrub. California coffeeberry (*Rhamnus californica* ssp. *californica*) and red huckleberry (*Vaccinium parviflorum*) are also prevalent. Also in the area are the less altered, lateritic soils called peridotites, which support a western white pine (*Pinus monticola*) forest associated with sugar pine (*Pinus lambertiana*). Shrub cover is very high in these western white pine-dominated areas, with a sparse herbaceous layer relative to the Jeffrey pine-dominated stand (USFS 1998).

Perhaps one of the most distinctive features of the botanical area is the presence of Port Orford-cedar (*Chamaecyparis lawsoniana*, POC). POC reaches its southern-most extent in this area where it associates with western azalea (*Rhododendron occidentalis*) to form the primary plant community along streams dissecting the ultramafic terrain. Results of genetic research conducted on POC populations scattered throughout northern California demonstrated that the Horse Mountain population is important due to the presence of unique alleles (Millar & Marshall 1991). From a conservation perspective, populations supporting unique or unusual genetic diversity should be protected (Millar & Libby 1989 *in* USFS 1998).

The herbaceous cover in the Botanical Area is highest in open stands dominated by mature Jeffrey pine. Spreading phlox (*Phlox diffusa*), fawn lily (*Erythronium* spp.), beargrass (*Xerophyllum tenax*), wedge-leaf violet (*Viola cuneata*), pussy ears (*Calochortus tolmiei*), Idaho fescue (*Festuca idahoense*) and California fescue (*F. occidentalis*) are among the more common species (USFS 1998).

- *What are the potential impacts to botanical area values (i.e., plant communities, including Port Orford-cedar, rare plants) from past mining?*

There are a number of mining sites (tailings, excavation sites), which have not recovered their historic botanical values. These sites may be causing other resource damage and have altered the scenic quality of the area. Abandoned mine shafts within the Special Interest Area (SIA) also pose a safety risk. There are a number of safety, aesthetic, and noise concerns associated with the target shooting and related dumping at the mine tailing site and along the roads within the SIA.

The Horse Mountain Mine site (the remnants of an early copper mine) is located near the serpentine barrens of the southern portion of the SIA. The vegetation at this and a number of other abandoned mining sites and associated roads within the SIA have not recovered to their previous natural condition (USFS 1998). A detailed field evaluation and analysis of the condition of these mine sites and their impact upon the surrounding plant communities is not currently available.

- *To what degree are current uses in the area incompatible with botanical area values?*

There are some non-system roads within the SIA, and access on these roads (some of which cross POC) can contribute to resource damage. For example, road-related gullies alter drainage patterns, remove habitat, and contribute sediment to the creeks. Access to areas within the SIA has the potential to introduce POC root disease into the uninfested Horse Mountain and Ruby Creek drainages. In addition, vehicle use on the old ski run at the Horse Mountain Snowplay Area is causing serious resource damage (soil erosion, gullying, removal of vegetation, soil compaction, loss of visual aesthetics).

Christmas tree cutting along the section of Route 1 that divides the SIA (and along other primary routes within the SIA) depletes young white fir trees from stands.

The SIA is used for commercial decorative and personal rock collecting, and there is concern that rock collectors may be affecting unique plant habitats (USFS 1998). Examples of potential damage to the area by this activity include soil compaction and damage to vegetation caused by off-road vehicles, stepping on and trampling plants, removal of habitat microsites, and picking plants.

Noxious Weeds

- *What priority invasive plant species are in the analysis area?*

There are currently a number of noxious weed species within the MTWAA, primarily associated with roads and disturbed sites. Table 3-47 and Figure 3-25 show the currently documented yellow star thistle (*Centaurea solstitialis*, CESO3) and scotch broom (*Cytisus scoparius*, CYSC4) weed populations within the MTWAA. These locations are based upon initial noxious weed roadside surveys conducted by the Forest Service in FY2001. More intensive weed surveys are planned for the entire MTWAA in the coming years.

The worst roadside weed populations that have been documented by the initial FS Survey are along Highway 299 and certain county-maintained roads (Table 3-47 and Figure 3-25). The yellow star thistle population along Highway 299 north of Hawkins Bar to south of China Flat has medium-level stand density, with moderate potential to spread. This population has spread from Hwy. 299 south along South Fork Road over one mile. It has also spread from Hwy. 299 east along Friday Ridge Road more than one and a half miles. The cumulatively affected acreage of this continuous yellow star thistle population along roadsides totals more than 29 acres and is by far the most extensive roadside noxious weed infestation known on the WAA.

Smaller, potentially serious roadside noxious weed populations have been identified on the MTWAA. A yellow star thistle population is dispersed at low density along more than two miles of the road from Hawkins Bar northeast to Happy Camp Campground. It is considered to have low potential to spread and currently covers a total of just over half of an acre. Six additional yellow star thistle populations are documented to occur in the eastern portions of the MTWAA, each totaling less than a quarter acre, and ranging from low to medium spread potential. There is a large dense population of Scotch broom on Waterman Ridge, just northeast of, and extending into, the MTWAA (1.27 acre total). Within less than a mile to the north along Waterman Ridge Road is a second dense Scotch broom population which covers just over one acre. Both populations are classified as having medium level spread potential. There are two additional known roadside sites of Scotch broom in the MTWAA that are smaller than a quarter acre and are classified as having medium-level spread potential, and one other has low spread potential. These documented sites are all located in the eastern portion of the MTWAA and correspond to coverage by the initial roadside survey. This preliminary information indicates that a number of noxious weed populations require immediate management. Most of these sites are associated with State and County road maintenance activity.

Table 3-47. Documented noxious weed sites on the Mainstem Trinity Watershed Analysis Area from a roadside noxious weed survey conducted in FY2001 (McRae 2002).

Map Site Code[1]	Weed Species[2]	Acres Infested	Infestation Density[3]	Spread Potential
46	CESO3	0.01	Low	Low
47	CYSC4	0.05	Low	Low
48	CYSC4	1.27	High	Medium
49	CESO3	0.14	Medium	Medium
50	CYSC4	0.23	Medium	Medium
52	CESO3	0.18	Medium	Low
56	CYSC4	0.03	Low	Medium
58	CYSC4	1.03	High	Medium
59	CESO3	0.04	Low	Low
60	CESO3	0.20	Medium	Medium
62	CESO3	0.57	Low	Low
63	CESO3	29.22	Medium	Medium
67	CESO3	0.15	Medium	Medium

[1] Number corresponds with the map site code in Figure 3-25.
[2] CESO3 (yellow star thistle, *Centaurea solstitialis*), CYSC4 (Scotch broom, *Cytisus scoparius*).
[3] Low (<5% coverage), Medium (5 to 25% coverage), High (>25% coverage).

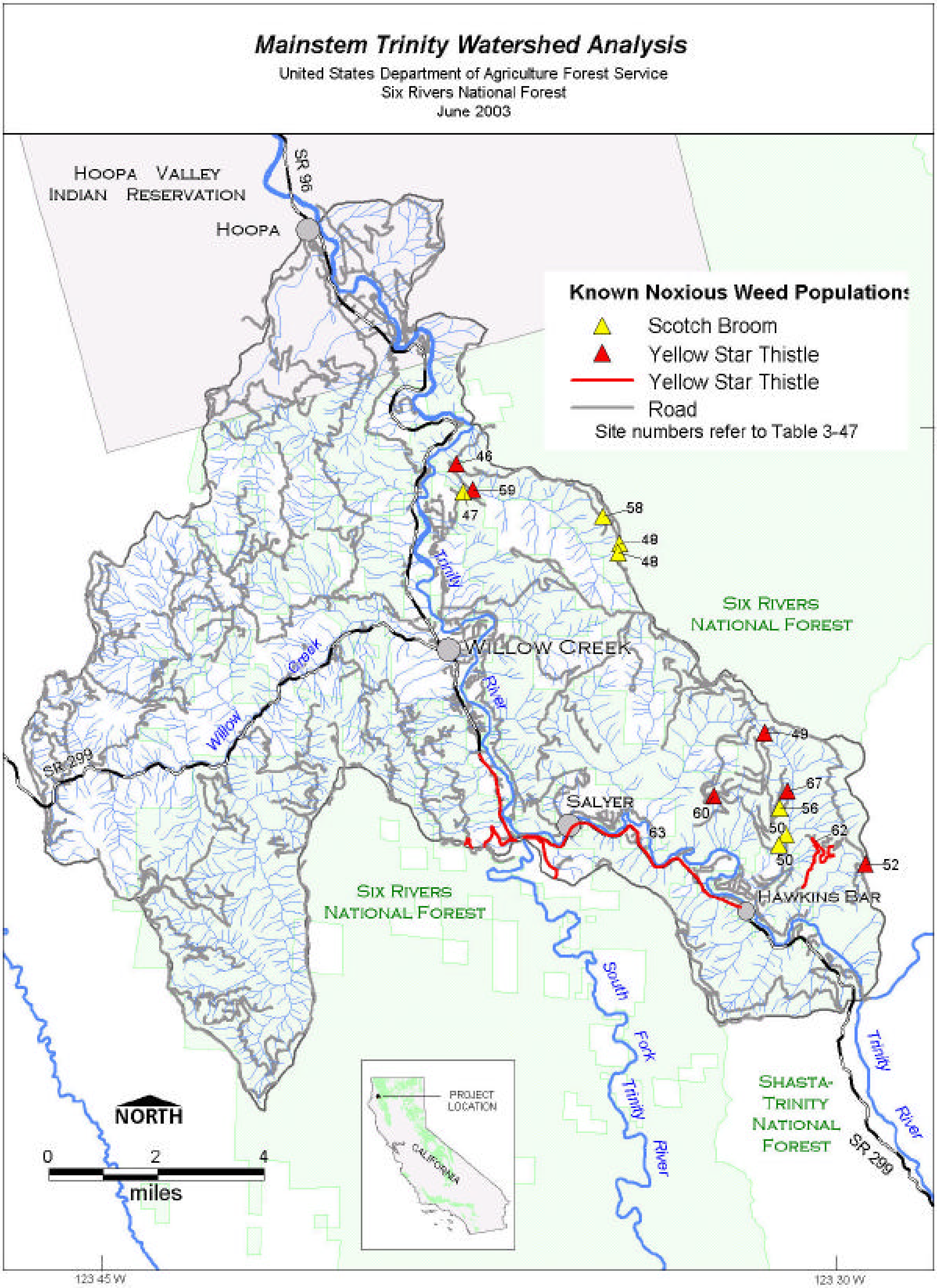
In addition to the invasive yellow star thistle and Scotch broom, other noxious weeds having a significant presence in the MTWAA include the following species for which survey work has not yet been completed:

- bull thistle (*Cirsium vulgare*, CIVU)
- French broom (*Genista monspessulana*, GEMO2)
- Klamathweed (*Hypericum perforatum*, HYPE)
- Himalayan blackberry (*Rubus discolor*, RUDI2)
- English ivy (*Hedera helix*, HEHE)
- Dalmatian toadflax (*Linaria dalmatica*, LIDA)
- Dyer's woad (*Isatis tinctoria*, ISTI).

- *What management activities exacerbate the introduction, spread, and ability to manage invasive plant species?*

All of the noxious weeds currently occurring on the MTWAA have been introduced since the mid-1800's. In addition, the types of human disturbance on the Forest today are far different from those of previous cultures. Particularly susceptible areas to weed infestations are those sites associated with roads and road access; residential, commercial and agricultural developments; and recreational activity. Areas at greatest risk to noxious weed infestation include sites of ground disturbance; change in canopy closure; vehicular, human, and pack animal traffic, and proximity to existing weed populations.

Figure 3-25. Noxious Weed Populations Within the Mainstem Trinity Watershed Analysis Area.



Historically, delays in recognition of weed presence and indifference to potential problems have led to locally well-established weed populations within in the MTWAA. Movement of equipment for road maintenance and firebreak construction has readily dispersed weed propagative materials (seed, tubers, roots, etc.). Feed brought in for pack animals has also been a source of weed seed introduction. Use of certified weed-seed-free feed on the Forest is now required of visitors and personnel alike. The lack of native vegetation on controlled and natural burns can encourage invasive weed establishment before the native vegetation is able to reestablish itself.

The Forest Service is making focused efforts to prevent the further dispersal of noxious weeds by requiring that all restoration, erosion control, and roadside materials (e.g., gravel, fill, straw, weed-free seed mixes) be weed-free. Provincial Guidelines for road related activities such as construction and maintenance are being developed to minimize risk of introduction or spread of noxious weeds (Koop & Yost in prep.).

Wildlife Species and Habitat

- *What are the types and distribution of habitat and, where known, populations of these wildlife species within the analysis area, and what are the trends for those populations?*

The MTWAA provides habitat for a wide variety of terrestrial and riparian dependent species. However, few current or up-to-date wildlife surveys have been completed in the MTWAA. Consequently, historic population levels and the current status of wildlife species within the analysis area are poorly understood. Based on existing survey information, species range maps, incidental wildlife sighting reports (SRNF Wildlife Sightings Database hereafter USFS 2002a), Zeiner et al. (1988, 1990a, and 1990b), the CNDDB (CDFG 2002b), and the California Wildlife Habitat Relationship database, Version 8.0 (CWHR, hereafter CDFG 2002c), there are an estimated 34 reptile and amphibian, 147 bird, and 64 mammal species present or likely to occur within the MTWAA. Species distribution and habitat has been differentially affected by the Megram Fire both within and outside of the MTWAA. Depending on the species and burn intensity, the effects could be detrimental (short or long term) or beneficial. The loss of late seral attributes within the high intensity burn areas may impact late-seral dependent species. However, these stands will provide habitat for species that require early-successional habitats. This section provides an overview of the suitability of wildlife habitat conditions both before and after the Megram Fire.

Threatened and Endangered Species

Preliminary guidelines for evaluating federally threatened, endangered, and candidate species through watershed analysis were provided in a memo from the U.S. Department of Interior and U.S. Department of Agriculture, June 13, 1994. The Endangered Species Act includes provisions for "a means whereby the ecosystem upon which endangered species and threatened species depend may be conserved (and) to provide a program for the conservation of such endangered species and threatened species..." . Watershed analysis provides an avenue to assess habitat conditions for listed and candidate species. This information is then available for use in planning and subsequent consultations with the NMFS or USFWS.

There are three federally threatened wildlife species that are known or have habitat within or contiguous to the MTWAA: the bald eagle, northern spotted owl (NSO), and marbled murrelet (murrelet). The NSO is the only federally threatened species known to nest within the MTWAA. Although no known bald eagle nest sites are present in the MTWAA, a portion of the "Todd Ranch/South Fork Trinity River Territory" is located within the MTWAA. The portion of this territory within the MTWAA only contains foraging habitat, and there is no designated bald eagle nesting habitat within the MTWAA. Although critical habitat for the murrelets has been designated within the MTWAA, surveys associated with Marbled Murrelet Range and Distribution Study have detected no murrelets within the MTWAA.

The USFWS has designated critical habitat for the NSO and murrelet within the MTWAA. Additionally, a large portion of the MTWAA is within LSR RC-306 (hereafter RC-306) and, to a lesser extent, LSR RC-305 (hereafter RC-305), which were designated to maintain a functional late-successional and old-growth forest ecosystem for late-successional dependent species.

Eight of the nine Region 5 Forest Service sensitive species are likely to occur within the MTWAA. The great gray owl is not likely to occur in the MTWAA.

Northern Spotted Owl (*Strix occidentalis caurina*) - Federally Threatened

The first segment of this analysis focuses on the habitat conditions for the NSO prior to the Megram Fire. Current population information is from surveys conducted between 1987 through 1997. The MTWAA contains portions of the Northern Spotted Owl Willow Creek Demographic Study Area, which has been annually surveyed since 1985 (Franklin et al. 2002).

Suitable Habitat

Suitable NSO nesting habitat typically exhibits moderate to high canopy closure with a multi-layered, multi-species canopy dominated by large overstory trees, a high incidence of large trees with cavities, broken tops and other indications of decadence, numerous large snags, heavy accumulations of logs and other woody debris on the forest floor, and considerable open space within and beneath the canopy. These attributes are usually found in old-growth, but they are sometimes found in younger forest, especially those that contain remnant large trees or patches of large trees from earlier stands (Thomas et al. 1990, USFS & USDI BLM 1994).

Acres in the appropriate series are considered suitable for nesting and/or roosting if the stands contained trees with at least a 21 inch DBH (mid-mature, late mature, and old-growth seral stages) and at least 60 percent total canopy cover, of which a minimum of 40 percent consists of conifer. Acres are considered foraging habitat if the stands contained trees with at least 11 inches DBH with similar cover.

Prior to the Megram Fire, there were approximately 35,291 acres (49 percent) of suitable NSO habitat within the MTWAA, excluding Hoopa Valley Indian Reservation lands and some private lands. More specifically, there were approximately 17,778 acres (25 percent) of nesting and/or roosting and 17,528 acres (24 percent) of foraging habitat on SRNF and some private lands, excluding Tribal Lands, within the MTWAA (Table 3-48). Figure 3-26 shows the distribution of suitable spotted owl habitat prior to the Megram Fire within the MTWAA.

Table 3-48. Pre- and Post-Megram fire northern spotted owl habitat acres within the Mainstem Trinity Watershed Analysis Area.

Habitat Type	Pre-Megram Fire	Post-Megram Fire	Change
Nesting and/or Roosting	17,778	17,692	86
Foraging	17,528	17,505	23
Total Spotted Owl Habitat	**35,306**	**35,197**	**109**

Activity Centers

There are 26 known NSO activity centers (with associated 1.3 mile buffers) located within the MTWAA (Table 3-49 and Figure 3-26). There are also an additional 18 NSO territories with portions of their 1.3 mile radius buffer overlapping the MTWAA (Figure 3-26). The majority of these activity centers were established based on data recorded prior to 1995. An additional 18 activity centers are located outside of but within 1.3 miles of the MTWAA.

Table 3-49. Acres of suitable northern spotted owl habitat on Six Rivers National Forest within 0.7 and 1.3 miles of known activity centers. Abbreviations are as follows: NR = acres of habitat suitable for nesting and/or roosting if the stands contained trees with at least a 21 inch DBH (mid-mature, late mature, and old-growth seral stages), and at least 60 percent total canopy cover, of which a minimum of 40 percent consists of conifer; F = Acres of habitat suitable for foraging (F) if the stands contained trees with at least 11 inches DBH with similar cover.

SRNF Owl No.	Territory Name	NR Acres 0.7 Miles	F Acres 0.7 Miles	NR Acres 1.3 Miles	F Acres 1.3 Miles	Last Year Surveyed
111	Campbell Creek North	180	286	437	831	1991
129	Cow Creek	643	75	1,368	687	1992
138	Quinby Creek North	354	313	1,204	914	1993
139	Huckleberry Creek	429	306	902	1,507	1979
140	Zeigler Point	477	340	1,147	1,544	1993
141	China Creek	278	320	789	906	1995
142	Icebox Creek	627	119	1,507	989	1995
144	Campbell Creek	310	255	990	768	1993
145	Brannan Mountain	412	15	1,375	316	1989
146	Three Creeks	134	83	466	197	1992
147	Panther Ridge	159	70	468	443	1995
149	East Fork Willow Creek	516	124	1,306	330	1995
150	Four Mile Creek	254	228	985	666	1987
151	East Fork Willow Creek	453	130	1,655	477	1995
154	East Fork Willow Creek	437	224	1,315	695	1995
158	Horse Mountain Creek	564	161	1,905	489	1995
161	Friday Camp	392	179	1,482	511	1985
172	Pony Creek	469	344	1,368	1,147	1989
173	Gray Ranch	270	329	1,057	1,164	1994
175	Gray Creek	452	274	1,221	1,412	1995
271	East Fork Willow Creek	479	13	893	225	1995

SRNF Owl No.	Territory Name	NR Acres 0.7 Miles	F Acres 0.7 Miles	NR Acres 1.3 Miles	F Acres 1.3 Miles	Last Year Surveyed
276	Campbell Creek West	190	230	386	383	1991
320	Waterman West	254	167	1,132	343	1992
321	Indian Field Ridge	105	21	207	28	1992
356	Campbell Creek South	126	27	531	364	1995
359	Salyer	467	354	978	1,368	1993

Critical Habitat

Critical habitat for NSOs was designated by the USFWS in 1992 to protect the physical and biological features essential to the conservation of the species. Projects that might have an effect on the Primary Constituent Elements of NSO Critical Habitat on forested lands that are used or potentially used for nesting, roosting, foraging, or dispersal require consultation with the USFWS. Designated Critical Habitat Units (CHU) roughly overlap the area encompassed within Habitat Conservation Areas, which include LSRs. Portions of two CHU CA-29 and CA-30 are located within the MTWAA, and their boundaries are synonymous with the boundaries of RC-306 and RC-305, respectively. Figure 3-27 (below) shows northern spotted owl critical habitat within the MTWAA.

Late-Successional Reserves (LSR)

The Northwest Forest Plan identified LSRs, which are large areas to be managed to protect and enhance habitat for northern spotted owls and other plants and animals associated with mature and old-growth forests. The MTWAA contains 9,737 acres (23 percent) of designated LSR within two LSRs: RC-305 and RC-306 (Figure 1-2 and see Chapter 1, *Land Allocations*).

A Forest-wide LSR assessment (USFS 1999a) has been completed and is available at the SRNF Supervisor's Office in Eureka.

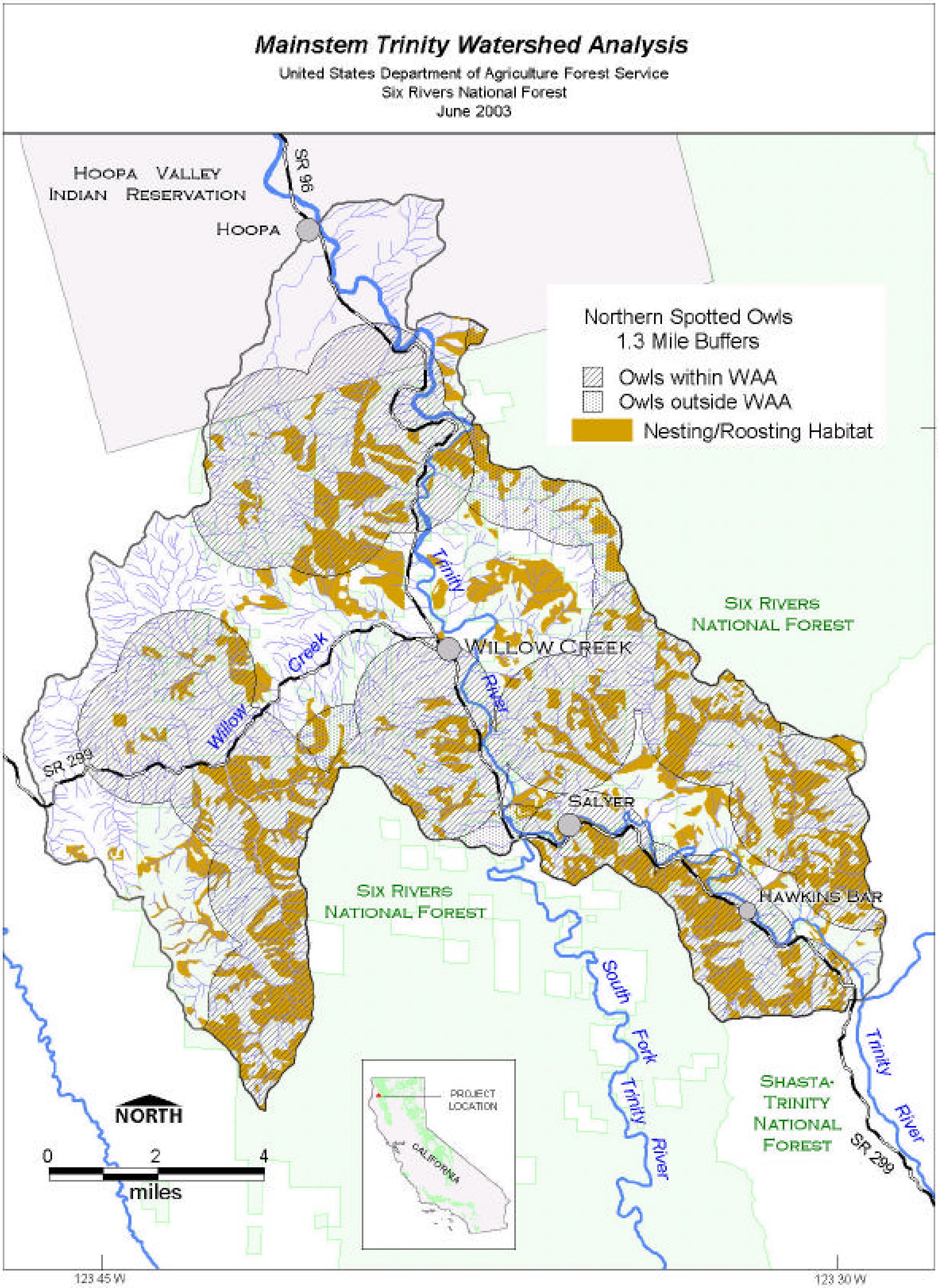
LSR 306

Approximately 9,760 acres (20 percent) of LSR 306 are within the MTWAA. Of the 9,760 acres, 5,124 acres (53 percent) are classified as suitable spotted owl habitat. More specifically, 3,725 acres (38 percent) are classified as nesting/roosting, and 1,400 acres (14 percent) are classified as foraging habitat (Table 3-50). Habitat within RC-306 was not affected by the Megram Fire.

Table 3-50. Acres of northern spotted owl habitat within RC-306 (which includes LSR RC-810).

LSR 306 (and LSR 810)	Acres
Nesting/Roosting	3,725
Foraging	1,400
Total	**5,124**

Figure 3-26. Northern Spotted Owl (NSO) Territories (Activity Centers With 1.3 Mile Buffers) and Nesting/Roosting Habitat Within the Mainstem Trinity Watershed Analysis Area.



LSR RC-305

Late Seral Reserve RC-305 totals 96,000 acres, of which 479 acres (0.005 percent) are within the MTWAA. Although habitat within RC-305 was impacted by the Megram Fire, the portion within the MTWAA was not.

100-Acres LSRs

Outside of the large LSRs, NSO sites known as of January 1, 1994 received the protection of 100-acre LSRs, which are made up of the best 100 (±) acres of habitat surrounding the nest site or activity center. There are 20 100-acre LSRs within the MTWAA (Figure 3-27). According to SRNF GIS information, these 20 100-acre LSRs total approximately 1,364 acres. Timber management activities within 100-acre LSRs should comply with management guidelines for large LSRs.

Habitat Connectivity

Suitable NSO dispersal habitat is defined as forest conditions containing trees with a minimum average of 11 inch DBH and 40 percent total canopy cover. The role of dispersal habitat for NSOs is to provide patches of suitable habitat between stands of mature and old-growth forest conditions. The principle is that LSRs would provide healthy clusters of NSO pairs, and resulting juveniles could successfully disperse to surrounding LSRs and suitable habitat blocks in the matrix. Dispersal habitat for NSOs and other late seral-dependent species is intended by the ROD (USFS & USDI BLM1994) to be primarily provided by Riparian Reserves. Figure 3-26 (above) shows the distribution of nesting/roosting NSO habitat within the MTWAA.

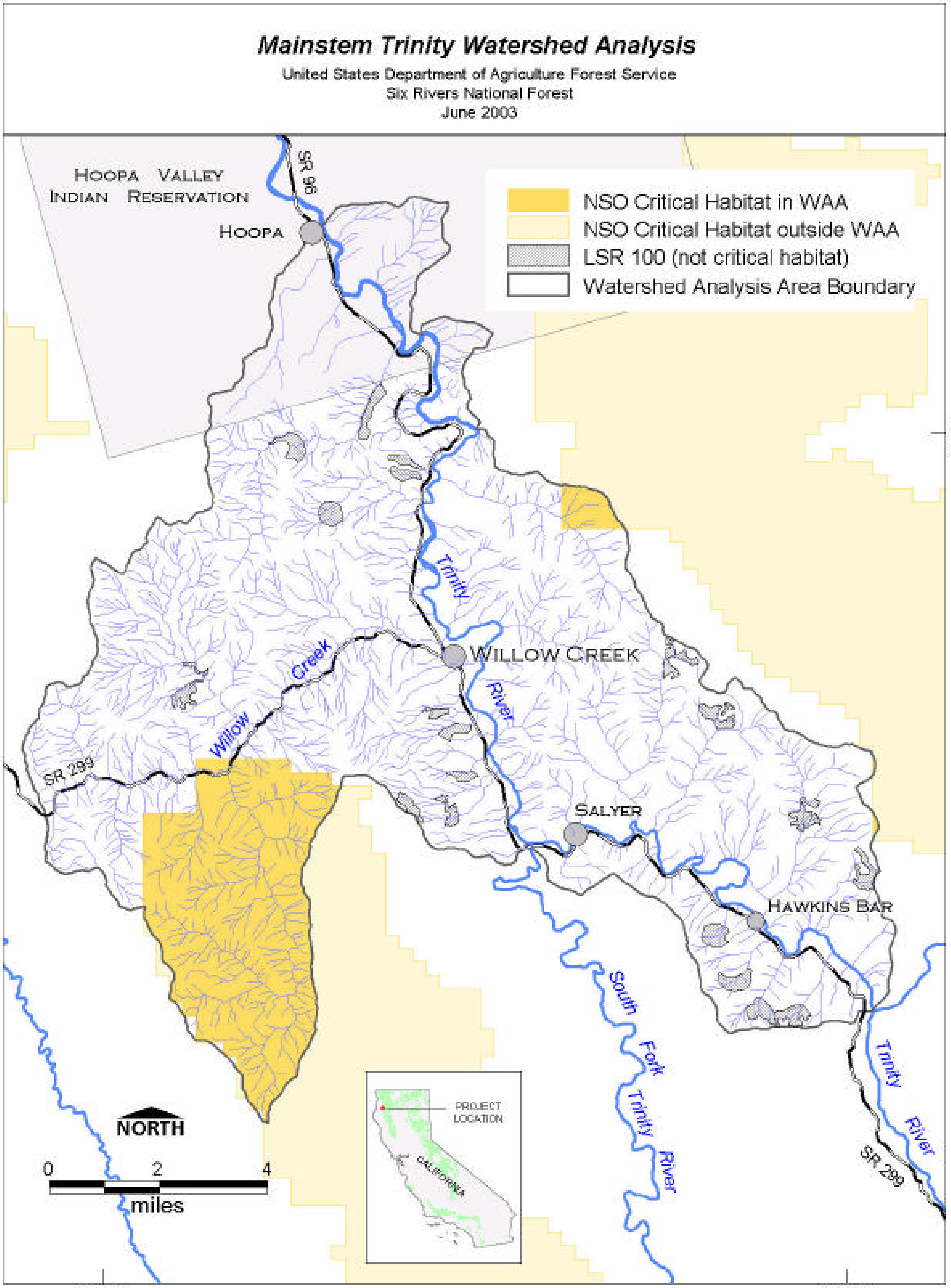
There are approximately 34,995 acres of potential dispersal habitat (49 percent) in the MTWAA, excluding Hoopa Valley Indian Reservation lands, based on vegetation series (tanoak, Douglas-fir, Port Orford-cedar, white fir), seral stage (early mature, mid-mature, late mature, and old-growth) and canopy closure (≥40 percent).

Population and Trend

The location and status of NSO sites discussed herein are based primarily on data collected prior to 1997. Without regular surveys and monitoring of existing NSO activity centers, it is difficult to assess the trends in local spotted owl populations. However, in Franklin et al. (2002) Willow Creek study area, which overlaps a portion of the MTWAA, NSO populations were not different from a stationary population (? = 1).

Although the cutting of late seral stands has contributed to the loss of NSO habitat, this practice has been significantly reduced on the Forest lands since the 1995 Northwest Forest Plan, and it is unknown whether harvest impacts continue to negatively affect NSO survival and/or reproduction. Conversely, the lack of timber harvest and fire suppression may be reducing the amount of habitat for the dusky footed woodrat, the primary prey species of the spotted owl in northwestern California (Zabel et al. 1995). Woodrats were found to be most abundant in 20-30 year old sapling to early-aged pole timber stands (Sakai & Noon 1993) or along the edges between young and old stands (Ward 1990). The availability of early successional forest stands is being reduced through the natural development of these younger stands.

Figure 3-27. Northern Spotted Owl (NSO) Critical Habitat and 100-acre LSRs Within the Mainstem Trinity Watershed Analysis Area.



According to Sakai & Noon (1993), where woodrats dominate the diet of spotted owls, silvicultural procedures that maintain or enhance woodrat populations adjacent to spotted owl habitat may benefit spotted owls.

There is a high potential within the MTWAA for more severe wildfires, which continues to threaten NSOs with high habitat loss. The phenomenon of subcanopy in-growth of vegetation that would naturally have been held in check under historical fire regimes is possibly having a negative effect on the amount of open subcanopy foraging habitat available. Conversely, normal forest growth is expected to gradually increase the amount of suitable NSO habitat over time and is likely to result in the formation of additional nesting structure.

Given the Standards & Guidelines identified within the NWFP, land allocations (LSRs and Critical Habitat Units), and the current level of management on Forest Service lands, the rate of NSO habitat loss has been greatly reduced. However, large fires, such as the Megram and Biscuit fires, can burn significant amounts of habitat within LSRs, which could have a detrimental effect on future NSO populations.

Bald Eagle (*Haliaeetus leucocephalus*) - Federally Threatened

Suitable Habitat

Bald eagles typically nest in large (greater than 36 inches in diameter) trees near fish-bearing water, such as large rivers, bays, and lakes. They primarily feed on fish but will also take waterfowl and carrion, especially in fall and winter.

Nest Sites and Management Zones

There are no known existing or historic bald eagle nest sites located within the MTWAA. The nearest known bald eagle nest site is located within the Todd Ranch/South Fork Trinity River bald eagle territory, approximately 3.5 miles south of the MTWAA. Approximately 594 acres of the Todd Ranch/South Fork Trinity River bald eagle territory overlaps the MTWAA (see Figure 3-29 below). Habitat within the overlapping area is classified as bald eagle foraging habitat.

Population and Trend

There are no current or historic accounts of bald eagles nesting in the MTWAA. However, in the last ten years there has been an increase in eagle activity within the Klamath River Basin, which may be tied to an increase in spring and summer anadromous fish runs. In addition, bald eagles have been observed in late fall along the Trinity River within the MTWAA (D. Halligan pers. comm.). According to the California Department of Fish and Game (DFG), bald eagle populations were increasing in California as of 1997 (CDFG 2000a).

<u>Marbled Murrelet (*Brachyramphus marmoratus*) - Federally Threatened</u>

Suitable Habitat

Suitable murrelet nesting habitat is considered to be late mature and old-growth coniferous forest or younger forests with large trees and limbs to provide nesting opportunities (Ralph et al. 1995). There are approximately 13,727 acres of potential nesting habitat for murrelets within the MTWAA (Figure 3-28). This estimate is fairly liberal until further refinement of habitat classification is conducted. Marbled murrelets have never been recorded within the MTWAA.

Critical Habitat

Collectively, 98 percent of the MTWAA falls within Marbled Murrelet Zones 1 and 2 (USFS & USDI BLM 1994). The USFWS has designated Critical Habitat for the murrelet within LSRs within Zones 1 and 2 that includes RC-305 (CA-11-D) and RC-306 (CA-11-B), both of which encompass portions of the MTWAA (Figure 3-28).

Population and Trend

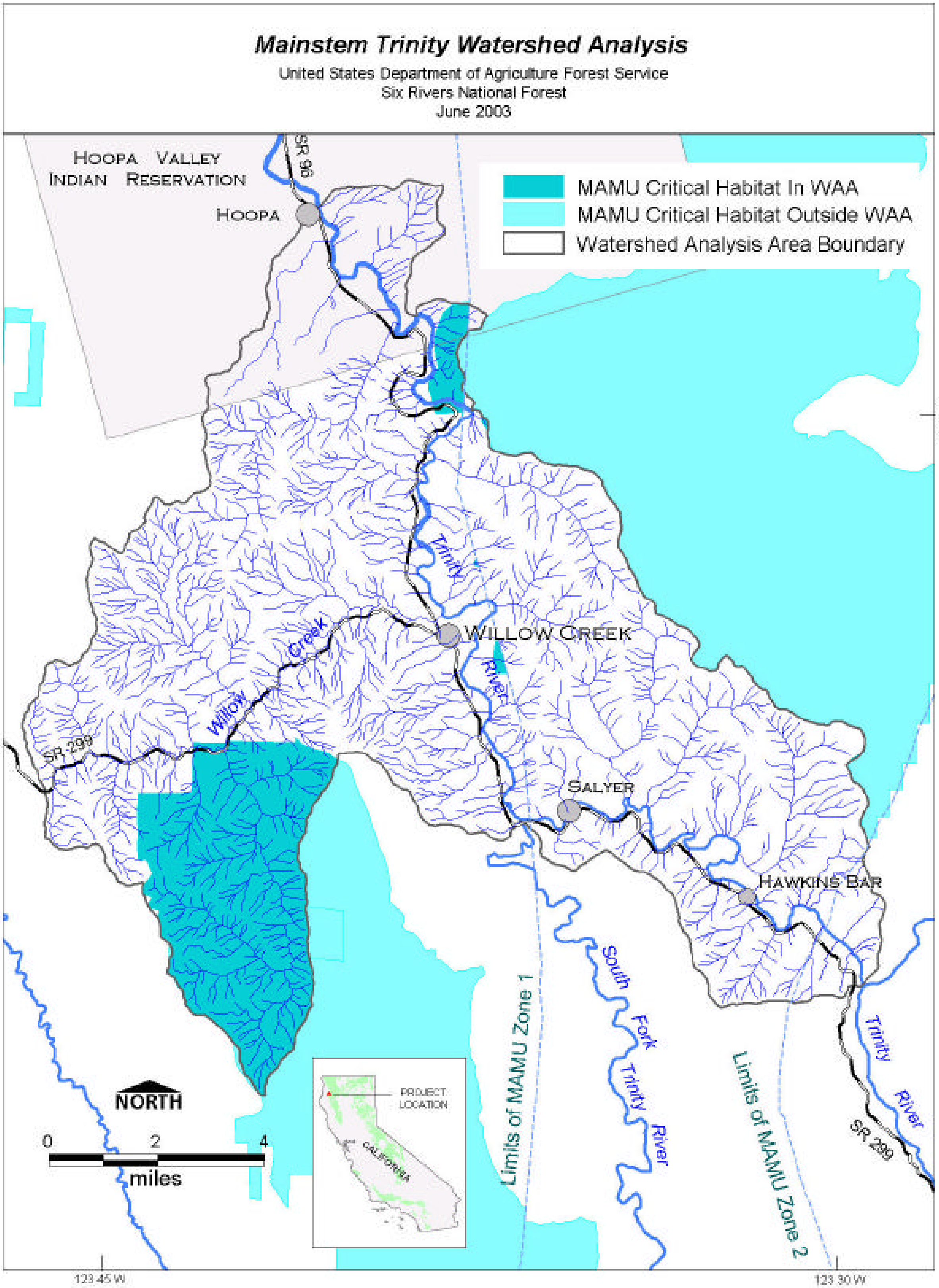
There are no known current or historic records of murrelets occurring in the MTWAA. However, according to the DFG (CDFG 2000a), murrelet populations were continuing to decline in California as of 1999.

Forest Service Sensitive Species

Forest Service Sensitive species are those given special consideration by the Forest Service due to concerns about future population viability. Habitats for Forest Service Sensitive species are to be managed to maintain well-distributed populations throughout their ranges and to prevent them from becoming federally listed as threatened or endangered.

Sensitive wildlife species that are known or suspected to occur within the MTWAA currently include the American peregrine falcon, northern goshawk, Pacific fisher, American marten, willow flycatcher, Townsend's big-eared bat, southern torrent salamander, and northwestern pond turtle. Although the range of the California wolverine includes the MTWAA, this species typically occurs in high elevation red fir and sub-alpine habitats, which are lacking in the MTWAA. Therefore, the California wolverine will not be further discussed herein. Current types and distribution of habitats, populations, and estimated population trends will be discussed in this section. Habitat availability within the MTWAA was based on the SRNF GIS database and/or a query of the CWHR.

Figure 3-28. Marbled Murrelet (MAMU) Zones and Critical Habitat In Relation to the Mainstem Trinity Watershed Analysis Area.



American Peregrine Falcon (*Falco peregrinus anatum*) - FS Sensitive

Suitable Habitat

In the Pacific states, suitable peregrine falcon habitat consists of high cliffs with ledges for nesting and perching. Ridge-top snags are also an important habitat component. Cliff nests, called eyries, are typically near a body of water with an adequate prey base. The diet of peregrine falcons consists almost entirely of birds.

Nest Sites

There is one historic peregrine falcon eyrie located within the Gray Creek territory and MTWAA. The Gray Creek nest site was first discovered above the Trinity River in 1992. Fledgling success continued in 1993, and incubation was observed in 1994 and 1995. In 1996 one adult was observed; however, no birds where detected during surveys completed in 1997, 1998, 1999, and 2002, although incidental sightings have been reported.

Management Zones

Portions of the Gray Creek and Horse Linto Creek peregrine falcon territories are located within the MTWAA. The Gray Creek territory has 11,241 acres designated as Nest Site Protection Zone, Primary Disturbance Zone, and Foraging within the MTWAA. The Horse Linto Creek territory has 478 acres designated as Foraging within the MTWAA (Figure 3-29).

Population and Trend

Since 1996, it appears that peregrine falcons are no longer nesting at the Gray Creek site. During 1996 and 1997, residential construction began as well as timber harvest adjacent to Hwy. 299, which may have led to the abandonment of this nest site (K. Schlick pers. comm.). Nevertheless, peregrine falcons have been observed along the Trinity River and could be nesting elsewhere within the territory or MTWAA, or they may return to this site in the future.

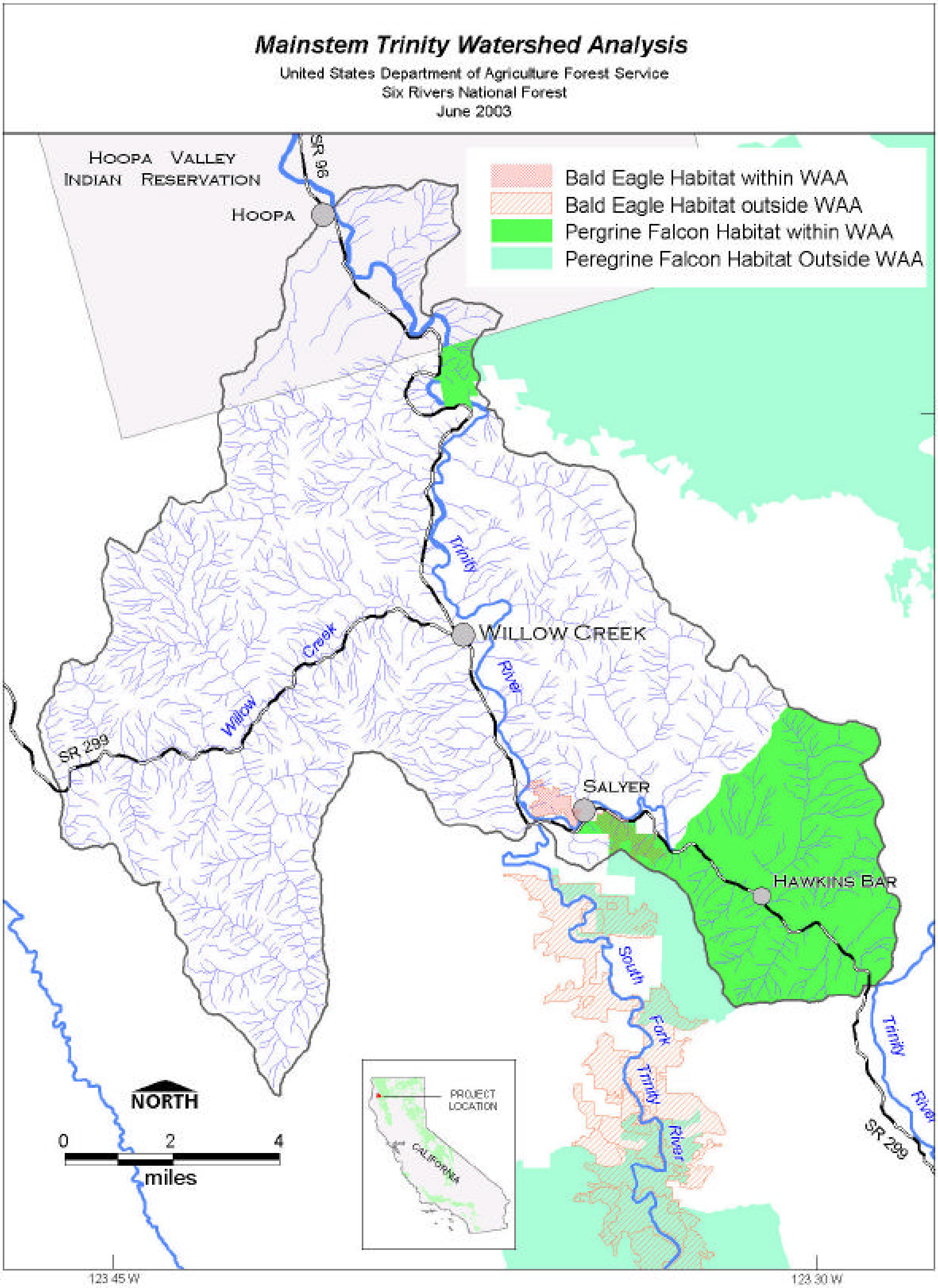
In California, peregrine falcon populations were increasing as of 1999 (CDFG 2000a). On August 25, 1999, the USFWS delisted the American peregrine falcon.

Northern Goshawk (*Accipiter gentilis*) - FS Sensitive

Suitable Habitat

Although northern goshawks (goshawks) use a variety of forest types, forest ages, structural conditions, and successional stages (Reynolds 1992), they typically nest in old-growth and mature coniferous and hardwood stands with high canopy closures and an open understory. Nests are usually located in the largest tree in the stand (Squires & Reynolds 1997) and on low gradient north-facing slopes or benches near water and small openings (Reynolds et al. 1982, Zeiner et al. 1990). Snags and dead-topped trees are important for observation and prey-plucking perches (Zeiner et al. 1990). Goshawks feed primarily on birds, but small mammals are also taken. Foraging habitat typically consists of open, unfragmented mature stands with small forest openings and meadows (Hall 1984).

Figure 3-29. Designated Bald Eagle and Peregrine Falcon Critical Habitat In Relation to the Mainstem Trinity Watershed Analysis Area.



The amount of goshawk nesting habitat in the watershed was based on a query of the CWHR (CDFG 2002b). The following CWHR habitat types were queried: Douglas-fir, white-fir, Ponderosa pine, Jeffery pine, and Port Orford-cedar. CWHR Douglas-fir habitats also include the tanoak and Port Orford-cedar series. Subsequently, there are a total of 23,130 acres of medium and high quality goshawk nesting habitats available in the MTWAA. These consist of the above habitats classified as CWHR 4M, 4D, 5M, and 5D.

Nest Sites and Territories

There is one known historic goshawk nest site and associated territory, referred to as the East Fork Willow Creek territory, located within the MTWAA. The nest site was first discovered in 1978 and was last known to be occupied in 1987. According to the SRNF records, the site was unoccupied in 1994, 1995, and 1996. The site was not surveyed from 1988 to 1993 or from 1996 to 2002. The East Fork Willow Creek goshawk territory totals 316 acres.

Population and Trend

In the past, most goshawk nest areas were discovered incidentally by forestry and other crews laying out timber sales on the forest. Since this type of timber activity has greatly diminished on the Forest, and monitoring of known sites has been sporadic, it is difficult to accurately assess the trends in the local population. Although goshawks are known to annually vary their nest site, the monitoring that has occurred locally suggests that goshawk populations are in decline. This is likely due to the residual effects of extensive logging of late seral stands up until the late 1980's coupled with the insidious effects of subcanopy in-growth due to active fire suppression and human disturbance at nest sites.

Pacific Fisher (*Martes pennanti pacifica*) - FS Sensitive

Suitable Habitat

Moderate to high quality Pacific fisher habitat is similar to that preferred by NSOs. Fishers occupy mid-elevation, multi-storied mature and old-growth mixed conifer and deciduous-riparian habitats. These habitats have moderate to dense canopy closure (>50 percent), scattered patches with six to eight large snags per acre, and abundant accumulations of downed woody debris (Buck et al. 1983). Fishers use cavities in large trees, snags, logs, rock areas, brush piles, and concentrations of downed woody debris for denning and nesting. In the west, all natal and maternal dens were found in large diameter snags or logs (Powell & Zielinski 1994). Hardwoods are also important because they provide mast crops that affect potential prey species of the fisher (Powell & Zielinski 1994). Fishers often forage in proximity to accumulations of dead wood; therefore, both standing snags and downed log densities are important. Fishers use ridges and streamside areas covered by closed canopy forests when moving between quality habitat areas. According to Powell & Zielinski (1994), the fisher's limited ability to disperse across open habitats, its large home range size, and low fecundity make it sensitive to habitat alterations such as extensive regeneration logging.

Estimates of available suitable habitat for fishers were based using the same parameters used to determine acres of suitable nesting/roosting habitat for NSOs. Thus, there are approximately 17,773 acres of suitable fisher habitat in the MTWAA. There have been 58 incidental sightings reported from within the MTWAA between 1964-1992 (USFS 2002a). The CNDDB also shows numerous fisher observations.

Population and Trend

There is insufficient information available to determine the population trends of fishers within the MTWAA.

In California, the fisher's range is restricted to two areas: the North Coast Range and the southern Sierra-Nevada (Zielinski et al. 1995). This is a result primarily of trapping and habitat loss (Powell & Zielinski 1994). Fishers are widely distributed, and detections are common throughout the northern Coast Range and Klamath Mountains of California where detections appear to be consistent with previous reports of fisher distribution (Zielinski et al. 1995). Based on the review of agency wildlife observations, Schempf & White (1977 *in* Zielinski et al. 1995) concluded that fishers were "common and increasing" in the extreme northwestern counties of California. In northwestern California, fisher populations ("*have sustained themselves while nearby populations have apparently declined and failed to recover*") (R. Golightly, pers. comm. and W. Zielinski, pers. obs., *in* Powell & Zielinski 1994).

Large black oaks appear to be in decline in the MTWAA as well as surrounding areas primarily due to their intolerance to the shade caused by emergent Douglas-firs. Under natural and Native American-influenced fire regimes, there were likely greater densities of large black oaks across the landscape. This factor could be influencing the trend in local populations of fishers.

American Marten (*Martes americana*) - FS Sensitive

Suitable Habitat

Preferred habitat is characterized by multi-storied, multi-species, mid-high elevation (>3,000-feet), late seral coniferous forests with >40% canopy cover. Moderate and high quality habitats contain key habitat elements such as large snags and downed wood, which are important for denning and resting. They also require travel corridors comprised of closed canopy forests to move between foraging areas (Freel 1991). According to the SRNF, there are 529 acres of marten habitat within the MTWAA, all within RC-306.

Population and Trend

There have been seven recorded marten observations in the MTWAA between 1972 and 1990 (USFS 2002a). However, it is very difficult to visually discern between a fisher and a marten therefore those observations are questionable. Current detections are known in Orleans and north. No detections where made in the Pilot Creek track plate study which included the southern portions of Grouse Creek and Board Camp drainages. The MTWAA area is indeed a gap in data collection; however, habitat loss and fragmentation as well as unsuitable low elevation hardwoods create unfavorable conditions for this species to persist. Studies are necessary to access population trends.

Townsend's Big-eared Bat (*Corynorhinus townsendii*) - FS Sensitive

Suitable Habitat

Townsend's big-eared bats are generally associated with caves but also use abandoned mineshafts and buildings for colonial breeding and roosting. Cave-like basal hallows in Redwoods have been documented locally. It is likely that tanoak and cedars would provide potential habitat as well (T. Weller pers. comm.). Metal bridges with concrete footings are used as night roosts by females with their pre-volant juveniles primarily because of the latent heat they retain. Structures where the temperature does not remain below freezing are suitable for hibernation. Townsend's big-eared bats are extremely sensitive to human disturbance, especially from spelunkers. The Forest Service published a final rule on Cave Resource Management in the NWFP (which has been incorporated into the LRMP), which establishes criteria nominating, evaluating, and designating significant caves for sensitive bats. Key habitats, such as abandoned caves, mines, or abandoned buildings are apparently lacking in the MTWAA.

Population and Trend

It is likely that this species occurs within the MTWAA; however, there are no confirmed detections. This species has been detected in the adjacent watershed during mist net surveys (implemented by USDS PSW Redwood Science Laboratory) between 1996-1998 in the Pilot Creek drainage. Population trends for this species are believed to be decreasing within the state of California as a result of sealing off mines and caves for safety reasons, the deterioration of abandoned buildings, and an increase in recreational spelunking. Population and trends are difficult to determine because individuals move between roosts; however, monitoring of large aggregations over time is recommended (T. Weller, pers. comm.).

Willow Flycatcher (*Empidonax traillii*) - FS Sensitive

Suitable Habitat

Willow flycatchers typically nest within approximately five feet of the ground in dense willow and other riparian shrubs in wet meadows or willow/alder-dominated riparian zones with open areas for foraging. They appear to prefer both the presence of low dense shrubs, such as willows (*Salix* sp.) and/or alders (*Alnus* sp.), and still or slow moving water within their breeding territories. This type of habitat is not readily available within the MTWAA, and the existing vegetation information is not specific enough to quantify. Based on available information, the best habitat is probably found along the Trinity River and Willow Creek, where the density of willow and alder is greatest.

Willow flycatchers have been observed within the MTWAA, primarily along the Trinity River, during their fall migration. They may be using the MTWAA as a forage area to build the fat reserves necessary for their migration to the tropics (bulking). No nests (or nesting activity) have been found within the MTWAA.

Population and Trend

In California, several subspecies of the willow flycatchers have shown both historic and recent population declines. The primary cause of these declines is probably the loss and degradation of the riparian habitats and nest parasitism by brown-headed cowbirds. Additionally, willow flycatchers generally construct their nests along the edges of willow thickets clumps where they are vulnerable to incidental destruction by cattle. Livestock grazing can also indirectly affect willow flycatcher habitat by altering vegetation and hydrology. Livestock can graze the lower branches of riparian deciduous shrubs and consume or trample young riparian plants.

Northwestern Pond Turtle (*Clemmys marmorata marmorata*) - FS Sensitive

Suitable Habitat

The northwestern pond turtle is generally found along rivers, tributaries, and other waterbodies with exposed basking sites, such as rock, logs, or mud banks, and deep water and terrestrial refugia. This species uses both the terrestrial and aquatic landscapes and displays seasonal cycles of activity and overland journeys. They exhibit a high degree of site fidelity in both aquatic and terrestrial environments. Spring through late summer turtles use aquatic landscapes for foraging, mating, and refuge. Autumn through spring turtles over-winter (i.e., terrestrial aestivation and hibernation) on land clear of hazardous high flows (~ 200 meters from water).

Adult turtles inhabit portions of rivers with relatively low velocities and deep water. Juveniles and hatchlings are relatively poor swimmers and are found in warm, shallow, and slow waters of main river channels (typical of edge water) as well as in nearby ponds and vernal pools with emergent vegetation. Emergent basking sites such as rocks and floating logs are favored by adults and juvenile turtles.

Research shows that, along the mainstem and South Fork Trinity river adults start leaving the aquatic environment in August and return in April and May after over-wintering; gravid females make multiple journeys to nesting sites (e.g., river terrace) during summer (Reese 1996). Eggs are laid in shallow holes dug by females in friable soils with sparse vegetation and good solar exposure (Holland 1991). Nest sites have been found as far as 400 meters from the water at a Trinity River site. Incubation of eggs ranges from May through September, although at certain locations where winters are severe, hatchlings likely over-winter within the nest. Hatchlings emerge from the nest and travel to water during August and September, unless they over-winter, and then they emerge in March.

Boaters report incidental sightings annually on the Mainstem and South Fork Trinity River and residents report them in their ponds. Confirmed detections in the pond at Gray Falls campground are known (K. Schlick pers. comm.). They have been reported from a general location approximately two miles up Brannan Mountain Road. A pond turtle was observed in the Trinity River downstream of the mouth of Willow Creek in 1996 (Halligan 1997). Outside the MTWAA, they are known to occur along the South Fork Trinity River.

Population and Trend

Available information indicates that pond turtles in the Klamath River drainage are in serious condition (Jennings & Hayes 1994). Much of the concern is based on the lack of young turtles in this population and the implications for future population viability. Other attributing factors include habitat loss and degradation, predation, and competition by exotic species, such as bullfrogs. Pond turtle adults can live for decades and have relatively high survivorship because once they attain their adult size (at 8 to 10 years) the number of predators decreases. Over-land migration trips can be in excess of four trips a year, often requiring road crossings, which put the adults at risk with vehicle traffic. Collecting young turtles as pets or "rescuing" migrating turtles on the roads (often gravid females enroute to nest sites) impacts reproductive success. Exotic turtles from pet stores get released in occupied waters and introduce exotic diseases that kill pond turtles (Holland 1991). Turtles are most vulnerable to predation when in the egg stage and when they are juveniles and subadults. Due to their high degree of nest site fidelity, the eggs are preyed upon year after year by meso-carnivores and reptiles (e.g., skunks, raccoons, foxes, bobcats, and snakes). These same predators, including bullfrogs, consume small turtles as well. Suitable upland nesting areas are decreasing due to brush encroachment into grassy openings that were historically kept open by fire and due to residential development on river terrace (often optimal nesting bench habitat).

Southern Torrent Salamander (*Rhyacotriton variegatus*) - FS Sensitive

Suitable Habitat

Southern torrent salamanders are nearly always seen in or within the splash zone of cold (8° –12° C), clear streams, seepages, or waterfalls and below 3,900 feet (1,200 m) elevation (Nussbaum et al. 1983). Their typical haunt is the splash zone, where a thin film of water runs between or under rocks. Seepages running through talus provide ideal habitat. Larvae are sometimes found with adults, but they usually occur in slightly deeper water. Larvae may be abundant in gravel with water percolating through it, while metamorphosed individuals may be found in humid forest habitats generally close to flowing water (Nussbaum et al. 1983). According to Welsh et al. (1992), southern torrent salamanders avoid open riparian or aquatic habitats and relatively fast and deep water situations.

Southern torrent salamanders have been found in or near Boise Creek, Brannan Creek, and an unnamed tributary of Quinby Creek; between 0.5 to 1.0 miles east of Salyer near the Trinity River; on Brush Mountain, just south of Brannan Mountain; and on Indian Butte (CDFG 2002b). The SRNF wildlife database (USFS 2002a) shows an additional three records.

Population and Trend

Although southern torrent salamanders have been observed in the MTWAA, data regarding populations and population trends are not currently available.

Foothill Yellow-legged Frog (*Rana boylii*) - FS Sensitive

Suitable Habitat

The foothill yellow legged frog is found in or near rocky streams in a variety of habitats, including valley-foothill hardwood, valley-foothill hardwood-conifer, valley-foothill riparian, ponderosa pine, mixed conifer, coastal scrub, mixed chaparral, and wet meadow types. Adults often bask on exposed rock surfaces near streams. Egg clusters are attached to gravel or rocks in moving water near stream margins. Foothill yellow-legged frogs have been observed along Coon Creek. This species has been observed along the Trinity River within the MTWAA (Halligan 1997, 1998, 1999).

Population and Trend

Populations of foothill yellow-legged frogs are declining or absent in much of the southern portion of their historic range. In this area, although yellow-legged frogs are not uncommon in suitable habitats, this species is at risk due to exotic predators and poorly timed water releases from upstream reservoirs that scour egg masses from their oviposition substrates and leave egg masses high and dry during the ramping-down of flows releases. Additionally, decreased waterflows can force adult frogs to move into permanent pools where they may be more susceptible to predation.

Survey and Manage Species (S&M)

A number of Survey and Manage (S&M) species and/or protection buffer (PB) species are known or suspected to occur in the MTWAA. Surveys for the following species are required for ground-disturbing activities on SRNF lands within the MTWAA: hooded lancetooth snail, Trinity shoulderband snail, yellow-based sideband snail, Klamath sideband snail, Pressley hesperian snail, and the papillose tail-dropper slug. The habitat descriptions are taken from the Survey Protocol for Survey and Manage Terrestrial Mollusk Species From the Northwest Forest Plan, Version 3.0 2003.

Hooded Lancetooth snail (*Ancotrema voyanum*)

Habitat

Pre-disturbance surveys are not required for projects other than grazing however this species has been incidentally detected during pre-project mollusk surveys within the MTWAA. Hooded lancetooth snails ~~s~~ appear to be typically found associated with moist forest sites in either upland or riparian habitat with perennial subsurface dampness. Late seral, closed forest canopy, hardwood leaf litter, and woody debris are important habitat elements, which provide protection from desiccation. According to three ISMS records with elevation, this species is found between 3,200-4,800 feet.

Population and Trend

Pre-disturbance surveys are not required for projects other than grazing; however, this species has been incidentally detected during pre-project mollusk surveys within the MTWAA. There have been four detections according to the ISMS database. No studies have been published or undertaken to determine long-term population trends, and there is no data available on reproduction for this species. Due to small dispersal distance of this species and the apparent low density of individuals, functional populations are expected to be small in area and made up of few individuals. Intense wildfire has the potential to directly kill animals, remove habitat, and isolate populations.

Trinity Shoulderband Snail (*Helminthoglypta talmadgei*)

Habitat

The Trinity shoulderband snail has been found associated with deciduous tree species (especially oaks) in mixed hardwood/conifer stands. On moister sites it is associated with woody debris or root structures and moss and leaf litter, while rock refugia may be used in dry situations. Partial shading (or a combination of dense shade and open areas) is preferred, and the presence of seasonal herbaceous plants or grass may be a limiting factor. According to 72 ISMS records with elevation, this species is found between 1,045-5,160 feet.

Population and Trend

There have been no studies published or undertaken to determine long-term population trends, nor is there data available on reproduction for this species. The Trinity shoulderband snail is known to occur on SRNF and within the MTWAA (K. Schlick pers. comm..). The ISMS database shows 18 detections at pre-disturbance surveys within the MTWAA. Within suitable habitat, this species appears to be moderately well-distributed based on observations of local biologists. Intense wildfire has the potential to directly kill animals, remove habitat, and isolate populations. Fuels treatment and prescribed burns can potentially increase foraging habitat by the presence of seasonal, herbaceous plants and grasses as well as prevent catastrophic effects from intense forest fires.

Klamath Sideband Snail (*Monadenia fidelis klamathica*)

Habitat

There have been no studies undertaken to determine long-term population trends, nor is data available on reproduction for this species. Pre-disturbance surveys are not required for projects other than grazing; however, this species has been incidentally detected during pre-project mollusk surveys on SRNF. The Klamath sideband is found in late-successional conifer forests with high canopy closure and is associated with woody debris or rock talus within this habitat. Upland as well as riparian sites have been documented where moisture is available in refugia. According to three ISMS records with elevation, this species is found between 1,800-4,940 feet.

Population and Trend

Pre-disturbance surveys are not required for projects other than grazing. Extensive surveys have not uncovered this species, and it is unlikely that this species inhabits the MTWAA. There have been no studies undertaken to determine long-term population trends, nor is there data available on reproduction for this species.

Yellow-Based Sideband Snail (*Monadenia fidelis ochromphalus*)

Habitat

New information provides strong evidence for a lack of association with Riparian Reserves. Dunk et al., (2002) in a statistical analysis of strategic survey data, found that this "species was associated at the micro-scale with the oldest stands and with a number of late-successional forest features." Mean tree age was 150.2 years where present. Mean conifer diameter was 54.4 cm (approximately 21 inches). While the species appears to be LSOG associated, it is found in common vegetation types (mixed conifer and oak) but requires the presence of refugia sites such as large wood or rock talus. According to three ISMS records with elevation, this species is found between 4,540-4,950 feet.

Population and Trend

There have been no studies undertaken to determine long-term population trends, nor is there data available on reproduction for this species. Pre-disturbance surveys are not required for projects other than grazing; however, this species has been incidentally detected during pre-project mollusk surveys. According to the ISMS database, one detection is within the MTWAA. Within suitable habitat, this species appears to be moderately well distributed based on observations of local biologists. Due to small dispersal distance of this species and the apparent low density of individuals, functional populations are expected to be small in area and made up of few individuals. Intense wildfire has the potential to directly kill animals, remove habitat, and isolate populations. Fuels management activities, especially concentrated in river corridors where the majority of both people and mollusk sites are located, can result in significant adverse effects to habitat quality and distribution of populations.

Blue-Gray Tail-Dropper (*Prophysaon coeruleum*)

Habitat

The blue-gray tail-dropper slug is found in moist conifer and mixed conifer/hardwood forests. It is usually located in sites with relatively higher shade and moisture levels than those of the general forest habitat. It is usually associated with partially decayed logs, leaf and needle litter (especially hardwood leaf litter), mosses and moist plant communities such as big leaf maple, and sword fern associations. According to 374 ISMS records with elevation, this species is found between sea level to 6,700 feet.

Population and Trend

No confirmed blue-gray tail-droppers have been detected in California (B. Roth, Malcologist pers. comm.). There is confusion with a common species (*P. dubium*), whose color morphology varies in certain areas and often resembles that of *P. coeruleum*. However, extensive surveys have not uncovered this species, and it is unlikely that this species inhabits the MTWAA.

Pressley Hesperian Snail (*Vespericola pressleyi*)

Habitat

The Pressley Hesperian snail inhabits conifer and/or hardwood forest habitat in permanently damp areas within 200 m of seeps, springs, and stable streams. Woody debris and rock refugia near water are used by species during dry periods. Herbaceous vegetation and leaf litter are common habitat elements associated with this species. According to the 29 ISMS records, no records have elevation data.

Population and Trend

The Pressley Hesperian snail is not known to occur on SRNF or in the MTWAA. It remains on the list for the Lower Trinity Ranger district because range information is lacking and it is known to occur just upstream along the Trinity River on the Shasta-Trinity National Forest. Extensive surveys have not uncovered this species, though other species of this genus have been detected. It is unlikely this species inhabits the MTWAA.

Protection Buffer Species

Bats

The long-eared myotis (*Myotis volans*), fringed myotis (*Myotis thysanodes*), long-legged myotis (*Myotis volans*), silver-haired bat (*Lasionycteris noctivigans*), and the pallid bat (*Antrozous pallidus*) are discussed below.

Habitat

The above bat species occur in a wide variety of habitats, including hardwood/coniferous forests. The long-eared myotis, long-legged myotis, and pallid bat also occur in chaparral and brush habitats. The pallid bat prefers dryer habitats than those within the MTWAA and are very sensitive to human disturbance at roosting sites. Except for the pallid bat, the primary roost site is large snags; the pallid bat prefers buildings and rock outcrops. Other day and night roost sites can include caves, mines, buildings, hollow trees, crevices, and under bark, where they can find protective cover and ideal temperatures. These bats feed over streams, ponds, and open habitats.

There are no known caves, accessible mines, or abandoned buildings located on SRNF lands within the MTWAA. Thus, available roost sites within the MTWAA are generally limited to large snags, tree cavities, under bark, and in rock crevices.

Population and Trend

It is highly unlikely that the pallid bat occurs with in the MTWAA or on the district. It is likely that the other four bat species occur within the MTWAA. All four species have been detected in adjacent watersheds during mist net surveys (implemented by USFS PSW Redwood Science Laboratory) between 1996-1998. Population and trends are difficult to determine because individuals move between roosts; however, monitoring of large aggregations over time is recommended (T. Weller pers. comm.).

Flammulated Owl (*Otus flammeolus*)

Habitat

Flammulated owls occur in a variety of semi-open montane coniferous forests, especially ponderosa pine (Zeiner et al. 1990). This species is a secondary cavity nester that nests in cavities, snags, and live trees. In Oregon, Bull & Wright (1990) found 91 percent of flammulated owl nests in snags located in the forest types of ponderosa pine/Douglas-fir (58 percent) and white fire (42 percent).

Population and Trend

Although flammulated owls are known to occur in the MTWAA, there is no information regarding current populations or trends of this species.

<u>White-Headed Woodpecker (*Picoides albolarvatus*)</u>

Habitat

White-headed woodpeckers occur in mixed coniferous forests dominated by pines (Zeiner et al. 1990). According to Garrett et al. (1996),

Throughout range, dominant requisite habitat components are abundance of mature pines (with large cones and abundant seed production), relatively open canopy (50-70%), and availability of snags and stumps for nest cavities. Understory vegetation is generally sparse within preferred habitats.

Other important species include sugar pine, white fir, incense cedar, and Douglas-fir (Short 1982 *in* Kimball et al. 1996). Nests are excavated in a large snag or stump (>24" DBH) and generally located near forest openings such as near roads or edges of small clearings (Zeiner et al. 1990).

Population and Trend

Although white-headed woodpeckers are known to occur in the MTWAA, there is no information regarding current populations or trends of this species. However, due to the positive response this species experiences as a result of fire, populations are expected to have increased in areas affected by the Megram Fire.

Harvest Species

The Redwood Creek black-tailed deer herd utilizes habitat within the MTWAA. Although deer in this area are not considered migratory, they do move downslope in winter to avoid snow. Thus, the summer range of deer is generally characterized by habitat in the upper elevations, and the winter range is generally characterized by lower elevation habitats. Although there are no key fawning or wintering areas identified within the MTWAA, key wintering habitat has been identified in the Tish Tang A Tang Creek and Horse Linto Creek drainages located just outside the MTWAA. Currently, the Redwood Creek deer herd population has been in a slow decline since the mid 1970's.

There have been several incidental sightings of Roosevelt elk in recent years. The MTWAA is within close proximity to several established herds (i.e. Marbled Mountain, Trinity Alps, and the Lewiston herds), and expansion of the herds within the near future is probable. Black bear, California quail, mountain quail, blue grouse, and band-tailed pigeon are also harvested in the MTWAA.

- *What is the current distribution of late seral stage and old-growth habitats within the MTWAA?*

As shown in Figure 3-15 (in the *Vegetation Seral Stages section* above), old-growth and late seral habitats are widely distributed throughout the MTWAA. The larger concentrations of these habitat types are found in the northern portion of LSR 306, within the upper portions of the Quinby Creek and Hawkins Creek drainages, and south of Highway 299 between Salyer and Icebox Creek. Lesser amounts of these habitats are found within the MTWAA in the area north of Highway 299 and west of Highway 99, where the majority of land is in private and Tribal ownership and was not evaluated in this analysis.

- *What is the habitat and population status of the northern spotted owl within LSR 306?*

This section will address spotted owl habitts and populations within LSR 306. Significant LS/OG stands within the marbled murrelet Zone 1 were reserved through the NWFP ROD and the SRNF LMP, and these stands form the adjacent LSR RC-810. Because the Forest Wide LSR Assessment (USFS 1999a) of RC-306 also includes RC-810, and information regarding these two LSRs is indivisible, RC-810 will be included in the analysis of RC-306.

RC-306 totals 48,600 acres. According to USFS (1999a), there are 24,000 acres of late-successional and a total of 30,500 acres of suitable spotted owl habitat (NR= 24,700 acres and F=5,800 acres). Habitat also includes 8,615 acres of plantations. There is a total of 11,100 acres that have the potential to mature into suitable nesting/roosting and/or foraging habitat in the future. There are also 382 acres of non-vegetation types, including rivers, streams, and landslides, within these LSRs (Table 3-51).

Table 3-51. Summary of LSR 306 and LSR 810 (from USFS 1999a).

Total Acres	48,600
Acres capable of supporting Late-Successional Habitat	24,000
Current Late Successional as a percent of Capable	56%
Current Acres of Suitable Spotted Owl Habitat	30,500
Current Acres of NR Habitat	24,700
Current Acres of F Habitat	5,800
Acres Capable of Providing Suitable Spotted Owl Habitat	41,600
Suitable Spotted Owl Habitat as a Percent of Capable Spotted Owl Habitat	73%
Plantation Acres	8,615
Non-vegetation types	382

The dominant vegetation series include tanoak, Douglas-fir and white-fir. The dominant subseries are tanoak/dry shrub; tanoak-canyon live oak; Douglas-fir-canyon live oak; and white fir-incense cedar. Most of the old-growth is in the tanoak series. Many of the stands in the white fir series are in the early and mid mature seral stages. The Douglas-fir series is dominated by old-growth and mid mature seral stages. Most of the shrub/forb and pole harvested stands are in the tanoak series (USFS 1999a).

A total of 36 activity centers are located within LSR-306, and there are an additional seven in RC-810 for a total of 43. According to USFS (1999a) the Draft Recovery Plan for the NSO predicted that RC-306 (as DCA CD-50 and at 38,000 acres) would support 28 Current Projected Federal Pairs and 25 Future Projected Federal owl pairs (Recovery Plan Table 3.23).

- *How has the Megram Fire altered conditions for TES and special status species within the watershed?*

Although the Megram Fire substantially altered habitat conditions outside of the MTWAA, the fire impacted less than 3 percent (2,017 acres) of the analysis area (Table 3-52). The fire burned primarily at low and low-moderate severities (80 percent) along the southern portion of Waterman Ridge and in the upper reaches of the Hawkins Creek drainage. Approximately 20 percent of the affected area was burned at moderate to extreme severities. Because the fire burned through a variety of vegetation types at the aforementioned severities, the end result is a mosaic of post-fire habitats within the area affected by the Megram Fire. Elsewhere within the MTWAA, habitats remained unchanged as a result of the fire.

Table 3-52. Megram Fire burn severity and acres affected within the Mainstem Trinity Watershed Analysis Area.

	Burn Severity	Vegetation Impact	Acres	Percent
1	Low	<25% vegetation cover killed	1,094	54
2	Low-Moderate	25-40% vegetation cover killed	523	26
2a	Moderate	40-60% vegetation cover killed	95	5
3	Moderate-High	60-70% vegetation cover killed	34	2
4a	High	>70% vegetation cover killed	243	12
4b	Extreme	>70% vegetation cover killed and mostly vaporized	28	1
	Total		**2,017**	

Of the 35,306 acres of suitable spotted owl nesting/roosting and foraging habitat available within the MTWAA, the Megram Fire impacted approximately 1,335 acres (4 percent, see Table 3-53 below). Of this, 791 acres (59 percent) were burned at low severity (<25 percent of the vegetation cover killed), 331 acres burned at low-moderate severity (25-40 percent of the vegetation cover killed, and 80 acres burned at moderate severity (40-60 percent of the vegetation cover killed). A total of 132 acres burned at high-moderate to extreme severity; over 60 percent of the vegetation cover was killed. At a minimum, this represents a loss of 132 acres of spotted owl habitat. An additional 683 acres of non-spotted owl habitat (poles, shrub, and unclassified) burned at various intensities that have not been classified.

Substantial losses of late seral habitat occurred in the adjacent Horse Linto Creek watershed as a result of the Megram Fire. Thus, late seral habitat within the MTWAA is of increased importance, especially to those species that were displaced by the fire. Moreover, NSOs and other species whose home range included the Horse Linto Creek watershed may be subjected to offsite impacts as a result of the fire that are not addressed in this analysis.

Table 3-53. Northern spotted owl nesting/roosting (NR) and foraging (F) habitat burned by the Megram Fire by severity (See Table 3-52).

Habitat	1	2	2a	3	4a	4b	NC	Total
NSO NR Habitat	314	182	34	6	38	2	8	583
NSO F Habitat	477	149	46	5	47	1	26	751
Total	**791**	**331**	**80**	**11**	**85**	**3**	**34**	**1,335**

Fire Intensity: 1 = low severity, <25% vegetation cover killed; 2 = low-moderate severity, 25-40% vegetation cover killed; 2a = moderate severity, 40-60% vegetation cover killed; 3 = high-moderate severity, 60-70% vegetation cover killed; 4a = high severity, >70% vegetation cover killed; 4b = extreme severity, >70% vegetation cover killed and mostly vaporized; NC= burn not classified.

Areas subjected to low severity fire are expected to maintain functional nesting/roosting or foraging habitat characteristics for NSOs and northern goshawks. However, areas that received greater than 50 percent tree mortality are probably no longer suitable for nesting by either species, although they may continue to be used for foraging. The fire also resulted in the recruitment of numerous snags throughout the affected area. This will benefit many species, including the white-headed woodpecker, bats, fishers, and martens. Although limited in quantity, small patches of early successional habitats were created in areas subjected to high and extreme intensity fire.

Human Uses, Values, and Expectations

Socio-Economic

Socio-Economic – Reference Conditions

Most of the MTWAA is located in the eastern portion of Humboldt County. The southeastern part of the MTWAA, including the area east of the South Fork Trinity River, is located in westernmost Trinity County. The MTWAA also includes a small portion of the southern part of the Hoopa Valley Indian Reservation.

The environment of the MTWAA provided resources that allowed tribal populations to live in permanent villages and establish a material culture unique to the Pacific Northwest. Due to the richness of the natural resources found within the MTWAA, this same environment also lured the trappers, miners, settlers, loggers, and the government.

Communities

Humans have inhabited this watershed for over 8,000 years. Numerous prehistoric and historic sites exist in the area, documenting human use of the MTWAA. The analysis area was first inhabited by bands of Native Americans belonging to the Hupa, Tsnungwe, and Chimariko tribes.

The first contact between tribal inhabitants and Euro-Americans took place in 1828 when the Jedediah Smith party traveled along the Trinity River on their way to the coast, camping near the Trinity River at what is now known as Kimtu Bar. In the 1850's, Willow Creek, then known as China Flat, became a distribution center for the pack trains carrying supplies to gold mines in Siskiyou, Trinity, and eastern Humboldt Counties. Numerous violent skirmishes with the local Indian population occurred during this period.

The cessation of violent conflicts between Indian populations and Euro-Americans in the mid-1860's opened up interior sections of Humboldt County to development and settlement. A number of settlers homesteaded in Hoopa Valley, and agreements were eventually reached creating the Hoopa Valley Indian Reservation. At the time of reservation establishment, tribes in the surrounding area were expected to go to this reservation. Lands to the south of the Hoopa Valley remained in public domain.

The gold mining and packing trade that started in the 1850's continued until the Great Depression of the 1930's. Following World War II, the Willow Creek area experienced economic expansion related to demand for the region's quality fir timber. Lumber mills and logging operations became the dominant industries throughout the Klamath and Trinity river valleys. The communities in the MTWAA developed around this resource-based economy. As the timber industry grew within the MTWAA, local residents developed their skills in this profession and began to diversify their small homestead income by becoming laborers in the timber industry. The demand for timber kept local mills operating 24 hours a day for many years. By the late 1970's, the region's timber industry peaked, and mills and logging companies ceased their operations for various reasons, including the effects of resource-protection measures and regulations.

More recently, recreation and tourism have provided the basis for community development. Fishing, hunting, hiking, and whitewater sports are popular in the MTWAA and draw visitors to the communities within the MTWAA.

Key Economic-Generating Activities

Recreation

Historically, recreational uses in the MTWAA have included fishing, hunting, boating, swimming, hiking, sightseeing, camping, and small-scale mineral resource extracting (i.e. gold mining). The area is part of the ancestral territory of the Hoopa, who developed trails and fishing access points that are still in use today. The establishment of the Hoopa Valley Indian Reservation in the 1860's led to increased use of the non-reservation areas for fishing and seasonal grazing by non-natives. In the 1950's, private land ownership and construction of summer homes increased as the area became more popular as a recreation destination. During the 1960's, recreational interest in the area continued to grow, leading to development of camping and picnic facilities, skiing facilities (Horse Mountain), river access, and trails. Roads on Forest Service lands that had been developed for timber harvesting were used for recreational purposes as well.

Since the 1960's, there has been a decrease in the number of river access points provided by the Forest Service, and the number of camping and boat launching sites has been reduced as well.

See the *Recreation – Reference Conditions* section (below) for more information.

