United States
Department of
Agriculture

Forest Service

Shasta-Trinity
National Forest

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Upper Trinity River Watershed Analysis

Including Watershed Analysis for:

Main Trinity River Watershed

Coffee Creek Watershed

East Fork Trinity River Watershed

Stuart Fork Watershed

Trinity Reservoir Watershed

Granite Peak and the Trinity Alps, looking north into the Upper Trinity River Watershed.

Upper Trinity River Watershed Analysis

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Introduction

The watershed analyses for the five 5th field watersheds in the Upper Trinity River provide a broad, landscape-scale evaluation of the watersheds that allow public, private, and government agencies to plan for future management of resources at a project level scale. Wherever possible the document has been arranged in a manner that will allow the five individual watersheds to be evaluated separately.

This watershed analysis can be considered one step of an iterative process for developing our knowledge about the physical and ecological conditions and processes that occur within the Upper Trinity River ecosystem. Existing conditions are compared with historic conditions to evaluate impacts, describe trends and infer the possible causes of change through time. Not all resources or possible issues have been addressed in this iteration of watershed analysis. The scope of the time scale evaluated has also been limited to ten years. As such the opportunities that have resulted from this analysis should be adequate to provide sufficient direction to land managers as to the highest priority work needed in the next decade. This analysis should be amended in the future as new information from surveys, inventories, monitoring reports, and other analyses are made available; or if other issues beyond the ones covered are being addressed. New information may describe impacts from natural events and/or management activities, and compare those impacts against baseline conditions described herein. In response to the new information and analyses, future additions to this watershed analysis will also enable adaptive management of watershed activities and conditions.

The Upper Trinity River Watershed Analysis followed the six-step process of analysis as described in the *Ecosystem Analysis at the Watershed Scale - Federal Guide for Watershed Analysis*, version 2.2 (Regional Interagency Executive Committee 1995). The six-step process ensures that the watershed analysis will include the following:

- A characterization of the watershed that identifies the dominant physical, biological, and human processes and features of the watershed that affect ecosystem functions and conditions;
- A description of issues and key questions regarding issues most relevant to natural resource management in the watershed;
- A description of the current range, distribution, and condition of ecosystem elements in the watershed;
- A description of how these ecosystem elements have changed through time as a result of human influence and natural disturbances;
- A synthesis and interpretation of information which compares existing and reference conditions of specific ecosystem elements and explains significant differences, similarities, trends and causes; and
- Management opportunities responsive to watershed processes identified in the analysis

Chapter 1: Characterization of the Watershed

The purpose of step 1 of watershed analysis is to identify the dominant physical, biological, and human processes or features of the watershed that affect ecosystem functions or conditions. First these features will be related to those occurring in the larger Trinity River Sub-Basin. Secondly the characteristics of the five 5th field watersheds in the Upper Trinity River will be addressed. The third topic of characterization is the identification of the most important land allocations that influence resource management within these watersheds.

The Trinity River Sub-Basin

The Upper Trinity River Analysis Area comprises the headwaters of the Trinity River Sub-Basin, constituting approximately one third of the Sub-Basin's total area (See **Figure 1: Upper Trinity Watershed Analysis Area**). The Trinity River is a 3rd field watershed that flows into the Klamath River Basin whose water flows to the Pacific Ocean. The Upper Trinity River Analysis Area (hereafter referred to as Upper Trinity River) is partitioned from the Sub-Basin as a whole by the dams for Trinity and Lewiston Reservoirs. The dams control all resources relating to water flows, including fish passage, flood flows and sediment delivery.

Some important characteristics of the Trinity River Sub-Basin are:

- The dominant vegetation cover is mixed conifer forest and evergreen brush.
- It is bisected east and west by State Highway 299 and north and south by State Highway 3 .
- The terrain is predominately mountainous and forested, with elevations ranging from 9,000 feet above sea level in the headwater areas, to less than 300 feet at the confluence with the Klamath River.
- Prominent features include Lewiston and Trinity reservoirs, the main Trinity River corridor and the town of Weaverville.
- The majority of the basin (approximately 70%) is under public ownership, including the Trinity Alps Wilderness areas, the Shasta-Trinity National Forest, Six Rivers National Forest, Bureau of Land Management, Bureau of Reclamation, and various state and county entities. The Hoopa Valley Tribe occupies 144 square miles of the lower basin, while industrial timber companies and other private landowners make up the remaining portions of the basin.
- Several geologic strata transect the basin including the Eastern Klamath Subprovince, Central Metamorphic Subprovince, Hayfork Terrain, Galice Formation, and others.
- The Trinity River has historically been recognized as a major producer of chinook and coho salmon and steelhead trout.
- Recreation use is high, especially in the National Recreation Area at Trinity and Lewiston Lakes and along the Hwy 299 corridor of the Trinity River.
- The entire main stem of the Trinity River below Lewiston dam was designated a National Wild and Scenic River by the Secretary of the Interior in 1981. Approximately 97.5 miles of the river

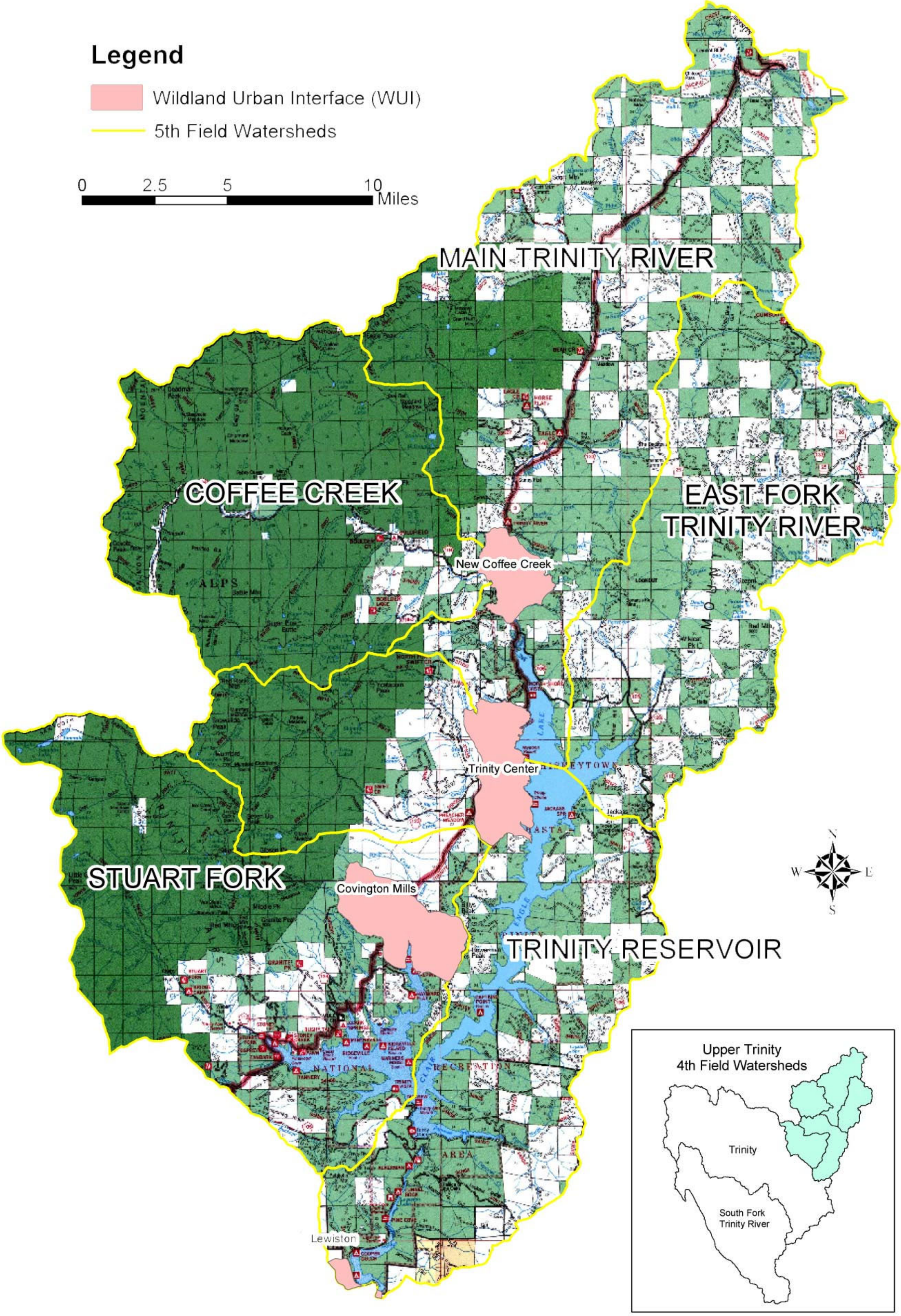

Figure 1: Upper Trinity River 5th Field Watersheds; inset, 4th Field Watersheds

are classified as recreational under the National Wild and Scenic River Act. The main stem Trinity River is also classified as recreational and scenic under the California Wild and Scenic Rivers Act.
- The incident of human-caused wildland fires is high along the Hwy 299 corridor.
- Port-Orford Cedar is present along some perennial streams within the sub-basin.
- The sub-basin supplies domestic water to the cities of Weaverville and smaller communities along the Trinity River.

Watershed Setting of the Upper Trinity River

Characteristics that are common to all of the 5th field watersheds within the Upper Trinity River will be listed under this title. Characteristics of each of the five fifth field watersheds within the Upper Trinity River will be listed separately. Some prominent characteristics of the entire Upper Trinity River watershed are:
- It contains approximately 460,000 acres of public and private lands.
- Approximately 70 percent of the watershed (322,000 acres) is Federal land administered by the U. S. Forest Service.
- The Upper Trinity River area is located inside two management units on the Shasta-Trinity National Forest, the Trinity River Management Unit and the Shasta-McCloud Management Unit.
- The entire watershed is within Trinity County.
- Population concentrations within the watershed are near Trinity Center, Coffee Creek, Covington Mill and the northern edge of Lewiston. Each of these areas is designated as a Wildland Urban Interface (WUI).
- The two major private landowners are Roseburg Lumber Company and Sierra Pacific Industries.
- Elevations range from 1800 feet at Lewiston Dam to 9000 feet along the western divide.
- Dominant physical features include Lewiston and Trinity Reservoirs and the Upper Trinity River.
- Recreation use is high in the Trinity Unit of the National Recreational Area and in the Trinity Alps Wilderness.
- The dominant vegetation type is Klamath Mixed Conifer, with Ponderosa Pine, Douglas fir, White fir, Cedar and Sugar Pine the major components.
- The dominant shrub species are Tan Oak, Brush Chinquapin and Green Leaf Manzanita.
- California Black Oak is a component of the Mixed Conifer type.
- Port-Orford Cedar populations are present along some perennial streams and spring areas in the northeast portion of the watershed.
- Several plants listed as Forest Service sensitive as well as many rare plants occur in the watershed.
- Water flow from the Upper Trinity River is controlled by the releases from the Trinity and Lewiston Reservoirs.
- The majority of human uses and habitation are concentrated along State Highway 3 and the shoreline of Lewiston and Trinity Reservoirs.

- Unlike the majority of the Trinity River Sub-Basin the Upper Trinity River Watershed contains no anadromous fish habitat because of the dams for Lewiston and Trinity Reservoirs.

Watershed Setting of the Main Trinity River

- The Main Trinity River watershed is 117,248 acres of the headwaters of the Trinity River, 43,524 acres, or 37 % of which is private land.
- 17% of this watershed is within the Trinity Alps Wilderness.
- Several small water diversions are used as domestic water supplies.
- This watershed contains the largest population of Port Orford cedar of any of the other watersheds in the Upper Trinity River.
- The majority of the New Coffee Creek Wildland Urban Interface (WUI) is located in this watershed as is a portion of the Trinity Center WUI.
- State Highway 3 traverses this watershed from north to south.
- Several of the major marinas and other recreational facilities on Trinity Lake are within this watershed.

Watershed Setting of Coffee Creek

- The Coffee Creek watershed is 74,533 acres of the Upper Trinity River, 5,899 acres, or 8% of which is private land.
- 86% of this watershed is within the Trinity Alps Wilderness.
- Several small water diversions are used as domestic water supplies.
- A small portion of the New Coffee Creek WUI is within this watershed.

Watershed Setting of the East Fork Trinity River

- The East Fork Trinity River watershed is 73,965 acres of the Upper Trinity River, 34,221 acres, or 46 % of which is private land.
- Several small water diversions are used as domestic water supplies.
- This watershed contains several populations of Port Orford cedar
- There are no WUIs within this watershed.

Watershed Setting of Stuart Fork

- The Stuart Fork watershed is 88,162 acres of the Upper Trinity River, 19,393 acres, or 22% of which is private land.
- 46% of this watershed is within the Trinity Alps Wilderness.
- Several small water diversions are used as domestic water supplies.
- The Covington Mill WUI is within this watershed.

- State Highway 3 traverses this watershed from north to south.
- Several of the major marinas and other recreational facilities on Trinity Lake are within this watershed.

Watershed Setting of Trinity Reservoir

- The Trinity Reservoir watershed is 105,620 acres of the Upper Trinity River, 34,811 acres, or 33% of which is private land.
- 22% of this watershed is within the Trinity Alps Wilderness.
- Several small water diversions are used as domestic water supplies.
- The Trinity Center and a portion of the Lewiston WUIs are within this watershed.
- Several of the major marinas and other recreational facilities on Trinity Lake and all of the recreational facilities on Lewiston Lake are within this watershed.

Land Allocations and Prescriptions for the Upper Trinity River Watershed

Table 1 provides information from the Shasta-Trinity Land and Resource Management Plan (LRMP) that provides guidance for how the land within the Upper Trinity River watershed is to be managed (USDA Forest Service, 1994). (See **Figure 2: Land Allocations and Management Areas**)

Table 1: Upper Trinity River Land Allocations and Prescriptions from the Forest LRMP

Land Allocation	Prescription	Approx. Acres	Approx. % Watershed
Congressionally Withdrawn	Wilderness	148,500	(32 %)
Late Successional Reserve	T&E, Sensitive Species Management	75,800	(16.5%)
Matrix	Comm. Wood Products	27,900	(6%)
	Roaded Recreation	42,900	(9%)
	Wildlife Habitat Mgt. (6)	19,000	(4%)
Administratively Withdrawn	Unroaded Non-motor. Rec. and Special Area Mgt	7,600	(2.5%)
Private Land		137,800	(30%)

Riparian Reserves. Within the land allocations are Riparian Reserves, land dedicated to the protection and enhancement of the stream channels they surround. The area of Riparian Reserves within all land allocations ranges from 26% to 29%. Further field verification will increase this percentage by as much as 40%.

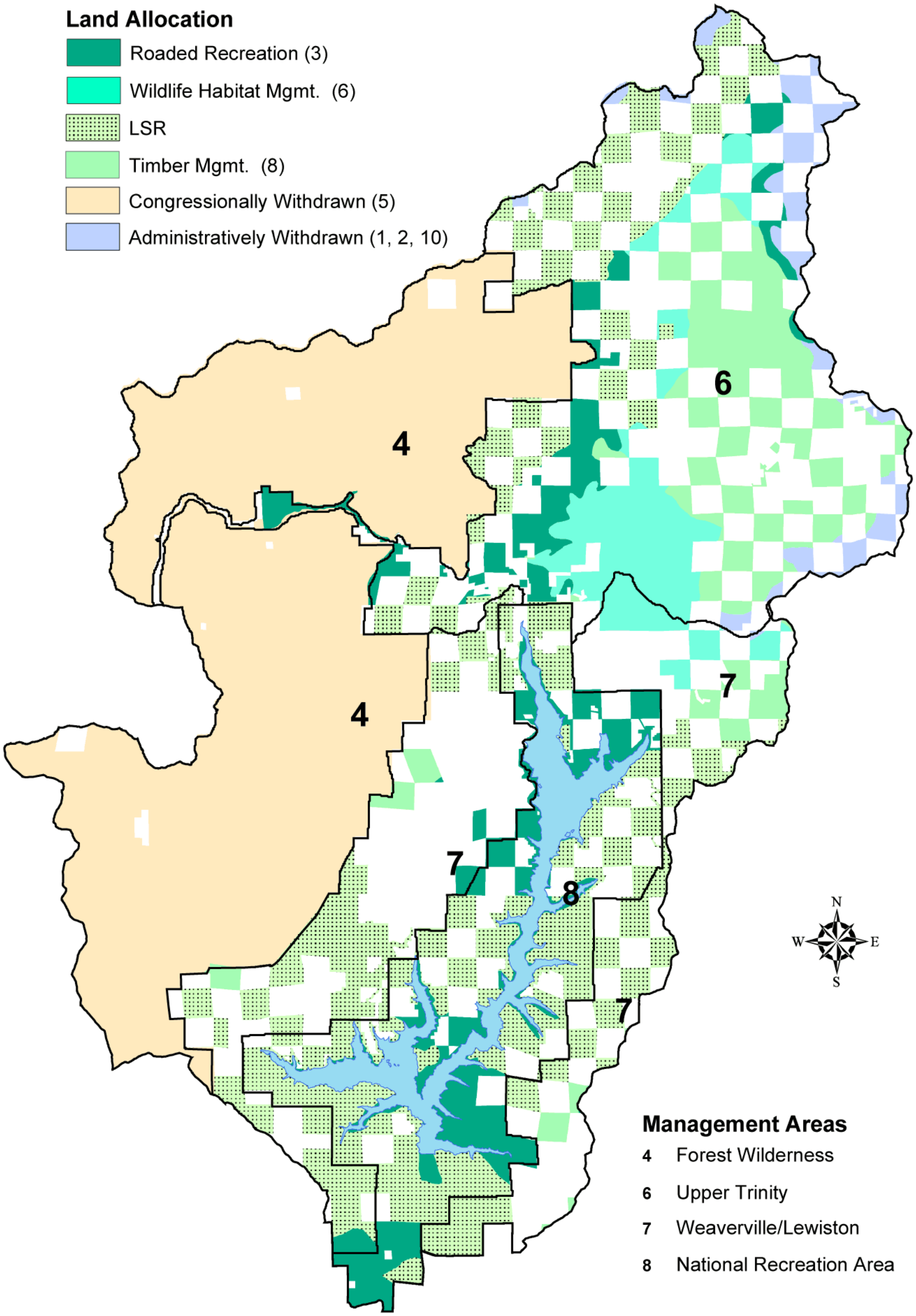

Figure 2: Land Allocations and Management Areas from the Shasta-Trinity National Forest Land and Resource Management Plan

Management Areas

The five 5th field watersheds in the Upper Trinity River Basin contain portions of the following Management Areas:

- Management Area 4: Forest Wilderness (Trinity Alps)
- Management Area 6: Upper Trinity
- Management Area 7: Weaverville/Lewiston
- Management Area 8: National Recreation Area

The following information from the Shasta-Trinity LRMP (USDA Forest Service, 1994) provides insights into existing watershed condition and potential issues for each management area in the Upper Trinity River Basin. Watershed conditions are characterized as observations from the plan while and management direction provides information on potential resources concerns.