Timber Production

The communities in the MTWAA developed around a resource-based lifestyle that eventually included an active logging industry. As the timber industry grew within the MTWAA, the local people developed their skills in this profession and began to diversify their small homestead income by becoming laborers in the timber industry. See the *Timber Production – Reference Conditions* section (below) for more details.

Special Forest Products

Historically, harvests of special forest products were primarily related to subsistence activities. See the *Special Forest Products* section (below) for a discussion of these activities.

Farming

Small produce farms, orchards, and vineyards have operated off and on in the MTWAA for many years. Crops grown in the area include peaches, pears, grapes, corn, and tomatoes. Additionally, grazing by transport animals and, to a lesser extent cattle, was extensive prior to the establishment of roads for motorized vehicles.

In the Hoopa Valley, the Hupa Tribe supplemented their food from hunting and fishing with berries, acorns, chinquapin, and pine nuts. Little was grown other than tobacco, which was used for pipe smoking. In 1890, the Indian Agency began to raise crops, including mainly wheat and oat grains, in an effort to teach the Indians how to farm. Hogs, cattle, goats, sheep, fowl, and horses were also raised, and by 1935 hogs were an important source of cash income. After World War II, sawmills were built in the Hoopa Valley and agricultural production dwindled. Floods in 1955 and 1964 destroyed many of the remaining crops, and only a few areas of the valley are currently under cultivation (Hoopa Valley Tribe 2000).

Historically, the hills and mountains surrounding tribal villages located along or near the Trinity River were visited seasonally to secure both plant and animal resources. These groups were dependent on anadromous fish as a major subsistence resource. For this reason, they tended to inhabit permanent village sites located along the major waterways within their territory. The following descriptions of subsistence activities of the Hupa, Tsnungwe, and Chimariko peoples summarize information developed for the *Heritage Resources* section of this chapter. Please see that section for a more-detailed discussion of the subsistence activities of tribal populations in the MTWAA.

For the Hupa, salmon and acorns (both fresh and dried) were the tribe's principal food resources. They also fished for steelhead, lamprey eels, trout and other small fishes, hunted for deer and elk, and gathered a variety of nuts, seeds, berries, fruits, roots and greens (Wallace 1978) to add variety to their diet. The Hupa also had a rich material culture including distinctive types of architecture such as the *xonta* (family house) and *taikyuw* (men's sweatlodge); an array of expertly woven basket types associated with all phases of the Hupa life cycle; fishing, hunting and food processing tools made of wood, stone, animal parts, and plants fibers; elaborate ornaments and regalia made of furs and skins, feathers, beads (e.g., pine nuts, imported marine shells), twine, and basketry materials; distinctive fishing and hunting tool kits with associated traits and constructions such as fish weirs and deer blinds; and more.

Similar to the Hupa, the Tsnungwe depended heavily on acorns and fish as food staples, as well as the other subsistence foods and materials used by the Hupa. Important Tsnungwe fishing spots along the Trinity River were located in Willow Creek Valley (near *Saqe"q'it* village) and at Burnt Ranch Falls.

Principal subsistence foods for the Chimariko included salmon, acorns, deer, elk, and bear; these were supplemented by eels, pine nuts, wild seeds, berries, several varieties of roots, fowl, and small mammals (Silver 1978). Fishing techniques included use of flat nets (like a tennis net)—either set or seined; setting a large (8-ft-wide) sack-like net made of iris fibers; harpooning; scooping with baskets; use of bare hands; shooting with bow and arrow; and clubbing. Hunting methods included smoking out (bear, rodents); spring-pole traps (deer, wildcat, small mammals, birds); driving and trailing (deer, rabbit, quail); and setting of two converging fires for both large and small game. Fishing, gathering, and hunting places were communally owned, whereas tobacco plots were fenced and privately or jointly owned for a season only.

Socio-Economic – Current Conditions

- *What does this watershed contribute to the economies of local communities?*

The MTWAA, which contains 130 square miles, is located in a rugged area that is sparsely populated, with most of the area's population residing in the unincorporated communities of Willow Creek (in Humboldt County), Salyer and Hawkins Bar (in Trinity County), and in the Hoopa Valley Indian Reservation.

Communities

The Watershed is predominately composed of public lands under the jurisdiction of the SRNF, the Hoopa Valley Indian Reservation under the jurisdiction of the Hoopa Valley Tribal Council, and community lands within Willow Creek, Salyer, and Hawkins Bar. In addition, there are less populated communities such as Adens Flat, Suzy Q Ranch, and Gray Ranch located within the MTWAA. The local communities, including Hoopa, have a long history of use of resources within the MTWAA and have a high level of concern in the management of the environment, river resources, and economic conditions that surround their communities.

The following sections discuss current economic conditions of the communities within the MTWAA.

Willow Creek

Willow Creek, the largest non-reservation community in the MTWAA (with a population of 1,743 in 2000) and the commercial center for the area, is located along Highway 299 at its junction with Highway 96. [This population figure represents persons residing within the Willow Creek Census Designated Place (CDP) (i.e., the portion of the Watershed west of the Trinity River and South Fork Trinity River).] The Trinity River, which includes a section of wild and scenic river, runs adjacent to the community and provides for an economic basis of tourism associated with whitewater rafting, canoeing, and kayaking. The river also offers salmon, steelhead, and trout fishing that attracts both local and out-of-town anglers. Several businesses in Willow Creek offer services that support these activities, including at least four restaurants, five bed-and-breakfast inns, and two motels.

Other businesses and employers in Willow Creek include two banks, a pharmacy, two real estate offices, a public library, two medical facilities, a chiropractor, a message therapist, a physical therapy office, several gift shops, two hardware stores, a craft store, an espresso house, a video rental shop, three gas stations, an auto repair and towing service, a golf course and country club, an aggregate and asphalt operation, a Highway Patrol substation, a Caltrans maintenance facility, a CDF office, and the SRNF Lower Trinity Ranger District office. Commercial uses are predominantly located in the central Willow Creek area near the intersection of the two highways. A smaller number of commercial establishments are located on Highway 299 south of the central commercial area. Willow Creek also is developing as a "bedroom community" for the greater Arcata-Eureka area.

According to the 2000 Census, the Willow Creek CDPs resident labor force totaled 1,379 persons. Unemployment within the Willow Creek area was relatively low, at 5.5 percent, at the time of the 2000 Census. More than 43 percent of the Willow Creek CDPs labor force was employed in management, professional, and related occupations in 2000 (Table 3-54). Services, sales, and office occupations are also dominant in the local area, accounting for a combined 37 percent of local occupations. Important economic sectors in the Willow Creek area include educational, health, and social services (employing 30 percent of area residents) and arts, entertainment, recreation, accommodation, and food services businesses (providing nearly 11 percent of the area's employment) (Table 3-55). One-third of the Willow Creek CDPs employed residents were government workers in 2000 (U.S. Census Bureau 2002).

Salyer and Hawkins Bar

The small unincorporated communities of Salyer and Hawkins Bar are located along Highway 299, five to ten miles southeast of Willow Creek. Also in this general area, the two small unincorporated communities of Oden Flat and Suzy Q Ranch are located between Salyer and Hawkins bar, and the small unincorporated community of Gray Ranch is located to the east of Hawkins Bar. Salyer lies along the Trinity River in the vicinity of Burnt Ranch Gorge, a class-five stretch of whitewater that attracts experienced kayakers and rafters. Below the gorge are quiet stretches of the Trinity River that flow through sheer canyons. Groceries, gas, restaurants, a bed-and-breakfast inn, and an RV park are available to anglers, boaters, and others attracted to the area. The population of the Salyer/Hawkins Bar area (as defined by the boundary of Census Tract 2, Block Group 2, which includes most of the Watershed area in Trinity County east of the South Fork Trinity River) totaled 794 in 2000, including an employed resident labor force of 288 persons. Unlike the Willow Creek CDP, the Salyer/Hawkins Bar area contains fewer management and professional occupations (17 percent compared to 43 percent). Instead, dominant occupations include service occupations (26 percent) and production, transportation, and material-moving occupations (20 percent) (Table 3-54). Key economic sectors include the educational, health, and social services sector and the retail trade sector, which employed 24 percent and 15 percent of the resident labor force, respectively, in 2000 (Table 3-55). The agriculture, forestry, fishing, hunting, and mining sectors are also important to the local economy, employing 13 percent of the resident labor force.

Hoopa Valley Indian Reservation

The Hoopa Valley, which is bisected by the Trinity River, lies about 12 miles north of Willow Creek. The valley is separated into nine districts or fields, which represent traditional villages of the Hupa people, including Norton, Soctish, Chenone, Mescat, Hostier, Agency, Matilton, Bald Hills, and Campbell (Hoopa Valley Tribe 2000).

Most of the Hoopa Valley Indian Reservation's population resides in the portion of the 144-square-mile reservation located outside of the Watershed boundary. The Tribe manages its lands, administering timber, fisheries, wildlife, cultural plants and sites, and other natural resource-based programs. The business sector of Hoopa, the reservation's largest community, includes a restaurant, a delicatessen, a fast-food restaurant, a gas station, auto parts and repair shops, an office supply store, two plant nurseries, a propane utility company, a credit union, three independent logging companies, and instream aggregate operation, and craft and beauty shops. The Tribal Shopping Center houses the Tribal Museum, a radio station, a grocery store, a motel, and the Lucky Bear Casino. Seasonal tourism, logging, the local school district, tribal operations, the Federal government, and private businesses provide most of the employment opportunities for reservation residents (Hoopa Valley Tribe 2000).

In 2000, 758 of the Hoopa Valley Indian Reservation's 2,633 residents (as measured by the 2000 U.S. Census) were employed, with the majority (78 percent) working in management, professional, services, sales, and office occupations (Table 3-54). Key economic sectors for reservation residents include the educational, health, and social services sector, accounting for 31 percent of reservation employment, and the public administration sector, providing for 21 percent of the reservation's employment opportunities (Table 3-55).

According to the Draft Land Use, Development Standards and Zoning Plan (Hoopa Valley Tribe 2000) for the reservation,

The Hoopa Valley Indian Reservation represents an isolated pocket of extremely high unemployment. Recent analysis of the situation indicates that access to employment is a major problem. The nearest job market for residents of the reservation is more than 120 miles round-trip to the Eureka/Arcata area.

Table 3-54. Occupational distribution of employed residents in the Mainstem Trinity Watershed Analysis Area. All numbers are percentages. Source: U.S. Census Bureau, Census 2000 Summary File 3.

Occupation	Willow Creek CDP	Census Tract 2, Block Group 2 (includes Salyer and Hawkins Bar)	Hoopa Valley Indian Reservation
Management, professional, and related occupations	43.4	17.1	32.0
Services	18.7	26.1	22.2
Sales and office	17.9	17.0	23.5
Farming, fishing, and forestry	0.6	6.9	5.1
Construction, extraction, and maintenance	10.7	12.5	10.6
Production, transportation, and material-moving	8.7	20.4	6.6

Note: CDP = Census Designated Place.

Table 3-55. Distribution of employment of Mainstem Trinity Watershed Analysis Area residents by industry. All numbers are percentages. Source: U.S. Census Bureau, Census 2000 Summary File 3.

Industry	Willow Creek CDP	Census Tract 2, Block Group 2 (includes Salyer and Hawkins Bar)	Hoopa Valley Indian Reservation
Agriculture, forestry, fishing, hunting, and mining	4.7	13.2	6.7
Construction	6.8	8.3	7.1
Manufacturing	5.0	0.7	0.9
Wholesale trade	3.3	5.9	0.0
Retail trade	8.6	15.3	7.8
Transportation, warehousing, and utilities	6.8	4.2	3.6
Information	1.9	0.7	2.0
Finance, insurance, real estate, and rental/ leasing	5.3	1.0	4.9
Professional, scientific, management, administrative, and waste management	8.3	10.4	4.2
Educational, health, and social services	30.1	23.6	30.9

Industry	Willow Creek CDP	Census Tract 2, Block Group 2 (includes Salyer and Hawkins Bar)	Hoopa Valley Indian Reservation
Arts, entertainment, recreation, accommodation, and food services	10.7	6.6	7.5
Other services	3.6	5.2	3.8
Public administration	4.9	4.9	20.5

Note: CDP = Census Designated Place.

Key Economic-Generating Activities

Recreation

The MTWAA is important to the Willow Creek, Salyer, and Trinity Village business communities, and indirectly to the Hoopa Valley business community, for its recreational uses and the economics those uses generate. Currently some businesses refer their customers to specific locations within the watershed for swimming, fishing, or hiking into the backcountry.

Wildlife-related recreation, fishing, wildlife viewing, and hunting on National Forest System lands provide economic benefits. A 1999 published report on the economic impacts of fishing, hunting, and wildlife viewing on National Forest System lands concluded that over 40 percent of the money spent by California anglers for fishing activities on National Forest System lands was for trip related expenditures such as food and lodging and the rest for equipment purchased primarily for fishing and other purchases specifically related to inland fishing (Maharaj & Carpenter 1999).

There are many outdoor recreation opportunities in the MTWAA, each drawing visitors to the area and contributing to the economies of local communities. Current recreational uses include rafting, kayaking, tubing, canoeing, fishing, boating, sunbathing/swimming, hiking, backpacking, dispersed and developed camping, picnicking, sightseeing, off-highway vehicle use, biking, horseback riding, winter sports, hunting/target shooting, and mining. Most recreationists within the MTWAA are local residents (i.e., living within a 2- to 3-hour drive).

The Mainstem Trinity River offers whitewater experiences ranging from calm (Classes I and II) to challenging and skilled (Classes III and IV). The most popular rafting, tubing, and kayaking area is the eleven-mile river run from Gray Falls to the South Fork Bridge. Access is limited. There are Class I and II rapids from Gray Falls to Hawkins Bar. A more novice run is the six-mile run from South Fork to Big Rock, just west of Willow Creek. The eight-mile section from the Big Rock river access to the Tish Tang campground is also used for river rafting. It provides some Class I, II, and III rapids, interspersed with long stretches of calm water. There are several commercial guides offering rafting and kayaking trips in the MTWAA. They offer several trips per day, from Hawkins Bar to Big Rock, and from Big Rock to Tish Tang, with the latter experiencing more user days.

The portion of the Trinity River and its tributaries in the MTWAA offers both bank and boat anglers the opportunity to fish for salmon, steelhead, and trout species. The area is popular with both fly-fishing and bait and lure anglers. Some of the more popular fishing areas are at Hawkins Bar, Salyer Bridge Hole, Sandy Bar, Big Rock, Horse Linto Creek, and near the Hoopa Campground. Several local commercial fishing guides offer day trips in the MTWAA.

A number of other recreational opportunities in the MTWAA attract visitors to the area who spend money at local businesses. Public access points along the Trinity River allow for swimming in the summer. Trails in the National Forest also provide public access for a number of uses including hiking, mountain biking, equestrian use, and hunting. Camping in developed campgrounds and areas available for dispersed camping also attracts visitors to the MTWAA. Sightseeing and wildlife viewing are also popular activities, especially in the vicinity of the area's two highways. Winter recreational activities include cross-country skiing and snow-shoeing.

The Trinity River was designated in 1981 by the Department of Interior Office of the Secretary as a Wild and Scenic River -- from the confluence with the Klamath River to one-hundred yards below Lewiston Dam. The reach of the Trinity Wild and Scenic River in the MTWAA is classified as "scenic" and "recreational," with a small segment from Gray Falls upriver to the MTWAA boundary (at New River) being classified as "scenic," and the rest of the Mainstem Trinity River, down river from Gray Falls, classified as "recreational."

See the *Recreation – Current Conditions* section (below) for more information.

Timber Production

Although timber production was once a key industry within the MTWAA, timber production has declined over the past 30 years for various reasons. Nevertheless, timber production is still an important component of resource management on the Hoopa Valley Indian Reservation. See the *Timber Production – Current Conditions* section for more details.

Special Forest Products

A number of personal use permits are issued annually by SRNF for the gathering of SFP in the MTWAA. For details on levels of SFP harvesting, see the *Special Forest Products* section (below).

Farming

Small produce farms, orchards, and vineyards have operated off and on in the MTWAA for many years, including several organic and other commercial farms operating in the Willow Creek area. Crops grown in the area include peaches, pears, grapes, corn, tomatoes, peppers, squash, melons, flowers, and herbs for cooking and medicinals. Oat hay and alfalfa are grown on limited acreage.

In the Hoopa Valley, agricultural uses include cattle operations, a pilot wine grape vineyard, feed crops, and subsistence gardening and orchards. Of these uses, cattle raising and feed crop production are significant contributors to the local economy. Several families in the Hoopa Valley Indian Reservation drive cattle to the summer grazing ranges in the high country of the reservation or in the SRNF where grazing permits allow for range access (Hoopa Valley Tribe 2000).

- *What are the subsistence activities of plant gathering, hunting, and fishing by local communities?*

As discussed in greater detail in the *Heritage Resources* section of this chapter (and in full detail in Appendix B), Native American populations, including Hupa, Tsnungwe, and Chimariko peoples residing within and near the MTWAA place great importance on the availability of natural resources for subsistence purposes. Access for gathering traditional plants on SRNF lands has become increasingly more important, with an increasing number of Indian persons involved in collecting for traditional purposes.

For many local Indians, deer, and to a lesser degree elk, continue to be hunted as important subsistence foods. Blue grouse and ruffed grouse are also hunted for food. Fishes remain the most important subsistence resource and ceremonial food item. Other birds and animals identified as important to the Hupa include species described in the ethnographic literature as being sources of materials for making regalia or other ceremonial uses (pileated woodpeckers, fishers, golden eagle, bald eagle, northern flicker, Stellar's jay, mink, ring-tailed cat, river otter, and ring-necked snake). Protecting and/or enhancing the habitats of these species are important management concerns both on and off the Hoopa Valley Indian Reservation.

A wide range of plants are collected for food, traditional medicine, ceremonial uses, and craft making (see Table 3-57 below and Appendix B, Attachment 1, Tables B-11 through B-14). Relative to those who gather plants for subsistence purposes, fewer numbers of Hupa gather for making native arts, notably basketmakers who gathered annually, and woodworking (mostly by men), generally on an as-needed basis (Heffner 1984). Basketmaking materials are particularly sought after along creeks and ridges. Especially important are hazel and beargrass, both of which need to be burned regularly to produce good quality materials for baskets (Heffner 1984). Among woodworkers, the important materials are yew, cedar, manzanita, and mock orange, mostly gathered in the interior mountains and creeks, and redwood, which is only found along the coastal zone (Heffner 1984). Both basketweavers and woodworkers generate income for the bulk of their finished crafts (Heffner 1984). The bulk of Hupa gathering occurs on the Hoopa Valley Indian Reservation and in the Lower Trinity Ranger District of the SRNF, within the MTWAA (Heffner 1984).

- *How do peoples' quality of life relate to the watershed?*

Residents adjacent to and within the MTWAA are users of the land, vegetation, wildlife, and the Trinity River itself. The MTWAA's resources contribute to the quality of life of MTWAA residents by providing employment and career opportunities through recreation-related tourism and timber production, income through resource-related jobs and sales of special forest products, food and materials for personal and ceremonial uses through subsistence activities, and personal recreation opportunities through access to hiking trails, hunting areas, boating areas, and fishery resources. In addition, the Trinity River itself is a major factor in the quality of life of local residents.

The living strategy of communities in the MTWAA tends to be oriented toward subsistence goods procurement and preservation on a seasonal basis. Families supplement income with subsistence hunting, fishing, and gathering. These occupations are engaged in on a seasonal basis and are essential to the annual survival of many individuals and families. For the Hupa and other Native American populations, these activities additionally serve as vehicles for the transmission of cultural knowledge. These activities are participated in by multi-generational groups and are a means of sharing stories, techniques and practices, and spiritual observances from the elders to the younger generations. As such, interruption of or non-participation in these food gathering and preparation activities occludes participation in cultural knowledge that is vital to the continuation of the culture. Although plant gathering is carried out among the larger populations in the MTWAA, local Native Americans gather more plant resources more often than other users within the MTWAA. Acorns, berries, mushrooms, various wild fruits, plants used for basketry, and herbs are gathered annually.

There are also materials used in building structures that are gathered by these communities such as sand, gravel, cobbles, timber, and fence poles. For traditional Native American structures there is a need for cedar planks, cobbles, poles, grapevine, and hazel, among others.

Fishing and hunting are significant elements of these communities' lifestyles and adds to their yearly food supply. Fishing of coho and chinook salmon is by far the most significant yearly subsistence item brought into the homes of Hupa and other local Native Americans and is a significant item to other local residents.

Botanical uses include uses of plant resources that are gathered for personal use but not for subsistence, such as greenery for making wreaths or fence post used for a deer fence around a home garden. Basketmaking materials are the most sought-after SFP commodity by local Native Americans.

Fishing, whitewater rafting, swimming, camping, wildlife photography, and bird watching are the recreational draws to the MTWAA. Locals and state and out-of-state visitors come to fish and boat the lower Trinity River. The trend is for the sports fishing tourist to spend two months at a time at the commercially-developed campgrounds. Campgrounds with upgraded facilities and that have RV space available are popular for these tourists. See the *Recreation* section of this chapter for more details.

Also important to drawing tourists to the area are the Heritage Resources and Native American culture. The Hoopa Tribal Museum and local events such as the World Renewal Ceremonies are open to the public. For details on Native American cultural attractions and events, see the *Heritage Resources* section below.

Heritage Resources

Heritage resource is the term used in the following discussions to describe several different types of properties or places that are known or may be expected within the study area, including:

- Prehistoric Native American archaeological sites predating sustained Euro-American settlement in 1850, such as habitation sites marked by house pit depressions and temporary camps containing scatters of flaked and groundstone artifacts
- Historic archaeological sites typically dating from the period from 1850 to 1952 (50 years is the general threshold for recognizing historic period resources), such as mining sites marked by tailings, ditches, collapsed structural remains, and refuse dumps

- Historic period architectural features older than 50 years, such as buildings (e.g., old houses, barns) and structures (e.g., old bridges)
- Traditional cultural places important to contemporary Native Americans who have heritage ties to the study area, such as sacred sites used by spiritual practitioners, burial grounds and areas where native plants are gathered for use in making regalia and baskets or for traditional foods or medicines

Heritage Resources – Reference Conditions

- *What were the prehistoric lands uses and practices?*
- *What were the historic lands uses and practices?*

Information sources used to reconstruct past human land uses and their effects on the study area environment were drawn from on-going regional archaeological research, Native American ethnographic data mostly compiled in the early twentieth century, and historic archival data including review of historic newspaper accounts, etc. The further back in time, the less we know definitively.

Following is the summary discussion of prehistoric and historic land uses and practices, which is drawn from the more detailed description provided in the stand-alone Appendix B.

Prehistoric Period Land Uses and Practices

Archaeological studies coupled with paleoenvironmental data provide insights into some of the major regional trends spanning the past 8,000 years of human occupation. Summarized below is the prehistoric cultural sequence for the region that is best understood in terms of archaeological patterns.

The Early Period: Borax Lake Pattern

The seminal work defining early prehistoric period assemblages in the northern North Coast Ranges of California was the Pilot Ridge-South Fork Mountain (PR-SFM) project sponsored by Six Rivers National Forest for logging and road-building undertakings in compliance with Section 106 of the National Historic Preservation Act (Hildebrandt & Hayes 1983, 1984), Hayes & Hildebrandt 1986). The PR-SFM study area is located just south of the MTWAA boundaries in interior northwest California.

More recently, a radiocarbon date of ca. 8,000 years B.P. (Before Present) was obtained for a housepit floor with associated Borax Lake Pattern artifacts at a site on Pilot Ridge, making this the oldest dated structural remains in northwest California to-date (Fitzgerald & Hildebrandt 2001).

Archaeological evidence implies that the human subsistence strategy dating from ca. 8,000 to 3,000 years B.P. involved small groups. These groups probably consisted of one or several extended families who frequently moved their camps and foraged for a wide range of subsistence resources that required little handling or processing. The high frequency of large stemmed projectile points and millingstones infers a reliance on large game (elk and deer) and hard seeds (e.g.,grasses, nuts).

This adaptive pattern corresponded to a significant Xerothermic warming trend that followed the Ice Age. Yearly average temperatures were estimated to be 1.3 to 2.1 degrees Centigrade warmer than today, resulting in warmer summers with a longer dry season for interior northwest California (West, *in*

Hildebrandt & Hayes 1983). Palynological data for the North Coast Ranges imply that oak woodlands were more widely distributed than at present, while Douglas-fir forests were more restricted. Keter (Eel River Basin n.d.) hypothesized that fauna of interior northwest California would have been affected by shifts in vegetation and climate during the Xerothermic. Summer deer habitat would have been reduced in area and concentrated at higher altitudes, and anadromous fish runs would have been significantly reduced due to lower stream flows and reduced density and distribution of riparian vegetation. In addition, perennial springs were probably reduced in number and flow. Warmer temperatures may have allowed for longer human occupations at higher elevations.

Early Period sites are best evidenced at higher elevations, especially along the major trending ridges of interior northwest California (South Fork Mountain, Pilot Ridge, Bald Hills of Redwood National Park), where the Xerothermic climatic regime would have favored longer periods of occupation, a more diverse and abundant mosaic of plant communities, and concentrated deer populations. Borax Lake Pattern assemblages are also known for lower elevation settings along the mainstem Trinity and South Fork Trinity rivers, where alluvial processes are more active and may have eroded away, buried, or otherwise obscured their identification. Hypothetically, the population was relatively low with no permanently settled villages or defined territorial boundaries, no or little competition for resources, low population growth, and ad hoc (versus regularly established) interactions and trade with people in outlying areas. The linguistic archaeology model for the region infers that the earliest inhabitants of the Trinity MTWAA may be related to Hokan affiliated Indian language groups (e.g., proto-Chimariko, proto-Karuk) (Whistler (1977, 1979), Fredrickson 1984).

The Middle Period: Willits Pattern

The Middle Period dating from ca. 3,000 to 1,100 years B.P. in interior northwest California coincided with a significant cooling trend (Neoglacial) that triggered a downslope migration of oak woodlands, expanded riparian vegetation, and promoted a more productive and reliable anadromous fishery in the Trinity River watershed. The first permanent settlements were established along the rivers, where extended family groups lived together during the winter months and relied on stored foods (especially fish and acorns) to sustain them during lean times. During warmer months, the village populations dispersed into smaller groups who carried out a seasonal round of hunting and collecting, occupying seasonal base camps and using various special activity sites in more upland areas. Middle Period components excavated on the high elevation PR-SFM implied specialized activities, including the establishment of Indian burning practices to maintain open prairies as suggested by palynological data (Weigel *in* Hildebrandt & Hayes 1993).

Archaeolinguistic studies infer that during the Middle Period, the ancestral Wintuan entered the upper Sacramento Valley between ca. 2,000 and 1,500 years B.P., followed some 200 years later by ancestral Patwin in the lower Sacramento Valley and then by Hill Patwin expansion up the drainages toward Clear Lake in the southern North Coast Ranges. Based on reconstruction of Wintuan plant and animal terms, the upper Rogue River was the most likely Wintuan homeland (Moratto 1984, Whistler 1980).

The Late Period: Gunther and Gunther/Augustine Patterns

Dating from ca. 1,100 years B.P., the Late Period within the study area and interior northwest California is represented archaeologically by the Gunther/Augustine Pattern, a subsistence adaptation that relied principally upon anadromous fish, deer and acorns as staple foods. Permanent winter villages occupied by multiple extended families were sited along the major fish-bearing rivers and creeks, usually well above flood levels. Village sites are typically marked by well-developed ash-stained midden deposits; a variety and abundance of artifact types made of stone, bone and shell; discarded food remains such as animal and fish bones, charred acorns and seeds; architectural features such as housepit and sweathouse depressions; and cemeteries. Away from the village sites in a variety of latitudinal and environmental settings were seasonal camps used as bases for hunting, gathering acorns, collecting berries and bulbs, etc., and task-specific sites used for mining tool-stone, doctor training, trapping birds, etc. Throughout the region, Native Americans regularly set fire to the prairies and oak woodlands for reasons related to strategies of hunting and gathering (Gates et al. 2002, Heizer 1972, Keter 1986, King & Bickel 1980, Lewis 1973, 1985, Lewis & Ferguson 1987, Loud 1918, Thompson 1990, Veirs 1989). Food processing and storage technologies were advanced, promoting population growth, establishment of resource area claims by certain families or village communities, and craft specialization. Exchange relationships became more regularized as evidenced by relative increases in imported goods such as obsidian traded in from the Medicine Lake Highlands near Mount Shasta and used locally for making utilitarian tools and ceremonial blades. Our understanding of Late Period Indian cultures in northwest California is greatly enriched by the relative detail found in ethnographic accounts (see below).

The most commonly cited archaeolinguistic model infers that peoples representing three distinct language groups moved into interior and coastal northwest California during the Late Period. The beginning of the Late Period in northwest California hypothetically coincided with expansion of Wintu speakers from the Sacramento Valley into the upper Trinity River drainage ca. 1,100 to 1,000 years B.P. This population movement may have displaced the Chimariko on the eastern and southeastern fronts.

Hypothetically, ca. A.D. 900, the Wiyot entered and occupied the lower Klamath River and adjacent coast, leaving behind their mid-Columbia River homeland. Some 200 years later, the Yurok moved down the Klamath River from a northern origin, settling along the lower Klamath and displacing the Wiyot to the vicinity of Humboldt Bay. The Wiyot and Yurok languages are assigned to the Algic Stock, and linguistic differences imply separate movements to the north coast rather than in situ divergence.

Hypothetically, the last to enter the region ca. 1,300 A.D. were the Athabascans (Hupa, Tsnungwe, etc.) who moved south from coastal Oregon, possibly through the inland hill country, skirting the Algic enclaves and taking up residence along the relatively sparsely populated streams of interior northwest California (Moratto 1984, Whistler 1979). Expansion of Athabascan speakers up the Trinity River and possibly into the New River drainage may have displaced and/or absorbed through marriage alliances the Chimariko on their western and northwestern fronts (Kroeber 1925, Powers 1877).

Gmoser (1988) presents an alternative model of population movements and establishment of territorial boundaries in northwestern California based on ecological factors. He argues that distributions of hunting and gathering populations in any given area cannot be understood without reference to underlying environmental conditions, especially the productivity and distribution of principal food sources. Gmoser's analysis predicts that the present study area was the focus of initial human occupation in northwest California (Gmoser 1988). His alternative model of population movements has implications for future archaeological research. Gmoser's model posits that all the major linguistic groupings (stocks and families) were in place at the general locations observed ethnographically, by the end of the Middle Period, dating ca. 500 to 900 A.D.

Yurok, Hupa and other Native peoples of northwest California assert their ancestors have been here "since time immemorial."

Ethnographic Background

The following ethnographic summary focuses on land uses and subsistence practices described in the literature for the Hupa, Tsnungwe, and Chimariko.

Hupa

Hupa ethnography is among the best documented of any Indian group in California

Territory

Ethnographic Hupa territory encompassed the lower Trinity River watershed from a point upriver of its confluence with the Klamath, where they bounded Yurok territory on the north, to a point upriver of present-day Willow Creek, where they bounded the linguistically and culturally related Tsnungwe (also known as South Fork Hupa) on the south (Baumhoff 1958). Hupa territory bounded another Athabascan group (Chilula) on the west and Hokan language affiliated groups (Karuk, Shasta and Chimariko) on the northeast and east. The six-mile-long by one to two-mile-wide Hoopa Valley, with its moderate climate and relative isolation, is the heartland of ancestral Hupa territory, where the population, permanent settlements, ceremonial places, and other land-uses were concentrated.

Settlements and Population

Access to both spring and fall runs of anadromous fishes and positioning of winter villages as well as summer camps along the lower Trinity River distinguished the Hupa as being more firmly attached to their riverine environment than any other Athabascan group in northwest California (Baumhoff 1958). Table 3-56 lists the seven named ethnographic Hupa villages mapped along the river within the present study area by Baumhoff (1958). Those villages identified in Table 3-56 located in southern Hoopa Valley ("Southern Division") were affiliated for the purposes of constructing a nearby fish weir and holding important religious ceremonies. Hupa villages of the "Northern Division" were similarly affiliated and constructed a fish weir upriver near Mill Creek, downriver of the study area (Wallace 1978). Hupa villages outside Hoopa Valley proper were more widely spaced apart, had lower populations, and the lowest status with regard to access to anadromous fish runs, being sited further upriver. The estimated 1848 Hupa population numbered 1,000 persons (Cook 1976), and this number apparently includes the Tsnungwe. Individual Hupa village populations numbered from 50 to 200 inhabitants (Wallace 1978).

Table 3-56. Named ethnographic villages within the Mainstem Trinity Watershed Analysis Area.

Village Name	Notes	Reference
Hupa Villages		
Medildin (per Goddard)	"place of boats," "canoe place," largest village in Hoopa Valley on Trinity River with 28 houses, a village of southern Hupa division that manifests itself in religious matters, fish weir built near here in alternate years	Baumhoff 1958:212 Wallace 1978:Table 1 Goddard 1903:24
Ho-wung-kut (per Merriam)	village of southern division in Hoopa Valley on Trinity River, 14 houses	Baumhoff 1958: 213
Tish-Tahng-ah-tung (per Merriam)	on Trinity River, 9 to 13 houses reported	Baumhoff 1958: 213
'Has-lin-ting (per Merriam)	"waterfall place" on Trinity River just outside Hoopa Valley, southernmost of principal villages, 6 to 9 houses reported	Baumhoff 1958: 213
She-ach-pe-ya (per Gibbs)	on Trinity River outside Hoopa Valley, probably the Yurok name for village, 4 houses	Baumhoff 1958: 213
Wang-ulle-watl (per Gibbs)	on Trinity River near Willow Creek, probably the Yurok name for village, 3 houses	Baumhoff 1958: 213
Wang-ulle-wutle-kauh (per Gibbs)	on Trinity River above Willow Creek, probably the Yurok name for village, 1 house	Baumhoff 1958: 213
Tsnungwe (South Fork Hupa) Villages[1]		
Hlah'-tung (per Merriam)	on high ground on both sides of major tributary at Trinity River confluence	Baumhoff 1958: 213
Ti-koo-et-sil'-la-kut (per Merriam)	on Trinity River opposite major confluence	Baumhoff 1958: 213
Me-meh (per Merriam)	on Trinity River in Salyer vicinity[2]	Baumhoff 1958: 213
Chimariko Villages		
Mamsu-ce	on Trinity River near Salyer[2]	Silver 1978: Figure 2
Hamayce	on Trinity River near Hawkins Bar	Silver 1978: Figure 2

[1] Additional named Tsnungwe villages, camps and places reported along mainstem Trinity River by Tsnungwe Council (2001, cited by Tsnungwe Council 2002).
[2] Village locations infer overlapping boundaries between Tsnungwe and Chimariko along the Trinity River; linguist Victor Golla (1996, cited by Tsnungwe Council) also recognizes Tsnungwe territory overlapped with that of the ethnographic Chimariko in the Burnt Ranch and New River areas.

Subsistence

While salmon and acorns (both fresh and dried) were the principal food resources for the Hupa, they also fished for steelhead, lamprey eels, trout, and other small fishes, hunted for deer and elk, and gathered a variety of nuts, seeds, berries, fruits, roots and greens (Wallace 1978) to add variety to their diet. The Hupa also had a rich material culture including distinctive types of architecture such as the *xonta* (family house) and *taikyuw* (men's sweatlodge); an array of expertly woven basket types associated with all phases of the Hupa life cycle; fishing, hunting and food processing tools made of wood, stone, animal parts and plants fibers; elaborate ornaments and regalia made of furs and skins, feathers, beads (e.g., pine nuts, imported marine shells), twine and basketry materials; distinctive fishing and hunting tool kits with associated traits and constructions such as fish weirs and deer blinds; and more. In order to demonstrate the wide range of environments familiar to and resources relied upon by the Hupa, Table 3-57 summarizes important resources found in different environmental zones as drawn from ethnographic data.

*Table 3-57. Important resources by environmental zone used ethnographically by the Hupa.**

Riverine Resources	
Fisheries	Salmon, steelhead, lamprey eel, trout, other small fishes, otters Salmon was a principal food. For salmon and steelhead, used dip nets, weirs (fall runs), gill nets, dragnets, harpoons; for eel, used nets and basket traps; for trout and small fishes used hook and line. Otter skins used to make quiver pouches, hair wraps, clothing, etc.
Cobbles and pebbles	Used as paving stones for house and sweathouse paving, lining fire hearths; used to manufacture notched net weights, groundstone milling tools (mortars, pestles), selected rock types (e.g., chert) used to make flaked-stone tools; used as hammerstones for making flaked-stone tools, as cooking stones (especially for acorn), for building fish weirs
Potable water	Freshwater drinking source, water for leaching acorns in sand basin, used for cooking
River for transportation	Dugout canoes
River for bathing	Personal hygiene and ritual bathing
River for ceremony	Ritual travel for Boat Dance and other activities associated World Renewal Ceremony (see Kroeber and Gifford 1949)
Riparian vegetation	Alder, willow, red bud, cottonwood, grape and other associated plants important for making baskets, twine, rope; wood sources for firewood, constructing fish weirs; certain medicinal plants collected
Various birds	Especially important as source of feathers for arrows, making regalia (especially woodpecker scalps), some hunted for food (ruffed grouse, pheasant, mountain quail)
Prairie and Oak Woodland Resources	
Acorns	Tan oak (*Lithocarpus densiflora*) preferred, staple food (understory managed by burning)
Deer and elk hunting grounds	Hunted with bow and arrow, using snares, blinds, camouflaging hunters scent and appearance, driven by dogs into entrapments, pursued by canoe and clubbed when in river; provided food, material for clothing, blankets, footwear, sinew for bow strings and thread, bone and antler for manufacturing tools such as awls, wedges and flaking tools, and making ornaments and regalia; brains used for tanning hides; marrow mixed with pigments for dyes (browse vegetation managed by burning)
Various plants	Seeds (grasses, certain *Compositae*), bulbs (lily family), leaves (wild grape, wood sorrel), roots (hazel), berries (manzanita, madrone, huckleberries, raspberries, thimble berries, gooseberries, currants, blackberries, etc.), nuts (hazel nut, chinquapin, pepperwood, sugar and gray pine nuts), fresh shoots (*Wyethia* sp., *Angelica* sp.), ferns (bracken, chain, maidenhair), herbs, mushrooms, etc. Provided foods, medicines and materials for making baskets, nets for fishing and bird hunting, cordage used for house construction, making clothes and other uses (Hazel managed by burning)
Oak and other hardwoods	Used for cooking fires, smoking fish, making stools and headrests, etc.
Conifer Forest Resources	
Cedar	Principal source of house and sweatlodge building material
Pines	Pine nuts collected for food, making ornaments; yew wood preferred for making bows, tobacco pipe stems; roots of gray and yellow pine used in basketmaking
Beargrass	Important basketmaking material (beargrass managed by burning)

Various berries, mushrooms, etc.	Food sources
High Elevation Resources	
Prominent peaks, springs, etc.	Used by religious practitioners for doctor training and purification before important ceremonies
Upland flora and fauna	Seasonal subsistence round brought smaller groups to higher elevations in late summer when important plants ripened and hunting opportunities best; lichen (*Evernia vulpine*) used to dye basket materials grows best on trees at higher elevations
Geological Resources	
Clay	Used for sealing cracks and lining floors of houses
Steatite	Used for making tobacco pipes, bowls, ornaments
Chert	Outcroppings mined for toolstone

*Principal data sources are Goddard (1903), Nelson (1978), Wallace (1978), Steinberg et al. (2000), and author's familiarity with local archaeological assemblages and Hupa ethnographic collections.

Baumhoff (1958) best summarizes the subsistence round among Athabascan groups, relying heavily on accounts for the Lassik to the south but noting that, while there was undoubtedly variation among the groups, "they must have followed a similar pattern."

The most difficult time in the annual cycle of food production was winter. There were then few fish and almost no game animals or crops for gathering. From late November to early March people had to rely on food that had been stored the previous year. Essene's informant said that about every four or five years there would be a hard winter, but she could remember only one when people actually starved to death.

In February or March the spring salmon run began, and after that the danger of starvation was past. At about this time the grass began to grow again, and the first clover was eaten ravenously because of the dearth of greens during the winter.

The herb-gathering and salmon-fishing activity lasted until the spring rains ended in April or May, when the people left their villages on the salmon streams and scattered out into the hills for the summer. Usually only a few families would stay together during the summer, while the men hunted deer, squirrels, and other animals and the women gathered clover, seeds, roots, and nuts. Food was most plentiful at this season, and the places visited varied with the abundance of different crops. If a certain crop was good, the Indians would spend more time that summer in the area where the crop grew best. The next year they might go somewhere else. The vegetation of the Athabascan habitat is not well enough mapped to permit a precise delineation of these various summer camping grounds.

In September or October, when the acorns were ripe, the Indians would return to their winter villages and smoke meat for storing and probably store the acorns. Each family built a new house to protect it from the heavy winter rains. After the first rain in the fall the salmon run again in some of the streams of the region and were caught and smoked for winter storage.

It is evident that the crucial factor in the economy was the amount of food stored for winter and that this food supply was a controlling influence on the size of the population, since, in bad years, people starved.

At least, this was so far the Lassik, and it was no doubt true among the other groups as well. Salmon, meat, and acorns were doubtless the chief foods stored, and thus population size would have responded quite sensitively to the quantity and condition of the salmon, deer, and oak trees. (Baumhoff 1958).

Traditional Burning Practices

Ethnographers documented that the Hupa employed fire to keep areas open, enhance the quality of basketry materials, clear the duff under oaks where they annually collected acorns, and drive deer (Curtis 1924, Goddard 1903, Wallace 1978). Throughout the region, ethnographic and historical accounts indicate that Native Americans regularly set fire to the prairies and oak woodlands for reasons related to strategies of hunting and gathering (Heizer 1972, Keter 1986, King & Bickel 1980, Lewis 1973, 1985, Lewis & Ferguson 1987, Loud 1918, Thompson 1990,Veirs 1989). Evidence of historic encroachment on prairies by Douglas-fir in the Bald Hills of Redwood National Park, west of the study area, is well documented by the National Park Service and linked most directly to cessation of Indian burning practices (Gates et al. 2002).

Travel

River travel was common among the Hupa, who obtained redwood canoes in trade from the Yurok (Kroeber 1925, Wallace 1978). They also relied upon a network of trails that connected the permanent river settlements with more remote camps, procurement areas, and ceremonial sites and linked the Hupa to neighboring groups.

Ceremonial Activities and Sacred Places

Among the Hupa and other Indian groups of northwest California, daily activities (cleansing, hunting, plant collecting, hunting, basketmaking, etc.), as well as significant events in a person's life (birth, puberty, marriage, childbearing, death), were imbued with sacred qualities acknowledged by performing ritual observances. Prayers were made for success in hunting, fishing and gathering. For hunting success, the Hupa sought the favor by singing songs and praying to the *Tans*, deer-tending gods who lived on principal ridges and certain peaks and practiced certain ritual behaviors. Rituals marked the beginning of the annual spawning runs and acorn harvests. Within the present study area, a First-Salmon Ceremony was held in Sugar Bowl Valley, a place famous among the Hupa for fishing, associated with myths, and the location of a sacred rock inhabited by a spirit that influenced weather and was referred to by the Hupa as "Thunder's Rock" (Wallace 1978, Goddard 1903). Rituals were recited and songs sung when gathering basket making materials, foodstuffs or other plant materials, and when making baskets.

Two major Hupa ceremonies were the White Deerskin Dance and the Jump Dance, which are intended to renew the world for the coming year and to prevent famine, disease and other disasters (Wallace 1978, Kroeber & Gifford 1949). World Renewal Dances were (and continue to be) enacted by the Hupa at designated locations, none of which fall within the present study area.

Trails were often invested with religious significance and were "just the same as people" (Goddard 1903). It was wrong to step out of them without some good reason. Ritual practices were observed when traveling along trails that led to spiritual areas and other places. The trail from Hoopa to Sugar Bowl

Valley, within the MTWAA, was marked by places along the side for prayer and rest (Theodoratus et al. 1980).

Religious doctors (both women and men) observed religious practices when preparing for ceremonies, taking instruction from trained practitioners and observing strict rules governing diet, sexual activities, and other aspects of daily life. Doctor training involved making a series of trips to sacred places in the high country, including Telescope Peak and Horse Mountain within the Trinity MTWAA, Trinity Summit, and other locations (Theodoratus et al. 1980, Winter et al. 1979). With regard to Horse Mountain, it was said that the Hupa "borrowed" its use from the Whilkut. The trails to the high country were imbued with sacredness and places where ritual observances were made. Just north of the present study area in Hoopa Valley was a main access corridor leading to the Trinity Summit area (De-No-To District).

Tsnungwe

The term *tse:ningxwe*, as spelled in the current orthography of the Hupa language, was the name used by the Hupa speaking people of the Willow Creek, South Fork, Burnt Ranch, and New River areas, whose descendants today refer to themselves as Tsnungwe (Tsnungwe Council 2002). The derivation is from the word for Ironside Mountain, *Tse:nung-ding* (*tse*, rock; *nung*, a sloped face; *ding*, place), referring to the people from around their sacred mountain (Eargle 2000; Tsnungwe Council Federal Acknowledgement Petition, December 2000, cited by Tsnungwe Council 2002).

Published ethnographic data concerning the Tsnungwe are sketchy relative to the Hupa. Accounts distinguish the Tsnungwe from the Hupa based on two or possibly three principal traits, including the following: although speakers of an Athabascan affiliated language, their dialect was slightly different that that of the Hupa; the Tsnungwe were not considered a part of the Hoopa Valley people by the Hoopa Valley Tribe in their authorized tribal history, although it was noted that they respected the authority of the Hupa leaders, served as soldiers for the Hupa, and sometimes attended Hupa ceremonies; and their geographic separation from Hoopa Valley and the village groups who controlled important ceremonial activities (Nelson 1978, Goddard 1903).

Territory and Settlements

Reconstructions of ethnographic Tsnungwe territory by Goddard (1903) and Baumhoff (1948) describe their ancestral lands as including the South Fork Trinity River watershed from Grouse Creek to its confluence with the mainstem Trinity, easterly along the deep canyon of the mainstem from South Fork to Cedar Flat (including Salyer, Hawkins Bar, and Burnt Ranch), westerly to the divide between the tributary watersheds of the South Fork and those of Redwood Creek (a little west of the courses of Madden Creek and Mosquito Creek), and north to the Hupa boundary just downstream of the South Fork confluence (described above). Tsnungwe territory was nevertheless relatively densely populated with at least a dozen villages identified—all situated on high terraces overlooking the deep canyons.

Table 3-56 above lists three named ethnographic Tsnungwe villages located within the present study area according to Baumhoff (1958). The estimated pre-contact population of the Tsnungwe was not distinguished from the greater Hupa group (Cook 1976). A more comprehensive list of Tsnungwe place-names cross-referenced to the anthropological literature has been assembled by the Tsnungwe Council (2001, cited in Tsnungwe Council 2002), including 18 place-names for Willow Creek area and 18 place-names for mainstem Trinity River area between South Fork and Cedar Flat, among others.

The Tsnungwe Council today recognizes a larger aboriginal territory than that described above by Goddard and Baumhoff—extending more northeasterly to include the New River, overlapping what anthropologists described as ethnographic Chimariko territory, and more southerly to include places ascribed to the Hupa around Willow Creek. Scholarly research by Tsnungwe tribal members clarifies and provides important contextual insights for interpreting the original ethnographic place-name data obtained by non-Indian anthropologists from so few Indian consultants (Saxey Kidd, Sally Noble) so long after disruption of the traditional cultures and dispersal of surviving populations. It notes that as a matter of practicality, the Tsnungwe were multilingual, speaking Hupa as their primary language and also speaking Chimariko and Shasta with a Hupa accent. As stated by the Tsnungwe Council in their Federal Acknowledgement petition (December 2000, cited in Tsnungwe Council 2002),

Our identity as a people through countless generations has remained constant—as that of a <u>people and community rightfully belonging on our traditional territory, the area of Trinity River, and its tributaries, the Willow Creek, the South Fork, and the New River</u>, where today the counties of Humboldt and Trinity join… Our identification as a group belonging to this territory has been recognized by all surrounding tribes over the ages, regardless of what name we are called… <u>We, as a people, are more closely tied to our land than to a name</u>. We do not rely on anthropologists and others to define who we are. We already know… [emphasis added].

<u>Subsistence</u>

Acorns and fish were the staple foods of the Tsnungwe. The importance of the acorn to Tsnungwe people is seen in their word for an Indian person, *k'iwinya'nya:n*, which translates to "acorn eater" (Tsnungwe Council 2002). Important subsistence resources and related land-uses likely included those compiled above in Table 3-57. Named Tsnungwe places with associated land-uses are listed in Table 3-58, including important fishing spots along the Trinity River in Willow Creek Valley (near *Saqe"q'it* village) and at Burnt Ranch Falls. In addition to these, Tsnungwe language names are recited for other prominent places and features within the MTWAA (e.g., Brannan Mountain, Clover Flat, Kimtu, Horse Mountain), implying potentially significant (and confidential) cultural associations.

Table 3-58. Named Tsnungwe places and associated land-uses within the Mainstem Trinity Watershed Analysis Area.

Tsnungwe Place-name (reference # applied by Tsnungwe Council [1])	Location	Land-use
xowiyk'iLxowh-ding (63a)	on Trinity near Coon Creek	where wagons descend trail
d'ahilding (58a)	on Trinity near Kirkham Creek	village with 4 houses (Gibbs)
saqe"q'it (59)	on Trinity in Willow	old village; place where fishing nets set in river

Tsnungwe Place-name (reference # applied by Tsnungwe Council [1])	Location	Land-use
	Creek valley	
saqe'q'it, mima:n-chi'ing (30)	west side of Trinity in Willow Creek vicinity	Kidd/Bussell ranch (historic?)
t'unchwing-tah (62)	on Trinity near Willow Creek	old village; Zach Bussell's old place (historic?); dances held here
da:chwan'-ding (31a)	Willow Creek, near Seely-McIntosh Road	old village with 1 house (Gibbs); home of Annie Leach, Indian Friday, Fanny Lack (historic)
me:lchwin-q'it (37)	South Fork confluence area	big rancheria
Le:lding (3)	South Fork confluence area	important village, site of Tsnungwe Jump Dance led by Saxey Kidd, home of Squirrel Tail Tom and many others
ta:ng'ay-q'it (38)	South Fork confluence area	village, home of South Fork Pole and South Fork Pete
miy-me' (7)	Fountain Ranch area, Salyer	village (Gibbs)
ta:wha:wh-ding (22)	Gray Flat area	place to ford river, where Indian trail passed, acorn gathered here
tse:nding (12)	Ironside Mountain & Burnt Ranch area	eels caught at Burnt Ranch Falls, Indians from as far as Arcata gathered to camp and fish in summer

[1] Manuscript provided via email to Janet Eidsness on 10/20/01 by Danny Ammon, entitled "Tsnungwe Place Names" by Tsnungwe Tribe (also listed on website by Tsnungwe Council 2002).

Ceremonies and Sacred Places

The prominent old-time Tsnungwe village at the mouth of South Fork Trinity (*Lleldin*) was associated with the chief divinity among the Hupa named *Yimantuwinyai*, or "the one who is lost across the ocean" (Goddard 1903). It was at *Lleldin* that he settled and presided as chief over the other mythological beings, took two wives who bore him children and who became jealous, burying his children alive, when he became enamored with a beautiful maiden from another place. This was the first case of death, since before this time, the first-people had grown old but had renewed their youth by sleeping in the sweathouse.

The nature and types of ceremonies practiced by the Tsnungwe prior to Euro-American contact are not well documented. Presumably, their religion and ceremonial life were similar to that described above for the better documented Hupa, with whom they were most closed affiliated both culturally and linguistically. Data compiled by Tsnungwe scholars (Table 3-58 above) indicate that the Jump Dance was held at *Lleldin*, and another dance was held at the old-time village of *T'unchwing-tah* near Willow Creek. As described above, Ironside Mountain just outside the MTWAA was (and still is) a sacred place among the Tsnungwe.

Chimariko

The Chimariko are among the least known of California's aboriginal peoples, being described as "one of the smallest distinct tribes in one of the smallest countries in America" (Kroeber 1925, 109). The Chimariko language is classified as a member of the Hokan stock, hypothesized to have temporal priority in the region (see above). Ethnographic and linguistic information was obtained from a dozen consultants (including persons said by contemporary Tsnungwe scholars to have not been Chimariko, or to have been of mixed ancestry), with the most intensive fieldwork (J.P. Harrington's) never synthesized and published (Eidsness 1985).

Territory

Six published accounts have described ethnographic Chimariko territory; however, none agree on boundaries between the neighboring Tsnungwe (to west), Wintu (to east and south), New River Shasta (to north), and Whilkut (to southwest). It is known they traditionally occupied the mainstem Trinity upriver of the Tsnungwe at historic contact.

Settlements and Population

The Chimariko population in 1848 was estimated to number 250 persons who occupied six principal villages along the Trinity River (Cook 1976, Kroeber 1925, Silver 1978). The two named Chimariko villages within the MTWAA at Salyer and Hawkins Bar are listed above in Table 3-56. Other named Chimariko villages are documented for Burnt Ranch and Cedar Flat, overlapping the Tsnungwe area.

Each Chimariko village had a sweathouse big enough to accommodate eight or ten men and dwellings large enough to house two or more families. Both the sweathouse and dwellings differed from the Hupa architecture style by being constructed on a circular floor plan with shallower excavations, the roofs supported by a single ridgepole and covered with earth over madrone bark, and entrances at ground level. Like the downriver tribes, Chimariko social status was determined by wealth (e.g., typically imported items such as red obsidian blades, clamshell beads, dentalia) or a combination of wealth and birth.

Subsistence and Travel

Principal foods included salmon, acorns, deer, elk and bear, supplemented by eels, pine nuts, wild seeds, berries, several varieties of roots, fowl, and small mammals (Silver 1978). Fishing techniques included use of flat nets (like a tennis net)—either set or seined, setting a large (8-ft-wide) sack like net made of iris fibers, harpooning, scooping with baskets, use of bare hands, shooting with bow and arrow, and clubbing. Hunting methods included smoking out (bear, rodents), spring-pole traps (deer, wildcat, small mammals, birds), driving and trailing (deer, rabbit, quail), and setting of two converging fires for both large and small game. Fishing, gathering and hunting places were communally owned, whereas tobacco plots were fenced and privately or jointly owned for a season only.

It has been debated whether the Chimariko used canoes for transportation along the narrow canyon of the Trinity which they inhabited. One source says they used dugout canoes made of pine worked with horn wedges (Silver 1978); another says canoes were not used (Kroeber 1925). Clearly, the Chimariko relied upon a network of trails connecting them with neighboring groups and linking their settlements, camps, hunting and gathering grounds, and sacred places. One such trail crossed the Trinity River near Gray Falls (Theordoratus et al. 1980), possibly the same known to the Tsnungwe (see Table 3-58 above).

Ceremonial Activities and Sacred Places

Unlike their downriver neighbors, the Chimariko did not hold first-salmon or first-acorn rites or the World Renewal Ceremonies. They conducted an annual summer dance, girl's puberty rite and the doctor-making ceremony (Silver 1978). Ironside Mountain was also sacred to the Chimariko, a place "to whose top the first people made pilgrimages when they got old and where they would pray and descend young again" (Silver 1978).

Historic Period Land Uses and Practices

Euro-American Exploration and Settlement

The MTWAA was explored in 1828, when the Jedediah Smith party came up the Sacramento Valley, crossed the mountains into the Hayfork Valley and traveled down the South Fork Trinity. They camped on Supply Creek in the Hoopa Valley in May, establishing the first recorded entry of Euro-Americans into the Lower Trinity region and the Hoopa Valley.

The discovery of gold on the Sacramento River in January 1848 and on the Trinity River by Pierson B. Reading six months later initiated a mining rush to the Douglas City area, which spread up and down the Trinity. A group of miners from the North Fork Trinity area, seeking a coastal supply route, traveled westward in the fall of 1849, eventually arriving on what became known as Humboldt Bay.

Mining

Early mining was of the pick-and-shovel type with sluices and rockers. During the 1850's, mining activity in the Lower Trinity region was centered on New River. Hydraulic mining began on the Lower Trinity in the 1870's and continued at various places along the River until at least 1950. Quartz mining was also practiced on New River, involving stamp mills and the use of an amalgam. River dredges were introduced on the upper Trinity in 1898 and continued through 1953. Suction dredge mining in the River became popular in the 1970's and 1980's, notably between Cedar Flat and North Fork.

During one of the boom periods in the late 1880's, mining activities along the Trinity below Burnt Ranch, along Willow Creek, and on Three Creeks sparked some excitement. On Willow Creek, the major mine was at Clover Flat, first operated by the Bussell Family and later by the Clover Flat Mining Company. On Lower Trinity, the Moston Claim at the mouth of the South Fork was developed by the Salyer Consolidated Mines Company in 1930. A large hydraulic operation, the Salyer Mine was conducted up to the Second World War and was opened after the War, but only briefly.

The Horse Mountain Mine operated at various times, but its most intensive activity was during the 1910's. Anticipated copper riches never materialized and today the area is recognized for its unique botanical values.

Figure 3-30. Hydraulic mining of bench gravels at the Salyer mine, Trinity County (1933).

Photo 71. Hydraulic Mining of Bench Gravels, Trinity County. This is a 1933 scene at the Salyer mine. *Photo by Olaf P. Jenkins.*

Farming and Livestock Raising

Flats along Lower Trinity, Willow Creek Valley, and the Hoopa Valley were all cultivated for grains such as wheat and oats. Home gardens were basic to any homestead, and in recognition of its climatic advantage over coastal Humboldt County, the Lower Trinity area became well known for truck vegetables. Fruit and nut orchards were also planted wherever suitable ground could be located. The Willow Creek area is still known for this production.

Beef and hog raising was also an important agricultural use of the land. Herds of cattle were moved seasonally between the wintering grounds on the lowland along the River and the upper ranges on New River and at Trinity Summit. Hogs were essentially feral, running loose throughout the settled areas where they fattened on orchard produce and the acorn mast of the extensive tanoak stands. Periodically, cattle and hogs were driven to the coast for sale to the meat markets or the creameries. Dairying at Clover Flat, along the Lower Trinity, and even on New River became popular in the 1920's. Milk was transported to the creameries near Arcata, using mail trucks and, in some cases, pack mules.

Transportation

Travel corridors, long established by Native people, were the first routes utilized by Euro-American immigrants. Needed access to specific mining regions and homesteads resulted in the construction of local trails. The first wagon road into the Willow Creek area, via Three Creeks, was completed from the coast in December 1889. Within the next two years, the Willow Creek to Hoopa wagon road was constructed. Slides, washouts, snow, and mud often precluded use of these roads during winter months.

Various segments of the Trinity Highway were constructed over a period of years until the route was formally opened in 1923. Slides have been and continue to be a major maintenance headache for this important lateral between the Central Valley and the Redwood Coast.

Forestry

Early logging was for local use only. Small mills of several thousand feet capacity produced lumber for mining purposes and for house and barn construction. The Hoopa Agency's sawmill was an exception, producing up to 250,000 feet annually in the late 1890's for use on the Reservation.

With the completion of the Trinity Highway, commercial logging became economically feasible. The first logging of Port Orford-cedar (POC) began in the 1920's on Three Creeks and upper Willow Creek. Logs from these operations were transported by truck to Essex, loaded on the Eureka-bound train, and exported to Japan. During the 1930's, POC was logged and milled in the upper Willow Creek area, along Cedar Creek and Low Gap Creek.

The Trinity National Forest was established in 1905. The Salyer District, now known as Lower Trinity District, was transferred to the newly created Six Rivers National Forest in 1947. Following World War II, the Douglas-fir logging and milling boom hit the entire northwestern California region. Mills were built in the Hoopa Valley, at Burnt Ranch, and at Willow Creek. Both private and Forest Service timber was purchased with mills operating locally from 1946 to 1980.

Recreation (Skiing)

Skiing at Horse Mountain developed after the Grouse Mountain area. In 1940, the Humboldt State College Ski Club warming hut, called the Lumberjack Ski Lodge, was completed at Grouse Mountain, using donated materials and lumber from old Barrel Factory buildings on the North Fork Mad River (Arcata *Union* [AU], 14 Jan. 1940). Grouse Mountain continued to be the center of winter sports after the war with two ski tows. In 1948, a new ski tow at Titlow Hill above Fern Prairie was opened on a site which the Forest Service and visiting skiers claimed to be "one of the best in the state" (BLA, 7 Feb. 1948). The Humboldt Ski Club initiated this development, which included the Cedar Creek Lodge under a Forest Service special use permit. The top of the mountain is now dominated by telecommunications equipment.

Fire

Both a natural event and a human practice, fire in the MTWAA was an annual occurrence that generally made its appearance in August and September. Native burning was practiced before Euro-American settlement and continued for sometime after. Native and White stockmen burned regularly to maintain range for their stock and to keep encroaching forests at bay. Localized burning of plant communities to produce food and materials was practiced by Native people. Fire suppression was instituted with the arrival of the Forest Service. Several major fires have burned large forest areas in northwestern California during the past 30 years.

Trinity Dam

The Trinity River Division of the Central Valley Project was authorized on August 12, 1955 by the U.S. Congress. Construction of the Trinity Dam began in 1957, and its gates were closed on November 22, 1960. The Lewiston Dam and associated features of the project were completed in 1962. For the past forty years, Trinity River water has been diverted out of the basin into the Central Valley, generating power and irrigating crops.

Heritage Resources – Current Conditions

- *What heritage resources exist?*

Information concerning the above question was obtained between October and December 2002 by conducting record searches at the Six Rivers National Forest Supervisor's Office in Eureka, the North Coastal Information Center (NCIC) of the California Historical Resources Information System (CHRIS) in Klamath, and the Northeast Information Center (NEIC) of CHRIS in Chico.

<u>Recorded Heritage Resources and Archaeological Survey Coverage</u>

A total of 67 heritage resource sites and two isolated artifacts (both prehistoric stone items) have been formally recorded within the bounds of the MTWAA. The recorded sites include 41 resources dating to the historic period, 20 dating to the prehistoric period, five sites with both historic and prehistoric components, and one site lacking descriptive information (Appendix B, Attachment 1, Table B-7).

The historic period sites are categorized under the following themes: mining sites including ditches, adits, tailings and associated equipment and debris (15 sites); transportation including foot and pack animal trails and wagon roads (10 segments recorded); settlement, typically evidenced by remains of old homesteads (eight sites); government including early US Forest Service and Civilian Conservation Corps (CCC) era buildings and fire lookouts (seven sites); recreation/tourism, including remains of former ski and tourist resorts (three sites); cemeteries (two sites); and timber industry (one sawmill recorded). Among the historic period resources, the complex of buildings presently occupied by the Forest Service at the Salyer Station Historic District, constructed by the CCC between 1934 and 1940, has been determined eligible for inclusion in the National Register of Historic Places (NEIC records).

The recorded prehistoric Native American sites consist of the following: principal settlements (11 sites), including seven ethnographically documented Hupa and Tsnungwe villages; scatters of flaked and/or groundstone tools (11 sites); ceremonial places (two sites); and a quarry used to mine chert used to make tools (one site).

Within the near viewshed, but just outside the MTWAA boundaries, are two National Register eligible and/or listed sacred sites of on-going religious significance to contemporary Hupa, Tsnungwe and/or Chimariko descendents: Ironside Mountain (CA-TRI-352) and a corridor (CA-HUM-494H) originating in Hoopa Valley that accesses the Trinity Summit area (De-No-To District). Management actions within the mainstem Trinity River watershed have the potential to affect the important characteristics of setting associated with these two sacred sites.

An estimated 4,250 acres plus 8.5-linear-miles, or less than 1 percent of the MTWAA (private, Federal and Tribal lands), have been systematically surveyed for cultural resources. Surveys have focused almost exclusively on identifying and locating archaeological sites dating to the historic (ca. 1850-1950) and prehistoric (before ca. 1850) periods, as reflected in the recorded sites data. Numerous undocumented historic and prehistoric period archaeological sites and architectural features are expected to be present within the MTWAA.

The majority of this survey coverage has been accomplished on lands administered by Six Rivers National Forest, primarily for timber sales and administrative land-uses and pursuant to compliance with Section 106 of the National Historic Preservation Act (NHPA) and the National Environmental Policy Act (NEPA). Within the HVIR and pursuant to Federal laws, cultural resource surveys have been accomplished for the highly sensitive valley floor for planning purposes (e.g., Offerman et al. 1976), and for upland areas prior to timber sales administered in the past by the Bureau of Indian Affairs (BIA) and now by the Tribe's Forestry Department. On private lands, archaeological surveys have been conducted mainly in advance of certain proposed developments, land subdivisions, and timber harvest plans, primarily due to requirements of the California Environmental Quality Act (CEQA). Caltrans has performed several surveys along narrow stretches of State Highways 299 and 96 for road improvement and/or maintenance projects, which required environmental review under NEPA, NHPA and/or CEQA. Graduate student research contributed survey coverage biased towards ethnographically sensitive places in the eastern portion of the MTWAA (Eidsness 1986).

Contemporary Native American Traditional Land-uses, Important Resources, and Management Concerns

Presently, descendants of the Hupa, Tsnungwe and Chimariko living within and near the MTWAA, as well as in more distant locations, maintain strong heritage ties with their ancestral homelands, cultures and traditions. Various Federal laws and policies require that Federal land-managing agencies, such as the US Forest Service, consult with tribes and other interested Native Americans when managing places and resources important to promoting those lifeways that are central to maintaining tribal cultural identities (e.g., NHPA Section 106 regulations published at 36 CFR 800; National Register Bulletin 38; NEPA; Executive Order 13007 of 1996, Indian Sacred Sites; Executive Order 12898 of 1994, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations).

Information concerning contemporary Native American traditional land-uses, important resources, and management concerns within the MTWAA is principally drawn from the following sources: USDA Forest Service studies (Heffner 1984, Theodoratus et al. 1980); recent Environmental Impact Reports (U.S. Fish and Wildlife Service [USFWS] et al. 1999, 2000); various tribal documents (Hoopa Valley Tribal Forestry 1994, Hoopa Valley Tribe 2000, Tsnungwe Council 2002); records of Forest Service interaction and consultation with the Hoopa Tribe (Heffner McClellan 2002a, 2002b); interviews with representatives of the Hoopa Tribe and the Tsnungwe Tribe and Chimariko descendents; and interviews with staff (Jennifer Kalt, Deborah McConnell, John Button) of the non-profit California Indian Basketweavers Association (CIBA), which maintains its Northwestern Field Office in Willow Creek.

The Forest Service is responsible for governmental consultation with elected officials of the federally recognized Hoopa Valley Tribe and the Yurok Tribe regarding federally reserved Tribal Trust Resources, which for this study, consist of fish and water (Heffner McClellan 2002a). Tribal Trust Resources are addressed separately and under specific headers throughout this MTWA document. At the onset of this MTWA, the Forest Supervisor of Six Rivers National Forest instructed that he will maintain his responsibility to conduct formal governmental consultation with the Tribes and relay pertinent information for incorporation into this analysis (Heffner McClellan 2002a).

Important Natural Resources (Hunting and Gathering)

Information about natural resources within the MTWAA of importance to continuing Native American traditional land-uses and practices is best documented for the Hoopa Valley Indian Reservation and the Hupa (see Appendix B, Attachment 1, Tables B-8 through B-14). However, these data may be generally applicable to Tsnungwe and Chimariko descendant, as well as other Native peoples of the region who use local forest resources. As noted by Heffner (1984),

Historically, people gathered… closer to home... Today, because of better access and transportation, people can go places and travel faster than they could historically. In many instances, it has become necessary to travel further into the mountains to gather. Most of the traditionally owned family plots are now in other private ownership… access for those lands closer to home is often physically denied by locked gates… This has caused an increase in … gathering on public lands… (p. 11).

With a Census Year 2000 population of 11,368, American Indian and Alaska Native persons living in Trinity, Humboldt, Del Norte and Siskiyou counties (the ancestral homelands of the Hupa, Tsnungwe, Chimariko, Wiyot, Yurok, Tolowa, Karuk, and Wintu, among others), access for gathering traditional plants on Six Rivers National Forest System land has become increasingly more important. Contrary to the trend in the 1950's and 1960's when most gathering was performed by Indian elders (Bushnell 1968), Heffner (1984) noted that by 1984, the task was being carried out predominately by the young and middle aged. Today, that trend appears to be continuing, with an increase in the number of persons of Indian descent involved in collecting for traditional purposes. This may be exemplified by the 10-year-old California Indian Basketweavers Association (CIBA), whose membership includes 81 tribally affiliated basketweavers who reside in Humboldt and Trinity counties (18 percent of total membership in this category), only eight of which are 60 years of age or older (John Button pers. comm. 2003).

For many local Indians, deer and, to a lesser degree, elk continue to be hunted as important subsistence foods. "Wildlife Core Areas and Travel Corridors" mapped for the Hoopa Valley Indian Reservation (HVIR) include locations within the present MTWAA boundaries (watersheds of Hospital, Heck and Campbell creeks and Captain John Gulch), most of which extend boundary the reservation boundaries onto National Forest System land (Hoopa Tribal Forestry 1994). In addition, the Hoopa Tribe has mapped three "Traditional Species Activity Centers" located adjacent to the MTWAA boundaries and National Forest System land along the upper watershed of Supply Creek and along Tish Tang Creek (Hoopa Tribal Forestry 1994).

Hunting within the bounds of HVIR is regulated by the Hoopa Valley Tribal Council, which permits tribal members to hunt without restrictions (no bag limits, no seasons, no limits on hunting methods). Non-tribal members generally are not allowed to hunt within the HVIR, however, if the Tribal Council does grant its permission, hunters are subject to CDFG regulations along with any additional regulations imposed by the Council (Steinberg et al. 2000).

Fishes remain the most important subsistence resource and ceremonial food item, as well as a commercial product (see discussion under *Tribal Trust Resources* below). Blue grouse and ruffed grouse are also hunted for food. Other birds and animals identified as important to the Hupa include species described in the ethnographic literature as being sources of materials for making regalia or other ceremonial uses (pileated woodpeckers, fishers, golden eagle, bald eagle, northern flicker, stellar jay, mink, ring-tailed cat, river otter, and ring-necked snake). Protecting and/or enhancing the habitats of these species are important management concerns both on and off the Reservation (see Appendix B, Attachment 1, Table B-9).

A wide range of plants is collected for food, traditional medicine, ceremonial uses, and craft making (Appendix B, Attachment 1, Tables B-11 through B-14). As observed by Heffner (1984) in her analysis of interviews conducted between 1974 and 1984 with 100 local Native Americans who gather on Six Rivers National Forest System land, "the act of gathering plants, for whatever purpose, serves as a strong aspect of their ethnic identify." Among the Hupa, she observed that the largest number of interviewees were engaged in subsistence gathering, and the foods "are an ethnic food and are gathered because they are preferred." Subsistence gathering generally occurred in meadows, oak groves and along ridges, with acorns being the favored plant food such that "…traditional Indians believe that being Indian means eating acorns."

Relative to those who gathered for subsistence purposes, fewer numbers of Hupa gathered for making native arts, notably basketmakers who gathered annually, and woodworking (mostly by men) who generally gathered on an as-needed basis (Heffner 1984). Basketmaking materials were particularly sought after along creeks and ridges. Especially important were hazel and bear grass, both of which need to be burned regularly to produce good quality materials for baskets (Heffner 1984). Among woodworkers, the important materials were yew, cedar, manzanita and mock orange, mostly gathered in the interior mountains and creeks, and redwood, which is only found along the coastal zone (Heffner 1984). Both basketweavers and woodworkers generated income for the bulk of their finished crafts (Heffner 1984).

Even fewer Hupa consultants in Heffner's sample gathered for ceremonial purposes, and these individuals had specialized training and knowledge (formulas, prayers) requisite for this cultural activity (Heffner 1984). Those Hupa Indian doctors who gathered for their personal use, for treating patients, for ritual use, and to contribute to the religious ceremonies, comprised the smallest sample of interviewees. Persons who gathered for ceremonial or shamanistic purposes generally sought resources on the ridges of the high country on National Forest System land (Heffner 1984).

For the period 1974-1984, the bulk of Hupa gathering (Appendix B, Attachment 1, Table B-13) occurred on the HVIR and Lower Trinity Ranger District of SRNF, within the MTWAA (Heffner 1984). Specific locations used by the Hupa for gathering within and adjacent to the MTWAA include the following: the vicinity of Telescope Peak and Hospital Mountain at the southern edge of the HVIR; lower Tish Tang Creek and Tish Tang Ridge to the south along Forest Service Route 8N03; and along Forest Service Route 4 from the river up Waterman Ridge to nearly Ziegler Point (Heffner 1984).

On-going Ceremonial Practices and Sacred Places

Current information about ongoing ceremonial practices and sacred places of concern to contemporary Native Americans is difficult to access because of their confidential and sensitive nature. Sacred places within the MTWAA where ongoing ceremonial activities are being carried out by traditional practitioners include the following: Horse Mountain, important to both the Tsnungwe and Hupa (Merv George, Jr. and Dena Magdeleno, pers. comms. 2002); two places along Friday Ridge Road; Buck Buttes area, important to the Tsnungwe (Ed Chase, pers. comm. 2003); and Telescope Peak, important to the Hupa (Hoopa Tribal Forestry 1994, Heffner 1984).

Activities Affecting Heritage Resources

- *What types of activities have the highest potential to affect heritage resources?*

As a general rule, any ground-disturbing activity has the potential to directly impact archaeological sites if present in the vicinity by disturbing their depositional contexts. Ground-disturbing activities that have the highest potential to impact archaeological site integrity may include, but not be limited to, the following:

- New construction of roads, buildings, underground utilities or other facilities
- Maintenance of existing roads and facilities where earth moving activities extend beyond previously disturbed ground
- Certain timber harvesting activities and practices such as tractor logging, construction of spur roads, skid trails, and landings
- Certain fire suppression and rehabilitation activities such as grading of fuelbreaks, establishment of base camps, mop up and erosion control actions, and possibly revegetation
- Certain restoration activities designed to enhance riparian vegetation, wildlife corridors and fishery habitats, control landslides and erosion, and decommission unneeded roads
- Mining activities including permitted gravel extraction operations or placer mining that extends beyond the limits of water channels
- Unauthorized excavation and artifact collecting by recreationists, USDA Forest Service staff, contractors or others

LRMP Standard 12-3 states that identified cultural resources will be protected from disturbance and artifact theft through the implementation procedures outlined for the NHPA and the Archaeological Resources Protection Act (ARPA) (USFS 1995).

Historically significant buildings or structures are subject to adverse effects when they are altered, maintained, or repaired in a manner incompatible with *The Secretary of the Interior's Standards for*

Rehabilitation, requiring NHPA Section 106 review and consultation for those places determined to be NRHP eligible. Further, vandalism and arson are significant threats to historic buildings and structures. Presently, only the complex of historic buildings comprising the Salyer Station Historic District constructed by the CCC between 1934 and 1940 has been determined NRHP eligible by the USDA Forest Service within the bounds of the MTWAA. Many of the older bridges, fire lookouts, mining complexes, homesteads, and barns that once dotted the landscape have been removed or remodeled, affecting their architectural integrity.

Generally, the greatest threat of impacts to *Traditional Cultural Properties (*TCP), such as ceremonial places, are those that introduce characteristics that are incompatible with the important associated characteristics of setting as defined by those who hold these places dear. Sacred places qualifying for the NRHP as TCPs are typically characterized as having integrity of setting, feeling and association. For example, high places where natural environmental settings and surrounding viewsheds have been maintained, modern developments are lacking, and quiet and solitude are preserved. Therefore, impacts to such places may occur when new incompatible visual or auditory characteristics are introduced, for example, by establishing a new land use or building a nearby road, development, or attraction that introduces new sounds, sights, and more people. A number of TCP have been identified through discussions with local Tribes and surveys. However, registering these localities with the NRHP requires sensitive consultations with Native Americans and sensitivity to their concerns about confidentiality.

Standard and Guideline #12-4 established by the LRMP states "Proposed projects with potential to affect local Native American cultural values or contemporary uses, or in locations known as traditional Native American spiritual use areas, will be discussed with a cross section of the local Indian population and Tribal Governments. These discussions will take place in the early stages of planning and environmental analysis to identify possibly mitigation opportunities or alternatives."

Public access related to recreation also has the potential to affect heritage resources. The Native people understand that their heritage—past, present, and future—is fundamentally connected to their ancestral lands. The health of the plants, the animals, the fishes, the water, the air, and the earth are inseparable from the health of the people who have the relationship with place, especially one that extends back to time immemorial. Public access for recreational pursuits (especially rafting) has increased significantly within the MTWAA, resulting in increases in the amount of waste and trash discarded along the river, in the number of people using the river, and seeking river access even where no access is established or permitted, and in the number of people sometimes crowding out and being insensitive to the old-time residents. Many recreationists are from out of the area, so they may be especially insensitive to dumping garbage, cutting green trees for firewood, or otherwise impacting the environment, since this is not their home. For some, this insensitivity may just be ignorance, and educating the public about Native American culture and respect for place can rectify that.

Tribal Trust Resources

- *What are the federally reserved trust resources and responsibilities within the analysis area?*

While the focus of the legal history surrounding Indian rights to resources has mostly focused on water and fisheries, it is important to recognize that other resources such as wildlife and vegetation are extremely important to the tribes and no less reserved (USFWS et al. 1999, 3-212).

Fish Trust Resources

The establishment of the Hoopa Valley Indian Reservation (HVIR) and the Yurok Indian Reservation (YIR) vested the Hoopa and the Yurok with Federally Reserved Trust Resource Rights of fish and water. Several court rulings have established that an important "Indian purpose" for the reservations was to reserve the tribes' rights to take fish from the Klamath and Trinity Rivers (USFWS 1999, EIS for Trinity River Fisheries Restoration). The Hoopa and Yurok tribes retain and fully exercise federally-recognized fishing rights within the Klamath-Trinity watershed basin. Protection of these rights is a federal government trust responsibility. In managing these rights, the federal government recognizes the vested interest the Tribes retain in habitat, water flow, and fish production outside the reservations in the Klamath-Trinity basin. Tribal fishing rights are vested property rights held in trust by the U.S. for the benefit of the Indians (USFWS 1999, EIS for Trinity River Fisheries Restoration).

Due to the migratory nature of the Klamath Basin runs of fish, the protection of downstream Tribal fishing rights depends on coordinating regulations, policies, planning, and other activities with the Hoopa and Yurok. The SRNF holds a trustee responsibility for Tribal interests related to federally reserved trust resources as well as administrators of Forest Service lands and resources. The SRNF must properly consider off-reservation effects to on-reservation trust resources in management activities that might affect Tribal fishing rights or other reservation resources. The Campbell Creek watershed, in the northern portion of the MTWAA, is in the south-central portion of the HVIR.

It is important to note that the Yurok and Hoopa are riverine people. The fishery is as important to their traditional and cultural lifeways today as it has always been. They have great respect for the fact that all have a need for a healthy Trinity River basin and fishery, no matter what the legal status of rights are. Historically they honored each other's needs, uses, and right to the basin fishery through their self-regulated building of fish dams and ceremonies. This respect continues today as they work together in coalitions as well as independently within each tribal government to restore the Klamath-Trinity basin health, to obtain through the legal system adequate flows into the rivers, and to restore habitat related to fishery, particularly native fish.

Please refer to the *Aquatic Species and Habitat* section to understand the conditions and situation of the health of the fish resource on the Trinity River.

Water Trust Resources

Beginning in 1905 with the Supreme Court's decision in *Winters v. United States*, 207 U.S. 564, federal law has recognized that creation of an Indian reservation carries with it a federal reserved water right sufficient to carry out the purposes for which the reservation was established. The purpose for which the HVIR and the YIR was established was to enable the people to continue their fishing way of life. The Hoopa and Yurok tribes have a federal reserved right to an in-stream flow of water in the Klamath and

Trinity Rivers sufficient to support the Tribes' rights to take its allowable share of fish within the Reservations.

The HVIR has been granted "Program Authority" status under the several sections of the Federal Clean Water Act. Under that authority and following due process, the Hoopa Valley Tribe Water Quality Control Plan has water temperature, suspended sediment, turbidity, and pesticide and herbicide standards that either meet or exceed those of the State of California. The Tribal Environmental Protection Agency has collected physical water quality parameters on Campbell Creek during the development of the Water Quality Control Plan. Water leaving National Forest System land and flowing into the HVIR is subject to meeting the Tribe's standards under their Water Quality Control Plan. Likewise, stakeholders downstream of Tribal lands have authority to enforce receiving waters' standards.

The Yurok Tribe is currently seeking "Program Authority" status under the several sections of the Federal Clean Water Act and is drafting a Water Quality Plan for the Yurok Reservation. The draft was not ready for review at this time.

Please refer to the *Hydrologic Regimes* and *Water Quality* sections of this chapter for the conditions of the waters of the Trinity River.

Timber Production

Timber Production – Reference Conditions

An extensive history of the logging and timber industry in the watershed and surrounding region is provided in the *Historical Resources, Historic Period Land Uses and Practices* section of this chapter (above) and in Appendix B. In summary, logging started in the region concurrent with the settlement of the area. Early logging was undertaken to support early mining activities and to provide lumber for settlers and ranchers. Numerous small mills of very limited capacity were dispersed across the landscape, and the milled lumber was used locally. By the early 1920's regional sawmills were developed that could process larger quantities of logs. These mills were located to take advantage of rail lines that could be used to ship lumber out of the area. From the 1920's into the 1940's, logging levels generally increased, fluctuating in response to market demand. Forest Service records indicate the establishment of a plantation in the MTWAA as early as 1931, and air-photos from the early 1940's show evidence of limited logging in the Three Creeks and East Fork of Willow Creek drainages. The overwhelming majority of the MTWAA shows no evidence of logging in the 1940 photos.

Following World War II, rapidly increasing demand for lumber lead to intensive timber harvesting in the region. Historically, the Forest management strategy was to maximize timber yields from lands designated for timber management while setting aside areas to manage for other resource values. This general strategy continues through the designations of "management areas" as discussed in Chapter 1. Forest-wide, harvest levels ranged from 80 MMBF/year (million board feet per year) in the 1950's and 1960's, up to 200 MMBF/year in the 1970's, to current levels of less than 10 MMBF/year.

In the 1950's, the Forest primarily used overstory removal and other partial cutting methods to harvest timber. Clearcutting became the dominant harvest method in the 1960's and continued through the mid-1980's, while the use of partial cutting declined. Recent harvests have reversed this trend, focusing on commercial thinning, selection, and sanitation salvage operations with a decline in the use of clearcutting.

The three watersheds in the MTWAA total 78,545 acres. Of this, 43,025 acres are under the jurisdiction of the Forest Service, 6,921 acres are under the jurisdiction of the Hoopa Tribe, and 28,599 acres are privately owned. Within the Forest Service lands, approximately 13,038 acres have been harvested from the late 1940's to current times (see Table 3-59 and Figure 3-16 above). The silvicultural treatments that were used can be grouped into two general categories: regeneration harvests where the intention was to harvest the merchantable timber and establish a new timber stand, and partial harvests where the intention was to harvest a portion of the stand and leave a residual stand to occupy the site. Clearcutting is a common regeneration harvest method, and commercial thinning and sanitation/salvage are common partial harvest methods.

Table 3-59. Number of acres harvested in the Six Rivers National Forest portion of the Mainstem Trinity Watershed Analysis Area based on vegetation mapping.

Watershed	Partial Harvest	Regeneration Harvest	Total
Hawkins-Sharber	768	2,479	3,247
Upper Trinity Tributaries	1,589	2,844	4,433
Willow Creek	1,710	3,648	5,358
Total	**4,067**	**8,971**	**13,038**

Within the Hoopa Tribe lands, approximately 1,510 acres were commercially harvested. Of this, approximately 1,110 acres were pre-1972 era harvests and approximately 400 acres were 1972-1980 era clearcuts. In addition, approximately 120 acres of hand thin and release treatments occurred on the Hoopa Tribe lands.

An analysis of timber harvesting on private lands in the MTWAA has not been completed as part of this analysis. However, the California Department of Forestry and Fire Protection (CDF) maintains harvest history records for the private timberlands in California, including the MTWAA. Specific harvest history information for private lands can be developed for specific projects as needed. In general, nearly all of the private timberlands within the MTWAA have had some sort of harvest activity since the 1940's. As with the National Forest, the private silvicultural treatments have ranged from regeneration harvests to thinning to sanitation/salvage.

Timber Production – Current Conditions

- *What portion of the Forest Plan timber outputs, i.e. Allowable Sale Quantity, is expected from this watershed?*

Although once a key industry within the MTWAA, timber production has declined over the past 30 years for various reasons. By 1981, all five lumber mills that had operated in the vicinity of the MTWAA had either closed or relocated to other areas. Local logging operations generate employment for local residents; however, logging-related employment has declined as production levels have dropped off. Currently, according to the Forest's current land allocations, approximately 8,270 acres (19 percent of the 43,025-acre SRNF land base within the MTWAA) are designated for timber production with a primary goal of producing a sustained yield of timber. The Allowable Sale Quantity (ASQ) of timber from this land base is 1.1 MMBF/year (million board feet per year). The ASQ for the entire SRNF is 15.5 MMBF.

Timber harvesting is the single most critical aspect of resource management on the Hoopa Valley Indian Reservation. The Tribe almost exclusively depends on the timber resources of the reservation for its income and employment opportunities. The timber industry in Hoopa is the single largest sector of the reservation economy, and the Hupa Tribe has assumed all of the non-Trust responsibilities of forest management on the Hoopa Valley Indian Reservation under the Self-Governance Demonstration Project. The Tribe prepared a Forest Management Plan (FMP), approved in 1994 by the Bureau of Indian Affairs, covering the period of 1994 through 2003. The purpose of the FMP is to manage approximately 75,000 acres of commercial timberland with an estimated volume of 1.2 billion board-feet of commercially important timber (Hoopa Valley Tribe 2000).

Special Forest Products

Special Forest Products – Reference Conditions

- *What are the levels of historic and prehistoric utilization of SFP?*

Note: For details on SFP use in the MTWAA, please see the *Heritage Resources* section of this chapter (above) as well as the various Tables in Appendix B.

Over time, many SFP have been harvested from the MTWAA, with demand enhanced by the close proximity of SFP resources to prehistoric village sites, the town of Willow Creek, the Hoopa Valley Indian Reservation, and State Highway 299. Native Americans cultured and utilized many of these products for thousands of years.

Special Forest Products – Current Conditions

In recent years, demand has increased for commercial utilization of some SFP. General personal use of some SFP has also increased. The most commonly collected products include firewood; holiday trees; a wide variety of floral products, medicinal plants, fungi, edible plants, nuts and berries; and plants used in Native American basket weaving and spiritual practices.

The SRNF policy is that gathering of SFP for personal use does not require a special use permit unless it is a species that needs management due to impacts, effects, health, or sustainability of the plant, such as the tanoak mushroom. Therefore, more gathering of forest products for personal use is happening than is reflected in Table 3-60. Under this policy, many local residents gather small amounts of numerous species of plants for subsistence and medicinal reasons that are not reflected in the data below. The majority of this population is Hoopa, who gather consistently the same botanical each year or every other year for subsistence, medicinal, and ceremonial purposes.

Table 3-60 shows the personal use permits issued in 1999, 2000, and 2001. These data reflect records that were input into a national database of only personal special use permits issued within the Lower Trinity Ranger District and is not necessarily specific to the MTWAA.

Table 3-60. Personal and free Special Use Permits – Lower Trinity Ranger District for 1999-2001.

Use	Product	Year	Quantity	# of Permits
Personal	Christmas Trees	2000	913 each	913
Personal	Christmas Trees	2001	926 each	926
Personal	Firewood	2000	2,941 cds.	1,370
Personal	Firewood	2001	2,941 cds.	1,376
Personal	Mushrooms/Matsutaki	2000	2,131 days	95
Personal	Mushrooms/Matsutaki	2001	2,139 days	96
Personal	Poles/Posts	2001	35 lft	5
Free	Beargrass	1999	203 lbs.	1
Free	Beargrass	2001	203 lbs.	1
Free	Boughs	1999	270 lbs.	3
Free	Boughs (Conifer)	2000	270 lbs.	3
Free	Boughs (Conifer)	2001	281 lbs.	5
Free	Cones	2000	10 bshls.	2
Free	Cones	2001	10 bshls.	2
Free	Ferns	1999	50 lbs.	1
Free	Ferns	2000	50 lbs.	1
Free	Ferns	2001	50 lbs.	1
Free	Mushrooms (other)	1999	7 days	4
Free	Mushrooms (other)	2000	7 days	4
Free	Mushrooms (other)	2001	7 days	4
Free	Poles	1999	39,160 lft.	90
Free	Poles	2000	39,160 lft.	90
Free	Poles/Posts	2001	39,292 lft.	92
Free	Posts	1999	132 lft.	2
Free	Posts	2000	204 lft.	4
Free	Shrubs	1999	58 lbs.	3
Free	Shrubs/Plants	2000	58 lbs.	4
Free	Shrubs/Plants	2001	63 lbs.	5

Table 3-61 shows the commercial use permits issued in 1999, 2000, and 2001. These data reflect records that were input into a national database of only commercial special use permits issued within the Lower Trinity Ranger District and is not necessarily specific to the MTWAA.

Table 3-61. Commercial use Special Use Permits – Lower Trinity Ranger District for 2000-2001.

Use	Product	Year	Quantity	# of Permits
Commercial	Beargrass	2000	2,500 lbs.	11
Commercial	Beargrass	2001	2,833 lbs.	14
Commercial	Boughs (Cedar)	2000	1,200 lbs.	3
Commercial	Boughs (Conifer)	2000	10,500 lbs.	16
Commercial	Boughs (Conifer)	2001	12,500 lbs.	15
Commercial	Christmas Trees	2000	1,200 each	3
Commercial	Christmas Trees	2001	1,301 each	4
Commercial	Ferns	2000	1,901 lbs.	8
Commercial	Ferns	2001	1,833 lbs.	3
Commercial	Greens (Salal)	2000	1,800 lbs.	3
Commercial	Greens (Salal)	2001	1,688 lbs.	4
Commercial	Herbs/Flowers	2000	125 lbs.	1
Commercial	Herbs/Flowers	2001	125 lbs.	1
Commercial	Huckleberry	2000	3,400 lbs.	10
Commercial	Huckleberry	2001	3,650 lbs.	5
Commercial	Mugwort Greens	2000	187 lbs.	1
Commercial	Mugwort Greens	2001	167 lbs.	1
Commercial	Mushrooms (other)	2000	760 days	37
Commercial	Mushrooms (other)	2001	780 days	37
Commercial	Mushrooms (Matsutaki)	2000	960 days	38
Commercial	Mushrooms (Matsutaki)	2001	980 days	38
Commercial	Shrubs/Plants	2000	10 lbs.	1
Commercial	Shrubs/Plants	2001	10 lbs.	1

- *What are the projected commercial and personal use demands for SFP over the next decade?*

To a large extent, the personal and commercial demand for SFP in the MTWAA over the next decade will be driven by local and regional population growth. According to the California Department of Finance (2001), local and regional population growth in Humboldt and Trinity counties over the 2000-2010 period is projected to total 6.9 percent and 9.9 percent, respectively. Assuming communities in the MTWAA maintain their current shares of countywide populations over the next decade, the population within and near the analysis area (i.e., the Willow Creek, Hoopa Valley Indian Reservation, Salyer, and Hawkins Bar areas) could increase by approximately 7.4 percent, indicating an average growth rate in the demand for SFP of less than 1 percent per year. Based on this rate of growth and SFP harvest levels in the Lower Trinity Ranger District in 2000, projections for the annual demand for personal and commercial SFP requiring permits have been prepared and are presented in Tables 3-62 and 3-63. These demand levels would not be substantially higher than current levels, but because the commercial harvest quantities of some SFP currently exceed limits established by the Forest Service, any increase in demand could lead to these limits being further exceeded.

Table 3-62. Projected annual demand for personal, free, and commercial Special Forest Products in 10 years on the Lower Trinity Ranger District of Six Rivers National Forest. Source: California Department of Finance (2001).

Use	Product	Quantity	# of Permits
Personal	Christmas Trees	980 each	980
Personal	Firewood	3,160 cds.	1,470
Personal	Mushrooms (Matsutaki)	2,290 days	100
Free	Boughs (Conifer)	290 lbs.	4
Free	Cones	11 bshls.	2
Free	Ferns	54 lbs.	1
Free	Mushrooms (other)	8 days	5
Free	Poles	42,060 lft.	100
Free	Posts	220 lft.	5
Free	Shrubs/Plants	62 lbs.	5
Commercial	Beargrass	2,700 lbs.	12
Commercial	Boughs (Cedar)	1,300 lbs.	4
Commercial	Boughs (Conifer)	11,300 lbs.	17
Commercial	Christmas Trees	1,300 each	4
Commercial	Ferns	2,050 lbs.	9
Commercial	Greens (Salal)	1,950 lbs.	4
Commercial	Herbs/Flowers	135 lbs.	1
Commercial	Huckleberry	3,650 lbs.	11
Commercial	Mugwort Greens	200 lbs.	1
Commercial	Mushrooms (other)	820 days	40
Commercial	Mushrooms (Matsutaki)	1,030 days	41
Commercial	Shrubs/Plants	11 lbs.	1

Recreation

Recreation – Reference Conditions

Historically, recreational uses in the MTWAA have included fishing, hunting, boating, swimming, hiking, sightseeing, camping, skiing, and small-scale mineral resource extracting (i.e.; gold mining). The area is part of the ancestral territory of the Hoopa, who developed trails and fishing access points still in use today. With the discovery of gold along the Trinity River in the mid 1800's, mining and dredging occurred, which resulted in sprouting of communities and supply trails from the mines to the Pacific coast and increased harvesting of timber resources to support these activities.

The Hoopa Reservation was established to the north of the analysis area in the 1860's, which led to increased use of the non-reservation areas for fishing and seasonal grazing by non-natives. Large-scale timber harvesting, starting in the 1950's, also drew people to the area. Private land ownership and construction of summer homes increased as the area became more popular as a recreation destination. During the 1960's, recreational interest in the area continued to grow, leading to development of camping and picnic facilities, skiing facilities (Horse Mountain), river access, and trails. Roads on Forest Service lands that had been developed for timber harvesting were used for recreational purposes as well.

Since the 1960's there has been a decrease in the number of river access points provided by the Forest Service, and the number of camping and boat launching sites has been reduced as well.

According to the Trinity River Strategic Planning Visitor Survey (Clark and Pagen 1995), funded by the Forest Service, visitors are attracted to the area for its scenic beauty; river access; water-oriented recreation; salmon, steelhead, and trout fishing; boat rentals; climate; clean and uncrowded nature; solitude; hiking and horseback riding trails; and visitor facilities, such as campgrounds and picnic areas. Although not currently active, the Forest Service, the Willow Creek Community Services District, and the Hoopa Valley Tribe have, in the past, partnered to jointly promote recreational activities for the Trinity Recreation Area.

Recreation – Current Conditions

- *What types and levels of recreation use are now occurring in the analysis area?*
- *What are the issues concerning river access and other key activities?*

Current recreational uses include rafting, kayaking, tubing, canoeing, fishing, boating, sunbathing/swimming, hiking, backpacking, dispersed and developed camping, picnicking, sightseeing, off-highway vehicle use, biking, horseback riding, winter sports, hunting/target shooting, and mining. Most recreationists within the MTWAA are local residents (i.e. living within a 2-3 hour drive).

Much of the recreational activity in the MTWAA is considered dispersed recreation, in that individuals and small groups seek individual sites and experiences rather than larger group activities. A few exceptions are the popular group facilities at Camp Kimtu and large rafting parties. Many recreational facilities in the MTWAA are either semi-primitive non-motorized, semi-primitive motorized, or roads and trails that provide access along the river corridors and to the interior of the forest. Wildlife and nature viewing and river/creek experiences are offered in a very natural setting. Today, recreational users can find locations with striking natural features that have changed little in hundreds of years.

Rafting, Kayaking, Floating, Boating (Water-Based Recreation)

With the completion of Clair Engle (Trinity) Dam and the filling of Trinity Lake in 1963, the Trinity River now flows steadily all summer long. The Trinity River was designated in 1981 by the Department of Interior Office of the Secretary as a Wild and Scenic River -- from the confluence with the Klamath River to one-hundred yards below Lewiston Dam. The reach of the Trinity Wild and Scenic River in the MTWAA is classified as "scenic" and "recreational," with a small segment from Gray Falls upriver to the MTWAA boundary (at New River) being classified as "scenic" and the rest of the Mainstem Trinity River, down river from Gray Falls, classified as "recreational." A "scenic river" area is a river, or section of a river, that is free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads. A "recreational river" area is a river, or section of a river, that is readily accessible by road or railroad, that may have some development along the shorelines, and that may have undergone some impoundment or diversion in the past.

The Mainstem Trinity River offers whitewater experiences ranging from calm (Classes I and II) to challenging and skilled (Classes III and IV). Caution is needed when negotiating the rapids, since the class (difficulty) of the rapids can change with the river flow. The most popular rafting, tubing, and kayaking area is the eleven-mile river run from Gray Falls to the South Fork Bridge. Access is limited, with a half-mile foot trail at Gray Falls Day Use Area. There are Class I and II rapids from Gray Falls to Hawkins Bar, a section which takes approximately three hours to traverse. Continuing on to Salyer and the South Fork Bridge takes an additional two to four hours. A more novice run is the six-mile run from South Fork to Big Rock, just west of Willow Creek, which takes approximately three hours.

The eight-mile section from the Big Rock river access to the Tish Tang campground is also used for river rafting. It provides some Class I, II, and III rapids, interspersed with long stretches of calm water. The one Class III rapid on this stretch is at Sugar Bowl, and there have been some injuries sustained there by boaters. In the lower five miles of this section, the river narrows and flows north, through a very scenic gorge. This section is primarily used by private rafters, kayakers, tubers, and canoeists, but is also used by commercial guides. The Big Rock river access is also frequented by users who walk on the runway, walk with their dogs, or watch the river from the parking lot. However, beach use by sunbathers and swimmers has declined in this area, since winter and spring high waters have reconfigured the beach.

There are several commercial guides offering rafting and kayaking trips in the MTWAA. They offer several trips per day, from Hawkins Bar to Big Rock and from Big Rock to Tish Tang, with the latter experiencing more user days.

Boat launching sites are available at Hawkins Bar, Kimtu Beach, Big Rock, Tish Tang Campground, and Hoopa Campground. These launching sites are used by whitewater guides, private rafting groups and individuals. Drift boats, and motorboats commonly used for fishing and recreating in calmer waters of the river, are also launched from these sites. Use conflicts have occurred, due to the presence of both motorized and non-motorized crafts on the river.

Fishing

The portion of the Trinity River and its tributaries in the MTWAA offers both bank and boat anglers the opportunity to fish for salmon, steelhead, and trout species. The area is popular with both fly-fishing and bait and lure anglers. Some of the more popular fishing areas are at Hawkins Bar, Salyer Bridge Hole, Sandy Bar, Big Rock, and near the Hoopa Campground. Several local commercial fishing guides offer day trips in the MTWAA. However, Horse Linto Creek is closed to fishing for species preservation. Fishing access sites are shown on Figure 3-31 (below).

River Access Points

River access is a precious public commodity in the MTWAA. The existing public access points within the MTWAA, along with their features and locations, are listed on Table 3-63. These river access points are also shown on Figure-3-31. Six of the access points are accessible from Hwy. 299; the remaining five can be accessed from Hwy. 96. There is only one boat launch accessible from Hwy. 299, at Hawkins Bar. Four boat launches are accessible from Hwy. 96.

Table 3-63. River access points in the Mainstem Trinity Watershed Analysis Area.

Access Point	Features	Location
Gray Falls Day Use Area	Trail Access, short but steep trail; Impressive falls	12 miles east of Willow Creek; Access from Hwy. 299
Hawkins Bar Bridge	Trail Access (split in guard rail leads to trail); Short but steep trail; Vehicle parking on bridge	10 miles east of Willow Creek; Access from Hwy. 299 from Denny Rd, across Hawkins Bar Bridge
Hawkins Bar	Boat Launch, Narrow road; Fishing access.	10 miles east of Willow Creek; Marked access across from store; Access from Hwy. 299
Tunnel Flat	Trail Access; Gravel road to trail; Fishing access	1.5 miles west of Hawkins Bar; Across from Salyer Rest Area; Access from Hwy. 299
Salyer	Trail Access (10 minute hike); Fishing access	Across Salyer Bridge, left on Campbell Ridge Rd. to fire station; Access from Hwy. 299
Hlel Din	Trail Access; Fishing access	1 mile west of Salyer (across the South Fork Bridge on east side); Access from Hwy. 299
Kimtu Beach	Boat Launch (closed in summer); Community park; Fishing access	In Willow Creek, on Kimtu Road; Access from Hwy. 96
Big Rock	Boat Launch with parking; Fishing access	North of Hwy. 299 / 96 junction, opposite Lower Trinity Ranger Station; Access from Hwy. 96
Sugar Trail	Trail Access (1/4 mile trail to river)	5 miles north of Willow Creek; Access from Hwy. 96
Tish Tang Campground	Boat Launch; Limited vehicle access; Fishing access	8 miles north of Willow Creek and 3 miles south of Hoopa; Access from Hwy. 96, outside the campground entrance
Hoopa Campground	Boat Launch; Fishing access	Access off Hwy. 96; Over 8 miles north of Willow Creek

Public river access is affected by land ownership, which is predominantly private along Hwy 96 (below the confluence with the South Fork Trinity) and around the communities of Willow Creek, Hawkins Bar, and Salyer.

Hiking

All trails in the MTWAA, which are listed in Table 3-64, are open for multi-use (via foot, horse, and mountain bike). No motorized use is allowed on these trails. Trails with river access include Gray Falls, Tunnel Flat, Salyer, Lower Campbell Ridge, Hlel Din, and Sugar Trail.

Table 3-64. Trails in the Mainstem Trinity Watershed Analysis Area.

Trail Name & Number	Trail Length	Elevation (ft.)	User Types
Salyer Trail–5E31	0.5 miles	400 - 500	Hiking and Trinity River access
Hlel-Din Trail–5E32	0.3 miles	400 - 500	Hiking and Trinity River access
Sugar Trail–5E33	0.3 miles	500 - 700	Hiking and Trinity River access
Lower Campbell Ridge-5E37	1.1 miles	600 – 1,400	Hiking and Trinity River access
Bremer Trail–5E38	3.0 miles	1,200 – 3,000	Hiking
Boise Creek Trail–5E65	0.5 miles	600 - 800	Hiking and camping, easy trail
Tish Tang Trail–6E18	5.5 miles	3,700 – 6,000	Hiking, backpacking, horseback riding, Trinity Alps access trail

Trail Name & Number	Trail Length	Elevation (ft.)	User Types
Gray Fall Trail–6E30	0.9 miles	200 - 300	Hiking and Trinity River access
Tunnel Flat Trail–6E75	0.3 miles	600 - 700	Hiking and Trinity River access

Camping and Picnicking

Dispersed Camping

Most of the National Forest System lands in the MTWAA are open for dispersed (primitive/rustic) camping, except for certain areas which are closed due to fire hazards, restoration activities, or to protect Native American resources and practices. Dispersed camping is free of charge and is limited to thirty days per year. No public services or amenities are provided for dispersed camping, which must be separated by a distance of at least one-quarter-mile from developed sites. When camping, a vehicle may be taken up to one-hundred feet off public roads, provided it does not cross a stream, wet meadow, or otherwise fragile area. Campfire permits are required for all fires, gas lanterns, barbecues, and camp stoves used outside developed campgrounds. The permit is free and is available at any Forest Service Office. Most dispersed camping occurs in the Horse Mountain area and in hunter camps throughout the Lower Trinity Ranger District.

Developed Camping

Developed campgrounds are areas that have been improved and developed to meet Forest Service standards. They may offer public conveniences such as defined parking, restroom facilities, and well-designated, maintained trails. There are only two campgrounds (East Fork and Boise Creek) on Forest Service System lands, currently open in the MTWAA. Both of these facilities have been recently renovated and have universally accessible vault toilets, water spigots (Boise Creek), parking, and camp sites with picnic tables and fire rings. Gray Falls campground has been closed by the Forest Service due to health and safety hazards. Camp Kimtu, operated under special use permit with the Six Rivers National Forest, is partially located on Forest Service System lands. It is managed by the Willow Creek Community Services District. Tish Tang and Hoopa campgrounds are within the Hoopa Square, the sovereign lands of the Hoopa Valley Tribe, and are managed by the Hoopa Tribe Forestry Department.

Developed camping is a popular activity that provides a variety of amenities and services such as water, picnic tables, fire rings, barbecue grills, toilets, site maintenance, site hosts, and security (which are not provided in dispersed camping areas). Table 3-66 lists existing campgrounds in the MTWAA, including their features and locations. Figure 3-31 (below) shows campground locations.

Picnic Areas

There are four designated picnic areas in the MTWAA on Forest Service System lands (East Fork, Big Rock, Hawkins Bar, and Gray Falls). A fifth area (Camp Kimtu) is partially situated on Forest Service System lands. Four of these developed picnic areas are located near the Trinity River (Big Rock, Camp Kimtu, Hawkins Bar, and Gray Falls), and the other (East Fork) is adjacent to a tributary and accessible from Hwy 299. Picnickers also use rest areas and vista points, the river edge, and stops along Forest Service roads. Picnic areas are listed in Table 3-65.

Table 3-65. Campgrounds and picnic areas in the Mainstem Trinity Watershed Analysis Area.

Name	Features	Location
East Fork (seasonal)	11 camp spaces; universally accessible camp sites and vault toilets; Picnic area; Campground host in summer; No water	6 miles west of Willow Creek; along East Fork Willow Creek; Access from Hwy. 299
Boise Creek (open all year)	17 camp spaces; universally accessible camp sites and vault toilets; Picnic area and piped water; Campground host in summer; RV parking and trail access	2 miles west of Willow Creek; near Boise and Brannan Creeks; Access from Hwy. 299
Big Rock (open all year)	Picnic area (two tables); boat launch; portable toilet in summer; information board; easy river access	About half a mile north of Hwy. 299 (near Willow Creek); Access from Hwy. 96
Gray Falls	Picnic area (four tables); vault toilet; and trailhead; Campground is closed due to health and safety hazards	12 miles east of Willow Creek; Access from Hwy. 299
Camp Kimtu (open all year)	11 camp spaces; picnic area; running water; bathrooms; Boat launch and river/beach access; group camp with lodge ball fields; tennis court.	Willow Creek, Kimtu Road via Country Club Drive; Access from Hwy. 96
Tish Tang (seasonal)	32 campground units; Picnic area; boat launch; and trail access	8 miles north of Willow Creek; Access from Hwy. 96
Hoopa (seasonal)	25 camp spaces; Trail with river access; Boat launch	8+ miles north of Willow Creek; Access from Hwy. 96
Knights Park (seasonal)	Private campground; 15 camp spaces	8 miles north of Willow Creek; Access from Hwy. 96

Sightseeing by Vehicle

Sightseeing by vehicle (motorized recreation) is the most popular recreational activity occurring within the MTWAA. Sightseeing vehicles typically include (but are not limited to): passenger cars, motorhomes, 4-wheel drive vehicles, motorcycles, snowmobiles, all-terrain vehicles (ATV), and sports utility vehicles (SUVs). The main travel corridors in the MTWAA – Hwy. 299 and Hwy. 96 -- are designated scenic routes, which offer sightseeing opportunities on well-maintained roads and at vista points. An eighty-five mile section of Hwy 96, between Willow Creek and Happy Camp, was designated as the Bigfoot National Scenic Byway in 2000. The portion of Hwy 299 within the MTWAA is part of the Trinity Heritage Scenic Byway.

Forest Service offices, along with other local visitor centers, offer tourist and recreational information for sightseers. The Lower Trinity Ranger District office is located on Hwy 96, approximately one mile north of Hwy 299. Specific information about local recreational activities and public safety is available there. The Salyer Rest Area on Hwy 299, between Salyer and Trinity Village, provides visitor information, restrooms, picnic facilities, and a short walking trail. Both the Willow Creek and Hoopa Chambers of Commerce offer visitor information on interpretive services, recreational activities, and community events in the local communities and on public lands.

Off-Highway Vehicle Use (OHV)

OHV use (including ATVs, 4x4s, and motorcycles) are restricted to designated routes. Level II roads are open to motorized recreation vehicles (including OHVs). Level II roads may or may not be surfaced and are not designed nor maintained for passenger vehicles. They may be subject to seasonal closures, due to fire or safety hazards, restoration activities, or to protect Native American resources and practices. OHVs operated on Forest Service System lands require properly installed and operating spark arresters and mufflers on all vehicles. A current State of California OHV registration (commonly known as "green stickers"), on vehicles not registered for highway use, is also mandatory. Helmets are required when riding on open OHVs, such as motorcycles and ATVs. Riders of street-legal OHVs must also have a valid driver's license. The Forest Service has also granted a special use permit to one concessionaire for guided jeep trips on public roads in the MTWAA.

Wildlife Watching

An abundance of terrestrial, aquatic and avian wildlife exists in the MTWAA. Birdwatchers have the possibility of seeing a wide variety of native species, such as ospreys, bald eagles, great blue herons, quail, grouse, and a number of resident water birds. Neotropical birds, such as willow flycatchers, sapsuckers, grosbeaks, and orioles, to name a few, use the Trinity River corridor as a flyway during their regular spring and fall migrations. Native terrestrial species include black bear, deer, red fox, gray squirrels, wild turkeys, and mountain lions. Though harder to spot without a boat, salmon and steelhead may be observed in the pools of the Trinity River and certain tributaries.

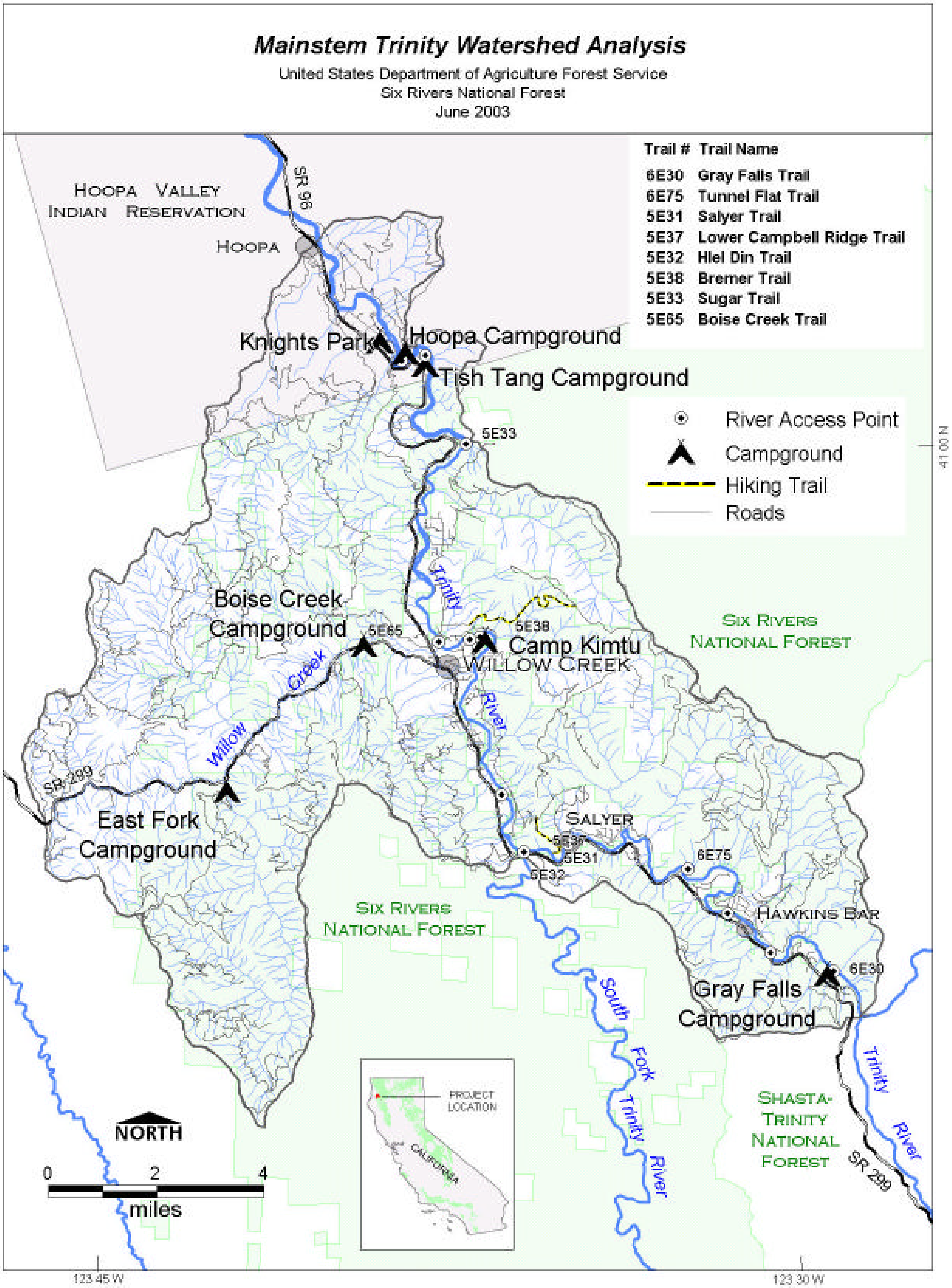
Points of Interest

Points of interest include museums (Hoopa Reservation Tribal Museum, the Bigfoot exhibit at China Flat Museum, and Old Lookout in Willow Creek); the Caltrans Salyer Rest Area with local historical information; the nation's largest tanoak tree (southeast of Salyer); cultural heritage sites; historic gold mining remnants; and South Fork Mountain (on South Fork Road), the longest continuous ridge in the continental United States. The Salyer Guard Station, which was constructed by the Civilian Conservation Corps during the 1930's, is located on Hwy 299, four miles east of Willow Creek.

Cultural Sites

Throughout the MTWAA, there are Native American heritage and cultural sites, used for religious and spiritual activities, both historically and currently. Protection measures are in place to protect these fragile and important sites. Local Native American points of interest include Hoopa Reservation Tribal Museum and the artwork at the Tish Tang Campground, where a retaining wall has been transformed into a mural featuring natural designs and Hoopa tribal motifs. Due to the sensitive nature of identifying cultural site locations, detailed information is not included in this study.

Figure 3-31. Recreational Sites Within the Mainstem Trinity Watershed Analysis Area.



Horse Mountain Botanical Area

Horse Mountain Botanical Area offers 1,077 acres of protected botanical features, including rare plants, wildflower displays, conifer diversity, and the distinctive plant communities at this 4,500 feet elevation. It offers glimpses of the local botanical and cultural past, which is a part of our natural heritage. Pre-historic and historic sites and artifacts may be encountered here and are protected by federal law. This is a highly sensitive area that requires carefully controlled access and considerate use by those who visit. Use of pack animals is discouraged in this area. Vehicle access into the botanical area is via low-maintenance forest roads. The use of no-maintenance roads and cross-country travel access are allowed for pedestrian use only. Trails within the botanical area are not wheelchair accessible. The botanical area is part of Horse Mountain, which is the most popular winter recreation use destination in the MTWAA.

Other Uses

Mountain Biking

Mountain bikers are the fastest growing user group in the sport of cycling. Technological bike improvements -- such as lighter materials, suspensions, stronger tires, and improved brakes -- have made mountain biking more accessible and increasingly popular. Mountain biking is currently allowed on Forest Service System trails, except where specifically restricted. The most popular trail for mountain biking in the MTWAA is the Tish Tang Trail, which is one of the main west-side access trails leading to the Trinity Alps. In the past, organized mountain biking events have been held in the MTWAA. This use was allowed under a special use permit for recreational events. For example, the Tish Tang Tangle mountain bike racing event, sponsored by the Willow Creek Kiwanis and Lions Club, was held annually until 2001, when the racing ground they used was no longer available.

Horseback Riding

The MTWAA also offers trails for horseback riding. All the trails listed in Table 3-64 (above) allow horseback riding, unless access is specifically restricted. Tish Tang Trail is the most suitable horseback-riding trail. The trailhead has suitable parking and turn around space for horse trailers.

Swimming

Although the Trinity River is cold for most of the year, long summer days and lower flows can warm water temperatures enough for good swimming. Kimtu Beach is currently the most popular swimming and sunbathing spot on the river, with 100-180 visitors on peak summer weekend days (Willow Creek Community Services District). In the past, the swimming area at Big Rock was the most popular swimming and sunbathing area, with 300-400 visitors on peak summer weekend days (Willow Creek Community Services District). Day use at Big Rock, in the form of swimming and sunbathing, has declined significantly, due to a loss of beach area when winter high waters altered the riverbed. However, other forms of recreation (walking along the runway, playing with dogs, viewing the river, sightseeing, and birding) are popular year-round activities at this site.

Winter Sports

Winter recreational opportunities are available at Horse Mountain, located about two miles south of Hwy 299, off of Titlow Hill Road. It has the highest accessible elevation in the MTWAA. Snowfall varies from year to year, but winter sport opportunities include: cross-country skiing, snow shoeing, sledding, snow mobiling, and snow play. This area's roads and trails are not plowed or maintained for winter use. In the past, a local ski group operated a rope tow at Horse Mountain and built a small chalet. That rope tow has been removed, but the chalet's ruins still remain. In addition to winter recreation activities, Horse Mountain offers panoramic views of the Trinity River watershed forests and river valleys as well as distant views of the Pacific Ocean to the west and the Trinity Alps to the east.

Hunting/Target Shooting

Hunting is allowed on designated public lands, during recognized seasons, in the MTWAA. Game animals that are commonly hunted include deer, bear, grouse, and quail. Target shooting is also allowed, with most of this use occurring on Horse Mountain. These uses are regulated to preserve multi-user safety and avoid conflicts between incompatible user groups. The desires of hunters and target shooters must be balanced with those of sightseers, botanical area visitors, bird watchers, and private landowners within earshot of these activities.

Mining and Gold Panning

Evidence of historic mining activities includes tailings (mounds of rock and dirt) along the river. These tailings are remnants of the hydraulic and dredger mining. Some mining activity still occurs along the river. The preferred method is suction dredging, which is allowed on the Trinity River with a valid dredging permit in the reach between the South Fork Trinity and the New River. Permits are not required for gold panning. There is no designated recreational mining area in the MTWAA (the nearest designated mining area is the Big Flat Free Use Permit Area). However, there is a gravel removal operation below Big Rock river access. The public has the right to recreate on this claim area as long as recreational activity does not interfere with the mining operation. The location of claims is available through the state.

Transportation System

The transportation system within the MTWAA encompasses state highways, county roads, Forest Service jurisdictional roads, and private roads. State Highway 299 follows an east-west corridor adjacent to the mainstem Trinity River and mainstem Willow Creek. State Highway 96 also follows the mainstem Trinity River, traveling north from its junction with Highway 299 in Willow Creek. Both highways are designated as National Scenic Byways.

Historical practices show that roads were developed along watercourses because they were easier to construct. Forest Service roads were initially developed to provide access for extraction of natural resources. With the reduction of timber harvesting over the last decade or more, road construction has been curtailed and road maintenance activities have declined in proportion to the reduction in resource extraction. As maintenance activities continue to decline, the potential exists for unsafe conditions and road-related resource damage.

Road density (usually expressed as miles of road per square mile) is used as an indicator of habitat fragmentation, the potential for wildlife harassment, visual quality, recreation opportunities, the cumulative potential for erosion and sedimentation from road surfaces, and cumulative increases in peak flow due to runoff from road surfaces and ditches. In general, road density of five miles of road per square mile of land is considered on the high side. The MTWAA has moderate to low road density per square mile. The highest road density for the subwatersheds in the MTWAA is just under three miles per square mile (Table 3-66).

Table 3-66. Road densities (road miles/square miles) in the subwatersheds of the Mainstem Trinity Watershed Analysis Area. [Abbreviation: FS = Forest Service]

Subwatershed	Area (sq. mi)	Total Road Miles	Total FS Road Miles	Overall Road Density	Road Density on FS land
Upper Tributaries Lower Trinity River	48.66	91.67	53.72	2.98	1.75
Willow Creek	43.35	141.01	52.54	2.90	1.08
Hawkins-Sharber	30.72	108.99	59.40	2.51	1.37
Total Miles		**341.67**	**165.66**		

Note: Does not include decommissioned road miles or trails.

Access to the Forest for resource management and for its use and enjoyment by the public is dependent on state, county, and Forest Service jurisdictional roads and trails. Most activities on the Forest, including camping, hunting, fishing, motorized recreation, hiking, enjoying rivers and streams, suction dredge mining, and gathering fuel-wood and other forest products, are available because a Forest road or trail provides access to them. Driving for pleasure and viewing scenery is a popular recreational activity on the Forest. The existing road system is currently used for Forest Service administrative access, fire and fuels management, commercial timber activities, recreation, hunting, woodcutting, special forest products gathering, and sightseeing, among others.

The zone immediately surrounding SRNF is predominantly rural and highly dependent upon the Forest's natural resources for its social and economic well-being. These resources link the people and communities of this area to the Forest through employment, incomes, and environmental conditions that affect the lifestyles, population, and quality of life of the North Coast region. Because of this, issues relating to transportation management and roads are frequently the focus of social concern.

- *Which roads pose the greatest risk for erosion or prism failure if inadequately maintained?*

Roads are generally recognized as the principal land management influence on erosion and sedimentation rates. The most common problems associated with roads are the following: (1) improper locations of road cuts and fills on unstable or erodible terrain; (2) improper design or construction of stream crossing fills; (3) undersized or improperly installed culverts; (4) inadequate or improper road maintenance; (5)

steep hillslope gradients; (6) alteration of slope drainage by interception; and (7) concentration of surface and subsurface water.

Culvert failures can cause a variety of impacts to the stream channels, from localized impacts to compounding downstream impacts. Failures may introduce sediment volumes that exceed the transport capacity of the channel, causing the channel to aggrade and widen, followed by fluvial adjustments that could take many years to complete. Sudden mass failure of stream crossings also may generate debris flows that entrain additional sediment and destroy riparian vegetation as they move downstream. Stream crossings in steep terrain with a lot of organic debris upstream that could plug the culvert during large storms have the highest debris flow potential. Stream diversions also pose significant risks in terms of off-site sedimentation. Diversions occur when a culvert plugs and the stream flow follows the roadbed instead of crossing the road and returning to the original channel. When the stream flow eventually crosses the road, it may create a new channel on the hillslope with considerable erosion consequences. Identification, maintenance, storm proofing, or decommissioning is a high priority for roads and crossings with these types of potential.

The identification and decommissioning of unneeded roads is a management objective identified in the SRNF LRMP and as a national priority. Roads are most often decommissioned for watershed restoration purposes or because they are no longer needed to manage NFS lands. The Forest LRMP states that road mileage on the Forest will be reduced by 250 miles over a ten-year period.

Approximately 29 percent of the total road miles (99 miles) are located in the upper one-third of the watersheds. Of those 99 miles, nearly 71 miles (72 percent) are under Forest Service jurisdiction. The 71 miles of Forest Service upper watershed roads constitutes approximately 43 percent of all the Forest Service road miles. Comparatively, State Highways 299 and 96, which run adjacent to the mainstem Trinity River and to the mainstem Willow Creek, constitute approximately 10 percent of the total road miles (34 miles) in the MTWAA.

In order to help determine and guide the road management objectives for Forest Service jurisdictional roads, Forest Service roads were inventoried, and an Access and Travel Management Plan (ATM) was developed for lands on the Lower Trinity River Ranger District in 1998. The Forest Service has already implemented some of its decommissioning work in the MTWAA, with approximately six miles of road having been decommissioned over the last several years.

- *What road maintenance is needed for each road to minimize future road deterioration and provide for safe vehicle access?*

Extensive road inventories on Forest Service roads were conducted throughout the MTWAA to address the current conditions of the transportation system and determine what opportunities existed for road restoration and upgrading. The Access and Travel Management Plan included implementation plans for road restoration and upgrading. The ATM included most of the roads on the GIS layer for the analysis area. Approximately ten miles of road (six percent of Forest Service road miles) less the immediate ridge roads located in the upper drainage areas of the Quinby-Sharber Slough and Hawkins Creek watersheds were not specifically addressed in the ATM. Table 3-67 describes the Operational Maintenance needs assigned to the roads in the GIS layer.

Table 3-67. Operational Maintenance levels for roads in the three subwatersheds of the Mainstem Trinity Watershed Analysis Area.

Operational Maintenance Code (GIS)	Maintenance Description	UTLTR	Willow Creek	Hawkins Sharber	Total Road Miles	USDA-FS Jurisdiction Road Miles
1	Closed to vehicular traffic, but still open to non-motorized uses; Hydrologically maintenance free	7.53	3.58	11.56	22.67 (7%)	22.67 (14%)
2	Open for use by high clearance vehicles; Recreation and general purposes	25.86	37.77	25.39	89.02 (26%)	89.02 (54%)
3	Open to passenger cars; Often single lane with turnouts and spot surfacing	1.46		13.04	14.50 (4%)	14.50 (9%)
4	Open to passenger cars, with moderate comfort and speed levels	7.11	7.83	2.63	17.57 (5%)	17.57 (10%)
20	State Jurisdiction	15.20	9.99	9.14	34.34 (10%)	0
30	County Jurisdiction	10.92	6.15	12.75	29.81 (9%)	0
40	Non-system* and Private roads (including Hoopa Reservation roads)	72.94	43.67	17.15	133.76 (39%)	21.90 (13%)
Total Road Miles		**141.01**	**108.99**	**91.67**	**341.67**	**165.66**
60	System and non-system trails	1.51			1.51	1.22
100	Decommissioned roads	0.23	5.80		6.03	6.03

*Non-system roads are roads that show up on all or most maps for the area, are generally used by the public, but are not in the Forest Service road system database and are therefore not eligible for funding. Non-system roads were generally not constructed, maintained, or intended for long-term vehicle use, such as roads built for temporary access and other remnants of short-term use activities associated with fire suppression, timber harvest, oil, gas, or mineral activities, as well as travel-ways resulting from off-road vehicle use.

It has become widely accepted that road restoration can be one of the most effective, long-term means of erosion control and prevention, particularly in light of diminishing funding for continued road maintenance needs. The term storm-proofing is the improvement of a road drainage system to withstand large storm events without appreciable on-site or off-site damage. It can be accomplished in several ways. The most common methods are by increasing culvert sizes to accommodate larger flows, modifying the inlet geometry to accommodate organic debris better and correcting stream diversion potential. These types of corrective measures are gradually being applied to the road network within the MTWAA as time and funding permits.

CHAPTER 4
SYNTHESIS & INTERPRETATION

Introduction

This step of the analysis process is designed to synthesize and interpret information collected in the previous steps across resource areas. Emphasis is placed on understanding ecosystem processes and functions as they relate to the issues and key questions in Chapter 2 and to identify the capability of the system to achieve key management plan objectives.

Erosion Process and Water Quality

Landscape Evolution and Disturbance Regimes

- *How have the distribution or intensity of hillslope processes changed over time in the MTWAA?*

Hillslope processes within the MTWAA have changed over time in response to both natural and human-induced factors. Long-term natural changes affecting the watershed that impact hillslope processes are primarily associated with climatic fluctuations (i.e., glacial/nonglacial cycles). These climatic cycles operate on time scales of hundreds to thousands of years. During glacial periods, climate in the analysis area is cooler and wetter, resulting in a higher rate of mass wasting relative to the current dry, warm interglacial climate. Short-term natural changes in the distribution or intensity of hillslope processes would be anticipated to be relatively minor, resulting from localized storm patterns and bedrock weathering cycles. In general, unstable areas that are prone to dynamic hillslope processes persist for long periods under natural conditions; similarly, relatively stable areas will remain so if left undisturbed. The distribution and intensity of hillslope processes, however, has been significantly affected by human influences.

Human-induced impacts have increased both the distribution and intensity of hillslope processes. The earliest human impacts were associated with Native Californians who utilized burning as a means to improve hunting and foraging opportunities. Early European settlers had a much greater impact on hillslope processes. The most profound impacts associated with "industrial" settlers came from mining (especially hydraulic forms) and timber harvesting. The introduction of roads into previously unentered portions of the MTWAA also disrupted natural drainage conditions and increased the intensity of hillslope processes.

The landslide inventory for the MTWAA suggests that the rate of landsliding has decreased dramatically since 1975. From a high of nearly eight million cubic yards of estimated sediment mobilized by landslides between 1960 and 1975, the volume of mobilized sediment since 1975 (1975 to 1998) has only been just over 300,000 cubic yards. We anticipate that the Standards & Guidelines contained within the

LRMP will aid in minimizing the impacts associated with management of the MTWAA in the future, which should help keep sediment mobilization at reduced levels (barring extreme "natural" events). These guidelines specify that the location and design of roads, landings, and harvest units be completed to avoid triggering or accelerating mass wasting.

- *What effects have natural and human-caused disturbances (including storm/flood events, landslides, wild and prescribed fire, logging, road construction or maintenance, and mining) had on mass wasting and erosion processes within the analysis area?*

In general, environmental "disturbances," either natural or human-caused, result in increases in the rate of mass wasting and erosion. These disturbances often alter the balance between driving and resisting forces at work in hillslopes, which can affect slope stability, or modify drainage patterns, which increases erosion potential. Natural disturbances that have impacted mass wasting and erosion processes in the MTWAA are primarily associated with large storm events and subsequent floods. Within the time period covered by historic aerial photographs, the single most significant geomorphic event in the area was the 1964 flood. One hundred-plus year storms such as the 1964 event are associated with dramatic geomorphic impacts that may remain evident in the landscape for many years. Not surprisingly, the landslide inventory for this study identified significant increases in the number of landslides and sediment delivery in the photo interval from 1960-1975.

Human-caused disturbances have increased mass wasting and erosion processes in the MTWAA. The most significant human activities relative to mass wasting and erosion have been associated with mining and timber harvest. Mining influences were most profound in the late 19th and early 20th centuries. Of the various types of mining operations documented in the MTWAA, hydraulic mining was associated with the most significant impacts to mass wasting and erosion. Hydraulic mining of raised alluvial terrace deposits near the mainstem watercourses of the analysis area resulted in direct delivery of large quantities of sediment. Timber harvest impacts increased after 1960 as use of heavy equipment and construction of forest roads became prevalent. The harvest of trees affects mass wasting and erosion processes through the reduction of forest canopy and root strength and the loss of evapotranspiration. Forest road construction impacts mass wasting and erosion processes by interrupting or diverting natural drainage patterns, construction of watercourse crossings that frequently fail, and placement of fill on steep or unstable slopes (this was especially prevalent during early road construction).

- *To what degree and where have management activities affected mass wasting and erosion processes?*

Nearly half of the landslides in the MTWAA are believed to be related to management activities. These management activities have the greatest impacts in areas most susceptible to disturbance. These areas include inner gorges, headwall swales, the lower parts of slopes, steeper slopes (especially near watercourses), dormant or ancient landslide deposits, and particular geologic units (in the study area, those are the Galice Formation and Rattlesnake Creek mélange). Management-related impacts were more significant in the past, when heavy equipment was frequently operated within stream channels and on steep, streamside slopes and sidecast road construction was the norm, regardless of slope steepness. The landslide inventory conducted for this study suggests that management-related impacts have decreased since 1975. As described above, we anticipate that Standards & Guidelines contained within the LRMP (to reduce the impacts associated with future management) will minimize future management-induced mass wasting.

Hydrologic Regimes

- *To what extent have flow characteristics of the watersheds been altered, and what effects has this had on key dependent aquatic species?*

Trinity River

Completion of the Trinity River Diversion (TRD) project in 1962 initiated biological, physical, and geomorphic changes in the Trinity River. From 1962 to 1979, Central Valley Project (CVP) diversions delivered nearly 90 percent of the Trinity River annual water yield above Lewiston into the Sacramento River for urban and agricultural use. After 1979, river releases were increased from 110,000 acre-feet (af) to 340,000 af, such that the diversion percentage was reduced to roughly 70 percent (McBain & Trush 1997).

The Trinity River Flow Evaluation found that "disruption of the annual pre-TRD flow regimes with diverse hydrograph components and the loss of coarse sediment supply responsible for creating and sustaining the Trinity River ecosystem, caused substantial habitat degradation. Downstream tributaries partially offset the TRD effects by contributing flow and sediment to the mainstem, but downstream tributaries cannot mitigate the lost snowmelt hydrograph components once generated above Lewiston" (USFWS & Hoopa Valley Tribe 1999).

The primary effects of the changes in hydrology resulting from TRD operations on the key dependent aquatic species within the MTWAA include the degradation of fish habitat by a reduction of gravel necessary for spawning habitat as well as the inability of reduced and less variable flows to flush fine sediments from the existing gravels. In addition, post-TRD flows (as measured at the Hoopa gage) from April through June flows have decreased by 35 to 45 percent from the pre-project levels. Several researchers have found that increased flows result in reduced travels times of smolts (Zedonis & Newcomb 1997). The results of the studies generally indicate that migration rates are positively correlated with river flow. While there are no known studies of investigating the effect of flow levels on the travel rates of natural outmigrating smolts in the Trinity River, it is likely that smolts in the river would respond to changes in flow levels similar to the results reported in the studies cited in Zedonis & Newcomb (1997). Current migration rates would be less than migration rates of pre-TRD operations.

The reduced spring flows may also adversely affect the quantity and quality of edgewater rearing habitat normally utilized by salmonid fry. The reduction in edgewater habitat could force fry into less hospitable faster water or crowd them into what suitable habitat remains.

Tributaries of the Trinity River

A limited amount of streamflow data is available for tributary streams that flow into the mainstem Trinity River. Therefore, it is difficult to develop any inferences or conclusions regarding changes in the hydrologic regime of the tributary watersheds based on an analysis of the flow records. However, timing of flows in the tributary streams most likely have been altered to some extent by increased road densities within the watersheds. Correlative evidence suggests that roads are likely to influence the frequency, timing, and magnitude of disturbance to aquatic habitats (Gucinski et al. 2001). The changes in the hydrologic regime due to roads most likely has contributed to localized increase in channel scour and lateral migration. Less frequent fire in tributary watersheds has reduced or eliminated peak flow responses to the removal of duff, understory vegetation, and overstory vegetation by fire. As a result, the frequency of inputs of coarse sediments and flushing of fine sediments associated with peak flow responses to fires has been reduced in tributary channels.

Water Quality

- *What water quality parameters within the watersheds may be detrimental to native aquatic organisms?*

Water quality of the Trinity River is listed as impaired for sediment throughout its length by California State Water Resources Control Board under Section 303 (d) of the Federal Clean Water Act. With respect to cold freshwater habitat, the beneficial use may be threatened due to conditions either in the water column (e.g., suspended sediment and turbidity) or on the streambed (settleable material), or both. Other water quality parameters of concern that may affect native aquatic organisms include water temperature and dissolved oxygen concentrations.

- *Where are domestic water sources located and how vulnerable are they to sedimentation from natural or human-caused landscape disturbances?*

There are 43 permitted and approximately 25-40 non-permitted domestic water sources within the analysis area (Frey pers. comm. 2002). Most of these water sources have surface or subsurface intakes that are dependent upon surface water quality. The known locations of the permitted water sources are illustrated in Figure 3-10.

Many of the domestic water sources are within or downstream of areas with high to extreme predicted fire behavior. If fires do occur in these areas post-fire ash, sediment and nutrient discharges could have short-term water quality impacts that could make the water unusable for domestic purposes without treatment. In addition, several of these water sources are downstream of active landslide areas that are chronically producing sediment. Sediment concentrations for water sources that are downstream of landslide source areas are most likely elevated and possibly make the water unusable without treatment after significant precipitation events that activate landslide erosion.

The landslide inventory for the MTWAA suggests that the rate of landsliding has decreased dramatically since 1975. From a high of nearly eight million cubic yards of estimated sediment mobilized by landslides between 1960 and 1975, the volume of mobilized sediment since 1975 (1975 to 1998) has only been just over 300,000 cubic yards. In addition, the SRNF has developed and implemented an Access and Travel and Management Plan (ATM) to help determine and guide the road management objectives for Forest Service jurisdictional roads.

The LRMP Standard 1-9 states that BMPs will be implemented for land disturbing activities as means to achieve state water quality objectives. In addition, Standard 1-10 requires the Forest to consider the beneficial uses of water as part of a project level cumulative effects analysis. Continued implementation of the Aquatic Conservation Strategy and the LRMP Standard and Guidelines should result in continued decreases in sediment delivery from project areas.

Effects on Beneficial Uses

- *Where beneficial uses have been impacted, when will they be considered recovered?*

The North Coast Regional Water Quality Control Board has designated the following beneficial uses for the Lower Trinity River Hydrologic Area:

- Municipal and Domestic Water Supply (MUN)
- Agricultural Supply (AGR)
- Groundwater Recharge (GWR)
- Freshwater Replenishment (FRSH)
- Water Contact Recreation (REC-1)
- Non-Contact Water Recreation (REC-2)
- Commercial and Sport Fishing (COMM)
- Warm Freshwater Habitat (WARM)
- Cold Freshwater Habitat (COLD)
- Wildlife Habitat (WILD)
- Migration of Aquatic Organisms (MIGR)
- Spawning Reproduction, and/or Early Development (SPWN)

Section 303(d) of the federal Clean Water Act requires that states develop a list of water bodies that are impaired. Impairment means water quality objectives are not being met or beneficial uses are not being supported. Listing factors include the following:

- Effluent limitations or BMPs are not stringent enough to protect beneficial uses
- Fishing, drinking water or swimming advisory currently in effect
- Beneficial uses are impaired or are expected to be impaired. Impairment determination is based upon evaluation of chemical, physical, or biological integrity

The Lower Trinity River is currently listed as sediment impaired. The determination of sediment impairment is based on non-attainment of water quality objectives and threat to designated beneficial uses. With respect to cold freshwater habitat, the beneficial use may be threatened due to conditions in either the water column (e.g., suspended sediment) or the channel substrate (settleable material), or both. Indicators of channel conditions include channel morphology (e.g., riffle to pool ratios, residual pool depth, V* - a measure of sediment that has filled-in pools, cross-section and thalweg profiles) and substrate conditions (e.g., median particle size). Beneficial use impairment is determined by assessing site specific suspended sediment concentrations, turbidity levels, and/or substrate conditions and comparing the data to threshold levels.

Identification of a specific threshold causing impairment is difficult. Current research supports the assessment of the effects of discrete suspended sediment events. However, the assessment of the effects of multiple events occurring during a storm season is lacking (North Coat Regional Water Quality

Control Board 2001). Because it is difficult to determine a threshold level for impairment, it is also difficult to determine when the beneficial uses have recovered from any impacts.

Impacts to beneficial uses within the MTWAA are primarily associated with the following:

- Chronic sediment sources associated with natural and management induced mass wasting and road related sediment
- Elevated water temperatures and alteration of the migration of anadromous fisheries associated with the modification of the flow regime of the Trinity River by the Trinity River Diversion
- Removal of shade producing riparian vegetation by flood flow scouring and timber harvest

The sediment related beneficial use impacts will be addressed in the sediment Total Maximum Daily Load (TMDL) for Trinity River that will be developed by the North Coast Regional Water Quality Control Board. The TMDL will identify both natural and management related sediment sources and measures to reduce sediment production and delivery to the Trinity River. Once the sediment reduction measures are implemented, sediment-related parameters will be monitored and compared to water quality objectives to determine if the impairment of beneficial uses has been reduced or eliminated.

Stream temperature impacts related to removal of riparian vegetation by flood flow scouring have gradually recovered from the 1964 flood event in the tributaries to the Trinity River because riparian vegetation is sufficient to provide adequate shading. The Trinity River within the MTWAA has not been listed as impaired for stream temperature by the North Coast Regional Water Quality Control Board, although elevated stream temperatures that impact beneficial uses associated with aquatic species occur during the low flow summer period. Periodic stream temperature impacts on the Trinity River will likely occur because of the significant modification of the Trinity River flow regime. Altered anadromous fisheries migration patterns will not recover under the current hydrologic regime.

- *Where within the watersheds have management activities tended to produce adverse effects on beneficial uses (water quality and instream habitat), either directly or indirectly?*

Adverse effects on beneficial uses are primarily associated with management-activity-related mass wasting, surface erosion from road surfaces, removal of riparian vegetation, loss of large woody debris in stream channels, and a decline in the quality of large woody debris in stream channels.

The percentage of annual sediment delivery to streams from mass wasting relative to management influence through the analysis period is shown in Figure 3-6. That graph shows clearly the relative significance of the major contributing management influences, mining and timber harvest, and the steady increase in the relative significance of natural landsliding. Timber harvest road related mass wasting accounts for 9.5 percent of the sediment delivered to streams; county road-related sediment delivery is 1.8 percent; harvest-related sediment delivery is 14.5 percent; Highway 299-related sediment delivery is 2.3 percent; Highway 96-related sediment delivery is 0.6 percent; and mining-related sediment delivery is 13.3 percent.

Sediment delivery was evaluated on a subwatershed basis to identify high and low susceptibility portions of the overall MTWAA (Table 3-6). Between 1944 and 1960, the Hawkins-Sharber and Willow Creek subwatersheds contributed more sediment than the Upper Tributaries subwatershed, despite being smaller. The sediment peak between 1960 and 1975 was fairly evenly distributed among the three subwatersheds. Landslide activity was again highest in the Hawkins-Sharber subwatershed in the 1975-1990 interval, although mass wasting in the MTWAA as a whole was much reduced. Mass wasting was low throughout all subwatersheds between 1990 and 1998. In the Hawkins-Sharber subwatershed mining, harvest, harvest road-related, and harvest-related mass wasting have produced the greatest percentage of sediment delivery to streams (Refer to Table 3-6 for percentages of mass wasting sediment delivery by management influence). In the Upper Tributaries harvest, harvest road-related and harvest-related management activities have produced the majority of the sediment delivered to streams by mass wasting (Table 3-6). In the Willow Creek subwatershed, harvest-related, Highway 299-related, and other road-related landslides have delivered the majority of the sediment produced by mass wasting (Table 3-6).

Surface erosion-related sediment delivery was not quantified in Chapter 3; however, management-related surface erosion effects can be inferred from soil properties. Soils that have a high Erosion Hazard Rating are most likely to deliver sediment to streams after management activities are implemented. The implementation of BMPs, however, should reduce or eliminate sediment delivery for the more frequent storm events. Sediment is periodically delivered where ground cover has not recovered in areas like road cuts, fill slopes, landings, and skid trails. The soils that are most susceptible to producing sediment and adversely effecting beneficial uses are Chaix, Clallam, Madden, Maymen, Goldridge, and Skalan. These soil types are found in the Hawkins-Sharber subwatershed (8,200 acres, 42% of the watershed), the Upper Tributaries (7,088 acres, 23% of the watershed), and the Willow Creek subwatershed (6,609 acres, 24% of the watershed).

Most of the riparian vegetation stream temperature effects produced by the 1964 flood and timber harvest prior to 1975 have been reduced by the growth of deciduous vegetation in riparian areas. Isolated channel openings still exist in the subwatersheds and are more prevalent in the Willow Creek subwatershed, primarily in the mainstem of Willow Creek in the Highway 299 corridor. The deciduous vegetation in riparian areas does contribute large woody debris (LWD) to channels. However, the smaller size and more rapid decay rate of this material results in a lower instream persistence and functionality relative to coniferous LWD. In riparian areas where coniferous regeneration has occurred, the size of the trees is relatively small, limiting instream functionality and increasing the probability that they will be flushed through the system. These effects on LWD function and persistence have reduced the ability of streams to route, sort, and store sediment and create pools and high quality rearing habitat.

Erosion Processes

- *How do the water quality parameters and erosion processes within the watersheds compare to the entire Trinity Basin?*

Water quality within the MTWAA watersheds that are tributaries to the Trinity River compare favorably to the entire Trinity Basin. None of tributary watersheds are listed as impaired for any water quality parameters. In comparison, Stuart Creek, Coffee Creek, and the North Fork Trinity River are listed as impaired for sediment, and the East Fork Trinity River is on a watch list for mercury. Water temperature and dissolved oxygen concentrations in the watersheds are generally within a range that supports salmonid rearing, reproduction, growth, and survival. Summer low flow temperatures occasionally exceed threshold levels for salmonids; however, these higher-than-threshold temperatures most likely occur in watersheds throughout the Trinity Basin during the summer low flow period. Dissolved oxygen concentrations are typical of streams in northwestern California.

A sediment TMDL was completed for the South Fork Trinity River and Hayfork Creek (US EPA 1998), which estimated management-related and non-management sediment delivery from 1944 to 1990 for a 387-mi^2 area. Management-related sources were found to contribute 185 tons/mi^2/yr, and non-management or natural sources contributed 361 tons/mi^2/yr. Using the sediment delivery estimates in Table 3-4 for the period 1944-1998, management-related sources delivered 1,293 tons/mi^2/yr, and non-management-related sources delivered 1,381 tons/mi^2/yr. Based on this analysis, it appears that sediment delivery from both management-related and non-management-related sources and total sediment delivery is higher in the MTWAA relative to the South Fork of the Trinity River.

Soil Productivity and Protection

- *What soil types occur in the analysis area that are especially sensitive to natural or management disturbances (such as wildfire, fuel treatments or logging), and in what locations are special mitigations warranted?*

The areas occupied by soils with high burn damage susceptibility and high erosion hazard ratings are areas at high risk for impacts to long-term soil productivity. The soils with high burn damage susceptibility and high EHR were isolated and acres summed for the subwatersheds in the MTWAA (Table 3-16). Only the Chaix soil family, located in the Hawkins-Sharber subwatershed, has both a high sensitivity to burns and a high EHR.

- *What are the key factors for protection of the various soils in this analysis area when conducting treatments to preserve other ecosystem values (such as fuels reduction)?*

Protection of soil resources in the MTWAA should be addressed on a project basis through the application of the Standards & Guidelines presented in the SRNF LRMP. These guidelines are intended to provide a management approach that will protect soil porosity and soil organic matter. From a project-specific standpoint, potential impacts to soils, including soil loss, are generally considered "significant" during NEPA analysis.

Standards & Guidelines contained within the SRNF LRMP require that soil porosity be maintained to at least 90 percent of its natural condition over at least 85 percent of a timber harvest unit. This is important because significant reduction in soil porosity can increase the potential for soil loss through surface erosion. Most soil compaction in a forested setting such as the MTWAA occurs through the use of heavy equipment and as such is focused on unsurfaced roads and skid trails. Per the Standards & Guidelines in the LRMP, tractor skid trails must be limited to 15 percent of the harvest area, and the potential for soil compaction must be mitigated. Restricting use of heavy equipment to the dry season may also significantly reduce soil compaction.

Soil organic matter is a critical component of soil productivity. To protect soil productivity, the LRMP contains guidelines that soil organic matter in the upper 12 inches of soil should be at least 85 percent of the total soil organic matter found under undisturbed conditions for the same or similar soils. The R5 Soils Handbook states that soil quality standards will be used to guide the type of management practices and to define necessary modifications to meet threshold values for the affected soil properties.

The soil organic matter standard is implemented during the development of project alternatives and by specifying design criteria and mitigation measures. The R5 Soils Handbook described several options for meeting soil quality standards, including emphasis on pile burning rather than broadcast burning and a lop-and-scatter prescription for especially sensitive soils to augment natural soil cover and gradually replace organic material. Risks and tradeoffs between prescribed surface organic matter standards, the potential for future wildfire, and the need to protect and rehabilitate existing damaged soils should be important factors in any project design.

Regardless of soil type, the potential to damage soil organic matter during fuels reduction treatments can be minimized by modifying the timing of burning as long as the burn prescription and management objectives of the burn are still met. Burning post-treatment or natural fuels during wet weather conditions (when soils are wet or moist to a depth of 4 inches) to prevent excessive soil heating can significantly reduce the loss of organic material. Experience in the SRNF with fall and spring burning under these conditions has shown that the surface duff layer is protected. Therefore, organic matter in the upper 12 inches underlying the duff layer will also be protected, and the standard will be met or exceeded.

Soils damaged during high temperature wildfires may require special treatment. These soils may lose significant organics from the surface O horizon (duff and litter layer) and sometimes from the underlying A horizon. These soils may need to be avoided altogether, or at a minimum treated with extreme caution, to protect them during future management activities. Proactive treatments (e.g., slash placement, etc.) may also be useful to minimize erosion and loss of damaged soils in wildfire areas.

- *What are the major uncertainties in protecting soil productivity within this Analysis Area while conducting management activities?*
- *How should the relative risks and benefits to long-term soil productivity of actively managing vs. not managing be evaluated when planning or executing projects?*

The type of information that will be needed to protect soil productivity will depend on the type of project being implemented. Typical information will include the texture of the soil and its potential to be compacted, an estimate of both existing and post-project soil cover, risk of damage to long-term productivity from heating damage from wildfires or prescribed fires, and loss of soil due to site characteristics including inherent levels of soil organic material, current and projected fuel loads, and slope. Field observations and analysis of soil properties and estimates of pre and post-management effective ground cover will reduce the uncertainties of how to prevent damage to long-term soil productivity. Modeling of surface erosion using the Revised Universal Soil Loss Equation (RUSLE) or WEPP, using both existing soil conditions and cover conditions and estimated post-project or wildfire soil conditions, would provide an estimate of the magnitude of soil erosion that will result from management activities or wildfires. Modeling results will indicate where management activity prescriptions need to be modified to prevent detrimental changes in soil productivity.

The uncertainty regarding the use of prescribed fire focuses on the likelihood that soil productivity objectives (effective ground cover, organic matter, large woody debris) will be achieved by the prescription. However, this uncertainty is a non-issue if compared to the soil productivity conditions that would result from a hot wildfire that occurs during severe weather conditions. Wildfire impacts on soil productivity would in all cases be higher than experienced under prescribed fire conditions.

Riparian Areas

Riparian Corridors and Stream Channels

- *How have vegetative conditions of riparian areas changed over the past century within the analysis area, and what have been the causes of those changes?*
- *What effects have natural and human-caused disturbances (including logging, mining, fire and fuel treatments) had on riparian areas throughout the analysis area during the past century?*

The vegetation conditions within riparian areas have changed significantly over the past century. Based on review of the 1944 aerial photos, riparian areas along main tributary streams in the MTWAA contained moderate to dense, unentered conifer riparian stands. The mainstem Trinity River riparian zone was either devoid of vegetation or contained scattered willow scrub.

The most dramatic change in riparian canopy and stream channel condition was visible in the 1960 aerial photos of Willow Creek. Although Forest Service land remained largely undisturbed, large scale timber harvesting was occurring on private land that utilized primarily tractor yarding. Much of the yarding was downslope into the creek beds, which were used as skid roads and landing locations. The landings were located in the Willow Creek channel and adjacent terraces, presumably to facilitate truck hauling on the nearby Highway 299. Nearly all of the late successional/old-growth riparian vegetation was removed along Highway 299 where it ran through private land. Channel and riparian disturbance also occurred on private land in Sharber Creek from tractor logging during the interval between the 1944 and 1960 air photos. Willow Creek showed extensive channel widening and landsliding with some riparian vegetation scoured away due to the 1964 flood. The most recent aerial photos (1998) show that much of the coniferous riparian canopy disrupted by floods, road construction, and logging between 1960 and 1975 has been replaced by dense deciduous vegetation.

Large-scale hydraulic mining occurred within the MTWAA primarily near the mouth of the South Fork Trinity River, Clover Flat, and Sugar Bowl. Hydraulic mining washed away entire hillsides, obliterated creeks and drainage patterns, and deposited massive amounts of substrate in stream channels.

See the *Riparian Areas, Vegetation*, and *Heritage Resources* sections of Chapter 3 for more information.

Large Woody Debris Recruitment Within Riparian Areas

- *Given the historic and recent impacts of natural and human-caused disturbances, what is the potential and what are the principal mechanisms for large woody debris recruitment within riparian areas?*

The principal mechanisms for large woody debris recruitment within riparian areas involves transport from upstream areas or trees entering through either natural mortality, bank erosion, landslide movement, wildfire, or windthrow.

Approximately 58 percent of the Interim Riparian Reserves contain barren, shrub, pole, early seral, or mid-seral vegetation stages. These seral stages may not provide much large wood currently except as shallow landslides occur, but they are likely to be primary sources for recruitment several decades in the future. Approximately 50 percent of the trees in the MTWAA are size classes 1, 2 or 3. Large woody debris (LWD) recruited from these relatively small size classes would likely decay at a relatively rapid rate when compared to large diameter logs. In addition, the 1998 aerial photos show that many of these riparian areas currently have a large component of deciduous riparian vegetation (probably alders). By contrast, the 1944 photos show old-growth conifers dominated nearly all riparian areas. These observations suggest that the intermediate-term recruitment potential for LWD has been reduced from recent historic levels. It is likely that areas with relatively low percentages of late mature and old growth in riparian areas have a longstanding deficit in LWD recruitment potential.

See the *Riparian Areas, Vegetation*, and *Heritage Resources* sections of Chapter 3 for more information.

The ACS objectives include to "maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distribution of coarse woody debris sufficient to sustain physical complexity and stability."

The Standards & Guideline TM-1(c) in the Riparian Reserve section of the Record of Decision (ROD) states timber harvesting within Riparian Reserves is prohibited unless silvicultural practices are used to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain ACS objectives.

Restorative treatments may include single tree selection or understory thinning to release the remaining trees and develop late successional stand conditions at a more rapid rate than if left untreated. In addition, removal of deciduous trees along with interplanting of conifers will help restore aquatic and riparian habitat conditions as well as abundance and distribution of species dependent on late successional conditions. Some of these treatments could also be considered within the context of fuels reduction projects in the upslope areas to provide a wider range of benefits. The combination of riparian enhancement and fuels reduction in the same project area is more efficient from a cost, planning, and contract management perspective.

Riparian Area Beneficial Uses

- *What are the principal beneficial uses associated with riparian areas and water bodies within the analysis area, and how functional are riparian areas in meeting those uses?*

The principal beneficial uses associated with riparian areas and water bodies within the MTWAA include shading for water temperature moderation, deposition of organic matter that helps drive primary productivity, contributing LWD that help form or enhance aquatic and terrestrial herp species habitats, stabilization of streambanks, sediment filtration, and providing wildlife corridors. With the exception of shading and perhaps organic inputs, riparian areas within the MTWAA appear to have suffered some loss of functionality from the historic baseline. The ability of the riparian areas to contribute functional LWD has diminished due to the shift from being dominated by late seral conifers to deciduous vegetation. Streambank stability was reduced by historic harvest activities that introduced large amounts of sediment into the system and flood events that widened channels and destabilized the toe of slopes. Sediment filtration has suffered especially along Highway 299, where slides are common. The ability of riparian areas to serve as travel corridors for wildlife species may have been affected to some unknown degree by development within the MTWAA.

In some cases the functionality of riparian areas seems to be slowly improving. Although many active landslides are located in the WAA, their number is significantly lower than that found in the late 1960's and early 1970's. Riparian planting projects have helped stabilize some slopes and reduced sediment inputs in some areas. However, the ability of riparian areas to provide functional LWD remains low. The beneficial uses of water will continue to be affected by the sediment inputs from the Highway 299 right-of-way. See the *Erosion Process and Water Quality, Riparian Areas*, and *Heritage Resources* sections of Chapter 3 for additional information.

As stated above, the ACS objectives include to "maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distribution of coarse woody debris sufficient to sustain physical complexity and stability." The implementation of projects that include riparian planting, riparian silvicultural treatments, and erosion control measures could be used to help attain ACS objectives.

- *What criteria should be used to establish appropriate riparian reserve widths or to guide management adjacent to or within riparian areas, in order to protect and restore beneficial uses?*

The ACS states "Watershed analysis will identify critical hillslope, riparian, and channel processes that must be evaluated in order to delineate Riparian Reserves that assure protection of riparian and aquatic functions. Riparian Reserves are delineated during implementation of site-specific projects based on analysis of the critical hillslope, riparian, and channel processes and features. Although Interim Riparian Reserve boundaries may be adjusted on permanently flowing streams, the prescribed widths are considered to approximate those necessary for attaining ACS objectives. Post-watershed analysis Riparian Reserve boundaries for permanently flowing streams should approximate the boundaries described in these (ACS) standards and guidelines. However, post-watershed analysis Riparian Reserve boundaries for intermittent streams may be different from the existing boundaries. The reason for the difference is the high variability of hydrologic, geomorphic, and ecologic processes in a watershed affecting intermittent streams. At the same time, any analysis of Riparian Reserve widths must also consider the contribution of these reserves to other, including terrestrial, species...The prescribed widths of Riparian Reserves apply to all watersheds until watershed analysis is completed, a site-specific analysis is conducted and described, and the rationale for final Riparian Reserve boundaries is presented through the appropriate NEPA decision-making process."

The ROD specifies that IRRs will exist only until *both* WA and site assessment are completed so that a more appropriate Riparian Reserve can be designed to fit the ecological setting and proposed land management treatment. IRRs can not be modified during the WA because the analysis is not a site-specific implementation project subject to NEPA. In addition, appropriate widths cannot be delineated at a watershed scale because of the large spatial variability and the wide range of possible land treatments. Many crucial conditions and functions can only be broadly generalized or guessed at for areas where on-site observations have not been made. Site-scale information and analysis of proposed actions must be considered in almost any Riparian Reserve design.

The most important factor in determining appropriate management within Riparian Reserves is the deployment of an interdisciplinary team to review the site in the field with the proposed management in mind. The team should be composed of well-qualified people with knowledge appropriate to the issues expected for the area. A reasonable consensus among an ID team in the field is the best practical approach to achieving ecologically and geomorphically appropriate Riparian Reserve design. The appropriateness of a particular design cannot be "proven," and documentation of reasoning is at best an incomplete description of the thought process of the group. Yet it is the deliberations of the ID team that will integrate the necessary considerations, build a picture of sensitivities and risks, and critically evaluate options. The considerations that should go into designing Riparian Reserves are described below.

Typical considerations and management recommendations for designing Riparian Reserves include, but are not limited to, the following:

- Maintenance of connectivity throughout the Riparian Reserves for wildlife corridors, riparian dependent species and aquatic ecosystem health
- Riparian Reserves should be wide enough to maintain low summer surface and ground water temperatures, high water clarity year-round, and a stable streamside microclimate
- Riparian stands should be managed to restore or maintain LWD delivery to stream channels
- Upslope fuels treatment projects should also consider treating riparian areas to decrease the potential for the stream zone to act as a "wick" for introducing fire to other areas of the watershed or as a break in the continuity of a shaded Fuelbreak along a road or ridge
- Sources of large pieces of wood should be retained on such lands if it appears that they are likely to accompany landslide debris into fish-bearing streams

- Streamside slopes should be carefully evaluated for erodibility to determine appropriate setbacks of ground-disturbing activities
- The ground-disturbing operations should not be allowed within inner gorges and some adjoining ground (to be determined on-site)
- The streambed and banks of some channels are controlled or stabilized by a combination of LWD and rocks, roots and bedrock. It is very important to preserve these components
- Streams in weak geologic terrain may require a wider riparian buffer, due to heavier dependence on LWD and root structure for stability, than those in bedrock controlled channels
- Except where travel corridors are desired, protection along intermittent streams may need to focus only on LWD recruitment as well as slope and channel stability to maintain or restore natural or background LWD and sediment delivery rates
- Evaluations of necessary intermittent stream buffers must be made on the ground because the conditions and resource risks vary greatly according to geology, slope, soils, proposed management activity, and other considerations

Riparian Species of Concern

- *What riparian dependant species of concern exist in the MTWAA?*
- *How have the abundance and distribution of riparian species of concern and their habitats changed as a result of natural and human caused disturbances?*

A variety of wildlife and botanical riparian dependent species of concern inhabit the MTWAA. These include bald eagles, willow flycatchers, northwestern pond turtles, southern torrent salamanders, and yellow-legged frogs. One botanical riparian dependent species of concern, bensoniella, occurs just south of the MTWAA. Bensoniella has not been observed within the analysis area, though potential habitat is present in spring and pond areas along Route 1. Comparisons of current and baseline data on the abundance and distribution of populations of riparian dependent species of concern are generally lacking, making the understanding of how populations have changed over time elusive. However, there are some data on bald eagles that show the species abundance and range has been increasing in the last 10 years. This may more likely be due to the cessation of DDT use than improvement in riparian conditions.