Management Area 4 (Main Trinity River, Coffee Creek, Stuart Fork Watersheds)

Watershed condition

- Remnants of early-day mining activity are scattered throughout the Wilderness. Old ditches, adits, equipment, and structures are widely dispersed and substantially unnoticeable (LMP 4-93).

Management direction

- Manage the grazing allotments so that they will not create erosion problems or cause over use of the forage resource or deterioration of riparian habitat (LMP 4-95).

Management Area 6 (Main Trinity River, Coffee Creek, East Fork Trinity River Watersheds)

Watershed Condition

- Geology within the Upper Trinity River Management Area is mixed ultramafic (serpentine) and granitic rock. Soils derived from these rock types present a host of management concerns due to high erodibility, low to non-plantable site, and high landslide potential (LMP 4-103).
- This management area is rich in wet ultramafic plant communities, especially Darlingtonia seeps (LMP 4-103).
- Port-Orford cedar, found primarily along stream courses, remains healthy and free of the root disease that threatens this species in areas to the north (LMP 4-103).
- Mining practices modified the riparian habitat along much of the Trinity River in the past, and revegetation efforts are underway (LMP 4-103).
- Mining activities continue along Coffee Creek and the Upper Trinity River. However, the heavy impacts typically associated with these operations are not readily evident (LMP 4-103).

Management Direction

- Perform a risk analysis for any planned management activities in areas with Port-Orford cedar. Implement the appropriate mitigation measures to prevent the introduction for *Phytophthora lateralis*, the cause of Port-Orford cedar root disease (LMP 4-105).
- Monitor recreation and grazing use in the Deadfall Basin area. Limit resource impacts to this area (LMP 4-105).
- Consider the mass movement potential of the serpentine soil types during management activities (LMP 4-105).
- Identify the ultra-low site areas with mass movement, low plantability, and low regeneration potential in the serpentine soil types.

Management Area 7 (Stuart Fork and Trinity Reservoir Watersheds)

Management Direction

- Perform a risk analysis for any planned management activities in areas with Port-Orford cedar. Implement the appropriate mitigation measures to prevent the introduction for *Phytophthora lateralis*, the cause of Port-Orford cedar root disease (LMP 4-109).
- Plan and conduct activities in Swift Creek, East Fork of Stuarts Fork, and Snow and Bear Gulch so that water quality will be protected for domestic use (LMP 4-109).

Management Area 8 (East Fork Trinity River, Stuart Fork, Trinity Reservoir Watersheds)

Management Direction

- Construct new roads for timber harvest in the foreground areas of Trinity Lake, Lewiston Lake, and the Trinity River only where these roads can meet adopted Visual Quality Objectives (VQOs) (LMP 4-115).
- Cooperate with the DFG in developing fish habitat management plans for Trinity and Lewiston Lakes. Maintain a fishery consistent with demand, recognizing that there are habitat limitations that cannot be overcome. Emphasize coldwater and warmwater fish habitat management at Trinity Lake (LMP 4-115).
- Perform a risk analysis for any planned management activities in areas with Port-Orford cedar. Implement the appropriate mitigation measures to prevent the introduction for *Phytophthora lateralis*, the cause of Port-Orford cedar root disease (LMP 4-115).

Chapter 2: Identification of Issues and Key Questions

The issues addressed in this analysis are common to all of the five watersheds within the Upper Trinity River analysis area. The issues listed are relevant to the area in the time frame of the next ten years and do not include all resource management issues pertaining to the area. Analysis of other issues, such as recreation, wildlife and fisheries can be amended to this document in future iterations.

Issue: Vegetation Management

Approximately 47,000 acres of the basin (10%) are in Prescriptions that emphasize or permit timber management. Production of timber is an objective for lands designated as Matrix by the Northwest Forest Plan. As is typical of vegetation types in this basin, there are some areas of Knobcone Pine that are the result of historic stand-replacing wildland fires. These areas may be suitable for conversion to their historic vegetation type, Klamath mixed conifer. There are active bald eagle nest territories within the basin area around the National Recreation Area. Eagles actively forage the majority of the reservoir and utilize the perimeter trees for nesting, roosting, and as foraging perches. The entire National Recreation Area is classified as intermediate winter range for Columbian black-tailed deer. Critical winter range is located on most of the south-facing slopes, especially on the east side of the reservoirs. Opportunities exist within the watersheds where vegetation management can be used to manage vegetation to meet old growth habitat needs within the Late Successional Reserve (LSR). Opportunities exist within the watershed for vegetation management that will decrease the spread of insects and disease.

Key Question: What sustainable level of timber can be expected from this watershed?

Key Question: Are there areas where revegetation or stocking control efforts are needed?

Key Question: How can vegetation management be used to help maintain and develop wildlife and bald eagle habitat in the watershed?

Key Question: What can be done to maintain and develop late-successional habitat in the watershed?

Key Question: What can be done to promote forest health in the watershed?

Issue: Port Orford Cedar Protection

Populations of Port Orford cedar (POC) occur in the Main Trinity River and East Fork Trinity River 5th Field Watersheds. Port Orford cedar populations in both watersheds have not been infected by *Phytophthora lateralis*. The lack of infection is significant because the Upper Trinity River Basin is the only basin on the west coast where the infection is not present. The absence of *Phytophthora lateralis* is attributable to the relative isolation of the Port Orford cedar stands, however these stands are still significantly at risk to disease introduction and spread.

Prior to 1996 no Port Orford cedar populations in the Upper Trinity or Upper Sacramento River Basin (the most eastern population) were infected with *Phytophthora lateralis*. In 1996 the disease was discovered in POC located on the Sacramento River near Conant. A second infected POC stand was discovered on Scott Camp Creek in 2001. The presence of *Phytophthora lateralis* to the Upper

Sacramento River Basin has increased the potential for the disease to be transmitted to POC stands in the Upper Trinity River Basin.

Despite their isolation many stands of POC are located in heavily roaded areas and in close proximity to roads and associated land-use activities (e.g. timber harvest and mining). Opportunities for introduction of the disease to POC stands are numerous in heavily roaded areas.

A POC Risk Analysis is required for all projects that could potentially introduce *Phytophthora lateralis* to Port Orford cedar stands. The risk analyses enable the Forest Service to address the potential impacts of each project and design mitigation measures to protect POC stands. Currently there are no POC risk reduction projects identified in the Upper Trinity River Basin. There is a need to complete Watershed Analysis for all watersheds in the Upper Trinity River Basin containing POC and to identify, plan and implement risk-reduction projects that will decrease the probability of future stand infection by *Phytophthora lateralis*.

Key Question: What is the current condition of Port Orford cedar stands located in the Upper Trinity River and East Fork Trinity River 5th Field Watersheds?

Key Question: Where do opportunities exist to reduce the risk of disease introduction to Port Orford cedar stands?

Key Question: What types of management activities can be employed to protect Port Orford cedar populations? Where should these activities be focused?

Issue: Fire Protection and Fuels Management

This issue addresses the need to provide fire protection and management of fuels in order to reduce the risk of loss of human life, property and resource values within the Upper Trinity River watersheds. The time frame of reference focuses on the actions needed to optimize resource management in the next 10 years.

Key Question: What is the nature of fire hazard and risk within the watersheds of the Upper Trinity River?

Key Question: What and where are the most critical values that need immediate protection within the watersheds?

Key Question: Where are the priority areas for the next 10 years to do fuels management projects that will reduce the risk of human and resource damage from wildfires?

Issue: Watershed Condition

Core Topics Addressed: Erosion Processes, Hydrology, Stream Channels, Water Quality

The Forest Service has not intensively managed the Upper Trinity River Basin over the past several decades. Almost all timber harvest activities occurring during this period have been confined to private lands. Stream channels are still recovering from impacts from historic mining activity and the 1997 Flood.

All of the 5th field watersheds in the basin are prone to natural and human caused instability. Mass wasting processes are prevalent in each of the five watersheds.

Little is known about the overall condition of aquatic and riparian habitats in the 5th Field Watersheds located in the basin. Many small riparian habitats (e.g. seeps, hillslope meadows) are unmapped.

A maximum daily load for sediment in the Trinity River has been established by the Environmental Protection Agency due to the determination by the State of California that excessive amounts of sediment are adversely affecting water quality and the fishery (U.S.EPA, 2001). Prior to completion of the TMDL the natural and anthropogenic disturbances that affected hillslope erosion processes and sediment delivery to Trinity Lake had not been considered as detrimental to beneficial uses below the dam. The realization that large floods have caused elevated turbidity levels in Trinity Lake and the lower Trinity River for prolonged periods makes it impossible to discount the role that the upper basin plays in terms of sediment contribution to the Trinity River. There is a need to assess the overall condition of each 5th Field Watershed and identify management opportunities to reduce sedimentation from land-use activities. There is also a need to identify areas where land-use activities have degraded aquatic and riparian habitats and identify opportunities for restoration.

Key Question: What is the current condition of each 5th Field Watershed with respect to erosion processes, channel stability, and water quality?

Key Question: Where do opportunities exist to improve watershed condition and restore natural processes and aquatic and riparian habitats?

Chapter 3: Current Conditions

Vegetation Management

Vegetation is generally mixed conifer and evergreen shrubs at lower elevations with true fir and lodgepole pine at the higher levels. Vegetative cover around Trinity Lake includes a mixed conifer forest with areas of oak and grass. Several south facing slopes on Trinity Lake contain shrub fields that are prime winter range for the Weaverville deer herd. (USDA Forest Service, 1994)

This analysis organizes vegetation into five communities within the Trinity River basin. The five communities include Hardwoods, Mixed Fir (consisting primarily of Douglas fir and Red Fir), Mixed Conifer (which includes lodgepole pine and knobcone pine), Non-Forested, and Shrubs. The USDA Forest Service Remote Sensing Lab provided the Vegetation coverage.

The dominant vegetation community on National Forest lands for the Trinity River basin is Mixed Conifer (75%). Other smaller vegetation communities within the Trinity River basin include Shrubs (10%), Hardwoods (3%), and Mixed Fir (3%). Non-forested areas include soils, barren rock, gravel or pavement, and water features, such as Trinity Lake and Lewiston Lake, which together cover approximately 9% of the National Forest lands in the Trinity River basin. Roughly 30% of the basin is under private ownership.

Mixed conifer/Mixed fir communities contain various mixtures of ponderosa pine (*Pinus ponderosa*), Jeffrey pine (*Pinus jeffreyi*), Douglas fir (*Pseudotsuga menziesii*), white fir (*Abies concolor*), red fir (*abies magnifica*), sugar pine (*Pinus lambertiana*), knobcone pine (*pinus attenuata*), and incense cedar (*Calocedrus decurrens*) (USDA Forest Service, 1994).

Mixed hardwood communities occur at lower elevations and include species such as black oak (*Quercus kelloggii*), madrone (*Arbutus menziesii*), tanbark oak (*Lithocarpus densiflora*), canyon live oak (*Quercus chysolepis*), and big leaf maple (*Acer macrophyllum*). The most predominant hardwood varieties include black oak and live oak. Hardwoods are not a commercially valuable timber resource other than for firewood and biomass for energy producing wood-burning plants. Hardwoods are also common components of riparian woodlands, which grow in the vicinity of perennial and intermittent streams.

The shrub community includes an array of chaparral species. Chaparral species commonly include numerous ceanothus species, such as wedgeleaf (*Ceanothus cuneatus*), lemmon's ceanothus (*C. lemmonii*), snowbrush (*C. velutinus*), deerbrush (*C. intergerrimus*), whitethorn (*C. cordulatus*), or mahala mat (*C. prostratus*). Other species include manzanitas (*Arctostaphylos* spp.), bittercherry (*Prunus emarginata*), silk tassel (*Garrya fremontii*), Brewer's oak (*Quercus garryana* var. *brewerii*), dwarf tanbark oak (*lithocarpus densiflora* var. *echinoides*), chinquapin (*Castanopsis sempervirens*), chamise (*Adenostoma fasciculatum*), mountain mahogany (*Ceracarpus betuloides*), serviceberry (*Amelanchier alniflora*), and bitterbrush (*Purshia tridentata*).

Following is the breakdown of vegetation communities on National Forest lands by watershed.

Main Trinity River

The Main Trinity River Watershed is comprised of 3% Hardwoods (1,938 acres), 6% Mixed Fir (4,531 acres), 76% Mixed Conifer (55,946 acres), 5% Non-Forested (3,485 acres), and 10% Shrubs (7,567 acres); roughly 37% (43,524 acres) is under private ownership.

Coffee Creek

The Coffee Creek Watershed is comprised of 2% Hardwoods (1,485 acres), 86% Mixed Conifer (59,061 acres), 2% Non-Forested (1,248), and 10% Shrubs (6,906 acres); roughly 8% (5,899 acres) of the watershed is under private ownership.

East Fork Trinity River

The East Fork Trinity River Watershed is comprised of 3% Hardwoods (1,286 acres), 7% Mixed Fir (2,623 acres), 78% Mixed Conifer (30,532 acres), 4% Non-Forested (1,450 acres), and 8% Shrubs (3,295 acres); almost half of the watershed (34,222 acres) is under private ownership.

Stuart Fork

The Stuart Fork Watershed is comprised of 3% Hardwoods (2,035 acres), 69% Mixed Conifer (47,755 acres), 14% Non-Forested (9,768), and 14% Shrubs (9,144 acres); roughly 22% (19,393 acres) of the watershed is under private ownership.

Trinity Reservoir

The Trinity Reservoir Watershed is comprised of 6% Hardwoods (3,919 acres), 72% Mixed Conifer (51,056 acres), 15% Non-Forested (10,910 acres), and 7% Shrubs (5,122 acres); roughly one-third (34,811 acres) of the watershed is under private ownership.

The Upper Trinity River area is located inside three management units on the Forest, the Trinity River Management Unit, the National Recreation Area Management Unit and the Shasta-McCloud Management Unit. The Weaverville Ranger District is responsible for all of the vegetation planning for lands in the Trinity River Management Unit. This would include all of Stuart Fork, Coffee Creek, and Trinity Reservoir watershed, including the National Forest lands in the National Recreation Area, and the southern half of the East Fork and Main Trinity River watershed. The Mt. Shasta Ranger District is responsible for all of the vegetation planning for the Trinity River Basin lands in the Shasta-McCloud Management Unit. The northern portions of East Fork and the Main Trinity watershed fall under their management.

The dominant vegetation community for all five watersheds is Mixed Conifer. Mixed Conifer stands primarily consist of vegetation types that have a value for commercial timber harvesting. Since we are addressing vegetation management, the Mixed Fir community was combined with Mixed Conifer due to their commercial value for timber harvesting. An analysis of the Mixed Conifer/Mixed Fir vegetation strata (species type, size, density) is one way to determine the current timber-producing National Forest lands within each watershed. Mixed Conifer/Mixed Fir vegetation was divided into four stages in each watershed. The first stage was young conifer plantation or seedlings, the second stage was pole-size conifer (determined by a crown diameter of less than 12 feet), third stage was early or mid-mature conifer (determined by a crown diameter of 12 to 24 feet) and the fourth stage was mature or old growth conifer (determined by a crown diameter of greater than 24 feet). This strategy was used to display the acreages of conifer stands existing within each watershed. The following tables display the four stages of Mixed Conifer/Mixed Fir, the corresponding acreages, and the management prescription that they fall under.

Table 2: Current timber producing NF lands within the Main Trinity watershed

Veg Strata	Wildlife Emphasis	LSR	Timber Mgmt Emphasis	Limited Roaded Recreation	Unroaded non-motorized Recreation	Special Mgmt Area	Eagle	Wilderness	Roaded Recreation Emphasis	Total Acreage
Young Conifer Plantation or Seedling	400	590	473	23	0	0	0	0	174	1660
Pole-size Conifer	919	1007	652	3	0	6	0	1831	901	5319
Early or mid-mature Conifer	3052	9849	2042	661	461	17	60	4960	3540	24642
Mature or old growth Conifer	4448	8140	1325	324	316	113	109	7037	3428	25240
Total	**8819**	**19586**	**4492**	**1011**	**777**	**136**	**169**	**13828**	**8043**	**56861**

Table 2 displays the acreage of timber on National Forest lands within the Main Trinity watershed. This watershed has 24% of the timbered lands in Wilderness, and therefore unavailable for harvesting. Thirty-eight percent of the timbered lands are in the Matrix prescription, 8% with a timber management emphasis, 15% with a wildlife management emphasis, and 14% in roaded recreation. Thirty-four percent of the timbered lands are in LSR, and therefore may be harvested to a limited degree. Less than 4% of the timbered lands fall under an Administratively Withdrawn prescription.

Table 3: Current timber producing NF lands within the East Fork Trinity River watershed

Vegetation Strata	Wildlife Emphasis	Timber Management Emphasis	Limited Roaded Recreation	LSR	Roaded Recreation Emphasis	Total Acreage
Young Conifer Plantation or Seedling		1186		363	26	1575
Pole-size Conifer	684	1232	40	11	0	1967
Early or mid-mature Conifer	1686	10311	1423	471	1147	15038
Mature or old growth Conifer	2436	6054	1168	2920	1098	13676
Total	**4806**	**18783**	**2631**	**3765**	**2271**	**32256**

Table 3 displays the acreage of timber on National Forest lands within the East Fork Trinity River watershed. This watershed has the largest amount of timbered acres under the Matrix Prescription, 80%; of this 58% (18,783 acres) is under a timber management emphasis, 15% (4,806 acres) is under a wildlife management emphasis, and 7% (2,271 acres) has a roaded recreation emphasis. The East Fork Trinity River watershed is the only watershed in the Trinity River Basin that does not include any Wilderness acres. Twelve percent of the timbered acres are under the LSR prescription that may be harvested to a limited degree, and 8% of the acres are Administratively Withdrawn, identified as limited roaded recreation.