The change in riparian conditions from the historical baseline has likely resulted in some species experiencing a decrease in abundance and distribution, while some species may have benefited. For example, southern torrent salamanders are known to be dependent on very high water quality with relatively small amounts of fine sediments and low water temperatures. Land-use that reduced canopy and increased fine sediment deposition in watercourses likely had a detrimental effect on southern torrent salamanders. By contrast, yellow-legged frogs and northwestern pond turtles might have benefited from a more open canopy that helped increase water temperatures and the number of basking sites. See the *Riparian Areas* and *Wildlife* sections of Chapter 3 for more information on the presence of riparian dependent species.

The current abundance and distribution of riparian dependent species of concern, whether it represents an improvement or decline from the baseline condition, is in large part due to the effects of land-use activities. The current condition of the riparian areas, and the species that depend on them, is the result of a departure from that which would have occurred under a natural disturbance regime. The intent of the ACS is to maintain or restore the natural disturbance regime. As specified in the ACS, the Forest Service is required to implement actions to restore conditions.

Restorative actions that may benefit riparian dependent species and be used to attain ACS objectives could include the following:

- Riparian treatments that restore the species composition and structural diversity of plant communities in riparian areas
- Restoration of the shoreline and banks of watercourses
- Restoration of the sediment regime under which aquatic ecosystems evolved
- Restoration of floodplain connectivity which may also re-establish species composition and nutrient cycling while allowing fine sediments to be deposited outside the active channel

Directed projects that do not retard or prevent attainment of ACS objectives are allowed within riparian reserves. Projects within the IRRs may include slope stabilization, riparian planting, silvicultural treatments, fuel treatments, road erosion control, and others.

Cooperative Efforts for Riparian Restoration

- *What cooperative efforts with private landowners and other groups might be used to restore riparian vegetation, reduce erosion and sedimentation while maintaining "fire safe" defensible spaces on the forest/urban interface?*

Approximately 45 percent of the land within the MTWAA is held in private ownership. Therefore, cooperation between the Forest Service and private landowners in the MTWAA is critical for the restoration of riparian vegetation, reduction in sedimentation, and developing defensible zones in the wildland/urban interface.

There does not appear to be guidance in the Forest Plan relating to the development of cooperative relationships with private landowners and other groups specifically with regard to riparian restoration or erosion control. However, the Rural Community Assistance Standards & Guidelines in the LRMP state the Forest Service will assist National Forest dependent communities to develop and implement local action plans; develop natural resource-based enterprises; develop and maintain partnerships with cooperating organizations and agencies; and where appropriate, identify opportunities for non-traditional forest-based programs and activities.

Cooperative relationships could start with development of a Memorandum of Understanding (MOU) between local Community Services Districts, Resource Conservation Districts, California Department of Fish and Game (DFG), California Department of Forestry and Fire Protection (CDF), and the Forest Service that establishes guidelines for coordinated resource management and planning among the signatories. Development of a Coordinated Resource Management Plan then could occur that considers management objectives and options for restoration and fire-safe activities. Action plans then could be implemented to restore riparian function, reduce sedimentation, and create or maintain fire-safe areas in and around communities.

Aquatic Species and Habitat

Historic Fish Distribution and Abundance

- *What were the historic distribution, relative abundance, and habitat conditions of fish known to occupy the analysis area?*

Historically, anadromous fish populations such as chinook, coho, steelhead, lamprey, and to a lesser extent Green sturgeon inhabited the Trinity River. With the exception of the green sturgeon, the tributaries within the MTWAA supported one or more of these species. Species distribution was dependent on access, stream gradient, substrate, and other instream habitat conditions.

Salmonid run sizes prior to the 1900's are difficult to determine. However, native fish populations in the Klamath River Basin sustained themselves in numbers sufficient to provide for lucrative fishing enterprises in the mid-1800's to early 1900's (URS 2000). It was estimated that 141,000 chinook salmon were caught and canned in the Klamath River during 1912 (Snyder 1933). Declining fish populations were noted on the Trinity River as early as 1890. It appeared from this article that in-river commercial fishing contributed to a decline in salmonid population. In addition, mining sedimentation was also linked to decreasing fish populations. Snyder (1931) also reported that by 1931 the spring run of chinook salmon was so depleted as to be scarcely evident, and catches of silvers and fall chinook could only be maintained with greatly increased fishing effort.

Prior to the arrival of European settlers and miners in the Trinity River Basin and MTWAA, aquatic habitat conditions and fish populations evolved almost entirely in response to natural events such as forest fires, landslides, floods, and drought. These episodes were of a periodic nature and varied in intensity across the landscape. These events introduced variability in habitat types and conditions that healthy fish populations depended upon. A review of the 1942-1944 aerial photographs show a healthy riparian zone that likely influenced aquatic habitats through shading to moderate water temperatures and introduction of LWD that helped store sediment, provide cover, and form pools.

With the arrival of European miners and settlers came an accelerated level of disturbance that was more of a chronic rather than periodic nature. These new disturbances, including road construction, mining (placer, hydraulic, gravel), timber harvesting, water diversions, land clearing, and residential development, overlaid those already present from natural events. As development and resource extraction increased and persisted, the ability of the watershed and aquatic habitats to recover from impacts decreased.

At-Risk Species

- *Which fish species have been identified as being at risk, and what are their current trends?*

Coho salmon, spring-run chinook, summer-run steelhead, and green sturgeon appear to be the species most at risk within the MTWAA. The long term trend of coho salmon, spring-run chinook, and summer-run steelhead has been downward, especially within native populations. However, the number of spring chinook captured at the Willow Creek weir has increased since the mid-1990's. There is very little information on the population status of green sturgeon. NMFS added green sturgeon to the agency's list of candidate species and will reevaluate their status in five years, provided sufficient new information becomes available indicating that a status review update is warranted. Anadromous and non-anadromous lamprey (*Lampetra spp.*) species have been petitioned for listing as of January 23, 2003. Species included in this listing are known or suspected to occur within the WAA.

- *Which subwatersheds in the Analysis Area are critical for the maintenance, protection and restoration of at-risk species?*

In addition to the Mainstem Trinity River, it appears that there are only two subwatersheds that are critical for the maintenance, protection, and restoration of at-risk species. These watersheds are Willow Creek and Sharber Creek. These watersheds were selected due to the amount of anadromous habitat and fish utilization within them. Willow Creek has approximately 14 miles of anadromous habitat and produces a significant number of juvenile chinook and steelhead. Sharber Creek has only 1.2 miles of anadromous habitat, but it contains the largest spawning population of coho salmon in the MTWAA. However, all the smaller tributaries that flow into the Trinity River, whether they are fish-bearing or not, provide critical cool water refugia areas around their mouths. Fish utilize these cool water plumes to escape from high mainstem water temperatures during the summer months.

Causes of Change Between Historic and Current Conditions

- *What have been the natural and human causes of change between the historic distribution and abundance of at-risk species and their current distribution and abundance in the analysis area?*

The distribution of at-risk fish species within the MTWAA has changed to some degree as a result of land-use activities. The reduction in instream habitat quality within the last 50 to 60 years likely reduced the distribution of coho salmon in lower Willow Creek. The installation of the stream crossing on Hawkins Creek limited distribution of anadromous salmonids to the lower 600 feet of stream. Other than these two incidences, it appears that at-risk species currently inhabit their historic range within the MTWAA. However, the withdrawal of water from tributary streams may have some unknown level of impact on the location and utilization of cool water refugia.

Despite hatchery programs, habitat restoration efforts, and increasingly restrictive fishing regulations, salmon and steelhead populations have suffered a general decline in the last few decades. The causes of fish declines in the Trinity Basin are complex and probably interactive. The decline of these fish species can be attributed to a variety of factors including dam construction, intensive timber harvest, road construction, mining, and stream habitat alterations. Other important but often overlooked factors include climatic change, large flood events, droughts, El Niño, fires, changes in water quality and temperature, reduced genetic integrity from hatchery production, predation, disease and poaching.

Opportunities exist to improve the distribution and abundance of at-risk species in the MTWAA. Continuing ongoing and developing new cooperative relationships with private landowners and State agencies may lead to identification and implementation of new riparian and instream restoration projects. Attainment of the ACS objectives by continuing upslope erosion control treatments and development of new riparian restoration projects on Forest Service land should improve species abundance.

See the Erosion Process, Aquatic Species and Habitat, Riparian Areas, Heritage Resources, Timber Production, and Transportation System sections in Chapter 3 for more information.

Factors Influencing Essential Fish Habitat

- *What physical and environmental factors have the most influence on the quality and distribution of essential fish habitat for species at-risk?*

Some of the most significant factors affecting the quality and distribution of Essential Fish Habitat (EFH) within the MTWAA involve land-uses such as logging, road construction, the Trinity River Diversion (TRD), mining, and natural events such as the 1955 and 1964 floods and natural landsliding. These activities and events have also significantly altered riparian areas throughout the MTWAA, which also affects instream habitat. The physical factors that appeared to have the most influence on aquatic habitat were the increase in soil disturbance, sediment delivery, and reduction in riparian condition. The increase in soil disturbance from skid and haul road construction that occurred in stream channels during pre-1970's timber harvesting severely impacted fish habitat. The 1955 and 1964 floods occurring during this period resulted in the delivery of massive amounts of sediment from disturbed landscapes and a smaller amount from undisturbed slopes. This sediment filled in pools, widened channels, and resulted in the further destabilization of the toes of slopes. In addition, these early timber harvesting activities and construction of Highway 299 removed much of the riparian canopy along streams located on private land. Stream zones on Forest Service land were also subject to harvesting, but riparian retention measures were instituted that limited impacts to aquatic habitat. The removal of conifers in the riparian zone reduced LWD loading in the streams. The reduction in LWD reduced the ability of the channel to store and route sediment and create pools, thereby simplifying aquatic habitats.

See the *Erosion Process, Aquatic Species and Habitat, and Riparian Areas* sections in Chapter 3 for more information.

- *What enhancement projects or changes in management would benefit anadromous fish and other aquatic species in this watershed?*

Enhancement projects that have been utilized within the MTWAA to improve anadromous fish habitat have generally included installation of LWD or boulder structures in streams, vegetation planting on unstable slopes, and road maintenance or erosion control. Instream structure projects are generally considered short-term fixes that must be accompanied by riparian and upslope restoration to achieve long-term watershed restoration. The revegetation of unstable slopes and road erosion control projects are a significant part of a long-term restoration program. However, restoration activities should also occur within riparian reserves to improve LWD recruitment to streams. Restoration activities within reserves that increase LWD recruitment can produce many benefits. Increased instream LWD loading can function to help restore sinuosity and create access to floodplains, improve sediment storage, slow water velocity to allow juveniles to remain in rearing habitats longer, create backwaters for rearing and nutrient cycling, and improve macro-invertebrate production.

The Aquatic Conservation Strategy (ACS) objectives include to "maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distribution of coarse woody debris sufficient to sustain physical complexity and stability."

The Standards & Guideline TM-1(c) in the Riparian Reserve section of the ROD states timber harvesting within Riparian Reserves is prohibited unless silvicultural practices are used to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain ACS objectives.

Restorative treatments could include single tree or understory thinning to release the remaining trees and develop late successional stand conditions at a more rapid rate than if left untreated. In addition, removal of deciduous trees, along with interplanting of conifers, will help restore aquatic and riparian habitat conditions. However, it may be necessary to continue to construct instream structures until such time riparian reserves are properly functioning. Some of these treatments could also be considered within the context of fuels reduction projects in the upslope areas to provide a wider range of benefits. The combination of riparian enhancement and fuels reduction in the same project area is more efficient from a cost, planning, and contract management perspective.

Influence of Exotic and Hatchery Fish

- *How have exotic and hatchery-raised fish affected native fish populations in this part of the Trinity River?*

Exotic fish may be a factor that continues to affect native fish populations; however, the degree of impact is unknown. Although there is no quantitative answer regarding the degree to which hatchery-raised fish have affected native populations, evidence suggests that some level of impact is occurring. Straying and natural spawning by large numbers of hatchery fish result in competition with wild populations for suitable territory and mates. Hatchery reared fish may also affect native populations through the introduction of disease. In addition, the cross breeding of hatchery and wild fish reduces the genetic integrity of wild populations, which can lead to loss of fitness in local populations and loss of diversity among populations (Weitkamp 1995). Even if they are unlikely to survive to breed, large numbers of juvenile prodigy of hatchery fish compete with wild juveniles for food and space and may adversely affect survival of the natural populations.

Vegetation

Trends in Seral Stage Distribution and Forest Stand Structure

Comparing the historic vegetation conditions to the current vegetation conditions allows for the identification of trends in seral stage distribution and forest stand structure. Timber harvesting has had a significant influence on seral stage distribution in the watershed. Timber harvesting operations that were designed to harvest mature timber stands and regenerate a new timber stand led to a decrease in late seral and old-growth stands and an increase in shrub/forb and pole seral stage stands. Approximately 8,967 acres have been harvested and regenerated in the watershed over the past 70 years. Approximately 2,857 acres of the harvested areas are currently classified as shrub/forb seral stage and 6,110 of the harvested acres are classified as the pole seral stage.

Fire has historically had an important role in developing and maintaining the seral stage distribution and stand structure of the forest vegetation. Wide ranging, stand-replacing fires following long periods of drought may have been responsible for the establishment of the even-aged early and mid mature conifer stands that are currently present in the watershed. Forty percent of the tanoak series, 90 percent of the Douglas-fir series, and 50 percent of the white fir series in the watershed are early to mid seral stages. Fire has been largely excluded from these stands since their origin, promoting the development of a dense, uniform, even-aged forest with heavy fuel loading from the forest floor into the forest canopy. Under the mixed severity, short interval fire regime that existed prior to the current fire suppression practices, these stands may have developed into a more diverse forest.

The majority of recent fires in the watershed have not been stand-replacing events. Fire history studies in the region indicate that the watershed falls within a mixed severity, short interval fire regime where fires would burn through stands frequently. Return intervals were approximately 15 to 20 years for the tanoak and Douglas-fir vegetation series that occupy the majority of the watershed. Fire intensities were mostly low to moderate with patches of high intensity, stand-replacing fire. The effect of this type of fire regime on forest vegetation would generally be to promote the development and maintenance of a complex forest characterized by a mosaic of stand densities and discontinuous fuel profile from the forest floor into and across the canopy. Successful fire suppression efforts have generally excluded fire from the majority of the watershed for the past 50 years. Fire exclusion has promoted an increase in stand densities with heavy fuel loading from the forest floor into the forest canopy.

The Forest LRMP provides overall vegetation management direction for the Forest and the Central Zone. It describes the desired vegetation conditions for vegetation types and seral stages in the RMRs (recommended management ranges). The Forest-wide LSR Assessment (LSRA) provides management recommendations for LSRs. The LSRA emphasizes the maintenance and promotion of late seral conditions to the maximum amount sustainable over time. According to the USFS LSRA (1999a), "It is expected that the acreage of each LSR in the mid-mature, late mature, and old-growth seral stages will be at the upper end, or even exceed, its relative contribution to the RMRs for the Zone in which the LSR is located…"

When vegetation is outside the RMRs for a specific vegetation series and seral stage in any Zone, the LRMP directs that all vegetation management activities should be aimed at returning vegetation within the RMR for the Zone. The LSRA directs that management activities promote or maintain late seral vegetation.

Recommended Management Ranges (RMRs)

RMRs are management guidelines developed as an extension of the Historic Range of Variability (HRV) analysis. The HRV represents a wide range of seral stage conditions, including infrequent, high intensity catastrophic events at the extremes of the range. Such catastrophic events are unpredictable and beyond the control of the Forest; however, it is anticipated that they will occur in the future. Based on this, the Forest endeavors to maintain the HRV by establishing the RMRs, which are a restricted range of variability that can be used to establish "sideboards" for management activities. The RMRs represent the range of seral stages that the Forest can manage within while maintaining ecosystem process and function. The criteria used to develop RMRs included the following:

1. Recent climate conditions are relatively moist when compared to historical conditions. Based on the moist climate and current disturbance regimes, there is an increased capability to maintain more acres in late seral stages and fewer acres in early seral stages.
2. The RMR should provide a buffer against unpredictable large-scale stand-replacing events.
3. The current management emphasis is to maintain habitat for late-successional forest related species.

- *Using the year 2000 revised seral stage distribution, what management opportunities exist within the watershed to bring the existing conditions more in line with the recommended management ranges (RMRs) for the Central Zone?*

Table 4-1 shows the RMR for tanoak, Douglas-fir, and white fir series in the MTWAA. Refer to table 4-5 for the RMRs for the central zone. These tables can help to guide management by indicating where the Forest is under the minimum, over the maximum, or within the RMR. In the MTWAA, the late mature and old-growth seral stages for all three of the vegetation series are below the minimum RMR and are indicated with a negative number. On the other hand, early and mid-mature stands in the MTWAA are all over the RMR and are indicated with a positive number.

Table 4-1. Recommended Management Ranges for the seral stages in the Tanoak, Douglas-fir, and White fir series in the MTWAA.

	RMR Min Acres	RMR Max Acres	MTWAA Current Acres	Acres Over / Under (+/-) Min	Acres Over Max
Tanoak (27,366 acres total)					
early mature	**3010**	**3831**	**4141**	**+1131**	**310**
(percent)	11	14	15		
mid-mature	**3284**	**4652**	**6940**	**+3656**	**2288**
(percent)	12	17	25		
late mature	**3831**	**5200**	**3699**	**-132**	**0**

	RMR Min Acres	RMR Max Acres	MTWAA Current Acres	Acres Over / Under (+/-) Min	Acres Over Max
(percent)	14	19	14		
old-growth	**9852**	**13683**	**4407**	**-5445**	**0**
(percent)	36	50	16		
Douglas-fir (7,295 acres total)					
early mature	**948**	**1313**	**3601**	**+2653**	**2288**
(percent)	13	18	49		
mid-mature	**875**	**1459**	**2991**	**+2043**	**1532**
(percent)	12	20	41		
late mature	**875**	**1021**	**235**	**-640**	**0**
(percent)	12	14	3		
old-growth	**2043**	**2480**	**299**	**-1744**	**0**
(percent)	28	34	4		
White fir (1,646 acres total)					
early mature	**247**	**313**	**403**	**+156**	**90**
(percent)	15	19	24		
mid-mature	**230**	**296**	**427**	**+197**	**131**
(percent)	14	18	26		
late mature	**198**	**263**	**98**	**-100**	**0**
(percent)	12	16	6		
old-growth	**576**	**658**	**175**	**-483**	**0**
(percent)	35	40	11		

There are two primary management opportunities for the Forest to bring the existing conditions more in line with the RMRs for the Central Zone.

- Protect late mature and old growth stands from catastrophic loss.
- Retain and promote the development of late mature seral characteristics including snags, logs on the forest floor, large trees, and canopy gaps that enable establishment of multiple tree layers and diverse species composition in early and mid mature stands.

Approximately 75 percent of late mature and old-growth indicated in Table 4-1 has a high to extreme fire hazard rating. Catastrophic loss of late mature and old-growth stands due to wildfire is a significant concern that can be addressed through management activities including silvicultural treatments, fuel reduction treatments, application of prescribe fire, and creation of shaded fuel breaks within and adjacent to the stands. These opportunities are discussed in detail in the *Fire* section of this chapter.

Table 4-1 indicates that there are approximately 2,598 acres of early and mid mature seral stage vegetation over the maximum RMR acres for the Tanoak series, 3,820 acres for the Douglas-fir series, and 221 acres for the White fir series. These acres may be available for management that would promote the development of late seral characteristics. Management opportunities to retain and promote the development of late mature seral characteristics include activities such as non-commercial vegetation treatments (fuels treatment including biomass removal or precommercial thinning), commercial thinning, or other commercial timber harvest. Vegetation treatments that integrate the retention and development of late seral characteristics with fuels treatments are addressed below. Refer to the *Timber* section for an estimate of the General Forest (matrix) acres available for timber production.

- *Are there opportunities for vegetation management that would increase resilience to catastrophic disturbance such as fire?*

A combination of silvicultural and fuel reduction treatments that alter vertical and horizontal stand structure of forest stands has the potential to promote the development of late seral characteristics. In addition to promoting the development of late seral characteristics through diversification of stand structure, such treatments have the potential to increase stand survivability of a wildfire through fire hazard reduction. Small gaps or patches created by tree removal will reduce fire hazard and, in many locations, promote regeneration of a new age class of trees and other vegetation, providing both vertical and horizontal diversity. In other stands, density reduction will allow the remaining trees to more fully utilize the site resources to maintain or enhance diameter and height growth. These treatments will retain desired levels of snags and downed wood and not remove large remnant trees (predominants) that were survivors from stand-replacing fires in the late 1800's or early 1900's, which are important stand components for snag recruitment, coarse woody debris, and wildlife habitat.

Additional opportunities for vegetation management to increase resilience to catastrophic disturbance from fire are discussed in the *Fire* section of this chapter. Recommendations to increase resilience to fire are also included in the *Fire* section of chapter 5.

- *What is the potential impact of Port-Orford-cedar root disease (Phytopthora lateralis) and sudden oak death disease (Phytopthora ramorum) on plant community composition and function?*

The potential impacts of this fatal disease on POC communities are immense. POC tend to concentrate in riparian areas, although they are also present in upland areas within the MTWAA. Port Orford-cedar is the primary shade tolerant conifer species found along the streams of the Horse Mountain Botanical Area. It regenerates naturally under its own canopy, providing stream shading and habitat for a variety of wildlife species. In addition, POC is known to have the highest species richness of the primary vegetation series found in Northwest California (Jimerson & Daniel 1994). Due to POC's resistance to decay, its snags and logs are long-lived components of wildlife habitat and also provide in-stream structure as well as organic input to streams containing anadromous fish (Jimerson & Daniel 1994). Once introduced into a drainage, the disease can spread rapidly downstream in the water and kill entire stands of POC.

The understory plants in a plant community are reliant on the specific conditions provided by the presence of the particular overstory species, and are directly impacted by the loss of the POC. Many of the low elevation examples of these communities have already been infested, resulting in replacement of this shade-tolerant species by less shade-tolerant species such as Douglas-fir (*Pseudotsuga menziesii*) and alder (*Alnus* sp.) and a change in the plant species composition of the previously rich, diverse communities.

Sudden oak death (SOD) is currently not known to occur on the Six Rivers National Forest, and it is not known if the pathogen, *Phytophthora ramorum*, is capable of causing disease as far inland as the MTWAA. The nearest confirmed occurrence of SOD is at Redway, California (foliar infection on California bay laurel) in an old-growth redwood grove. SOD tree decline and mortality of both tanoak and canyon live oak across the MTWAA would have a potentially significant effect upon their respective associated plant communities. Both of these trees are a major component of the Forest, and their widespread loss would permanently alter the habitat for all plant and wildlife species within the affected areas.

Fire

The SRNF, including this WA, has a history of extensive, stand-replacing fires following droughts and periods of infrequent, less severe fires during wetter climates. The analysis of fire history data and vegetation patterns indicates that fire has been the defining disturbance agent. Between about 1860 and 1910, high severity, stand-replacing fires burned significant areas of the Forest. These fires followed prolonged droughts, which led to dense accumulations of fuels and contributed to the mainly stand replacing fire severity. Current landscape distribution of vegetation seral stages indicates that most of the stand replacing fire took place in upslope (upper 1/3) positions. These locations are most susceptible to lightning strikes, strong, drying winds, and stand replacing fire.

Recorded fire histories dating back to 1911 show that large wildfires have occurred throughout the Forest, with a decline in burned acres after 1950. The post-war period was also a period of aggressive fire prevention and suppression in combination with a wetter overall climate. The aggressive fire prevention and suppression efforts resulted in significant increases in fuel loadings, vegetation density, and the ladder component across the landscape. These factors have contributed to the increase in the amount of high severity fire that is occurring throughout the Forest and the high fire hazard rating in the MTWAA.

There has been a change in potential fire effects, from low/moderate severity fires to high severity fires, that has placed communities and resources at risk. The need for proactive and integrated management of fire to reach a more natural fire regime is apparent, through fuels management, prescribed burning, and wildland fire use. However, because of the dense accumulation of fuels and vegetation across the landscape, mechanical fuels treatment (which could include commercial removal of merchantable trees, tree thinning, mechanical piling, and/or hand piling) may be necessary prior to fire reintroduction for a large proportion of the watershed. This preburning treatment may prove to be critical in order to avoid damaging the Forest's resources during prescribed burning.

Fire Occurrence

- *What was the pre-European fire regime?*

Fire history studies in the region indicate that the pre-European fire regime falls within a mixed severity, short interval fire regime where fires would burn through stands frequently, about every 15 to 20 years for the tanoak and Douglas-fir vegetation series that occupy most of the watershed. Fire intensities were mostly low to moderate with patches of high intensity stand-replacing fire. Two fire history studies have been conducted on the Six Rivers National Forest. One found mean fire return intervals from 12 to 22 years in Douglas-fir dominated mixed evergreen forests, and another recorded median fire intervals of 27 years in white fir forests in the pre-European (pre-suppression) period. Adams & Sawyer (1980) concluded, "the old-growth stands of Douglas-fir surveyed were all-aged and experienced a number of fires. The all-aged nature of these stands, infrequent scarring of trees and frequency of fires strongly suggests that ground fires were the common mode of burning."

Fire Risk and Hazard

- *What is the trend of the wildfire risk (lightning vs. human-caused)?*

The SRNF fire data indicate that approximately 829 fires have occurred within the MTWAA between 1911 and 2001. The Hoopa data indicate that 403 additional fires have occurred in the portion of the Hoopa reservation within the MTWAA area between 1986 and 1998.

Human activities caused the majority of the recorded fires. The majority of these fires were small fires that burned limited acreage; however, the six largest recorded fires started in the watershed were human caused, burning 1,834 acres. There were two human-caused fires in 1955 that burned a total of 1,152 acres. The majority of the human-caused fires within the MTWAA were located near areas of concentrated human activity such as communities, roads and highways. The largest lightning-caused fire that started in the MTWAA was the Three Creeks Fire that started in 1938 and burned 80 acres in the MTWAA. Lightning fire starts are generally located in more remote locations. Multiple lightning fire starts generally originated from July to October and are generally clustered along ridges. The Megram Fire was a lightning fire that started outside the MTWAA and burned into the MTWAA, resulting in the largest recorded burned area within the MTWAA.

During the recent period of 1997 to 2001, there were 77 fires, with one lightning-caused fire and 76 human caused fires. The breakdown of the human causes is as follows: incendiary (8), campfire (24), children (1), debris burning (16), equipment use (6), smoking (1), and unspecified miscellaneous (20) (Figure 3-18). The majority of the human-caused fires occurred July through October, which tend to be high-use months.

The overall high risk rating since 1950 and high percentage of human caused fires indicate that human-caused risk is a significant concern in the MTWAA. Incendiary and miscellaneous are the recorded causes for 69 percent of the fires from 1980-1996 and 37 percent from 1997-2001. The areas with the highest risk are generally along the Trinity River corridor as well as highways and major rural roads. Increasing recreation activity levels on the SRNF and increasing rural residential development adjacent to SRNF contribute to this risk. The very high risk rating of fire occurrence on the Hoopa Valley Indian Reservation (HVIR) would also be a concern for management on nearby SRNF lands. The more remote areas tend to have lower ignition risk ratings. Given all these factors, the overall MTWAA is expected to continue to experience a high risk rating in the future (i.e., at least one fire per 10 years per thousand acres), with the highest risk in areas that are most accessible to the public.

- *What is the fire hazard and what are the potential effects of wildfires to the communities and resources within the MTWAA?*

Approximately 60 percent of the Forest Service lands in the MTWAA have a high fire hazard rating. This is based on areas that have a high to extreme rating for modeling results both August rates of spread (ROS) and August flame length (FL) (Table 4-2). The assessment of current wildfire hazard included the analysis of projected fire behavior and associated suppression effectiveness. For this hazard assessment, projected fire behavior was modeled in terms of ROS and FL, which are calculated based on inputs fuel models (Anderson 1982), NFDRS slope class, and typical August weather.

Table 4-2. ROS and FL value groupings

Value	ROS (ft/min)	FL (ft)	Suppression Effectiveness
Low	0 - 5	0 - 2	3-person hand crew or engine
Moderate	5.1 - 11	2.1 - 4	5-person hand crew or engine
High	11.1 - 22	4.1 - 6	engines/hand crews/water tender plus aerial attack
Very High	22.1 - 33	6.1 - 8	all above plus tractor/aerial support
Extreme	33.1+	8.1+	beyond initial attack, into extended attack

The communities of Willow Creek, Salyer, Hawkins Bar, Oden Flat, Suzy Q Ranch, Gray Ranch, Hoopa and the HVIR were listed in the Federal Register (August 17, 2001, Vol. 66, No. 160) as communities at high risk from the threat of wildfires. The effect of large, sustained, severe wildfires on these communities and on Forest resources could be severe and long lasting.

The overall high fire risk rating for the MTWAA indicates that a wildfire has a very good chance of occurring throughout the MTWAA. A subwatershed level analysis of fire risk indicates that the watersheds associated with the Trinity River corridor are generally at greater risk of a fire start than the surrounding watersheds. When a fire does occur, the predominant vegetation and topographic conditions present within the watersheds increase risk of a fast moving, high intensity fire. In the absence of an aggressive fuel treatment program, fuels will continue to accumulate with an associated high to extreme fire behavior potential.

High intensity fires generally result in a large portion of the areas burned at a stand replacing severity. These fast moving, high-intensity fires are very hard to contain due to extensive crowning and increased spotting distances. With the increase in extreme fire behavior, fire suppression effectiveness is severely hampered. With increased densities of brush and understory, access for fire fighting forces becomes limited, and line construction rates are reduced. Fire crews may not be able to use direct attack suppression methods. Strategies can change to indirect attack with fire line locations further away from a fire, so there is time to construct and secure fire lines before the fire gets there. Burning from these lines is still difficult because the fuels build-up creates a higher risk that the wildfire can cross the control lines if the fire behavior becomes severe and the control areas are not large enough. This type of indirect attack can greatly increase the size of fires and is not always successful as the fire has more time to increase its momentum.

Large stand-replacing wildfires with high to extreme fire behavior could drastically affect the communities of Willow Creek, Salyer, Hawkins Bar, Hoopa, the HVIR and numerous groups of rural homes. Fast moving, high intensity fires often make it more difficult to get to isolated homes to do structured protection. Even smaller fires, if they are located close to private property or are wind driven, could have severe impacts on populated areas.

High-intensity fires can burn large areas with a mosaic of stand replacing impacts. Widespread stand replacing fires may either destroy or degrade critical habitat to a point where it is no longer suitable to meet desired functions. Uncharacteristically large and intense wildfires followed by severe winter storms can be detrimental to watershed function and water quality. Severe fires can accelerate runoff from the watershed through the combined effects of large-scale vegetation mortality, burning of organic matter in litter and soil, and creation of hydrophobic, impervious soil layers. This is especially true when these wildfires are associated with heavy winter storms, when more water is discharged over a shorter period of time and peak flows may be greater, which contribute to increased flood hazards. Bare soils and increased runoff can result in higher levels of sedimentation, and landslides could become more prevalent, again negatively affecting the local communities.

It must be noted that during periods of extended or extreme drought, fuel treatments may not always be effective. Extreme wind-driven crown fires may still occur in areas that have had some fuel reduction treatments.

Air Quality

- *What are the impacts on air quality and visibility from wildfires compared to prescribed burns within and adjacent to the analysis area?*

As fire has historically been a dominant force in the evolution of the analysis area ecosystems, smoke production from fires is certainly not a new phenomenon. Historically, fire occurred relatively frequently within the MTWAA, sometimes on a very large scale. Many early California explorers commented on the presence of smoke throughout the mountains of California during this same period. As noted in the *Heritage Resources* section of this document (Appendix B), old issues of the *Advocate* reveal that fire was a regular and expected occurrence. Augusts and Septembers meant fires in the forests surrounding Willow Creek. People complained about the "annual supply of smoke," but when it passed with the first rains, life went on (NA 24 Aug. 1889). While smoke from fires has always been a component of the watershed conditions, only relatively recently have environmental concerns required us to consider the impacts of smoke upon air quality. The historical condition therefore is not necessarily the desired condition due to the mandates of the Clean Air Act. The standard to which air quality is measured and regulated is described in the Clean Air Act as amended in 1977 and 1990.

The air quality in this air basin today is generally considered good, which is likely much different than those conditions described by early settlers, a result due in part to the ongoing fire suppression period.

The exception to the generally good air quality is during large wildfires of long duration (e.g., the 1987 wildfire events and the Megram Fire). Smoke levels were so extreme during the Megram Fire that a State and Federal state of emergency were declared for Humboldt, Napa, and Yuba Counties. Except during these extreme events, all Federal standards of air quality are consistently achieved (including those for ozone, carbon monoxide, particulate matter, and nitrogen dioxide). The overall area is considered to be in "attainment" by Federal standards, and it has previously met and currently meets ambient air quality standards.

Both wildfire and prescribed fire emit fine particulates and other pollutants that have the potential to impact public health and impair visibility. In general, 70 percent of particulates from prescribed burning are less than 2.5 microns in diameter (0.30 to 0.07 size class is responsible for scattering light and produce poor visibility); 20 percent are between 2.5 and 10 microns (this size is the larger contributor to public health issues); and 10 percent are greater than 10 microns in diameter (Ward & Hardy 1984). The size distribution of particulates produced from prescribed fire can vary greatly depending on the rate of energy release of the fire. The wide variation in the emission factors is dependent on several opportunities found in prescriptive applications of fire such as ignition methods, size, defined weather variables (e.g., moisture content, wind direction and speed), and ignition timing to enable burning that would have the least impacts on air quality and visibility.

The variation in the emissions produced as a result of wildfire is dependent upon the same elements that prescriptive fire applications can alter through selection rather than random occurrence. Application of prescribed fire allows for planned ignition location, timing, and methods based on known fuel and weather conditions to achieve the desired burn results and minimize impacts on air quality and visibility. Wildfire burning does not allow for control of ignition or other variables in the same way as a prescribed fire; therefore, the effects on air quality are much less predictable. The generally high risk of ignition combined with the widespread high to extreme fire-behavior potential indicates that air quality will continue to be impacted from wildfires.

There has been no site-specific analysis that compares the air quality effects of past wildfires and prescribed fire use within the MTWAA. However, it appears evident that historical air quality and visibility conditions were likely far outside of the current mandated standards as required in the Clean Air Act. Recreational opportunities within the MTWAA include many outdoor activities that could be hindered or devalued due to reduced air quality. To maintain current conditions of "generally good" air quality, considerations of prescribed fire use should be evaluated to balance historical fire occurrence and its positive effects upon ecosystems, with the need to reduce public health hazards and provide a quality experience to Forest users.

Fire Regime

- *Is returning to pre-European fire regimes achievable and sustainable?*

An ecosystem can be called fire dependent if periodic changes in the system, due to fire, are essential to the maintenance of a properly functioning condition. In such systems, fire is a significant environmental factor that initiates and terminates key vegetation successions and regulates the age structure and species composition of a landscape. As described earlier in this document, fire has shaped much of the vegetation seral stage distribution and overall pattern evident in the watershed. Pre-European fire regimes worked to maintain stability in fire adapted forest structures. Low intensity surface fires maintained lower surface fuels loads, lighter crown bulk densities, and discouraged encroachment of non-fire adapted species. The resulting fire behavior was not stand-replacing in nature as is evident today.

Currently, many fires burn outside of the historic regime and will continue to do so without modification of existing vegetation conditions. The existing altered fire regimes are primarily results of fire exclusion in fire-adapted regimes. Recent SRNF wildfires have shown significant portions to be stand-replacing crown fires rather than surface fires. Stuart & Salazar (2000), in a study of the white fir forest type, found that "since the early 1960's, and presumably since fire suppression began, forests with white fir have become denser. Stand density indexes increased for all tree species combined, increased for tolerant tree species, and decreased for intolerant tree species." This same increase in density (especially in shade-tolerant species) was shown by a graduate study comparing Continuous Forest Inventory plots in stands between the 1960's and the 1990's (Talbert 1996). This indicates that changes in stand density are due to the interruption of a frequent low-intensity fire return interval. These studies indicate that substantial portions of the forest may need high levels of restoration treatments, including thinning, before fire can be used to restore historical fire regimes.

To evaluate the pre-European fire regime in context with current burning levels, consider that there are roughly 40,000 vegetated acres of Forest Service lands in the MTWAA where, historically, a mixed severity, short interval fire regime would apply. Assuming an average recurrence interval of about 15 to 20 years for the majority of the vegetation types in the MTWAA, and 40,000 acres to burn, about 2,000 to 2,667 acres/year within the MTWAA would have to burn annually to return to the pre-European fire regime. This equates to approximately 5 to 6 percent of the Forest Service lands within the MTWAA, or about 3 percent of the total MTWAA, burning annually. To put this in perspective of current conditions, from 1911 to 1996, 4,703 acres have burned in the MTWAA, or approximately 55 acres/year (0.0007 % of the MTWAA). Also consider that overall, all of MTWAA has a high risk of ignition start, and when a fire start occurs, 61 percent of the MTWAA is modeled as having a high to extreme fire hazard during typical August weather conditions. In addition, 77 percent of the MTWAA is in condition class that shows a departure from its natural historical fire regime description.

Although it may be physically possible to achieve this level of prescribed burning (2,667 acres/year) over time in this MTWAA, it is not feasible to expect this level of change in the short term. The LRMP indicates that based on a 10-year average, approximately 5,390 acres are projected to be treated for fuels reductions on the SRNF annually: hazard-related (4,000 acres), timber-related (390 acres), and other resources (1,000 acres). (Note: These timber-related acres do not include thinning, either commercial or precommercial.) This relatively small acre value was derived from the reality of intense competition for funding with other more developed fuels programs on other National Forests and the overall complexity of implementing projects on the SRNF (e.g., weather variability, steep slopes, dense vegetation, and limited access).

There are many regulatory, environmental, and social considerations in planning such an undertaking. For example, society may not accept this level of burning on Forest Service lands in the MTWAA due to the impacts on air quality, recreation, access, vegetation mortality, aesthetics, or other potential perceived impacts. Social values associated with the Forest are an important element when considering the feasibility of establishing a pre-European fire regime. It is also important to consider that the MTWAA is about 45 percent private or other non-Forest Service ownership in a complex ownership pattern. Re-establishing the pre-European fire regime may not be feasible in subwatersheds with intermixed ownership patterns.

Returning fire regimes to pre-European conditions would require the re-introduction of fire through prescribed burning as well as vegetation management practices, tree harvesting, and other treatments that would effectively alter the current trends in forest structure development. While the return to historical regimes is a large undertaking that may not be feasible for the MTWAA, the current trend of altered regimes that display stand-replacement fire behavior is unacceptable. Successful fuel management strategies that include prescribed fire must complement suppression protection needs. The current high risk condition of the MTWAA indicates that retuning to a pre-European fire regime would likely require extensive landscape planning and possibly pre-burn vegetation treatments to safely conduct broad scale prescribed burning activities.

Minimizing Risk

- *What efforts can help minimize risk of wildfire, especially the human caused risk?*

Wildfire risk relates to the probability of a fire start occurring in an area over a period of time. Chapter 3 shows that fire risk rating has increased over time in the MTWAA, and that on a watershed-wide basis, risk has been rated as high for every decade starting with 1950. In a subwatershed level analysis, the highest risk areas are shown to exist within the watersheds associated with the Trinity River Corridor. Human-caused fires account for most of the fire risk, and the fire starts tend to occur from July to October. The Incendiary and Miscellaneous categories account for a significant percent of human fire starts.

The overall high fire risk, in combination with high hazard fuel conditions, is a threat to communities. The communities of Willow Creek, Salyer, Hawkins Bar, Oden Flat, Suzy Q Ranch, Gray Ranch, Hoopa and the HVIR are listed in the Federal Register as communities at high risk from the threat of wildfires. Supporting this conclusion is the widespread occurrence of condition class 2 and 3 around Willow Creek, Salyer, Hawkins Bar and the HVIR.

While little can be done with the risk of lightning ignitions, much can be done towards the prevention of human ignition starts. Several strategies could be considered to help minimize risk of wildfire ignition, especially the human-caused risk, and protect key communities from the threat of catastrophic wildfire. The risk of fire starts is an issue that could be directed to prevention efforts within the communities themselves, with a focus primarily on demographics of concern for "Incendiary " and "Misc." ignition causes. Public involvement that crosses agency boundaries and includes urban interface education, cooperative community involvement, planning, and preparedness could be considered. Cross-jurisdictional cooperation in the development of local fire safe councils could be implemented as well as cooperation in efforts to promote local building standards that link home and landscape design with degree of wildfire risk. This would likely include the involvement of citizen groups and homeowner associations and education on the emphasis of reducing fire risk and creating defensible space around homes and communities of concern. The Forest Service should continue to work cooperatively with other agencies and with fire safe councils and other groups to facilitate the acceptance of fuel treatments around communities through education efforts focused on the risks of fire occurrence.

The Forest Service could consider the creation of community defense zones where fuels are modified to increase protection from wildfire entering the communities and to reduce the chance of fire spreading into the wildland from the community. Such zones would also increase the effectiveness of suppression efforts and firefighter safety. Zones could be located to facilitate the best protection considering areas with high fire risk and integrated with natural barriers within, adjacent to, or near communities.

- *What combination of fuel treatments could help to reduce the fire hazard and where are the priority areas?*

This WA has highlighted a number of important elements that should be considered in the development of fuel treatments and priority areas:

- Fire severity is related to topographic position and slope. Upper slopes, ridge tops, and south- and southwest-facing aspects typically have the more severe fire behavior and effects.
- There is a high potential for wildlife habitat loss for key species due to high fuel loads and extensive dense multi-layer canopies.
- There is a potential in the MTWAA for severe fire to continue to threaten northern spotted owl habitat. Also, historical fire regimes that previously held in check the growth of sub-canopy have been altered, allowing increased growth that may have negatively affected some habitat elements required by the species.
- Studies have shown that effective fire suppression efforts have reduced the extent of wildfires and resulted in accumulation of ladder fuel components and denser stands.
- The Willow Creek subwatershed has the highest percentage of area occupied by soils with a predicted high burn damage susceptibility and high to extreme predicted fire behavior.
- A high risk of stand replacement fire exists in a substantial fraction of riparian reserves and poses a significant concern.
- The onset of sudden oak death disease (SOD) could affect the extent and severity of future wildfires, negatively affecting suppression effectiveness and strategies.
- The shaded fuel breaks within the Megram Fire provided an example of effective fuel treatments, including mechanical treatments and understory burning.
- The most complicated and largest wildland/urban interface is the high-density population centers along the Trinity River corridor.

- Treating fuel profiles in their entirety is critical for effective fuels treatments. Crown bulk density and related surface fuel condition are key. Treating single elements of the fuel profile is less effective.

All of the information points to the conclusion that there is a need to change the trend of altered fire regimes in the MTWAA. There are several opportunities to do this through fuels management projects applied independently or cooperatively with harvest practices and through land stewardship programs. The key to the overall fuels strategy should be cohesive and integrated management and planning to accomplish broad objectives rather than focusing on isolated single objectives. Treatment strategies should consider all ecosystem components (Table 4-3).

Table 4-3. Potential fuels treatment strategies in the Mainstem Trinity Watershed Analysis Area.

Proposed Treatment Strategies	Applications
Prescribed Fire	Applied over large areas where opportunities still exist and multiple treatments applied over time can restore fire dependent regimes
Shaded Fuelbreaks	Identify strategic locations where fuelbreak systems can be located to support prescribed fire treatments as well as urban protection. Integrate fuelbreak systems with other features that provide a cohesive strategy throughout the watershed or forest.
Timber Harvest	Use timber harvesting to modify vegetation so that vegetation conditions progress towards the range of conditions that would support natural fire regimes. Look for opportunities to build compatible combinations of surface fuel loads, crown bulk densities, surface to live crown ht., etc., within the fire adapted vegetation types.
Wildland/ Urban Interface Risk Reduction	Provide a wildland/urban interface protection plan that considers cooperative relationships, interagency agreements, and public education on associated community risk. Construct defensible fuel profiles around community zones through active fuels management projects, harvest practices, stewardship agreements, and community involvement.
Natural high hazard fuel area	Fuels treatments should focus on those areas of high concern (Condition Class 2 and 3) within the watershed. Areas of high SOD (if it is found to occur), heavy mortality from past fires, heavy mortality from insect attack, large blow down areas, etc., should be targeted.
Other Strategies	The following types of treatments should be considered as opportunities arise (e.g., funding availability, cooperative projects with private landowners, multi-agency projects, etc.): Mechanical fuel treatment Hand Pile/Burn treatment Preattack Planning Treatments across jurisdictions Stewardship opportunities Plantation protection treatment Treatments for Condition Class I areas to maintain Condition Class I status

Botanical Area

- *What are the distinctive elements of the botanical area and how do these elements compare to the rest of the analysis area?*
- *What are the potential impacts to botanical area values (i.e. plant communities, including Port Orford cedar, rare plants) from past mining?*
- *To what degree are current uses in the area incompatible with botanical area values?*
- *What are the trends for this area related to use, private-public land interface, and botanical area stewardship?*

- *What opportunities exist to curtail resource impacts and increase public enjoyment of the area?*

There is a broad diversity in vegetation and habitat (13 plant associations) within the Horse Mountain Botanical Area (HMBA). This is partially due to topography and the ultramafic origin of its soils and outcrops. It is estimated that nearly one third of the HMBA has potential occurrence of rare plant habitat. A rare plant survey identified five rare plant species within the botanical area: Sonoma manzanita, (*Arctostaphylos canescens* spp. *sonomensis*), evergreen everlasting (*Antennaria suffrutescens*), serpentine arnica (*Arnica cernua*), Tracy's lomatium (*Lomatium tracyi*), and pale yellow stonecrop (*Sedum laxum* var. *flavidum*). The majority of the acreage making up the botanical area is within a Late Seral Reserve (LSR) where the forest vegetation and associated habitats remain similar to those of past reference conditions. However, fire suppression, and specifically the absence of traditional controlled burns by Native Americans, has resulted in a denser understory in some areas and a reduction in density and extent of certain culturally important native plants (e.g., beargrass) (USFS 1998).

A number of manmade physical features are present today that were not a part of the reference conditions within the HMBA. The summit of Horse Mountain is currently occupied by a number of commercial communication towers and outbuildings, which are delimited by chainlink/barbwire fencing. A powerline with cleared vegetation leads directly to the towers from the west. There are unpaved roads leading to, around, and beyond the radio towers. Associated ground disturbance from vehicular traffic has led to considerable erosion. On the upper north slope of Horse Mountain are the remains of an abandoned ski ropetow concession, which is now used by off-road vehicles in the off-winter months. This site and the surrounding area remains a major recreational draw during the winter, and is known as the Horse Mountain snow play area. The vegetation in this dispersed recreation area has been widely disturbed and the land eroded. Another popular winter snow area is the abandoned quarry and appurtenant roads to the south of Horse Mountain summit. Historical quarry operations and modern year-round recreational vehicle traffic have severely damaged the vegetation at this site. To the southeast of the quarry is Horse Mountain Mine, an abandoned copper mine with extensive ground disturbance and tailings piles. Recreational activity in the area continues to be popular, with heavier use by off-road vehicles here than elsewhere in the MTWAA. The quarry and mine area are favorites for target shooting, sightseeing, and dispersed camping. Unsafe conditions exist in association with the deteriorated industrial sites as well as the nature of some of the recreational activities occurring there.

Aside from the roads, communication towers, snow-play area, and abandoned quarry and mine, the remainder of HMBA remains in its natural state. Most of the disturbed sites have become historical and recreational features of the Botanical Area and, ironically, are those which draw the majority of visitors. This continued use of the disturbed sites does not permit natural revegetation and stabilization to occur at the sites. The human-caused physical features of the botanical area create a visual discontinuity with the surrounding terrain and have altered the aesthetic nature of a traditionally important regional spiritual site. In addition, a major component of forest management in the area has historically included fire suppression, which has permitted dense growth of forest understory and brush in some areas. The botanical area continues to support a healthy population of Port Orford-cedar, even though POC root disease continues to spread in the region.

There are many complex reasons for the changes that have occurred to the area since reference conditions were present. The historical mining and quarrying in the area brought significant land disturbance, timber harvesting for local use, installation of residential and industrial structures, and the development of access roads. The presence of State Highway 299, Forest Route 1, and the historic mining and quarrying roads make the area readily accessible by recreationists visiting from the nearby communities within the watershed and from local coastal communities.

Active fire suppression in the HMBA has been on going for over 50 years. However, the natural fire regime, particularly in the brushy and chaparral stands of the botanical area, is thought to be 10 years (USFS 1998). Prescribed fire has been used to reduce flammable fuels near the communication towers site. In general, the HMBA does not have excessive fuel loading (USFS 1998). However, the overall area does have a moderate to high susceptibility to burning damage that is typically associated with steep slopes and shallow soils. This indicates that high-intensity wildfires could result in soils concerns (USFS 1998).

The extensive ground disturbance, which began with historic land works such as mining, quarrying, roads, and installation of a winter recreational site, continues today with dispersed recreational use. This creates heavy ecological pressure on the vegetation and soils of the HMBA, particularly in the Horse Mountain area. There currently are no public facilities, educational postings, or specific parking areas to accommodate the public and minimize its impact within the HMBA.

Noxious Weeds

- *What priority invasive plant species are in the analysis area?*
- *What management activities exacerbate the introduction, spread and ability to manage invasive plant species?*
- *What are the trends for further weed introduction and spread in the analysis area?*

Noxious weeds are present in the area, some as localized populations. The dominance and persistence of noxious weeds displaces native species (flora and fauna) and alters various ecosystem processes. Noxious weeds also reduce property values, the quality of pastureland, and quality of riverside recreation. Potential exists for these species to spread into currently uninfested areas by such vectors as roads and equipment relocation. Opportunities exist to manage localized and leading edge populations.

The noxious weeds currently present in the MTWAA are all known to have been introduced since the mid-1800's. The most widespread species documented are yellow star thistle and Scotch broom (30.5 acres over eight sites and 2.6 acres over five sites, respectively). In addition, there is documentation of occasional small populations of bull thistle, French broom, Klamathweed, and Himalayan blackberry, mostly at disturbed sites throughout the MTWAA.

There are three additional known, but not yet mapped, noxious weed populations in the MTWAA that are of concern. English ivy (*Hedera helix*) occurs in proximity to the town of Willow Creek and other nearby urban centers. Dalmatian toadflax (*Linaria dalmatica*) occurs at the boundary between Shasta-Trinity and Six Rivers National Forests along Highway 299. Dyer's woad (*Isatis tinctoria*) was recently hand pulled along Highway 69 on the Hoopa reservation; however, this population could spread along Highways 96 and 299, and beyond.

Human disturbance of the natural resources within the MTWAA has continued to increase along with the greater numbers of residents and visitors within the area. Also, the nature of disturbance on the forest during historic times is profoundly different from disturbance that occurred during the preceding periods. These changes are especially evident throughout the forest in association with roads and road access, residential commercial and agricultural developments on private land, and fire suppression on both private and public lands within the MTWAA.

Forest Service surveys of weed populations within the MTWAA have thus far focused upon roadside habitat. The worst current weed encroachments of Forest Service lands within the MTWAA that have been documented are along Highway 299 and certain county-maintained roads. The yellow star thistle population along Highway 299 north of Hawkins Bar to south of China Flat has medium-level stand density, with moderate potential to spread. This population has spread from Hwy. 299 south along South Fork Road over one mile. It has also spread from Hwy. 299 east along Friday Ridge Road more than one and a half miles. The cumulative affected acreage of this continuous yellow star thistle population along roadsides totals more than 29 acres and is by far the most extensive noxious weed infestation known on the MTWAA.

Smaller potentially serious noxious weed populations have been identified on the MTWAA. A smaller yellow star thistle population is dispersed at low density along more than two miles of the road from Hawkins Bar northeast to Happy Camp Campground. It is considered to have low potential to spread and currently covers a total of just over half of an acre. Six additional yellow star thistle populations are documented to occur in the eastern portions of the MTWAA, each totaling less than a quarter acre, and ranging from low to medium spread potential. Not yet mapped, but well-known, sites of yellow star thistle occur at river access recreation areas within the MTWAA, where prime habitat can be found. These populations seriously compromise river recreation quality. There is a large dense population of Scotch broom on Waterman Ridge, just northeast of, and extending into, the MTWAA (1.27 acres total). Within less than a mile to the north along Waterman Ridge Road is a second dense Scotch broom population, which covers just over one acre. Both populations are classified as having medium-level spread potential. There are two additional known sites of Scotch broom in the MTWAA that are smaller than a quarter acre that are classified as having medium-level spread potential and one additional having low spread potential. These are all located in the eastern portion of the MTWAA. Further road surveys are planned to identify other noxious weed sites within the area.

The yellow star thistle and Scotch broom weed populations are nearly all associated with roads, and the most extensive populations are along Highway 299 and county-maintained roads within the National Forest. This suggests that either travel and transport or road building and maintenance activities may be involved with weed introduction and establishment. In addition, the open canopy and disturbed nature of roadsides provide a preferred habitat for many weed species, including the most widespread noxious invasives found within the MTWAA. Weed management policy and practices by Caltrans and County road crews are likely having an effect upon weed populations along Highway 299 and the county roads.

Natural ecosystem functions such as floods and subsequent landslides could create large areas of disturbed ground where noxious weeds could become established. Roadside erosion and movement of weed seed along with siltation can allow movement of weed seed downstream along streams and rivers.

Wildfires can create vast areas of disturbed land, and certain weeds prefer such sites that are recently disturbed by fire. The Forest Service has in place a weed prevention policy for fire fighting activities to help minimize weed introduction in burn areas.

The Forest Service implements and enforces pest management through prevention, detection, evaluation, suppression, and monitoring.

- *What invasive plant management opportunities are available and applicable to the analysis area?*

Invasive noxious weeds under suitable conditions can aggressively displace native plants and alter their natural habitat. The continuous trend within the WAA for increasing human activity greatly increases the risk of weed introduction and establishment.

Pest management goals in the LRMP (USFS 1995) are directed toward reducing pest-related losses to levels that maintain a healthy forest environment. The Noxious and Invasive Weeds Program Strategy, Northern Province (Klamath, Mendocino, Six Rivers & Shasta-Trinity National Forests) provides specific weed management guidelines (Coop and Vost 2001). The Forest Service implements and enforces an integrated pest management (IPM) approach to dealing with forest pests, such as prevention, detection, evaluation, suppression, and monitoring. Much of the MTWAA lies within the Weed Management Area for Humboldt County, where there is opportunity for cooperative weed management by federal, state, county, and local government and individuals.

Wildlife Species and Habitat

- *How has the Megram Fire altered conditions for TES and special status species within the watershed?*
- *What possible management practices are needed to facilitate recovery of special status species habitats lost due to the affects of the Megram Fire?*

Historically, wildfire has been a natural and human caused occurrence that has played a significant role in shaping the landscape throughout much of this region. Species native to this area have adapted to a fire regime consisting of frequent low intensity fire and less frequent high intensity fire. Wildfires can be devastating, especially when fuels have been allowed to build and large areas are subjected to high intensity fire. However, fire can also have several positive results including restoring and renewing the environment, perpetuating healthy and diverse plant and animal communities, creating and maintaining a patchwork or mosaic of habitats diverse in its makeup, and providing opportunity for early successional pioneer species of vegetation to quickly grow on affected sites.

The Megram Fire affected approximately 2,017 acres (<3 percent of the MTWAA) along Waterman Ridge and in the headwaters of Hawkins Creek and Cow Creek, all within the eastern and southeastern portion of the MTWAA. Approximately 1,617 acres (80 percent) of the fire burned at low and low-moderate severity, 129 acres (7 percent) burned at moderate and high-moderate severity, and 271 acres or 13 percent burned at high and extreme severity (Table 4-4). The portion of the Megram Fire within the MTWAA burned during the end of the fire and formed the final fire perimeter for this portion of the large fire. The timing of the fire and the fire suppression activities, along the fire perimeter in this area, likely affected the distribution of burn severities noted here.

Table 4-4. Severity and acres burned by the Megram Fire within the Mainstem Trinity Watershed Analysis Area.

Burn Code	Burn Severity	Acres	Percent
1	Low severity: <25% veg. cover killed	1,094	54
2	Low-moderate severity: 25-40% veg. cover killed	523	26
2a	Moderate severity: 40-60% veg. cover killed	95	5
3	High-moderate severity: 60-70% veg. cover killed	34	2
4a	High severity: >70% veg cover killed	243	12
4b	Extreme severity: >70% veg. cover killed; most vaporized	28	1
Total		**2,017**	**100**

Although the impacts of the fire within the analysis area were relatively small, approximately 109 acres of northern spotted owl (NSO) Nesting/Roosting (N/R) and Foraging (F) habitat were lost in the fire (N/R= 86 acres; F=23 acres). Of the 26 spotted owl activity centers located in the MTWAA, habitat within 1.3 miles of four owl sites (SRNF Nos. 127, 136, 138, and 313) were impacted by the fire, both in the MTWAA and in the adjacent Horse Linto Creek watershed. Spotted owl sites 127 and 138 were the most affected, while impacts to sites 136 and 313 were relatively small.

Impacts of the Megram Fire on Federally Designated Critical Habitat, 100-acre LSRs, and Conservation Areas

No federally designated critical habitat for the marbled murrelet or NSO was affected by the Megram Fire within the MTWAA. This includes LSR 305 and LSR 306; however, the former was largely affected outside the MTWAA (see Horse Linto Creek WA; USFS 2001). The Megram Fire also affected three 100-acre LSRs within the MTWAA.

Designated northern goshawk and bald eagle habitat within the analysis area was also unaffected by the Megram Fire. However, a large portion of the Gray Creek peregrine falcon habitat conservation area was affected, although the fire probably improved habitat conditions by opening up the stand for this open-habitat hunter and improving habitat conditions for some prey species.

Although some suitable habitat was lost, the Megram Fire likely improved overall habitat conditions for spotted owls, goshawks, American martens, Pacific fishers, and white-headed woodpeckers by opening up the stand and creating snags and small openings. Based on some recently collected data regarding the impacts of fire on spotted owls, Bond et al. (2002) states that "relatively large wildfires that burned nest and roost areas appeared to have little short term effect on survival, site fidelity, mate fidelity, and reproductive success, as rates were similar to estimates independent of fire. While post-fire reproductive success of spotted owls were greater than background rates for these populations, they were well within the range of variation seen in these populations."

As discussed above, species native to this region have adapted to a regular fire regime. Due to the relatively low intensity and small scale of the Megram Fire within the analysis area, many species, including many of those listed as TES, are likely to respond positively to these post fire conditions. On the other hand, fuel loading within the analysis area is high, and fuels created by the Megram Fire continue to or have even increased the risk of a large-scale catastrophic fire that could remove substantial amounts of habitats.

- *What are the types and distribution of habitats and, where known, populations of these wildlife species within the analysis area, and what are the trends for those populations?*
- *What is the current distribution of late seral stage and old-growth habitats within the Watershed?*
- *What possible management practices are needed to maintain and improve habitats for special status species within the watershed?*

There are a variety of habitats found within the analysis area, including various types and seral stages of mixed hardwood/conifer, riparian, California live oak, chaparral, grasslands, and non-vegetated areas (Table 3-27 & Figure 3-14). There are also rocky outcrops, high cliffs along the Trinity River, numerous seeps, springs, and large and small watercourses. These areas provide habitat for a variety of TES, game, and non-game wildlife species.

Based on the information provided by the Forest Service, there are 26 NSO sites containing either pairs or territory singles; one northern goshawk nest site and associated territory; portions of two peregrine falcon territories, including one nest site; and a portion of one bald eagle territory. Other species known to occur in the analysis area include the Pacific fisher, American marten, northwestern pond turtle, southern torrent salamander, willow flycatchers, and several species of S&M mollusks. No marbled murrelets are known to occur in the MTWAA.

Due to the lack of population studies from within the analysis area, population trends cannot be determined for these species, although some inferences can be made based on available information, including regional trends of some state listed species (see CDFG 2002a). There are no historic accounts of marbled murrelets or bald eagles nesting in the MTWAA, although the latter are occasionally observed along the Trinity River. According to Franklin et al. (2002), spotted owl populations in the Willow Creek study area are not different from a stationary population (λ=1).

According to CDFG (2002b), peregrine falcon populations are increasing regionally; however, there is insufficient information to determine trends within the MTWAA. Although the birds at the Gray Creek site have not been observed at their historic nest site since 1996, incidental sightings suggest that falcons could be nesting elsewhere in the vicinity. Goshawks have not been observed in the MTWAA since 1987; however, survey efforts have been limited. According to Jennings and Hayes (1994), pond turtles are in serious trouble in the Klamath River drainage. The lack of reported turtle observations from within the analysis area also suggests low numbers. Pacific fishers, American martens, willow flycatchers, southern torrent salamanders, and foothill yellow-legged frogs are known to occur in the MTWAA, although their population status and trends are unknown. Few surveys have been conducted within the analysis area for S&M mollusks and bats.

Approximately 94 percent (39,348 acres) of the MTWAA is comprised of the following vegetation series: Tanoak, Douglas-fir, White fir, Jeffery pine, and Canyon live oak (Table 3-30). Old-growth and late mature habitats make up approximately 24 percent (9,553 acres) of the habitats within the MTWAA (Table 3-29). This is 8,544 acres below the Recommended Management Range (RMR) for old-growth and late mature seral stages within the Tanoak, Douglas-fir, and White Fir series (Table 4-1 above). Tanoak represents approximately 80 percent (8,106 acres) of the old-growth and late mature habitats found within the watershed. For more information regarding vegetation, please refer to the *Vegetation* section of chapters 3 and 4.

Old-growth and late seral habitats are widely distributed throughout the watershed, with the greatest concentrations found in the southwestern and southeastern portions of the MTWAA. The largest and most continuous stands are located in LSR 306 and in the Quinby Creek drainage. Smaller, less continuous patches are located in the Hawkins Creek drainage, south of Highway 299 east of Salyer, and widely scattered north of the town of Willow Creek along Highway 96 and east to Waterman Ridge. Conversely, old-growth and late seral habitats are under-represented in the MTWAA north of Highway 299 and west of Highway 96 and southwest and southeast of the town of Willow Creek to Salyer (Figure 3-15).

- *What is the relationship of LSR 306 to other adjacent LSRs, and what actions are needed, if any, to improve habitat conditions and connectivity for late-seral stage dependent species? What is the habitat and population status of the northern spotted owl within LSR 306?*

According to the Standards & Guidelines (ROD), LSRs are to be managed to protect and enhance old-growth forest conditions. Standards and guidelines for the matrix are designed to provide for important ecological functions such as dispersal of organisms, habitat connectivity between LSRs, carry-over of some species from one to the next, and maintenance of ecologically valuable structural components such as downed logs, snags, and large trees. The matrix will also add ecological diversity by providing early-successional habitats. The Northwest Forest Plan ROD provides a standard and guideline (pp. C-10-11) to preserve the intensively used portion of a breeding owl's home range for spotted owl activity centers located on federal lands within the matrix. Management around and through 100-acre LSRs will be designed to reduce risks of natural disturbances that could eliminate the suitable nesting, roosting, and foraging habitat.

LSR 306 is continuous with LSR 810, which consists of significant stands of late seral and old-growth habitats within Marbled Murrelet Zone 1, the wild river corridor along the South Fork Trinity River, and administratively withdrawn lands for other T&E species, including the peregrine falcon (USFS 1999a).

LSR 306 and 810 are discussed as one in the Forest Wide LSR Assessment; therefore, this assessment includes LSR 810. LSR 306 and 810 total 48,600 acres, of which 43,100 (89 percent) are capable of supporting late-seral habitat; 41,600 acres (86 percent) are capable of supporting spotted owl habitat, of which 30,500 (73 percent) were classified as suitable spotted owl habitat.

Approximately 9,566 acres (20 percent) of LSR 306 overlap the MTWAA. Of this, approximately 5,124 acres (54 percent) are classified as spotted owl nesting/roosting (3,725 acres; 73 percent) and foraging habitat (1,400 acres; 27 percent). Therefore, it appears that spotted owl habitat is under-represented in this portion of the LSR, although the number of acres capable of supporting spotted owl habitat is unknown.

There are 36 activity centers located in LSR 306, six of which are in the analysis area, and seven in LSR 810 (USFS 1999a). The Draft Recovery Plan for the spotted owl predicted that LSR 306 (as DCA CD-50 and at 38,000 acres) would support 28 Current Projected Federal Pairs and 25 Future Projected pairs (Table 3.23 in Recovery Plan, USFS 1999a).

Socio-Economic

- *What does this watershed contribute to the economies of local communities? What management practices can assist in sustaining or improving the economies?*

The communities in the MTWAA, including Willow Creek, Salyer, Hawkins Bar, and Hoopa Valley Indian Reservation (HVIR), have long relied on MTWAA resources for employment opportunities and income. Over time, major resource use has shifted from gold mining to timber production and recreation. In addition, gravel extraction from the Trinity River and the associated asphalt production facility continues to contribute to the local economy. As timber production declined over the past 30 years, recreation opportunities provided by the MTWAA, such as fishing, rafting, swimming, hiking, camping, and hunting, have become increasingly important to the local economy, attracting visitors to the area who spend at local businesses that provide goods and services to visitors.

For the local population, the MTWAA also is a source for special forest products (SFP) gathered for subsistence, ceremonial, medicinal, and commercial purposes. The availability of SFP is particularly important to tribal communities. Although timber production has declined over time, timber harvesting is the single most critical aspect of resource management on the HVIR and provides employment opportunities for local non-tribal residents. Additionally, small produce farms, orchards, and vineyards have operated off and on in the MTWAA for many years. In the Hoopa Valley, agricultural uses include cattle operations, a pilot wine grape vineyard, feed crops, and subsistence gardening and orchards. To some extent, management of MTWAA resources has generated economic activity in local communities through expenditures on aquatic and riparian restoration efforts, erosion control projects, and fuels management activities.

Trends indicate that demands on MTWAA resources will increase in the future. As local, regional, and statewide populations increase, the demand for recreational opportunities in the MTWAA, including greater access to the Trinity River, improved trail opportunities and access, and increased campground capacity, will also grow. Maintaining and improving access to private properties will also become increasingly important as private property owners seek to construct primary homes and vacation homes. Similarly, the demand for SFP in the MTWAA will grow as the local population increases. Additionally, the domestic and international demand for timber products will continue to increase, creating more demand to harvest trees in the MTWAA. The need for road base and asphalt will continue to increase as more infrastructure is constructed to handle the population increase.

Conversely, several trends indicate that the MTWAA, under current conditions and policies, may have difficulty meeting future demands for resources and resource usage. For example, since the 1960's there has been a decrease in the number of river access points provided by the Forest Service in the MTWAA, and the number of camping and boat launching sites has been reduced as well. Additional river access points, campgrounds, and trails will be needed to satisfy projected demands for river-dependent and land-dependent activities. Similarly, the long-term trend of coho salmon, spring-run chinook, and summer-run steelhead has been downward, especially within native populations, although the number of spring chinook captured at the Willow Creek weir has been on an increase since the mid-1990's. Although the Willow Creek weir counts are currently the best available population data, they are more indicative of the success of the hatchery program than of the ability of the watershed to naturally produce salmonids.

Future timber harvests from the MTWAA are likely to be limited to 1.1 MMBF of green sales in addition to small harvests related to salvage, thinning, and fuel treatments. This harvest level would be similar to recent levels. The ability of the MTWAA to meet the future demand for SFP may also be limited because current demand for certain SFP exceeds limits set by the Forest Service. (For more information on these trends, see the *Aquatic Species and Habitat, Timber Production, Special Forest Products,* and *Recreation* sections of this chapter.)

The Standards & Guideline TM-1(c) in the Rural Community Assistance section of the SRNF Land Use and Resource Management Plan includes several measures designed to integrate MTWAA management activities with local economic assistance and development efforts. In essence, these measures call for the Forest Service to assist with development and implementation of local action plans, seek funding cooperatively with local agencies for implementing rural development opportunities, and develop, where possible, human resource programs that provide employment, training, and education.

- *What are the subsistence activities of plant gathering, hunting, and fishing by local communities? What management practices will be supportive of these activities?*

Historically, the hills and mountains surrounding tribal villages located along or near the Trinity River were visited seasonally to secure both plant and animal resources. These groups were dependent on anadromous fish as a major subsistence resource. As discussed in greater detail in the *Heritage*

Resources section of Chapter 3, Native American populations, including Hupa, Tsnungwe, and Chimariko peoples residing within and near the MTWAA, continue to place great importance on the availability of natural resources for subsistence purposes. Access for gathering traditional plants on MTWAA lands has increased in recent years, with larger numbers of Native persons involved in collecting for traditional purposes. A wide range of plants is collected for food, traditional medicine, ceremonial uses, and craft making. Additionally, hunting provides an important source of subsistence foods and ceremonial food items for many local Indians and non-tribal residents. Protecting and/or enhancing the habitats of these species are important management concerns both on and off the HVIR.

Competition for plants and animals that are important to local subsistence activities will continue to increase in future years as the local and regional population grows and as the demand for commercial uses of subsistence resources increases. As discussed in more detail in the *Special Forest Products* sections of Chapter 3 and this chapter, the commercial collection of SFP already exceeds the limits imposed by the Forest Service. Competition for subsistence resources is likely to increase in the future as demand grows, potentially resulting in conflicts among user groups.

The Forest Service in its SRNF Land Use and Resource Management Plan has developed a set of standards and guidelines to ensure that SFP are collected in a sustainable manner. According to the plan, certain areas are to be reserved for personal and traditional collection and will be off-limits to commercial collection. Refer to the *Special Forest Products* section of this chapter for further discussion of subsistence resource-related issues.

- *How does people's quality of life relate to the watershed? What are the contemporary spiritual and traditional activities of the Hoopa and Tsnungwe tribes within the watershed? What management practices might contribute quality of life and cultural traditional activities?*

As discussed in the *Socio-Economic* section of Chapter 3, tribal and non-tribal residents living adjacent to and within the MTWAA are users of the land, vegetation, wildlife, and the Trinity River itself. The resources of the MTWAA contribute to the quality of life of watershed residents by providing employment and career opportunities through recreation-related tourism and timber production; income through resource-related jobs and sales of special forest products; food and materials for personal and ceremonial uses through subsistence activities; and personal recreation opportunities through access to hiking trails, hunting areas, boating areas, and fishery resources. The living strategy of communities in the MTWAA tends to be oriented toward subsistence goods procurement and preservation on a seasonal basis. Families supplement income with subsistence hunting, fishing and gathering. These occupations are engaged in on a seasonal basis and are essential to the annual survival of many individuals and families. For the Hupa and other Native American populations, these activities additionally serve as vehicles for the transmission of cultural knowledge.

The *Heritage Resources* section of Chapter 3 addresses important traditional activities among contemporary Hupa, Tsnungwe, and Chimariko within the MTWAA. In brief, these activities, which add to the quality of life of tribal communities, include hunting, fishing, and gathering native plants and plant products for traditional subsistence purposes, traditional medicines, ceremonial uses, and craft making.

Current information about ongoing ceremonial practices and sacred places of concern to contemporary Native Americans is difficult to access because of its confidential and sensitive nature. Sacred places within the MTWAA where ongoing ceremonial activities are being carried out by traditional practitioners include Horse Mountain, which is important to both the Tsnungwe and Hupa (Merv George, Jr., Dena Magdeleno, Ed Chase, pers. comm. 2002-2003); two places along Friday Ridge Road, the Buck Buttes area, which are important to the Tsnungwe (Ed Chase, pers. comm. 2003); and Telescope Peak, which is important to the Hupa (Hoopa Tribal Forestry 1994, Heffner 1984).

As discussed previously in this section, several trends in resource usage and management could diminish the use of MTWAA resources that historically and currently contribute to the quality of life of local residents. These include reductions in river access points and decreases in camping and boat launching sites, which have affected recreation opportunities for local residents; reductions in runs of coho salmon, spring-run chinook, and summer-run steelhead; limits on timber harvests; and competition for SFP and subsistence resources. Potential management conflicts at odds with promoting traditional Native American cultural activities potentially include issues related to public access, especially at certain places and times when religious practitioners are conducting ceremonial activities that require solitude and quiet and competition for certain SFP (e.g., beargrass, tanoak mushrooms) that are desired by non-Indians for commercial or personal uses.

- *What opportunities exist for developing cooperative partnerships with the communities, organizations, tribal governments, and other to increase the health and function of the resources and communities of the Mainstream Trinity River?*

Presently, the Lower Trinity District Ranger meets regularly with Tsnungwe Tribal representatives to identify and address management issues of concern (Ann Garland & Dena Magdeleno, pers. comm. 2002). Government-to-government consultations between the Forest Service and the Hupa Tribe are conducted as appropriate by the Forest Supervisor and key staff (i.e., Tribal Relations Program Manager, District Ranger). Chimariko descendents have expressed the desire for regular communication with Forest Service officials of both SRNF and the neighboring Shasta-Trinity National Forest, which overlap their ancestral territory. Government-to-government consultations are also conducted between the SRNF and Yurok Tribe as appropriate. The Yurok Reservation is located several miles downstream of the MTWAA.

The California Indian Basketweavers Association (CIBA) and others, which include representatives of the Hupa, Yurok, and Tsnungwe Tribes, are interested in establishing stewardship agreements with the Forest Service so that Natives can burn and maintain critical resource patches, especially beargrass and hazel. Potential beargrass areas within the MTWAA include East Fork Campground road access area, Titlow Hill, and Horse Mountain, which is a botanical area with policy direction on acceptable harvesting activities. (For more information about CIBA and their concern about noxious weed spread, see the *Noxious Weeds* section of Chapter 3.)

As discussed in the *Recreation* section of this chapter, cooperative management of recreation activities among Native American tribes, private landowners, and the Forest Service will be increasingly important for protection of property rights and sacred sites. Educating the public about cultural history and land management policies will be key factors for long-term recreation management that must be addressed by all parties. Education, signage, and use regulations will be needed to avoid conflicts between user groups such as hunters and target shooters, who discharge firearms that affect other user groups, and motorized vehicle users on roadways that affect non-motorized users.

Partnership opportunities also exist for future restoration projects in the MTWAA. As described in the *Aquatic Species and Habitat* section of this chapter, continuing ongoing, and developing new, cooperative relationships with private landowners and State agencies may lead to identification and implementation of new riparian and instream restoration projects.

The Standards & Guideline TM-1(c) in the Rural Community Assistance section of the SRNF Land Use and Resource Management Plan includes several measures designed to encourage partnerships and coordination of Forest Service activities with local entities. These measures include assisting communities with establishing local action teams and developing and implementing local action plans; working with local community leaders and individuals to provide opportunities for the development of natural resource-based enterprises identified in action plans; developing and maintaining partnerships with cooperating organizations and agencies in developing and implementing resource-based programs supportive of local action plans; and developing, where possible, human resource programs that provide employment, training, and education.

Heritage Resources

- *What were the prehistoric land uses and practices?*

Archaeological research discloses that humans have occupied the MTWAA vicinity for at least 8,000 years, with prehistoric land-use adaptations corresponding to three major prehistoric periods and reflected in archaeological patterns. The Early Period Borax Lake Pattern (ca. 8,000-3,000 years B.P.) implies that the subsistence strategy involved small family groups who frequently moved their camps while hunting and foraging for a wide range of resources including large game (elk and deer) and hard seeds (grasses, nuts, etc.). This adaptive pattern corresponded to a significant warming trend (Xerothermic) characterized by warmer summers and a longer dry season, which triggered a wider distribution of oak woodlands and restriction of Douglas-fir forests. The Middle Period Willits Pattern (ca. 3,000-1,100 years B.P.) hypothetically corresponded with a significant cooling trend (Neoglacial) that triggered a downslope migration of oak woodlands, expanded riparian vegetation, and promoted a more reliable and productive anadromous fishery. During this period, technologies for processing and storing staple foods were adopted (especially for fish and acorns), the first permanent river-side settlements were established and occupied during winter months, and village populations dispersed in warmer months to carry out the seasonal round of hunting and collecting. Regular Indian burning practices to maintain open prairies may have been established during the Middle Period. The Late Period Gunther/Augustine Pattern (ca. 1,100 B.P.-A.D. 1,850) in interior northwest California featured a subsistence adaptation that was an elaboration of that initiated during the previous period (i.e., reliance on anadromous fish, deer and acorns as staple foods, occupation of winter villages along rivers, group dispersal during summer months, regularized trade, craft specialization, elaboration of ceremonies and rituals, etc.).

At historic contact, ca. A.D. 1850, three Native American groups occupied portions of the MTWAA: the Hupa, Tsnungwe, and the Chimariko. The Hupa were among the best documented ethnographically, whereas limited information was obtained for the Tsnungwe and Chimariko. Published data elaborate on the territories, settlements and population, subsistence and traditional burning practices, travel, ceremonial activities, and sacred places documented for these groups.

- *What were the historic lands uses and practices?*

Although the MTWAA was first explored by Euro-Americans in 1828, discovery of gold in the upper Trinity River watershed in 1848 triggered an onslaught of Argonauts and sustained non-Indian settlement in the region. Gold mining was never as intensive or profitable within the MTWAA compared to upriver mining areas (New River, Junction City, etc.), which periodically introduced tremendous amounts of sediment into the Trinity River. Within the MTWAA, mining operations commenced below Burnt Ranch, along Willow Creek, and on Three Creeks in the 1880's; and the large hydraulic Salyer Mine operated at the mouth of South Fork between ca. 1930 and World War II. Copper mining at Horse Mountain was most active in the 1910, but never produced much.

Homesteaders in the MTWAA raised grains, vegetables, orchards, beef, hogs and dairy cows to support the mining operations and growing population of the region. Indian trails were the first travel routes utilized by the immigrants. The first wagon road into the Willow Creek area via Three Creeks was completed to the coast in 1889, and a link with Hoopa was constructed two years later. In 1923, the Trinity Highway formally opened, enabling commercial logging to be economically feasible. Port Orford-cedar was first logged along Three Creeks and upper Willow Creek in the 1920's, expanding into Cedar Creek and Low Gap Creek during the 1930's. After World War II, the Douglas-fir and milling boom hit the entire northwest California region, with mills operating at Hoopa Valley, Burnt Ranch, and Willow Creek from 1946 to 1980 and purchasing timber from both private and Forest Service lands.

- *What heritage resources exist?*

Systematic survey of less than 1 percent of the MTWAA has resulted in formal recordation of 67 heritage resource sites and two isolated prehistoric stone tools. As would be expected given the record of land uses documented for the MTWAA, the recorded historic period sites include mining sites, trail and road segments, homesteads, government administrative sites, recreation sites, and a sawmill. The recorded prehistoric Native American sites consist of principal settlements, scatters of flaked and/or groundstone tools, ceremonial places, and a quarry for extracting toolstone. Many additional heritage resources have been identified but remain undocumented for the MTWAA on both public and private lands. Most of the heritage resource surveys were conducted in response to the passage of environmental and historic preservation laws in the 1970's, with the majority being accomplished by Six Rivers National Forest for prior timber sales in high country areas removed from the river. Due to the relatively small survey coverage, there is a large data gap in heritage resources existing in areas of the Forest that are not addressed by timber harvesting activities, such as terraces along river bars.