Table 4: Current timber-producing NF lands within the Coffee Creek watershed

Veg Strata	LSR	Wilderness	Roaded Recreation Emphasis	Total Acreage
Young Conifer Plantation or Seedling	365		73	438
Pole-size Conifer	200	3467	471	4138
Early or mid-mature Conifer	331	12846	566	13743
Mature or old growth Conifer	849	32106	894	33849
Total	**1745**	**48419**	**2004**	**52168**

Table 4 displays the acreages of timber on National Forest lands within the Coffee Creek watershed. Over 92% of the commercial value timber species is under the Wilderness prescription, and unavailable for

harvesting. There is roughly 3% of timbered lands under LSR, and the remaining 4% is under a Roaded Recreation Emphasis on Matrix lands.

Table 5: Current timber-producing NF lands within the Stuart Fork watershed

Vegetation Strata	LSR	Timber Management Emphasis	Wilderness	Roaded Recreation Emphasis	Total Acres
Young Conifer Plantation or Seedling	1203		0	108	1311
Pole-size Conifer	83		597		680
Early or mid-mature Conifer	6261	449	7768	249	14727
Mature or old growth Conifer	13137	88	12684	1457	27366
Total Acres	**20684**	**537**	**21049**	**1814**	**44084**

Table 5 describes the acreages of timber existing on National Forest lands within the Stuart Fork watershed. Almost 48% of the timbered lands are found in the Wilderness, therefore unavailable for harvesting; the 20,684 acres of LSR may be harvested to a limited degree- where harvesting is expected to enhance desired old growth conditions and/or protection. In Matrix lands, 537 acres are available under Timber Management Emphasis and 1,814 acres under Roaded Recreation Emphasis. Timber harvesting may be done on Matrix lands to a greater extent, providing it is consistent with the Forest Plan's ecosystem management objectives.

Table 6 - Current timber producing NF lands within the Trinity Reservoir watershed

Vegetation Strata	LSR	Eagle Management Emphasis	Timber Management Emphasis	Wilderness	Roaded Recreation Emphasis	Total Acreage
Young Conifer Plantation or Seedling	616		135	21	157	929
Pole-size Conifer	212		63	525	320	1120
Early or mid-mature Conifer	5735	14	1154	6041	3610	16554
Mature or old growth Conifer	16338		965	7160	5025	29488
Total	**22901**	**14**	**2317**	**13747**	**9112**	**48081**

Table 6 displays the acreage of timber on National Forest lands within the Trinity Reservoir watershed. Twenty-eight percent of the commercial value timber species are under the Wilderness prescription, and unavailable for harvesting; the almost 23,000 acres (48%) of LSR may be harvested to a limited degree. Twenty-four percent of the commercial value timber species are in Matrix lands and therefore available to a greater extent for timber harvesting.

Port Orford Cedar

One of the most important drivers for water quality protection is the occurrence of Port Orford cedar in the Mainstem Trinity River and East Fork Trinity River Watersheds. These two watersheds contain the only populations of POC on the west coast that have not been infected by *Phytophthora lateralis*. Port Orford cedar populations are most prevalent along the mainstem of the Trinity River and in the headwater reaches of the East Fork Trinity River.

Port Orford cedar root disease is primarily a water borne and transmitted disease. The disease can also be transported by humans and other vectors in mud from wet area to wet area. The disease requires running or standing water for introduction into uninfected areas. Port Orford cedar risk analyses categorize areas in high or low risk classes. High-risk areas are described as low-lying wet areas that are located down slope from already infested areas or below likely sites for future introductions, especially roads. Low-risk areas include areas that are not influenced by wet conditions or periodic water flow. Wildlife and humans can transmit the disease to low risk areas. It is believed, however, that in-growth and reseeding of POC will replace much of the mortality and the habitat loss will be minimal (USDA Forest Service, 2004). Most of the greatest impacts to POC stands from the disease, and the most habitat loss will likely occur in the high risk stands located in floodplains adjacent to streams and in areas of high road or trail density.

While not infected by *Phytophthora lateralis*, Port Orford cedar stands in the Upper Trinity River Basin have been impacted by both anthropogenic and natural disturbance. Port Orford cedar stands in both the Upper Trinity River and East Fork Trinity River Watersheds were damaged during the January 1997 Flood. Damage was most extensive at lower elevations in each watershed where rain-on-snow impacts were greatest. Port Orford stands located on the floodplains of the Trinity River and its tributaries were battered by floodwater and debris. Many POC trees were ripped from the ground, washed downstream and deposited on the floodplain of the Trinity River. The flood caused channel aggradation that buried tree trunks in some locations and channel degradation in other reaches that resulted in the exposure and scarring of POC roots. Field observations occurring in 2004 indicate that some POC stands are still in decline and experiencing mortality resulting from the physical damage that occurred during the 1997 Flood (Dave Schultz, personal communication, 2004).

The transportation system in the Upper Trinity River and East Fork Trinity River has also directly impacted POC stands. Roads located in close proximity to streams, springs, wet meadows and other hydrologic features have been located within Port Orford populations in some areas resulting in the direct loss of Port Orford Cedar habitat. In addition to direct habitat loss, roads located in and in close proximity to POC stands greatly increase the risk of *Phytophthora lateralis* introduction. Port Orford Cedar stands located immediately adjacent to roads are particularly vulnerable to infection because they can easily intercept spores from mud that drops off the bottoms of vehicles in wet weather (Dave Schultz, personal communication, 2004).

The current condition of Port Orford Cedar stands previously described is applicable to both the Upper Trinity River and the East Fork Trinity River 5th Field Watersheds. The following information is specific to each watershed.

Upper Trinity River Watershed

- Port Orford mapping information is incomplete on private lands.
- Mapped Port Orford cedar stands are confined to river and stream corridors.
- The largest population of POC is located along the Trinity River.
- Several mining claims and dispersed recreation areas are located near or in close proximity to POC stands along the Trinity River.
- Port Orford cedar seedlings are prevalent along the Parks Creek Road (42N17). POC seedlings are at risk of infection from spores introduced to the inside ditches of the Parks Creek Road.
- One low-water crossing on Road 39N20 is located upstream of a POC population on Tangle Blue Creek.
- POC stands located in or in close proximity to roads occur on the Little Trinity River and Cedar, Graves, North Fork Ramshorn, Masterson Meadow, and Tangle Blue Creeks.
- Roads occur within or adjacent to every mapped population of Port Orford cedar in the watershed.
- Existing information on potential POC problems and protection needs is sparse. There is a need to conduct a watershed improvement needs inventory to identify all potential POC risk-reduction projects.

East Fork Trinity River Watershed

- Port Orford mapping information is incomplete on private lands.
- Large populations of Port Orford cedar are located in the headwaters of East Fork Trinity River adjacent to Tamarack and Twin Lakes, and in the headwaters of Baker, Smith and Pond Lily Creeks and Halls Gulch. Populations of POC are also present along the East Fork Trinity River, lower Mumbo Creek and the headwaters of Grouse Creek.
- Roads occur within or adjacent to every mapped population of Port Orford cedar in the watershed.
- Existing information on potential POC problems and protection needs is sparse. There is a need to conduct a watershed improvement needs inventory to identify all potential POC risk-reduction projects.

The condition of populations of Port Orford cedar in the Upper Trinity River Basin is monitored annually by the Forest Service entomologists (Peter Angwin, personal communication, 2004).

Fire and Fuels

The present character of the fire regime in the northern Klamath mountains results from the changes made as a result of human activities in the last century. Historically, fire has been a natural influence on the landscape within the upper Trinity River watershed. Before the influence of humans, wildfires started from lightning strikes or hot dry winds and spread across large tracts of land before burning out. Some conifer species (e.g., knobcone pines) require fire, heat or stress for seed germination. Such frequent, low intensity fires burn quickly through under brush, preserving large trees and maintaining diverse, multistory forests. Forest management practices over the past 70 years, however, have suppressed fire on many of the public lands and have profoundly affected the structure and composition of vegetation in low to middle elevation forests (Weatherspoon 1996). Conifer stands have become denser, mainly in small- and medium-size classes of shade-tolerant and fire-sensitive species. Additionally, dead and downed trees, due to drought, disease, or pest infestation, increase the amount of fuels on the forest floor. One consequence of these changes has been a large increase in the amount and continuity of both live and dead forest fuels, resulting in a substantial increase in the probability of large, severe wildfires (Weatherspoon and Skinner 1996). The conditions are now set for hot stand replacement type fires that consume underbrush, overstory trees and the duff layer. Stand replacement type fires burn hotter, longer and are usually more difficult to control. Fire size is predicted to increase with these conditions especially in the Upper Trinity River watershed that has steep, rugged topography and limited access.

The west side of the watershed is predominately in the Trinity Alps Wilderness. Typically the fuels in the wilderness have built up over the years of fire suppression below elevations of about 6500 feet. Access is limited and response times may be affected if other fires demand available resources for higher priority fires.

The east side of the watershed is in checkerboard ownership and has been heavily managed for timber production in the last two decades. Generally the fuel loading has increased in the last twenty years on those private lands that have been harvested with cable systems. Tractor logged lands have less fuel buildup after harvest. There are many young stands of timber in plantations in this part of the watershed that need fuel reduction work around them to protect them from wildfires.

Trinity County has developed a program through the Resource Conservation District (TCRCD) that includes a Fire Management Plan (TCRCD, 2003), a Memorandum of Understanding for participants in the Trinity County Fire Safe Council (TCRCD, 2000a) and a site-specific management plan for the area around Covington Mill (TCRCD, 2000b)

Fire Protection and Fire Occurrence

Currently, fire protection in the Upper Trinity River watershed is a cooperative effort between the Forest Service and CDF. CDF direct protection areas are limited to a relatively small portion of land east and west of Lewiston Lake, outside of the NRA boundary.

Over the past 70 years, a regime aimed at total fire suppression has been in operation on forestlands in the watershed. While the purpose of a full-suppression regime is to protect resources and structures valued by resource managers and residents of the area, it has also led to the build-up of underbrush and ladder fuels that increase the hazard for catastrophic wildfires in the area. With the increased development of roads, and use of residential and recreational areas in the watershed, the incidence of fire starts has also increased over time.

Fire Regimes

The area within the Upper Trinity River watershed has a fire regime that is characteristic of other watersheds in the Klamath and Southern Cascades Provinces. Fires have historically been low intensity surface fires with short return intervals. The mixed conifer series is the most common series found throughout the province that includes stands of ponderosa pine at the drier ends of the mixed conifer zones. Mixed conifer and ponderosa pine series as well are both characteristic of short interval fire adapted fire regimes. Pine sites may have shorter intervals of disturbance (5-15 years) due to drier site conditions and extended burn seasons where higher elevations and transitions zones to mixed conifer stands may experience longer intervals (5-30 years) due to climatic variables (Skinner, 1997a). Within the lower elevation and thus drier sites fire regimes have experienced a change from frequent low intensity surface fires to that of infrequent high intensity stand replacement fires. Correspondingly higher elevation moist sites within the same fire regime have changed from infrequent low to moderate intensity surface fires to infrequent low, moderate and high intensity stand replacement fires.

Fuel Profiles

The following are distinct fuel profiles that can be expected to occur within the Watershed Analysis area that characterizes probable fire behavior expected.

Mature mixed conifer/lower elevations: generally reflects one of the most vulnerable fuel profiles to catastrophic wildfires as drier moisture sites and fire exclusion promote high intensity fire behavior. General fuel loads are between 15-25 tons/ac.

Mature mixed conifer/midslopes-mountain tops: Higher elevations experience longer return intervals due to differing moisture regimes and climate. Heavier fuels are common due to lengthened fire intervals. General fuel loads are 20-30 tons/ac.

Small timber/mixed conifer: Fire is carried in the litter layer with less residual fuels than mature timber. Brush in the understory is more common. Can include plantations over 20 years old. General fuel loads are 10-15 tons/ac.

Shrub Fields: Fire is carried from the litter layer into the shrub overstory. Includes plantations 11-20 years old. Commonly found on south slopes with low residual wood surface fuels but dense horizontal and vertical fuel ladders. General fuel loads are 0-10 tons/ac.

Knobcone: Footprints of past high intensity wildfires that occur at long intervals resulting in dense fuel buildup as the stands mature. General fuel loads are 15-25 tons/ac.

Grasses: New plantations, some south aspect mature stands at lower elevations. General fuel loads are 0-10 tons/ac.

Heavy Insect mortality/Blow-down: Heavy residual fuels develop high intensity fires. Intermixed within other fuel profiles occasionally on large scales. Can include past harvest areas without hazard reduction work. General fuel loads are 25-45+ tons/ac.

Current Conditions Unique for the Five 5th Field Watersheds

Main Trinity River

The Main Trinity River watershed is characterized by have 17% Wilderness and as much as 45% of the area outside of the Wilderness in private land checkerboard ownership. The New Coffee Creek WUI is located primarily in this watershed as is about 30% of the Trinity Center WUI. Most of the land surrounding the Trinity Center WUI is in private ownership. Highway 3 travels up the Trinity River riparian corridor where several developed Forest Service campgrounds are located. Fire control access is good in all but the Wilderness portion of this watershed.

Coffee Creek

Coffee Creek is predominately Wilderness and has the typical fire and fuel characteristics as described above. There is also an area of timber blow-down in the East Fork of Coffee Creek that has significantly increased the fuel loading there. The extreme lower end of the watershed contains a portion of the New Coffee Creek WUI.

East Fork Trinity River

About half of the East Fork Trinity River watershed is in private timber management. Although Forest Service timber harvesting has been curtailed in the last two decades the rate of timber harvesting on private lands has increased in that time frame. Fire control access is good throughout the watershed but response times are lengthened due to travel distances for fire equipment. There are no WUIs in this watershed although there are some structures on private land and recreational facilities in the lower elevations.

Stuart Fork

The Stuart Fork watershed is 21% Wilderness. It contains The 6,553 acre Covington Mills WUI and a majority of the high use recreational developments and marinas on the lake. In addition to the existing WUI the private land in the Estraleta area near the lake is beginning to be developed. These areas are difficult to protect from wildfire due to steep terrain and limited access. There are also valuable timber resources outside of the wilderness in this watershed that need protection from wildland fires.

Trinity Reservoir

This watershed is on both sides of Trinity Lake, but the most difficult lands to manage for fire protection lie on the east side of the lake. Response time to fires in this area has been increased by as much as three hours by the closing of the Trinity Mountain Guard Station. Another fuels problem is related to the amount of debris built up along the shoreline of the lake each year as the water level recedes. These build ups are potential fire start locations during the summer when houseboat activity is high in the coves. About 70% of the Trinity Center WUI is located in the northern end of this watershed and the Lewiston WUI borders the southern end. The west shoreline of Lewiston Lake is a popular recreational area having several Forest Service developed recreational facilities. The watershed has checkerboard ownership east of the lake where both private and National Forest management have resulted in many acres of young plantations. These plantations are susceptible to wildfire and are the second highest priority for protection in the Upper Trinity River watershed behind protection of the WUIs. The Trinity Reservoir watershed contains the Swift Creek watershed that has nearly 23,000 acres in the Trinity Alps wilderness.

Watershed Conditions

Erosion Processes

The Trinity River Basin is located within the Klamath Mountain Geologic Province. The province is a product of tectonic accretion of fragments of oceanic crust and island arcs. Paleozoic rocks of the eastern Klamath region formed a nucleus against which other tectonic slices later accreted. The nucleus was a long-standing arc, built on a dominantly ultramafic base (the Trinity ultramafic sheet) and shows evidence of intermittent volcanism ranging from early Paleozoic into the Jurassic. A layer of amphibolite and mica schist (Salmon Hornblende & Abrams Mica schist) developed beneath the ultramafic substratum of the eastern Klamath region during the Devonian period, probably as a result of subduction of the more westward oceanic rocks. Although the record of volcanism in the eastern Klamath region suggests that subduction took place during the late Paleozoic and early Mesozoic, no accretion to the eastern Klamath nucleus seems to have occurred between the Devonian and Jurassic. The various tectonic slices of the western Klamath Mountains were swept against the Paleozoic nucleus only during Jurassic time (Ernst, 1981). Several distinct sedimentary units associated with ancient terrace deposits (Weaverville formation) and recent floodplain features are found throughout the watershed.

Granitic plutons intruded many parts of the province during Jurassic time. These plutons can now be seen in some locations in the Trinity Alps. The topography of many headwater drainages within the Trinity Alps has also been shaped by recent glacial activity occurring within the past 10,000 years. Glacial features found in the headwater areas include cirque lakes, large rounded cirques, and sharply defined ridges (KRIS, 2005).

The rate of uplift for the Klamath Mountains has been relatively rapid, occurring within the last 2-3 million years. The rapid uplift has created the steep relief found in all of the drainages located within the Upper Trinity River. Mass wasting has also played a role in shaping the geomorphology of the area. Mass wasting features are found throughout the watershed. Primary local characteristics that contribute to mass wasting include: bedrock type and geologic structure, geomorphic location (such as inner gorges) and slope aspect. In several instances, mostly in wet areas adjacent to draws and inner gorges, the processes which contribute to mass wasting are presently active, but in the large majority of instances they are dormant.

Several bedrock formations within the watershed are particularly vulnerable to disturbance. These include the granitic rocks that form many of the peaks within the Upper Trinity River Basin, the Weaverville formation and serpentines of the Trinity ultramafic sheet. Land management activities such as timber harvest and road construction have the potential to accelerate hillslope erosion and mass wasting processes and cause gully formation and erosion (KRIS, 2005).

Soils

Soils within the Upper Trinity River Basin have predominately formed in metavolcanic and metasedimentary residuum on upper mountain side slopes and ridges. Soils formed in these areas are generally shallow (less than 20 inches) to moderately deep (20 to 40 inches) loams to gravelly and very gravelly clay loams (Chaix, Chawanakee, Deadwood, Goulding, Ishi Pishi, Marpa, and Neuns soils). Soils formed in nonmarine sediments are moderately deep to very deep (greater than 60 inches) loams and gravelly clay loams (Forbes, Holland, Soulajule). See **Table 7** for soil information.