Heritage resources of importance to contemporary Native Americans include sacred places used for on-going ceremonial practices and localities for plant collecting, hunting and fishing (important for subsistence foods), traditional medicine, ceremonial uses, and craft making. Access to certain natural resources, sacred places, and other heritage resources on forest land is important to maintaining and perpetuating tribal identities.

Effects of Land Management on Heritage Resources

- *How has land management after the 1850's affected heritage resources?*

Formal site records for the 67 heritage resources documented for the MTWAA provide some indications about the types of impacts each may have suffered; however, these data, recorded over the last twenty-five years, are incomplete by current standards. Furthermore, these data only reflect what has been located on the ground during field survey of less than 1 percent of the entire MTWAA. If the question is rephrased "*How have land uses after the 1850's affected heritage resources?*" the general answer may be summarized as follows, with discussion provided below.

1. Older sites suffered impacts from re-use or new land uses, e.g., mining washed away Native American archaeological sites on terraces, and homesteads and towns typically occupied older Indian village sites.
2. Cessation of Indian burning practices and application of modern fire suppression strategies likely resulted in changes to traditional gathering locations for cultural plant materials.
3. Assertion of American private property rights imposed access restrictions on Native Americans, rendering access to public lands even more important for continuation of certain traditional Indian cultural practices.
4. Development of modern transportation routes often coincided with older Indian trails, obliterating these traces and impacting nearby associated sites such as camps, villages, etc.
5. Early timber harvesting activities that utilized tractor yarding and road construction in stream channels likely resulted in the loss or alteration of historic placer mining sites in the Willow Creek watershed.

Mining

The Trinity River has been and continues to be an integral part of life for Native Americans of the area. Much of their traditions and practices center on the river whose salmon runs provide a major part of their sustenance. During the centuries before contact and continuing today, Native people relied heavily on anadromous fishes for survival. It was a food they depended on and an association that sustained them culturally and spiritually. Euro-American settlement and mining substantially affected those relationships. The effects of historic mining on heritage resources included direct impacts to archaeological sites (e.g., where placer and hydraulic mining activities coincided with earlier occupied settlements). By altering conditions in the river, historic mining indirectly impacted traditional Native American land uses and practices as follows:

- Early mining operations were limited to four or five wet-weather months, which were the same months that spawning salmon were moving upriver. Debris-laden waters, heavy bedloads, and high levels of suspended sediment likely affected migration patterns and spawning success. River dredges maintained those conditions year-around.

- The muddy waters that resulted from mining made fishing with dip nets and spears difficult because of reduced visibility.
- Impacts to salmon production have a direct impact on Native people, whose relationship to salmon is not only one of food but also one of tradition and culture. Tributary mining operations that dammed and diverted the streams may have resulted in the loss of certain salmon stocks.

Homesteading and Ranching

The first homesteads on the Lower Trinity occupied the flats along the river where level ground provided space for buildings, orchards, and crops. Mountain prairies were also settled, and the open high country was summer range for the stockmen's cattle. Typically, the historic homesteads occupied the same prime riverine real estate occupied and used by Native Americans for centuries. The same mountain prairies and open high country had previously been used by Native Americans as base camps for summer foraging and hunting expeditions and for ceremonial practices.

Following are some of the effects of Euro-American homesteading and ranching on Native American heritage resources and associated land uses:

Homesteaders took over land already occupied by Native people.

Large numbers of hogs fattened on the acorn crops, which Native Americans managed and depended upon as a staple in their diet.

Cattle grazing on prairies, long-managed by indigenous burning, trampled, ate, introduced non-native grasses, or otherwise made inedible the native grass seeds annually harvested by Native Americans.

Wildlife hunted by Native people was killed off by the homesteaders, either for food or because they competed with their livestock.

Miners and homesteaders usurped native fishing spots.

Fencing and farming activities interfered with Native American travel and access to use areas.

Transportation

The first Euro-Americans into this country followed trails long established by Native Americans. New trails were built, and the old ones improved and expanded to become wagon roads and in some cases highways. New road and highway construction not only has obliterated evidence of the aboriginal trails they replaced but also impacted spatially associated Native American and historic sites.

Logging

Initially, historic logging was small-scale and occurred near settled areas on the river. The post World War II logging boom extended into the higher, less accessible places by developing a network of access roads. Logging impacts on heritage resources include the following.

- Early logging at low-elevation sites and near the river and the lower reaches of watercourses directly impacted Native habitation, activity, and gathering sites.
- High country logging and associated roads affected traditional spiritual sites.
- Culturally important plant gathering areas may have been affected by logging activities that resulted in ground disturbance or changes in vegetation characteristics.
- Historic timber harvesting activities that utilized watercourses as skid trails and haul roads likely damaged or destroyed early placer mining sites in tributaries.

Fire Suppression

- *What effect has fire suppression had on culturally important plants and cultural settings?*

Fire has been one of the major forces shaping the vegetation in the MTWAA on a landscape level. Historic data trends show that while only about 10 percent of fires started in the MTWAA are due to lightning starts, these fires have caused the largest burns within the MTWAA and vicinity. Effective fire suppression efforts were first available for the MTWAA ca. the 1940's and continue today. The number of fires per decade generally increased in number, but the average acreage burned per fire generally decreased.

Intentional burning by Native Americans has been documented generally for northwest California; however, specific data concerning Indian burning practices for the MTWAA are unknown. Ethnographic accounts and pollen data suggest that fire was used to keep areas open, enhance the quality of basketry materials, clear the duff under oaks where they collected acorns, and maintain habitat for stock (deer). Some timbered areas were also burned, either to convert them to grassland or to develop and maintain understory forage to support livestock.

The need to regularly burn patches of beargrass and hazel has been well documented. Burning of these plants improves their qualities for use in making traditional baskets by contemporary Native Americans. These plant resources have become more valuable and sought after, especially on public lands due to access restrictions imposed elsewhere. CIBA staff and local Native Americans interviewed for this study stressed desires to enter into partnerships with the Forest Service to identify and regularly manage (through burning) patches of beargrass and hazel within the MTWAA.

Fire suppression activities can result in significant direct and indirect impacts on culturally important plants and cultural settings. Dozer and hand-cutting of firelines, establishing base camps, or causing other ground disturbances can affect the stratigraphic integrity of archaeological deposits. Fuel reduction activities could potentially affect important characteristics associated with sacred sites. For example, manzanita is needed to ignite ceremonial fires (Ed Chase, pers. comm. 2003), so a fuel reduction activity that resulted in the removal of manzanita from the vicinity of a sacred site could affect an important characteristic of the site. One of the effects of fire suppression has been to increase the density of understory vegetation and increase fuel loads, which may affect production of culturally important understory plants such as beargrass and hazel.

Activities Affecting Heritage Resources

- *What types of activities have the highest potential to affect heritage resources?*

In general, archaeological resources can be affected by ground-disturbing activities that are present in the vicinity by disturbing depositional contexts. Such activities include road construction and improvement; timber harvesting activities; fire suppression; certain restoration activities addressing habitat, soils, or roads; mining; recreation (particularly 4WD off-road driving); and public access to heritage resource areas resulting in unauthorized excavation and artifact collecting.

Culturally-important places and resources can be affected by other activities that alter the accessibility or setting. Such altering activities include decreased access to historically-owned family plots that are now in private ownership and the anticipated increase in commercial collection of special forest products. Historically significant buildings or structures are subject to adverse effects when they are altered, maintained, or repaired in a manner incompatible with the Secretary of the Interior Standards for Rehabilitation, requiring NHPA Section 106 review and consultation for those places determined to be NRHP eligible. Vandalism and arson also affect historic buildings and structures.

Standards & Guidelines for Heritage Resources within the LRMP should mitigate most of the impacts to heritage resources caused by the above factors.

Tribal Trust Resources

- *What are the federally reserved trust resources and responsibilities within the analysis area?*
- *What cooperative governmental opportunities are there to enhance trust resources?*

The establishment of the Hoopa Valley Indian Reservation and the Yurok Indian Reservation vested the Hoopa and the Yurok with Federally Reserved Trust Resource Rights of fish and water. Several court rulings have established that an important "Indian purpose" for the reservations was to reserve the Tribes' rights to take fish from the Trinity and Klamath Rivers (USFWS 1999, EIS for Trinity River Fisheries Restoration). The Hoopa and Yurok tribes retain and fully exercise federally recognized fishing rights within the Klamath-Trinity watershed basin. Protection of these rights is a federal government trust responsibility. In managing these rights, the federal government recognizes the vested interest the Tribes retain in habitat, water flow, and fish production outside the reservations in the Klamath-Trinity basin. Tribal fishing rights are vested property rights held in trust by the U.S. for the benefit of the Indians (USFWS 1999).

The SRNF holds a trustee responsibility for Tribal interests related to federally reserved trust resources, as well as administrators of National Forest System land and resources, and must properly consider off-reservation effects to on-reservation trust resources in management activities that might affect Tribal fishing rights or other reservation resources. The Hoopa and Yurok tribes have a federal reserved right to an in-stream flow of water in the Klamath and Trinity Rivers sufficient to support the Tribes' rights to take their allowable share of fish within the Reservations. These Tribes also have a right to water for domestic purposes.

The SRNF has a variety of working relationships with the Hoopa and Yurok Tribes covering areas such as wildland fires and governmental consultation protocols. Tribal governments are often involved in forest planning, implementation, and management. The expectation is that this governmental cooperation and partnership will continue to increase in the future with Tribes playing a significant role in the overall management of the natural resources in the MTWAA.

The Forest Service has formal governmental consultation protocols with the federally recognized Tribes adjacent to or within the area of influence of the SRNF, and it conducts consultations with Tribal Councils routinely. This process is especially significant if the federally reserved trust resources of the Hoopa or Yurok Tribes might be affected. Management decisions and actions that may have the potential to affect federally reserved trust resources will require priority attention and additional governmental collaboration. It is through the government-to-government consultation that potential impacts or effects are identified and ways are developed to eliminate or minimize these impacts or effects. This consultation process also opens up numerous opportunities to be innovative, creative, and mutually supportive as it relates to the natural resources of the Klamath-Trinity River basin.

Since the LRMP was finalized, law and executive orders have further defined the relationship and consultation processes that federal agencies are to have with Federally Recognized Tribal governments. The government-to-government consultation protocol Memorandums of Understanding between the Forest and individual tribes reflect current law and how formal governmental consultation and cooperation will take place.

Timber Production

Trends

Commercial timber harvesting started in the region concurrent with the settlement of the area. What began as small-scale operations to support mining and ranching operations grew into a self-sustaining industry. By the early 1920's regional sawmills were developed, and from the 1920's into the 1940's, logging levels generally increased. The end of World War II was the start of intensive timber harvesting in the region to meet the rapidly increasing demand for lumber. Following the post-war period, harvesting continued to increase and peaked in the 1970's. Since this peak, timber production on the Forest has generally declined. By 1981, the lumber mills that had operated in the vicinity of the MTWAA had closed or relocated to other areas. Logging-related employment has declined as production levels have dropped off. Forest-wide, harvest levels ranged from 80 MMBF/year (million board feet per year) in the 1950's and 1960's, up to 200 MMBF/year in the 1970's, to current levels of less than 10 MMBF/year.

Aerial photos from 1944 to 1998 indicate that harvesting activities on the private and National Forest System land have followed separate trends. In the 1944 photo series, there was little apparent harvest activity on either the private or National Forest System land. By the 1960 photo series, significant differences were apparent. Relatively little harvest activity was apparent on the National Forest System land, while private lands were undergoing significant timber harvesting. The 1975 photos show reduced logging activity on private ground with increased operations on National Forest System land throughout the MTWAA. The 1998 aerial photos show that little timber harvesting has occurred on National Forest System land since 1990. Harvesting on private lands continued sporadically, fluctuating in response to vegetation and market changes.

Forest Service management strategy, historically and currently, is to maximize timber yields from lands designated for timber management while setting aside areas to manage for other resource values. However, the extent and intensity of timber harvesting in the MTWAA has influenced other resources throughout the MTWAA. The existing transportation system in the Forest was developed in a large part to facilitate timber harvesting. These roads now provide public access into the Forest for recreation, hunting, special forest products gathering, fire protection, and forest products transportation. The extent and intensity of timber harvesting and the associated roads have also had an effect on water quality. Table 3-4 in Chapter 3 shows how sediment delivery to watercourses associated with harvesting and harvest roads peaked in the 1970's and has decreased since then, following the same trend as harvesting. Timber harvesting also modified the quality and quantity of various habitat types available for wildlife. Past regeneration harvests have decreased late mature and old-growth seral stages and increased shrub/forb and pole seral stages. Early seral stages support a variety of important game species utilized by hunters and enjoyed by sightseeing recreationists, while late seral dependent species have potentially less available habitat. In this context, timber harvesting can be considered one method of vegetation modification that can be used to achieve and develop desired habitat conditions.

In the 1950's, the SRNF primarily used overstory removal and other partial cutting methods to harvest timber. Clearcutting became the dominant harvest method in the 1960's, and continued through the mid-1980's, while the use of partial cutting declined. Recent harvests have reversed this trend, focusing on commercial thinning, selection, and sanitation salvage operations with a decline in the use of clearcutting.

Vegetation management to maintain biological diversity at a physiographic scale is a goal of the Forest Plan. A combination of management strategies in both reserved and matrix areas shall provide a range of ecological conditions, meet a variety of resource objectives, and provide a continuous supply of forest products. More specifically, the Forest Plan provides direction for lands where timber management is an objective, including direction in regards to RMRs. According to the Plan, the Forest will manage to be within the RMRs for each vegetation series on a landscape (Forest Zone) scale. Subwatersheds may not be within the RMR; however, the objective is to meet the RMRs in each zone. Within individual watersheds, vegetation shall be managed to provide the diversity of stand structures and species composition characteristics of the vegetation type, slope position, disturbance regime, past stand history, and desired management objective.

Stand regeneration may be utilized where current conditions are in excess of the RMR. Stand regeneration should be limited in areas where current conditions are below the RMR. Intermediate harvesting and uneven age prescriptions should be implemented to accelerate stand growth from one seral stage to another, or to increase diversity within stands.

Within the Central Zone, the old-growth seral stage is currently below the RMR for the Tanoak, Douglas-fir, and White fir series (Table 4-5). The late mature seral stage is within the RMR for the Tanoak, Douglas-fir, and White fir series for the Central Zone; however, this seral stage is needed as future recruitment for the old-growth seral stages in all series.

The early and mid-mature seral stages of the Tanoak, Douglas-fir, and White fir series are within or above the RMR, with the exception of the early mature White fir, which is below the RMR. Refer to Table 4-1 for the RMRs in the MTWAA.

Table 4-5. The Recommended Management Range (RMR) for the seral stages within the Tanoak, Douglas-fir, and White fir series in the Central Zone.

Series Seral Stage	RMR %	Existing %	RMR Status
Tanoak			
early mature	11-14	21	Above
mid mature	12-17	17	Within
late mature	14-19	18	Within
old-growth	36-50	24	Below
Douglas-fir			
early mature	13-18	28	Above
mid mature	12-20	36	Above
late mature	12-14	12	Within
old-growth	28-34	15	Below
White fir			
early mature	15-19	10	Below
mid mature	14-18	21	Above
late mature	12-16	13	Within
old-growth	35-41	26	Below

- *What portion of the Forest Plan timber outputs, i.e., Allowable Sale Quantity, is expected from this watershed?*

The Forest Plan establishes a sustainable level of timber production that could be provided from general forest (matrix) lands. Currently, approximately 8,270 acres, or 19 percent of the 43,025-acre SRNF land base within the MTWAA, are suited for timber production according to the Forest's current land allocations. The Allowable Sale Quantity (ASQ) of timber for this land base is 1.1 MMBF/year (million board feet per year).

- *In light of existing (year 2000) seral stage distributions in the central zone, and given all other Forest Plan Standards & Guidelines, is the answer to the preceding question realistic to achieve?*

Yes, the ASQ of 1.1 MMBF/year for the MTWAA is a realistic goal to achieve. As indicated in the preceding Management Direction section and Table 4-5, there are vegetation series and seral stages that are within and above the RMRs that provide opportunities for the application of stand regeneration, intermediate harvesting, and uneven age silvicultural prescriptions. As indicated in Table 4-5, the old-growth seral stage for tanoak, Douglas-fir and white fir series, and the early mature seral stage for white fir are below the RMRs for the Central Zone. Table 4-6 indicates the acres of General Forest lands by seral stage for the MTWAA and the three subwatersheds. With the exception of the vegetation series and seral stages referenced above that are below the Central Zone RMRs, these General Forest lands are potentially available for harvest. The timber volume harvested from General Forest (matrix) lands capable, available, and suitable (CAS) for commercial timber production would be applied to the ASQ referenced above. As indicated in the Forest Plan, the suitability of land for timber production should be field verified at the project level.

Table 4-6. Acres of General Forest (matrix) land by seral stage for the MTWAA and the three sub watersheds.

Seral Stage	Hawkins-Sharber	Upper Tributaries	Willow Creek	MTWAA Total
Shrub/Forb	507	552	232	1,291
Pole	938	1,216	755	2,909
Early Mature	543	1,059	137	1,739
Mid Mature	414	1,086	261	1,761
Late Mature	316	370	200	886
Old-Growth	948	352	0	1,300

The Forest Plan establishes a Forest-wide Long Term Sustained Yield (LTSY) of approximately 20 MMBF annually from suitable lands of the Forest. Determination of LTSY amounts takes into consideration the Standards & Guidelines of the Forest Plan and reduces annual yield to account for the various constraints the Standards & Guidelines place on timber production. The Forest wide ASQ is based on the LTSY, and at 15.5 MMBF annually it is less than the LTSY. On a Watershed Analysis Area scale, the ASQ is less than the LTSY for the suitable lands within the watershed.

Based on the planning efforts presented in the Forest Plan and the current seral stage distributions in the central zone and the MTWAA, the ASQ for this watershed is realistic to achieve. However, the project specific considerations including habitat availability / connectivity / fragmentation, cumulative watershed effects, unmapped riparian reserves, etc. that must be considered as part of project level analysis may further reduce the lands available for harvest. Therefore, even though the 1.1 MMBF ASQ figure for the MTWAA is a realistic and fairly conservative estimate of available harvest volume, project specific considerations could reduce the actual amount of volume available for harvest.

- *Are there opportunities for timber harvesting to occur outside of general forest (matrix) while still meeting the goals, standards, and guidelines of the Forest Plan?*

As stated above, one Forest Plan goal is to utilize vegetation management to maintain biological diversity of the Forest at a physiographic scale. As per the Forest Plan, a combination of management strategies in both reserved and matrix areas shall provide a range of ecological conditions, meet a variety of resource objectives, and provide a continuous supply of forest products.

In addition to General Forest (MA #17), the following Management Areas are present within the MTWAA:

- MA #8 – Special Habitat – LSR
- MA #9 – Interim Riparian Reserve (IRR)
- MA #13 – Retention VQO
- MA #15 – Recreation River
- MA #16 – Partial Retention VQO

The Forest Plan Goals, Standards & Guidelines for these MAs include opportunities for timber harvest. There are 32 acres of Recreation River MA in the MTWAA. This small area is not likely to provide significant timber harvesting opportunities. However, there are over 14,000 acres of Retention and Partial Retention VQO, over 8,000 acres of LSRs, and significant areas of dispersed IRRs in the MTWAA that may provide timber-harvesting opportunities. Fuels treatments, fire hazard reduction, habitat enhancement, and other vegetation management projects in these MAs may present opportunities for timber harvesting. Integrating commercial timber harvest with these types of projects will contribute to the local and regional economy.

Special Forest Products

- *What are the levels of historic and prehistoric utilization of SFP?*
- *What are the projected commercial and personal use demands for SFP over the next decade?*
- *What opportunities exist to provide increased quantities and/or improved quality of SFP for all uses?*
- *What are the opportunities to manage a commercial harvest program that is supportive of community subsistence and cultural traditional uses of plants?*

As discussed in the *Special Forest Products* section of Chapter 3, many SFP have been harvested from the MTWAA over time including firewood; holiday trees; a wide variety of floral products, medicinal plants, fungi, edible plants, nuts and berries; and plants used in Native American basket weaving and spiritual practices. In recent years, demand has increased for commercial utilization and personal use of some SFP. Based on regional population projections, the demand for personal and commercial SFP in the MTWAA could increase by 7-8 percent over the next decade, increasing the competition for high demand SFP and potentially exacerbating existing conflicts between commercial and personal harvesters.

In recent years, demand for certain SFP has exceeded the commercial harvest limits established by the Forest Service in coordination with the Native Americans, reflecting current problems with meeting the demand for SFP in the MTWAA. Because these SFP are important plant resources gathered for on-going

Native American subsistence and other traditional uses, there is concern about overharvesting of certain SFP and the sustainability of these resources.

The LRMP contains a set of Standards & Guidelines to ensure that SFP are collected in a sustainable manner. According to the plan, certain areas are to be reserved for personal and traditional collection and will be off-limits to commercial collection. The Standards & Guidelines also provide guidance regarding management of a commercial SFP program that is supportive of community subsistence and traditional uses. Standard 19-4 states "Where there are potential conflicts between commercial and traditional collection, specific collecting areas will be identified and designated for Tribal collecting in consultation with Tribal Governments. For beargrass, acorns, and other traditional plant materials, areas will be established that prohibit commercial harvest but allow for personal use."

- *What effects will State and Federal quarantines relating to sudden oak death (SOD) have on the opportunities for SFP utilization?*

Sudden oak death (SOD) is currently not known to occur on the SRNF and it is not known if the pathogen (*Phytophthora ramorum*) is capable of causing disease as far inland as the MTWAA. Humans are among the primary vectors of the SOD pathogen, especially over long distances. This is generally through the transport of infested plant materials and soils into previously uninfested areas.

It is evident that personal and commercial SFP harvesting on the MTWAA is already subject to regulatory action. Humboldt County (including about 335,000 acres within the Six Rivers N.F.) has been declared an SOD infested county and is thereby subject to State and Federal quarantines. These restrictions currently impact the movement of SFP from parts of the MTWAA (including the Horse Mountain Botanical Area) that are within Humboldt County. The interim 2003 Six Rivers N.F. policy is that firewood, logs, or other host material (branches, leaves, twigs) from hardwood species (coast live oak, California black oak, Shreve's oak, tanoak, California bay laurel, pacific madrone, big-leaf maple), California buckeye, common manzanita, toyon, California honeysuckle, canyon live oak, California coffeeberry, rhododendron, Western starflower, evergreen huckleberry, California hazelnut, cascara, salmonberry, poison oak, etc. that is cut on NFS lands in Humboldt County areas may not be transported outside of Humboldt County. In addition, no small branches (less than one inch in diameter) and leaves (needles) of coast redwood and Douglas-fir on NFS lands in Humboldt County areas may be transported outside of Humboldt County. A number of these plant species are harvested from the MTWAA as Special Forest Products.

Before SFP from NFS land may be removed from an infested county, a "free-from" determination for the site must be made by a qualified Forest Service officer, and a compliance agreement must be in place at the time of removal. In the event that SOD infested plants should be detected within 1/4 mile of the SFP collection sites, no further movement would be permitted from the sites of any known SOD host plant species or portions of those plants.

Recreation

This section discusses popular demands and current management trends for recreational use, primarily regarding activities along the Mainstem Trinity River. High quality off-river recreational opportunities within the MTWAA via Scenic Byways, other accessible roads, trails, and in Special Interest Areas, are also considered. Recreational activities have the potential to impact natural and heritage resources. New facilities can disturb natural vegetation and potentially introduce invasive species (see Noxious Weeds Section in this Chapter). Recreational activities can also intrude on and disturb areas considered sacred by Native American Groups (see *Heritage Resources* Section in this Chapter). The majority of recreational activities and facilities addressed in this Chapter, and the opportunities described in Chapter 5, focus on established recreation use areas. This would allow for increased recreational opportunities while minimizing natural and heritage resource impacts.

- *What types and levels of recreation use are now occurring in the analysis area?*
- *What are the issues concerning public river access for recreational activities?*
- *How can recreation be developed and managed to be responsive to culturally significant locations and protect heritage resources as well as other sensitive resources?*
- *What opportunities exist for increasing river access and enhancing existing access sites through partnerships?*

River Access

River access points are important recreational use facilities. Opportunities for additional public river access sites are possible, most notably where Highways 299 and 96 come close to sections of the Trinity River on Forest Service lands. These potential accesses include sites upstream near the Forest Service Salyer Work Station and downstream between Big Rock and Tish Tang. Due to topography, and lack of National Forest Lands with safe access, potential access opportunities between Big Rock and Tish Tang would be found on private lands.

Projected demands for river-dependent activities indicate the need for additional river access points. Recreational user responses, gathered from the Trinity River Strategic Planning Visitor Survey (1995), identified the desire for increasing river access points, enhancing existing access sites with more recreational facilities, and improving access roads. Desirable facilities at these locations include toilets, signage and bulletin boards informing users about river conditions, and the Trinity's Wild and Scenic designation.

Increased river access would, in certain cases, necessitate cooperative agreements between the various local stakeholders, including the Forest Service, other public agencies, the Hoopa Valley Tribe, private landowners, concessionaires, and local user groups.

Boat Launch

River accesses with boat launches, suitable for kayaks and drift boats, are available in the upper and lower portions of the watershed and in the Willow Creek area. However, there is limited accessibility from Willow Creek upriver to Hawkins Bar and downriver from Big Rock to Tish Tang Campground.

Given that the Willow Creek area is an important tourist destination, additional river access points in that area could increase recreational use. As noted above, increasing the number and locations of boat launches in these areas would necessitate cooperative agreements between the Forest Service and other parties due to land ownership patterns. There is an opportunity to improve the river access at Hlel Din to include a boat launch facility.

Campgrounds and Picnic Areas

Public inquiries and interests frequently focus on camping opportunities near the river, according to Forest Service visitor information staff interviewed during preparation of this WA. Currently, only two Forest Service campgrounds (East Fork Willow Creek and Boise Creek) offer overnight accommodations near the Trinity or a tributary. Gray Falls Campground, located on a bench above the Trinity River at the upper end of the watershed, is closed due to health and safety concerns. Four other campgrounds along the Mainstem Trinity River (Hoopa, Tish Tang, Knights Park, and Camp Kimtu) are operated by other entities.

Increasing the number of developed camp spaces along the Mainstem Trinity River would also improve related recreational opportunities. Recreational users of developed campgrounds typically take advantage of a variety of day-use activities, such as boating, swimming, sightseeing, and fishing on the Trinity River (Willow Creek is closed to fishing). A group camp facility would provide additional accommodations to organizations or whitewater boating groups.

Trails

Seven of the nine trails in the watershed are 1.1 miles or less in length, which is relatively short for users looking for a distinctive hiking, biking, or equestrian experience. The longest trail is Tish Tang, accessible from the lower watershed, and it is the only trail in the watershed that offers connections to the Trinity Alps. Extending shorter trails or providing connections to other trails would offer increased opportunities over those currently available. The existing roadway at the Tunnel Flat river access is planned to be closed to vehicles, except for emergency access, and represents an opportunity to add an additional mile of river access trail in the MTWAA.

Area visitors have expressed interest in both short trails that follow along the river or tributaries and longer trails that connect to other destinations. Mountain bikers and equestrians are two user groups that require longer trails than are currently available in the watershed. They also need trailheads with sufficient parking and turn around space for trailers.

To accommodate multiple use, trail signs should specify rights-of-way among different user groups. Trail information such as length, use restrictions, and elevation gain would increase visitor familiarity with these facilities. Trails could also be enhanced with interpretive information and rest areas.

Horse Mountain Botanical and Winter Use Area

Horse Mountain is a popular recreation area year-around, with the heaviest use occurring in winter (Horse Mountain Botanical Area Special Interest Area Management Strategy, USFS 1998). It is the closest winter recreation area for Humboldt County and southern Del Norte County residents and offers the most desirable winter recreation conditions in the MTWAA. Recreational activities during other seasons include bird watching, sightseeing, botanical study, and OHV use, hunting, and target shooting. Cooperation and sensitivity to local tribal concerns regarding increased recreational use and impacts on sacred sites are essential in order to assure continuation of this popular area's use.

The addition of clearly marked parking, use area, and trail signage would help protect sacred Native American sites. Signage would also direct seasonal user groups, such as cross country skiers, those engaged in other types of snow play (e.g., tubing, sledding), hunters, and sightseers, to appropriate areas for those activities. These features are necessary to manage use in this Special Interest Area.

OHV Use

Accessible Forest Service roads are desired by all OHV users including private vehicles and jeep tour concessionaires. OHV is a popular activity that will continue to be in demand but needs to be regulated to avoid the overuse of roadways, which are highly susceptible to erosion. Fire risks from OHV users during periods of high fire hazards also need to be addressed through vehicle safety measures and seasonal closures. OHV users have expressed interest in developing a parallel access along Route 1 (referred to as a companion route) that could connect to OHV facilities planned for the Pilot Creek area in the Mad River District.

Scenic Byways

Approximately twelve miles of the 85 mile long Bigfoot National Scenic Byway (located along Highway 96 from Willow Creek and Happy Camp) and approximately 22 miles of the Trinity Heritage Scenic Byway (located along Hwy 299) are within the MTWAA. Additional interpretive facilities and vista points would further enhance these byways. Self guiding tours of various distances would serve a variety of interests and, ideally, involve cooperative development efforts by local stakeholders, including Native American groups, the local China Flat - Bigfoot Museum organization, and Caltrans. This would include developing printed tour guides, placing them at local commercial businesses, and developing corresponding interpretive displays at points along the Scenic Byways where there is adequate space and safe ingress and egress. The Forest Service and local visitor serving groups and businesses could jointly develop these tour guides.

Opportunities for Partnerships

The cooperative management of recreation activities between Native American tribes, private land owners, local communities, and the Forest Service will be increasingly important for property right, natural resource, and sacred sites protection. Cultural history, as well as land and resource management policies, are key long-term recreation management factors that must be addressed by all potential partners. Public education, clear signage, and effective, enforceable use regulations will be critical in order to avoid conflicts between multiple, and sometimes incompatible, user groups. Partnerships are also effective means to access funds and draw upon resources that may not be accessible to an individual entity or organization. Agency grant programs criteria often encourage partnerships and require local matching funds.

Transportation System

The road transportation network in the MTWAA is a compilation of numerous jurisdictions, of which the Forest Service has jurisdiction of less than 50 percent. Additionally, approximately half of the National Forest System land jurisdictional roads are on or near the ridgetops. Due to the steep topography of the terrain in the MTWAA, the Forest Service road network can be characterized as a road network that follows the ridge lines with short dead-end spurs that branch off these primary ridge roads, which were utilized for timber harvesting and other land management activities.

The LRMP provides direction and standards and guidelines for the transportation network on the Forest (pp. IV 115-116). The Aquatic Management Strategy also provides standards and guidelines for roads management (ROD, pp. C-32-33). In general, road decommissioning, hydrologically sound road improvements, and temporary road utilization are emphasized as effective measures towards sustaining or improving watershed functionality. To that effort, SRNF compiled an Access and Travel Management Plan (ATM) that reviewed road operational maintenance levels and future road direction on the forest. The ATM includes the majority of the Forest Service jurisdictional roads in this MTWAA. Already decommissioning and upgrading of roads has been accomplished within the MTWAA in accordance to these objectives. Any new road construction is guided by Best Management Practices (LRMP M-2) to direct correct design and placement and minimize associated erosion.

- *Which roads pose the greatest risk for erosion or prism failure if inadequately maintained?*

Roads that pose the greatest risk for erosion are those that are inadequately designed (see Chapter 3 *Transportation System* section) and/or those roads that cross unstable areas. The Galice and Rattlesnake bedrock formations (75 percent of the MTWAA) are considered moderately susceptible to debris slides, debris flows, and accelerated gully erosion (see *Erosion Process* sections). As the natural characteristics of MTWAA tend to make it susceptible to erosion, it is essential that the roads are properly located and designed for the conditions. Older roads that do not meet current design standards would need to be upgraded or decommissioned based on a high risk rating of potential future erosion.

The ATM has identified the majority of the roads in the MTWAA and reviewed and re-designated road operational maintenance levels. Decommissioning work has already been implemented on over six miles of road.

- *What road maintenance is needed for each road to minimize future road deterioration and provide for safe vehicle access?*

Road maintenance needs are primarily based upon road design, road purpose, and road usage. Highly traveled roads for two-wheel drive vehicles will have different road maintenance requirements than a dirt road that has a limited frequency of vehicle traffic. The purpose of a dirt road may be to provide access for recreation, fire related purposes, or timber or land management related purposes, and thereby has different operational maintenance needs. As a result, each user group is affected by the road network, and each group has specific road issues regarding how they should be maintained.

Port Orford-cedar root rot and noxious weed spread are particular botanical road concerns. Roads and road spurs located in and around the East Fork Willow Creek and Three Creeks (i.e. Titlow Hill, Berry Summit, Horse Mountain, Friday Ridge, Three Creeks, and 7N18 areas) are considered high risk roads for the transportation of root rot, although the MTWAA is currently disease-free. Temporary seasonal road closures do occur to protect against the spread of this disease. Maintenance practices utilizing application of weed free straw is part of the BMPs to reduce the spread of noxious weeds along the roads. Further discussion can be located in the *Noxious Weeds* sections of this document.

Maintenance and accessibility of the ridge roads is important for fire response activities (see *Fire* section).

In cases where roads cross fish bearing streams, fish passage is a priority as well as minimizing sediment delivery to the streams.

Unstable areas and/or erosive geology and soils are factors in sediment production on historic and active roads, and site specific considerations for any future road planning are where the *Erosion Process* and *Soil Productivity and Production* sections of this document are of particular importance.

Trinity River access is an important road consideration for recreation, trail access, and OHV user access. Trail and recreational road considerations can be reviewed in the section on *Recreation*.

- *What factors should be considered for maintaining roads to meet user access needs; and*
- *What factors should be considered for maintaining roads to protect forest resources?*

The road analysis that resulted in the ATM was conducted to direct road maintenance decisions. Road decommissioning and upgrading has generally been based upon an analysis of erosion risk (factors typically include geology, topography, stream crossing density, and proximity to fish bearing streams), user access needs (vehicle access, recreation, traditional subsistence activities or cultural activities), and opportunities to reduce road maintenance costs. The LRMP summarizes these consideration factors in the goals and direction of the Forest transportation system (p. IV – 115).

The drawback to the ATM is that it does not provide an apparent priority rating for the road network based upon factors such as (but not limited to) erodibility, stream crossing density, recreational use, cultural use, maintenance costs, botanical concerns, fire suppression and fuel treatment access, and anadromous fish issues. A prioritization matrix system based on a number of these transportation issues would be helpful to identify and drive future projects.

CHAPTER 5
RECOMMENDATIONS

Introduction

This chapter will identify types of management recommendations/opportunities that are responsive to watershed processes identified in the analysis. Monitoring activities are identified that are responsive to the issues and key questions. Suggested criteria for selecting treatments and treatment areas will be listed as will data gaps and monitoring needs to facilitate better future management.

Erosion Process and Water Quality

Opportunity 1: Develop Landslide Potential Map.

Possible Management Practice

The existing GIS-based data should be compiled to generate a Landslide Potential Map for the analysis area. The purpose of this type of map is to guide management and to identify high-risk areas to aid in the prioritization of road repair/decommission sites and problematic timber harvest areas. The Landslide Potential Map should be based on the existing landslide inventory, geology (lithology and structure), slope steepness, and geomorphology (e.g., inner gorges, headwall swales, etc.). Most of these data have already been generated, so the final step of creating a Landslide Potential Map should be relatively easy.

Opportunity 2: Require geologic evaluation.

Possible Management Practice

Field based evaluation of proposed management projects involving earthwork, burning, or timber harvest in areas identified on the Landslide Potential Map as High Potential should be required. The evaluation should be conducted by Forest Service geologists, or, if unavailable, by qualified contract geologists licensed in the State of California. The geologist should weigh the benefits of the proposed project against the risks associated with the landslide and erosion potential of the site.

Opportunity 3: Conduct a mine inventory.

Possible Management Practice

An inventory of existing mines would help in the identification of old mining sites with extensive spoils or tailings that may persist as sediment sources. Historically, mines have been a major source of human-caused sedimentation within the MTWAA. Development of reclamation plans at problematic mine sites may be a future management task.

Opportunity 4: Balance the need for riparian restoration with the high level of inner gorge instability.

The riparian analyst has identified the need to conduct riparian restoration that may include thinning trees or re-introduction of conifer in areas that have been overtaken by hardwood or alder. Much of this restoration would occur along inner gorge slopes, however, which is where the most landslides occurs and the highest sediment delivery potential exists. As such, any riparian restoration should be conducted in a low impact manner sensitive to the unstable nature of streamside slopes.

Possible Management Practice

Thinning may need to be conducted in a phased approach to preclude removal of too much canopy at any one time, and any yarding should be minimized, eliminated, or modified to mitigate potential impacts.

Opportunity 5: Landslide stabilization.

Possible Management Practices

Chronic problematic landslides should be identified and mitigated where feasible. Specifically, landslides near water sources (e,g., Campbell Creek area), populated areas, roads, cultural sites, and/or recreation sites should be considered for mitigation. Not all landslides can be feasibly stabilized, but many can be treated with planting, buttressing, or earthwork to reduce the potential for additional movement. These efforts may require collaboration between the USFS and other Federal, State, or Tribal agencies (e.g., EPA, CalTrans, Hoopa, etc.).

Data Gaps

The landslide inventory, upon which the preceding discussions of mass wasting and erosion potential are based, lack the necessary geomorphic data to complete a landslide potential map. The additional geomorphic data required would include identification of ancient, deep-seated landslides, inner gorges, headwall swales, and other specific geomorphic features usually associated with elevated mass wasting potentials.

Additionally, the landslide inventory was conducted utilizing historic aerial photographs at roughly 15 year intervals. This long photo interval makes it difficult to interpret management impacts when multiple triggering factors may be occurring within the interval. Shorter photo intervals would allow an increased level of interpretation that could more accurately focus on specific events. For example, the impacts of the 1964 flood event could be better understood if aerial photographs from 1960 and 1965 were evaluated.

Hydrologic Regime Management Recommendations

<u>Opportunity 1: Restoration of Trinity River</u>

Instream flow and water quality issues in the Trinity Basin will continue to affect the beneficial use of water within the analysis area.

Possible Management Practices

Restoration of aquatic resources in the Trinity River should focus on re-creating natural flow regimes. A higher frequency of the various components of the natural flow regime and specifically the snowmelt and summer low flow components will restore some of the aquatic functions essential for many aquatic species. Restoration should also address sediment delivery to the Trinity River and the watersheds within the analysis area.

Continue dialogue with other Federal, State, and Tribal governments and private entities on instream flow and sediment issues. Participate in the development of the Lower Trinity River sediment TMDL.

Data Gaps

Detailed data about sediment transport and storage within the tributary watersheds are lacking. Key data that are essential to the assessment of the level of beneficial use impairment by sediment (such as pool to riffle ratios, cross section and longitudinal channel geometry, V*, pool depths, and substrate conditions) are needed to determine the condition of aquatic habitat.

Monitoring

Develop a program to monitor channel morphology and fisheries response to flows.

Water Quality Management Recommendations

<u>Opportunity 1: Restoration of MTWAA Tributaries.</u>

Possible Management Practices

Restoration should address sediment delivery to the subwatersheds within the analysis area that can help reduce impacts to aquatic habitat and domestic water systems. Conduct a road sediment source inventory in the Hawkins Creek area and develop and implement a prioritized road restoration plan. Try to stabilize landslide areas upstream of domestic water systems if possible. Techniques could include toe buttressing, dewatering, and vegetation planting.

Data Gaps

Detailed data about sediment transport and storage within the tributary watersheds are lacking. Key data that are essential to the assessment of the level of beneficial use impairment by sediment (such as pool to riffle ratios, cross section and longitudinal channel geometry, V*, pool depths, and substrate conditions) are needed to determine the condition of aquatic habitat.

<u>Opportunity 2: Reintroduction of fire and reduction of fuel loading.</u>

The lack of periodic fire within the analysis area is more likely to produce adverse effects on beneficial uses of water than the reintroduction of fire and the implementation of management activities to reduce fuel loadings, fire intensity and fire severity. Increased fuel loads in the analysis area could result in large areas of high severity fire that could adversely affect beneficial uses for several years after a wildfire. Manage fuels to reduce the severity and intensity of future wildfires.

Possible Management Practices

Reintroduce fire and implement management activities to reduce fuel loadings to reduce the severity and intensity of wildfires. Decreased wildfire intensity and severity will reduce sediment and stream temperature effects on beneficial uses.

Criteria for Selecting Treatments

The following criteria should be used in determining the highest priority treatment areas:

- Watersheds with domestic water sources
- Watersheds with resident or anadromous fisheries
- Geologic types susceptible to mass wasting
- Watersheds with stream crossings at risk of failure

Considerations/Criteria for Treatments

- Design mitigation measures to minimize surface erosion, mass wasting, and sediment delivery to streams.
- Design treatments to maintain effective ground cover at levels that will minimize surface erosion and reduce fuel loadings to a level that will reduce the probability of a high severity wildfire.
- Design treatments for retention of downed woody debris to meet long-term soil productivity objectives and future recruitment of large woody debris.
- Avoid constructing additional permanent roads and construct any new temporary roads on upper slopes and terrain less susceptible to mass wasting when possible.

Considerations/Criteria for Monitoring

- Monitor on-site surface erosion and downstream sediment delivery from treatment areas
- Monitor effective ground cover and downed woody debris within treatment areas to ensure that design objectives are being achieved.

Soil Productivity and Protection Management Recommendations

Project related impacts to soil resources are addressed through application of the LRMP Standards & Guidelines. However, high severity and/or intensity wildfire may also cause impacts to soil resources.

The following opportunities exist to address the effects of high severity and/or high intensity wildfire on soil productivity.

Opportunity 1: Use fuel reduction treatments, fire hazard reduction activities, prescribed burning treatments and other activities to reduce the risk and hazard of wildfire in the MTWAA, thereby minimizing the effects of high severity wildfire on soil productivity.

Opportunity 2: Protect and restore soils damaged by high severity wildfire.

Possible Management Practices

- The Fire section of this Chapter includes possible management practices for reducing wildfire risk and hazard.
- Soils damaged during high severity and/or intensity wildfires may need to be avoided, or at a minimum treated with extreme caution, to protect them during future management activities.
- Proactive treatments (e.g., slash dispersal, etc.) may also be useful to minimize erosion and loss of damaged soils in wildfire areas.
- Proactive treatments for soil protection may also include treatments to reduce fuels and fire hazard in areas of high severity wildfire to minimize the effects of subsequent high intensity wildfires.

Considerations/Criteria for Treatments

- Design prescribed burn treatments in terms of antecedent soil moisture criteria to minimize the soil heating effects of prescribed fire.
- Design treatments to maintain effective ground cover at levels that will minimize surface erosion and reduce fuel loadings to a level that will reduce the probability of a high severity wildfire.
- Design treatments for retention of downed woody debris to meet long-term soil productivity objectives and future recruitment of large woody debris.

Considerations/Criteria for Monitoring

- Monitor treatment areas to ensure that project design objectives are being achieved.
- Monitor proactive treatments designed to restore or protect soil productivity to evaluate effectiveness of treatments.

Riparian Areas

Opportunity 1: Improve riparian stand condition by utilizing understory thinning and single tree selection silviculture techniques, where appropriate.

Possible Management Practices

Thinning is a management tool that may be used to enhance aquatic conditions while at the same time possibly reducing the risk of catastrophic fire in riparian areas. Thinning programs may be used in specific timber types to release the remaining trees and achieve a late successional condition at a faster rate than if left untreated. Appropriate timber types for thinning include those in the pole, early, or mid-seral stages that exhibit high canopy closure and small diameter sizes. The Campbell, Willow, and Sharber Creek watersheds may provide opportunities for these types of projects.

Opportunity 2: Improve riparian stand condition by thinning deciduous stands and interplanting conifers, where appropriate.

Possible Management Practices

Deciduous tree thinning and conifer interplanting are management tools that may be used to move the riparian area toward a desired condition, eventually enhancing aquatic habitat. These projects may be appropriate in watersheds that have a heavy deciduous vegetation component that hinders the development of conifers. Investigations into geologic stability should be conducted prior to project implementation within inner gorge areas. The Campbell, Willow, and Sharber Creek watersheds may provide opportunities for thinning/interplanting projects.

Opportunity 3: Conduct riparian planting projects on unstable slopes adjacent to perennial streams, where appropriate.

Possible Management Practices

The establishment of vegetation may help stabilize slopes and trap sediment that could be deposited into area streams due to sheet erosion. Exposed soils and landslide areas along the Highway 299 corridor may provide opportunities for riparian planting projects. However, planting projects may have a greater chance of success if they are combined with other slide stabilization efforts such as buttressing or earthwork to reduce the potential for additional movement. These efforts may require collaboration between the USFS and other Federal, State, or Tribal agencies (e.g., EPA, CalTrans, Hoopa, etc.).

Opportunity 4: Develop cooperative relationships with the local community to restore riparian vegetation, reduce sedimentation, and develop defensible fuel profile zones on the wildland/urban interface.

Possible Management Practices

Cooperative efforts could begin with the development of a Memorandum of Understanding between local Tribes, Community Services Districts, Resource Conservation Districts, DFG, California Department of Forestry and Fire Protection (CDF), and the Forest Service that establish guidelines for coordinated resource management and planning among the signatories. Development of a Coordinated Resource Management Plan could then occur that considers management objectives and options for restoration and fire hazard reduction activities.

Opportunity 5: Conduct effectiveness monitoring in reaches that experienced riparian treatments.

Considerations/Criteria for Monitoring

Monitoring activities to assess the success of treatments may include, but are not limited to, the following:

- Pre- and post-project timber inventories

- Instream and riparian LWD surveys
- Vascular and nonvascular plant and ground cover surveys
- Terrestrial wildlife and amphibian surveys
- Pre- and post-project geologic investigations
- Monitor on-site surface erosion and downstream sediment delivery from treatment areas

Opportunity 6: Conduct seasonally appropriate surveys of wet meadow and spring areas.

Considerations/Criteria for Monitoring

Seasonally appropriate surveys should be conducted at sites having moist sedimentary soils along streams or meadow edges for possible bensoniella locations within the MTWAA. Some appropriate sites may be located in wet meadow areas along Route 1. In addition, riparian shrub and forest openings would also be examined, especially on upper slopes and ridge top saddles with northerly aspects.

Aquatic Species and Habitat

Opportunity 1: Conduct instream habitat and LWD surveys in the MTWAA.

Possible Management Practices

Recent detailed data about instream habitat conditions are lacking in the MTWAA. The last of the instream habitat surveys were completed in 1992 at the end of the 1986-1992 drought. In some watersheds the latest information dated back to the early 1980's. The MTWAA has experienced a number of large storms since that time that likely resulted in significant channel and instream habitat modification. It is recommended that new instream habitat and LWD surveys be conducted to determine the current condition. This information can be used to identify instream restoration projects and contribute to NEPA analyses of and ESA consultations for upslope projects within the MTWAA.

Opportunity 2: Improve LWD loads in Willow Creek and Sharber Creek.

Possible Management Practices

The latest stream surveys as well as the perceived need to install instream LWD structures in the past indicates the amount of functional LWD in channels is less than desirable. It appears that LWD amounts may not be at properly functioning levels in Willow Creek and Sharber Creek. Improvements in LWD loads can be achieved through active placement in reaches lacking appropriate structure and riparian treatments that can accelerate the development of late seral conifer stands. LWD structures may provide short-term habitat benefits while the riparian LWD loading potential improves over time. However, planning LWD installation must consider channel gradient, stream width, bank morphology and stability, water velocities, bedload transport, size of construction material, and other factors to improve structure persistence and success.

Opportunity 3: Initiate efforts to identify and treat road-related sediment sources and fish migration barriers on private land within the MTWAA.

Possible Management Practices

There may be opportunities for the Forest Service to enter into cooperative agreements with local landowners, Tribes, Resource Conservation District, and the Willow Creek Community Services District to identify and treat road-related sediment sources and fish migration barriers. The Forest Service has completed road sediment source inventories through out the MTWAA (except in the Hawkins-Sharber subwatershed). An unknown number of private land road inventories have been conducted. Trinity and Humboldt counties, Caltrans, and the SRNF have completed barrier inventories on their roads. Such a survey has not been done on mixed-management roads or private roads.

Opportunity 4: Conduct, continue, or initiate cooperative monitoring programs and information sharing.

A number of fisheries inventory and monitoring projects by federal, state, tribal, and private interest organizations occur every year within the analysis area. Cooperative monitoring programs and data and information sharing could greatly increase efficiency and reduce cost. Monitoring should first be focused around high priority issues to make sure scarce funds are spent most effectively.

Opportunity 5: Inventory spring and ponds.

Possible Management Practices

Conduct inventories of spring and pond habitats along Route 1. These habitats may contain aquatic-dependent or riparian-dependent species of concern.

Vegetation

Opportunity 1: Conduct site-specific analyses of all late mature and old-growth stands for risk of loss to stand replacing events such as fire.

Possible Management Practices

Approximately 75 percent of the existing late mature and old-growth stands have a high to extreme fire hazard rating under typical August weather conditions, indicating a high potential risk of catastrophic loss in the event of a wildfire. Maintaining these stands in the event of a wildfire is essential for the watershed to contribute to the Recommended Management Ranges (RMR) for the Central Zone. Conduct site-specific analyses of all late mature and old-growth stands to determine which stands may be suitable for protection through the development of silvicultural, vegetation management, and/or fire and fuels treatments. The East Fork Willow Creek and Hawkins-Sharber watersheds have significant areas of late mature and old-growth stands with high to extreme fire hazard ratings.

<u>Opportunity 2: Include retention and development of late mature seral characteristics as part of vegetation management activities, where appropriate.</u>

Possible Management Practices

Include retention and development of late mature seral characteristics as part of vegetation management activities in early mature and mid-mature tanoak, Douglas-fir, and white fir stands where site specific analysis indicates that such management would contribute to the RMR for the Central Zone. Development of late-mature seral characteristics in riparian zones would also benefit aquatic habitat. These stands are dispersed throughout the MTWAA.

Fire

The following recommendations are aimed at reducing fire risk and hazard in the MTWAA. The primary focus of risk reduction is aimed at the river corridor itself and the many small communities that exist there. While little can be done with the risk of lightning ignitions, much can be done towards the prevention of human ignition starts and hazardous fuel conditions within and adjacent to these communities (Table 5-1).

<u>Opportunity 1: Work toward developing a wildland/urban interface protection plan that considers cooperative relationships, interagency agreements, and public education.</u>

Possible Management Practices

Consider development of community protection evaluation criteria to determine critical elements to better focus any prevention, suppression, or fuel treatment efforts. Pre-attack planning activities should be considered as part of this effort.

<u>Opportunity 2: Develop and implement integrated and strategic fuels treatment and fire hazard reduction projects.</u>

Possible Management Practices

Construct defensible fuel profiles around community zones through applied fuel and hazard reduction projects, harvest practices, stewardship agreements, and community involvement.

Integrate fuelbreak systems with other features that provide a cohesive strategy throughout the watershed and throughout the river corridor itself.

Projects should consider the entire fuel profile and entire watershed conditions including interim riparian reserves (IRR), upland hillslopes, and ridgelines.

Plan cooperative fuel treatments with private landowners as well as the Hoopa Tribe to ensure effective fuel treatments on a landscape scale.

Opportunity 3: Interagency coordination for fire suppression and preparedness.

Possible Management Practices

Coordinate activities within the corridor with the Trinity County Resource Conservation District and Fire Safe Council, the Willow Creek Fire Safe Council, Humboldt County and the Humboldt County Fire Safe Council, and local volunteer fire departments.

Consider the importance of strategic control points that are located near critical communities such as major ridgelines features, key transportation routes, and natural barriers.

Key Locations for Community Risk Reduction

- Willow Creek
- Hawkins Bar
- Salyer
- Ogden Flat
- Susy-Q Ranch
- Gray Ranch
- Hoopa
- Hoopa Valley Indian Reservation

Key Treatment Criteria for Community Risk Reduction

- Predominant vegetation patterns within 300 feet of structures and Forest/private boundaries
- Major and minor access roads and their accessibility for emergency response
- Topographic features adjacent to communities that affect fire behavior
- Areas of high fire occurrence, mortality, or potential for extreme fire behavior
- Adjacent and surrounding ridgelines that would provide strategic wildland fire suppression opportunities

Key Locations for Treatment Priorities

- Areas of heavy mortality from past wildfire events or other causes that create a potential for high to extreme fire behavior
- High value areas (e.g., communities, wildlife habitat reserves, critical riparian areas, botanical protection areas, and high value plantations) where the associated potential for stand replacement fire behavior is also high
- Upper 1/3 slopes, especially those with associated roads
- Adjacent to the Hoopa Reservation where tribal trust responsibilities are critical
- Where multiple treatment methods could be applied to enhance their effectiveness over the long term

Table 5-1. Treatments and Management Practices That Could Address Key Treatment Areas

Potential Treatments	Comments
Piling and/or removal of fuels	• Hand piling material • Mechanical piling material • Biomass removal • Chipping
Prescribed fire	• Includes pile burning, jackpot burning, broadcast burning and understory burning • Consider as a maintenance treatment for shaded fuelbreak systems • Consider where high ecological values are at risk and where long term protection is needed.
Shaded fuelbreaks	• Design as strategic control locations around communities, including roads and upper 1/3 slopes • Integrate fuel break systems into a cohesive landscape strategy, including across the boundary with the Shasta-Trinity National Forest and the Hoopa Valley Indian Reservation • Make long-term commitments for system maintenance • Take advantage of natural barriers, road systems, and waterways for connectivity to the communities at risk
Timber harvest	• Thinning to reduce crown bulk densities to levels less conductive to crown fires • Removal of dead and dying material in high value areas to ameliorate high fire behavior potential • Biomass removal of surface fuels and/or ladder fuels to reduce potential negative fire behavior effects
Pre-attack Planning	• Design infrastructure to address need for water sources, staging areas, helispots, evacuation routes, etc.

Data Gaps

Wildfires are not restricted by watershed or administrative boundaries. Therefore, cooperative efforts with the Hoopa Tribe, adjacent landowners, Fire Safe Councils and the Shasta-Trinity National Forest can provide invaluable information to help determine fire hazard and associated effective fire suppression and fuel treatment strategies for the Mainstem Trinity River watersheds.

The available data on pre-European and early settlement era fire regimes (i.e., extent, severity, and frequency) are somewhat limited for this area. Further data analysis would be of interest to more fully document fire regimes for this watershed. This could include fire frequency studies in different vegetation types, using fire slabs or the reconstruction of fire perimeters, and more extensive fire severity studies based on fire scars and stand ages.

Fire effects data are also lacking, including effects on native and exotic plant and animal species. Localized data collection and analysis are critical to refining and improving prescriptions and assessments of fire effects. Models such as FOFEM (First Order Fire Effects Model), which can be used to assess wildfire mortality based on species, trees/acre, DBH, tree height, and flame lengths, should be validated by analysis of future wildland fire and prescribed fire mortality. In addition, fire effects data on hardwoods, especially tanoak, would especially be of interest due to its wide spread extent within this watershed. Fire monitoring plots could be initiated in the watershed in selected vegetation types of interest to assess the short and long-term effects of fire and a lack of fire on the ecosystem.

Botanical Area

The following recommendations concerning off-highway vehicular traffic, POC and SOD also apply to the HMBA.

Opportunity 1: Continue POC risk minimization strategies.

Possible Management Practices

The Trinity River Basin POC Risk Assessment contains possible mitigation measures for the following roads that pass through POC within the SIA: 6N36, 16N36A, 6N38, 6N18, and a non-system road that accesses a watering hole. These roads have been classified as high risk for POC root disease introduction. Seasonal road closure and other prevention practices are already in place, and all efforts to prevent POC root disease introduction should continue.

Opportunity 2: Take active measures to avoid SOD introduction into the MTWAA.

It is currently still not known whether SOD can occur as far inland as the analysis area, so conscious preventive actions should be taken to prevent SOD introduction to the botanical area. Other National Forests have developed Best Management Practices for SOD, which could also apply here (USFS 2002).

Opportunity 3: Reduce recreational impacts to sensitive botanical areas.

Possible Management Practices

Develop trails and/or access points that would route people away from sensitive areas. Develop interpretative displays to educate the public on sensitive plants, their habitats, and ways to reduce recreational impacts.

Data Gaps

Fire ecology of the numerous plant communities within the botanical area is poorly understood and requires more study before management recommendations can be confidently applied.

At preparation time of this analysis, it was still not established whether SOD caused by *Phytophthora ramorum* could occur as far inland as the MTWAA. However, a number of potential SOD hosts are part of the HMBA vegetation including big-leaf maple (*Acer macrophyllum*), Pacific madrone (*Arbutus menziesii*), tanoak (*Lithocarpus densiflorus* var. *densiflorus*), canyon live oak (*Quercus chrysolepis*), Douglas-fir (*Pseudotsuga menziesii*), California bay laurel (*Umbellularia californica*), California coffeeberry (*Rhamnus californica* ssp. *californica*), and Pacific starflower (*Trientalis latifolia*).

Though the riparian dependent plant species of concern, bensoniella, is known to occur south of the MTWAA, it is not known whether it is present in the analysis area.

Monitoring and Research Activities

The *Special Interest Area Management Strategy, Version 1.0* (USFS 1998) includes a detailed analysis of the Horse Mountain Botanical Area (HMBA), including management objectives and recommendations. All National Forest System land within Region 5 is continuously being monitored for evidence of Port-Orford-cedar root disease (POC) and sudden oak death (SOD) presence. In addition to regional surveys and monitoring efforts, all Forest Service personnel are on alert for possible disease occurrence on the Forest during the daily course of their regular assignments.

Noxious Weeds

The integrated pest management (IPM) approach for selecting methods for preventing, containing, and controlling noxious weeds is strongly supported by the Forest Service, in coordination with other resource management activities to achieve optimum management goals and objectives.

Management Recommendations

Opportunity 1: Immediate eradication of small noxious weed populations.

Possible Management Practices

Early detection and management are most cost effective. Delays in eradication efforts of known weed populations should be avoided, since the spread of noxious weeds progresses exponentially over time. Immediate eradication upon detection of small populations is highly recommended, before the weeds produce large reserves of seeds. Follow-up monitoring for possible recurrence is also recommended. Populations too large for immediate eradication should be mapped and reported to the Forest Botanist for inclusion in the Forest-wide weed inventory.

Opportunity 2: Application of Best Management Practices.

Possible Management Practices

The Forest Service should continue to follow the Northern Province Noxious and Invasive Weeds Program Strategy and to apply the Best Management Practices for Weed Control set forth in the USDA-Forest Service Guide to Noxious Weed Prevention Practices. All aspects of the Forest Service's activities within the watershed should incorporate the Best Management Practices for Weed Control.

Opportunity 3: Interagency collaboration.

Strong collaboration between the Forest Service, Caltrans, and the County already exists in the Humboldt County Weed Management Area to address the problem of starthistle and Scotch broom roadside infestations along Hwy. 299 and County-maintained roads on National Forest System land within the MTWAA.

Possible Management Practice

Prevention of further spread of these populations should be a high priority for the Forest Service, and every effort to manage and eventually eradicate them should be made.

Data Gaps

The Forest Service's forest-wide noxious weed survey is well under way, with initial emphasis upon roadside populations. The current data are limited to roadside populations. This survey continues to address the remaining road coverage in the area, with more extensive watershed surveys planned when resources become available. Information on the level of weed infestations on adjacent private lands is not currently available.

Monitoring and Research Activities

The Forest Service requires planning and NEPA documentation for all new groundbreaking activities on the National Forest. These must address the impact of weeds to the site and surrounding area and establish mitigations to minimize those impacts.

The *Forest Service, Northern Province (Klamath, Mendocino, Six Rivers, and Shasta Trinity National Forests) Weeds Program Strategy* (Coop and Vost 2001) emphasizes coordination and cooperation, prevention and education, control/project planning, inventory/mapping/ monitoring, research, and the planning and administration of weed management.

Wildlife Species and Habitat

The old-growth and late mature habitats in the MTWAA have an increased importance to late seral dependent species in this area as a result of the substantial loss of late seral habitats in the adjacent Horse Linto Creek watershed. In addition, the analysis area is currently below RMR for late these seral stages. Therefore, it is important to protect existing old-growth and late mature stands and advance the development of younger stands within the analysis area, particularly in the LSRs. To this end, the following recommendations are provided.

Opportunity 1: Create shaded fuelbreaks.

Possible Management Practices

Create shaded fuelbreaks along primary ridges and other strategic ridges, such as along the western administrative boundary 6N01 near RC-306. The creation of shaded fuelbreaks will reduce fuels while maintaining or improving the structural integrity of the habitat, which is especially important in areas managed for late seral habitat, such as in LSRs.

Opportunity 2: Implement thinning and slash removal, where appropriate.

Possible Management Practices

Thinning with slash removal is recommended in dense stands of pole to mid-mature seral stages (i.e. CWHR types 2D and 4D) to reduce fuels and fuel ladders, and advance the development of younger stands (<80 years) into late seral habitats. Opportunities exist throughout the watershed, although efforts should focus on the LSR 306 and near areas of existing late seral habitat, such as in the Quinby Creek drainage and the lower portion of the East Fork Willow Creek drainage. This will help protect existing late seral stands, help to meet the objectives of the LRMP with regards to Recommended Management Ranges, and increase the amount and connectivity of late seral habitat within and between LSRs.

Opportunity 3: Prescribed burning, where appropriate.

Possible Management Practices

Prescribed burning techniques should be implemented to reduce fuels, accelerate stand development, perpetuate healthy and diverse plant and animal communities, provide a mosaic of habitats, and allow pioneer species of brush, forbs, and grasses to grow quickly on burned sites.

Opportunity 4: Manage for harvest species as well as late-successional-dependent species.

Possible Management Practices

In addition to managing for late successional dependent species, SRNF should also manage for game species such as deer, bear, and quail. Harvest species typically require a variety of habitats, including early successional habitats, grasslands, hardwood, and mixed hardwood-conifer stands. These species are not only native to this region, but also are of historical, social, recreational, and economic importance. Timber harvest, controlled burns, and hardwood retention can be used to help achieve this objective. Grassland, black oak, or white oak habitats are primarily found along the Trinity River and in the Cow and Hawkins creek drainages.

Opportunity 5: Conduct population analyses for sensitive wildlife species.

Possible Management Practices

Recently collected data regarding the location, status, and population sizes and trends of T&E and Forest Service sensitive species are lacking in the MTWAA. As an example, northern goshawk surveys and nest site monitoring efforts have not been conducted since 1996. This information can be used to protect existing nest or den sites and associated habitats, evaluate habitat thresholds, identify habitat restoration projects, and contribute to NEPA analysis and ESA consultations for projects within the MTWAA.

Opportunity 6: Survey for undesired exotic/non-native species that pose a threat to native T&E and Forest Service Sensitive species.

Possible Management Practices

There are several species, including the barred owl (*Strix varia*), brown-headed cowbird, and bullfrog (*Rana catesbeiana*), that are known to negatively impact several native T&E and Forest Service sensitive species, such as the NSO, willow flycatcher, yellow-legged frog. Although these species are known to occur in the MTWAA, data regarding their population and status are unknown. Without this information their impact on native species is unknown and management to address these impacts cannot be determined.

Socio-Economic

As described in the Socio-Economic sections in Chapter 3 and summarized in Chapter 4, key economic generating activities that occur on the forest and contribute to the economy of local communities include recreation, the collection of special forest products (SFP), timber production and harvesting, and habitat restoration. Recommended management actions that affect these activities and data gaps associated with implementing these recommendations are identified below.

Opportunity 1: Improve opportunities and facilities for recreation in areas that are not culturally sensitive and promote recreation activities that attract visitors from outside the area.

These actions could generate local construction-related economic opportunities (jobs and income) as well as generate economic benefits for tourism-related businesses and the local economies. Improving recreation opportunities would enhance the quality of life for locals as well. Please see the *Recreation* section of this chapter for opportunities for improving recreation resources in the MTWAA.

Data Gaps

Data gaps associated with these management actions include limited information currently available about the place of residence of visitors to the watershed, quality of their recreation experience when visiting the area, and facility needs and improvements that would attract more visitors from outside the area. Existing relevant data should be compiled, and surveys should be conducted with visitors to the forest to obtain data that could be used to profile recreation visitors and their needs and to help identify recreation facility improvements.

Opportunity 2: Provide more opportunities to meet current demands for Special Forest Products (SFP) consistent with resource protection and sustainability goals.

Possible Management Practices

Opportunities to adjust the harvest limitation established for some high demand SFPs should be investigated. This action should be implemented only through close coordination and cooperation with the tribes and be consistent with resource protection and sustainability objectives for SFP resources. In addition, actions recommended elsewhere (e.g., see *Heritage Resources* section of this chapter) to improve the quality of SFP, such as periodic burning of beargrass, should increase the income generated to commercial harvesters from the sale of higher quality products made from these resources.

Data Gaps

Data gaps potentially include limited scientific information to establish limits on collecting certain products based on sustainability criteria. Also, additional information on the potential benefits of recommended management activities, such as the burning of beargrass, to improve the quality of SFPs would be useful.

Opportunity 3: Enhance opportunities for local businesses and individuals to participate in resource management and utilization projects.

Possible Management Practices

Opportunities for local businesses and individuals to participate in resource management and utilization projects, such as timber harvesting and habitat restoration programs, should be enhanced. This should be done through encouraging partnerships and agreements, providing training opportunities in bidding and contracting procedures, and providing a variety of contract sizes and complexities so that there are some smaller contracts available for less experienced contractors. Specific opportunities are listed below.

1. Expand cooperative efforts with timber interests to identify markets and buyers for timber harvested from the Forest (up to the limits identified in the LRMP for sustainability), and explore opportunities to market timber products from thinning and fuels treatment. These opportunities include cooperative efforts in keeping track of timber product markets and milling techniques, and developing innovative ways to offer timber products to cut down on service costs (e.g., combine fuels treatment with timber sales and stewardship programs). Through cooperative agreements, ensure that human resources from the local communities are utilized to the extent possible in forest harvesting activities.
2. Utilize human resources from the local communities to participate in the ongoing restoration programs (see Aquatic Species and Habitat and Riparian Area sections). Through cooperative agreements with local communities, including tribal communities, establish a human resources program to train persons in the skills needed to participate in these programs. In addition to the forest-based resources, natural resource-based activities on private lands that generate economic activity in the local communities include mining and farming operations, such as small produce farms, orchards, and vineyards. As discussed elsewhere, private lands comprise about 45 percent of the watershed; consequently, productive use of these lands is important to accomplishing the local economic development goals. Through cooperative partnerships, including Memoranda of Understanding for developing and implementing Coordinated Resource Management Plans and local action plans, the Forest Service can help to remove barriers to sustained economic activity on private lands in the watershed.

Heritage Resources

<u>Opportunity 1: Monitor known heritage sites to protect them from vandalism.</u>

Possible Management Practice

Enter into partnerships with the local Tribes and others, as appropriate, to monitor conditions at heritage sites considered most at risk of damage from vandals. An ongoing project that may help in such an endeavor is the site steward monitor training and agency coordination program provided by the non-profit California Archaeological Site Stewardship Program (CASSP) of the Society for California Archaeology (SCA).

<u>Opportunity 2: Education of the general public about local Tribal culture, history and contemporary concerns.</u>

Possible Management Practices

Post signs and interpretive displays at authorized trail access points that identify and educate the public about issues relating to culturally sensitive resources, including the cultural significance of certain places. Interpretive materials can be developed with the assistance of Tribal members, descendants, and associates, as well as other organizations that may have special knowledge of cultural traditions and resources. The signage could also potentially include the federal penalties for violating the Archaeological Resources Protection Act (ARPA) and Native American Graves Protection and Repatriation Act (NAGPRA).

<u>Opportunity 3: Prioritize and conduct heritage resource inventories and evaluations to fill heritage data gaps.</u>

Possible Management Practices

Conduct heritage resource inventories and evaluations within the MTWAA that are characterized by high sensitivity and high risk of impacts. Such areas may include, but may not be limited to, the following:

- Contemporary Native American plant resource gathering areas
- Sacred sites and other places that may qualify as traditional cultural properties (TCPs)
- Places characterized by high visitor use such as the mainstem river corridor
- Places accessible by high-use Forest roads
- Popular recreational areas for hunters, campers, SFP users or others
- Sensitive areas at risk from natural forces such as erosion, etc.

Priority for heritage resource surveys could also be focused on those areas that have not been previously surveyed. For example, one potential priority area for conducting heritage resource surveys could be along river terraces.

Only limited systematic survey coverage has been accomplished for most of the highly sensitive valley and canyon floor along the mainstem Trinity River. No palynological or other paleoenvironmental data for the Holocene have been obtained, nor have archaeological studies designed to identify, locate, and investigate Early, Middle, or Late Prehistoric Period sites been conducted for the study area to date.

The MTWA identifies a number of heritage resource data gaps for the MTWAA. It is clear that many historic period resources identified through archival research have yet to be located and documented for the MTWAA (Appendix B), such as mining camps, ditches, flumes, structures, old farms complexes, fences, boundary markers, roads and trails, mill sites, and other tangible remains of past land uses associated with mining, homesteading, transportation, logging, and other relevant themes. Likewise, research discloses that a number of ethnographically described Native American sites have yet to be located, formally recorded, and their present conditions assessed.

In particular, geo-archaeological studies for the MTWAA would be productive for identifying geological units where older sites may be preserved in buried contexts. Natural catchments may be present that could be used for pollen core studies.

In addition, cultural landscape surveys might look for collections of associated resources and investigate their links to better understand how people responded to the natural and cultural environment in which they lived for the ca. 8,000-year record of human habitation preserved in the MTWAA.

Opportunity 4: Develop cooperative partnerships for heritage resources interpretation and enhancement.

There are numerous organizations, individuals, Tribes and other entities interested in MTWAA heritage resources that may be considered by the Forest Service as potential partners in future cultural resources management, education and interpretation efforts. Groups and organizations include local Tribes, tribal organizations, museums, schools, professional historic preservation organizations, local community groups, and other agencies.

Tribal Trust Resources

Opportunity 1: Watershed function

Retain, restore and protect watershed functions that promote high quality habitat for native fish and other aquatic organisms, in cooperative efforts with tribal governments, as per trust responsibilities.

Opportunity 2: Cooperative partnerships

Possible Management Practices

1. Partner with local tribal scientific staffs to coordinate, share data, develop mutual management strategies, and by consulting with the Tribal Councils on off-Reservation management activities that have a potential to affect on-Reservation fish and aquatic resources. Work with tribal

planning staffs to assure that management plans, practices, and policies along the National Forest/Reservation boundaries are compatible.

2. Cooperatively identify, with tribal staffs, areas of high potential for future fires spreading on to the Hoopa Valley Reservation and reduce this potential risk by jointly conducting appropriate management activities.
3. Work with the tribal governments to identify needs for access through National Forest System land to manage tribal trust properties and the Reservation's needs for access for domestic water supplies and other uses. Develop formal agreement for mutual road management of significant access roads.
4. Develop partnerships with Tribes to conduct a long-term effort to monitor water quality for T&E fish species habitat and domestic water sources across jurisdictions in order to take a basin approach to water quality as it relates to fish. Cooperatively conduct spawning surveys within the MTWAA.

Timber Production

Opportunities exist within the watershed to utilize an assortment of silvicultural prescriptions for timber production while still meeting the goals, standards and guidelines of the Forest Management Plan. Recommendations to make the most of these opportunities include, but are not limited to, the following.

Opportunity 1: Utilization of silvicultural prescriptions to contribute towards ASQ.

Possible Management Practices

Within the suitable lands of the MTWAA, utilize a variety of silvicultural prescriptions to contribute towards the Watershed's portion of the Forest ASQ. Stand regeneration may be utilized where current conditions are in excess of the RMR. Intermediate harvesting (thinning) and uneven age prescriptions (selection) should be implemented to accelerate stand growth from one seral stage to another, or to increase diversity within stands. Priority for management under this strategy would be primarily early and mid-mature stands that would not otherwise maintain growth or accelerate development of late seral stand structural attributes. There are about 1,740 acres of Early Mature and 1,760 acres of Mid Mature General Forest (matrix) lands that could be evaluated for silvicultural treatments, including regeneration harvest. There are an additional 2,900 acres of pole stands that could be evaluated for treatments that would accelerate stand development. The acres are located in the subwatersheds as follows:

Hawkins-Sharber	938 acres pole	543 acres Early Mature	414 acres Mid Mature
Upper Tributaries	1,216 acres pole	1,059 acres Early Mature	1,086 acres Mid Mature
Willow Creek	755 acres pole	137 acres Early Mature	261 acres Mid Mature

<u>Opportunity 2: Utilization of silvicultural prescriptions during the design of fuels reduction activities.</u>

Possible Management Practices

For all Management Areas of the Forest, utilize a combination of silvicultural prescriptions and fuels reduction activities to create shaded fuel breaks in strategic areas near communities. Shaded fuel breaks could increase fire suppression effectiveness by providing safe firefighter access and possibly slowing the rate of spread, reducing flame lengths, and reducing the overall intensity of wildfire, whether the fire is burning into or out of private property. Existing roads and upper 1/3 slopes would generally be used when planning a shaded fuel break strategy for community protection objectives. Priority should be given to the communities along the Trinity River corridor as addressed in the *Fire* section of this Chapter.

Use a combination of silvicultural prescriptions and fuels reduction activities as part of a shaded fuel break strategy adjacent to, and within, LSR boundaries to help protect the integrity of old-growth and late mature seral stages within the LSRs. Timber management and fuels reduction could be used as a tool to lessen the chances of a severe wildfire burning into the LSR and degrading or removing stands from old-growth or late mature classification. This type of treatment could also help lessen the chance of a fire burning from the LSR into the matrix or other lands. To help protect the integrity of old-growth and late mature seral stages within LSRs and its related resource values, the areas with the greatest resource value and highest fire risk and hazard would be treated first. There are roughly 20 miles of ridgelines and upper slopes associated with LSRs that could be evaluated for this type of practice including about 11 miles generally along Waterman Ridge, about 5 miles along Friday Ridge and about 4 miles along the west side of LSR 306 in the vicinity of FS Route 1.

<u>Opportunity 3: Utilization of silvicultural prescriptions in LSRs and IRRs to achieve desired vegetation characteristics.</u>

Possible Management Practices

Use thinning silviculture prescriptions that are beneficial to the creation of late-successional forest conditions and that meet the management objectives for LSRs. In addition, salvage operations should be used following stand replacing events. Timber volume production should be incidental to any thinning or salvage project in an LSR and should be subordinate to objectives that are beneficial to the creation of late-successional forest conditions. Priority for thinning should be given to the stands that have the best potential to respond positively to thinning. There are approximately 9,760 acres of LSR 306 and 479 acres of LSR 305 within the MTWAA that could be evaluated for this type of practice.

Within the IRRs, timber management should be considered to control forest stocking levels and manage stands to promote the development of desired vegetation characteristics and attain ACS objectives. Salvage operations should be considered when catastrophic events result in degraded riparian conditions and salvage is required to attain ACS objectives. Priority for IRR thinning or salvage should be given to areas that are adjacent to upslope timber management or salvage operations.

Opportunity 4: Utilization of silvicultural prescriptions in plantations for stocking control and/or to accelerate seral stage development.

Possible Management Practices

Conduct site-specific analysis of plantations that may be suitable for stocking control (thinning) through the development of silvicultural prescriptions. Commercial harvesting opportunities from the plantation areas may be limited; however, precommercial thinning operations can be combined with fuel reduction efforts in stands adjacent to older timber stands and communities. There are about 4,200 acres of plantations in the shrub/forb and pole seral stage within General Forest lands that could be evaluated for stocking control needs. This includes about 1,445 acres in Hawkins/Sharber, 1,768 acres in Upper Tributaries and 987 acres in Willow Creek subwatersheds.

Special Forest Products

Opportunity 1: Provide more opportunities to meet current demands for Special Forest Products (SFP) consistent with resource protection and sustainability goals.

Possible Management Practices

Opportunities to adjust the harvest limitation established for some high demand SFP should be investigated. This action should be implemented through close coordination and cooperation with the tribes and should be consistent with resource protection and sustainability objectives for SFP resources. The quality and quantity of traditional–use SFP (e.g., bear grass, hazel) could be increased by identifying localities for fuels treatments that include periodic burning. Potential beargrass areas within the MTWAA include East Fork Campground road access area, Titlow Hill, and Horse Mountain, which is a botanical area with policy direction on acceptable harvesting activities.

Opportunity 2: Reduce conflicts between commercial and traditional harvesting of SFP.

Possible Management Practices

Future opportunities to reduce conflicts could include development of management practices and/or stewardship agreements that address concerns of both traditional-use and commercial harvesters. For example, the CIBA has expressed interest in establishing stewardship agreements with the Forest Service so that Indians can burn and maintain critical resource patches (especially beargrass and hazel). The Forest Service could designate beargrass restoration sites for Indian basketweavers that would include areas in each Tribe's ancestral areas. Commercial harvesters tend to collect older unburned beargrass for floral displays. Designated commercial harvest areas could be set up that do not include burning as a part of fuels reduction programs.

Opportunity 3: Collect additional data for improving resource management, including monitoring of SFP harvesting practices.

Possible Management Practices

Limited information is available to establish limits on collecting certain SFP based on sustainability criteria. The collection of additional data on the potential benefits of recommended management activities, such as the burning of beargrass, to improve the quality of SFP could result in additional opportunities for improving the quality of these resources.

Harvesting practices of SFP should be monitored to ensure compliance with existing limits and any potential changes to these limits. Development of a report card-based system (similar to that used by CDFG for salmon, abalone and ducks) could help with harvest volume tracking. A self-addressed report card could be issued at the time of permit issuance.

Recreation

Opportunity 1: Increase river access and enhance existing access sites.

Possible Management Practices

Develop new river access points along Hwy 96, downstream of Willow Creek, and along Hwy 299 near Salyer. This would increase day-use opportunities, primarily for shorter float trips. An additional access near the Forest Service Salyer Work Station could be located on Forest Service lands. Another access between Big Rock and Tish Tang, which would need to be on private lands due to limited availability of National Forest Lands, would allow boaters to avoid Class III rapids at and below Sugar Bowl.

Opportunity 2: Provide additional developed camping opportunities and visitor information sites close to the Mainstem Trinity River.

Possible Management Practices

If health and safety issues that necessitated closing Gray Falls Campground can be resolved, converting the site to a group camp is a possible opportunity. This would require a development and operation partnership between the Forest Service, recreation outfitters and the community. If the Gray Falls site is not converted, then a new, suitably-sized river accessible group campground should be developed.

Opportunity 3: Consider changing the use status of the Tunnel Flat access point.

Possible Management Practices

Convert the Tunnel Flat vehicle access to a trail through use of interpretative displays and gates. The conversion of the Tunnel Flat vehicle access must include adequate provisions for emergency vehicle access. Look for other potential trail connections on decommissioned roads that would accommodate equestrian, mountain biker, and hiker user groups.

Opportunity 4: Increase interpretative displays for hikers and other recreationists.

Possible Management Practices

Improve signage at trailheads to include trail maps, trail length, use type, and interpretive displays. Incorporate interpretive trails at campgrounds, such as a loop trail on the fuel break surrounding the Boise Creek Campground. Short (one mile or less) interpretive-themed trails should be the priority for adding signage and interpretive displays at trailheads.

Opportunity 5: Improve parking and trail signage at Horse Mountain for seasonal recreational users.

Possible Management Practices

Add interpretive displays to educate users regarding the importance of this area to Native American groups and its special botanical values. Place a winter conditions bulletin board at the Hwy 299 and Titlow Hill intersection to inform winter recreationists of snow and road conditions. Provide displays that identify the surrounding peaks and botanical diversity of the area.

Opportunity 6: Increase non-motorized recreation use.

Possible Management Practices

Look for other potential trail connections on decommissioned roads that would accommodate equestrian, mountain biker, and hiker user groups.

Opportunity 7: Encourage development of a scenic byway interpretive plan for the Bigfoot Scenic Byway to enhance travel experiences and increase tourism opportunities.

Possible Management Practices

This would involve collaborating with Caltrans and local tourism groups to develop and place interpretive displays and printed information at vista points, rest areas, and visitor centers. Develop guides for trips of various lengths (e.g., 2-hour, 4-hour and all-day trips) that would draw people to the area. In addition to the Bigfoot Scenic Byway, there are interpretive opportunities along the Trinity Scenic Byway as well. Local community and tourism groups should pursue grants to develop this plan.

Protecting Heritage and Other Sensitive Resources

Opportunity 1: Consider renewing the Forest Service partnership agreements with the Willow Creek Municipal Service District and the Hoopa Tribe to promote tourism and recreational use in the area.

- Clarify common goals and commit to marketing the area in a way that will not detract from the local the quality of life or negatively impact natural resources and sensitive cultural sites.

Opportunity 2: Educate recreational users about tribal values, outdoor ethics, and responsible use through printed and posted information at strategic places such as river access points, campgrounds, trail heads, interpretive areas, visitor centers, rest areas, concessionaire sites, and ranger stations.

Opportunity 3: Offer opportunities for interactions and cultural exchanges between visitors, local tourism groups, and the Native Americans by sponsoring festivals and events with cultural and recreational significance.

- Provide local products (i.e., Native American and pioneer arts and crafts) for sale at all such events and festivals.

Transportation System

The main two recommendations for transportation are to develop an accessible road prioritization matrix and to develop cooperation with the various jurisdictional parties within the MTWAA. The latter recommendation is particularly important because the Forest Service jurisdiction in this MTWAA comprises less than 50 percent of the landbase and less than 50 percent of the road miles.

The primary opportunities for transportation include the following:

Opportunity 1: Complete the assessment of the roads not identified in the ATM and located in the Hawkins-Sharber subwatershed area.

Opportunity 2: Develop a road prioritization matrix to identify specific road issues to direct future projects.

Possible Management Practices

Develop a priority rating for the road network based upon factors such as (but not limited to) erodibility, stream crossing density, recreational use, cultural use, maintenance costs, botanical concerns, fire suppression and fuel treatment access, and anadromous fish issues. A prioritization matrix system based on a number of these transportation issues would be helpful to identify and drive future projects. If the priority rathing can be expanded to incorporate other jurisdictional roads in the MTWAA, it is that much more powerful.

Opportunity 3: Initiate efforts to develop cooperative agreements on non-Forest Service roads within the MTWAA.

Possible Management Practices

There may be opportunities for the Forest Service to enter into cooperative agreements with local landowners, Tribes, Resource Conservation District, and the Willow Creek Community Services District to provide technical assistance to local governments and private property owners with organizing road associations and County Service Areas (CSA). Associations can be formed where private property owners share maintenance costs on private roads, which can ensure well-maintained access for emergency vehicles and provide a communications network and basic structure for localized community disaster plans and reducing non-point sediments. Strong collaboration between the Forest Service, Caltrans, and county governments of Humboldt and Trinity is highly recommended for immediate action to address the problem of sediment input from chronic road-related slides on state and county jurisdictional roads and highways.

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APPENDIX A

Horse Mountain Plant Species List

Table A-1. Vascular plant species list, Horse Mountain Botanical Area[1] (rare plants are in bold type).

Scientific Name	Common Name
TREES	
Abies concolor	white fir
Abies magnifica	Shasta red fir
Acer macrophyllum[2]	big-leaf maple
Arbutus menziesii[2]	Pacific madrone
Calocedrus decurrens[2]	incense cedar
Chrysolepis chrysophylla var. *chrysophylla*	giant chinquapin
Cornus nuttallii[2]	mountain dogwood
Chamaecyparis lawsoniana (=Cupressus lawsoniana)	Port-Orford-cedar
Lithocarpus densiflora var. *densiflora*[2]	tanoak
Pinus attenuata	knobcone pine
Pinus jeffreyi	Jeffrey pine
Pinus lambertiana	sugar pine
Pinus monticola	western white pine
Quercus chrysolepis	canyon live oak
Pseudotsuga menziesii[2]	Douglas-fir
Umbellularia californica[2]	California bay laurel
SHRUBS	
Amelanchier alnifolia var. *semiintegrifolia*	Pacific serviceberry
Amelanchier utahensis	Utah serviceberry
Arctostaphyllos canescens* ssp. *sonomensis[2]	**Sonoma manzanita**
Arctostaphyllos nevadensis[2]	pinemat manzanita
Arctostaphyllos viscida[2]	whiteleaf manzanita
Berberis aquifolium var. *aquifolium*[2]	tall barberry
Berberis aquifolium var. *repens*	Creeping Oregon grape
Berberis nervosa[2]	Oregon grape
Ceanothus cuneatus var. *cuneatus*	common buckbrush
Ceanothus pumilus	Siskiyou mat
Ceanothus velutinus[2]	sticky-laurel, tobacco brush
Corylus cornuta var. *californica*[2]	California hazelnut
Garrya buxifolia	dwarf silktassel
Gaultheria shallon[2]	salal
Quercus vaccinifolia	huckleberry oak
Rhamnus californica ssp. *californica*[2]	California coffeeberry
Rhamnus californica ssp. *occidentalis*	coffeeberry
Rhododendron occidentalis	western azalea
Ribes sanguineum[2]	red flowering currant
Ribes velutinum	plateau gooseberry
Rosa gymnocarpa[2]	wood rose
Rubus parviflorus	thimbleberry
Vaccinium parviflorum	red huckleberry
HERBS	
Achillea millefolium[2]	common yarrow

Scientific Name	Common Name
Achlys triphylla[2]	deer-foot, vanilla-leaf
Adiantum aleuticum[2]	five-finger fern
Allium falcifolium	falcate onion
Allotropa virgata	sugar stick
Anemone deltoidea	three-leaf anemone
Angelica genuflexa[2]	kneeling angelica
Antennaria suffrutescens	**evergreen everlasting**
Apocynum androsaemifolium	bitter dogbane
Aquilegia formosa	western columbine
Aralia californica[2]	elk clover
Arnica cernua	**serpentine arnica**
Asarum caudatum[2]	long-tailed ginger
Asarum hartwegii[2]	Hartweg's wild ginger
Aspidotis densa	Indian's dream, snake fern
Athyrium filix-femina	ladyfern
Boschniakia strobilacea	California ground-cone
Calochortus tolmiei	Tolmie's pussy-ears
Calypso bulbosa[2]	calypso orchid
Campanula prenanthoides	California harebell
Castilleja pruinosa	pruinose Indian paintbrush
Chimaphila menziesii	little prince's pine
Chimaphila umbellata var. *occidentalis*[2]	western prince's pine
Claytonia lanceolata	western spring beauty
Collinsia grandiflora	giant blue-eyed Mary
Collinsia parviflora	maiden blue-eyed Mary
Collinsia rattanii	sticky blue-eyed Mary
Collinsia sparsiflora var. *sparsiflora*	spinster's blue-eyed Mary
Crepis pleurocarpa	hawksbeard
Cryptogramma acrostichoides	American parsley fern
Dodecatheon hendersonii	mosquito bills, Henderson's shooting star
Eriogonum nudum	naked-stemmed buckwheat
Eriogonum umbellatum	sulfur flower
Eriophyllum lanatum var. *lanceolatum*	common whooly sunflower
Erythronium californicum[2]	California fawn lily
Galium bolanderi	Bolander's bedstraw
Galium muricatum	Humboldt bedstraw
Goodyera oblongifolia[2]	rattlesnake plantain
Heuchera micrantha	crevice alum root
Hieracium albiflorum	white hawkweed
Holodiscus discolor	oceanspray
Hypericum perforatum[2]	klamathweed
Iris tenuissima	long-tubed iris
Linnaea borealis	western twinflower
Lomatium tracyi	**Tracy's lomatium**

Scientific Name	Common Name
Lotus crassifolius var. *crassifolius*	buck lotus
Lotus humistratus	hill lotus
Lotus oblongifolius var. *oblongifolius*	stream lotus
Lupinus albicaulis	pine lupine
Mimulus cardinalis	scarlet monkeyflower
Mimulus pulsiferae	candalabrum monkeyflower
Moehringia macrophylla	large-leaved sandwort
Penstemon laetus	gay beardtongue
Phlox diffusa	spreading phlox
Phlox gracillus	slender phlox
Plantanthera sparsiflora	sparse-flowered bog-orchid
Polygala cornuta var. *cornuta*	horned milkwort
Polystichum munitum	western sword fern
Pseudostellaria jamesiana	false sticky starwort
Pteridium aquilinum var. *pubescens*	bracken fern
Pyrola picta[2]	white-veined wintergreen
Sedum laxum* ssp. *flavidum	**pale yellow stonecrop**
Silene californica	California Indian pink, catchfly
Smilacena racemosa[2]	false Solomon's seal
Spiraea densiflora	rose-colored meadow-sweet
Symphoricarpos mollis	creeping snowberry
Trientalis latifolia	Pacific starflower
Trillium ovatum[2]	western wake-robin
Triteleia laxa	Ithuriel's spear
Vancouveria planipetala	redwood ivy
Viola cuneata	wedge-leaved violet
Viola glabella[2]	stream violet
Viola hallii	Hall's violet
Whipplea modesta[2]	modesty, yerba de selva
Wyethia angustifolia[2]	narrowleaf mule ears
Xerophyllum tenax[2]	beargrass
GRASSES	
Danthonia unispicata	one-spike oatgrass
Festuca californica	California fescue
Festuca idahoensis	Idahoe fescue
Festuca occidentalis	western fescue

[1] Table from USDA-Forest Service, Six Rivers National Forest Special Interest Area Management Strategy, Version 1.0 , 1998 (pages 127-129).

[2] Culturally significant plant species.

APPENDIX B

Heritage Resources

Attachments for Appendix B

Attachment 1: Tables BB-1 through BB-13

Attachment 2: Maps

Attachment 3: References Cited

HERITAGE RESOURCES

Heritage resource is the term used in the following discussions to describe several different types of properties or places that are known or may be expected within the study area, such as:

?? Prehistoric Native American archaeological sites predating sustained Euro-American settlement in 1850, such as habitation sites marked by house pit depressions, and temporary camps containing scatters of flaked and groundstone artifacts;

?? Historic archaeological sites typically dating from the period from 1850 to 1952 (50 years is the general threshold for recognizing historic period resources), such as mining sites marked by tailings, ditches, collapsed structural remains, and refuse dumps;

?? Historic period architectural features older than 50 years, such as buildings (e.g., old houses, barns) and structures (e.g., old bridges); and

?? Traditional cultural places important to contemporary Native Americans who have heritage ties to the study area, such as sacred sites used by spiritual practitioners, burial grounds, areas where native plants are gathered for use in making regalia, baskets, or as traditional foods or medicines.

Human beings have inhabited the watersheds of interior northwest California for at least 8,000 years, as evidenced by results of archaeological research conducted in Six Rivers National Forest (Fitzgerald & Hildebrandt 2001, Hildebrandt & Hayes 1983, 1984, 1993) and elsewhere. Regional paleoenvironmental studies indicate that significant Holocene climatic fluctuations likely influenced prehistoric Native American subsistence practices, demographics and population movements. Native American occupation and land-uses spanning millennia are evidenced by numerous prehistoric archaeological sites found in the study area and beyond. Also known are numerous historic archaeological sites, generally dating after sustained Euro-American contact ca. 1850, that are associated with post-contact Native Americans (including those descended from the indigenous peoples), or Euro-Americans, or Chinese or other ethnic minorities who emigrated to the area for various reasons—mining, homesteading, ranching, logging, and recreation, to name a few. Beginning in 1905 with establishment of the Trinity Reserve by President Theodore Roosevelt, the Federal government began administering forestlands within the study area. Throughout all these time periods, human beings have influenced the natural environment to greater or lesser degrees.

Heritage Resources – Reference Conditions

?? *What were the prehistoric lands uses and practices?*

?? *What were the historic lands uses and practices?*

Information sources used to reconstruct past human land uses and their effects on the study area environment were drawn from on-going regional archaeological research, Native American ethnographic data mostly compiled in the early twentieth century, and historic archival data including review of historic newspaper accounts, etc. The further back in time, the less we know definitively.

Prehistoric Period Land Uses and Practices

Northwest California archaeological research initially focused on identifying Native American artifact assemblages and deciphering the prehistoric chronology, with an emphasis on examining prehistoric Native American burial lots and cemeteries (Loud 1918; Heizer & Elsasser 1964; Elsasser & Heizer 1966; Fredrickson 1984). More recent studies have broadened their view to address such issues as paleoenvironmental reconstructions (West, in Hildebrandt & Hayes 1993), site catchment analysis (Simons, in Hildebrandt & Hayes 1983; Simons, in Eidsness 1993), technology and adaptive responses to environment (Hildebrandt 1984; Levulett & Hildebrandt 1987; Hildebrandt & Hayes 1993; Hildebrandt & Swenson 1985), and trade (Bennyhoff & Hughes 1987; Hughes 1978; Levulett & Hildebrandt 1987). These studies have provided insights into some of the major environmental and archaeological trends within the region over the past 8,000 years. Summarized below is the prehistoric cultural sequence for the region that is best understood in terms of archaeological patterns, defined as follows:

> *An archaeological pattern…represents an adaptive mode shared in general outline by a number of analytically separable cultures over an appreciable period of time within an appreciable geographic space. A pattern is characterized by (a) similar technological skills and devices (specific cultural items); (b) similar economic modes (production, distribution, consumption), including especially participation in trade networks and practices surrounding wealth (often inferential); and (c) similar mortuary and ceremonial practices…* (Fredrickson 1973:118).

The Early Period: Borax Lake Pattern

The seminal work defining early prehistoric period assemblages in the northern North Coast Ranges of California was the Pilot Ridge-South Fork Mountain (PR-SFM) project sponsored by Six Rivers National Forest for logging and road-building undertakings in compliance with Section 106 of the National Historic Preservation Act (Hildebrandt & Hayes 1983, 1984; Hayes & Hildebrandt 1986). The PR-SFM study area is located just south of the WAA boundaries in interior northwest California.

The Early Period adaptation referred to as the Borax Lake Pattern is characterized as generalized hunting and gathering by small, highly mobile family groups who employed the "searcher" strategy as defined by Binford (1980). Provisional dates of 3,000 to 6,000 years Before Present (B.P.) were assigned to the Borax Lake Pattern sites at PR-SFM based on obsidian hydration data, although radiocarbon dates were not initially obtained. Subsequent databased on correction rates constructed for the Sacramento River Canyon translated into dates that were in general concordance with the previous provisional dates (Hildebrandt & Hayes 1993:110). More recently, a radiocarbon date of ca. 8,000 years B.P. was obtained for a housepit floor with associated Borax Lake Pattern artifacts at a site on Pilot Ridge, making this the oldest dated structural remains in northwest California to-date (Fitzgerald & Hildebrandt 2001).

The assemblage consists of relatively large Borax Lake Widestem projectile points (typically made of locally available chert), handstones and millingslabs, and ovoid and domed scrapers (Figure B-1). Borax Lake pattern sites typically contain a similar array of artifact types, implying each served as a base camp where similar activities took place, and a lack of specialization. Obsidian is poorly represented, suggesting exchange networks with obsidian rich areas (southern North Coast Ranges, northwest California) were not established.

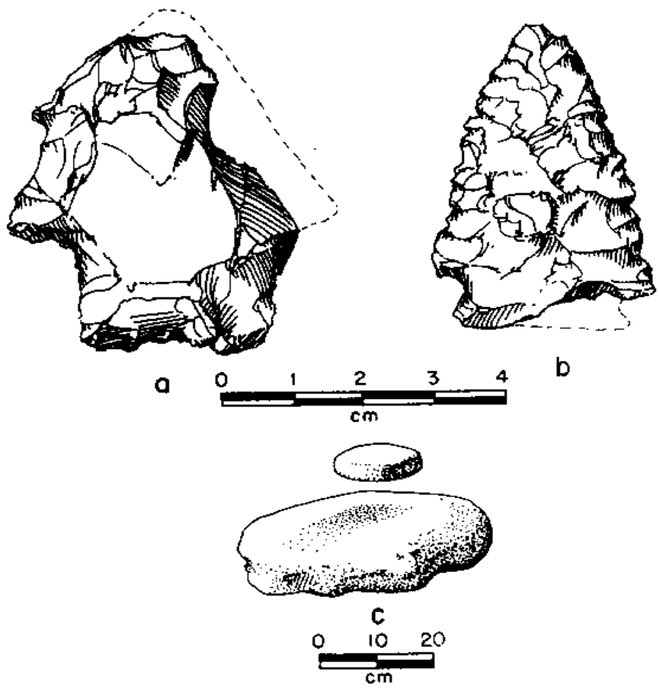


Figure B-1. Borax Lake Pattern. Objects a and b – stone spear points; c – handstone and milling slab

This adaptive pattern corresponded to a significant Xerothermic warming trend that followed the Ice Age when yearly average temperatures were estimated to be 1.3 to 2.1 degrees Centigrade warmer than today, resulting in warmer summers with a longer dry season for interior northwest California (West, in Hildebrandt & Hayes 1983). Palynological data for the North Coast Ranges imply that oak woodlands were more widely distributed than at present, while Douglas-fir forests were more restricted. Keter (Eel River Basin n.d.:7) hypothesized that fauna of interior northwest California would have been affected by shifts in vegetation and climate during the Xerothermic. Summer deer habitat would have been reduced in area and concentrated at higher altitudes, and anadromous fish runs would have been significantly reduced due to lower stream flows and reduced density and distribution of riparian vegetation. In addition, perennial springs were probably reduced in number and flow. Warmer temperatures may have allowed for longer human occupation at higher elevations.

The PR-SFM excavations, coupled with research in Mendocino National Forest to the south (Hildebrandt & Swenson 1985) and analysis of collections from the Bald Hills area of Redwood National Park (Hayes et al. 1985) to the west of the present study area indicate that Borax Lake Pattern sites are spatially skewed to high (relative) elevation locations. Major trending ridge systems, such as South Fork Mountain, likely served as principal travel corridors in the North Coast Ranges as evidenced by the high number of Early Period base camp sites and frequent isolated artifacts. Subsequent studies have identified several Borax Lake Pattern assemblages at lower elevation settings, including a single-component site on the Trinity River at Big Bar (Sundahl 1988) and a site on the elevated ocean terrace at McKinleyville in Humboldt County (Roscoe 1995). Widestem points have been found at sites along the Trinity River and South Fork Trinity River outside the present study area (Eidsness 1985), but none of these sites have been formally investigated.

In summary, archaeological evidence implies the human subsistence strategy dating from ca. 8,000 to 3,000 years B.P. involved small groups, probably consisting of one or several extended families, who frequently moved their camps and foraged for a wide range of subsistence resources that required little handling or processing. The high frequency of large stemmed projectile points and millingstones infers a reliance on large game (elk and deer) and hard seeds (grasses, nuts, etc.). Early Period sites are best evidenced at higher elevations, especially along the major trending ridges of interior northwest California (South Fork Mountain, Pilot Ridge, Bald Hills of Redwood National Park), where the Xerothermic climatic regime would have favored longer periods of occupation, a more diverse and abundant mosaic of plant communities, and concentrated deer populations. Borax Lake Pattern assemblages are also known for lower elevation settings along the mainstem Trinity and South Fork Trinity rivers, where alluvial processes are more active and may have eroded away, buried, or otherwise obscured their identification. Hypothetically, the population was relatively low with no permanently settled villages or defined territorial boundaries, no or little competition for resources, low population growth, and ad hoc (versus regularly established) interactions and trade with people in outlying areas. The linguistic archaeology model for the region infers that the earliest inhabitants of the Trinity WAA may be related to Hokan affiliated Indian language groups (e.g., proto-Chimariko, proto-Karuk) (Whistler 1977, 1979; Fredrickson 1984:508-509).

The Middle Period: Willits Pattern

The Middle Period in northwest California is represented by the Willits Pattern as proposed by Hildebrandt & Hayes (1983, 1984). This adaptive pattern was oriented towards use of low-elevation villages, located along salmon-bearing streams near acorn crops and occupied by larger concentrations of people during the winter months. Compared to the earlier Borax Lake Pattern, this adaptation is hypothetically linked to the advent of storage facilities, particularly for fish and acorns to feed the population during the lean winter months. It represents an adaptive shift to the "pursuer" pattern of Binford (1980), wherein resources were moved to the people, resulting in a variety of functionally different site types that reflect more specialized activities. For example, Middle Period site types include (1) more permanent, winter occupied villages near anadromous fish streams; (2) temporary seasonal camps at various elevations that served as basis for hunting deer or other animals, acorn collecting or procuring other subsistence resources such as bulbs, berries, grass seeds, or basketmaking materials; and (3) task-specific sites used for quarrying locally available rock types (primarily Franciscan chert) used to manufacture flaked-stone tools, harvesting or processing certain plants, or used for spiritual training or ceremonial activities.

This adaptive shift hypothetically coincided with a significant cooling trend referred to as the Neoglacial. The distribution of vegetation communities in interior northwest California began responding to the more maritime weather pattern by approximately 3,000 to 2,500 years ago. This climatic shift resulted in a relative decline in the variety and productivity of upland resources, expanding the distribution of

Douglas-fir forests in the uplands, triggering a downslope reduction in oak woodlands, and promoting expansion of riparian zones along waterways. The moderating conditions (shorter dry season, reduced evapotranspiration, possible increased annual rainfall) likely provided for increases in groundwater flows and the number of active springs (Keter n.d.:7). Significantly, anadromous fish runs are believed to have become more productive and reliable in local rivers.

Archaeologically, Willits Pattern sites are marked by a greater variety of generally smaller projectile point forms (Willits Series and Oregon Series), distinctive unifacial flake tools (McKee Uniface), and greater reliance on mortars and pestles (associated with acorn processing) over millingslabs and handstones (Figure B-2). Middle Period components excavated on the high elevation PR-SFM implied specialized activities, including the establishment of Indian burning practices to maintain open prairies as suggested by palynological data (Weigel, in Hildebrandt & Hayes 1993). Hildebrandt & Hayes (1993:116) noted that Willits Pattern components at lower elevations in interior northwest California contained a diversity of artifacts including bowl mortars, pestles, non-utilitarian items, and well-developed middens. Apparently, limited human use of coastal resources is evidenced by Willits Pattern components investigated at sites located at the mouth of the Mattole River (Levulett & Hildebrandt 1987:27-28), at Point St. George in Del Norte County (Gould 1966, 1972), and on the margin of Humboldt Bay (Eidsness 1993).

At least one study area site (CA-TRI-429) along the mainstem Trinity River contains artifacts (McKee Unifaces) that are time-sensitive for the Middle Period Willits Pattern (Eidsness 1985:332). Other Willits Pattern time-markers have been documented for sites along the mainstem Trinity and South Fork (Eidsness 1985).

In summary, the Middle Period dating from ca. 3,000 to 1,100 years B.P. in interior northwest California coincided with a significant cooling trend (Neoglacial) that triggered a downslope migration of oak woodlands, expanded riparian vegetation, and promoted a more productive and reliable anadromous fishery in the Trinity River watershed. The first permanent settlements were established along the rivers, where extended family groups lived together during the winter months and relied on stored foods (especially fish and acorns) to sustain them during lean times. During warmer months, the village populations dispersed into smaller groups who carried out a seasonal round of hunting and collecting, occupying seasonal base camps and using various special activity sites in more upland areas.

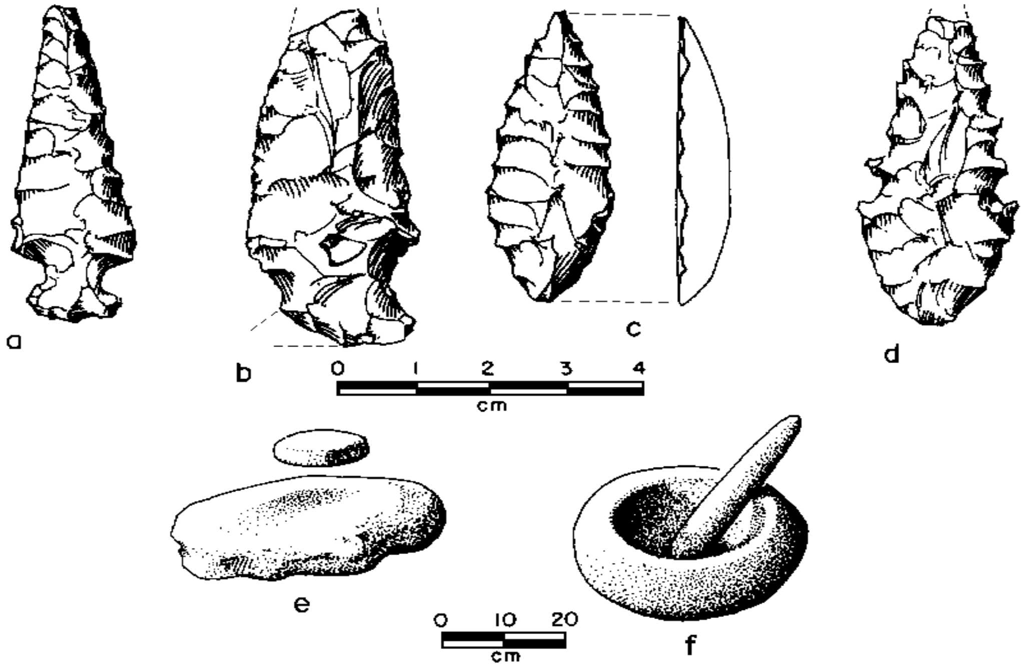


Figure B-2. Willits Pattern Assemblage. Objects a, b, and d – stone spear and atlatl points; c – unifacial tool; e – handstone and milling slab; f – stone bowl mortar and pestle

Archaeolinguistic studies infer that during the Middle Period, the ancestral Wintuan entered the upper Sacramento Valley between ca. 2,000 and 1,500 years B.P., followed some 200 years later by ancestral Patwin in the lower Sacramento Valley and then by Hill Patwin expansion up the drainages toward Clear Lake in the southern North Coast Ranges. Based on reconstruction of Wintuan plant and animal terms, the upper Rogue River was the most likely Wintuan homeland (Moratto 1984:560-563; Whistler 1980).

The Late Period: Gunther and Gunther/Augustine Patterns

The Late Period in northwest California exemplifies some of the most socially complex hunter-gatherer populations who relied heavily on marine and/or riverine resources (Fredrickson 1984; Kroeber 1925; Loud 1918). The Gunther Pattern characterizes the Late Period adaptation among north coastal populations. This Late Period assemblage was first described by Loud (1918) based on archaeological data from Gunther (Indian) Island in Humboldt Bay (ethnographic Wiyot territory). It comprises several specialized tool kits intended for a variety of subsistence activities fishing, hunting (including sea mammal hunting), and vegetal resource procurement and storage. Significant traits include a well-developed woodworking technology, marine and riverine fishing specialization, wealth consciousness, and distinctive artifact types including zoomorphs, large obsidian ceremonial blades, antler spoons, steatite bowls and pipes, and small distinctive barbed, Gunther Series arrow points. Populations were concentrated in permanent villages sited around Humboldt Bay and coastal lagoons, along the coast and adjacent to the major rivers. Exchange networks had become regularized in the Late Period. Trade is documented both archaeologically (Hughes 1978; Levulett & Hildebrandt 1987) and ethnographically (Powers 1877; Loud 1918; Kroeber 1925; Nomland 1935, 1938), with exchange relationships reaching north to Vancouver Island for dentalia shells, east to the Warner Mountains and Medicine Lake Highlands for obsidian, and south to the San Francisco Bay region for clam shell disc beads.

Gunther Pattern sites are well documented for north coastal California (cf. Heizer & Elsasser 1964; Heizer & Mills 1952; Elsasser & Heizer 1966; Fredrickson 1984). The Gunther Pattern dates from ca. 1,100 years B.P. to historic contact, and characterizes the material culture of the ethnographically described Wiyot, Yurok, Tolowa and other North Coast tribes.

A blending of adaptive traits employed by Late Period populations of interior northwest California is referred to as the Gunther/Augustine Pattern. The Gunther Pattern is described above. Focused in California's Central Valley, the Augustine Pattern adaptation is distinguished by an emphasis on hunting, fishing and reliance on acorns as a staple food source. Gunther/Augustine Pattern assemblages identified in the upper Redwood Creek drainage in Redwood National Park (ethnographic Chilula territory) include a variety of small barbed and notched stone arrow points, and hopper mortar slabs and pestles (Hayes et al. 1985) (Figure B-3). Hypothetically, these Late Period adaptations are similar to but a more refined and specialized form of the preceding Willits Pattern adaptation (Hildebrandt & Hayes 1984). The Gunther/Augustine Pattern adaptation is evidenced archaeologically within ethnographic Chimariko territory (Eidsness 1985) and would be expected for Late Period sites within the ethnographic territories of the Tsnungwe and Hupa. Our understanding of Late Period Indian cultures in northwest California is greatly enriched by the relative detail found in ethnographic accounts (see below).

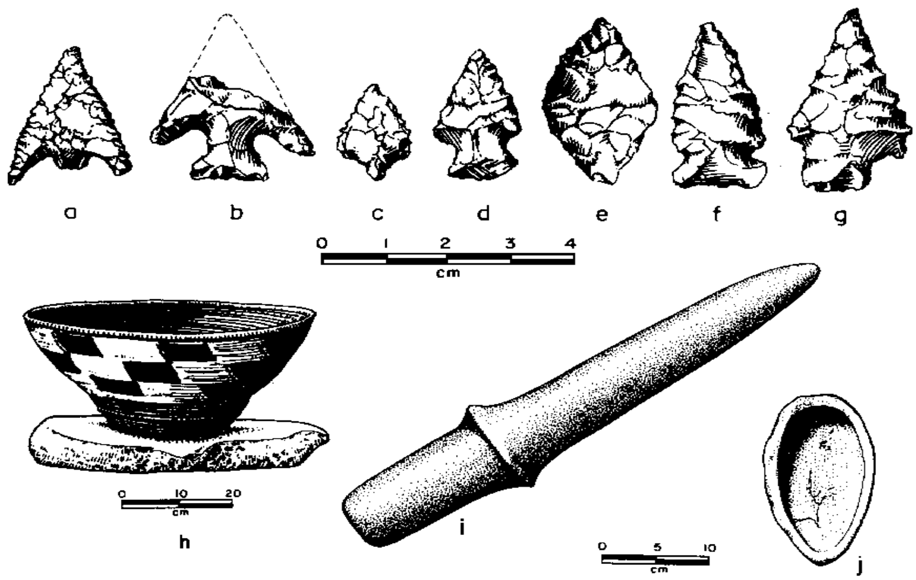


Figure B-3. Gunther/Augustine Pattern Assemblage. Objects a-g – stone arrow points; h – basket hopper on stone mortar base used with i, stone pestle; j – stone serving/cooking bowl

In summary, dating from ca. 1,100 years B.P. the Late Period within the study area and interior northwest California is represented archaeologically by the Gunther/Augustine Pattern, a subsistence adaptation that relied principally upon anadromous fish, deer and acorns as staple foods. Permanent winter villages occupied by multiple extended families were sited along the major fish-bearing rivers and creeks, typically well above flood levels. Village sites are typically marked by well-developed ash-stained midden deposits, a variety and abundance of artifact types made of stone, bone and shell, discarded food remains such as animal and fish bones, charred acorns and seeds, architectural features such as housepit and sweathouse depressions, and cemeteries. Away from the village sites in a variety of elevational and environmental settings were seasonal camps used as bases for hunting, gathering acorns, collecting berries and bulbs, etc., and task-specific sites used for mining tool-stone, doctor training, trapping birds, etc. Throughout the region, Native Americans regularly set fire to the prairies and oak woodlands for reasons related to strategies of hunting and gathering (Gates et al. 2002; Heizer 1972; Keter 1986; King & Bickel 1980; Lewis 1973, 1985; Lewis & Ferguson 1987; Loud 1918; Thompson 1990; Veirs 1989). Food processing and storage technologies were advanced, promoting population growth, establishment of resource area claims by certain families or village communities, and craft specialization. Exchange relationships became more regularized as evidenced by relative increases in imported goods such as obsidian traded in from the Medicine Lake Highlands near Mount Shasta and used locally for making utilitarian tools as well as ceremonial blades.

The most commonly cited archaeolinguistic model infers that peoples representing three distinct language groups moved into interior and coastal northwest California during the Late Period. The beginning of the Late Period in northwest California hypothetically coincided with expansion of Wintu speakers from the Sacramento Valley into the upper Trinity River drainage ca. 1,100 to 1,000 years B.P. This population movement may have displaced the Chimariko on the eastern and southeastern fronts, as implied by many original Chimariko place-names incorporated into the Hill Wintu language (Bauman 1980; Kroeber 1925:109-110). Archaeologically, the Wintuan incursion coincides with the beginning of the Augustine Pattern, inferring they introduced to the indigenous peoples such characteristic traits as bow and arrow technology, harpoons, flanged tobacco pipes and preinterment grave-pit burning (Moratto 1984:562-563; Whistler 1977).

Hypothetically ca. A.D. 900, the Wiyot entered and occupied the lower Klamath River and adjacent coast, leaving behind their mid-Columbia River homeland. Some 200 years later, the Yurok moved down the Klamath River from a northern origin, settling along the lower Klamath and displacing the Wiyot to the vicinity of Humboldt Bay. The Wiyot and Yurok languages are assigned to the Algic Stock, and linguistic differences imply separate movements to the north coast rather than *in situ* divergence. The Algic groups are believed to have introduced such traits as a woodworking technology, riverine fishing specialization, wealth consciousness, and other artifact types associated with the Late Period Gunther Pattern.

Hypothetically, the last to enter the region ca. 1,300 A.D. were the Athabascans (Hupa, Tsnungwe, etc.) who moved south from coastal Oregon, possibly through the inland hill country, skirting the Algic enclaves and taking up residence along the relatively sparsely populated streams of interior northwest California (Moratto 1984:564-545; Whistler 1979). Expansion of Athabascan speakers up the Trinity River and possibly into the New River drainage may have displaced and/or absorbed through marriage alliances the Chimariko on their western and northwestern fronts (Kroeber 1925; Powers 1877).

Gmoser (1988) presents an alternative model of population movements and establishment of territorial boundaries in northwestern California based on ecological factors, noting inconsistencies in both the nature and timing of the events predicted by Whistler's archaeolinguistic model and Hildbrandt & Hayes' more recent technoenvironmental archaeological model. Gmoser (1988:4) hypothesizes that distributions of hunting and gathering populations in any given area cannot be understood without reference to underlying environmental conditions, especially the productivity and distribution of principal food sources. For the north coastal and interior regions, terrestrial and riverine productivity values are calculated for both the mesic and the xerothermic climatic episodes. The mapping data show clear distinctions in the distribution of high terrestrial versus high riverine/coastal productivity areas, each representing largely exclusive niches for both the xeric and mesic episodes that require different technological emphasis, scheduling considerations and social arrangements for effective exploitation. The productive potential of riverine segments, especially at confluences of major streams, is especially noteworthy for the interior, with one of the most productive areas (both xeric and mesic regimes) along the mainstem Lower Trinity River and South Fork Trinity. Coupled with the extraordinarily high terrestrial productivity of Hoopa Valley, the present study area is predicted to have been the focus of initial occupation in prehistory (Gmoser 1988:203-205).

Gmoser concludes by proposing an alternative model of population movements that has implications for future archaeological research, as follows. About 5,000 years ago (xeric), Algic groups (ancestral Wiyot and Yurok) occupied areas largely to the north and west of the Klamath-Siskiyou crest and along the coast, Hokan groups (ancestral Chimariko, Karuk) occupied the area east, and Yukian (ancestral Yuki, Wappo) groups were south. These groups were highly dispersed, with the greatest amount of interactions occurring at places having higher terrestrial productivity. The onset of the Neoglacial between 2,500 and 3,000 years ago would have influenced a major realignment: relatively thinly spread populations retreated towards highest productivity areas along the rivers and coast, where they became less mobile and began developing specialized technologies; marginal areas became less used or were abandoned, allowing for the entry of bands speaking Athapascan languages (ancestral Hupa, Tsnungwe, etc.) who were the latest stock to expand southward on a more continental scale, perhaps acting as intermediaries in trade networks with their language being a kind of *lingua franca* among other tribes. The Wintuan and Shastan language family groups were the last to expand into interior northwest California, spreading from higher productivity areas further inland until they encountered higher productivity locations already occupied by the Karuk, Chimariko and Athapascans (Gmoser 1988:213-218). In conclusion, Gmoser's model posits that all the major linguistic groupings (stocks and families) were in place at the general locations observed ethnographically, by the end of the Middle Period, dating ca. 500 to 900 A.D.

Yurok, Hupa and other Native peoples of northwest California assert their ancestors have been here "since time immemorial."

Ethnographic Background

Information pertaining to languages and cultures of the Indian groups who inhabited northwest California at the time of historic contact was initially documented by early Euro-American explorers, settlers and government officials (e.g., Cox 1940, Gibbs 1853, Powers 1877). Most ethnographic data was obtained by trained anthropologists who conducted field research between ca. 1900 and 1930, several generations after the gold rush events decimated Native populations and disrupted traditional lifeways. The following ethnographic summary focuses on land uses and subsistence practices described for the Hupa, Tsnungwe, and Chimariko.

Hupa

Hupa ethnography is among the best documented of any Indian group in California. Major sources were authored by Baumhoff (1958), Driver (1939), Goddard (1903, 1904), Kroeber (1925), Powers (1877) and Wallace (1978). Other sources include more recent works sanctioned by the sovereign political body governing the Hoopa Valley Indian Reservation (Nelson 1978; Steinberg et al. 2000).

Territory

Ethnographic Hupa territory encompassed the lower Trinity River watershed from a point upriver of its confluence with the Klamath, where they bounded Yurok territory on the north, to a point upriver of present-day Willow Creek, where they bounded the linguistically and culturally related Tsnungwe (a.k.a. South Fork Hupa) on the south (Baumhoff 1958:Maps 16-17). Hupa territory bounded another Athabascan group, the Chilula, on the west along the divide between the Redwood Creek basin, and Hokan language affiliated groups (Karuk, Shasta and Chimariko) on the northeast and east along the high upcountry divides separating the middle Klamath River, Salmon River and New River watersheds. The six-mile-long by one to two-mile-wide Hoopa Valley with its moderate climate and relative isolation, is the heartland of ancestral Hupa territory, where the population, permanent settlements, ceremonial places and other land-uses were concentrated.

Settlements and Population

Access to both spring and fall runs of anadromous fishes and positioning of winter villages as well as summer camps along the lower Trinity River distinguished the Hupa as being more firmly attached to their riverine environment than any other Athabascan group in northwest California (Baumhoff 1958:209). Table B-1 lists the seven named ethnographic Hupa villages mapped along the river within the present study area by Baumhoff (1958:Map 17). Those villages identified in Table B-1 located in southern Hoopa Valley were affiliated ("Southern Division") for the purposes of constructing a nearby fish weir and holding important religious ceremonies. Hupa villages of the "Northern Division" were similarly affiliated and constructed a fish weir upriver near Mill Creek, downriver of the study area (Wallace 1978:169). Hupa villages outside Hoopa Valley proper were more widely spaced apart, had lower populations, and the lowest status with regard to access to anadromous fish runs, being sited further upriver. The estimated 1848 Hupa population numbered 1,000 persons (Cook 1976:236), and this number apparently includes the Tsnungwe. Individual Hupa village populations numbered from 50 to 200 inhabitants (Wallace 1978:169).

Table B-1. Named ethnographic villages within the Mainstem Trinity Watershed Analysis Area.

Village Name	Notes	Reference
Hupa Villages		
Medildin (per Goddard)	"place of boats," "canoe place," largest village in Hoopa Valley on Trinity River with 28 houses, a village of southern Hupa division that manifests itself in religious matters, fish weir built near here in alternate years	Baumhoff 1958:212 Wallace 1978:Table 1 Goddard 1903:24
Ho-wung-kut (per Merriam)	village of southern division in Hoopa Valley on Trinity River, 14 houses	Baumhoff 1958: 213
Tish-Tahng-ah-tung (per Merriam)	on Trinity River, 9 to 13 houses reported	Baumhoff 1958: 213
'Has-lin-ting (per Merriam)	"waterfall place" on Trinity River just outside Hoopa Valley, southernmost of principal villages, 6 to 9 houses reported	Baumhoff 1958: 213
She-ach-pe-ya (per Gibbs)	on Trinity River outside Hoopa Valley, probably the Yurok name for village, 4 houses	Baumhoff 1958: 213
Wang-ulle-watl (per Gibbs)	on Trinity River near Willow Creek, probably the Yurok name for village, 3 houses	Baumhoff 1958: 213
Wang-ulle-wutle-kauh (per Gibbs)	on Trinity River above Willow Creek, probably the Yurok name for village, 1 house	Baumhoff 1958: 213
Tsnungwe (South Fork Hupa) Villages 1		
Hlah'-tung (per Merriam)	on high ground on both sides of major tributary at Trinity River confluence	Baumhoff 1958: 213
Ti-koo-et-sil'-la-kut (per Merriam)	on Trinity River opposite major confluence	Baumhoff 1958: 213
Me-meh (per Merriam)	on Trinity River in Salyer vicinity2	Baumhoff 1958: 213
Chimariko Villages		
Mamsu-ce	on Trinity River near Salyer[2]	Silver 1978: Figure 2
Hamayce	on Trinity River near Hawkins Bar	Silver 1978: Figure 2

[1] Additional named Tsnungwe villages, camps and places reported along mainstem Trinity River by Tsnungwe Council (2001, cited by Tsnungwe Council 2002).

[2] Village locations infer overlapping boundaries between Tsnungwe and Chimariko along the Trinity River; linguist Victor Golla (1996, cited by Tsnungwe Council) also recognizes Tsnungwe territory overlapped with that of the ethnographic Chimariko in the Burnt Ranch and New River areas.

<u>Subsistence</u>

While salmon and acorns (both fresh and dried) were the principal food resources for the Hupa, they also fished for steelhead, lamprey eels, trout, and other small fishes, hunted for deer and elk, and gathered a variety of nuts, seeds, berries, fruits, roots and greens (Wallace 1978:164) to add variety to their diet. The Hupa also had a rich material culture including: distinctive types of architecture such as the *xonta* (family house) and *taikyuw* (men's sweatlodge); an array of expertly woven basket types associated with all phases of the Hupa life cycle; fishing, hunting and food processing tools made of wood, stone, animal parts and plant fibers; elaborate ornaments and regalia made of furs and skins, feathers, beads (e.g., pine nuts, imported marine shells), twine and basketry materials; distinctive fishing and hunting tool kits with associated traits and constructions such as fish weirs and deer blinds; and more. In order to demonstrate the wide range of environments familiar to and resources relied upon by the Hupa, Table B-2 summarizes important resources found in different environmental zones as drawn from ethnographic data.

Table B-2. Important resources by environmental zone used ethnographically by the Hupa.*

Riverine Resources	
Fisheries	Salmon, steelhead, lamprey eel, trout, other small fishes, otters Salmon was a principal food. For salmon and steelhead, used dip nets, weirs (fall runs), gill nets, dragnets, harpoons; for eel, used nets and basket traps; for trout and small fishes used hook and line. Otter skins used to make quiver pouches, hair wraps, clothing, etc.
Cobbles and pebbles	Used as paving stones for house and sweathouse paving, lining fire hearths; used to manufacture notched net weights, groundstone milling tools (mortars, pestles), selected rock types (e.g., chert) used to make flaked-stone tools; used as hammerstones for making flaked-stone tools, as cooking stones (especially for acorn), for building fish weirs
Potable water	Freshwater drinking source, water for leaching acorns in sand basin, used for cooking
River for transportation	Dugout canoes
River for bathing	Personal hygiene and ritual bathing
River for ceremony	Ritual travel for Boat Dance and other activities associated World Renewal Ceremony (see Kroeber and Gifford 1949)
Riparian vegetation	Alder, willow, red bud, cottonwood, grape and other associated plants important for making baskets, twine, rope; wood sources for firewood, constructing fish weirs; certain medicinal plants collected
Various birds	Especially important as source of feathers for arrows, making regalia (especially woodpecker scalps), some hunted for food (ruffed grouse, pheasant, mountain quail)
Prairie and Oak Woodland Resources	
Acorns	Tan oak (*Quercus densiflora*) preferred, staple food (understory managed by burning)
Deer and elk hunting grounds	Hunted with bow and arrow, using snares, blinds, camouflaging hunters scent and appearance, driven by dogs into entrapments, pursued by canoe and clubbed when in river. Provided food, material for clothing, blankets, footwear, sinew for bow strings and thread, bone and antler for manufacturing tools such as awls, wedges and flaking tools, and making ornaments and regalia; brains used for tanning hides; marrow mixed with pigments for dyes (browse vegetation managed by burning)
Various plants	Seeds (grasses, certain *Compositae*), bulbs (lily family), leaves (wild grape, wood sorrel), roots (hazel), berries (manzanita, madrone, huckleberries, raspberries, thimble berries, gooseberries, currants, blackberries, etc.), nuts (hazel nut, chinquapin, pepperwood, sugar and digger pine nuts), fresh shoots (*Wyethia* sp., *Angelica* sp.), ferns (bracken, woodwardia, maidenhair), herbs, mushrooms, etc. Provided foods, medicines and materials for making baskets, nets for fishing and bird hunting, cordage used for house construction, making clothes and other uses (Hazel managed by burning)
Oak and other hardwoods	Used for cooking fires, smoking fish, making stools and headrests, etc.

Conifer Forest Resources	
Cedar	Principal source of house and sweatlodge building material
Pines	Pine nuts collected for food, making ornaments; yew wood preferred for making bows, tobacco pipe stems; roots of digger and yellow pine used in basketmaking
Beargrass	Important basketmaking material (beargrass managed by burning)
Various berries, mushrooms, etc.	Food sources
High Elevation Resources	
Prominent peaks, springs, etc.	Used by religious practitioners for doctor training and purification before important ceremonies
Upland flora and fauna	Seasonal subsistence round brought smaller groups to higher elevations in late summer when important plants ripened and hunting opportunities best; lichen (*Evernia vulpine*) used to dye basket materials grows best on trees at higher elevations
Geological Resources	
Clay	Used for sealing cracks and lining floors of houses
Steatite	Used for making tobacco pipes, bowls, ornaments
Chert	Outcroppings mined for toolstone

* Principal data sources are Goddard (1903), Nelson (1978), Wallace (1978), Steinberg et al. (2000), and author's familiarity with local archaeological assemblages and Hupa ethnographic collections.

Baumhoff (1958) best summarizes the subsistence round among Athabascan groups, relying heavily on accounts for the Lassik to the south but noting that while there was undoubtedly variation among the groups, "they must have followed a similar pattern."

> *The most difficult time in the annual cycle of food production was winter. There were then few fish and almost no game animals or crops for gathering. From late November to early March people had to rely on food that had been stored the previous year. Essene's informant said that about every four or five years there would be a hard winter, but she could remember only one when people actually starved to death.*
>
> *In February or March the spring salmon run began, and after that the danger of starvation was past. At about this time the grass began to grow again, and the first clover was eaten ravenously because of the dearth of greens during the winter.*
>
> *The herb-gathering and salmon-fishing activity lasted until the spring rains ended in April or May, when the people left their villages on the salmon streams and scattered out into the hills for the summer. Usually only a few families would stay together during the summer, while the men hunted deer, squirrels, and other animals and the women gathered clover, seeds, roots, and nuts. Food was most plentiful at this season, and the places visited varied with the abundance of different crops. If a certain crop was good, the Indians would spend more time that summer in the area where the crop grew best. The next year they might go somewhere else. The vegetation of the Athabascan habitat is not well enough mapped to permit a precise delineation of these various summer camping grounds.*

In September or October, when the acorns were ripe, the Indians would return to their winter villages and smoke meat for storing and probably store the acorns. Each family built a new house to protect it from the heavy winter rains. After the first rain in the fall the salmon run again in some of the streams of the region and were caught and smoked for winter storage.

It is evident that the crucial factor in the economy was the amount of food stored for winter and that this food supply was a controlling influence on the size of the population, since, in bad years, people starved. At least, this was for the Lassik, and it was no doubt true among the other groups as well. Salmon, meat, and acorns were doubtless the chief foods stored, and thus population size would have responded quite sensitively to the quantity and condition of the salmon, deer, and oak trees. (Baumhoff 1958:158)."

Traditional Burning Practices

Ethnographers documented that the Hupa employed fire to keep areas open, enhance the quality of basketry materials, clear the duff under oaks where they annually collected acorns, and drive deer (Curtis 1924; Goddard 1903; Wallace 1978). Throughout the region, ethnographic and historical accounts indicate that Native Americans regularly set fire to the prairies and oak woodlands for reasons related to strategies of hunting and gathering (Heizer 1972; Keter 1986; King & Bickel 1980; Lewis 1973, 1985; Lewis & Ferguson 1987; Loud 1918; Thompson 1990; Veirs 1989). Evidence of historic encroachment on prairies by Douglas-fir in the Bald Hills of Redwood National Park, west of the study area, is well documented by the National Park Service and linked most directly to cessation of Indian burning practices (Gates et al. 2002).

Travel

River travel was common among the Hupa, who obtained redwood canoes in trade from the Yurok (Kroeber 1925; Wallace 1978:168). They also relied upon a network of trails that connected the permanent river settlements with more remote camps, procurement areas and ceremonial sites, and linked the Hupa to neighboring groups.

Ceremonial Activities and Sacred Places

Among the Hupa and other Indian groups of northwest California, daily activities (cleansing, hunting, plant collecting, hunting, basketmaking, etc.), as well as significant events in a person's life (birth, puberty, marriage, childbearing, death), were imbued with sacred qualities acknowledged by performing ritual observances. Prayers were made for success in hunting, fishing and gathering. For hunting success, the Hupa sought the favor by singing songs and praying to the Tans, deer-tending gods who lived on principal ridges and certain peaks (Goddard 1903:77-78), and practiced certain ritual behaviors (Steinberg et al. 2000:150). Rituals marked the beginning of the annual spawning runs and acorn harvests. Within the present study area, a First-Salmon Ceremony was held in Sugar Bowl Valley, a place famous among the Hupa for fishing, associated with myths, and location of a sacred rock inhabited by a spirit that influenced weather and was referred to by the Hupa as "Thunder's Rock" (Wallace 1978:174; Goddard 1903:78). Rituals were recited and songs sung when gathering basket making materials, foodstuffs or other plant materials, and when making baskets.

Two major Hupa ceremonies were the White Deerskin Dance and the Jump Dance, which are intended to renew the world for the coming year and to prevent famine, disease and other disasters (Wallace 1978:174; Kroeber & Gifford 1949). World Renewal Dances were (and continue to be) enacted by the Hupa at designated locations, none of which fall within the present study area.

Trails were often invested with religious significance and were "just the same as people" (Goddard 1903:88). It was wrong to step out of them without some good reason. Ritual practices were observed when traveling along trails that led to spiritual areas and other places. The trail from Hoopa to Sugar Bowl Valley, within the WAA, was marked by places along the side for prayer and rest (Theodoratus et al. 1980:96).

Religious doctors (both women and men) observed religious practices when preparing for ceremonies, taking instruction from trained practitioners and observing strict rules governing diet, sexual activities and other aspects of daily life. Doctor training involved making a series of trips to sacred places in the high country, including Telescope Peak and Horse Mountain within the Mainstem Trinity WAA, along with Trinity Summit, among others (Theodoratus et al. 1980:95-97; Winter et al. 1979). With regard to Horse Mountain, it was said that the Hupa "borrowed" its use from the Whilkut (Victor Golla interview by Heffner 12/8/78, cited in Theodoratus et al. 1980:96). The trails to the high country were imbued with sacredness and places where ritual observances were made. Just north of the present study area in Hoopa Valley was a main access corridor leading to the Mainstem Trinity Summit area (De-No-To District).

Tsnungwe

The term *tse:ningxwe*, as spelled in the current orthography of the Hupa language, was the name used by the Hupa speaking people of the Willow Creek, South Fork, Burnt Ranch and New River areas, whose descendants today refer to themselves as Tsnungwe (Tsnungwe Council 2002). The derivation is from the word for Ironside Mountain, *Tse:nung-ding* (*tse*, rock; *nung*, a sloped face; *ding*, place), referring to the people from around their sacred mountain (Eargle 2000 & Tsnungwe Council Federal Acknowledgement Petition dated December 2000, cited by Tsnungwe Council 2002).

Published ethnographic data concerning the Tsnungwe are sketchy relative to the Hupa. Accounts distinguish the Tsnungwe from the Hupa based on two or possibly three principal traits: although speakers of an Athabascan affiliated language, their dialect was slightly different that that of the Hupa; the Tsnungwe were not considered a part of the Hoopa Valley people by the Hoopa Valley Tribe in their authorized tribal history, although it was noted that they respected the authority of the Hupa leaders, served as soldiers for the Hupa and sometimes attended Hupa ceremonies; and their geographic separation from Hoopa Valley and the village groups who controlled important ceremonial activities (Nelson 1978:23 and footnote #37 on page 202; Goddard 1903:7).

Territory and Settlements

Reconstructions of ethnographic Tsnungwe territory by Goddard (1903:7) and Baumhoff (1948:210) describe their ancestral lands as including the South Fork Trinity River watershed from Grouse Creek to its confluence with the mainstem Trinity, easterly along the deep canyon of the mainstem from South Fork to Cedar Flat (including Salyer, Hawkins Bar, and Burnt Ranch), westerly to the divide between the tributary watersheds of the South Fork and those of Redwood Creek (a little west of the courses of Madden Creek and Mosquito Creek), and north to the Hupa boundary just downstream of the South Fork confluence (described above). Tsnungwe territory was nevertheless relatively densely populated with at least a dozen villages identified—all situated on high terraces overlooking the deep canyons.

Table B-1 lists three named ethnographic Tsnungwe villages located within the present study area according to Baumhoff (1958). The estimated pre-contact population of the Tsnungwe was not distinguished from the greater Hupa group (Cook 1976). A more comprehensive list of Tsnungwe place-names cross-referenced to the anthropological literature has been assembled by the Tsnungwe Council (2001, cited in Tsnungwe Council 2002), including 18 place-names for Willow Creek area and 18 place-names for mainstem Trinity River area between South Fork and Cedar Flat; among others.

The Tsnungwe Council today recognizes a larger aboriginal territory than that described above by Goddard and Baumhoff—extending more northeasterly to include the New River, overlapping what anthropologists described as ethnographic Chimariko territory, and more southerly to include places ascribed to the Hupa around Willow Creek. Scholarly research by Tsnungwe tribal members clarifies and provides important contextual insights for interpreting the original ethnographic place-name data obtained by non-Indian anthropologists from so few Indian consultants (Saxey Kidd, Sally Noble), so long after disruption of the traditional cultures and dispersal of surviving populations. It notes that as a matter of practicality, the Tsnungwe were multilingual, speaking Hupa as their primary language and also speaking Chimariko and Shasta with a Hupa accent. As stated by the Tsnungwe Council in their Federal Acknowledgement petition (December 2000, cited in Tsnungwe Council 2002),

> *Our identity as a people through countless generations has remained constant—as that of a people and community rightfully belonging on our traditional territory, the area of Trinity River, and its tributaries, the Willow Creek, the South Fork, and the New River, where today the counties of Humboldt and Trinity join… Our identification as a group belonging to this territory has been recognized by all surrounding tribes over the ages, regardless of what name we are called… We, as a people, are more closely tied to our land than to a name. We do not rely on anthropologists and others to define who we are. We already know…* [emphasis added].

Subsistence

Acorns and fish were the staple foods of the Tsnungwe. The importance of the acorn to Tsnungwe people is seen in their word for an Indian person, k'iwinya'nya:n, which translates to "acorn eater" (Tsnungwe Council 2002). Important subsistence resources and related land-uses likely included those compiled in Table B-2. Named Tsnungwe places with associated land-uses are listed in Table B-3, including important fishing spots along the Trinity River in Willow Creek Valley (near Saqe"q'it village) and at Burnt Ranch Falls. In addition to these, Tsnungwe language names are recited for other prominent places and features within the WAA (e.g., Brannan Mountain, Clover Flat, Kimtu, Horse Mountain), implying potentially significant (and confidential) cultural associations.

Table B-3. Named Tsnungwe places and associated land-uses within the Mainstem Trinity Watershed Analysis Area.

Tsnungwe Place-name (reference # applied by Tsnungwe Council [1])	Location	Land-use
xowiyk'iLxowh-ding (63a)	on Trinity near Coon Creek	where wagons descend trail
d'ahilding (58a)	on Trinity near Kirkham Creek	village with 4 houses (Gibbs)
saqe''q'it (59)	on Trinity in Willow Creek valley	old village; place where fishing nets set in river
saqe'q'it, mima:n-chi'ing (30)	west side of Trinity in Willow Creek vicinity	Kidd/Bussell ranch (historic?)
t'unchwing-tah (62)	on Trinity near Willow Creek	old village; Zach Bussell's old place (historic?); dances held here
da:chwan'-ding (31a)	Willow Creek, near Seely-McIntosh Road	old village with 1 house (Gibbs); home of Annie Leach, Indian Friday, Fanny Lack (historic)
me:lchwin-q'it (37)	South Fork confluence area	big rancheria
Le:lding (3)	South Fork confluence area	important village, site of Tsnungwe Jump Dance led by Saxey Kidd, home of Squirrel Tail Tom and many others
ta:ng'ay-q'it (38)	South Fork confluence area	village, home of South Fork Pole and South Fork Pete
miy-me' (7)	Fountain Ranch area, Salyer	village (Gibbs)
ta:wha:wh-ding (22)	Gray Flat area	place to ford river, where Indian trail passed, acorn gathered here
tse:nding (12)	Ironside Mountain & Burnt Ranch area	eels caught at Burnt Ranch Falls, Indians from as far as Arcata gathered to camp and fish in summer

[1] Manuscript provided via email to Janet Eidsness on 10/20/01 by Danny Ammon, entitled "Tsnungwe Place Names" by Tsnungwe Tribe (also listed on website by Tsnungwe Council 2002).

Ceremonies and Sacred Places

The prominent old-time Tsnungwe village at the mouth of South Fork Trinity (Lleldin) was associated with the chief divinity among the Hupa named Yimantuwinyai, or "the one who is lost across the ocean" (Goddard 1903:74-75). It was at Lleldin that he settled and presided as chief over the other mythological beings, took two wives who bore him children and who became jealous, burying his children alive, when he became enamored with a beautiful maiden from another place. This was the first case of death, since before this time, the first-people had grown old but had renewed their youth by sleeping in the sweathouse.

The nature and types of ceremonies practiced by the Tsnungwe prior to Euro-American contact are not well documented. Presumably, their religion and ceremonial life were similar to that described above for the better documented Hupa, with whom they were most closed affiliated both culturally and linguistically. Data compiled by Tsnungwe scholars (Table B-3 above) indicate that the Jump Dance was held at *Lleldin*, and another dance was held at the old-time village of *T'unchwing-tah* near Willow Creek. As described above, Ironside Mountain just outside the WAA was (and still is) a sacred place among the Tsnungwe.

Chimariko

The Chimariko are among the least known of California's aboriginal peoples, being described as "one of the smallest distinct tribes in one of the smallest countries in America" (Kroeber 1925:109). The Chimariko language is classified as a member of the Hokan stock, hypothesized to have temporal priority in the region (see above). Ethnographic and linguistic information was obtained from a dozen consultants (including persons said by contemporary Tsnungwe scholars to have not been Chimariko, or to have been of mixed ancestry), with the most intensive fieldwork (J.P. Harrington's) never synthesized and published (Eidsness 1985:33).

Territory

Six published accounts have described ethnographic Chimariko territory, however, none agree on boundaries between the neighboring Tsnungwe (to west), Wintu (to east and south), New River Shasta (to north) and Whilkut (to southwest) (Eidsness 1985:39). Comparative analysis of linguistic data led Bauman to postulate the following Chimariko territory boundaries:

> *… the Chimariko people originally extended up the lower New River as far as the forks, up the Trinity as far as Helena (North Fork), along the South Fork from about 20 miles downstream of Hyampom to at least Oak Flat, and along the Hayfork River (sic) from Hyampom to Hayfork.* (Bauman 1980:24).

Settlements and Population

The Chimariko population in 1848 was estimated to number 250 persons who occupied six principal villages along the Trinity River (Cook 1976:167; Kroeber 1925:109-110; Silver 1978:207). The two named Chimariko villages within the WAA at Salyer and Hawkins Bar are listed above in Table 3-55. Other named Chimariko villages are documented for Burnt Ranch and Cedar Flat, overlapping the Tsnungwe area.

Each Chimariko village had a sweathouse big enough to accommodate eight or ten men and dwellings large enough to house two or more families. Both the sweathouse and dwellings differed from the Hupa architecture style by being constructed on a circular floor plan with shallower excavations, the roofs supported by a single ridgepole and covered with earth over madrone bark, and entrances at ground level. Like the downriver tribes, Chimariko social status was determined by wealth (e.g., typically imported items such as red obsidian blades, clamshell beads, dentalia) or a combination of wealth and birth.

Subsistence and Travel

Principal foods included salmon, acorns, deer, elk and bear, supplemented by eels, pine nuts, wild seeds, berries, several varieties of roots, fowl and small mammals (Silver 1978:208). Fishing techniques included use of flat nets (like a tennis net)—either set or seined, setting a large (8 foot-wide) sack like net made of iris fibers, harpooning, scooping with baskets, use of bare hands, shooting with bow and arrow, and clubbing. Hunting methods included smoking out (bear, rodents), spring-pole traps (deer, wildcat, small mammals, birds), driving and trailing (deer, rabbit, quail), and setting of two converging fires for both large and small game. Fishing, gathering and hunting places were communally owned, whereas tobacco plots were fenced and privately or jointly owned for a season only.

It has been debated whether the Chimariko used canoes for transportation along the narrow canyon of the Trinity which they inhabited. One source says they used dugout canoes made of pine worked with horn wedges (Silver 1978); another says canoes were not used (Kroeber 1925:111). Clearly, the Chimariko relied upon a network of trails connecting them with neighboring groups and linking their settlements, camps, hunting and gathering grounds, and sacred places. One such trail crossed the Trinity River near Gray Falls (Theordoratus et al. 1980:102), possibly the same known to the Tsnungwe (see Table B-3).

Ceremonial Activities and Sacred Places

Unlike their downriver neighbors, the Chimariko did not hold first-salmon or first-acorn rites, or the World Renewal Ceremonies. They conducted an annual summer dance, girl's puberty rite and the doctor-making ceremony (Silver 1978). Ironside Mountain was also sacred to the Chimariko, a place "to whose top the first people made pilgrimages when they got old and where they would pray and descend young again" (Silver 1978:205).

Historic Period Land Uses and Practices

Historic Context

The history of northern California and Lower Trinity region does not begin with the arrival of Euro-Americans. Their entrance into this region was not the "Genesis" of this land's history. It does represent the beginning of a written, non-Native history, but occupation, use, management, and enjoyment of the land not only predate that history, but span a time period that far exceeds the short century and a half of "historic" residency. With this understanding and always mindful of the Trinity's Native people, this historic context for the Lower Trinity study area identifies six primary land uses and practices: mining; farming/stock raising; transportation; forestry; fire; and the Trinity Dam. In addition, historic information about the river itself, as affected by water management, pollution, and floods, provides a context for understanding the variety of forces and effects that have operated and do operate in the study area. Obviously, it is not possible to draw lines that can exclude ecological processes and human activities that occur upstream and outside the WAA. Thus, this historic context will include references to events that played out in distant places, but, nonetheless, affected and continue to affect the Lower Trinity River area.

It is important to acknowledge that the aboriginal peoples of the Trinity River did not vanish with the coming of Euro-Americans. Certainly, the first three decades of sustained Euro-American settlement in the region severely disrupted traditional lifeways, decimated the Native populations, and caused many of those who survived to seek security in areas more remote from the principal mining areas and settlements. But most of those survivors who initially fled returned to their homeland by the 1880's, marrying into local White families and taking up occupations in the various outdoor industries—especially farming, ranching and logging. Many of the names cited in the historical overview below represent families of mixed ancestry, whose descendents today are proud of their Indian and White heritage.

Exploration and Settlement

Jedediah Smith

In the preface to his biography of Jedediah Smith, Dale Morgan identified Smith as an "authentic American hero" whose exploration of the American West was overshadowed only by Meriwether Lewis and William Clark. During his eight years in the West, Smith discovered Wyoming's South Pass; was the first Euro-American (along with his party) to reach California overland from the American frontier; the first to cross the Sierra Nevada; the first to travel the length and width of the Great Basin; and the first to reach Oregon by a journey up the California coast (Morgan 1953). It was on this last-mentioned journey that Smith and his men entered the watershed of the Trinity River, another first for this American.

It was on his second trip to California that Smith and party made their way northward through the Sacramento Valley to cross the river near the site of Red Bluff on April 11, 1828. From there, they headed northwest toward a gap in the mountains, reaching the valley of the Hayfork on April 17. Following a trail that at times wound among the high, steep hills and at other times followed along Hayfork Creek, the Smith Party reached South Fork Trinity and turned northward. Moving down the South Fork through rugged terrain with a party of eighteen, plus pack animals and 300 half-wild horses and mules, was a difficult and tedious operation. Narrow passes, steep cliffs, and rough ground made for hard traveling, sometimes an entire day was required to go one mile (Morgan 1953). Continuing down the South Fork, the Smith Party eventually reached its confluence with Trinity River, which they followed into the Hoopa Valley and camped at Supply Creek on May 9th, establishing the first recorded entry of Euro-Americans into the Lower Trinity region and the Hoopa Valley (Lewis 1966).

Pierson B. Reading

After this first encounter, the Hupa and their neighbors, the Tsnungwe, continued their lives as they had for centuries—but only for another 20 years. The Sutter's mill event of January 24, 1848 on the American river inspired Major Pierson B. Reading's search for gold six months later near Douglas City. No single event resulted in such immediate and transforming consequences to the Trinity's landscape, its waters, and its indigenous people than Reading's announcement that he had, in fact, located gold in a tributary creek.

Josiah Gregg and Lewis K. Wood

With news of the Reading discovery on the Trinity, hundreds if not thousands of men converged on the scene by way of the Sacramento Valley. They spread up and down the Trinity, including the North Fork Trinity country and its East Fork tributary. At a place called Rich Bar on East Fork, where 50 miners were working in the fall of 1849, the need for supplies was acutely noted and a decision reached that a coastal supply point was needed. Instead of bringing provisions from Sacramento, wouldn't it be better to bring it overland from the coast, notwithstanding that it was 80 miles to the Pacific through rough, unknown (to the miners) country. Assured by the inhabitants of a nearby rancheria that the ocean was only eight day's travel, a party of eight, including Dr. Josiah Gregg, physician, scientist, and explorer, and Lewis K. Wood, who later chronicled the adventure, left Rich Bar on November 5. Wisely, the two men from the rancheria who had agreed to act as guides bowed out, explaining that the heavy rainstorm at

Rich Bar was a heavy snowstorm in the mountains. The intrepid miners did not heed their counsel and started on their way.

Their route lay not down the impenetrable canyon of the Trinity, but on the South Fork. Upon gaining the ridge between Trinity River and Cottonwood Creek, the party proceeded northwesterly and on the fifth day encountered the South Fork, which they followed to its confluence with the main Trinity. Here they crossed the South Fork and met the Tsnungwe residents of '*Lleldin*,' some of whom certainly recalled the Smith Party 21 years earlier. Moving onto Friday Ridge and thence northwesterly to Horse Mountain, the party reached what became later the Berry Ranch below the summit and began what Wood described as a "zigzag" course, endeavoring to find and follow the Trinity, which they believed discharged into the ocean at Trinidad. In due course, they entered the redwood forest and found it to be totally inhospitable--no food, no forage for the animals, and an obstacle course of fallen trees. On the 39th day after leaving Rich Bar, the party hit the Pacific Ocean at the mouth of Little River.

Moving southward along the coast, they crossed Mad River and most auspiciously reached the brackish waters of Humboldt Bay, somewhat unknowingly, stumbling upon the object of their mission. Continuing their journey southward, they arrived in Sonoma County, minus Dr. Gregg who died on the trail, and announced their discovery. Land-claiming companies were organized in San Francisco, and in April 1850, Euro-American settlement of the Humboldt Bay region began. Trinidad and Union (Arcata) established themselves as supply points for Trinity, Klamath, and Salmon River mining camps, just as Dr. Gregg had proposed, but never lived to see (Lewis 1966).

Mining

Major Reading's Trinity discovery brought armies of gold-seeking men into the upper Trinity via the Sacramento Valley. Upon establishment of the supply centers at Trinidad and on Humboldt Bay in 1850, they came by ship and thence by foot and mule to the interior mining regions on the Klamath, Salmon, and Trinity rivers. From the coast they found New River from its outlet via the South Fork Trail—the route that Dr. Gregg eschewed in 1849—or from its upper reaches via the Hoopa trail and Trinity Summit. Those early arrivals were prospectors with a bedroll, pick and shovel, a pan, and an untiring energy that was perpetually hopeful that the turning of the next boulder or the opening of the next crevice would make them rich men. When Dame Fortune failed to smile on them at one place, they shouldered their packs and headed for some new El Dorado (Moore, Blue Lake *Advocate* [BLA] 22 May 1897).

In his reminiscences of early mining on Lower Trinity, old-time miner Tom Moore lamented the passing of the pick and shovel era. He wrote that "no longer can the steady swash of a thousand rockers be heard along these streams or the rattle of the long tom" and wondered if those good old days might be better than the current "modern scientific methods" of 1897 (Moore, BLA 22 May 1897). His wonderment generally stemmed from the recognition that those early halcyon days required little investment, while the "modern" mining methods required considerable more capital to fund hydraulic equipment, sluices, and extensive systems of ditches and flumes to transport water long distances, in one case 20 miles (BLA 5 Dec. 1896).

Hydraulic mining began on Lower Trinity in the mid-1870's and continued on the river at Junction City until at least 1950 (Moore, BLA 5 June 1897; BLA 10 June 1950). Hard on the heels of the hydraulic operations were the river dredges that operated in the Trinity Center, Lewiston, and Junction City areas, beginning at Poker Flat in 1898 and continuing at least through 1953 near Trinity Center (BLA 19 March 1898; BLA 22 Oct. 1953).

Also practiced along the Trinity was "moss mining," which began in the Big Bar area about 1900 and was still being employed by perhaps less serious miners in the 1920's. This system involved gathering, drying, and burning "moss" found in the rocks and several feet above low water mark. After burning, the ashes were washed and using sluices, small particles of gold, which had lodged in the moss, were recovered. In 1922, six miners, engaged in such mining were "making more than wages" (BLA 20 May 1922). Two years later reports of moss mining said that "meager" wages were being made by 50 people so engaged, off and on, between Junction City and Hoopa (BLA 6 Sept. 1924).

Another mining method—the suction dredge—became popular on the Trinity, notably between Cedar Flat and North Fork, in the 1970's and 1980's. High gold prices, relatively inexpensive equipment, and the opportunity for one-person operations resulted in the filing of new claims and active mining along this stretch of the river. Currently, only an occasional suction dredge is seen in the Trinity where 20 years ago, several hundred were in operation.

Today's state-of-the-art gold mining operations in the western United States are mammoth cyanide heap-leach facilities, none of which have developed on the Trinity.

How much gold has California and the Trinity River produced? Twenty years after John Marshall and Sutter's Mill, John Hittell (1868) stated unequivocally, "Mining is the chief industry of California." He estimated that the annual yield from California gold mines at $40 million. The only records available for estimating production at that time were the customhouse books in San Francisco, but these were only the manifests for export. For the first 12 years of mining, the state exported $551,603,904, but Hittell was "entirely satisfied" that the total yield for that period was not less than $700 million.

Albers (1966) estimated that $140 million worth of gold had been produced in the Klamath Mountain region after 1880 and at least "several million dollars" worth between 1848 and 1880. Gold production reached a peak of about $3 million in 1894 and then declined irregularly to less than $1 million annually during the 1920's. Then in the 1930's, stimulated by the Great Depression that drove many people into prospecting and by a substantial rise in price from $20.47 to $35 a fine ounce in 1934, production rose sharply and reached a second peak of about $5.5 million in 1941.

Clark (1970) ranked California counties by their gold production for the years 1848 to 1965. Each of the top 12 counties produced over $100 million with Nevada County at the very top at $440 million. Trinity County produced $75 million. The bottom 12 produced between $1 and $10 million. Humboldt was among this bottom group, producing $5 million. In 1928, the Trinity *Journal* reported the county's annual gold output at $500,000. The La Grange Mine, noted for being the largest operating placer mine in the world when it was active, was reputed as having produced $5 million in gold during its lifetime (BLA 15 April 1933).

Articles in the *Advocate* reported on individual mining operations. For examples, Carrie mill using Excelsior ore on New River was paying $20 to $40 per ton; Hardtack ore had paid $180 per ton (*Northern Advocate* [NA] 26 Jan. 1889); Mr. Radelfinger's New River ore paid $200 a ton (NA 14 Sept. 1889); a Willow Creek mine—the Haney claim—was yielding such high grade ore that it paid its owner $10 a day (BLA 24 Oct. 1891); Excelsior mine on New River produced "$30 rock right along" (BLA 12 May 1894); after a two-month run the famous La Grange mine produced $92,000 worth of the yellow stuff, as rumor had it (BLA 14 July 1894); during 14 years of operation the Trinity Dredging company near Lewiston recovered $10,000 to the acre of ground mined (BLA 3 April 1926).

In the many mining articles carried in the Blue Lake *Advocate* between 1888 and the 1960's, only twice was any specific reference made to the export of gold. One was in Moore's first article on early mining along the Trinity, where he mentioned the mules laden with supplies bound for the mines and the sturdy, rough men in charge who "brought back the buckskin sacks filled with the products of the mines" (Moore, BLA 22 May 1897). This may be a more colorful story telling than hard fact. The other reference appeared in 1929, when the Madrona exported its first cleanup to the mint in San Francisco (BLA 22 June 1929).

The amount of gold produced from the Lower Trinity River, Willow Creek and Three Creeks is total speculation. No reports in the *Advocate* ever suggested that any fortunes, large or small, came out of these areas. Individuals and companies mined the Lower Trinity from Cedar Flat to Hoopa, along Willow Creek and on Three Creeks. Expectations and booms were duly reported to *Advocate* readers, but hard facts about rich miners never came to light. Historian and life-long resident of Willow Creek, Max Rowley (personal communication, 2002), dismisses any notion that substantial amounts of gold were ever taken from the area.

There were several reasons for this, not the least of which was that there simply was no gold to be had in quantities that made men rich. Willow Creek correspondent "34" wrote in June 1889, as the area's mining boom was just underway:

> *If this promised sale [of three claims] be realized, it will make lively times on Trinity for perhaps a year or two. But it is doubtful if it will last any longer, that is, the mining boom, for all the extensive mining operations of lower Trinity county have petered in about that time and certainly there isn't any more gold near the mouth of the river than there is near its source (the only place where it does pay)... invested capital along the river [has] failed to make the claims pay. Why? Cannot say, unless it is because there is not enough precious metal in the ground...* (NA 29 June 1889).

In addition to little gold, two reasons given for failed fortunes were water, or lack thereof, and capital. Willow Creek's correspondent to the *Advocate* reported on a number of occasions that the mining experts from elsewhere, scheduled to inspect local claims with an eye to purchase or investment, never arrived or proposed deals never materialized. Capitalists, for some reason, were "very timid" about investing their capital in Lower Trinity mines (NA 2 March 1889, 29 Nov. 1890, 18 July 1891, 21 Nov. 1891, 30 Jan. 1892, 6 Aug. 1892, and others).

Water was key to mining operations, considered just as necessary to the miner as money to the capitalists or rain to the rancher. When there was no water, there was no gold (BLA 16 Sept. 1893). Sluices and rockers required water, but the hydraulic operations required not only water, but in quantities and at a pressure sufficient to wash away gravel banks and terraces. Hydraulic operations had reservoirs to hold water for dry periods, but generally mining activities on the Lower Trinity and Willow Creek were limited to about four months out of the years (NA 2 March 1889). And if the rains were heavy, sluices, flumes, and ditches were washed away or broken and caved in, resulting in a cessation of operations.

New River Mines

The New River country was the focus of the first prospecting efforts on Lower Trinity. Pick-and-shovel miners who came over the divide from Salmon River country in the early 1850's explored the upper tributaries—Quinby, Virgin, North Fork, Eagle, Slide, Pony and East Fork. Pony Creek, considered one of the richest streams in the state, had its own city—Lake City—and that stream produced yellow nuggets up into the hundreds of ounces. Monuments to those early works were visible to Tom Moore in 1897, when he reported "piles upon piles of gray and blue granite boulders along the stream," old cuts, decayed sluice boxes and old cabins, crumbling away to dust. Those first miners worked the creek beds. Old channels, long buried under the debris of centuries, could be worked only when hydraulic mining became available in the 1870's (Moore, BLA 5 June 1897). New River also had quartz mines that required stamp mills for crushing the ore before an amalgam (mercury) was applied.

The 13th Report of the State Mineralogist for two years ending September 15, 1896 listed 195 mines in Trinity County. Of that number, 16 had mills, and of those, five were on New River. The list of New River mines included specific location, description of operation, and ownership. Only the name and general location are provided in Attachment 1, Table BB-1.

Occasional reports from Denny as late as the 1920's indicated some mining activity on New River, but the focus had shifted to the big operations on the river, both hydraulic and dredging, where capital was invested. By 1965, only one New River operation was still carried on the books of the California Division of Mines and Geology.

Lower Trinity River Mines

Mining on the Trinity River required much more than picks and shovels, and although claims by individuals were made and prospecting initiated, it took capital to put water on the old river channels—terraces of deep gravel often extending some distance back from the bank of the river. Companies were organized and stock sold to get start up money and when more work was required and that first money was gone, assessments were levied on the investors. All a bit speculative, but what could be more speculative than a gold mine. In that stretch of river, roughly between South Fork Trinity and Hoopa, the 13th Report of the State Mineralogist for two years ending September 15, 1896 listed four hydraulic and one placer mines (see Attachment 1, Table BB-2).

The object of prospecting, investigation, and ownership changes, all in an effort to gain sufficient capital for development, the Moston claim was eventually developed by the Salyer Consolidated Mines company. In 1930, Marshall Salyer and company began a large hydraulic operation on the property located on the east side of the South Fork between that stream and the mainstem Trinity (Figure B-4). With five pits and giants with nozzles ranging from five to ten inches in size under 200-600 feet of water pressure, the Salyer Mine property covered almost 2,000 acres and, when fully operating, the company anticipated moving a minimum of 30,000 cubic yards of gravel daily. The company's investment exceeded half a million dollars for the development of what the engineers believed was 125,000,000 cubic yards of gravel, which they estimated was worth 40 cents per cubic yard. Water for the operation was diverted from Campbell (Madden) Creek through nine miles of open ditch, one mile of flume, one steel siphon of 54 inch pipe 800 feet long, another steel siphon of 42 inch pipe 7,000 feet long. The facility had two steel suspension bridges each approximately 300 feet long, 2,500 feet of timber sluices with block riffles, and many miles of road (BLA 29 Nov. 1930).