Table 7: Soil Characteristics for the Upper Trinity River Basin (Lanspa, 1994)

Soil Series	Map Units	Depth	Rock Type	Surface Texture	Clay%	Rock Frags	Burn Damage	Compaction	Erosion Hazard
Chaix	18, 21, 22	MD	G	cosl	8-12	10-15	severe	slight	H/14
Chawankee	23, 25, 27	S	G	gsl	8-18	10-20	high	slight	H/13
Deadwood	34, 35, 37	S	MS	vgsl	10-20	50-85	moderate	moderate	M/7
Forbes	65, 66, 67, 68	VD	NS	l	20-50	5-10	moderate	severe	MH/12
Goulding	85	S	MS	gsl	6-14	30-65	moderate	moderate	M/9
Holland	123, 214	MD-D	MV	l	20-34	10-35	moderate	severe	MH/12
Ishi Pishi	148	MD	Serp.	vgl	25-40	35-65	moderate	moderate	M/10
Marpa	175, 218	MD	MS	gl	18-30	25-55	moderate	severe	M/10
Neuns	214, 218, 219	MD	MV	vgl	10-25	40-60	moderate	moderate	M/8
Soulajule	304, 305	MD	NS	gl	20-45	10-40	moderate	severe	MH/11
Xerofluvents	351	VD	NS	vcsl	4-10	50-90	low	slight	L/2

Legend

Depth Classes:
S = shallow (10-20")
MD = mod deep (20-40")
D = deep (40-60")
VD = very deep (>60")

Parent Material:
G = granitic
MS = metasediments
MV = metavolcanics
NS = nonmarine sediments

Soil Texture:
l = loam
gl = gravelly loam
vg = very gravelly
sl = sandy loam
vc = very cobbly

Compaction:
Slight = beneficial
Mod = slight harm
Severe = harmful

Erosion Hazard:
L = low (<4)
M = moderate (4 -12)
H = high (13-29)

Soil Cover and Erosion

Many land use activities have the potential to cause erosion rates to exceed natural soil erosion or soil formation rates. In order to assess the potential risk of a given soil to erode, an erosion hazard rating (EHR) was developed for the five 5th Field Watersheds in the Upper Trinity River Basin. Many interrelated factors were evaluated in an EHR system to determine whether land use activities had the potential to cause accelerated erosion.

The EHR system is designed to assess the relative risk of accelerated sheet and rill erosion. This rating system is based on soil texture, depth, clay percent, infiltration of soil, amount of rock fragments, surface cover (vegetative and surface rocks), slopes, and climate. Risk ratings vary from low to very high with the low ratings indicating a low probability of surface erosion. Moderate ratings mean that accelerated erosion is likely to occur in most years and water quality impacts may occur for the upper part of the moderate numerical range. High to very high EHR ratings mean that accelerated erosion is likely to occur in most years and that erosion control measures should be evaluated. These ratings assume varying amounts of vegetation cover depending on the degree of vegetative management.

Analysis shows that most of the soil erosion levels in the Upper Trinity River are moderate to high depending on slope and cover (See **Figure 3: Soil Erosion Hazard Rating**). Low to moderate erosion hazard ratings ensure that soil erosion will not exceed the rate of soil formation. High to very high erosion hazard ratings indicate that soil erosion will exceed the rate of soil formation and site productivity will degrade if no erosion control measures are enacted. Maintaining soil cover to reduce erosion is the goal of the regional Soil Quality Standards (USDA Forest Service, 1995).

The soil erosion map shows areas that have high to very high erosion potentials, granitic parent material and are very steep. On a 5th field watershed basis the Stuart Fork and Coffee Creek watersheds have the greatest potential for erosion followed by the Main Trinity and East Fork Trinity River watersheds. The Trinity Reservoir watershed has the least potential for erosion.

Soil Compaction/Porosity

Soil compaction reduces infiltration and increases runoff, which increases erosion hazard ratings and decreases down stream water quality. Compaction decreases porosity, which decreases tree root elongation during critical growing periods thus stressing the tree and decreasing timber site indexes. With stressed trees the stand becomes more likely to develop disease and is more susceptible to insect attacks. To address the problem of compaction, scientists from the Shasta-Trinity National Forest and Pacific Southwest Experimental Station developed a compaction rating criteria. In 1995 the Forest Service and Pacific Southwest experimental station soil scientists developed Soil Quality Standards (SQS) to set thresholds for erosion, fertility, and compaction (Rust, 2004).

The soil compaction hazard map created for this analysis shows areas that have high to very high compaction hazards that have fine textured sediment with high clay contents (See **Figure 4: Soil Compaction Hazard Rating**). On a 5th field watershed basis soils in the Stuart Fork Watershed have the greatest potential for compaction. Soils in the Main Trinity River Watershed have the least potential for compaction.

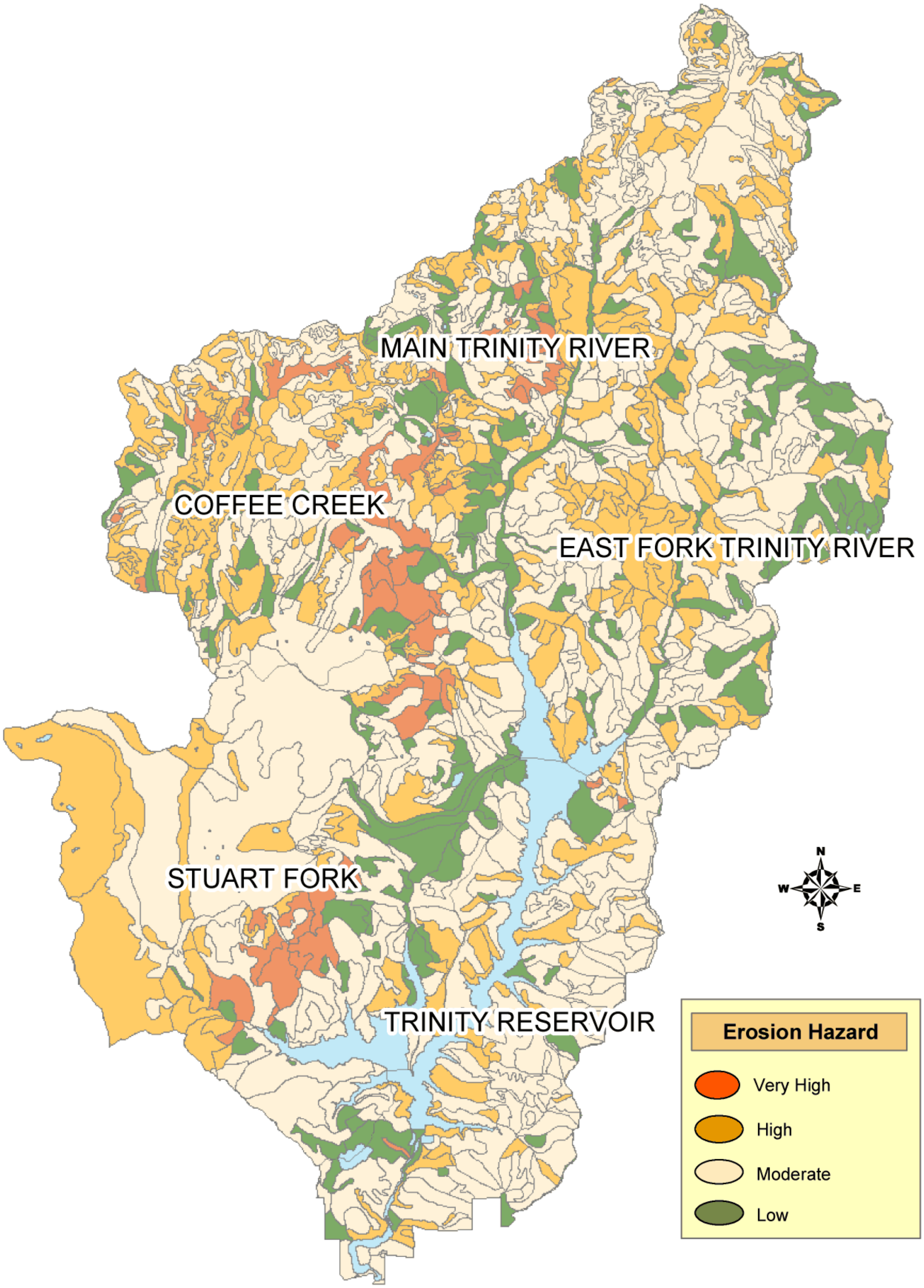

Figure 3: Soil Erosion Hazard Rating in the Upper Trinity River Watershed

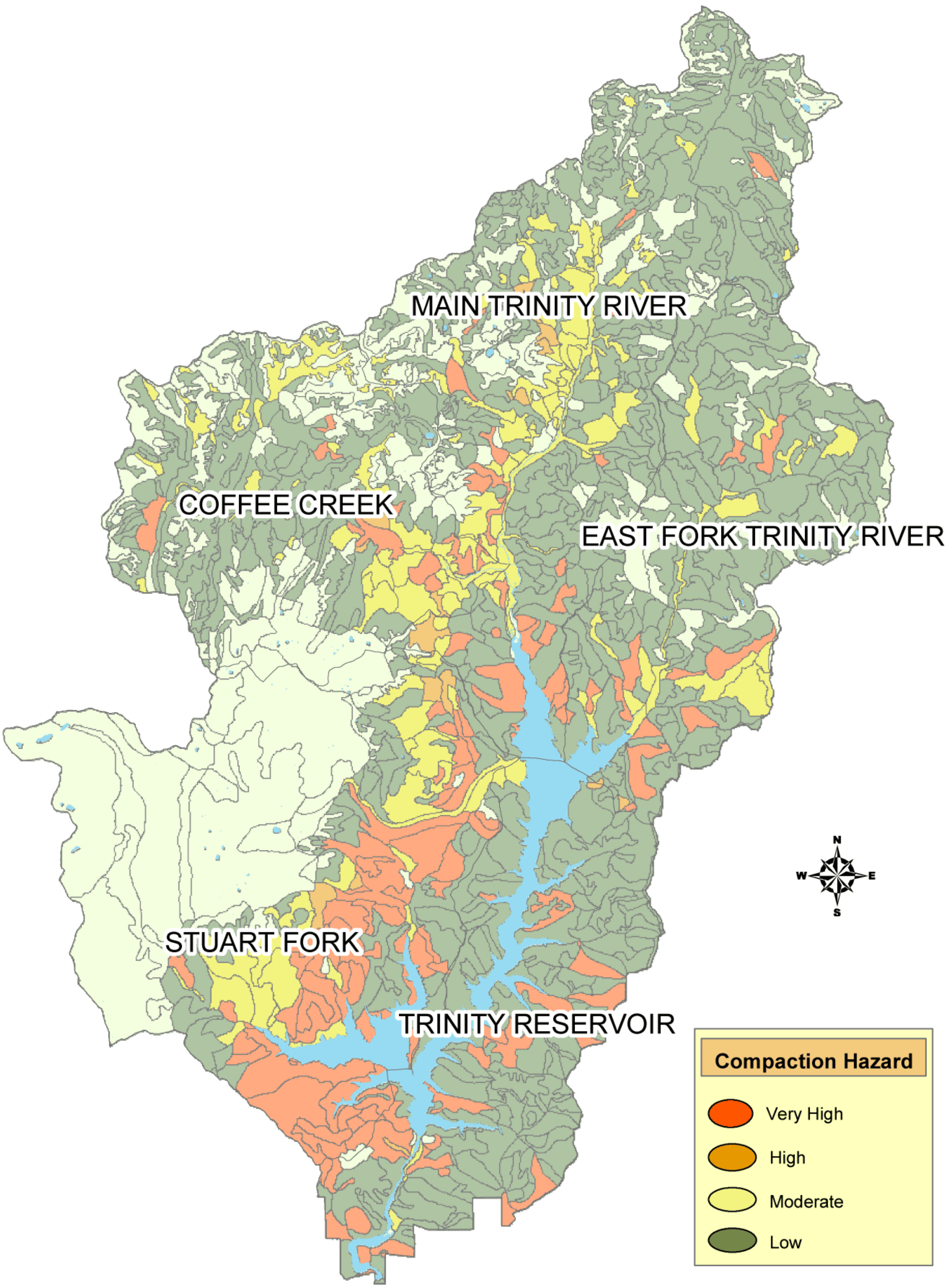

Figure 4: Soil Compaction Rating in the Upper Trinity River Watershed

Soil Fertility/Large Woody Debris

The fertility of soil is a product of the weathering age and type of parent material. Depending on age and leaching, some soils are more fertile for timber production. The soil fertility map shows that the areas in green and pink have the best soil fertility and areas in yellow and orange with the least (See **Figure 5: Soil Fertility Rating**). On a 5th field watershed basis soils in the Stuart Fork area have the best soil fertility due to the nonmarine sediments that exist along the lake. The areas of granitic parent material in the upper Stuart Fork and Trinity Reservoir watersheds have the poorest soil fertility.

Cover transects indicate that the dominate cover is the 1 to 3 inch and the 3 to 20 inch class of woody material. Duff thickness ranged from ½ inch on south-facing slopes to 3 inches on north-facing slopes. With these amounts of duff and woody debris soil organic matter levels are high thus insuring available nutrient retention.

Hydrology

The Upper Trinity River Basin is composed of 5 fifth field watersheds **(Table 8).** When combined, the fifth field watersheds drain a total area of 717 square miles. See Appendix A for a division of these watersheds into 6th and 7th field levels.

Table 8: Fifth field watersheds, area and drainage densities in the Upper Trinity River Basin (watershed area in square miles shown in parentheses).

Fifth Field Watershed Name	HUC ID #	Watershed Size (Acres)	Drainage Density (mi/mi^2)
Main Trinity River	1801021101	117,234 (183)	3.38
Coffee Creek	1801021102	74,380 (116)	3.19
East Fork Trinity River	1801021103	73,216 (114)	3.77
Stuart Fork	1801021104	123,746 (193)	3.51
Trinity Reservoir	1801021105	70,957 (111)	3.72

The Trinity River originates in northeast corner of the basin in the vicinity of Mount Eddy. The channel develops rapidly with increasing tributary drainage as it flows in a south to southwesterly direction over a distance of 60 miles before entering Trinity Lake, and later Lewiston Reservoir. The largest tributaries to the Trinity River progressing in a downstream direction include Coffee Creek, Swift Creek, East Fork Trinity River and the Stuart Fork. The terrain of the Trinity River Basin is rugged and steep. Valley bottom floodplains and terraces are limited and mostly located along the mainstem Trinity River.

The Trinity River is impounded by two reservoirs that when considered together occur partly within each of the five analysis watersheds with the exception of Coffee Creek. Trinity Lake (formerly Claire Engle Lake) is the larger of the two reservoirs with approximately 145 miles of shoreline. Trinity Lake is formed by an earthfill dam that was completed in 1960. The primary benefits of the reservoir are

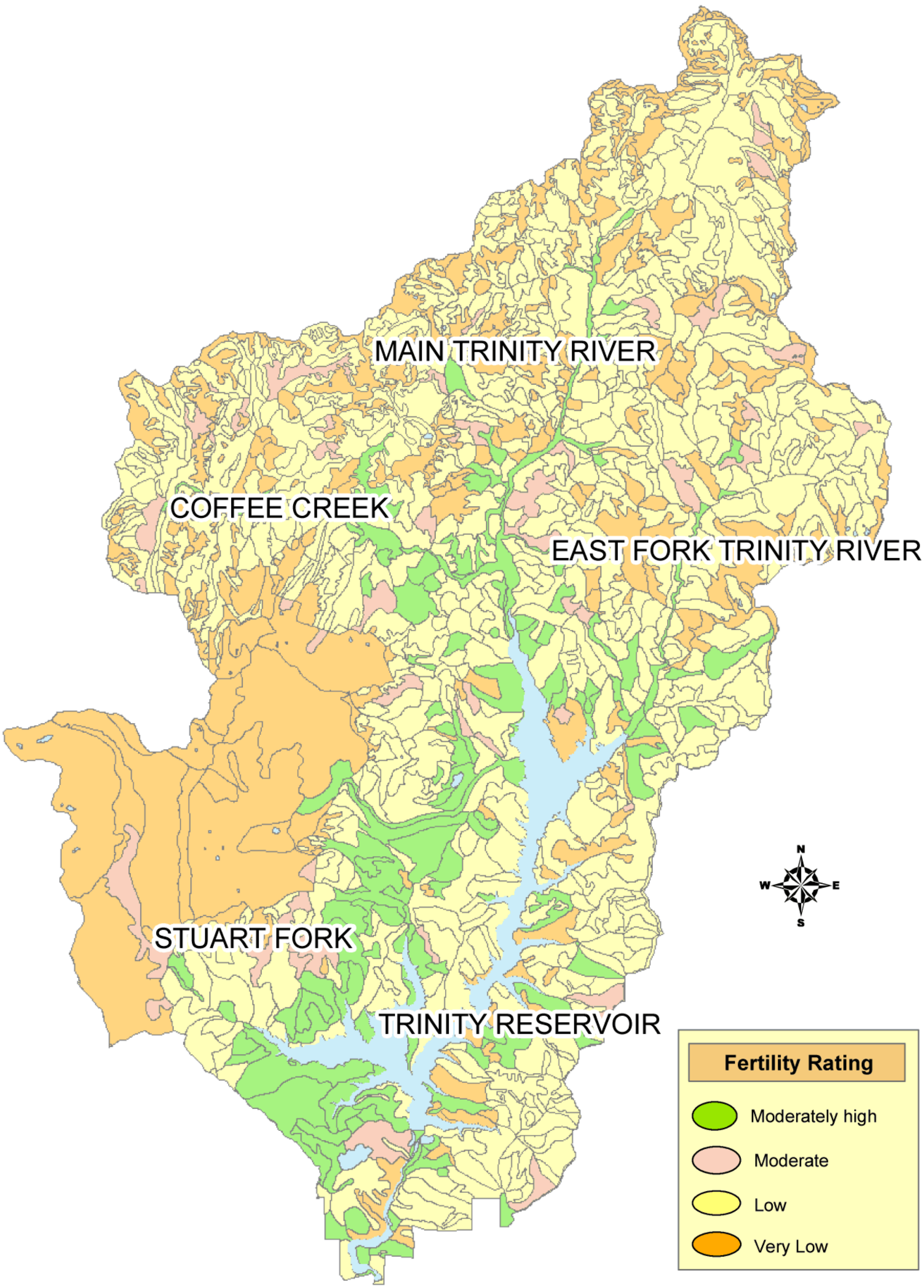

Figure 5: Soil Fertility Rating in the Upper Trinity River Watershed

hydropower production, flood control and recreation. The lake has a useable storage capacity of 2,437,700 acre-feet (USGS reservoir data, 1998). The surface pool area of the lake is approximately 15,640 acres.

Lewiston Lake is the smaller of the two reservoirs. Lewiston Dam is located approximately 7 miles downstream of Trinity Dam. The lake has a capacity of 14,660 acre-feet and a full pool surface area of 673 acres. Streamflow into Lewiston Lake is completely regulated by Trinity Lake releases. In addition to regulating releases into the lower Trinity River, diverted water from Lewiston Lake is used to generate power at Judge Francis Carr Power plant (USGS, discharge data, 1998). A large amount of Trinity Basin water is diverted to the Sacramento River Basin at Lewiston Dam. This water is diverted at Lewiston Dam through the Clear Creek Tunnel and Judge Francis Carr Powerhouse to Whiskeytown Lake in the Clear Creek Watershed (CDFG, 1974). Water from Whiskeytown Lake is released into lower Clear Creek or diverted through the Spring Creek Tunnel and powerhouse to Keswick Reservoir on the Sacramento River (CDFG, 1974).

The construction of both dams and the diversion of Trinity River water out of the Trinity Basin have had far reaching impacts on the hydrology, channel morphology and fishery in the Trinity River. A full discussion of all of the impacts associated with the reservoirs and diversions is beyond the scope of this analysis. In summary, the impacts include the following:

- The anadromous fishery above in the Upper Trinity River Basin has been completely eliminated. Approximately 109 miles of salmon and steelhead habitat located within 720 square miles of the Upper Trinity River Basin have been lost.
- All of the coarse sediment from the upper watershed is trapped in Trinity Lake.
- With the exception of uncontrolled spills, flows in the mainstem of the Trinity River below Lewiston Dam were reduced by 90 percent between 1963 and 1992 (CDFG, 1974). The Secretary of Interior increased the minimum releases into the Lower Trinity River to 25 percent in 1992. The Record of Decision (ROD, 2000) for the Trinity River flows will increase the amount of water to 50 percent of annual basin flows.
- Peak discharge events below Lewiston Dam have been significantly reduced.
- The duration of turbid runoff events in the lower river have increased as a result of the gradual release of turbid water (produced by large runoff events) from Trinity and Lewiston Lakes (CDFG, 1974).
- The water temperature signature in the lower Trinity River has changed. Reduced streamflows in the lower river cause water to warm more rapidly and earlier than prior to reservoir construction (CDFG, 1974).
- The reduction in streamflow has resulted in the accumulation of sediment and riparian vegetation in a 40-mile stretch of the Trinity River between Lewiston Dam and the Main Trinity River confluence with the Klamath River. Riparian vegetation has colonized the aggraded sediments resulting in a narrower channel that is more susceptible to downcutting and erosion (CDFG, 1974).

- Pools in the Trinity River below Lewiston Dam have filled with sediment and spawning gravels have been compacted (CDFG, 1974).
- The dam dramatically altered the magnitude of 1.5 and 10 year recurrence interval flow events. The $Q_{1.5}$ event in the Lower Trinity River was reduced from 10,700 cfs to 1,070 cfs and the Q_{10} event was reduced from 36,700 to 7,500 cfs (GMA, 2001).
- In addition to the aforementioned resource effects the reservoir management operations at Trinity Lake also affect recreation users. Low lake levels during the peak recreation season decrease the quality of lake recreation.

Base and Peak Flows

The hydrology of the Trinity River and its tributaries is characterized by low summer base flows, flashy winter flows, and sustained high flows during spring snowmelt. Streamflow data from the Trinity River above Coffee Creek (Station 11523200) were used to show the characteristics and shape of the annual hydrograph for watersheds in the Upper Trinity River Basin (**See Figure 6**). Baseflows in the basin are typified by low summer and fall baseflows and high spring baseflows during snowmelt. Mean monthly streamflow in the Trinity River above Coffee Creek ranges from a low of 44 cfs in September to a high of 1060 cfs in May. As with many watersheds in Northern California runoff extremes in the Upper Trinity River can be highly variable. The lowest and highest recorded flows on the Trinity River above Coffee Creek were 16 cfs (September 1977) and 26,500 cfs (January 1974), respectively.

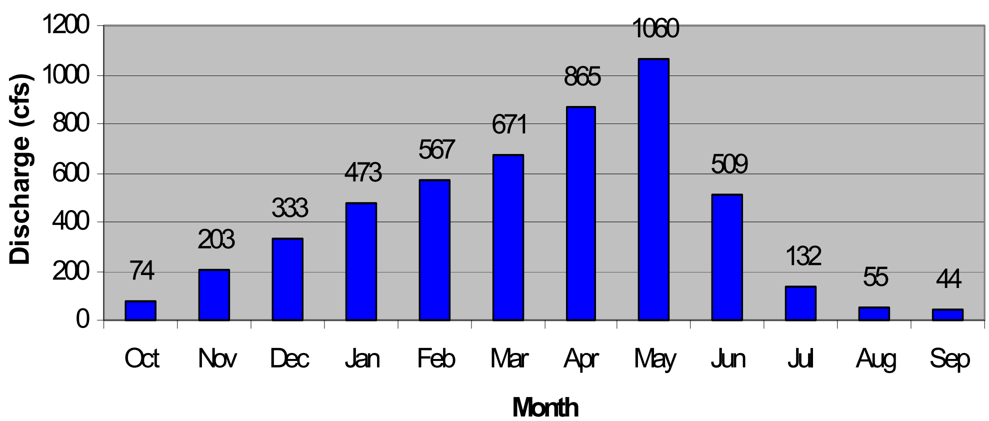

Figure 6: Mean Monthly Streamflow for Trinity River above Coffee Creek near Trinity Center, CA

Annual peak streamflows for the Trinity River above Coffee Creek are shown in **Figure 7.** Winter peak flows generally do not exceed 5000 cfs. Over the past 48 years (1957 excluded) the Trinity River has experienced three large flood events occurring in 1964, 1974 and 1997. Streamflow in the Trinity River above Coffee Creek peaked at 20,800 cfs (1964), 26,500 cfs (1974) and 20,100 cfs (1997), respectively for these events. Large floods events that also affected the Upper Trinity River Basin occurred in the water years of 1862, 1890, 1956 and 1986 (GMA, 2001).

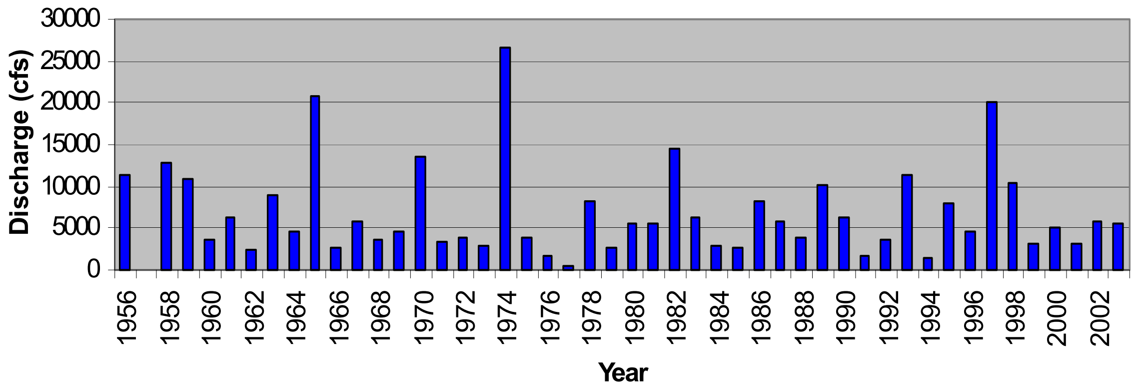

Figure 7: Annual Peak Streamflow for the Trinity River above Coffee Creek near Trinity Center, CA

Large floods such as 1964, 1974 and 1997 are produced by rain-on-snow events. Floods caused by rain-on-snow events generally impact the Trinity River and all of its mainstem tributaries. The 1997 flood mobilized large quantities of debris and sediment in the Trinity River and its tributaries. The flood completely modified the Trinity River and its floodplain by scouring riparian vegetation from the channel banks, ripping conifers out of the ground, redistributing channel bedload and habitat features, and eroding streambanks. The aforementioned impacts also occurred on the lower reaches of Coffee Creek, Swift Creek and the Stuart Fork. Port Orford cedar stands located on the Trinity River were particularly hard hit by the flood. Following the 1997 flood portions of the Trinity River and other tributaries were further modified when woody debris deposited from the storm was removed from the channel. Channel realignment and extensive debris cleaning also occurred following the 1974 Flood.

Channel impacts can also occur in response to summer thunderstorms. Summer thunderstorms occurring in 2003 in the Deadfall Lakes area beneath Mount Eddy caused landslides, hillslope gullying and elevated turbidity levels in some lakes for several months following the storms (Miller, et al., 2004). When compared to winter rain-on-snow events, the effects of summer storms appear to exert an equal to or greater influence on hillslope and channel processes in high elevation headwater drainages in the Upper Trinity River.

Land-Use Activities

Major land-use activities in the Upper Trinity River include timber harvest and road maintenance/construction and recreation activities (hiking, camping, fishing, boating). Mining continues to be active in the basin; however it occurs at a much smaller scale than in the late-1800s and early 1900s when it was the dominant land-use activity. Grazing also occurs in several Forest Service allotments.

When considered collectively the construction of Trinity Reservoir and historic mining activity were the two land-use activities that had the greatest impact on erosion processes, hydrology, stream channels and water quality in the Upper Trinity River. The impacts of Trinity Reservoir are discussed in the Hydrology section of this chapter and the effects of historical mining activities are summarized in

Chapter 4- Reference Conditions. No new mining claims are allowed in the NRA, and there are currently no existing claims.

Today timber harvest activities along with road construction and maintenance have the greatest influence on erosion processes, hydrology, stream channels and water quality in the Upper Trinity River. Approximately 21 percent of the total sediment load in the upper Trinity River Assessment Area can be attributed to timber harvest activities (US EPA, 2001). A ‘disturbance map’ showing timber harvest history and the transportation system was developed for the Trinity River Basin as part of a Cumulative Watershed Effects study (ACT 2, 2005). This layer shows that timber harvest activities were widespread throughout the upper basin outside of wilderness areas.

The Upper Trinity River contains a well-developed transportation system. The average road density for the Upper Trinity River is 2.69 miles of road per square mile (includes private land and wilderness). If the area of the watershed in wilderness and Trinity Lake is removed from the calculation the average road density in the Upper Trinity River is 4.9 mi/mi^2. Road densities for the 7th field watersheds were highly variable in the basin ranging from a low of 0.0 mi/mi^2 in the wilderness areas to a high of 6.1 mi/mi^2 in the Trinity Reservoir watershed (see Appendix B for a total list of road densities). The high road density in the latter is attributed to populated areas around Trinity Lake.

Roads in the Upper Trinity River impact hydrology and water quality by intercepting runoff from hillslopes and increasing sediment inputs to streams from ditches and segments with poor drainage. Roads in some locations also have affected slope stability. Large sediment pulses into the Trinity River from roads are particularly noticeable after the first fall or winter storms. Approximately 9 percent of the total sediment load in the upper Trinity River Assessment Area can be attributed to roads (US EPA, 2001).

Stream Channel Condition

The Upper Trinity River Basin contains numerous perennial streams most of which support residential trout populations. Information on the types and conditions of in-channel habitats on the Trinity River and its tributaries is very limited. Habitat surveys of the upper Trinity River conducted in 1991 describe habitat conditions as moderate to fair. The 1991 surveys also noted that the river still was recovering from past disturbance including historic or active mine tailings, mass wasting features, and bank erosion (USDA Forest Service, 1991).

The current condition for the mainstem Trinity River and the lower reaches of its larger tributaries is a product of historic hydraulic mining and dredging activities and the more recent channel alterations induced by the 1997 Flood. The flood destroyed much of the riparian and other floodplain vegetation on the Trinity River, caused extensive bank erosion and completely reconfigured the channel bed in the alluvial response reaches. Debris flows such as the one that occurred on Dan Rice Creek (Main Trinity River Watershed) completely reshaped channels and ripped conifers out of the ground, depositing them in downstream reaches. Channel recovery following floods appears to be very slow, particularly with respect to riparian vegetation. Riparian vegetation has difficulty becoming established due to the large areas of coarse sediment deposits over the floodplains.

Water Quality

The quality of water in the Upper Trinity River is generally very good. Sediment is the water quality parameter of greatest concern in the upper basin. Concerns have also been noted with respect to the upper basin's effect on water quality below Trinity Lake following large floods. High water temperatures in the mainstream Trinity River and the lower reaches of its tributaries during the summer months may also be a cause of concern.

Water quality in the Trinity River is impaired by excessive sediment. The Trinity River Total Maximum Daily Load for Sediment was released by the U.S. Environmental Protection Agency in December 2001. The purpose of the Trinity River TMDL was to identify the total load of sediment that could be delivered to the Trinity River and its tributaries without causing exceedence of water quality standards, and to allocate the total load among the sources of sediment in the watershed.

Suspended sediment concentrations in the lower Trinity River can still be influenced by the upper river and its tributaries during and for long periods of time following large peak flow events. Information from 1991 habitat surveys conducted on the mainstem Trinity River indicates that some tributaries are contributing excessive amounts of suspended sediments to the mainstem and that these sediments are capable of moving through the reservoir into the lower river. For example, elevated levels of suspended sediments released from Trinity Reservoir were observed following the floods of 1964, 1974 and 1997 (GMA, 2001). Elevated turbidity levels following the 1964 flood reportedly persisted for 9 months (GMA, 2001). The same is true for the floods of 1974 and 1997.

The change in duration of elevated turbidity levels following large flow events is apparent from USGS suspended sediment records collected on the Trinity River near Lewiston prior to reservoir construction. These data indicate that turbidity and/or suspended sediment loads responded rapidly to flow increases during large storms. The data also show that turbidity decreased rapidly after precipitation ceased (GMA, 2001).

Turbidity data are available for WY 2000 in selected locations in the Upper Trinity Basin **(Table 9)** (GMA, 2001). The number of actual measurements for each location was limited to less than 4. Maximum turbidity values were highly variable ranging from 1.3 NTU in Bear Creek at the Bear Creek Loop Road to 911 NTU in a small stream draining the Diener Mine area southwest of Trinity Center (GMA, 2001). Turbidity values were generally lower in streams draining undisturbed watersheds than in those draining watersheds with extensive urbanization, mining, roads and timber harvest activities.

Table 9: Maximum turbidity values for samples for selected sites in the Upper Trinity River in 2000 (GMA, 2001).

Location	Number of Samples	Turbidity NTU
Stoney Creek at Highway 3	6	68.4
Mule Creek at Highway 3	11	121.8
East Fork Stuart Fork at Guy Covington Drive	7	21.6
North Fork Creek at Highway 3	1	8.0
North Fork Swift Creek	7	24.3
Flume Creek at Highway 3	3	33.5
Hatchet Creek	7	46.8
Buckeye Creek at Highway 3	6	63.6
Snow Gulch at TC106	5	35.2
Squirrel Gulch at TC 106	6	84.3
Cedar Creek at TC 106	8	45.4
East Fork Trinity River at TC 106	6	33.9
Coffee Creek at Highway 3	8	41.4
Scorpion Creek at Highway 3	7	34.3
Trinity River above Coffee Creek	4	45.7
Minnehaha Creek at Eagle Creek Loop Road	3	48.7
Ripple Creek at Eagle Creek Loop Road	3	21.0
Eagle Creek at Eagle Creek Loop Road	3	33.1
Ramshorn Creek at Highway 3	6	14.2
Bear Creek at Bear Creek Loop Rd	2	1.3
Graves Creek at Highway 3	5	13.1
Sunflower Creek at Highway 3	5	12.2
Tangle Blue Creek at Highway 3	7	27.2
Scott Mountain Creek at Highway 3	1	4.4
Trinity River at Parks Creek Rd	7	20.0
Little Trinity River at Parks Creek Rd	1	12.1
Diener Mine at Highway 3	3	911.0

As part of their sediment source analysis, Graham Matthews & Associates estimated the total sediment yield of the Stuart Fork by evaluating the total amount of sediment that had been deposited in the Stuart Fork Arm of Trinity Lake. The sediment yield of the Stuart Fork was estimated to be between 148 and 244 tons/mi^2/yr (GMA, 2001).

Water temperatures in the Trinity River and the lower reaches of its larger tributaries can get very warm during the summer months. Water temperatures in the mainstem Trinity River sometimes exceed 80 degrees Fahrenheit. Diurnal fluctuations of greater than 10 degrees are common in the lower watershed. Both the high water temperatures and the large diurnal fluctuations can be attributed to the open nature of the Trinity River and its tributaries. These channels are very wide and shallow and have little to no canopy cover. During periods of low base flow in July and August sunlight warms the rocks in the Trinity River and its tributaries (e.g. Stuart Fork, Swift Creek) resulting in large fluctuations in water temperature.

Watershed Condition

The condition of the watersheds in the Upper Trinity River Basin was evaluated using information past watershed condition assessments, the Trinity River TMDL and by conducting a cumulative watershed effects assessment for each watershed. When considered collectively each of these analyses provides insightful information regarding the overall watershed condition for each of the 5th Field Watersheds in the Upper Trinity River.

Watershed Condition Assessment

The Forest Service conducted a watershed condition assessment of watershed located on Forest Service lands in Northern California in 2000. The information from the watershed condition assessment is derived from the Trinity River TMDL. Each watershed received a rating of its hazard of impairment to watershed resources and a watershed condition rating as described below.

- **Healthy (Reference) watersheds (Category 1)**: Watersheds that are currently exhibiting high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition and exhibit a stable drainage network. Physical and biological conditions suggest that aquatic and riparian systems are predominantly functional in terms of supporting dependent species and beneficial uses of water. The risks of management induced disturbance have not been expressed or resulted in significant alteration of geomorphic, hydrologic, and biotic processes.
- **Moderate watersheds (Category 2)**: Watersheds that are currently exhibiting moderate geomorphic, hydrologic, and biotic integrity relative to their natural potential condition and portions of these watersheds exhibit and unstable drainage network. Physical and biological conditions suggest that aquatic and riparian systems are at risk in being able to support dependent species and retain beneficial uses of water. The risks of management induced disturbance are variable and effects have partially been expressed or have resulting in localized alteration of geomorphic, hydrologic, and biotic processes.

- **Impaired watersheds (Category 3)**: Watersheds that are currently exhibiting low geomorphic, hydrologic, and biotic integrity relative to their natural potential condition and a majority of the drainage network is unstable. Physical and biological conditions suggest that riparian and aquatic systems do not support dependent species or beneficial uses of water. The risks of management induced disturbance are high; they have been fully expressed and/or have resulted in deterioration of geomorphic, hydrologic, and/or biotic processes.