Long-time Willow Creek resident Bruce McIntosh recalled the flume above Highway 299 dripping water on passing vehicles as debris from this operation was sluiced to the mainstem Trinity. The Salyer mine ran up to the Second World War, reopening in 1948, but only for about a year (McIntosh, personal communication 12/12/02; BLA 6 March 1948). A photo of this mine in operation appeared in Averill (1946) with the caption: "Hydraulicking a high bench-gravel deposit of the Trinity River, near its confluence with the South Fork. Location: Salyer Mines, pit No. 5." Another photo appeared in Clark (1970): "Hydraulic Mining at Bench Gravels, Trinity County. This is a 1933 scene at the Salyer mine."

An 1893 article in the *Advocate* gave a brief run-down of the mines along the Lower Trinity: China Flat Mine; Dungan Mine, two miles further; the Horseshoe Bend Mine, John Keach proprietor (three miles above mouth of South Fork); and the Hawkins Bar Mine, six miles further, owned by Jere Smith (BLA 9 Sept. 1893). Three years later the list included Corning and Smith at Hawkins Bar; John Sharber working to repair his ditch from Quimby Creek to Horseshoe Bend; Ferguson and Son near Sharber; and John Keach's mine (BLA 15 Feb. 1896). Trinity River gravel between New River and the Hoopa Valley, some 20 miles, was thought to average about 40 feet in depth and was estimated to contain gold at from 31 cents to 72 cents per cubic yard (BLA 13 March 1897). Wages for miners were considered good, running from $2.50 to $4.00 a day—better than those earned by Humboldt County mill workers (BLA 27 March 1897). In the fall of 1897, 12 or 13 mines, several of which were hydraulic, were scheduled to operate. It was predicted that operations on New River, Lower Trinity, and Willow Creek districts would total 40 for the season (BLA 9 Oct. 1897).

Figure B-4. Hydraulic mining of bench gravels at the Salyer mine, Trinity County (1933).

The Springville Mining Company hydraulic operation on east side of the Trinity near the junction with the South Fork was under the management of Clarence White in 1898 and was building a ditch to bring water from Horse Linto Creek (BLA 29 Jan. 1898, 23 April 1898). The Gem Mine of George Teal and Gus Perigot was being developed in 1911, with the construction of a ditch and flume to bring water from Sharber Creek to the Sharber claim and the Gem Mine (BLA 22 April 1911). That same summer a new company was organized with W.E. Olmstead at the helm. Known as the old Upton place at Hawkins Bar, the mine was located on a high bar about 1,500 feet above the river, exactly two miles from Jere Smith's ranch and two miles southeast of the Gem Placer mine on the north side of the river. A six-mile long ditch would carry water from Cedar creek to the gravel terrace (BLA 15 July 1911). This is the Corona de Oro Mine that still appears on the modern USGS topographic map. It was discovered by Jay Donahue about 1903 and was described as an ancient channel containing a gravel bed from 10 to 50 feet in thickness with an overburden of about 100 feet (BLA 24 July 1915).

Willow Creek and Three Creeks Mines

The resurgence of mining activity in the Lower Trinity region in the late 1880's sparked activity on Willow and Three Creeks. Numerous claims were filed, but development was not extensive, often being one-man operations without capital or any large water development.

During the rush, named claims were located along the entire length of Three Creeks—Marion C., Ethyl, Lodestar, Enterprise, Grandpa, Riverside, Ishber, Golden Gate, and Three Creeks (BLA 2 July 1892, 8

Oct. 1892). Speculation about rich quartz ledges and bonanzas in the stream beds promoted the area, but it was all "much ado about nothing." Between 1892 and 1899, recorded actions filed in the Humboldt County Courthouse, as reported in the *Advocate,* included claim locations and water rights in the Willow Creek mining district. Over this seven-year period, probably 35 to 40 notices appeared in the newspaper. But only a few, notably the Sugar Bowl and the Clover Flat mines, were seriously developed. The majority were filed upon not to be worked by the individuals, but to be held for future sale, should some rich strike be made on adjoining property. Water was appropriated from Willow, Campbell (the one just south of the Hoopa Square), Kirkham, Bremer, and Boyce (today's Boise) creeks (BLA, various dates between 1892 and 1899).

The Sugar Bowl Mine was developed primarily by the Hoopa Agency physician, Dr. C.A. Curl, and Will Humphreys after a couple of partners passed from view. A two and a half mile long ditch brought water from nearby Campbell Creek. Within a couple of years the mine was paying better than ever, having struck some of the finest gravel yet seen on the Lower Trinity (BLA 4 July 1896, 9 Oct. 1897, 11 Feb. 1899). Purchased by the Douglas Brothers in 1900, the Sugar Bowl Mine was described as 120 acres of promising property, where a No. 1 Giant washed the gravel with water from Campbell Creek via a three-mile long ditch (BLA 10 Nov. 1900).

The Clover Flat Mining company, formerly the Bussell Mine, began development of the property in 1897 with widening and extension of the ditch and fluming around the rocky bluff to bring Willow Creek water to the gravel. Formed by "progressive Humboldters," the company employed an experienced mining engineer, reported by the *Advocate* to represent a "rich English syndicate" (BLA 29 May 1897, 5 June 1897). Slides on the ditch were a continuing problem for this operation, precipitating a move to the lower end of the flat in 1899, where new sluice boxes, piping and two giants were installed (BLA 29 July 1899). The following spring, the operation was reported as running "red hot" with two giants washing away the gravel bed night and day (BLA 19 May 1900). The mine was still running in 1910, but one of its giants went to the Gem Mine in 1912, perhaps indicating that Clover Flat had ceased operations or at least, was winding down.

Mining Along Trinity River Above Cedar Flat

The largest hydraulic and river dredging operations were carried on above what might be termed Lower Trinity (Burnt Ranch to Hoopa). While outside the boundaries of the WAA, these operations are germane to assessment of impacts on the Lower Trinity region, most particularly in regard to water quality. Hydraulic operations required large quantities of water with sufficient pressure to wash the gravel benches, located 150 to 850 feet above the river (BLA 9 Nov. 1901). To run the hydraulic operation at Junction City's Red Hill Mine, water was brought through ditches and pipes from upper Canyon Creek using a suspension bridge to cross the Trinity (Bennion & Rohde 2000). Hydraulic operations were pursued along the river at the named flats between Weaverville and Cedar Flat. The largest hydraulic mine, the La Grange at Oregon Mountain, began operations in the late 1890's and was steadily active up to the First World War. Every traveler on the Trinity Highway knows this site, where the gulch was once filled to the brim with the left-over mountain. Out of sight was a complex of ditches and flumes to bring Stuart Fork water to giant nozzles for washing away the landscape. More washing occurred at the hands of the road builders in the 1930's, when the mountain was again subjected to the nozzles (Bennion & Rohde 2000).

The first boat-type dredge on the Trinity began operating in 1898 at Poker Flat near the Lowden Ranch, but it may have been a relatively small operation compared to the ones that came later. The Trinity *Journal* anticipated that the enterprise would be followed by other dredges the "entire length of the river" (BLA 19 March 1898). A report on the Poker Bar operation in 1899 stated that the Postlewaite, an Australian dredge, was running night and day with a capacity of 2,400 cubic yards in a 24-hour period (BLA 7 Jan. 1899). Initial development of dredging operations at Junction City began in 1900 on the Given Ranch. At the time, the editor of the Trinity *Journal* expressed his hope that construction of this dredge would be of great benefit by stimulating more such operations along the river (BLA 24 Nov. 1900).

In 1912, one of the largest gold dredges in the state was under construction by the Trinity Dredging Company, five miles above Lewiston. That gold boat was 109 feet long and 46 feet wide and cost $300,000 to build. With 45 eleven-foot buckets, the boat could handle between 100,000 and 110,000 cubic yards of earth a month, digging 45 feet below the line and 12 feet above. Owning 500 acres, the company planned to "clear up 25 to 30 acres a year" (BLA 24 Feb. 1912). This company was still operating 12 years later when it undertook construction of a new dredge, having worn out the first. Over the life of the operation, the company reported yields of $10,000 to the acre of mined ground (BLA 19 July 1924, 3 April 1926).

In 1922 the famous Estabrook dredge, the largest wooden dredge in the world at that time, was operating between Trinity Center and Carrville (BLA 5 Aug. 1922). It was reported closed down, perhaps permanently, in 1927 (BLA 17 Sept. 1927). The Madrona Dredging Company was organized in 1926 for the purpose of building a dredge at Junction City (BLA 3 April 1926). It took 20 men to build the 110 by 52 foot dredge with 400,000 feet of lumber from the company's sawmill (BLA 31 Dec. 1927). The Madrona dredge, two miles up river from Junction City, began operations in the spring of 1929, employing 25 men. Under construction for two years at a cost of $150,000, the dredge began work on the 1,000 acres at its disposal. It became the third operating dredge in the county at that time, the other two located above Lewiston (BLA 1 June 1929, 15 June 1929). The Madrona's first clean up was taken to Redding for shipment to the U.S. Mint (BLA 22 June 1929).

A report in 1932 stated that there were only two dredges in operation—the Trinity Dredge near Lewiston, still plugging away after 20 years, and the Trinity Gold Bar Mining Company's new dredge on the former Paulsen ranch at Lewiston. The Madrona was idle. No longer were dredges working at Carrville and Trinity Center (BLA 1 Oct. 1932). After the Second World War, dredges again operated on the Trinity. Minersville on the upper river had a dredge and one was operating at Del Loma (BLA 20 Oct. 1945). Dredging on the Trinity continued at least into the 1950's, a state ban not being imposed until the 1960's (BLA 22 Oct. 1953; Jerry Rohde, personal communication, 1/2/03).

Horse Mountain Mines

The mine at Horse Mountain, subject of some mystery to those who see the mine shaft, powder house, and building and equipment debris, was, despite the original hoopla, a failure. Anticipated riches and grand schemes of a Trinidad smelter run by Klamath River Power were touted at meetings and reported in the local newspapers (BLA 13 April 1912). But the reality was something far different; there were no riches on Horse Mountain.

Claims were filed on Horse Mountain and at the Ruby Mine over the ridge to the south as early as 1891. David Wilson, the dogged believer in Horse Mountain copper, filed a total of 54 claims between 1906 and 1909. E.G. Walters filed on 30 and, after Wilson secured these claims and others, the Horse Mountain Copper Mining Company owned 91 claims, practically the entire ore zone of 1,800 acres (Nash 1993).

Tunnel work was undertaken in 1910, always a good sign that managers could report to investors, i.e., so many feet built this year to add to those tunneled out the previous (BLA 24 Dec. 1910). In early 1911, an announcement was made that a large smelter was to be constructed on Horse Mountain and a road built to connect with the county road. A mine expert from Tulare county was sent for, Patrick Pine, one of the best "smelter men on the Pacific coast" (BLA 25 Feb. 1911). With the smelter, the company announced that it could produce mat copper bearing 50 percent pure metal. Tunneling continued. In March of that year, a "Big Strike" was reported and mining engineers proclaimed the richness of the ore (BLA 18 March 1911). The smelter never materialized, but the road was constructed. Running on a "easy grade" with the highest pitch being a mere 12 percent, the seven-mile road ran from Berry's old homestead up the ridge to the mine (BLA 22 July 1911, 23 Dec. 1911). And tunneling continued.

In early 1912, the company brought in a concentrator over the new road and the newspaper reminded its readers that Horse Mountain was one of the richer copper deposits in quantity in the known world (BLA 20 Jan. 1912). Throughout the year, construction, new equipment, and mining experts kept Humboldt County's interest in Horse Mountain (BLA 11 May 1912, 27 July 1912, 17 Aug. 1912). When time came to take out the first copper concentrates, Irving and Dyer of Lower Trinity were engaged to do the packing with their mules. The sacked concentrates roped to the "hurricane deck" were taken below, shipped by railroad to Eureka and placed on steamers en route to a Tacoma smelter (BLA 7 Dec. 1912). Sixteen mules took out the concentrate, but the company decided to discontinue that mode of transportation because it was too costly (BLA 28 Dec. 1912). Still tunneling and still hoping, the company pushed forward.

During the summer of 1913, quite a community resided there with 13 bunk houses for the men; family residences, including a two-story and basement cottage for Superintendent Gastman and son and their families; a two-story store and office with accommodations for visitors; and a cookhouse. With the mining structures, a total of 32 buildings were erected in and around the camp (BLA 29 March 1913). The 4th of July celebration that year included ice cream frozen in the snow dug from the saw dust pile at the mill. That evening, the celebrants walked to the dividing ridge to witness Eureka's fireworks display, but, the coast line was enveloped in a heavy bank of fog, extending north and south as far as the eye could see. Not to be dismayed, they returned to the cookhouse for dancing with the H.M. orchestra (BLA 12 July 1913).

Hard times followed. Shares in the company that once sold at speculation for $1.50 were put up at a delinquent stock sale, where thousands of shares were sold for three quarters of a cent (BLA 23 Oct. 1915). Unfailingly optimistic, David Wilson announced, on the quiet, in 1927 that "great" developments were in store at Horse Mountain, a new discovery having been made there that would "revolutionize the steel industry." New equipment and activity in the summer of 1928 led to the shipment of the first 400 of a 12,000-ton order to Liverpool, England (BLA 19 Jan. 1929). A second 300-ton shipment was scheduled to leave Eureka in April 1929 (BLA 27 April 1929). But within a few months, reports appeared that there were financial and, perhaps, management difficulties within the company. A committee, appointed to take charge of the company's affairs, requested the public not to advance credit to anyone without a proper voucher from the committee, which was expecting to find "ways and means" to take care of old obligations then pending against the company (BLA 7 Sept. 1929).

In 1948, the State Division of Mines announced and G.L. Speier of Arcata confirmed that the mine would be opened and developed. The early buildings and equipment, including the mill, sawmill, assay laboratory and accommodations for 200 men, were badly deteriorated. The new owner said plans to reopen were pending as they awaited the outcome of the "development process" (BLA 25 Sept. 1948). According to Nash (1993), the Palo Verde Mining Co. and Emperor Copper Co. constructed a mill, shop, two residences, lab, cookhouse, and bunkhouse for operation of an electrolysis process in 1958. The Horse Mountain Mines Engineer's Office was listed in the 1961 and 1962 telephone directories. Nash said the operation went bankrupt in a few years.

Recreation (Skiing)

Skiing at Horse Mountain developed after the Grouse Mountain area. In 1940, the Humboldt State College Ski Club warming hut, called the Lumberjack Ski Lodge, was completed at Grouse Mountain, using donated materials and lumber from old Barrel Factory buildings on the North Fork Mad River (Arcata *Union* [AU] 14 Jan. 1940). Grouse Mountain continued to be the center of winter sports after the war with two tow ropes. In 1948, a new tow rope at Titlow Hill above Fern Prairie was opened on a site which the Forest Service and visiting skiers claimed to be "one of the best in the state" (BLA 7 Feb. 1948). The Humboldt Ski Club initiated this development, which included the Cedar Creek Lodge under a Forest Service special use permit. Dr. Jack Walsh held this permit for many years (Nash 1993). The top of the mountain is now dominated by telecommunications equipment.

Farming and Stock Raising

While gold and timber tend to dominate northern California histories, the establishment of communities with schools, social organizations, transportation systems, and self-sufficient economies was the direct result of settlement by farmers and merchants. Lower Trinity was no exception. A little dabbling in mining here and there by those first homesteaders may have provided some cash money, but subsistence living--growing, gathering, fishing and hunting—was the name of the game. On Lower Trinity, farmers cultivated grains, cut hay for their stock and grew large gardens, eating the fresh produce in season and preserving the remainder for the winter months when the region was essentially isolated from the outside world.

Orchards

Locals planted fruit orchards, initially for themselves, but with the completion of a wagon road in 1890, for export to the coast. The Willow Creek correspondent opined that when the Lower Trinity Valley was cleared and cultivated, there would be "more dances, more weddings, more good times" and more need for a better road (BLA 3 Jan. 1891). He also calculated that five acres would support a family if divided into one acre for house and outbuildings, one acre for miscellaneous fruits and vegetables and three acres for peach trees. Planted 24-feet apart and double rowed, 360 trees in five years would produce 3,600, 20-pound boxes, which at $0.40 per box would return $1,400. After costs for picking, packing, and hay for the horse that pulled the plow and wagon, net profit would be $2.00 a day. If 20 or 25 ranches were producing at this level, the value of the products could substantially benefit the valley, but only if there were an adequate road to the coast (BLA 4 April 1891). Pending that road, the community called for a cannery and then a drying house (NA 31 Aug. 1889, 9 Nov. 1889; BLA 4 March 1893).

When Willow Creek became the terminus of the road, it was anticipated that farmers would improve their farms, turn some of the oak land into orchards, vineyards, or wheat fields, and bring the remaining three-quarters of tillable valley land under cultivation (BLA 21 Dec. 1889). When the road finally arrived, its reality was not the "highway" anticipated, but a rough, narrow hacked-out trail with few bridges large enough to accommodate a wagon. During the winter, it was closed due to washouts, slides, mud, and snow. But the enthusiasm for Willow Creek's agricultural potential remained—if only for a road.

The premier orchardists in Willow Creek were George and Will Hemsted. They began experimenting with fruits in the 1880's, planting different varieties of apples, pears, peaches, plums, nectarines, apricots, figs, cherries, and grapes. Sanguine of their success, they also experimented with olives and oranges (NA 9 Feb. 1889). The climate was considered ideal for fruit raising, despite late spring snows and frosts that occasionally resulted in major crop failures.

Humboldt County Horticultural Commissioner J.L. Noe visited the Lower Trinity and Hoopa Valley orchards in 1893 and was "enthusiastic in praise of the horticultural capabilities of that justly-famed country." He collected crabapples at the George Hemsted orchard that were developed from wild crabapple trees imported from Iowa. Peaches, both clings and freestones, were obtained from the Henry Carpenter and Frank Martin orchards. Pumpkin apples came from the Hemsted and Bussell orchards, Gloria Mundis from Bussell, and an another variety that Hemsted obtained from the Kidd orchard and identified as "Kidd's damned good" apples (BLA 7 Oct. 1893). Noe identified 11 or 12 principal fruit growers on the Trinity who had in aggregate 2,000 trees. The orchard of George Hemsted that contained 780 trees was the largest. A.N. Foote had 377 trees and a dry house. Frank Martin had 286 trees, and the fourth producer was Buck Kidd with 136 trees. The Commissioner put in a good word for dryhouses, noting that extraordinarily large quantities of fruit were going to waste. In one orchard he visited at least two tons of fruit were rotting on the ground and perhaps another eight on the trees would share their fate.

In the spring of 1896, nurseryman A.W. McDowell brought wagon loads of trees into the valley. Z. Bussell was the largest planter that year with six or seven hundred trees, mostly apples and prunes, and Hemsted added another 400 prunes to his orchard (BLA 8 Feb. 1896, 21 March 1896). The Hemsted orchard covered 18 acres and contained almost 800 fruit and nut trees and 600 grapevines (BLA 11 April 1896).

While the Hemsted Willow Creek Fruit Company was able to transport its fruit to Blue Lake, farmers further up the river did not yet have a road adequate for moving wagons. Jere Smith fattened his hogs on delicious winter apples—Baldwin, Smith Cider, Rambo, Newton, Pippin, Spitzenberg, and Rhode Island Greening—because of the impossibility of getting them to the railroad terminus 45 miles in a marketable condition. Fruit also wasted on the Martin and Campbell ranches and others near the South Fork (BLA 2 Sept. 1899, 29 Sept. 1900).

Franquette (English) walnuts became the rage on Lower Trinity in the 1910's. Dr. Matthew Fountain planted 1,000 trees on his ranch at Salyer, the former Campbell ranch just across the river (BLA 3 Feb. 1912). Frank Graham planted 200 walnut trees on his ranch, where the golf course is located, in 1913 (BLA 8 March 1913). L.B. Campton of Eureka set out 200 walnuts on his Clover Flat ranch in 1914 (BLA 25 April 1914). A.W. Symmes advertised the Franquette walnut as the "tree that will make Humboldt famous" and offered to sell them in lots of 75 or more at $1.00 each (BLA 8 March 1913). The beautiful Dailey ranch on New River was famous for its fine quality walnuts (BLA 24 April 1948).

One of the most famous orchards in the Willow Creek area was that of the Gambi family, started by Guglielmo Gambi, when he purchased 67 acres and planted an orchard in 1919 to supply his fruit business on the Arcata plaza (AU 9 Oct. 1919). In 1925, he sold the business to A. Brizard, Inc. and moved permanently to his new place on Trinity River, where the Gambi family operated the orchard and resort for many years (AU 6 Aug. 1925). Another well-known orchard belonged to Charles Burrell, who raised 20 different varieties of peaches at his place at Willow Creek (BLA 15 June 1929).

References to cultivated grains rarely specify the type of grain. However, the Hoopa Agency operated a grist mill and employed a miller, and a note in 1889 said that Martin, who lived at the mouth of South Fork, was packing his wheat to the Hoopa mill (BLA 28 Dec. 1889). A visitor to Hoopa Valley, then referred to as "Eden" valley, reported that upon descending the mountain he looked upon a fertile valley profusely dotted with grain fields, vegetables and gardens (BLA 10 Aug. 1895). Frank Hemsted, long-time miller at Hoopa, produced between 70,000 and 100,000 pounds of flour every year, nearly all of which was used on the Reservation (BLA 11 April 1896). Wheat was one of the cultivated grains, not for export, but for home consumption.

Farm production was not limited to the Hoopa Valley. Throughout the Willow Creek Valley and upriver as far as Burnt Ranch and into the New River country, cleared ground, sufficiently level, was cultivated. Even the Haas' stock ranch on the west slope of Three Creeks summit raised grain for threshing (BLA 19 Sept. 1891). All kinds of truck produce were grown, including corn, beans, watermelons, pumpkins, and potatoes. Hay making was a routine summer event. Hay—grass, oat, and alfalfa—was harvested, transported by wagons to barns and stored loose in ground-level and loft mows.

Livestock

Cattle and hogs were important operations on Lower Trinity and in the Hoopa Valley. Seasonally the cattle were moved from wintering grounds along the river to the high mountain ranges on Trinity Summit for summer pasture. The condition of feed on the ranges was vitally important and duly reported by the Willow Creek correspondent. Early reports of haying may not have indicated feed for stock, but rather for working horses and mules, and the family cow. Hard winters with lots of low-level snow often resulted in the loss of stock when there was no opportunity for them to graze (BLA 1 Feb. 1890). J.T. Ammon of South Fork was still finding dead cattle on his range in June after the severe winter of 1890 (BLA 7 June 1890).

Some of the early Lower Trinity ranchers included T.G. Campbell across the river at Salyer; P.O.M. Hennessey at Burnt Ranch; Charles Ammon of South Fork; George Latham at Hoopa; Wm. Campbell at Salyer; Thomas Brett of Willow Creek; James B. Patterson of Hawkins Bar, later at Willow Creek on the Patterson Ranch; Anderson Mesket of Hoopa; Charles Carpenter at Burnt Ranch; and Zachariah Hailstone of Burnt Ranch.

Cattle were driven to the Bull Meat Market in Arcata or the Northern Redwood Lumber Company at Korbel. Bands of hogs, which ran loose and foraged on acorns, were also taken to market or purchased by A.N. Hunt, but in some cases they went to the Arcata Creamery or to the Eel River Valley, where they were fattened on creamery wastes (BLA 26 May 1894, 15 Oct. 1898, 7 Oct. 1899, 22 March 1902, 21 May 1910, 18 Nov. 1911). Sheep and chickens came later. Wm. Gray drove 150 mutton sheep down to the train at Essex for shipment to the Eel River section in 1923 (BLA 2 March 1923). At Burnt Ranch, the Brannans had a poultry ranch where they raised Leghorns for eggs (BLA (10 March 1923). Not only was stock exported, it was also imported. A stock hog weighing 440 pounds was delivered to Grover Ladd at Denny from Colusa County, going first by train to Redding, then by truck to the New River trail and thence by mule to Mr. Ladd's place, a distance of 15 miles (BLA 2 Jan. 1926).

Prior to the establishment of the Trinity National Forest in 1905, summer ranges were readily available to the stockmen, but with the government's presence in the area, grazing allotments, fees, and regulations were imposed. In 1913, grazing on the Trinity Reserve was allocated for 9500 cattle and horses, 450 hogs and 19,000 sheep (BLA 8 Feb. 1913). In 1928, the Forest authorized grazing for 12,000 head of cattle and horses, 15,000 sheep and goats, and 600 hogs (BLA 25 Feb. 1928).

Accustomed to annual burning to keep brush and trees from encroaching on their ranges, stockmen sometimes found themselves in conflict with the Forest Service. On occasion, local ranchers were arrested and fined for burning on the Forest (BLA 9 Nov. 1918). But Ranger Wesley Hotelling kept the dialogue going between the new Six Rivers National Forest and the cattlemen who used the Trinity Summit area, including Anderson Mesket, Manuel Mattz, Everett Fountain, Hiram Lack, James Marshall, Jr., Harry Campbell, Glen Moore, Elmer Jarnaghan, and William Johnson (BLA 26 Nov. 1949, 22 July 1954).

Dairying

Distant from creameries and markets, the Lower Trinity country did not lend itself to dairy operations, particularly in the 1920's when the Trinity Highway still left much to be desired. But, notwithstanding that problem, people milked cows and sent the cream to Arcata. Never to be outdone, whether with hog or cream, Grover Ladd and his brother Willard began shipping cream to Arcata from the Denny ranch. Carried by pack train to the Trinity Highway, a distance of 15 miles over mountain trail, the cream was loaded onto the mail truck and shipped to Arcata 60 miles away, where it was made into butter. The Trinity *Journal* marveled that the cream was not already butter when it reached the creamery (BLA 19 Dec. 1925). Retired dairyman Ike Moxon of Arcata Bottom recalled seeing and smelling Lower Trinity cream when it arrived at its destination. He said a little baking soda was needed to "sweeten" it up.

The Clover Flat Dairy, owned by the Jameson Corp. of Los Angeles and operated by various managers, may have been the first dairy operation at Willow Creek. The Jamesons purchased the ranch in 1923, and the dairy was operating in the spring of 1924 (BLA 1 March 1924, 8 March 1924, 18 July 1925). From the Willow Creek area, six or seven dairymen were shipping cream to Arcata in 1926, and the Brannan and McDonald ranches at Burnt Ranch had arranged to ship their cream to the United Creameries at Arcata (BLA 6 March 1926, 3 April 1926).

Transportation

The Lower Trinity/Willow Creek/Hoopa Valley area was an isolated, distant section of eastern Humboldt County and western Trinity County long after highways and railroads had brought eastern Trinity and western Humboldt into the mainstream. Surrounded by mountain ranges and cut through by the Trinity River, the region remained a virtual backwater even after "completion" of the Trinity Highway. Although a grand celebration was held in 1923 to commemorate this connecting lateral between the coast and Redding, "completion" was a misnomer--a misnomer because construction and reconstruction would continue for the next 80 years. The Trinity Highway of 1923 was still a far cry from what would be considered a modern highway, even in that day. The region's transportation system is a road system. There are no commercial airports, no railroads, no waterfronts. There are two highways: Highway 299 runs east and west, and Highway 96 runs north from Highway 299 to the Klamath River and on upriver. Ranch and forest roads access the off-highway areas. Trails, wagon roads, and highways are the transportation history of the region.

Trails

The first Euro-Americans to enter the Lower Trinity came on foot with pack animals, following long-established Native trails used to access fishing and hunting areas and food and material procurement places, to visit neighbors and family, to attend social and traditional activities, and to trade. Jedediah Smith and the Gregg-Wood party followed these trails for, at least, a part of their travels through Lower Trinity. Tom Moore identified three trails used to transport supplies to the mines: the South Fork trail from Redwood Creek to the Trinity was one of the principal thoroughfares in those early days. A second trail was the one from Blue Lake via Long Prairie, Bair's, Camp Anderson on Beaver Creek to Hoopa and over Trinity Summit to Salmon River and New River. The third trail led over Liscom Hill to Weitchpec and up the Klamath River (Moore, BLA 22 May 1897).

The Doolittle Map of 1865 (Attachment 2, Map A) shows a trail with the notation "40 miles from Arcata to Maddens." This is the South Fork trail Moore described, but because the Doolittle Map was drawn prior to surveys, it is somewhat inaccurate in detail about the locations of ridges and streams. However, the Forbes Map of 1886 (Attachment 2, Map B) shows an identified South Fork trail running westward from the mouth of the South Fork, crossing the East Fork Willow Creek just above its mouth near the line between Sections 10 and 11, 6N;4E. It then proceeded about three miles somewhat northwesterly to the divide between Redwood and Willow creeks in Section 6, 6N; 4E, where it joined up with the Fort Gaston (Hoopa) to Grouse Mountain trail. Perhaps a mile to the northeast and the Three Creeks trail was reached, leading to the mouth of Willow Creek. If this turn off was ignored, another four miles and the trail to Bair's on Redwood Creek was intercepted. From Bair's the trail turned south to Bald Mountain and from there to Blue Lake. If the trail to Bair's was bypassed, the traveler continued easterly down Supply Creek to Fort Gaston in the Hoopa Valley.

Berryman Lack may have been the contractor on the Hoopa to Salmon River trail. The Humboldt *Times* announced that he had opened a new trail from Union (Arcata) via Eden Valley (Hoopa) to the Forks of Salmon, following the divide between the heads of New River and Red Cap (Humboldt *Times* [HT] Oct. 1854). The new trail was 65 miles long, considerably shorter than the 100 miles from Shasta. Trails out of the valley to the east led to the high country and the Trinity Summit area. Over the ridge beyond was the upper New River country, the destination of many prospectors during those early days. By way of the South Fork trail, the Lower Trinity area between Cedar Flat and Willow Creek and the South Fork country could be reached. The canyon of the Trinity from Cedar Flat to North Fork remained a barrier to travel until a road was blasted out in the early 1920's.

The rough terrain into New River discouraged trail construction, but in 1914 a suspension bridge was built a short distance below the mouth of New River, providing access to this country from Lower Trinity (Bennion & Rohde 2000). The 1922 Belcher Maps display trails throughout this Lower Trinity region. Along the north side of the river upstream from the South Fork, a trail passed by the Corona de Oro Mine thence to Hawkins Bar and from there branched, one heading north then east above Happy Camp Mountain toward Groves Prairie. Another continued easterly, branching again several times to reach various points along the west side of New River and continuing up that stream.

Pack Trains

Pack mules were the mainstay of this Lower Trinity country. Without them, settlement would have been delayed nearly a half century until construction of a wagon road to the coast. But construction of this road and even the Trinity Highway did not end mule packing. In fact, pack mules still plod the wilderness trails of the backcountry, carrying supplies and equipment for Forest Service activities or for the recreationist.

The Brizard mule trains carried supplies from its Arcata store to the branch stores at Solano (Bald Mountain), Willow Creek, Hoopa, Weitchpec, Orleans, Somes Bar, and along New River at Francis, and White Rock. The trains were composed of about 90 mules and six horses, divided into two trains, one of 45 mules and the other of 25, the remainder being replacements (NA 9 March 1889). Winter weather conditions that made trails too muddy and slippery to be safely traveled or snow-blocked sent the trains to their winter quarters, where they stayed until April or May (BLA 23 Jan. 1892). The majority of the packers were either Native or Latino, and their skill at packing, caring for their charges and safely maneuvering narrow, rough, and steep trails is nothing short of miraculous. During the season, these men traveled long distances. For the 1892 season, Ed Scott made three trip to Weitchpec, ten to Willow Creek, five to Orleans, eight to Francis and White Rock, two to the Trinity Tunnel and Mining Company, three to Jonathan Lyons' on the Bald Hills, two to Somes Bar, one to Wilder's at Orleans, one to Hoopa, and one to Jere Smith's at Hawkins Bar. Gregorio Vidal made four trips to Somes, one to Hawkins Bar, three to Francis and White Rock, two to Jonathan Lyons', one to Martins Ferry, and three to Orleans. He also made six trips from different stores to Scotts Valley in Siskiyou County, his train having been away from Blue Lake from July 22 to September 4 (BLA 26 Nov. 1892).

Mules packed in everything—mining supplies and equipment, food and household furniture, building materials, musical instruments, and even livestock. Generally each mule carried about 250 pounds, so when large pieces of equipment had to be transported—such as a stamp mill or a truck—it had to be disassembled. Moving an entire ten-stamp mill from Weaverville via Rattlesnake to the Ridgeway mine on New River, a distance of 40 miles, took 41 days. Since some of the parts weighed a ton, they had to be transported on "lizards," possibly some kind of litter rigged between mules, front to rear. It was a tedious undertaking, requiring the skill of Capt. George Dean and eight or ten men (NA 14 Sept. 1889). Backcountry hikers who have visited abandoned stamp mills, like the Dorleska Mine up Union Creek on the Shasta-Trinity National Forest, marvel that mules could transport such machinery.

Roads

The wagon road from the coast to Willow Creek was built in stages and announced as completed in December 1889, with the expectation of "wagons, buggies and good times" the following spring (BLA 18 Dec. 1889). This road followed the Three Creeks trail. Instead of crossing Redwood Creek at Bair's, the new route crossed at Berry's maybe three miles upstream, then onto the Redwood Summit dividing the Redwood Creek and Willow Creek watersheds. Heading northeast, the road skirted the Low Gap drainage passing through Section 6, 6N;4E, across the headwaters of the three branches of Three Creeks through Sections 32, 33, 27, 26, and 25, 7N;4E, and down to Brown's at the mouth of Willow Creek through Sections 30 and 29, 7N;5E (Lentell Map 1898) [Attachment 2, Map C].

A road in name only. The winter after its construction—the infamous winter of 1890—the road was covered with seven to eight feet of snow on the summit and where there was no snow, the road in many places was entirely gone or made impassable by the rain (BLA 15 Feb. 1890). But come May, the road overseer Douglas began work from the Willow Creek end and Stover at the Redwood end in hopes that by June, the road would be open and Blue Lakers could travel inland and "brown up" in the sun (BLA 17 May 1890). By June the new road was in splendid shape and William Lupton and Will Hemsted had thoughts of starting a stage between Willow Creek and Blue Lake (BLA 14 June 1890, 4 July 1890). The Three Creeks Road was the access route into Willow Creek until construction of the highway down Willow Creek in 1922. Steep and rough, the road could no longer be driven from end to end by 1950 (BLA 7 Oct. 1950).

During the summer of 1890, work on a wagon road between Willow Creek and Hoopa was started, with an announcement in August that the road was nearing completion. However, Roadmaster Douglas was anticipating that it would be another month before his Willow Creek crew met the Hoopa crew (BLA 23 Aug. 1890). Surveyed by Capt. W.E. Dougherty of Fort Gaston, the road was touted to be one of the finest in the northern part of the state with a good easy grade. That description indicates a road that followed more nearly along the river instead of the present one that rises some distance above. Despite the optimism that the road was nearing completion in August 1890, a February 1891 note called to the attention of the County Supervisor of that district that the Hoopa-Willow Creek road was not completed with a half-mile yet to be built (BLA 28 Feb. 1891). The following July, an announcement was again made that the Hoopa wagon road would be completed in August, but this time it was 1891, not 1890 (BLA 18 July 1891). The final announcement came in September that the "best finished road in the county" was open between Hoopa and Willow Creek, and J. Brett would make regular trips to Hoopa, connecting his Blue Lake and Willow Creek stage with that place (BLA 5 Sept. 1891, 19 Sept. 1891).

Stage connections with the outside world had finally arrived--but for only about half the year. Before Wm. Lupton could begin making regular trips from Blue Lake to Willow Creek and on to Hoopa, "some work" was needed on the roads: four miles of washouts and slides on the Willow Creek; two miles of slides on the Hoopa road, the "highway seriously obstructed" and unusable since the first heavy rains a month or two after its completion (BLA 5 March 1892). So much for the "finest" road in the county. And the reliable mule continued to carry civilization's necessities.

Road matters were a major topic of conversation. As the outside world drew nearer and nearer via the coastal road, Lower Trinity folks began to agitate for a connection eastward to the Sacramento valley. The Blue Lake to Willow Creek road followed the line of the old trail and road to Bald Mountain, then crossed Redwood Creek at Berry's, climbed the Redwood Creek summit, passed over the Three Creeks summit, and down to the mouth of Willow Creek at Brown's. The portion between Bald Mountain and Willow Creek was constructed over a twenty-year period, beginning in the 1870's, partly with private capital. The Willow Creek-South Fork road was constructed entirely by private means (Lentell Map 1909) [Attachment 2, Map D]. Suggestions were made that the road should be continued by way of Burnt Ranch through the Underwood place to the Hyampom valley and from there on two routes, one to Red Bluff and the other to Redding via Douglas City (BLA 13 Oct. 1894). A hot topic of discussion was the route this eastward connection should take, i.e., right up the Trinity River, or via Hayfork or the Bridgeville route.

By 1895, a traveler from the coast could, at the proper time of the year, drive a team and wagon to the Trinity County line at the South Fork Trinity River confluence. How much longer would Lower Trinity people be willing to drive a wagon to that point and pack the rest of the way and have no ready access to the growing communities at Weaverville, Redding, and Red Bluff? While people of other sections of Humboldt and Trinity counties quarreled over the best route, Lower Trinity folks knew that the only route was straight up the river's canyon, and estimates were made that this connecting link could be built for less than $300 per mile! That optimism projected that Blue Lakers would, within a year, hear the rattle of the stage coach bound for Weaverville by way of Willow Creek, Burnt Ranch and Big Bar (BLA 25 May

1895). Little did they know that it would be another quarter of a century before such a possibility could be realized, but then it was automobile stages not horse-drawn ones.

Advocates of this route stressed its commercial value in supplying the mines on Lower Trinity and New River. Supplies for A. Brizard's stores in Trinity County at Hawkins Bar, Francis, and Taylor's Flat (Del Loma) were supplied through Willow Creek. The company's White Rock store received its freight from Siskiyou County. Merchandise for William Campbell's store in Trinity County was nearly all hauled via Willow Creek in wagons to the line and packed from there to its destination. The Tinsley brothers of Cox's Bar (just upriver from Big Bar), the Taylor Flat Mining Company, and the Don Juan Mining Company, all received supplies via Willow Creek, as did the Hoboken Mine on New River. The country west of Big Bar was already being supplied from the coast, and with a road up the river, commerce would grow (BLA 18 May 1895). A wagon road was still in the future, but Lower Trinity residents were heartened in the summer of 1895, by the completion of a suspension mule bridge across the river at Cedar Flat, which eliminated a long and tedious mountain climb (BLA 31 Aug. 1895). The trail beyond, however, was so narrow that "a misstep or blunder would send animal and rider to certain death a hundred or more feet below...." (BLA 8 May 1897).

About this same time the Hoopa Agency was working on a Hoopa to Klamath wagon road to be built to the Hoopa Valley Indian Reservation boundary. Completed in the summer of 1895, the road came to within two miles of Weitchpec (BLA 16 March 1895, 13 July 1895). And back at the Blue Lake end of the road, citizens were pushing for a new piece of road called the Ellis-Lord that would cutoff the steep Bald Mountain section (BLA 30 March 1895). A trail was cut on the proposed line and a new bridge completed across the North Fork by the County in 1898 (BLA 19 March 1898, 7 May 1898, 23 July 1898). But this project took some doing and the years passed without construction of the road, named for William Lord, pioneer Klamath miner, packer, and sometimes resident of Arcata, where his wife and children lived, and Edward Ellis, a clerk for A. Brizard. The 14-mile road was finally completed over Green Point in 1921 (Bennion & Rohde 2002).

Trinity Highway

Taking matters into their own hands, Lower Trinity men began work on a wagon road up the river beyond the South Fork about two miles to the school house (BLA 18 Sept. 1897). And residents began campaigns, petitioning the Humboldt County Board of Supervisors to build a wagon bridge across the South Fork and petitioning the Trinity County Board of Supervisors to make a survey for a wagon road from Burnt Ranch to North Fork, a distance of 35 miles. North Fork was the eastern terminus, and a couple of miles above Burnt Ranch, the road petered out from the western end (BLA 6 May 1899).

Over the next decade, efforts continued to bring about construction of a road from South Fork eastward, eventually to North Fork. Private contractors worked on bits and pieces, gold-rich (not from Trinity mines, but Nevada ones) John Hennessey undertook construction of that section from South Fork to his family ranch, and Wm. Noble, the Swanson Bros., and Jere Smith in the reach between South Fork and Hawkins Bar took on construction contracts with Humboldt County Supervisor Rasmus Anderson promising a bridge over South Fork in the spring of 1913 (BLA 27 May 1905, 4 Nov. 1911, 14 Dec.

1912). Lots of talk, lots of work, lots of expectations—but it took the Forest Service to make the lateral link a reality.

In an article by the Trinity National Forest Supervisor, the facts began to emerge. The Forest Service had surveyed a trail between Burnt Ranch and North Fork on a wagon road grade in 1909 and estimated the cost of construction to be $65,000 with another $8,800 for bridges. He suggested it was logical to build the North Fork to Big Bar section first since Big Bar had the largest population—25 people! Still to be completed was a two-mile stretch of the Hennessey Road to Burnt Ranch at a cost of $5,000. The Forest Service, however, preferred a river road that would benefit the mining interests in the New River region as well as the ranches along the river. The estimated cost of this river route from South Fork to Burnt Ranch, a distance of 14 miles, was $21,000. A river route would put the road below the line of heavy snows for year-round travel. For development of this road, the Department of Agriculture appropriated just under $8,500 for 1913. In cooperation with the Forest Service, the Board of Supervisors had appropriated $2,000 toward the project (BLA 15 Feb. 1913).

In June 1913, Frank Smith was awarded the contract for construction of a suspension wagon bridge at the mouth of the South Fork on a bid of $10,000. Within two months W.L. Robertson had been engaged as foreman of the construction crew to build the new wagon road for the Forest Service from the mouth of South Fork up the Trinity toward Burnt Ranch, a distance of six or seven miles. Forest Ranger Frank Graham of Willow Creek was the agency's supervisor (BLA 9 Aug. 1913).

Things were beginning to move. And even more so with the announcement that fall that the Forest Service had appropriated $50,000 for construction of a road between North Fork and South Fork with another appropriation scheduled for 1914. The Hennessey Road would be used only temporarily because it exceeded the minimum three percent grade (BLA 27 Sept. 1913). October brought the completion of the South Fork bridge, the finest of its kind in the county, resting on two solid steel piers and suspended 125 feet above the river with a 300-foot span (BLA 4 Oct. 1913).

Work on the Burnt Ranch section of the road began in earnest in 1915. Men and steam shovels dug in to mark the beginning of a "gigantic" plan to traverse Trinity County with a federal road system second to none in the state, according to District Forester C. DuBois, who was traveling with the Secretary of Agriculture, a Mr. Houston (BLA 22 May 1915). The survey for the new Government Road from South Fork to Burnt Ranch included two bridges, one across the Trinity at Hawkins Bar and one at Gray Ranch. It was also possible that a wagon road bridge would be built as a lateral across the river at the Fountain ranch (BLA 10 July 1915). And stockman James B. Patterson of Hawkins Bar took the contract to clear the six-mile right-of-way (30 Oct. 1915).

As things were moving along at this end, Willow Creek folks were preparing to petition the Board of Supervisors for a new wagon road up the creek (BLA 20 Nov. 1915). The new-road movement asked the Supervisors to expend $40,000 to built a road between Berry's on Redwood Creek and Willow Creek, a distance of 17 miles, in order to shorten the distance, moderate the grade, and eliminate 1,200 feet of elevation (BLA 15 Feb. 1913, 20 Nov. 1915). One statewide event in 1915 had important implications for later construction of the Trinity Highway; California's experiment using convict labor on state highways was demonstrated to be a success (BLA 4 Dec. 1915).

Hacking and blasting their way eastward, crews of men, living in construction camps along the route, persevered over the years. By the early 1920's, the proverbial light at the end of the tunnel was in sight. On the new Willow Creek section to Berry's, 250 men were employed, and 150 men were working assiduously to close the 12-mile gap between Burnt Ranch and Big Bar (BLA 21 Oct. 1922). By December 1922, the new stretch of State highway between Redwood Creek and the Trinity River was 90 percent completed, and hopes were high for completion by the following summer (BLA 30 Dec. 1922). Even as the crews were building the roads, slides were a constant setback along the Trinity, necessitating a call-up of the steam shovels, but working right alongside were the pick and shovel guys, assisted by a little powder (BLA 10 Feb. 1923). In March 1923, the first automobile to travel from Eureka to Weaverville traversed the 100 plus miles in nine hours traveling time (BLA 31 March 1923).

The grand event to celebrate the formal opening of the Trinity Highway, held on August 4, 1923 at Salyer, marked a milestone in the history of the Trinity River country. Life along the Trinity would never be the same; perhaps the highway's completion was an event on par with the discovery of gold in its waters. Its construction was a cooperative effort among the State Highway Commission, the Forest Service and the U.S. Bureau of Highways. Superintendent Mortsolf of the Hoopa Agency noted another milestone for the region a few weeks later in announcing the completion of the 12-mile route between Hoopa and Weitchpec (BLA 22 Sept. 1923).

The first Trinity Highway was just the beginning of new construction, reconstruction, and continual repair and slide removal that have been ongoing over the intervening 80 years. It wasn't until 1962 that the last stretch of highway was paved (Wilutis 1990). Post War reconstruction of the highway involved both Forest Service financing and convict labor (BLA 24 Sept. 1949). Much of the Trinity Highway had been built by Forest Aid Money before the War, and with the expanding and booming lumber industry after the War, the Forest Service again became a key player in road and bridge construction (BLA 6 May 1950). Supervisor William F. Fischer of Six Rivers National Forest announced in March 1952 that the federal government had allocated $4,000,000 for road construction in Humboldt County forests. For construction of the 12-mile section from Berry Summit to Willow Creek, $3,000,000 had been earmarked. The present highway was considered inadequate for handling logging and lumber truck traffic (AU 7 March 1952; BLA 6 March 1952).

Forest Roads

Entering the Forest from Highway 299 near the South Fork Bridge, Friday Ridge Road proceeds perhaps six miles before gaining the ridge and heading due south another six miles to meet with Forest Highway 1. As the divide between the Campbell Creek/South Fork drainage and that of Willow Creek, Friday Ridge provides one boundary of the WAA. Built in the late 1930's by a CCC crew under the direction of the Forest Service, the road provided access to the Brush Mountain and Grouse Mountain lookouts (Max Rowley, personal communication 12/31/02).

Forest Highway 1 is a paved road that extends on the ridge from Highway 36 near the Mad River Ranger Station northward to Horse Mountain. From its intersection with Friday Ridge Road, the road runs along the divide between Redwood and Willow creeks, part of the western boundary for the watershed analysis area. In 1924, Trinity Forest Supervisor B.H. Mace announced plans for a new road leading from the Red Bluff road (Highway 36) on the summit between the South Fork and Mad River, northward right on top of South Fork Mountain and Grouse Mountain to connect with the Trinity Highway near Horse Mountain at the head of Willow Creek. Ten-feet wide, the road would provide the Forest Service an opportunity to reach the different lookouts and high points during the fire season. Instead of horseback, the Forest men could travel by automobiles. Mace also explained that it would open up a "wonderful playground" for hunters and fishermen in remote places only accessible by foot or horseback (BLA 30 Aug. 1924). Congress appropriated $6,000 for the South Fork Mountain Road in 1926 (BLA 3 July 1926). This ridge road was extensively improved and paved by the Forest Service in the early 1980's.

Waterman Ridge provides the northeastern boundary for the WAA. The Waterman Ridge road, like many others throughout Lower Trinity, was constructed to access timber sale areas (Max Rowley, personal communication, 12/31/02). Both Rowley and Bruce McIntosh said that during the CCCs' tenure on Lower Trinity, the crews constructed roads into the Forest for fire control and survey. In the spring of 1933 the Pony Bar Civilian Conservation Camp was established at Hawkins Bar, the first of eight planned for the Trinity (BLA 13 May 1933). Under the President's emergency conservation program, 35,700 forest workers in 166 camps throughout the National Forests of California would undertake 30 different kinds of conservation projects, including construction of truck trails and fire lines for fire suppression work (BLA 20 May 1933).

Forestry

Euro-American settlers of Lower Trinity were so focused on gold they failed to see the forests—wonderfully diverse, productive, beautiful, and very valuable, both ecologically and economically. But perhaps the region's isolation and distance from transportation were part of those blinders. The first report of the State Board of Forestry described the mountainous lands of the Siskiyou, Salmon River, New River, and Trinity ranges. It concluded that because of the extreme inaccessibility of these mountains, it was improbable that their timber would ever be cut to any considerable extent and if protected from fire, the timber would probably never be seriously encroached upon. The Board's report also recognized the value of these forests as the sources of the largest rivers in the State and upon their winter snows depended the summer flows of the upper Sacramento and the Klamath system (Board of Forestry 1886).

Early Sawmills

From the time of Euro-American settlement until about 1920, trees on Lower Trinity were cut and milled to provide lumber for local use only. Mining required lumber for sluices and flumes, and it was not uncommon for a mine to set up its own water-run sawmill to provide that material. When the Horseshoe Bend Gold Mining Company was preparing to tunnel Trinity River two miles from Hawkins Bar, a mill with a capacity of 1,000 to 1,500 feet per day was put into operation to supply the needed materials (BLA 1 Nov. 1893). In 1911, the sawmill for the Gem Mine was sawing 2,000 feet a day for the construction of a 1-½ mile long flume (BLA 14 Oct. 1911). Lumber was also in demand for houses, barns, outbuildings, stores, and community buildings and nearly all of it was furnished by very small mills operated by local men.

The Willow Creek Sawmill, owned by the Hemsteds, could produce about 1,000 feet of lumber and 1,600 feet of slabs in a 24-hour period. When construction was planned for a new hotel and other buildings in the valley, the Hemsteds got the contract for 75,000 feet of slab and 75,000 feet of lumber (BLA 22 Jan. 1890, 1 Feb. 1890). With the mining boom of the late 1880's and early 1890's, the Hemsted mill was unable to meet the demands, and a second mill was built on Three Creeks by Thomas Knight (BLA 28 Jan. 1893). He sold this mill in 1901 to Charles Newell and S.P. Corning. Newell and a new partner Harry Waterman were still running the mill in 1910 (BLA 16 Nov. 1901, 19 March 1910). By 1913, Waterman was sole owner of the Three Creeks mill, operated by waterpower with a big overshot wheel (BLA 8 March 1913, 10 May 1913). By July, Waterman was out of water and had to close down the mill, but during the season he produced 100,000 feet of pine and cedar lumber, a portion of which was to be used in the construction of the South Fork bridge (BLA 26 July 1913). Eleven other mills operating between 1914 and 1932 in the Lower Trinity area at Willow Creek, Gopher Gulch, Cedar Creek, Hawkins Bar, Clover Flat, Burnt Ranch, and Campbell Creek are identified in the Attachment 1, Table BB-3.

The Agency's sawmill at Hoopa ran "pine and spruce," annually sawing from 100,000 to 250,0000 feet of lumber, most of which was used on the reservation (BLA 11 April 1896). A 1910 article described the mill as being 36x80 feet with a 12-foot porch, 39x40 foot planing room and a 14x20 foot dynamo room. A Pelton water wheel furnished 50 horsepower. Species milled were sugar pine, yellow pine, white cedar, and yellow cedar (BLA 1 Oct. 1910). A photograph of this mill is in the Humboldt State University Library. Julius Marshall, one of the early loggers at Hoopa, contracted with the government for 50,000 to 60,000 feet (BLA 2 March 1912). The Marshall family, James Marshall, Sr. and son Edward, logged and milled at Hoopa, primarily for the Agency. In 1925, they cut and milled the lumber for the government's irrigation system (BLA 21 March 1925). Another Hoopa mill, operating in 1928, belonged to David Risling, who furnished 100,000 board feet of lumber for the new bridge in the valley in 1930 (BLA 24 March 1928,12 July 1930).

By the early 1920's, sawmills with substantially larger capacities, in the 20,000 to 30,000 feet-per-day range, began operating east of Blue Lake, along the Lord Ellis road (the Buckley mill) and at Fernwood beyond Bald Mountain (BLA 29 July 1922, 4 April 1923). These mills had ready access to the Northwestern Pacific Railroad at Essex for shipment of their lumber to the San Francisco Bay area, and set the stage for an industry that experienced quite a boom for about 20 years prior to the Second World War—cedar logging.

White Cedar (Port Orford-cedar) Logging

The roads crews had hardly called it a day on the new Willow Creek road, when it was announced that "Japan Gets White Cedar From Here; Logging Camp Established on Willow Creek on Trinity River; A One-Million Ft. Contract" (BLA 18 Aug. 1923). From local to international markets in one fell swoop, all because of a highway!

This first venture was located near the mouth of Three Creeks. Charles Lambert of Freshwater and several associates had the contract for one million feet to be delivered at a landing on the new Trinity Highway. The logs were two and a half feet in diameter and the right length for truck hauling to the Essex station. Shipped from San Francisco to Japan, the logs would be used by the Japanese government in airplanes and other articles of commercial use (BLA 18 Aug. 1923). By the first of September, 100,000 board feet had been delivered to Essex (BLA 1 Sept. 1923). A 1924 description, which appeared to be associated with this operation, said the logs were going to the Bayside Mill and Lumber Company's mill at Eureka, where they were manufactured into lumber for shipment to San Francisco and export to the "Orient" (BLA 14 June 1924).

In the spring of 1914, Andy Fitzgerald, who had hauled logs for Lambert, established a new logging camp on the Waterman claim at Three Creeks (BLA 26 April 1924). The 1922 Belcher map (Attachment 2, Map E) shows Waterman's claim, with the Three Creeks Road running through it, in the southwest quarter of Section 33, 7N;4E. Fitzgerald had the contract for hauling the logs along that old road to the Buckley mill for manufacture prior to shipment to San Francisco on the Northwestern Pacific Railroad (BLA 14 June 1924).

In 1925, new camps were established on Willow Creek near the mouth of Three Creeks, where the 1923 Lambert operation was conducted. Eber Beaulieu of Eureka was in charge of these camps; R.N. Dunn and Fred M. Kay of Eureka were the interested parties with a San Francisco company at the head of the venture. They expected to haul 25,000 feet of pine logs and 25,000 feet of white cedar each day to the railroad at Essex; 15 truck were doing the hauling (BLA 18 July 1925).

Another cedar logging show was established on Antone Koby's land near Willow Creek. The logs, purchased by W.A. Marlin of San Francisco, were also destined for Japan (BLA 20 July 1929). Koby's land, on Brannan Creek, was bisected by the Three Creeks Road in sections 25 and 36, 7N;4E (Belcher Map 1922, Attachment 2, Map E). These cedar operations were logging activities only, the logs transported elsewhere for milling or for shipment to Japan. But during the 1930's, five mills were operated on the Willow Creek side of Berry Summit—one on Low Gap Creek, one on Willow Creek along the Trinity Highway, and three on Cedar Creek (see Attachment 1, Table BB-4).

Post WWII Timber Boom

If the gold rush was a boom, the logging rush after the Second World War was even greater. Demand for building materials, the development of a local Douglas fir plywood industry, a ready labor force of returning veterans, and improved transportation systems opened up the remote, interior forests of northern California.

Shortly after the War, a new National Forest was created out of portions of the Siskiyou, Trinity, and Klamath national forests. According to Regional Forester S.G. Snow, "The chief reason for the transfer of these areas to the new national forest is the growing industrial development and utilization of heavy stands of uncut commercial timber on the west slopes of the Coast Range, which will be processed and shipped from points along the California coast" (BLA 2 Nov. 1946). Six Rivers National Forest, a name originally suggested by author Peter B. Kyne, had its headquarters in Eureka and was the 18th National

Forest in California and the 159th in the United States (BLA 20 Dec. 1946). The Lower Trinity District, which since the formation of the Trinity National Forest in 1905 had been a presence in the community at Salyer, was officially made part of the new Six Rivers National Forest on May 1, 1947 (BLA 3 May 1947).

The War's end was like firing a starting gun at a race. Mills and logging camps appeared overnight. In May 1946, the Humboldt *Times* reported that 100 mills were operating and 60 were under construction in the County. Unprecedented in the history of the Redwood Empire, the Arcata-Eureka area had 22 mills operating and 17 in various stages of construction (HT 19 May 1946). Six months later, 30 mills were operating in Arcata (AU 31 Jan. 1947). The spring of 1947 set a record for shipment of forest products through the Northwestern Pacific Railroad station in Arcata. Loaded with lumber, veneer, and other products, 1,315 cars left Arcata for markets along the Pacific Coast and throughout the country. March shipments amounted to 26.3 million board feet (MMBF) (AU 4 April 1947).

A year later, the Forest Service released figures showing Humboldt County to be the leading producer in California, breaking all-time records in 1946 with a production of 585 to 600 MMBF. Humboldt County's output was almost 12 percent of the state's yield, followed by Lassen County at almost 10 percent. The Forest Service estimated the total volume of standing timber in Humboldt County at 46 billion feet, nine billion of which were on public land. Forest Service statistics showed that the 24 mills operating in Humboldt County in 1941 had grown to 160, plus 14 shingle and shake mills. There were 27 independent logging contractors, and 7,000 men were employed in the industry (BLA 7 Aug. 1948).

In 1950, the Forest Service announced new and wider policies relative to its timber sale program for Doug-fir in Humboldt and Del Norte counties. The headline for the announcement read: "Forest Service Liberalizes Timber Sales; Billions of Feet of Fir, Now Over-Ripe Available to Mills"(AU 17 March 1950). The new policy would put billions of feet of timber up for competitive purchase. In commenting on the new policy, Forest Supervisor William Fischer pointed out that this over-ripe fir should be cut because the trees were presently not growing any new wood. His position was that to put the timber stands in a healthy, growing condition, the trees "must be cut." To accomplish this objective, the Forest Service was taking a more "realistic" view, factoring in cull and rot and making greater allowances for costs associated with cutting such stands.

Logging would be directed toward older component stands, which, because of the small amount of regeneration, would be clearcut, using a scattered setting system. This cutting prescription was a decided departure from the Forest's earlier policy. In 1949, a 27 MMBF sale on Bluff Creek in the Orleans District stipulated selective logging with 45 percent marked as "poor risk," leaving the mature trees. The remainder was cut under standard marking to include both poor risk and better trees. The Forest Service required selective logging in all cases with precautions taken not to damage the leave trees (BLA 12 March 1949).

Lower Trinity Mills

Over about a 35 year period from the late 1940's to about 1980, the Lower Trinity area was a booming lumbering region with mills stretching from Burnt Ranch to Hoopa Valley. Logging contractors, trucking companies and mill owners provided employment for hundreds of local residents and those who came to the area from Oregon and Washington.

A list of Lower Trinity mills and logging companies was developed, using newspaper references, telephone directories, and a 1951 Chamber of Commerce directory. The telephone directory listings are incomplete. There were no Willow Creek listings until 1957, when the Western Telephone Company began providing service. The 1942 Humboldt County Directory listed 12 lumber companies (redwood companies); the 1949 Directory listed 19 logging companies and 53 wholesale lumber companies; and the 1952 Directory listed 29 logging companies, 29 lumber manufacturers, 23 lumber retailers, and 89 lumber wholesalers.

The definitive sources, however, were: Max Rowley, retired Forest Service employee and life-long Willow Creek resident, who provided an initial list of mills to get started; Bruce McIntosh, life-long Willow Creek resident and owner of the McIntosh Sand and Gravel Company; and Doug Clayton of Eureka, manager of Cal-Pacific operations and later associated with Eel River Sawmills. Post-World War II mills in the Lower Trinity area began operations in 1945, and if the phone directories are close to accurate, all were closed by 1980. Attachment 1 (Table BB-5) provides an incomplete list of mills and logging companies for the Lower Trinity area.

Fire

Old issues of the *Advocate* reveal that fire was a regular and expected occurrence. August and September meant fires in the forests surrounding Willow Creek. People complained about the "annual supply of smoke," but when it passed with the first rains, life went on (NA 24 Aug. 1889; BLA 7 Aug. 1897). As the Willow Creek correspondent noted with some degree of resignation:

> *The excessive heat still continues. To add to the unpleasantness, numerous forest fires are burning....But us Willow Creekers are used to it, it being an annual occurrence. Every summer as quick as the brush will freely burn, some one will apply the match and our delightful climate is temporarily under a cloud.* (BLA 10 Aug. 1895).

Willow Creek summer heat and a smoke-filled valley, as forest fires burned at nearly "every point of the compass," made for some unpleasant weeks (BLA 31 July 1897, 7 Aug. 1897).

Fires started with late summer thunderstorms in the mountains. And, human-set fire was an accepted practice, long-employed by Native people for a variety of management purposes and continued by Euro-American stockmen. Sheep men on the Bald Hills above Redwood Creek regularly burned the prairies to keep the Douglas fir at bay and to maintain the native grasses—a practice suppressed by the state under its no-fire policy. Today, however, the National Park Service has reintroduced burning on those prairies.

Burning for food, materials, game, and tanoak management are some of the recognized reasons Native people burned. As Phoebe Maddux, Harrington's Karuk informant, said, "They do not set the fire for nothing, it is for something that they set the fire for" (Harrington 1932). Without the equipment used today for control of vegetation, Native people, nonetheless, kept trails open and maintained villages, cemeteries, dance sites, etc. They pruned and cut, but fire was the least labor-intensive, covered larger areas, and was very effective. A traveler coming from Callahan to Denny got lost on top of Mary Blaine Mountain during a snowstorm after night had fallen. He found the trail, however, when he saw a light and found a "log set on fire to clear the trail" (BLA 2 May 1896). Another reference in 1922 spoke about "burning a log out of a trail" (BLA 14 Oct. 1922). Native people used fire and so did the Euro-American settler.

Old practices, particularly ones that served them well, were hard to surrender. Hoopa stockmen whose cattle used the Trinity Summit area for summer range, were arrested and fined for setting fires on National Forest land (BLA 9 Nov. 1918). Writing from Hoopa about fires that had been set along the hills of the Reservation, extending several miles south to five miles north of Weitchpec, a correspondent explained this annual burning.

> *The burning of leaves at this time of the year is an old Indian custom of early days before the white man came. Burning of leaves and cobwebs on the underbrush is for the new growth of Indian basket weaving materials, new shoots of hazel brush and white grass and also helps the growth of grass and keeps down the underbrush, thereby furnishing good grazing for stock and also eliminating dangerous fire hazards such as we have in the surrounding forest outside the reservation.* (BLA 22 Jan. 1949).

In 1930, an old-time woodsman and retiring sheriff (Jones) of Fresno County interviewed by a United Press correspondent remarked,

> *Cattleman and lumbermen burned all brush and ground refuse off every year and before their time, the Indians had always set the fires to make good grass the next year... We had fires in my day in the hills. We had lots of them. But we never had fires that ruined good standing timber.* (Ferndale Enterprise [FE] 19 Sept. 1930).

In communication with the Ferndale *Enterprise*, William Ellis suggested that the Forest Service policy of fire suppression was all wrong. He pointed out that before the days of an efficient Forest Service, Indians in the autumn, after the fire rains, would burn off the small growth of brush. Such fires were small, easily controlled and did not damage the trees. The mountains then were like parks and the ground clean. Now with that burning stopped, the result is that the brush grows bigger and bigger through the years and the large fires that will come will destroy the big trees. He asked, "Would it not be wise to start burning off the brush in the autumn?" (FE 2 Oct. 1931).

Actually, there was a time in the administration of the Trinity National Forest when it was decided to burn, "as the Indians used to do from year to year," vast areas covered with underbrush and regarded as a menace to the standing timber. The benefits were considered to be immense to the growing timber (BLA 23 Oct. 1915). Two years later, the San Francisco office of the Forest Service issued a press release, entitled "Strange Belief in Forest Fires; The Theory Concerning ‘Light Burning' is Entirely Fallacious." The release said that there was an "odd belief" widespread through the mountainous regions of California in the benefit and value of forest fires, the essence of the belief being "light burning." The Indians and early settlers practiced light burning, believing that these fires were good. Experts of the Forest Service, however, disputed this, saying that the damage done to young growth by light fire was "severe." The

Forest experts stated, "It would have been much better for the forests of California, if the Indians and early settlers had not set the fires." They declared that it was because of this burning that no California forest contained as many mature trees as the ground was capable of supporting (BLA 8 Sept. 1917).

Reports in the Blue Lake *Advocate* from 1889 to the mid 1950's indicate that during that period, fires on Lower Trinity were relatively benign (see Attachment 1, Table BB-6). The largest in the area were the Jim Jam/Bake Oven fires in 1951, and even those totaled less than 7,500 acres. Much larger fires have burned forest lands during the past thirty years: the Klamath National Forest fires in 1977 and 1987; the Megram Fire in 1999 (125,000 acres); and the 2002 Biscuit Fire in northern California and southern Oregon (more than half a million acres).

Trinity Dam

Damming rivers to generate power, to store water, to control floods, to provide recreation, or to do all of these has been a hallmark of American progress. Both the Klamath and the Trinity rivers have been targets of massive water management schemes for nearly a century, and remain on State and Federal project lists. One big project on the Klamath below Ishi Pishi Falls was a cliff hanger for many years until, by State initiative, California voters approved a measure in 1924 that prohibited dams on the Klamath from its mouth to its confluence with Shasta River (BLA 22 Nov. 1924).

As early as 1912, Uncle Sam was giving the Trinity the once over, gathering data on its potential as a source of power (BLA 24 Feb. 1912). Ten years later, a former Tehama County Supervisor named W.H. Sampson and Bank of Corning cashier, C.D. Hill, applied for 2,000 cfs and one million acre-feet per year from the Trinity to be diverted into the Sacramento Valley south of Red Bluff. The $30,000,000 project was for irrigation of 400,000 acres of land in Glenn, Colusa, Yolo, and Tehama counties and the development of 285,000 horsepower of hydroelectric energy (BLA 9 Sept. 1922, 17 March 1923). The Sampson/Hill project was vigorously opposed by the Humboldt County Board of Supervisors, which retained attorney J.F. Quinn, who had previously served the County regarding Eel River diversions (24 March 1923).

During this same period, Los Angeles capitalists proposed hydro development using water from the North Fork and its East Fork tributary (BLA 7 Feb. 1925). And another Los Angeles developer filed for 1,000 cfs and 150,000 acre feet from the Trinity River for power purposes, the point of diversion being between Helena and Big Bar at the Narrows (BLA 16 April 1927). In 1927, a North Fork project was issued a permit for diversion of 400 cfs to develop 70,000 horsepower of electricity, the power plant to be located near Helena (BLA 6 Aug. 1927, 13 Aug. 1927).

These projects are worth noting for several reasons. First, out-of-the-basin, private interests had designs on the Trinity's waters before the State and Federal Governments had staked their claims. Secondly, the opposition from Humboldt County to Trinity diversion projects had nothing to do with the river's values and its fisheries. It was based on the County's concern for its own development. As Quinn pointed out, the time would come when steam or electric railroads would run down the Trinity River, giving the coastal county direct contact with the outside world and, "We will need all the water resources of this section to take care of the future growth." Marshall Salyer of Lower Trinity suggested that the citizens along the Trinity would need more water for irrigation, recreational purposes, mining, and for moving logs, as well as for fishing (BLA 22 Oct. 1927).

But what is most interesting is the Sampson project's similarity to the one the Bureau of Reclamation constructed 35 years later, so similar that even the name of one of the reservoirs was the same—Whiskeytown! The Sampson project included a dam site on Trinity River above the town of Lewiston, a tunnel to carry the water eastward into Clear Creek, discharge of Clear Creek's water into the Whiskeytown Reservoir, power generation, and release into the Sacramento River for irrigating Central Valley land. It was a perfect project, watering farm land, but doing no harm because the Trinity ran through mountainous country where there was no farm land needing irrigation and no farm land that would be inundated by the reservoirs (BLA 17 March 1923).

With private interests casting eyes toward North Coast rivers, the State Engineer was directed by the Legislature in 1921 to start a study of the water resources and needs of the state. He released his report in January 1927. It suggested a plan for taking "surplus" water from the Sacramento for release into the San Joaquin Valley and most importantly, part of that "surplus" was Trinity River water (BLA 29 Oct. 1927).

By the early 1940's, the Bureau of Reclamation was undertaking intensive study of the Trinity diversion project. Ferndale *Enterprise* editor George Waldner expressed his view from the Humboldt side of the fence, "We do not like the thought of taking any of our natural resources and pouring them forever into another section of the state" (FE 20 March 1942). In 1945, Governor Earl Warren signed Bill No. 981 which removed the Trinity River from the State Water Plan and prevented diversion of its waters into the Sacramento. News of this action was celebrated by civic and sportsmen's groups that were leading the fight to prevent the Trinity's diversion (BLA 19 May 1945). In 1949, the State Senate water resources committee voted six to one to kill a Senate Bill authorizing diversion of Trinity water (BLA 30 April 1949). Chambers of commerce, community groups, sportsmen's organizations, boards of supervisors. and conservation groups continued to defend the Trinity. Humboldt County's Board of Supervisors vowed a "fight to the finish" with the Bureau of Reclamation, but Rep. Claire Engle hit back (BLA 29 Dec. 1951). When Secretary of Interior Oscar Chapman ordered the Trinity River Diversion Plan into existence, the Humboldt Supervisors passed a resolution in opposition and sent copies to every Congressman in the country (BLA 15 Jan. 1953).

But for all this effort, the dam was constructed. The Trinity River Division of the Central Valley Project was authorized on August 12, 1955 by the U.S. Congress. Construction of the Trinity dam began in 1957 and its gates were closed on November 22, 1960. Bids for construction of the Lewiston Dam were advertised that fall, and all features of the project were completed in 1962 (Bureau of Reclamation [BOR] 1979).

The Trinity River Division is a major unit of the Central Valley Project, designed to provide water for irrigation, power, recreation, and fish and wildlife conservation. Surplus water from the Trinity River Basin is stored, regulated, and diverted through a system of reservoirs, dams, power plants, tunnels, and conduits into water-deficient areas of the Central Valley Basin (BOR 1979).

Still on the books are proposals for two more Trinity River dams: the Helena Reservoir Project (recall the Los Angeles developer's 1927 scheme), a chain-link project to relay Trinity waters into the Sacramento Valley; and the Burnt Ranch Reservoir (FE 21 April 1961).

Floods

Although floods do not fall within a category of historic lands uses and practices, they have, over the historic period, influenced not only natural conditions, but also human-associated resources. Flood damage rises with development. Moreover, the extent and intensity of flood impacts can, to some degree, be linked to lands uses and practices. Since Euro-American settlement, four epic flood events have been recorded: three in the month of December—1861, 1955, and 1964; the fourth in February 1890.

19th Century Floods

Of the four, the flood of 1861 may have exceeded the ones that followed, although damage was not as serious simply because there was so little development. The December 1861 flood was experienced throughout northern California. All North Coast rivers flooded, and so did the entire Sacramento Valley. The Sacramento *Union* of December 10, 1861 solemnly announced: "It is our duty to record this morning the fact that our city has been visited by the most extraordinary flood ever known since the settlement of the state by Americans" *(Daily Alta California* [DAC] 11 Dec. 1861).

The Humboldt *Times* reported the flood of December 1st and 2nd, which was the third within ten days, as having swept away Newkirk's Mill in the Hoopa Valley, Mr. Lake's new bridge, and the Martin's Ferry suspension bridge ninety feet above low water mark (HT 14 Dec. 1861). The Trinity *Journal* reported immense destruction of property to the tune of $150,000. Bridges, flumes, dams, mills, races, and water wheels were gone. In some cases sand and rock were deposited on rich alluvial bottomland, and in others, the soil was washed away, leaving barren sand bars (DAC 17 Dec. 1861). The Klamath Reservation at Fort Terwer was "submerged," fences, buildings, crops, and supplies gone (HT 21 Dec. 1861).

The Trinity *Journal* reported on December 14th, again in a most solemn voice: "It becomes our painful duty to chronicle still another flood in Trinity river—the greatest ever known, even by the Indians, for half a century." Where confined, the river reached 70 feet above low water. In other places banks were caved and carried away. "It became an ocean, spreading from mountain to mountain—sweeping in its furious...current farm houses, miners' cabins, mills, men, women and children... All that the flood of last week spared, this one swept away." All mining improvements for 100 miles were destroyed (HT 28 Dec. 1861).

Thirty years passed until the flood of 1890 caused immense destruction on the heels of a terrific winter. It was during this event that the China Slide came down, an episode recounted by various people in the years afterward. October 1889 was extraordinarily wet (BLA 9 Nov. 1889). The mountains were "deeply" covered with snow—eight feet at White Rock in January (BLA 11 Jan. 1890). A week later the Willow Creek correspondent reported that it has rained or snowed for nearly two months steady and the snow at White Rock had reached ten feet (BLA 18 Jan. 1890). Willow Creek Valley had a foot and the Three Creeks summit had over eight feet of snow pack. The correspondent opined that if a warm rain should set in, a "freshet, the likes of which the citizens of this valley have never seen would be the result" (BLA 1 Feb. 1890). Well, it did and the water was immense. At Big Bar the reports were that there was up to 30 feet of snow in the mountains when it began to rain (BLA 15 March 1890). A Hawkins Bar resident reported in April when he finally made it to town that the "whole face of the country is changed" (BLA 26 April 1890).

China Slide

The reports of the China Slide at the time and years later provide different versions of the same story. The mountain came down upriver of the WAA boundary near Burnt Ranch and dammed the river for miles. At the time the report from Big Bar was that the slide held the river in check for seven hours and raised it to a height of nearly 300 feet, backing water a distance of ten miles from Cedar Flat to Taylor's Flat (Del Loma) (BLA 15 March 1890). Patrick Hennessey reported on the event a year and a half later, saying the whole side of the mountain slid into the river and the noise caused by the conversion of a mountain side into a dam 100 feet high was terrible, people thinking it was either a tremendous earthquake or the eruption of a volcano (BLA 31 Oct. 1891). Nearly two years after the fact, Thomas Dungan, who lost his ferryboat near the mouth of the South Fork, recounted the event. A whole mountain side studded with large trees plunged into the river in the morning, followed by a remarkable fall in the river, 18 feet in one hour. The only water coming down was from the South Fork. Then about four in the afternoon the "tidal wave" reached Dungan's ferry and the river rose 35 feet in 20 minutes with a total rise of 56 feet.

In 1897, Tom Moore wrote that the slide's magnitude had been greatly exaggerated and then proceeded to give the most superlative description of the event. The slide was a quarter of a mile wide and extended back up the mountain a distance of a third of a mile or more and was of sufficient depth to completely shut the river off, damming an enormous volume of water. The Morton house which stood at an elevation of some 200 feet above the average high water mark and two miles above the slide, floated away within three hours (BLA 17 July 1897).

20th Century Floods

The two, 100-year floods of 1955 and 1964 resulted in lost lives and millions of dollars in property damage. The just-before Christmas flood of 1955 swept away entire communities on Eel River. The "remains of Klamath"—furniture, gas tanks, debris—washed up on ocean beaches, as 15 to 18 feet of water raced through its streets (HT 23 Dec. 1955).

Willow Creek and the Lower Trinity region were isolated by slides, the loss of bridges, and snow on mountain roads. Ray Roberts of the Willow Creek Logging Company was able to reach Berry Summit via Highway 299, but from that point, had to travel south on the Horse Mountain Road to the Friday Ridge Road, thence to Salyer and back to Willow Creek. Two feet of snow on Friday Ridge Road made for rough travel. The Hoopa bridge was out, going down river in an upright position and intact on a raft of logs (BLA 29 Dec. 1955).

In Hoopa, the Trinity River Lumber Company and Humboldt Fir, both located north of the bridge and damaged by the flood waters and debris, could not operate, putting nearly 200 men out of work (HT 30

Dec. 1955). The Somes Bar correspondent noted in January that although the creeks and rivers were dropping, 1955 was the "worst flood since 1890" (BLA 5 Jan. 1956). Bridges across the Trinity were knocked out at Lewiston, Douglas City, Big Bar, Hawkins Bar and Willow Creek. The peak flow at the USGS gaging station at Lewiston was a record 70,000 cfs on December 22 (BLA 5 Jan. 1956, 26 Jan. 1956). Located above many small and moderate streams and the larger ones—Canyon Creek, North Fork, French Creek, and the South Fork—this gage would have recorded a much smaller discharge than that experienced along the Lower Trinity.

The December 22, 1964 *Times* headline "Hundreds Flee Eel Flood" announced another flood nine years to the day after the 100-year flood of 1955. The following day the Trinity River was reported at 55 feet and still rising. Hoopa Valley was isolated by slides and washouts. There was no power and no water. The bridge over Willow Creek was washed out, and the roadway at Salyer had "slid into the river" (HT 23 Dec. 1964). It took several days before supplies could reach Willow Creek by air, no road access being available. And the community was on the verge of being wiped out by a huge slide coming down on the south side of town. Five feet of gravel and water were reported in the main part of town, and 25 feet of mud and debris covered the area between Bloody Nose Creek and the town's business district. Martin's Bluff three miles east of Willow Creek had a devastating slide. Crews were attempting to put out timbers so people could walk across, but this was temporary as they expected the bluff to continue sliding (HT 26 Dec. 1964). At the DeRossett Mill on the east side of Willow Creek, three people died when a large part of the mountain came down on a house and trailer, the buildings going out in the creek's floodwaters (BLA 31 Dec. 1964).

In Hoopa, an estimated 75 percent of the houses were damaged or destroyed, and the Humboldt Fir Mill lost its log deck and stock of lumber when nearly ten feet of water poured through the plant (HT 30 Dec. 1964). The Hoopa bridge remained in place despite drift lodged at the top of the piers. Bridges at Supply, Hostler and Mill creeks were either out or buried under tons of mud and silt. Near the confluence of Mill Creek and the river, the area was covered by acres of debris, drift and several feet of silt, and the creek had changed its channel (HT 1 Jan. 1965). At the Manuel Mattz residence on Bald Hills road on the west side of the valley, a tiny stream that was barely discernible in the summer became a torrent, carrying tons of silt and rock which buried his garage to within two feet of the roof and left only the ridge of his barn visible (HT 1 Jan. 1965).

Late in January, Six Rivers National Forest released preliminary estimates of flood damage to the Forest. Land managers noted that virgin lands and rivers suffered almost as much as the managed areas, with some of the landslides and timber losses occurring in areas without the influence of man's activities. Roads and bridges received the most damage; at least 50 miles of Forest roads would require complete relocation and construction. Another 130 miles would require major reconstruction before they would be suitable for timber access and travel. Forty-five major stream crossings would need reconstruction. Estimated costs of these repairs came to $9,000,000. Forest Supervisor Les Spinney emphasized that the timber access roads would receive priority for repair and construction. An estimated 65 MMBF of timber was down as the result of landslides. Of this volume, the Forest Service felt 20 MMBF could be salvaged. Recreation improvements along the rivers suffered extensive damage, requiring $168,000 to repair.

Supervisor Spinney reported that watershed damage on the Forest was tremendous with numerous slides and streambed changes occurring on both virgin and managed lands. The 1,400 miles of fishing streams within the Forest were almost all devastated by scouring, silt, and debris, and he was unsure if the major rivers could recover naturally from this damage and regain their fish spawning beds. The total damage estimated on the Forest came to $10,000,000 (BLA 28 Jan. 1965).

Heritage Resources – Current Conditions

?? *What heritage resources exist?*

Information concerning the question, "*what heritage resources exist?*," was obtained between October and December 2002 by conducting record searches at the Six Rivers National Forest Supervisor's Office in Eureka, the North Coastal Information Center (NEIC) of the California Historical Resources Information System (CHRIS) in Klamath, and the Northeast Information Center (NEIC) of CHRIS in Chico.

Recorded Heritage Resources and Archaeological Survey Coverage

A total of 67 heritage resource sites and two isolated artifacts (both prehistoric stone items) have been formally recorded within the bounds of the WAA. The recorded sites include 41 resources dating to the historic period, 20 dating to the prehistoric period, five sites with both historic and prehistoric components, and one site lacking descriptive information (Attachment 1, Table BB-7).