The majority of the watersheds analyzed in the watershed condition assessment were classified as Category 2 (Moderate). Coffee Creek, Swift Creek and Stuart Fork were classified as Category 1 (Healthy) watersheds. Portions of the Upper Trinity River mainstem, East Fork Trinity River and eastside tributaries to Trinity Reservoir were classified as Category 3 (Impaired).

TMDL Sediment Source Analysis

A sediment source analysis was completed for the entire Trinity River Basin as part of the Trinity River TMDL. The analysis identified source areas for sediment, identified sediment delivery processes and estimated sediment yield from each source. The following information and discussion is drawn from the Trinity River TMDL (US EPA, 2001). Refer to the TMDL for a complete description of the methodology used to produce the sediment source analysis.

The Trinity River TMDL partitioned the Trinity River Basin into five assessment areas. The Upper Assessment Area is nearly identical to the area of the five watersheds being analyzed in this analysis. The TMDL also identified reference or healthy subwatersheds in the basin. Reference subwatersheds in the Upper Trinity River Assessment area include Coffee Creek, Swift Creek and Stuarts Fork.

The results of the sediment source inventory for the Upper Trinity River Basin are shown in Table 10. The current load estimates for each sediment source category represent the total amount of sediment generated by the sum of the five 5^{th} field watersheds. In the Upper Trinity River Basin 31% of the total sediment load is derived from management associated activities including roads, timber harvest and legacy mining. Roads, timber harvest and legacy management activities generated estimated volumes of 154, 349 and 18 tons/mi^2/yr respectively. The remaining 69% of the total sediment load was attributed to the natural, or background, erosion caused by landsliding, bank erosion, soil creep and other various processes determined from plot data. Landslides contributed 83% of the total background sediment load.

Table 10: Sediment Source Summary by Category for Upper Trinity River Assessment Area (US EPA, 2001)

Source Category		Current Load Estimate tons/mi^2/yr (%)
Management Associated Load		
Roads	Landslides	108
	Cut-Bank	15
	Tread	17
	Other	14
	Total Roads	**154 (9%)**
Timber Harvest	Landslides	335
	Various processes (plot data)	10
	Surface	4
	Total Timber Harvest	**349 (21%)**
Legacy	Roads	17
	Mining (slides/gullies)	1
Total Management-related		**521 (31%)**
Background (Non Management-associated) loads		
Landsliding		960
Various Processes (plot data)		110
Bank Erosion		55
Soil Creep		30
Total Background		**1155 (69%)**
Total Sediment Yield		**1676**

Table 11: Sediment Source Summary by Category and Subareas within the Upper Trinity River Assessment Area (US EPA, 2001)

Sediment Source Categories		Current sediment delivery rates (tons/mi2/year) by subareas (GMA 2001b)				
		Reference Subwatersheds[1] (235 mi^2)	Westside Tributaries[2] (93 mi^2)	Upper Trinity[3] (161 mi^2)	East Fork Tributaries[4] (115 mi^2)	East Side Tributaries[5] (89 mi^2)
Background (Non-management)		1125	421	2759	258	241
Management	Roads	129	101	162	319	48
	Timber Harvest	240	31	1084	46	22
	Legacy (Roads, Mining)	7	25	21	26	26
	Total Management	**376**	**157**	**1267**	**391**	**96**
Total sediment delivery		**1501**	**578**	**4026**	**649**	**337**
Total as percent of background		**133%**	**137%**	**146%**	**252%**	**140%**

1. Stuarts Fork, Swift Creek, Coffee Creek
2. Stuart Arm Area, Stoney Creek, Mule Creek, East Fork Stuart Fork, West Side Trinity Lake, Hatchet Creek, Buckeye Creek
3. Upper Trinity River, Tangle Blue, Sunflower, Graves, Bear, Upper Trinity River Mainstem Area, Ramshorn Creek, Ripple Creek, Minnehaha Creek, Snowslide Gulch Area, Scorpion Creek
4. East Fork Trinity, Cedar Creek, Squirrel Gulch Area
5. East Side Tributaries, Trinity Lake

Sediment delivery rates were partitioned by subwatersheds in the Upper Trinity Basin and are shown in Table 11. It is important to note that the five subwatershed areas referenced in Table 11 are similar but not identical to the areas of the five 5th field watersheds. The following observations on the condition of the Upper Trinity River subwatershed can be ascertained from the data in Table 11.

- Of the five analysis areas, the Upper Trinity subarea contributes by far the greatest amount of management related and background related sediment.
- The total sediment yield from the Upper Trinity subarea is more than twice the volume of the next largest contributing area.
- The East Fork tributaries and Eastside tributaries to Trinity Lake have the lowest background sediment yields.
- The East Fork tributaries subarea is the only one in which management related sediment yield is greater than natural sediment yield (252% of background).
- Roads in the East Fork tributaries subarea contribute more to the total sediment yield (319 tons/mi^2/year) than timber harvest or legacy management activities (46 and 26 tons/mi^2/year, respectively.

- Roads and timber harvest activities generally account for the majority of sediment production in each subarea.
- The reference subwatersheds (Coffee Creek, Swift Creek, Stuarts Fork) have the second highest total sediment load but the lowest total yield when expressed as a percent above background (133%).

2005 Forest Service Cumulative Watershed Effects Analysis

The Forest Service conducted a cumulative watershed effects analysis for all watersheds in the Upper Trinity River Basin in 2005 (Act2, 2005). The analysis employed three quantitative models: (1) USLE – surface erosion sediment model, (2) GEO – mass-wasting sediment model, and (3) ERA – disturbance index model to evaluate cumulative effects at the HUC 7 scale (see Appendix A). The models seek to determine the extent to which watershed disturbances affect natural quantities, qualities and the distribution of water, sediment and wood (ACT2, 2005).

The 2005 CWE analysis is the first attempt at developing a new refined approach to model cumulative watershed effects on the Forest. The analysis should be viewed as iterative process that will evolve with the refinement of the existing methodology and new information that closes the existing data gaps. Refer to the Shasta-Trinity CWE 2005 paper for a complete description of the CWE methodology (ACT2, 2005).

The Equivalent Roaded Area Method has been the standard methodology used to evaluate cumulative watershed effects on the Shasta-Trinity National Forest (Haskins, 1986). Using this methodology the equivalent roaded area from disturbance activities is calculated for each HUC 7 watershed and then divided by the watershed Threshold of Concern (TOC) to yield a watershed condition class. Watershed condition classes on the Shasta-Trinity National Forest are defined as follows:

- Class 1 - %ERA / %TOC ratio < 0.40
- Class 2 - %ERA / %TOC ratio between 0.40 and 0.80
- Class 3 - %ERA / %TOC ratio > 0.80

The results of ACT2's CWE analysis for the Upper Trinity River watersheds showed that none of the 7th field watersheds had ERA levels that were 80% of the Threshold of Concern (TOC) or greater. Fifteen 7th field watersheds had ERA levels that were between 40% and 79% of the TOC. Ten of these watersheds were in the East Fork Trinity River 5th Field Watershed (**Table 12**).

A cumulative risk rating for each 7th Field Watershed was determined by combining the risk ratings from the USLE, GEO and ERA models (**Table 13**). The East Fork Trinity River and Trinity Reservoir Watersheds had the most 7th Field Watersheds classified as High Risk (III). Coffee Creek Watershed had the lowest risk (I) and risk ratings were variable for the Main Trinity River and Stuart Fork Watersheds (**Table 14**).

Table 12: Equivalent Roaded Area (ERA) condition classes for 7th Field Watersheds in the Upper Trinity River Basin

HUC 5 Watershed ID	HUC 5 Watershed Name	Total HUC 7 watersheds in Condition Class 1 (ERA)	Total HUC 7 watersheds in Condition Class 2 (ERA)	Total
1801021101	Main Trinity River	15	1	**16**
1801021102	Coffee Creek	11	0	**11**
1801021103	East Fork Trinity River	1	10	**11**
1801021104	Stuart Fork	10	2	**12**
1801021105	Trinity Reservoir	13	1	**14**

Table 13: Risk Rating for 7th Field Watersheds in the Upper Trinity River Basin. Number of 7th Field Watersheds within each risk class is shown

HUC 5 Watershed ID	HUC 5 Watershed Name	Risk Rating I	Risk Rating II	Risk Rating III
1801021101	Main Trinity River	6	4	6
1801021102	Coffee Creek	10	1	0
1801021103	East Fork Trinity River	0	0	11
1801021104	Stuart Fork	6	1	5
1801021105	Trinity Reservoir	3	1	10

Table 14: Combined Risk Rating for 7th Field Watersheds in the Upper Trinity River Basin

HUC 7 ID	HUC 7 Name	USLE	GEO13	ERA	Risk Rating
Main Trinity River (1801021101)					
18010211010101	High Camp Creek-Deadfall Creek	I	I	I	Low
18010211010102	Bull Creek-Cedar Creek	II	I	I	Mod
18010211010201	Picayune Creek	II	I	I	Mod
18010211010202	Little Trinity River	II	II	I	High
18010211010203	Sherer Creek-Trinity River	II	II	I	High
18010211010301	Tangle Blue Creek	I	I	I	Low

HUC 7 ID	HUC 7 Name	USLE	GEO13	ERA	Risk Rating
18010211010302	Log Lake-Tangle Blue Creek	II	I	I	Mod
18010211010303	Scott Mountain Creek	I	II	I	Mod
18010211010401	Sunflower Creek-Graves Creek	II	II	I	High
18010211010402	Ramshorn Creek	II	II	I	High
18010211010403	Bear Lakes	I	I	I	Low
18010211010501	Eagle Creek	I	I	I	Low
18010211010502	Minnehaha Creek-Trinity River	I	I	I	Low
18010211010503	Scorpion Creek-Trinity River	I	I	I	Low
18010211010601	Copper Creek-Trinity Lake	II	III	II	High
18010211010602	Buckeye Creek-Hatchet Creek	II	III	I	High
Coffee Creek (1801021102)					
18010211020101	Big Flat-Coffee Creek	I	I	I	Low
18010211020102	Union Creek	I	I	I	Low
18010211020103	South Fork Coffee Creek	I	I	I	Low
18010211020104	Battle Creek-Coffee Creek	I	I	I	Low
18010211020201	Saloon Creek-North Fork Coffee Creek	I	I	I	Low
18010211020202	Granite Creek	I	I	I	Low
18010211020203	Lick Creek-North Fork Coffee Creek	I	I	I	Low
18010211020301	East Fork Coffee Creek	I	I	I	Low
18010211020302	Boulder Creek-Coffee Creek	I	I	I	Low
18010211020303	Sugar Pine Creek-Coffee Creek	I	I	I	Low
18010211020304	Little Boulder Creek-Coffee Creek	I	II	I	Mod
East Fork Trinity River (1801021103)					
18010211030101	Horse Heaven Meadows	III	I	II	High
18010211030102	Crow Creek	III	III	II	High
18010211030103	Highland Lakes-Upper East Fork Trinity River	III	II	II	High

HUC 7 ID	HUC 7 Name	USLE	GEO13	ERA	Risk Rating
18010211030201	Upper Mumbo Creek	II	II	I	High
18010211030202	Lower Mumbo Creek	III	III	II	High
18010211030301	Pond Lily Creek-Middle East Fork Trinity River	III	III	II	High
18010211030302	Grouse Creek-Middle East Fork Trinity River	I	II	II	High
18010211030401	Devil's Creek-Lower East Fork Trinity River	II	II	II	High
18010211030402	Halls Gulch	III	III	II	High
18010211030403	Cedar Creek-Lower East Fork Trinity River	II	III	II	High
18010211030404	Squirrel Gulch-Lower East Fork Trinity River	III	III	II	High
Stuart Fork (1801021104)					
18010211040101	Morris Meadows	I	I	I	Low
18010211040102	Deer Creek-Upper Stuart Fork	I	I	I	Low
18010211040103	Alpine Lake-Summit Lake	I	I	I	Low
18010211040104	Owens Creek-Upper Stuart Fork	I	I	I	Low
18010211040201	Davis Creek-Hobel Creek	II	II	II	High
18010211040202	Bowerman Meadows	I	I	I	Low
Stuart Fork (1801021104)					
18010211040203	Covington Mill-Strope Creek	II	II	I	High
18010211040204	Hayward Flat-East Fork Stuart Fork	II	III	I	High
18010211040301	Van Matre Creek-Trinity Alps Creek	I	I	I	Low
18010211040302	Slate Creek-Stoney Creek	II	III	I	High
18010211040303	Mule Creek-Trinity Lake	I	II	I	Mod
18010211040304	Buckey Creek-Trinity Lake	II	III	II	High
Trinity Reservoir (1801021105)					
18010211050101	Horseshoe Lake-Swift Creek	I	I	I	Low
18010211050102	Bear Basin-Swift Creek	I	I	I	Low
18010211050103	Granite Lake-Preacher Meadow	I	I	I	Low

HUC 7 ID	HUC 7 Name	USLE	GEO13	ERA	Risk Rating
18010211050104	Lake Eleanor-Swift Creek	II	II	I	High
18010211050105	Swift Creek-Trinity Lake	III	I	II	High
18010211050201	Jackass Spring-Trinity Lake	I	II	I	Mod
18010211050202	Hay Gulch-Trinity Lake	III	III	I	High
18010211050203	Bragdon Gulch-Trinity Lake	II	III	I	High
18010211050204	Clawton Gulch-Trinity Lake	II	II	I	High
18010211050301	Feeny Gulch-Van Ness Creek	II	III	I	High
18010211050302	Papoose Creek	III	II	I	High
18010211050303	Trinity Dam-Trinity Lake	II	II	I	High
18010211050401	Eastman Gulch-Mooney Gulch	II	II	I	High
18010211050402	Baker Gulch-Lewiston Lake	I	III	I	High

All of the past attempts to evaluated cumulative effects can be considered collectively to gain an understanding of the condition of each of the 5th Field Watersheds relative to one another (Table 15). The methods do not show complete agreement however when the analyses are viewed in terms of similarities it is clear that the Coffee Creek and Stuart Fork Watersheds are considered to be the healthiest and the East Fork Trinity River is considered to be the most impaired. The general characterization of the Stuart Fork Watershed as 'healthy' is tempered by the fact that the bulk of these watersheds are within wilderness areas where management activities have not been prevalent. The front-country 7th Field Watersheds are more at risk to cumulative effects. When evaluated in the context of soil erosion and compaction potential the Stuart Fork Watershed is perceived as being the most at risk to cumulative effects of the 5 Fifth Field Watersheds.

Table 15: Cumulative Effects comparison of 5th Field Watersheds

CWE Analysis Method	Healthy	Impaired
Watershed Condition Assessment (2000)	Coffee Creek Stuart Fork	Main Trinity River East Fork Trinity River
Trinity River TMDL* (2001)	Coffee Creek Stuart Fork	East Fork Trinity River
ERA (2005)	Main Trinity River Stuart Fork Trinity Reservoir Coffee Creek	East Fork Trinity River
Cumulative Risk Rating USLE-ERA-GEO (2005)	Coffee Creek	East Fork Trinity River Trinity Reservoir

*The total sediment delivery as a percent above background was used to determine the most impacted watershed for the Trinity River TMDL.

Chapter 4: Reference Conditions

The purpose of this chapter is to explain how ecological conditions have changed over time as a result of human influence and natural disturbances. A reference condition for natural features and processes is developed for comparison with the current conditions. The effects of new and evolving land-use activities to the natural features and processes occurring in the watershed are discussed.

Vegetation Management

Pre-European Settlement

Vegetation patterns may have been altered prior to European settlement by natural and human-induced events. Natural and human-caused fires have been a source of disturbance to vegetation for thousands of years, influencing the development of plant characteristics and vegetative patterns on the landscape (USDA Forest Service 1997). Fires started naturally by lightning strikes and spread by hot dry winds could quickly burn large areas of land. Naturally caused fires occurred frequently due to annual weather patterns and seasonal climatic extremes and would have kept the accumulation of woody debris and brush to a minimum. Frequent, low-intensity fires burn out quickly, preserving large trees, and maintaining diverse, multi-story forests (Weatherspoon 1996). Mixed conifer forests are typical of short-interval, low-intensity surface fires (Chang 1996).

Manipulation of fire by Native Americans probably was used to increase wildlife habitat diversity and to increase the "edge effect" (the open space/woodland interface) as well. Burning served to rid an area of unwanted insects and disease, encouraged berry production, and cleared ground under oak trees to enhance acorn collection. Fires also encouraged new growth of plant species that were used in basketry as well as attracting foraging ungulates. These indigenous peoples presumable maintained a peaceful existence of relative abundance in the watershed for thousands of years.

1820 to 1963 (Trinity River Division of the Central Valley Project)

European man entered the watershed in the 1820's and, in the ensuing years of settlement, completely altered the landscape and the river system. These impacts were generated from mining, logging, the construction of dams, and intensive harvest of the river fishery. Gold was first discovered in 1848 at Reading Bar, near Douglas City. The news enticed a massive movement of miners and settlers into the region. Mining operations literally lined the banks of the Trinity River. The instream gravels were dredged and the river often diverted entirely out of the channel.

The timber industry commenced in the mid-1850's when numerous small sawmills began operating sporadically, usually in conjunction with mining activities. The timber companies at that time used very selective harvest techniques, taking only the largest and most easily accessible trees for the supply of a very localized market associated with the settlement of Weaverville and with local mining efforts. Though logging became an important industry by the mid 1940's, significant volumes were not taken until after WWII, when modernization and improved technologies occurred. Production peaked countywide (Trinity

County) in 1959 at 439 million board feet (mmbf), but was maintained at 200-300 mmbf through the 1980's. Timber markets served during this time were national, and even international. Extensive road building and logging on steep slopes took place over large areas of the watershed, resulting in accelerated erosion and sedimentation.

In 1963, the Bureau of Reclamation completed the Trinity River Division of the Central Valley Project. The two dams forming Trinity and Lewiston reservoirs resulted in the initial diversion of 90 percent of the average annual discharge in the Trinity River at Lewiston and blocked access to 109 miles of spawning and rearing habitat to migrating salmon and steelhead. The reduced river flows, combined with massive inputs of fine sediment, caused major changes in the morphology of the Trinity River.

1963 to Present

The following numbers are estimates of past timber volume harvested from 1970-present in the entire basin. The volumes are derived from a combination of interviews with Forest Service personnel and GIS data collected by the Act 2 Forest Enterprise Team.

- 1970's – 40 MMBF
- 1980's – 130 MMBF
- 1990's – 64 MMBF
- 2000 to Present - 0 MMBF

A majority of the volume harvested in these decades was with clearcutting as the prescription. There was also a lot of road construction associated with these sales, but it would be difficult to get an estimate of how many miles of road were actually constructed.

With the establishment of the President's Forest Plan, buffer zones along stream channels, called riparian reserves, now have specific restrictions on land use activities in order to protect the health and function of aquatic habitats.

Fire and Fuels

Pre-European Settlement

Natural and human-caused fires have been a source of disturbance to vegetation for thousands of years, influencing the development of plant characteristics and vegetative patterns on the landscape. Fires started naturally by lightning strikes and spread by hot dry winds could quickly burn large tracts of land. Naturally caused fires occurred frequently due to annual weather patterns and seasonal climatic extremes and would have kept the accumulation of woody debris and brush to a minimum. Frequent, low-intensity fires burn out quickly, preserving large trees, and maintaining diverse, multi-story forests (Weatherspoon 1996). Mixed conifer forests are typical of short-interval, low-intensity surface fires (Chang 1996). Prior to European settlement, Native Americans of the Wintu Tribe also lived in the area and used fire to increase the amount of grasslands and particular plant species favored as sources of food, building, or trade.

Evidence of past fires can be detected from tree rings of large trees that have lived a century or more. Fire scars on the stumps of trees that remain in previously logged areas record the occurrence of fires throughout the history of the tree. Evidence of fires recorded in tree rings provides the most accurate long-term record of fires that occurred before the twentieth century (Skinner 1997b).

Fire occurrence histories were determined from sites located in the Northwest Sacramento Province by fire specialist Carl Skinner (FS Pacific Southwest Research Station). This data, collected in 1997, contain measurements taken from large tree stumps in the vicinity of the Upper Trinity River watershed. Sampling sites nearest the Upper Trinity River watershed include those located along the Mosquito Creek Ridge and French Ridge, both of which lie just east of watershed divide near Damnation Peak. Table 11 shows data collected at these sites. Fire return intervals (FRIs) calculated from these data range from three to 34 years, with the median FRI of 11 years. These FRI values represent recurrence intervals for fire occurrence under natural, nonsuppression conditions.

Table 16: Natural Fire Occurrence - Data Collected Near Upper Trinity River Watershed

Site	N Samples	Earliest Scar	Last Scar	Years Record	Median FRI	Min Interval	Max Interval	Med. Prob. Interval	LEI	UEI
Mosquito A	5	1784	1916	132	13.0	3	17	9.6	4	16
Mosquito B	8	1729	1909	180	9.5	3	27	13.2	3	37
French Ridge	6	1724	1931	207	11.0	4	34	13.3	5	26

1820 to 1963 (Trinity River Division of the Central Valley Project)

Prior to the 1900s, coordinated, large-scale fire suppression efforts did not generally exist. Fires that started by lightning strikes or by human activities were often allowed to burn unabated until they were put out naturally or until they burned themselves out. Following the establishment of both the Shasta and Trinity National Forests in the early 1900s, fire was considered detrimental to growing trees, and fire suppression was considered important for protecting the timber resources on forestlands. However, in the early years of the Forest Service, rangers were spread thin, fire suppression conflicted with local interests, and many fires were allowed to burn unchecked. It wasn’t until after World War I that more personnel were made available to fight fires. Following the 1920s, fire suppression forces grew, and as fire prevention policies and fire suppression methods improved, attempts were made to suppress all fires.

1963 to Present

The fire history map for the Upper Trinity Basin shows only one fire greater than 5,000 acres that occurred in the lower south end of the Coffee Creek Watershed (6,350 acres). Other large fires have been documented in the community of Trinity Center (2,850 acres), upper Mumbo Creek - East Fork Trinity River (2,170 acres), and Papoose Creek - Trinity Reservoir (1940 acres).

The fire suppression capabilities of local resources increased between the 1960s and late 1970s, enabling local fire protection managers to attempt to suppress all fires occurring within the Upper Trinity River watershed. With these efforts in force, a regime aimed at total fire suppression has been in operation on forestlands in the upper watershed over the last 70 years. Effective fire suppression has shifted the fire regime within the Upper Trinity River watershed, increasing the potential for partial to complete stand-replacing fires within mature conifer and hardwood stands (Agee, 1993).

Watershed Condition

Pre-European Settlement

Natural processes occurring over millions of years have shaped the Upper Trinity River. These processes range from those operating over long time scales such as mountain uplift and changes in climate to processes operating over smaller time scales such as floods and fire. The natural processes described below were the dominant forces affecting erosion, stream channel morphology, water quality and hydrologic processes.

Klamath Mountain Uplift	Uplift of the Klamath Mountains began in the Middle Pleistocene (1.5 million years before present) and continues today. Uplift of the Klamath Mountains influences all natural processes in the Watershed.
Climate	Long-term shifts in climate from hotter/drier periods to wetter/cooler periods affect erosion processes, vegetation, and fires. Glaciers modified mountain morphology and altered erosion and hydrologic processes.
Floods and Mass Wasting	Large floods and mass wasting events have affected erosion processes, hydrology, water quality, and stream channel morphology in all of the Trinity River Watersheds.
Fires	Pre-historic fires control watershed fuel loading and distribution and age classes of vegetation. Fire was used by the Wintu to maintain open forest understories (Baldwin, 2000). Infrequent catastrophic fires affected erosion processes, stream channels and water quality.

1820 to 1963 (Trinity River Division of the Central Valley Project)

European settlement in the Upper Trinity River Basin began to expand rapidly in the mid-1800s when gold was discovered in the region. Mining activity and associated settlement was by far the largest land-use practice occurring in the Upper Trinity River in the late-1800s and early 1900s.

Mining activities occurring from 1848 though the mid 1900’s have had lasting effects on the hillslopes and channels in the Upper Trinity River. Minerals that were mined in the Upper Trinity River included gold (both load and placer mines), chromite, quicksilver, asbestos, copper, iron, sand and gravel (California Division of Mines and Geology, 1965). Most of the mines in the Upper Trinity River were gold mines. These mines occurred throughout the basin with concentrations occurring along Coffee Creek, Trinity River, East Fork Trinity River and the Bonanza King area. Many of these mines are now beneath Trinity Lake. Chromite and quicksilver was mined exclusively within the headwaters of the East

Fork Trinity River in the Crow Creek area. Asbestos, copper, iron and sand/gravel mining activity in the Upper Trinity River was minimal.

Mining operations had significant effects on the hydrology, water quality, channel and hillslope morphologies in the Upper Trinity River. Dredging and hydraulic mining activities removed millions of cubic yards of material from hillslopes and valley floors completely reworking river channels and floodplains. Mining activities had adverse effects on water quality, some of which continue to this day. Prior to World War II the Trinity River was reported to be constantly turbid throughout the low flow season due to mining activities. In recent years the highest turbidity values recorded during the GMA sediment source study came from Diener Creek southwest of Trinity Center. The high turbidity value was attributed to the large amount of bare ground around the mine that is present due to the removal of topsoil during historic mining operations (GMA, 2001). The full extent of mining activities and the impacts to the Trinity River drainages is beyond the scope of this analysis. These impacts are readily observed along the lower Trinity River above Trinity Lake (e.g. tailing piles in the reservoir) and along Coffee Creek.

Ditch systems were constructed in many of the Trinity River tributaries (e.g. Stuart Fork) for the purpose of conveying water to hydraulic mining operations. Approximately 20 miles of ditches were constructed in the Upper Trinity River. The ditches were subsequently abandoned and have created slope stability problems in some areas where they trap and divert surface runoff (GMA, 2001).

Timber harvest activity and road construction in the Upper Trinity River Basin began in the mid to late-1800s. All timber harvest activity was initially undertaken to support mining activities and settlement of the upper basin. Commercial harvest activity began to increase beginning in the early 1960s.

1963 to Present

The construction of Trinity and Lewiston Dams began in 1955 as part of the Trinity Diversion Project (CDFG, 1974). The diversion of Trinity River water to the Sacramento River began in 1963. An average of 1.2 million acre-feet of water, or 90 percent of the Trinity River flow was diverted to Sacramento River annually. The construction of dams had far reaching impacts on the fishery in the Upper Trinity Basin (see **Chapter 3 - Current Conditions**). The dams resulted in the loss of 59 miles of King salmon habitat, 109 miles of steelhead habitat and an unknown amount of habitat for silver salmon (CDFG, 1974).

Large flow events occurring over the last half century include the floods of 1964, 1974 and 1997. The 1996-97 floods hit the Upper Trinity River watershed hard, delivering massive amounts of sediment to the lakes. It took almost two years for the lakes to recover from the turbid conditions resulting from this sediment load. The harvest activity and road construction on public lands peaked during the 1980s. Over the past decade timber harvest activity in the Upper Trinity River Basin has almost been exclusively confined to private lands. Logging on both private and National Forest land has and is causing erosion and subsequent sedimentation of the streams and lakes.

Trinity and Lewiston Lakes are heavily used for recreational boating and personal watercraft. There are resorts and private housing around the lakes that use septic tank systems for wastewater disposal. Burn dumps at Carrville, Lewiston and Trinity Center were operated for years and closed. An unknown number of aboveground storage tanks exist in the area.

The Trinity River Diversion not only decreases the amount of water in the system by sending water to the Sacramento Valley and the Central Valley Project, but also creates a temperature elevation problem in the remaining water in the river and disrupts physical cues for migration and spawning of salmon. The Trinity River Fish Hatchery was constructed at the base of Lewiston Dam to help mitigate the loss of fisheries habitat resulting from the project, but the hatchery has not been effective in sustaining fish populations.

A review of the disturbance history map created for the cumulative effects analysis shows extensive timber harvest and road construction activity throughout the non-wilderness areas of the Upper Trinity River. The disturbance map does not show timber harvest activity that occurred in the basin prior to the 1980s but the map does illustrate the extensive activity that had taken place in watersheds in the Upper Trinity River over the past 25 years. The greatest amount of timber harvest activity and road construction occurred in the Stuart Fork and East Fork Trinity River Watersheds. The Coffee Creek and Trinity Reservoir Watersheds show the least amount of disturbance activity.

Natural and human-caused fires in the watershed have been very limited over the past 100 years. The fire history map for the Upper Trinity River shows only one fire greater than 5,000 acres that occurred in the lower south end of the Coffee Creek Watershed (6,350 acres). Other large fires have been documented in the community of Trinity Center (2,850 acres), upper Mumbo Creek - East Fork Trinity River (2,170 acres), and Papoose Creek - Trinity Reservoir (1940 acres). The effects of these fires on erosion processes, water quality, stream channels and hydrology are not known but are believed to have been minimal due to the lack of any effects documentation.

Grazing of cattle in the Upper Trinity River was limited in scope due to the steep terrain. Most of the grazing activity occurred on the flat terraces along the Trinity River in the Trinity Reservoir Watershed. Numerous ranches were present in the Upper Trinity River in the late-1800s and early 1900s. Many of the best rangelands were inundated by Trinity Lake in 1963. Grazing activity in the higher elevation areas of the upper basin was limited to several small allotments in the East Fork and Main Trinity River 5^{th} Field Watersheds. It is likely that cattle did have localized impacts to riparian areas and wet meadows in some locations, however the overall effects of historic cattle grazing in the Trinity River are believed to be small.

Chapter 5: Interpretations

The purpose of this chapter is to evaluate the existing information on watershed condition presented in Chapters 3 and 4 within the context of the key questions identified for watershed condition in Chapter 2.

Vegetation Management

Changes to structure of the vegetation in the analysis area can be attributed to two main factors: timber harvesting and fire. The policy towards fire suppression began to change forest conditions by allowing development of an understory of smaller trees and brush to become established in many areas due to the absence of the periodic fires that had previously limited such growth. This allowed the buildup of smaller understory fuels, setting the scene for the larger and higher intensity fires that have taken place over the last century. Fire suppression efforts have also arrested the culling of weaker, damaged, and/or insect kill trees that the periodic fires would have helped to reduce.

Timber harvesting began on the watershed in the early 1900s. There were no long-term timber management objectives at the time. The initial timber harvesting in these watersheds were selection harvests that targeted only the biggest and most valuable trees. Initial management direction for the Trinity National Forest, established in 1905, simply prescribed management that would ensure a continuing supply of timber and water. Changes in multiple-use direction for timber producing lands (such as for spotted owls), as well as reductions in the amount of land suitable and available for timber productions (such as for new wilderness lands, late successional reserves, and land exchanges), have significantly changed the watershed’s timber base.

The Trinity Alps Wilderness was designated as Wilderness in 1984. Under the Wilderness designation, emphasis is placed on maintaining natural ecosystems. This includes retention of old-growth vegetation and management of wildlife species requiring these late seral stage conditions. Almost half of the Trinity River Basin, 46% is under this designation. Prior to the designation the area had not been previously used as a timber harvest area due to the rugged and unroaded nature of the terrain. (USDA Forest Service, 2003)

Twenty-eight percent of the Trinity River Basin is in Matrix lands. Within the Matrix areas, timber harvesting opportunities still exist. Management changes to protect Riparian Reserves and forest habitat have emerged from historical practices, resulting in less timber harvesting opportunities to the benefit of other valued forest resources. LRMP prescriptions for Matrix lands emphasize a variety of management activities while maintaining healthy and vigorous ecosystems.

Twenty-four percent of the Trinity River Basin is in Late-Successional Reserves (LSR). LSR’s are to be managed to protect and enhance conditions of late-successional and old growth forest ecosystems, which serve as habitat for late-successional and old-growth species, including the northern spotted owl. (USDA Forest Service, 1994) LSR designation does not prohibit timber harvesting. In LSR’s timber harvest opportunities change from a timber yield objective to an objective to use timber harvesting as a tool to maintain and enhance old-growth forest ecosystems.

The remaining 2% of the Upper Trinity River is under the prescription Administratively Withdrawn Areas. Vegetation management is limited to burning and treatment by mechanical/manual/chemical methods to protect forest resources from loss to wildfire, pathogens and insects.

The basin is located in Management Area 6 and 8, Upper Trinity and National Recreation Area as described in the Forest Plan. A sustained level of forest products from suitable Matrix lands in Management Area 6 is expected to provide approximately 49 million board feet per decade in wood products. In Management Area 8, forest stand densities are managed to protect forest health and vigor, recognizing the natural role of fire, insects and disease and other components that have a key role in the ecosystem. Regulated harvest should be conducted in a manner that is compatible with NRA objectives. (USDA Forest Service, 1994).

As is typical of vegetation types in this basin, there are some areas of Knobcone Pine that are the result of historic stand-replacing wildland fires. These areas may be suitable for conversion to their historic vegetation type, Klamath mixed conifer. Wildfires and other natural disturbances have converted forested lands to shrub lands. Stocking levels need to be maintained to obtain optimum tree growth and minimize mortality.

Main Trinity River

The Main Trinity River Watershed is similar to the vegetation make up of the East Fork Trinity River Watershed, with the exception that there are lands under the Wilderness designation in the Main Trinity River Watershed. Forty-six percent of the watershed's lands are in an early or mid-mature conifer stand (not including Wilderness). Forty-two percent of the watershed is mature conifer. The remaining 12% is made up of 8% pole-size conifer and 4% young conifer plantation/seedling. Comparable again to the East Fork Trinity River Watershed, the private timbered lands in the Main Trinity Watershed are also continuously being logged. This activity is important to consider in analyzing the cumulative watershed effects.

Coffee Creek

In the Coffee Creek Watershed, over 92% of the timber producing stands are found in the Wilderness, and unavailable for timber harvesting. Three percent is in mature conifer, 2% early or mid-mature conifer and the remaining 2% is young conifer plantation/seedlings, and pole-size conifer.

East Fork Trinity River

The East Fork Trinity River Watershed is the only watershed in the analysis area that does not have lands under the Wilderness designation. Almost half, 46% of the watershed is in private ownership. On National Forest land 47% of the vegetation is early or mid-mature conifer. Three-quarters of this falls under the Matrix prescription that emphasizes Timber Management. Forty-two percent is categorized as mature conifer. The majority of the mature conifer lands are also found under the Matrix prescription that emphasizes Timber Management. The remaining proportions are 6% pole-size conifer, and 5% young conifer plantation/seedling. It is important to note that the private timbered lands in the East Fork Trinity River Watershed are continuously being logged. This activity is important to consider in analyzing the cumulative watershed effects.

Stuart Fork

In the Stuart Fork Watershed, over 60% of the total acreage of timber producing stands (not including acres in Wilderness) are in the mature category. Some of these larger diameter timber stands which lie outside of the LSR exhibit reduce growth characteristics, having achieved the point where the average annual growth no longer increases, also know as culmination of mean annual increment (CMAI). These areas may provide opportunities for regeneration treatments to reestablish more vigorous timber stands. Thirty percent of the total acreage (not including acres in Wilderness), are early or mid-mature conifer. Many of the stands in the mid-mature conifer strata are overstocked and are susceptible to insect attack or wildfire. This type of stand is a good candidate for intermediate silvicultural treatments including pre-commercial and commercial thinning. The remaining 4% is a combination of young conifer plantations/seedlings, and pole-size conifers.

Trinity Reservoir

The Trinity Reservoir Watershed is very similar to the Stuart Fork Watershed in vegetation make up. Sixty-five percent of the Trinity Reservoir Watershed (not including Wilderness acres), are in the mature category. Like the Stuart Fork Watershed, some of these larger diameter timber stands which lie outside of the LSR exhibit reduce growth characteristics, having achieved the point where the average annual growth no longer increases, also know as culmination of mean annual increment (CMAI). These areas may provide opportunities for regeneration treatments to reestablish more vigorous timber stands. Over 30 percent of the Trinity Reservoir Watershed vegetation is in an early or mid-mature conifer stand. Similar to the adjacent watershed (Stuart Fork), many of the stands in the mid-mature conifer strata are overstocked and are susceptible to insect attack or wildfire. This type of stand is a good candidate for intermediate silvicultural treatments including pre-commercial and commercial thinning. The remaining 4% is a combination of young conifer plantations/seedlings, and pole-size conifers.