The historic period sites are categorized under the following themes: *mining* sites including ditches, adits, tailings and associated equipment and debris (15 sites); *transportation* including foot and pack animal trails and wagon roads (ten segments recorded); *settlement*, typically evidenced by remains of old homesteads (eight sites); *government* including early US Forest Service and Civilian Conservation Corps (CCC) era buildings and fire lookouts (seven sites); *recreation/tourism,* including remains of former ski and tourist resorts (three sites); *cemeteries* (two sites); and *timber industry* (one sawmill recorded). Among the historic period resources, the complex of buildings presently occupied by the USFS at the Salyer Station Historic District, constructed by the CCC between 1934 and 1940, has been determined eligible for inclusion in the National Register of Historic Places (NEIC records).

The recorded prehistoric Native American sites consist of the following: *principal settlements* (11 sites) including seven ethnographically documented Hupa and Tsnungwe villages; *scatters of flaked and/or groundstone tools* (11 sites); *ceremonial places* (two sites); and a *quarry* used to mine chert used to make tools (one site).

Within the near viewshed, but just outside the WAA boundaries, are two National Register eligible and/or listed sacred sites of on-going religious significance to contemporary Hupa, Tsnungwe and/or Chimariko descendents: Ironside Mountain (CA-TRI-352) and a corridor (CA-HUM-494H) originating in Hoopa Valley that accesses the Trinity Summit area (De-No-To District). Management actions within the mainstem Trinity River watershed have the potential to affect the important characteristics of setting associated with these two sacred sites.

An estimated 4,250 acres plus 8.5-linear-miles, or less than 1 percent of the WAA (private, Federal and Tribal lands), have been systematically surveyed for cultural resources. Surveys have focused almost exclusively on identifying and locating archaeological sites dating to the historic (ca. 1850-1950) and prehistoric (before ca. 1850) periods, as reflected in the recorded sites data. Numerous undocumented historic and prehistoric period archaeological sites and architectural features are expected to be present within the WAA.

The majority of this survey coverage has been accomplished on lands administered by Six Rivers National Forest, primarily for timber sales and administrative land-uses and pursuant to compliance with Section 106 of the National Historic Preservation Act (NHPA) and the National Environmental Policy Act (NEPA). Within the HVIR and pursuant to Federal laws, cultural resource surveys have been accomplished for the highly sensitive valley floor for planning purposes (e.g., Offerman et al. 1976), and for upland areas prior to timber sales administered in the past by the Bureau of Indian Affairs (BIA) and now by the Tribe's Forestry Department. On private lands, archaeological surveys have been conducted mainly in advance of certain proposed developments, land subdivisions and timber harvest plans, primarily due to requirements of the California Environmental Quality Act (CEQA). Caltrans has performed several surveys along narrow stretches of State Highways 299 and 96 for road improvement and/or maintenance projects, which required environmental review under NEPA, NHPA and/or CEQA. Graduate student research contributed survey coverage biased towards ethnographically sensitive places in the eastern portion of the WAA (Eidsness 1986).

Contemporary Native American Traditional Land-uses, Important Resources, and Management Concerns

Presently, descendants of the Hupa, Tsnungwe and Chimariko living within and near the WAA, as well as in more distant locations, maintain strong heritage ties with their ancestral homelands, cultures and traditions. Various Federal laws and policies require that Federal land-managing agencies, such as the US Forest Service, consult with tribes and other interested Native Americans when managing places and resources important to promoting those lifeways which are central to maintaining tribal cultural identities (e.g., NHPA Section 106 regulations published at 36 CFR 800; National Register Bulletin 38; NEPA; Executive Order 13007 of 1996, Indian Sacred Sites; Executive Order 12898 of 1994, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations).

Information concerning contemporary Native American traditional land-uses, important resources and management concerns within the WAA is principally drawn from: USFS studies (Heffner 1984; Theodoratus et al. 1980); recent environmental impact reports (U.S. Fish & Wildlife Service [USFW] et al. 1999, 2000); various tribal documents (Hoopa Valley Tribal Forestry 1994; Hoopa Valley Tribe 2000; Tsnungwe Council 2002); records of USFS interaction and consultation with the Hoopa Tribe (Heffner McClellan 2002a, 2002b); interviews with representatives of the Hoopa Tribe and the Tsnungwe Tribe and Chimariko descendents; and interviews with staff (Jennifer Kalt, Deborah McConnell, John Button) of the non-profit California Indian Basketweavers Association (CIBA), which maintains its Northwestern Field Office in Willow Creek.

The USFS is responsible for governmental consultation with elected officials of the federally recognized Hoopa Valley Tribe and the Yurok Tribe regarding federally reserved Tribal Trust Resources, which for this study, consist of fish and water (Heffner McClellan 2002a). Tribal Trust Resources are addressed separately and under specific headers throughout this WAA document. At the onset of this WA, the Forest Supervisor of Six Rivers National Forest instructed that he will maintain his responsibility to conduct formal governmental consultation with the Tribes and relay pertinent information for incorporation into this analysis (Heffner McClellan 2002a).

Important Natural Resources (Hunting and Gathering)

Information about natural resources within the WAA of importance to continuing Native American traditional land-uses and practices is best documented for the Hoopa Valley Indian Reservation and the Hupa (see Attachment 1, Tables BB-8 through BB-13). However, these data may be generally applicable to Tsnungwe and Chimariko descendants, as well as other Native peoples of the region who use local forest resources. As noted by Heffner,

> *Historically, people gathered… closer to home... Today, because of better access and transportation, people can go places and travel faster than they could historically. In many instances, it has become necessary to travel further into the mountains to gather. Most of the traditionally owned family plots are now in other private ownership… access for those lands closer to home is often physically denied by locked gates… This has caused an increase in … gathering on public lands…* (Heffner 1984:11).

With a Census Year 2000 population of 11,368 American Indian and Alaska Native persons living in Trinity, Humboldt, Del Norte and Siskiyou counties (the ancestral homelands of the Hupa, Tsnungwe, Chimariko, Wiyot, Yurok, Tolowa, Karuk and Wintu, among others), access for gathering traditional plants on Six Rivers National Forest lands has become increasingly more important. Contrary to the trend in the 1950's and 1960's when most gathering was performed by Indian elders (Bushnell 1968:1112), Heffner noted that by 1984, the task was being carried out predominately by the young and middle aged (Heffner 1984:6-7). Today, that trend appears to be continuing, and with an increase in the number of persons of Indian descent involved in collecting for traditional purposes. This may be exemplified by the ten-year-old California Indian Basketweavers Association (CIBA), whose membership includes 81 tribally affiliated basketweavers who reside in Humboldt and Trinity counties (18 percent of total membership in this category), only eight of which are 60 years of age or older (John Button, personal communication 2003).

For many local Indians, deer and to a lesser degree, elk, continue to be hunted as important subsistence foods. "Wildlife Core Areas and Travel Corridors" mapped for the Hoopa Valley Indian Reservation (HVIR) include locations within the present WAA boundaries (watersheds of Hospital, Heck and Campbell creeks and Captain John Gulch), most of which extend beyong the reservation boundaries onto USFS lands (Hoopa Tribal Forestry 1994:Figure 15). In addition, the Hoopa Tribe has mapped three "Traditional Species Activity Centers" located adjacent to the WAA boundaries and USFS lands along the upper watershed of Supply Creek and along Tish Tang Creek (Hoopa Tribal Forestry 1994:Figure 16).

Hunting within the bounds of HVIR is regulated by the Hoopa Valley Tribal Council. Non-tribal members generally are not allowed to hunt within the HVIR, however, if the Tribal Council does grant its permission, hunters are subject to CDFG regulations along with any additional regulations imposed by the Council (Steinberg et al. 2000:150).

Fish remain the most important subsistence resource and ceremonial food item, as well as a commercial product (see discussion under Trust Resources). Blue grouse and ruffed grouse are also hunted for food. Other birds and animals identified as important to the Hupa include species described in the ethnographic literature as being sources of materials for making regalia or other ceremonial uses (pileated woodpeckers, fishers, golden eagle, bald eagle, northern flicker, stellar jay, mink, ring-tailed cat, river otter, and ring-necked snake). Protecting and/or enhancing the habitats of these species are important management concerns both on and off the Reservation (Attachment 1, Tables BB-9 and BB-10).

A wide range of plants is collected for food, traditional medicine, ceremonial uses, and craft making (Attachment 1, Tables BB-11 through BB-13). As observed by Heffner in her analysis of interviews conducted between 1974 and 1984 with 100 local Native Americans who gather on Six Rivers National Forest lands, "the act of gathering plants, for whatever purpose, serves as a strong aspect of their ethnic identify" (Heffner 1984:85). Among the Hupa, she observed that the largest number of interviewees were engaged in subsistence gathering, and the foods "are an ethnic food and are gathered because they are preferred" (Heffner 1984:86). Subsistence gathering generally occurred in meadows, oak groves and along ridges, with acorns being the favored plant food such that "…traditional Indians believe that being Indian means eating acorns" (Heffner 1984:12, 88).

Relative to those who gathered for subsistence purposes, fewer numbers of Hupa gathered for making native arts, notably basketmakers who gathered annually, and woodworkers (mostly men) who generally gathered on an as-needed basis (Heffner 1984:86). Basketmaking materials were particularly sought after along creeks and ridges. Especially important were hazel and bear grass, both of which need to be burned regularly to produce good quality materials for baskets (Heffner 1984:14, 16, 88). Among woodworkers, the important materials were yew, cedar, manzanita and mock orange mostly gathered in the interior mountains and creeks, and redwood, which is only found along the coastal zone (Heffner 1984: 14). Both basketweavers and woodworkers generated income for the bulk of their finished crafts (Heffner 1984:86).

Even fewer Hupa consultants in Heffner's sample gathered for ceremonial purposes, and these individuals had specialized training and knowledge (formulas, prayers) requisite for this cultural activity (Heffner 1984:86). Those Hupa Indian doctors who gathered for their personal use, for treating patients, for ritual use, and to contribute to the religious ceremonies, comprised the smallest sample of interviewees. Persons who gathered for ceremonial or shamanistic purposes generally sought resources on the ridges of the high country on National Forest lands (Heffner 1984:86-88).

For the period 1974-1984, the bulk of Hupa gathering (Attachment 1, Table BB-13) occurred on the HVIR and Lower Trinity Ranger District of SRNF, within the WAA (Heffner 1984:88). Specific locations used by the Hupa for gathering within and adjacent to the WAA include the following: the vicinity of Telescope Peak and Hospital Mountain at the southern edge of the HVIR; lower Tish Tang

Creek and Tish Tang Ridge to the south along Forest Service Route 8N03; and along Forest Service Route 4 from the river up Waterman Ridge to nearly Ziegler Point (Heffner 1984:Map IV).

On-going Ceremonial Practices and Sacred Places

Current information about ongoing ceremonial practices and sacred places of concern to contemporary Native Americans is difficult to access because of their confidential and sensitive nature. Sacred places within the WAA where ongoing ceremonial activities are being carried out by traditional practitioners include: Horse Mountain, important to both the Tsnungwe and Hupa (Merv George, Jr., Dena Magdeleno, Ed Chase, personal communications 2002-2003); two places along Friday Ridge Road, and Buck Buttes area, important to the Tsnungwe (Ed Chase, personal communication 2003); and Telescope Peak, important to the Hupa (Hoopa Tribal Forestry 1994; Heffner 1984). None of the above-named places located on USFS lands have been formally recorded, and each may be eligible for listing in the National Register of Historic Places as traditional cultural properties in accordance with *National Register Bulletin 38, Guidelines for Evaluating and Documenting Traditional Cultural Properties*.

Attachment 1: Tables for Appendix B

Attachment 1. Tables.

Table BB--1. New River area mines operating in 1896.

Table BB--2. Lower Trinity River area mines operating in 1896.

Table BB--3. Lumber mills operating in Lower Trinity area, 1914-1932.

Table BB--4. White (Port Orford) cedar mills operating in the 1930's in the Lower Trinity area.

Table BB--5. Post World War II boom lumber mills operating in the Lower Trinity area.

Table BB--6. News accounts of forest fires in Trinity River region, 1889-1955.

Table BB--7. Heritage resources recorded within Mainstem Trinity Watershed Analysis Area.

Table BB--8. Traditional resource land-use issues, concerns, and opportunities (ICO) adopted as objectives in Hoopa Valley Reservation Forest Management Plan (1994).

Table BB--9. Traditional wildlife of special concern in Hoopa Valley Indian Reservation.

Table BB--10. Candidate traditional wildlife of special concern in Hoopa Valley Indian Reservation.

Table BB--11. Abundant traditional plants within Hoopa Valley Indian Reservation.

Table BB--12. Traditional plants of special concern in Hoopa Valley Indian Reservation.

Table BB--13. Hupa plants gathered.

Table BB-1. New River area mines operating in 1896.
(Source: 13th Report of the State Mineralogist, ending Sept. 15, 1896).

1. **Ah Lin Mine (Placer)** New River.
2. **Antone Mine (Hydraulic)** New River
3. **Boles Mine (Placer)** Quinby creek
4. **Boomer Mine (Quartz)** Slide creek; 3-stamp mill
5. **Boyd Mine (Placer)** Emigrant creek
6. **Brizard Mine (Quartz)** Eagle creek; 2-stamp mill
7. **Brown Mine (Placer)** Emigrant creek
8. **Carrie Mine (Quartz)** Slide creek; idle
9. **China Creek Mine (Hydraulic)** New River
10. **Clark Mine (Placer)** Pony creek
11. **Clinton Mine (Placer)** Emigrant creek
12. **Excelsior Mine (Quartz)** New River; 6-stamp mill
13. **Gold Gate Mine (Quartz)** Slide creek; idle
14. **Grover Cleveland Mine (Quartz)** Slide creek
15. **Holz Mine (Hydraulic)** Quinby creek
16. **Hardtack Mine (Quartz)** New River; idle
17. **Hard Times Mine (Quartz)** Slide creek
18. **Hidden Treasure Mine (Quartz)** Slide creek
19. **Hirschberger Mine (Placer)** Pony creek
20. **Hoboken and Grand Slide Mine (Hydraulic)** New River
21. **Hunter Mine (Quartz)** Eagle creek; idle
22. **Jenkins Mine (Placer)** New River
23. **Jumbo Mine (Quartz)** Virgin creek
24. **Kirby Mine (Placer)** Emigrant creek
25. **Mary Blaine Mine (Quartz)** On mountain north of New River City
26. **New Moon Mine (Quartz)** Slide creek
27. **Nicholson Mine (Placer)** New River
28. **Nisbrink Mine (Placer)** Eagle creek
29. **Noble Mine (Placer)** New River
30. **Ridgeway Mine (Quartz)** North New River City; 10-stamp mill
31. **Rocky Point Mine (Quartz)** Eagle creek
32. **Scott Mine (Placer)** New River
33. **Self-Shooter Mine (Placer)** Pony creek
34. **Sherwood Mine (Quartz)** Eagle creek
35. **Stevens Mine (Placer)** North Fork New River
36. **Thomas Mine (Placer)** New River
37. **Toughnut Mine (Quartz)** New River
38. **Uncle Sam Mine (Quartz)** Eagle creek; 5-stamp mill
39. **Webber Mine (Placer)** East Fork New River

Table BB-2. Lower Trinity River area mines operating in 1896.
(Source: 13th Report of the State Mineralogist, ending Sept. 15, 1896).

1. Anderson Mine (Hydraulic) 160 acres on Trinity opposite China Flat, elevation 400 feet; water from Bremer Creek through 3x2 foot ditch two miles long; delivered through 400 feet of 6-inch pipe to a No. 1 Giant working under 80 feet of pressure; bank 15 feet high and all gravel; idle; Harry Close of Eureka, owner.

2. China Flat Mine (Hydraulic) On Trinity, two and a half miles above China Flat; 80 acres at elevation 560 feet; water from China Creek through a 3x2 foot ditch two miles long and delivered through 200 feet of 6-inch pipe to a No. 1 Giant under 80 feet of pressure; small reservoir used when water becomes scarce; Alfred Foote of China Flat, owner.

3. Clover Gulch [Flat] Mine (Hydraulic) Lies along Trinity River one mile below Brown's station at mouth of Willow Creek. About 500 inches of water is derived from Willow creek through two miles of ditch and 1000 feet of 12-inch pipe to a giant with three and a half and four-inch nozzles. The bedrock is soft blue slate and lies 10-25 feet above the river. The banks are 25 feet high and average eight feet of pay gravel. The claim is on an old channel which runs parallel to the Trinity River for nearly two miles, the whole of which is said to be rich in coarse gold. The claim has been idle for some time on account of the dam and upper part of the ditch being washed out by the floods in Willow creek. [description taken from 12th Report, 15 Sept. 1894]; Frank Bussell of China Flat, owner.

4. Dungan Mine (Hydraulic) Located on Trinity River six miles above China Flat; 160 acres, elevation 540 feet; water from Campbell [Madden] Creek by 3x4 foot ditch two miles long and delivered through 300 feet of 10-inch pipe to No. 2 Giant. The sluices are 24 inches wide; bank 35 feet high and all gravel; Thos. Dungan of China Flat, owner. This mine was incorporated as the Trophy Mining Company in 1897 (BLA 13 March 1897)

5. Moston Claim (Placer) [listed in 12th Report, 15 Sept. 1894] This claim lies at the mouth of South Fork Trinity; 300 acres of gravel; very rich; ditch eight miles long; will furnish 1000 inches of water under 200 feet head; J.J. Moston, superintendent.

Table BB-3. Lumber mills operating in Lower Trinity area, 1914-1932.

1. Whitesides: On Willow Creek, one-half mile from its mouth; steam-powered mill with planer and shingle saw (BLA 25 April 1914).

2. A.J. Jung: At Gopher Gulch, about five miles up Three Creeks Road;

portable sawmill to cut pine, fir, and some cedar for local market; donkey engine purchased by Frank Graham (BLA 22 May 1915, 20 Nov. 1915).

3. James B. Patterson: On Cedar Creek; to saw lumber for flume of Corona de Oro mine (BLA 5 June 1915).

4. George Hennings: At his "Willow Creek Mill;" lumber and lath (BLA 20 Nov. 1915); this may have been old Hemsted mill.

5. Gray: At Gray's place above Hawkins Bar; siding for barn at Carpenter ranch at Limestairs (BLA 22 July 1922). Later referred to as Wm. Schelke's mill; provided 10,000 feet in 1928 for bridges over North Fork and Canyon Creek (BLA 19 May 1928).

6. Sam Ferguson: Above Salyer; new mill completed 1924; sawing lumber for new garage and other buildings near Fountain bridge (BLA 23 Feb. 1924). Operated all winter strictly for local demand (BLA 21 Feb. 1925). Sawed lumber for temporary Cedar Flat bridge, Gray's Creek bridge and Salyer community hall in 1927 (BLA 30 April 1927).

7. Jameson Ranch: On Clover Flat; Harry Docker manager of logging crew; H.B. Waterman running mill at the ranch (BLA 13 June 1925). Waterman and Docker installed planer obtained from Brizard ranch at Hawkins Bar (BLA 6 March 1926).

8. McDonald-Hailstone: On the ranch at Burnt Ranch; Dick Schultz cutting the logs; running full blast spring 1926 (BLA 17 April 1926, 1 May 1926).

9. J.D. Griffith: Contemplated building small mill on or near Bud Carpenter ranch; to cut several thousand feet of timber (BLA 24 Sept. 1927). Maybe mill referred to as the "Burnt Ranch" sawmill on Carpenter ranch; going full blast with Irving Brothers in charge (BLA 30 Nov. 1929). Harris and James Irving sawed 120,000 feet of lumber for the Salyer Consolidated Mines in 1930 with lumber purchased from the Forest Service (BLA 22 Feb. 1930).

10. Wm. Campbell: On Campbell Creek at South Fork; sold mill and twelve and a half acres in 1928 (BLA 8 Sept. 1928).

11. G. Stillwell: In vicinity of Burnt Ranch; sawed out 12,000 feet in summer 1932 (BLA 17 Sept. 1932).

Table BB-4. White (Port Orford) cedar mills operating in 1930's in the Lower Trinity area.

1. Freeman Mill: Operated 1933-1935; located on the west side of Cedar Creek about 500 yards up hill from old Highway 299; operated with one large circle saw powered by a steam boiler; milled white cedar cut from both sides of the creek; produced battery shims that were sent to a factory in Berkeley; closed when available cedar had been cut; Freeman ended up in L.A. where he had a separator factory which purchased flitches from Harden Bros. for battery separators and venetian blinds.

2. Shady Lane Mill: Operated to 1937; located one-quarter mile east of Cedar Creek bridge on old Highway 299; 30 feet from highway on bench of land; operated off automobile engine; 52-inch circular saw. Bruce McIntosh (personal communication 2002) recalled this mill, saying it cut a variety of species, not just cedar.

3. Smith Mill: Operated 1936 to early 1940's; 160 acres on both sides of Highway 299; mill built on northwest corner of property where Low Gap Creek intersects the highway; mill was directly over and astride Low Gap Creek; steam power for circle saw, run by horizontal boiler; cut fir logs into standard building lumber 2x4s, 2x6s, and 2x8s; made flitches from clear, fine, vertical-grain white cedar that went to Arrow Mill in Eureka, a subsidiary of Sears, for battery shims; two cabins on south side of highway half-mile east of mill; John Dake operated mill; burned in early 1940's; site disturbed by highway construction and flooding.

4. Pierce Mill: Operated 1937-1940; located three miles up the mountain on south side of Highway 299 on upper Cedar Creek; eighteen cabins constructed; pond; largest of the mills in amount cut, number of men employed and size of structure; two boilers and top and bottom saws; lumber shipped to Inyo county for mine timbers.

5. Harnden Brothers Mill: Operated by steam 1935-1939; by electricity 1950-1955; two-man operation owned by Herb and Hal Harnden; 160 acres; single circular saw; did both consignment work and special orders; cut chinquapin and madrone, along with cedar. The brothers built a new mill at Cedar Creek with lumber cut by the old mill. With the new PG&E power lines close at hand, the Hardens were set to cut about three million feet annually, certainly a far cry from milling operation prior to the war (BLA 5 Nov. 1949).

Table BB-5. Post World War II boom lumber mills operating in the Lower Trinity area.

Dunn Mill: Near Salyer; 1945; operated by R.L. Lile and W.D. Blythe, former engineers with the Marsman company; employed 16 men; shipping lumber through Korbel (BLA 22 Sept. 1945).

Cal-Fir Mill: Located between Willow Creek and Salyer; 1946; Bruce McIntosh said this mill, located near Wright Spot on east side of highway, was run by Blythe so may be **Dunn Mill**; rebuilt 1946 with new burner, green chain, loading platforms; equipped with diesel power; output expected to be much larger than previous years (BLA 6 April 1946). Railroad depot in Blue Lake handling output of Cal-Fir mill (BLA (27 April 1946).Destroyed by fire in 1949; operating at 40,000 board feet per day output at the time; owner David W. Blythe (BLA 2 April 1949).

Willow Creek Stud Mill: Negotiations underway for new mill at Woods place on site of burned **Cal-Fir Mill** (BLA 18 March 1950). Anderson Logging company hauling logs to mill near Wright Spot (BLA 26 Aug. 1950). Logs from Hennessey and Frederick places and Cal Super's place on South Fork being hauled to the "mill near the county line" (BLA 9 Sept. 1950). Reference to stud mill between Willow Creek and Salyer (BLA 15 Jan. 1953). Employees of Willow Creek Stud Mill fighting fire in Grizzly Camp area (BLA 1 Oct. 1953). Fisher Logging Co. hauling peeler logs from Willow Creek Stud mill to Anderson to the U.S. Plywood Mill (BLA 7 Jan. 1954). Closed down, throwing large number of men out of work (4 Feb. 1954).

U.S. Plywood Company: Took over **Willow Creek Stud Mill** and called laid-off men back to work June 1, 1954 (BLA 13 May 1954). Leary Creek timber sale awarded to U.S. Plywood, which recently took over the stud mill at Willow Creek (BLA 10 June 1965). Willow Creek Stud mill shut down Jan. 1955 (BLA 27 Jan. 1955). Gen Minshall, manager of U.S. Plywood Stud Mill at Willow Creek (BLA (3 Feb. 1955). The Willow Creek Stud Mill, west of Salyer, putting on night crew; manufactured studs for building houses; trucked to Sacramento, San Francisco and L.A. (BLA (10 Feb. 1955).

Risling Mill: Hoopa; Risling mill there in 1928; 15 employees in 1946; shipping through Blue Lake 1946 (BLA 27 April 1946, 4 May 1946). Referred to as Oak Flat Risling in 1948 (BLA 10 July 1948). Oak Flat Mill, Anthony Risling, established 1948; 15 employees, daily output 35,000 feet (Humboldt Chamber of Commerce Dec. 1951). Risling mill to start up under management of Leslie Risling and his sister Vivian Hailstone (BLA 10 April 1952).

Trinity River Lumber Company: Hoopa; 1947 reference to an employee of the mill (BLA 21 June 1947); Doug Clayton said mill was located in the lower end of the valley across from Humboldt Fir. B.B. Byard; saw and planing, established 1947; 40 employees, daily output 50,000 feet (Humboldt Chamber of Commerce Dec. 1951). This is the mill built by **Vann, Byard and Waldner:** Hoopa; second mill built there in 1946; included planer; forty employees, mostly Hoopa people (BLA 4 May 1946). B.B. Byard, A.E. Vann and J.W. Waldner leased mill Feb. 1, 1953 to William A. Davis and W.A. Sparker; double circular steam mill with 80,000 feet production per shift; planing and resaw; cutting fir (BLA 29 Jan. 1953). Logs being hauled from Leary Creek to Trinity River Sawmill (23 Sept. 1954). Last phone directory listing was 1959.

Humboldt Fir: Hoopa; established possibly 1946; referred to as "Akins" in 1948 (BLA 19 July 1948) and "Atkins" (12 July 1951). Purchased 17 MMBF on Bluff Creek; sugar pine and Doug fir (BLA 10 Dec. 1953). Hauling logs from Bluff Creek sale to mill (BLA 7 April 1955). Largest mill in Hoopa; lost log deck and stock of lumber; mill damaged in 1964 flood (BLA 30 Dec. 1964). Located at confluence of Mill Creek and Trinity (HT 1 Jan. 1965). Doug Clayton said that Sam Arness and Mitch Wagner were associated with this mill. Last phone directory listing 1974.

Hoopa Veneer Co. Hoopa; appears in phone directories 1958 through 1979; no listing 1980. Doug Clayton thought this was the veneer division of Humboldt Fir.

George Nelson (Logging Contractor): Hoopa, 1946; Indian Agency sale of 1.5 MMBF of Doug fir; to maintain Nelson's logging operations and workers; timber will supply one of three miles on reservation (BLA 2 Nov. 1946).

Willow Creek Mill: Established 1948; Walter Hanson; 12 employees; daily output 40,000 feet (Humboldt Chamber of Commerce Dec. 1951). Bruce McIntosh said this mill was located on Willow Creek above Three Creeks on Highway 299.

Sugar Pine Lumber Company: Hoopa; **Spaulding:** Hoopa; building sawmill at Campbell place; fourth mill in valley (BLA 10 July 1948). To build mill in Hoopa to handle 27 MMBF timber sale on Bluff Creek; new plant to be a band mill, the first one in the area (BLA 12 March 1949). Purchased another sale of 2.83 MMBF on Four Mile creek four miles west of Salyer; accessed by Friday Ridge Road; manufactured into plywood at new plant in Hoopa (BLA 30 April 1949). Mill located at south end of valley (BLA 7 May 1949). Ray Spaulding; Mill B built 1950; 10 employees; daily output 50,000 feet (Humboldt Chamber of Commerce Dec. 1951). Sugar Pine Lumber Co. logging and hauling logs to Arcata (BLA 3 March 1955). Sugar Pine Lumber Co. of Hoopa purchases 33 MMBF in Big Bend area west of Bluff Creek, E.W. Spaulding and son Ray operate company (BLA 14 July 1955).

Van Vleet Wood Products Mill No. 2: Hoopa: Bruce McIntosh and Doug Clayton said Van Vleet took over Sugar Pine Lumber Company; located at south end of valley on right at entrance to valley. Appears in phone directories 1958-1967; no listing 1968.

California Pacific Mfg. Co: Hoopa; Doug Clayton said California Pacific took over Van Vleet, a.k.a. Sugar Pine Lumber Co. Doug was manager of all Cal-Pac operations. The Hoopa mill included a dry kiln, planing mill, and sawmill. They purchased Forest Service timber. Sales were two to ten million feet in size and with two shifts, employing 100 workers, produced 120,000 board feet of lumber. Logging and trucking were contracted out. Phone directory listings 1968 to 1979; no listing 1980.

Fisher Brothers: Logging Bluff Creek sale for Sugar Pine Lumber in 1949 (BLA 7 May 1949). At Willow Creek, brothers Jim, Lee and Call (Humboldt Chamber of Commerce Dec. 1951). Logging across river at Hawkins Bar June 1954 (BLA 1924 June 1954). J.W. Fisher Logging Co. listed in 1962 phone directory.

Ross & Riley Sawmill: Hawkins Bar; destroyed by fire in 1949 (BLA 10 Sept. 1949). **Grubb Lumber Company:** moved mill from Oregon to James Irving ranch; will utilize log pond formerly used by the Ross Mill which burned (BLA 1 May 1952).

Moss Lumber Company: Burnt Ranch on Hennessey Road; mill under construction 1950 (BLA 25 Feb. 1950). Began operating May 1950; owner Holis Moss; 20 employees; mill moved from Oroville to Burnt Ranch and reassembled; market will be in Sacramento (BLA 13 May 1950). New mill pond (22 Feb. 1951). Moss mill completely overhauled (BLA 7 Feb. 1952). Moved from 3 miles up Hennessey Road to Highway 299, one mile east of Burnt Ranch on 51 acres; two-acre pond to be built; will ship out only finished product (12 Feb. 1953). Purchased 10 MMBF from Forest Service, southwest of Burnt Ranch; Moss will put in resaw unit; employs 50 men (BLA 11 March 1954). Awarded 18 MMBF timber sale in South Fork and Burnt Ranch Forestry blocks; will build dry kiln (BLA 14 April 1955). Doug Clayton said Moss was bought out by Southwest Forest Plywood Co. in 1960's. Last phone directory listing for Moss was 1965. No listing for SWF in 1980.

Chilton: Bruce McIntosh said this mill was on Brannan Mountain road, later moved to Willow Creek; started during War; Chilton was getting ready to open in March 1950 after being idle for three years (BLA 18 March 1950). Chilton mill at Willow Creek sold to Bean Brothers (BLA 9 Sept. 1950). Purchased by Allen and Simpson of Arcata (BLA 15 Nov. 1951).

Walker and Sons Lumber Company: Operating six miles up Three Creeks road in 1950 (BLA 7 Oct. 1950).

Anderson Company: Logging contractors; cutting on Super, Ammon and Bussell places on South Fork 1950 (9 Dec. 1950). Taking fourteen loads a day to Redding (BLA 29 March 1951). Anderson Bros. Logging (Hoopa) listed in phone directories 1967 and 1968.

Dose: Burnt Ranch; under construction 1951 by Eric Dose and Cy Jensen on Dose place (BLA 5 April 1951). Moved their portable mill to Paul Kaut's timber for two years of cutting (BLA 16 Aug. 1951).

Barrett: A.M. Barrett purchased Sugar Bowl ranch for sawmill site (BLA 15 Nov. 1951).

Grenz: Sawmill at Willow Creek; purchased by A.M. Barrett (15 Nov. 1951). Mill established 1949; ten employees, daily output 40,000 feet (Humboldt Chamber of Commerce Dec. 1951).

DeRossett: Purchased Willow Creek mill (15 Nov. 1951). Bruce McIntosh said this mill was up Willow Creek near the East Fork and was washed out in ‘64 flood. Bud Walker working at the DeRossett Mill on east side of Willow Creek when slide came down during 1964 flood (HT 31 Dec. 1964).

Trinity Timber Inc. Hoopa; J.W. Griffin and Frank Blagen, Jr., sawmill, established 1951, 26 employees; daily output 35,000 feet (Humboldt Chamber of Commerce Dec. 1951).

Eureka Cross Arm Company (Cedar Creek Mill) Hawkins Bar; setting up mill on land purchased from Julian Ambrose; 1952; mill moved from Cedar Creek (BLA 1 May 1952). Located on Denny Road across river from Hawkins Bar; Elmer Hansen is the sawyer; branch of Eureka Cross Arms Mill (BLA 4 Dec. 1952). Cedar Creek mill built summer 1952 on old Brizard ranch at mouth of Pony Creek (BLA 29 Jan. 1953). Cedar Creek Mill installing a planer (BLA 7 Jan. 1954). Roy Jones associated with mill (BLA 28 Jan. 1954). Cedar Creek Mill across river at Hawkins Bar closed down; rumors say it will operate again under new management; affected 20 employees (BLA 22 July 1954). Cedar Creek Mill will open under two managements: Fisher Logging will operate planing mill and another firm will operate sawmill (BLA 29 July 1954).

Marcott Lumber Company: Burnt Ranch on Gray's place; 1952; Roy Marcott moved mill from Redding (BLA 1 May 1952). Mill operating 1953; Walter Gray is the sawyer (BLA 2 April 1953). Good-sized log decks for winter operations at Marcott Lumber Mill of Burnt Ranch (28 Oct. 1954). Operated on Bill Gray ranch for several years now moving to old Moss site, three miles up Hennessey road; logs from Paehnlein holdings (BLA 31 March 1955).

Willow Creek Lumber Company: Purchased timber sale for salvage of Jim Jam timber burned in 1951 fire; Harvey White, Ned Yenter and William Meadows have contract to do logging (BLA 30 April 1953).

Brock Logging (B&B Lumber Mill): Logging across the river at Hawkins Bar June 1954 (BLA 24 June 1954). New Brock mill at Hawkins Bar; moved from the mountain above Burnt Ranch; Fisher Logging Company hauling logs to Brock Mill for winter operations (BLA 28 Oct. 1954). Commenced operations Nov. 1954; sawing lumber to be planed at Moss Mill (BLA 18 Nov. 1954). V.M. Brock Logging (Hoopa) listed in phone directories through 1971.

Delta Lumber Company (Anderquist): Operated by Mel Anderson and Eddie Enquist, formerly of Cedar Creek Lumber Co; Mel Anderson is one of the operators of the large mill across the river at Hawkins Bar (BLA 26 Aug. 1954).Good-sized log deck at Delta Lumber Mill at Cedar Creek across Trinity at Hawkins Bar (BLA 28 Oct. 1954). Delta changes name to Anderquist to represent owners Mel Anderson and Eddie Enquist (BLA 26 May 1955).

Rochlin Veneer and Plywood Co: Willow Creek; purchased 1.25 MMBF of fire-killed Doug fir and 100,000 feet of white fir damaged in Three Creeks fire of 1951 (BLA 2 Sept. 1954).Willow Ruckman, millwright at Rochlin Veneer Plywood Co. in Willow Creek (HT 18 Aug. 1960). Bruce McIntosh and Doug Clayton said this mill was located on the golf course road on left just before bridge; phone directory listings 1957-1975; no listing 1976.

Trinity Forest Industries: W.C. Watkins, contractor for TFI, salvaging Jim Jam timber; 20 MMBF; two portable sawmills at sale area (BLA 17 March 1955). **Watkins Lumber Co.** of Denny manufacturing lumber at new mill on New River; hauled to Moss Mill for planing then trucked to Central Valley (BLA 7 April 1955).

Pat Veneer Plywood Mill: Land being cleared on Martin place at Humboldt-Trinity county line where South Fork enters the main river for new Pat Veneer Plywood Mill (BLA (23 June 1955).

Carolina-California Plywood, Inc.: Took over **Pat Veneer** 1958; name changed in 1972 to **Carolina Pacific Plywood** until 1977 when it became **Southwest Forest Plywood Co.** Doug Clayton said SWF bought out Moss; last phone directory for Moss was 1965; last available phone entry for SWF was 1978; no listing in 1980.

Big Four Mill: Hoopa, on Pine Creek Road; completely wrecked in 1964 flood (HT 1 Jan. 1965). Phone directory listings: 1959-1964; no listing 1965.

Little Twig Logging Company: Willow Creek; logging contractors; phone directory listings 1958 to 1967; no listing 1968.

Arrow Mills: Bruce McIntosh said they logged in Three Creeks for cedar.

Emmerson: Became Sierra Pacific Industries; Bruce McIntosh said Curly Emmerson had a mill on the Cedar Creek tributary to Willow Creek.

Edwards Logging Company: Willow Creek; phone directory listings 1959 through 1965.

Irvin Grenz Logging: Willow Creek; phone directory listings 1958-1961.

Tonkin Logging Company: Willow Creek; contract logger; phone directory listings 1957-1966.

Table BB-6. News accounts of forest fires in the Trinity River region, 1889-1955.

?? Fire on Willow Creek, three weeks previous, started two miles west of illow Creek city on south side of the creek; burned district now five miles square and burned as far south as Hemsted's mill [near mouth of Bloody Nose Creek] (NA 24 Aug. 1889).

?? Big forest fire ranging for three weeks on South Fork; started at head of Campbell creek; burned seven or eight miles; considerable damage to growing pine timber (BLA 27 Aug. 1910).

?? Forest Fires--two large fires near Hayfork, a couple at Hyampom, one at Dutch Creek, one at North Fork, one near Weaverville, three or four up New River, Campbell Creek fire and one opposite Junction City (BLA (27 Aug. 1910).

?? Trinity Forest--For 1911 season, 1203 acres burned over; 50 fires; largest fire on Campbell creek which burned less than 810 acres (BLA 28 Oct. 1911).

?? A "serious" fire on top of Horse Mountain (BLA 27 Sept. 1913).

?? Large fire at Cedar Creek above Hawkins Bar; 35 men on fire; very rough country (BLA 4 Sept. 1915). Continued to break out every few days (BLA 25 Sept. 1915).

?? Forest fires at Willow Creek and surrounding points (BLA (12 Aug. 1922).

?? Twelve fires on Trinity National Forest; one still not controlled on Eagle Creek, a tributary to New River; 50 men on this fire; 35 miles from a wagon road (BLA 31 July 1926).

?? New River fires finally under control; damage insignificant compared to good done (BLA 21 Aug. 1926).

?? Fire on Hoopa Reservation; started in 20-year-old burn on west side of Campbell creek; 40 men on fire; burned 200 acres on reservation and 200 acres of brush and Doug fir on private land within Forest boundary (BLA 7 Sept. 1929).

?? Fires reported all along the road to Willow Creek (BLA 23 Nov. 1929).

?? Incendiary fires--five near Orleans and five on Hoopa Reservation (BLA 20 Aug. 1949).

?? Forest fire swept through Three Creeks area and up the slopes of Telescope mountain; 4000-acre fire on Jim-Jam Ridge (BLA 23 Aug. 1951).

?? New River fire started on East Fork; almost to Cabin Peak in the Primitive Area; all mill and logging men, about 500, are on the fire (BLA 23 Aug. 1951).

?? Jim Jam and Bake Over Fires--burned over 7300 acres; 200 men fought the fire for over a month; burned every limb and the crown from the trees; black spikes; estimated 40 MMBF; new roads needed to salvage (BLA 29 Nov. 1951).

?? Lightning fires one on Burnt Ranch side of Hennessey Ridge; other on the South Fork on other side of ridge; converged into one of the largest of the 70 lightning-set fires; 200 acres burned; 600 men on the fire with twelve bulldozers; part of terrain so steep and rugged that the men were lowered down the cliffs on ropes (BLA 20 Aug. 1953).

?? Lightning fires in Grizzly Camp area northwest of Denny road; fought by mill crews (BLA 2 Oct. 1953).

?? Fire seven miles southwest of Willow Creek on the East Fork (BLA 30 Sept. 1954).

?? Major forest fire three miles southwest of Willow Creek, destroyed 300 acres of slash and some mature timber; 385 men on fire; 90 percent private land; traffic stopped on Highway 299 (BLA 9 June 1955). The large fire on the Willow Creek grade closed every mill in Lower Trinity and all employees were taken to fight the fire which burned over 300 acres (BLA 16 June 1955).

?? Fire in Six Rivers five miles south of Berry Summit; burned 900 acres of Douglas fir and slash; 300 men on fire; all logging operations in Horse Mountain area south of Berry have halted and men sent to the fire (BLA 25 Aug. 1955)

?? Fire on Pine Creek in the Bald Hills area; destroyed Alexander Lumber company mill and buildings (BLA 8 Sept. 1955).

TableBB-7. Heritage resources recorded within Mainstem Trinity Watershed Analysis Area.

Site Designations		Site Type - Description	7.5' USGS Quad Location	Notes
Trinomial or Primary #	USFS Site #			
CA-TRI-425	05-10-53-4	Historic: mule/foot bridge across Trinity River connecting to New River (Denny) trail, built 1918, reconstructed 1952 and in 1978, closed for use (since removed by USFS; pictured in Silver 1978:206)	Ironside Mountain	Record at NEIC, not at USFS-SO
CA-HUM-386H	05-10-53-07	Historic: ca. 1930 hunting or ski lodge with outbuildings, dumps	Grouse Mountain	Record at USFS-SO
CA-TRI-___H	05-10-53-68	Historic: mine adit, tailings, flume & equipment, ca. 1900	Salyer	Record at USFS-SO; Trinomial not assigned
CA-TRI-___	05-10-53-70	Historic: ditch from Hawkins Creek to Corona Mine	Salyer	Record at USFS-SO; Trinomial not assigned
CA-TRI-426H	05-10-53-72	Historic: burned structure, orchards, dump, post ca. 1915 Williamson Gray homestead	Ironside Mountain	Record at USFS-SO
CA-HUM-374H	05-10-53-73	Historic: orchard & square nails associated with ca. 1890's homestead	Willow Creek	Record at USFS-SO
CA-TRI-427	05-10-53-75	Prehistoric: possible chert quarry with flakes, tools, groundstone	Ironside Mountain	Record at USFS-SO
CA-TRI-428	05-10-53-76	Prehistoric: flake scatter	Ironside Mountain	Record at USFS-SO
CA-TRI-358	05-10-53-78	Historic: horse & foot trail segment linking Ft. Gaston to Weaverville, built 1863	Hennessy Peak	Record at USFS-SO
CA-HUM-383H	05-10-53-80	Historic: Ruby Copper Mine with adit, tailings, debris	Willow Creek	Record at USFS-SO
CA-HUM-384H	05-10-53-81	Historic: mine tailings and blazed trees	Willow Creek	Record at USFS-SO
CA-HUM-385H	05-10-53-82	Historic: foot trail segment possibly connecting to Ruby Copper Mine Trail, associated with can on tree with quartz claim paper	Grouse Mountain	Record at USFS-SO
CA-HUM-412H	05-10-53-87	Historic: mine with 2 shafts, building locations, connecting trail, refuse	Grouse Mountain	Record at NCIC; 2 USFS #s assigned (see 05-10-53-88)
CA-HUM-412H	05-10-53-88	Historic: log cabin ruins, dump, access road, possibly associated with ca. 1914-1915 Horse Mountain copper mining	Grouse Mountain	Record at USFS-SO
CA-HUM-413H	05-10-53-89	Historic: 1930's CCC camp with structural foundations and dumps	Grouse Mountain	Record at USFS-SO
CA-HUM-395H	05-10-53-91	Historic: ca. 1888 ditch segment	Hennessy Peak Salyer	Record at USFS-SO

Site Designations		Site Type - Description	7.5' USGS Quad Location	Notes
Trinomial or Primary #	USFS Site #			
CA-TRI-231H (?)	05-10-53-120	Historic: rock-lined cellar, mining ponds, ditches & flumes, orchard, access roads, associated with ca. 1900's Ole Swanson ca. 1900, Roth & Starr ("Swanson's Bluff-Paradise Claim-Lucky Star")	Salyer	Record at USFS-SO
CA-HUM-465H	05-10-53-123	Historic: cabin & refuse associated with Humboldt Ski Club ca. 1950-1958	Lord-Ellis Summit	Record at USFS-SO
CA-HUM-___/H	05-10-53-128	Prehistoric: projectile points and flakes Historic: lumber and roofing structure remains	Willow Creek	Record at USFS-SO; Trinomial not assigned
CA-HUM-470H	05-10-53-129	Historic: orchard, fence and refuse associated with ca. 1900 Roy J. Hanes homestead	Willow Creek	Record at USFS-SO
CA-HUM-471H	05-10-53-130	Historic: cabin remains and dump associated with ca. 1900 Roy J. Hanes homestead	Willow Creek	Record at USFS-SO
CA-HUM-472H	05-10-53-131	Historic: lumber and refuse associated with Brannan Mountain Lookout (destroyed 1974)	Willow Creek	Record at USFS-SO
CA-TRI-429	05-10-53-143	Prehistoric/Historic: ethnographic village site with midden, etc.	Salyer	Record at USFS-SO
CA-TRI-___H	05-10-53-144	Historic: log cabin ruins at active (1978) placer mine	Hennessy Peak	Record at USFS-SO; Trinomial not assigned
CA-TRI-___	05-10-53-145	Prehistoric: village site with midden, flaked and groundstone artifacts, 2 housepits, possible rock alignment	Salyer	Record at USFS-SO; Trinomial not assigned
CA-HUM-602H	05-10-53-165	Historic: ditch segment shown on 1883 map	Salyer	Record at USFS-SO
CA-TRI-848H	05-10-53-166	Historic: linear foot & pack trail to Denny	Denny	Record at USFS-SO
CA-TRI-220H	05-10-53-167	Historic: camp refuse on historic trail	Denny	Record at USFS-SO
CA-TRI-845H (also -846H, -1794H)	05-10-53-168	Historic: 7-mile-long mining ditch associated with Salyer Consolidated Mine, constructed between 1928 and 1930 (unfinished), declared an engineering failure because lacked proper grade to deliver water	Hennessy Peak Salyer	Record at USFS-SO; NEIC records show multiple trinomials assigned
CA-HUM-626/H	05-10-53-210	Prehistoric: projectile points, flakes, groundstone Historic: lumber, bottles	Lord-Ellis Summit	Record at USFS-SO
CA-HUM-630	05-10-53-211	Prehistoric: flaked-stone artifact scatter	Grouse Mountain	Record at USFS-SO
CA-HUM-631	05-10-53-212	Prehistoric: flaked-stone artifact scatter	Grouse Mountain	Record at USFS-SO

Site Designations		Site Type - Description	7.5' USGS Quad Location	Notes
Trinomial or Primary #	USFS Site #			
CA-HUM-632	05-10-53-213	Prehistoric: flaked-stone artifact scatter along trail segment	Grouse Mountain	Record at USFS-SO
CA-HUM-634/H	05-10-53-215	Prehistoric: possible prayer seat	Grouse Mountain	Record at NCIC, but not at USFS-SO
CA-TRI-1871H	05-10-53-245	Historic: two mining ditch segments separated by large slide	Salyer	Record at USFS-SO, NEIC (location shown as point plot vs. linear site)
CA-HUM-788	05-10-53-246	Prehistoric: groundstone, manuports	Salyer	Record at USFS-SO
CA-HUM-789	05-10-53-268	Prehistoric: flakes, groundstone	Salyer	Record at USFS-SO
CA-HUM-782/H	05-10-53-273	Ethnographic: Hupa village with housepits, midden, etc. Historic: possible homestead remains (orchard, square nails)	Tish Tang Point	Record at USFS-SO
CA-HUM-804H	05-10-53-274	Historic: ca. 1922 foot trail segment	Salyer	Record at USFS-SO
CA-HUM-___	05-10-53-275	Prehistoric: flakes, groundstone	Salyer	Record at USFS-SO; Trinomial not assigned
CA-HUM-___H	05-10-53-276	Historic: foot trail segment	Salyer	Record at USFS-SO; Trinomial not assigned
CA-HUM-___H	05-10-53-277	Historic: ditch segments	Salyer	Record at USFS-SO; Trinomial not assigned
CA-HUM-863H	05-10-53-284	Historic: 2 collapsed log cabins, fences, trail & refuse associated with USFS ranger station depicted on 1915 map	Willow Creek	Record at USFS-SO
CA-HUM-864H	05-10-53-285	Historic: sawmill ruins and refuse	Willow Creek	Record at USFS-SO
CA-HUM-875H	05-10-53-286	Historic: over-shot waterwheel, wheel housing, generator, water flume and ditch built by Gambi in mid-1920's to generate power for tourist resort; used until ca. 1947	Salyer	Record at USFS-SO
CA-TRI-1795/H	05-10-53-290	Prehistoric: flaked-stone artifacts Historic: stove parts, glass & can dump	Salyer	Record at USFS-SO
CA-HUM-894H	05-10-53-294	Historic: foot trail to Maple Springs built ca. 1930's by USFS for fire access	Salyer Tish Tang Point	Record at USFS-SO
CA-TRI-1375	05-10-53-300	Historic: Salyer Station Historic District constructed by CCC between 1934 and 1940, now used as USFS administrative site	Salyer	Record at NEIC, Not at USFS-SO; Determined National Register eligible

Site Designations		Site Type - Description	7.5' USGS Quad Location	Notes
Trinomial or Primary #	USFS Site #			
P-12-1336	05-10-53-305	Historic: CCC-era fire lookout constructed 1934	Willow Creek	Record at NCIC, but not at USFS-SO
CA-TRI-___	05-14-54-225	Historic: segment of ca. 1932 Denny-New River road	Hennessy Peak Salyer	Record at USFS-SO (overlaps 2 Forests); Trinomial not assigned
CA-HUM-196	n/a	Ethnographic: Hupa village with midden, etc.	Hoopa	In HVIR; record at NCIC
CA-HUM-198	n/a	Ethnographic: Hupa village with midden, cemeteries, etc.	Hoopa	In HVIR; record at NCIC
CA-HUM-199	n/a	Ethnographic: Hupa village with midden, housepits, cemeteries, etc.	Hoopa	In HVIR; record at NCIC
CA-HUM-204	n/a	Ethnographic: Tsnungwe village with midden, housepits; Historic: stopping place of 1849 Gregg expedition; site of old USFS Ranger Station	Salyer	Record at NCIC
CA-HUM-312	n/a	Prehistoric: possible housepits	Hoopa	In HVIR; record at NCIC
CA-HUM-340	n/a	Historic: cemetery	Hoopa	In HVIR; record at NCIC
CA-HUM-341	n/a	Historic: cemetery	Hoopa	In HVIR; record at NCIC
CA-HUM-344	n/a	Prehistoric: said to be ceremonial dance place	Hoopa	In HVIR; record at NCIC
CA-HUM-358	n/a	Ethnographic: Hupa village with midden, fire-cracked rock	Willow Creek	Record at NCIC
CA-HUM-433H	n/a	Historic: Native American burial(s), old road segment (replaced 1932-33), collapsed mining flume possibly associated with placer mine	Willow Creek	Record at NCIC
CA-HUM-434	n/a	Prehistoric: habitation site (per Stradford 1979:4-5)	Willow Creek	Site mapped but record not on file at NCIC
P-12-964H	n/a	No information available	Hoopa	In HVIR; site mapped but record not on file at NCIC
P-12-968	n/a	Prehistoric: isolated flaked-stone tool	Hoopa	In HVIR; record at NCIC
P-12-969	n/a	Prehistoric: isolated end-battered cobble	Hoopa	In HVIR; record at NCIC
P-12-1222	n/a	Historic: segment of Hoopa Valley wagon road	Hoopa	In HVIR; record at NCIC
P-12-1336	05-10-53-305	Historic: CCC-era fire lookout constructed 1934	Willow Creek	Record at NCIC, but not at USFS-SO

Site Designations		Site Type - Description	7.5' USGS Quad Location	Notes
Trinomial or Primary #	USFS Site #			
CA-TRI-887	n/a	Prehistoric: village site with midden, flaked-stone artifacts	Ironside Mountain	Record at NEIC
CA-TRI-1215	n/a	Historic: rock wall possible associated with nearby hydraulic mine	Salyer	Record at NEIC
"Henry Site" CA-TRI-__	n/a	Prehistoric: sparse flake scatter near location of mapped ethnographic Tsnungwe village	Salyer	Record at NEIC (backlog), trinomial not yet assigned

Acronyms: USFS SO, US Forest Service Supervisor's Office, Eureka; CA-HUM or CA-TRI (trinomial) California – Humboldt County, or California – Trinity County; NCIC, North Coastal Information Center of California Historical Resources Information System (CHRIS), Klamath; NEIC, Northeast Information Center of CHRIS, Chico; HVIR, Hoopa Valley Indian Reservation; n/a, not applicable.

Table BB-8. Traditional resource land-use issues, concerns, and opportunities (ICO) adopted as objectives in Hoopa Valley Reservation Forest Management Plan (1994).

Key Management Issue	ICO as described in Plan (ICO # applied by Tribe)
Wildlife Timber Production Recreation? (hunting-off reservation) Vegetation	adverse impact of a decline in *deer and elk populations* and their habitat due to logging, loss of habitat and overhunting (ICO #2)
Wildlife Timber Production	timber management impacts on culturally important wildlife such as *pileated woodpeckers and fishers* (ICO #109)
Timber Production Vegetation	impact of logging and precommercial thinning of tanoak and protection of tanoak for *acorn production* (ICO #31)
	impacts of logging on *traditional plants* including the definition of traditional plants and what constitutes a significant population of significant plants (ICO #39)
Timber Production SFP Vegetation	impacts on *mushrooms* from clearcutting, firewood cutting in designated firewood cutting areas, and cutting of young and old hardwood stands (ICO #41)
	to protect *culturally important plants* through alternative forest management such as precollecting plants before logging, and/or development of alternative forest products industry (ICO #116)
Fire Timber Production (Vegetation and Wildlife implied)	lack of *cultural burning* particularly in timber sale prescribed burn plans as well as lack of input from elders (ICO #55)
Vegetation Noxious Weeds	protection of *Port-Orford cedar* due to its cultural value and to the potential introduction of POC root wilt (ICO #82)
Timber Production Vegetation SFP ?	timber management impacts to *POC and yew* and whether to manage yew for taxol (ICO #113)
Transportation Wildlife Erosion Process	intended and unintended road closure leading to *lack of access for firewood cutting, ceremonial sites and cultural gathering areas*, but are *also reducing deer herd pressures* and road related erosion (ICO #54)
Transportation	loosing *historic trails* as well as building new trails (ICO #62)

Note: Each of the above ICO refers to Human Uses, specifically, contemporary Native American traditional land-use practices and resources of concern.

Table BB-9. Traditional wildlife of special concern in Hoopa Valley Indian Reservation[1] (Source: Hoopa Tribal Forestry 1994).

Pileated Woodpecker (*Dryocopus pileatus*)	Pacific Fisher (*Martes pennanti pacifica*)
Black-tailed Deer (*Odocoileus hemionus columbianus*)	Roosevelt Elk (*Cervus Canadensis roosevelti*)
Mink (*Mustela vison*)	Ring-tailed Cat (*Bassariscus astutus*)

[1] Hoopa Tribal Forestry has declared these "wildlife species of special concern," due to the potential for forest management to result in significant population changes in these species; no Tribal forest management activity shall knowingly result in "take" of a species of special concern unless the action is approved by the Tribal Council (this provision does not prevent hunting of these species) (Hoopa Tribal Forestry 1993:165).

Table BB-10. Candidate traditional wildlife of special concern in Hoopa Valley Indian Reservation[1] (Source: Hoopa Tribal Forestry 1994).

Spring Salmon	Chinook Salmon
Steelhead	Coho Salmon
Ring-necked Snake (*Diadophis punctatus*)	River Otter (*Lutra Canadensis*)
Bald Eagle (*Haliaeetus leucocephalus*)	Golden Eagle (*Aguila chrysaetos*)
Northern Flicker (*Colaptes auratus*)	Ruffed Grouse (*Bonasa umbellus*)
Blue Grouse (*Dendragapus obscurus*)	Stellers Jay (*Cyanocitta steller*)

[1] Hoopa Tribal Forestry considers these as candidate species of concern which do not warrant special protection measures because the riparian protection minimum management requirement is considered sufficient to prevent a significant on-Reservation decline of these species, or that forest management practices are not likely to result in impacts to the species (Hoopa Tribal Forestry 1993:166).

Table BB-11. Abundant traditional plants within Hoopa Valley Indian Reservation[1] (Source: Hoopa Tribal Forestry 1994).

Species of Concern	% Coverage at Site	Species of Concern	% Coverage at Site
Red Alder (*Alnus rubra*)	40% in type	Horsetail (*Equisetum arvense*)	25% at site
Barberry (*Mahonia nervosa*)	15%-0.1 acre	Redwood Sorel (*Oxalis Oregana*)	10%-0.1 acre
Black Oak (*Quercus kelloggii*)	20% in type	Buttercup (*Ranunculus* spp.)	n/a.
Huckleberry (*Vaccinium ovatum*)	50-75% in type		

[1] Abundant traditional plants do not need special protection measures, or regenerate sufficiently after timber management that their Reservation wide abundance is not threatened (Hoopa Tribal Forestry 1993:165).

Table BB-12. Traditional plants of special concern in Hoopa Valley Indian Reservation[1] (Source: Hoopa Tribal Forestry 1994).

Species of Concern	% Coverage at Site	Species of Concern	% Coverage at Site
Five-fingered Fern (*Adiantum pedatum*)	10% at site	Angelica (Indian) Root (*Angelica arguta*)	n/a
Ground Cone (*Boschniakia strobilacea*)	5% at site	Prince's Pine (*Chimaphila umbellate*)	15%-0.1 acre
Hazel Sticks (*Corylus cornuta*)	25%-0.1 acre	Tree Fern (*Evernia vulpine*)	n/a
Licorice Fern (*Polypodium californium*)	10% at site	Sword Fern (*Polystichum munitum*)	25%-0.1 acre
Bracken Fern (*Pteridium aquilinum*)	30%-0.1 acre	Yew (Taxus *Brevifolia*)	15%-0.1 acre
Tanoak Mushroom (Tricholoma magnivelare)	n/a	Chain Fern (*Woodwardia fimbriata*)	15% at site
Bear Grass (Xerophyllum tenax)	25% at site	Port-Orford Cedar (*Chameocypris lawsoniana*)	10%-0.1 acre
Coffeeberry (Rhamnus californicus)	10%-0.1 acre	Ironwood (*Cereocarpus betuloides* var. *betuloides*)	n/a

[1] These plants are considered species of special concern by Hoopa Tribal Forestry due to their historical and ceremonial uses, and because today, their abundance has declined significantly due to timber management. The "%Coverage at Site" establishes the "abundance threshold" for determining whether the named plant type is a SIGNIFICANT population at one site; a significant population of a species of special concern is based on the percent cover of the species within a certain area, such as 0.1 acre. For the HVIR, significant populations will be mapped, BUT NOT necessarily protected during project implementation. Port-Orford cedar will continue to be protected in all instances according to the minimum management recommendation (Hoopa Tribal Forestry 1993:164).

Table BB-13. Hupa plants gathered[1] (source: Heffner 1983: Table 2).

Basketry	Subsistence	Medicines	Traditional Crafts	Ceremonial [2]
Alder Bark	Berries	Alder Bark	Cedar	Angelica Root [6]
Bear Grass [3]	- Huckle	Cascara Bark	Hazel	Cedar Leaves
Hazel Sticks [3]	- Black	Cedar Leaves	Mock Orange	Wild Iris [6]
Maidenhair Fern	- Elder	Cedar Bark	Yew	Cedar Wood
Woodwardia Fern	- Manzanita	Cow Parsnip	Grape Vine	Yew Wood
Ponderosa Pine Root	- Salmon	Eucalyptus Leaves	Sugar Pine Nuts	Madrone Wood
Spruce Roots [5]	- Goose	Horsetail	Bear Grass	Sugar Pine Nuts
Doug-fir Moss [6]	- Blackcap	Juneberry	Manzanita	Wild Ginger
Sugar Pine Root	- Madrone	Madrone Bark	Digger Pine Nuts	Tan Oak Acorn [7]
Yellow Pine Root	Chinquapin Nuts	Madrone Leaves	Juniper Seeds	Bear Grass
Red Willow Root	Hazel Nuts	Mountain Balm [6]		Juneberry
Oregon Grape	Tan Oak	Nettles		Digger Pine Nuts
	Mushrooms	Oregon Grape Root [6]		Tobacco
	Sugar Pine Nuts	Prince's Pine [6]		
	Sunflower	Salal Leaves		
	Tan Oak Acorns	Soap Root		
	Digger Pine Nuts	Sunflower Stem/Root		
	Clover (tea)	Yarrow		
	Indian Tea	Wild Ginger		
	Spearmint	Willow Bark/Leaves		
	Yerba Buena	Wormwood		
	Mountain Balm	Yew Bark		
	Pepperwood Nuts			
	Black Oak Acorns			

[1] The data in this table reflect only data gathered in Forest Service interviewing and is not all inclusive as to plants gathered.

[2] Ceremonial means an item used in the ceremonies or used to make the regalia for the ceremonies.

[3] Good quality materials are scarce.

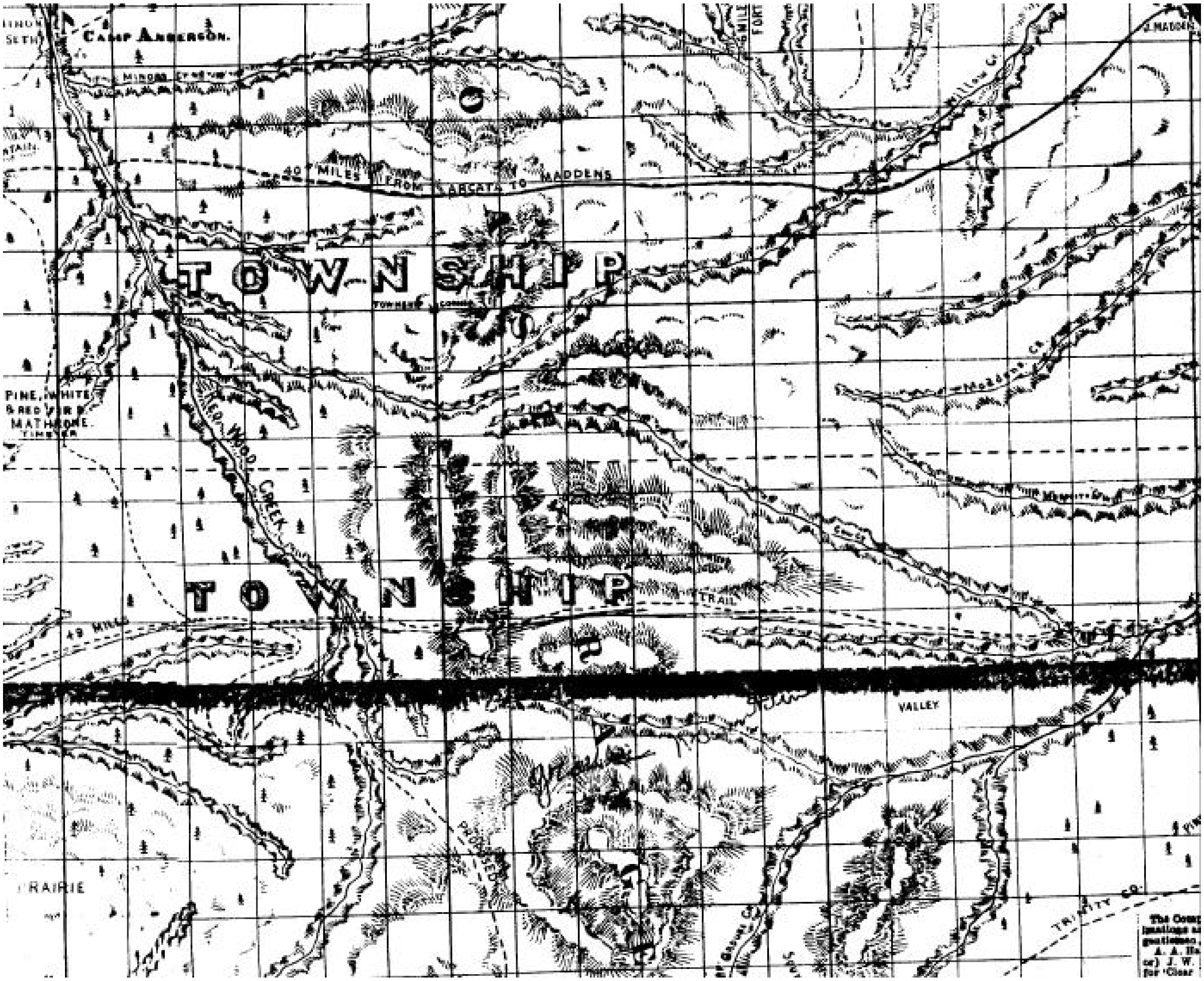
[4] Not found in Six Rivers National Forest.

[5] Gathered on the coast.

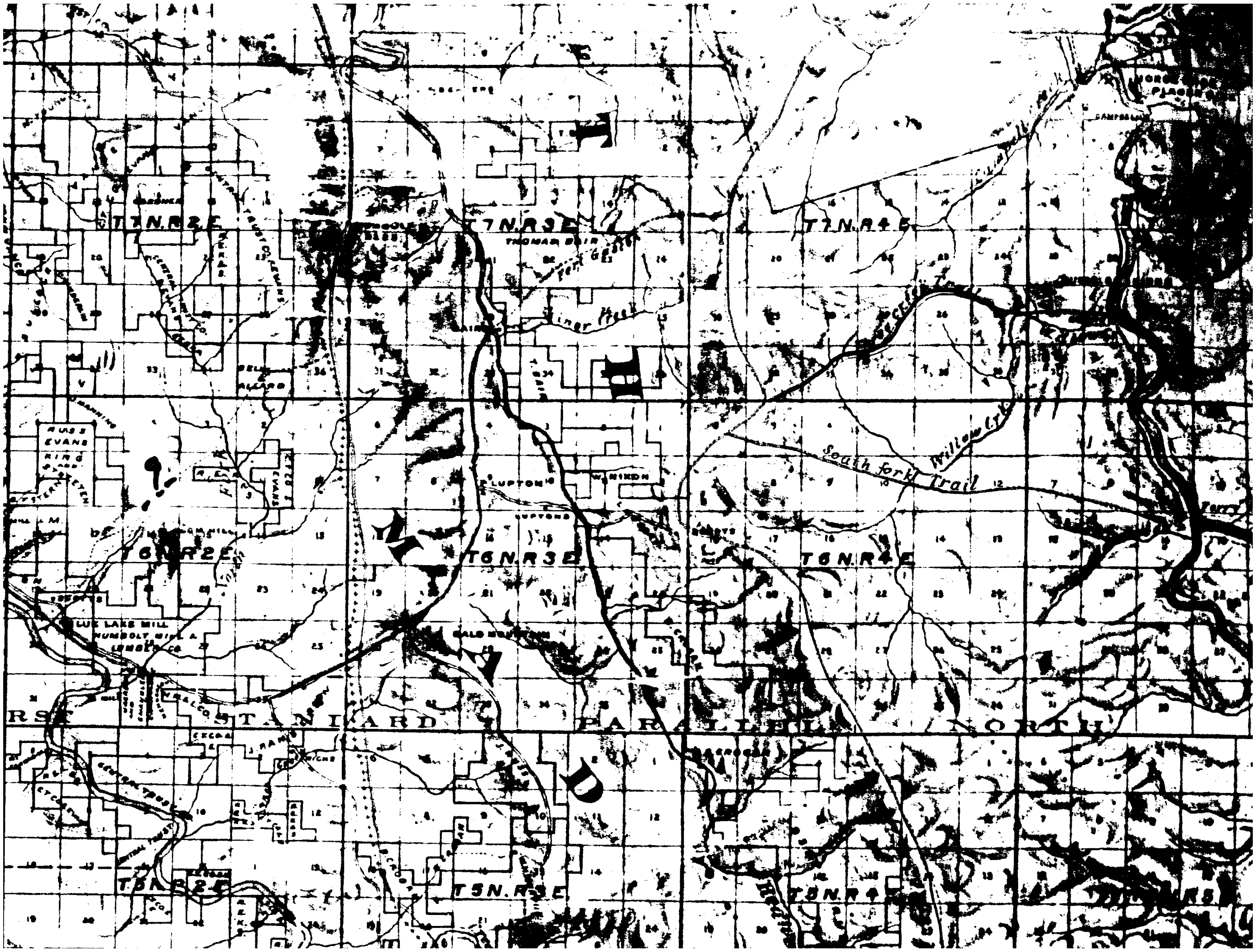
[6] Best gathered at high elevation.

[7] When gathered for the public ceremonials.

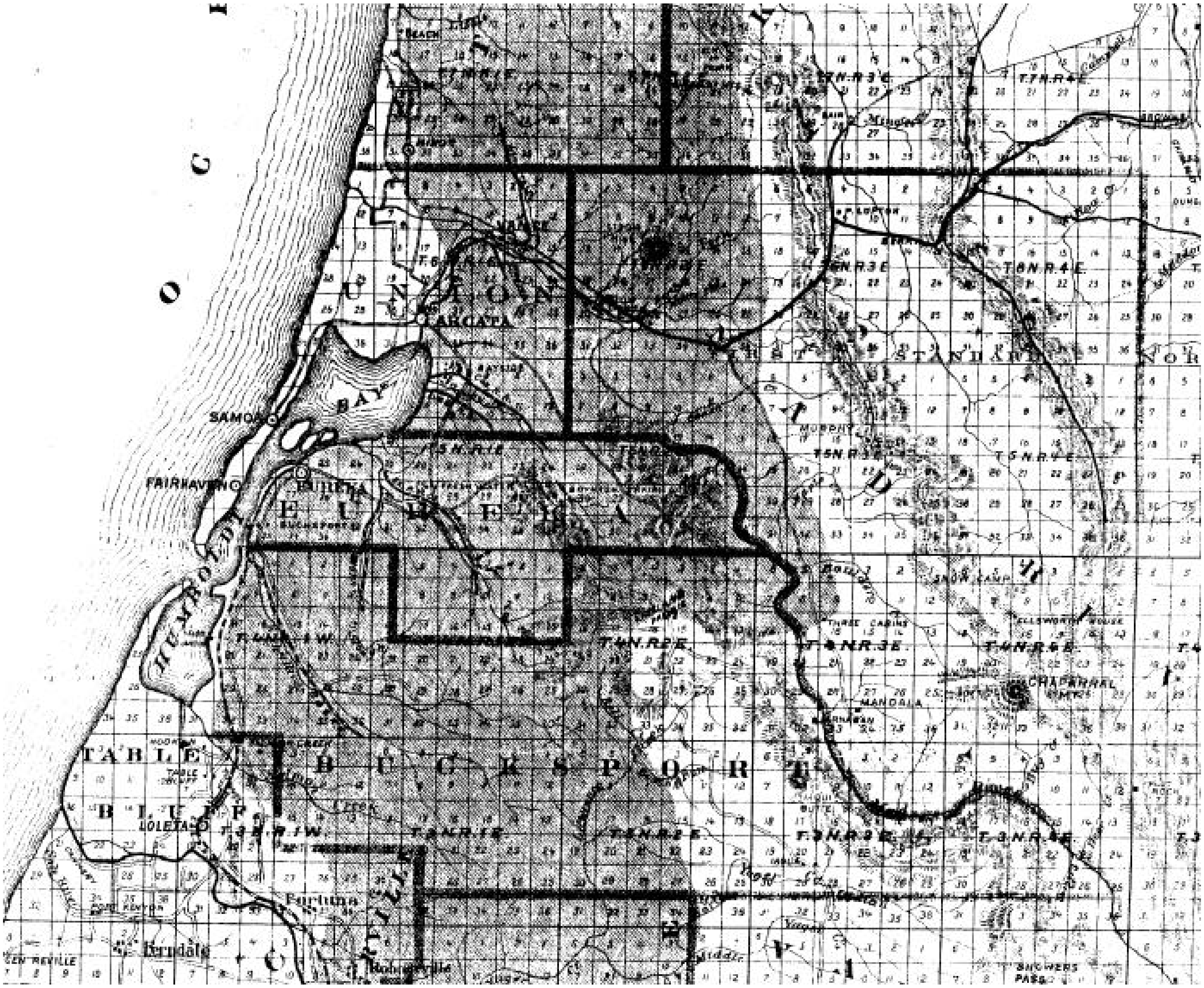
Attachment 2: Maps



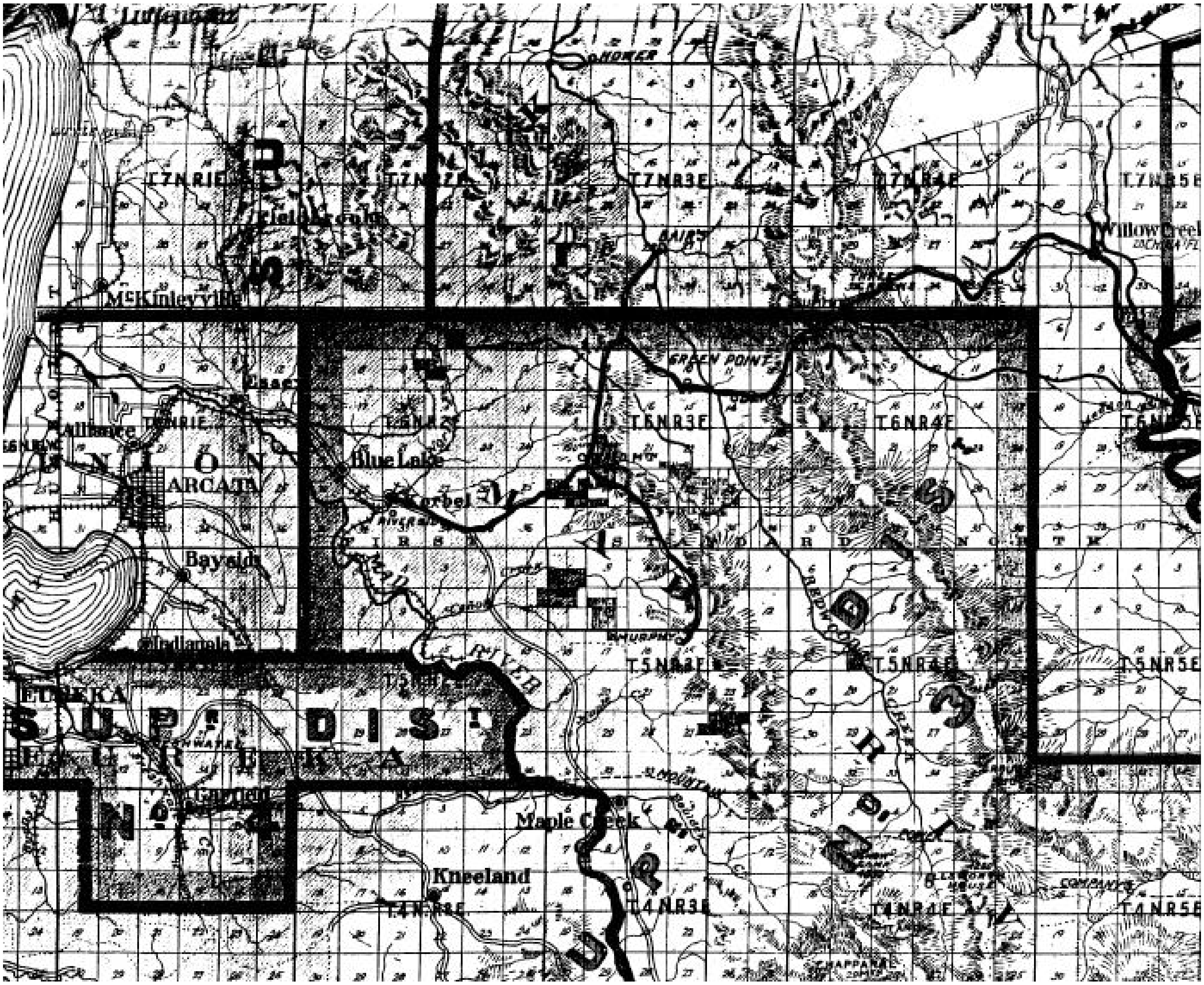
Map A A potion of Doolitlle's 1865 map of Humboldt County.



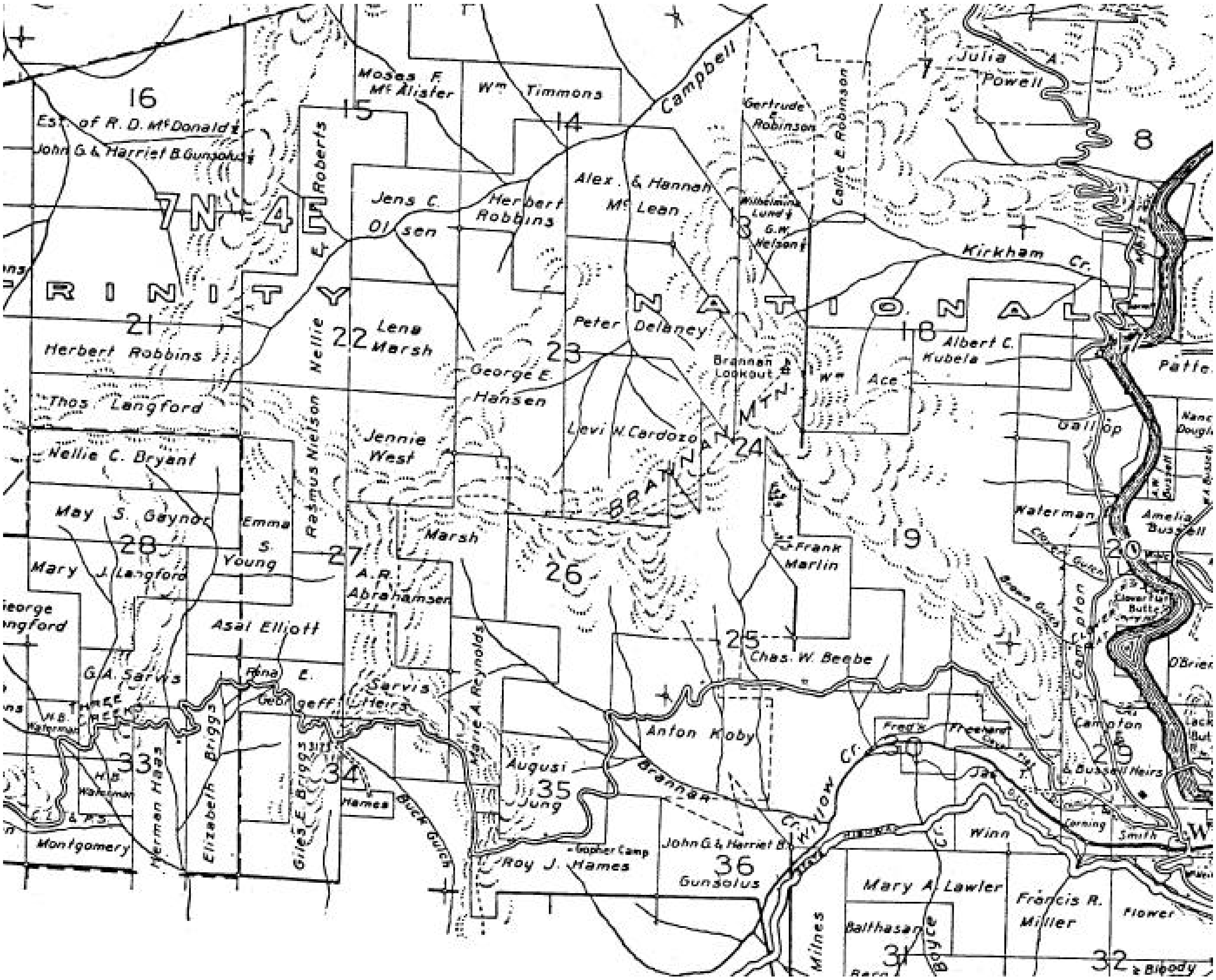
Map B. A portion of Forbe’s 1886 map of Humboldt County.



Map C. Portion of Lentell's 1898 map of Humboldt County.



Map D. Portion of Lentell's 1909 map of Humboldt County.



Map E. Portion of Belcher's 1922 Ownership Map of Humboldt County.

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