Port Orford Cedar

The current condition of Port Orford cedar stands in the Upper Trinity River is considered to be fair to poor. Port Orford cedar stands located on the Trinity River were damaged by the 1997 Flood and are still not showing signs of recovery. Port Orford populations in the headwater reaches of the East Fork and Main Trinity River watersheds are healthy but are increasingly at risk to infection by *Phytophthora lateralis* due to the close proximity of roads to POC and aquatic/riparian habitats.

Opportunities for risk-reduction activities appear to be abundant in all areas where POC stands occur in the East Fork Trinity River and Main Trinity River watersheds. With the exception of several site-specific instances (e.g. Tangle Blue Creek) these opportunities have not been identified.

Activities should be focused in areas where land-use activities (timber harvest, recreation) are greatest and the potential for disease introduction is high. See opportunities for POC management in Chapter 6.

For an analysis of POC on a 5th field watershed basis see **Table 17.**

Fire and Fuels

Upper Trinity River

The current condition of the Upper Trinity River watershed reflects a transition from a short return interval, low intensity surface fire regime to one of moderate to high intensity stand replacement fires and infrequent intervals. There are several mechanisms that have contributed to this condition. The primary contributing factor is undoubtedly the exclusion of fire as a recurring disturbance in a historical fire dependent ecosystem. Fire exclusion as well as other contributing factors such as past harvest activities have cumulatively altered fuel profiles thus altering fire behavior and their effects upon shifts in species, diversity, stand health, and promotion of late succession forest. Such causal mechanisms have developed overstocking not found under pre-settlement conditions and a transition towards fire intolerant species in a once fire tolerant ecosystem. Results of this condition are vertical fuel ladders and horizontal fuel continuity that encourage stand replacement fire behavior. Most affected by this are the lower and mid elevations where fire return intervals were typically shorter but not as a result of the absence of perhaps three to four fire cycles reflect moderate to high fuel profiles. Higher elevations have been affected only moderately where recurring fires had longer intervals although described within a like regime.

The development and maintenance of a forest relatively free of crown fire potential is primarily dependent on the management of the structure of the crown fuels. Topography and weather, the other "legs" of the fire behavior triangle are either fixed or uncontrollable. Therefore the efforts to reduce crown fire behavior should be focused on stand structure conditions that promote this behavior as well as surface fuel conditions that contribute to intensities that allow it. It is these elements within the fuel profile coupled with high risk from the high use road network that places the watershed at risk to stand replacement fires.

Of primary consideration when determining where within the watershed fuel management activities are to be focused in the next decade is the established WUIs (See **Figure 1**). These areas are considered to be of the highest value and are therefore the highest risk areas. Although fuel loading and potential fire starts may be higher in other areas of the watershed the political and economic values at risk are centered on these wildland/urban interfaces. With few exceptions the focus of fuels management in the Upper Trinity River Watershed for the next 10 years will be in the forested areas around the established WUIs.

Main Trinity River

This watershed contains the northern portion of the New Coffee Creek WUI. All WUIs are considered to be of high risk for wildfires because they have high values associated with the build up of high fuel levels. The WUI is located in the lower elevations of the watershed as are a majority of the roads in the watershed. The extensive road system on the mid and lower elevations of this watershed is an asset to wildland fire response and vegetation management projects for fuel reduction. Considering the location of the WUI the most effective area within the watershed to conduct fuel reduction projects is along the mid elevation ridges around the northern edge of the New Coffee Creek WUI.

Coffee Creek

Because most of the watershed is in wilderness only the extreme lower elevations have the conditions that would attract fuels reduction project planning in the next decade. This is due to the New Coffee Creek WUI that is partially within this watershed.

East Fork Trinity River

Fuels management will be difficult in this watershed because of the large amount of timber management that has occurred on the extensive privately managed timber lands and the remoteness of the area. There are no WUIs within this watershed that would attract fuel reduction project planning in the next decade.

Stuart Fork

The lower elevations of this watershed provide the most obvious locations for consideration of fuels reduction project work in the next decade. The Covington Mills WUI and several recreational developments and marinas are located at these elevations. In addition to the existing WUI the Estralleta area near the lake is beginning to be developed on the private land. Outside of the Wilderness the mid elevations contain high value timber resources which need protection from wildfire. All of these considerations make the management of fuels in the watershed a high priority relative to other watersheds in the Upper Trinity River Watershed.

Trinity Reservoir

This watershed may be the most problematic of the watersheds in the Upper Trinity River. The east side of the lake has high value timber land but is very difficult to protect because of its long response times. Fire starts are more likely around the shoreline of the lake. The Trinity Center WUI is located in this watershed but is adjacent to a considerable amount of private timberland. Fuels reduction projects on National Forest land will be difficult around the WUI. The west side of Lewiston Lake is populated with several developed recreational facilities and is immediately adjacent to the Lewiston WUI. Fuels reduction is a much needed management practice east of Trinity Reservoir because of the large number of regeneration stands located there.

Watershed Condition

Upper Trinity River

All five watersheds have similar conditions with respect to channel stability and water quality. The East Fork Trinity River Watershed has the greatest amount of human caused erosion when it is expressed as a percentage over natural background erosion (US EPA, 2001). The Stuart Fork and Coffee Creek watersheds are the most predisposed to surface erosion from management activities. Based on the sediment source inventory prepared for the Trinity River TMDL the Main Trinity River Watershed contributes the most sediment per unit area from both natural and land-use activities.

Based on the existing analyses there appear to be abundant opportunities for improving water quality by reducing erosion from roads and legacy sediment sources (e.g. timber harvest areas, mines, legacy roads). Site-specific information identifying restoration opportunities is lacking. Opportunities for restoration of aquatic and riparian habitats appear limited but this also may be due to the lack of existing habitat surveys in the Upper Trinity River.

Table 17: Analysis of the Five 5th Field Watersheds in the Upper Trinity River

Present Condition	Causal Mechanism	Trends	Conclusion
Of the 5 watersheds the Main Trinity River Watershed is the greatest source of sediments to streams on a per unit area basis (both natural and human causes).	Natural geologic, soil and climate conditions. Timber harvest, roads, and to a lesser extent mining (legacy and current).	The trend is static.	There is a need to conduct watershed improvement needs inventories with emphasis in 7th field watersheds with high road densities in all of the 5th Field Watersheds with an emphasis on those areas where management activities are proposed.
The East Fork Watershed is the most impacted watershed when evaluated in terms of cumulative effects.	Timber harvest Roads	The trend is static.	There is a need to conduct a watershed improvement needs inventory and to identify problems and solutions for controlling human-caused sources of sediment.
Based on existing analyses, the Coffee Creek and the Stuart Fork Watersheds have the lowest cumulative impacts.	Large percentage of total area within wilderness land allocation with minimal historic disturbance.	The trend is static.	
The Stuart Fork and Coffee Creek Watershed have the greatest potential for erosion. The Trinity Reservoir Watershed has the least potential for erosion.	Natural geologic, soil and climate conditions.	The trend is static.	There is a need to incorporate Best Management Practices that will minimize erosion and compaction when planning for future management activities in the Stuart Fork and Coffee Creek Watersheds.
The non-wilderness portion of the Stuart Fork Watershed has the largest area of compaction concerns and erosion and the best soil fertility in low elevation areas.	Natural soil and geologic conditions coupled with past disturbance (roads, timber harvest, mining).	The trend in condition for soil compaction and erosion processes is unknown but close to a static condition.	There is a need to carefully plan future management activities to address soil erosion and compaction concerns and minimize cumulative effects.

Present Condition	Causal Mechanism	Trends	Conclusion
Trinity Dam has altered the hydrology, channel morphology and water quality in the Trinity River within and below the reservoir.	Trinity Dam.	The trend for water quality is static. Changes in the hydrology (i.e. higher flow releases) will improve channel condition below the dam.	Of all land-use activities the construction of Trinity Dam and creation of Trinity Lake has had the greatest effect on watershed condition in the Upper Trinity River Basin and on the Trinity River below the dam.
Summer water temperatures in the Trinity River and the lower reaches of its larger tributaries are very warm, exceeding 80 degrees F. during the summer.	Lack of riparian canopy cover. Removal of vegetation by large floods. Slow vegetative recovery between floods. Wide shallow channels dominated by partly submerged alluvium.	The trend is static. Recovery of riparian vegetation cannot keep pace with scouring effects of large runoff events.	There appear to be few opportunities for reducing water temperature in the Trinity River mainstem or its tributaries.
The current condition of aquatic and riparian habitats in the Trinity River and its tributaries is poorly documented.	Lack of surveys.	The trend is static.	There is a need to evaluate the health of the Trinity River and its tributaries by conducting aquatic, riparian and biological surveys.
Port Orford cedar populations in the East Fork and Main Trinity River Watersheds are not infected by Phytophthora lateralis.	Relative isolation to infected areas.	The risk of contamination and infection of POC stands is increasing.	There is a need to identify restoration and management opportunities that will reduce the risk of POC infection by *Phytophthora lateralis*. Port Orford Cedar protection measures should be included in future WIN inventories in both watersheds.
Port Orford Cedar stands in the Main Trinity River and East Fork Trinity River are in a fair to poor condition.	1997 Flood. Roads (location, maintenance and construction activities).	Port Orford cedar stands damaged by the 1997 Flood continue to decline. The risk of infection continues to increase for all POC stands.	There is a need to identify restoration and management opportunities that will reduce the risk of POC infection and to determine if any actions can be taken to aid the recovery of POC stands on the mainstem Trinity River.

Chapter 6: Management Opportunities

Vegetation Management

The following recommendations apply to lands that fall within Prescriptions 3, 6, 8 and Roaded, High Density Recreation within the Basin:

- Treat overstocked stands by thinning and uneven-aged management. Maintain optimum stocking and/or provide an output of timber products. Improve stand growth and move more rapidly to an older-mature size class. Decrease the susceptibility of trees to insect and disease.
- Treat mature and poorly stocked stands, including knobcone stands, by regeneration harvest, site clearing and planting. Improve stocking and increase overall percentage of moderate and closed canopy stands.
- Treat young plantations by release, interplanting and precommercial thinning. Optimize tree growth to reach closed canopy conditions.

Inventory & Monitoring

- Complete a timber inventory. Establish current condition of forested lands within the watersheds that have lands that fall within Prescriptions 3, 6 and 8.
- Complete survival exams for all planted areas based on existing protocol. Verify attainment of stand composition and density as described in silvicultural prescriptions and forest standards and guidelines.
- Establish forest inventory plots and monitor these plots to determine growth trends and changes in stand composition and structure over time and validate sustainable output of wood fiber.

Recommendations by Watershed

Main Trinity River and East Fork Trinity River

The private timbered lands in the East Fork Watershed and Main Trinity River Watershed are continuously being logged. This activity is important to consider when planning on National Forest lands in those watersheds.

- Regeneration harvest within prescriptions that allow timber management. Treatments are recommended to increase the percent of early seral and late seral open canopy in the watershed.

Coffee Creek

In the Coffee Creek watershed, over 92% of the timber producing stands are found in the Wilderness, and unavailable for timber harvesting. Vegetation Management opportunities are identified in the Fire/Fuels section of this chapter.

Stuart Fork and Trinity Reservoir

The Stuart Fork and Trinity Reservoir watersheds are very similar in vegetation and management prescriptions. For this reason, the management opportunities have been combined, as the same ones pertain to each of the two watersheds.

A large portion of the Clear Creek LSR is located within the Trinity Reservoir and Stuart Fork Watersheds. Additional management opportunities have been identified in the Clear Creek LSR Management Assessment (USDA Forest Service, 1997).

The following LSR Management Opportunities applies to the Stuart Fork and Trinity Reservoir watersheds lands within the Clear Creek LSR:

Limited harvest opportunities are available and recommended within the LSR areas. Harvest activities within these areas have two principal objectives: 1) Development of old-growth forest characteristics; and 2) Prevention of large-scale disturbances by fire, drought, insects, etc.

- Thin and conduct understory burning or other fuel treatment in older stands in the LSR to accelerate creation of late successional forest conditions.
- Monitor vegetation management in LSR to assess changes in late successional species.
- Design vegetation treatments that will accelerate the development of LS/OG conditions and reduce fragmentation.
- Develop bald eagle nest trees as necessary on the slopes overlooking Trinity Lake.

Port Orford Cedar

a. Incorporate measures to protect Port-Orford-Cedar for all management activities. All management practices should be designed to:
    - Prevent/reduce the import of disease into uninfested areas (offsite spores picked-up and carried into an uninfested project area)
    - Prevent/reduce the export of disease to uninfested areas (onsite spores moved to offsite, uninfested area);
    - Minimize increases in the level of inoculums or minimize the rate of spread in areas where the disease is localized or infection is intermittent.

b. Perform a restoration needs inventory focusing on reducing the risk of POC infection by *Phytophthora lateralis* in the Main Trinity River and East Fork Trinity River Watersheds. Identify and implement projects that will minimize the risk of introduction of *Phytophthora lateralis*.

c. Perform a risk analysis for any planned management activities in areas with Port-Orford cedar. Implement the appropriate mitigation measures to prevent the introduction for *Phytophthora lateralis*, the cause of Port-Orford cedar root disease (LMP 4-105). For an example of potential risk-reduction techniques refer to - A Range-Wide Assessment for Port-Orford-Cedar (*Chamaecyparus lawsoniana*) on Federal Lands, pgs. 135-179 (USDA-USDI, 2003).

Fire and Fuels

Findings

- In general the low to mid elevation forested areas of the watershed are at an increased hazard of stand-replacing fire due to high fuel loading.
- Effective fire prevention and suppression programs have altered the character of the forests, resulting in extremely high fuel loads and combustibility. High fuel loads could produce catastrophic wildfires with the potential to destroy wildlife habitat and private property, including houses and timber stocks, and to increase soil loss and sedimentation.
- The areas of greatest risk within the watershed are the Wildland Urban Interface areas and the developed recreation areas in the vicinity of Trinity Reservoir.
- Future development in the area will increase the number of structures and expand the extent of WUIs, especially in the area west of the lake and north to the Coffee Creek area.

Opportunities Within 5th Field Watershed in the Next Decade

Main Trinity River

- Priorities for fuels management are: 1st the WUIs, 2nd developed recreation facilities along the Hwy 3 corridor, 3rd protection of timber resources.
- Conduct Fireshed Analysis for the areas affecting the New Coffee Creek and Trinity Center WUIs.
- Concentrate on reducing fuel ladders and providing defensible fire zones for the WUIs and recreational facilities.
- Coordinate fuels reduction efforts with other resource management opportunities including timber and recreation.
- Participate with other agencies in the Trinity County Fire Safe Council to implement the Trinity County Fire Management Plan (TCRCD, 2003).

Coffee Creek

- Priorities for fuels management are: 1st the New Coffee Creek WUI, 2nd treat the area of blow-down in the East Fork Coffee Creek, 3rd protection of timber resources.
- Conduct Fireshed Analysis for the areas affecting the New Coffee Creek WUI.
- Concentrate on reducing fuel ladders and providing defensible fire zones for the WUIs and recreational facilities.
- Coordinate fuels reduction efforts with other resource management opportunities including timber and recreation.
- Participate with other agencies in the Trinity County Fire Safe Council to implement the Trinity County Fire Management Plan (TCRCD, 2003).

East Fork Trinity River

- Fuels management opportunities in this watershed are limited in the next 10 years compared to surrounding watersheds because of the absence of WUIs.
- Participate with other agencies in the Trinity County Fire Safe Council to implement the Trinity County Fire Management Plan (TCRCD, 2003).
- Coordinate fuels reduction efforts with other resource management opportunities as the may arise.

Stuart Fork

- Priorities for fuels management are: 1st the Covington Mill WUI, 2nd protection of the developed recreational facilities associated with Trinity Reservoir, 3rd protection of timber resources, 4th protection of the area of potential future development in the Estralleta area.
- Conduct Fireshed Analysis for the areas affecting the Covington Mill WUI and developed recreational facilities.
- Concentrate on reducing fuel ladders and providing defensible fire zones for the WUIs and recreational facilities.
- Coordinate fuels reduction efforts with other resource management opportunities including timber and recreation.
- Participate with other agencies in the Trinity County Fire Safe Council to implement the East Fork Fire Management Plan (TCRCD, 2000).

Trinity Reservoir

- Priorities for fuels management are: 1st the Trinity Center and Lewiston WUIs, 2nd the recreational developments along Lewiston Lake, 3rd protection of timber resources, especially the plantations east of Trinity Reservoir.
- Conduct Fireshed Analysis for the areas affecting the Trinity Center and Lewiston WUIs.
- Concentrate on reducing fuel ladders and providing defensible fire zones for the WUIs and recreational facilities.
- Coordinate fuels reduction efforts with other resource management opportunities including timber and recreation.
- Participate with other agencies in the Trinity County Fire Safe Council to implement the Trinity County Fire Management Plan (TCRCD, 2003).

Watershed Condition

The following opportunities exist to improve the condition of the five 5th field watersheds in the Upper Trinity River:

Watershed Improvement Needs Inventories

Roads and timber harvest activities are acknowledged contributors of sediment to the Trinity River and its tributaries however little information is available regarding specific restoration opportunities that could reduce sediment sources. There is a need to conduct Watershed Improvement Needs (WIN) inventories in watersheds where there are opportunities to control sediment. There is a need to identify restoration opportunities focused on reducing or eliminating sediment sources originating from roads and timber sale areas. There is a need to focus WIN inventories in areas where management activities are proposed or resource conditions warrant future restoration funding for reduction of road sediment sources.

Trinity River TMDL Recommendations

Implement all recommendations from the TMDL for the Trinity River that pertain to public lands managed by the U.S. Forest Service in the five watersheds that drain into Trinity and Lewiston Lakes. These recommendations are as follows:

- Complete Watershed Analyses, particularly in Upper Assessment Area, and implement recommendations.
- Complete roads analysis and implement findings with focus on TMDL hillslope targets.
- Continue cooperative watershed restoration with local watershed groups, TCRCD, and TMC.
- Evaluate and limit effects of suction dredge operations in stream reaches that overlap spawning sites.
- Develop and implement a comprehensive aquatic monitoring plan for the basin including: habitat, fish populations, and management effectiveness.

Soil Quality Management

Provide for protection of soil resources when planning and implementing all projects in the Upper Trinity River. Appropriate treatment techniques to protect soil resources are described in the following literature:

- Adherence to the Region 5, Soil Quality Standards for land management (USDA Forest Service, 1995) i.e.
- Soil Stability – Soil Cover and Erosion Standards
- Soil Hydrology – Soil Compaction and Porosity Standards
- Nutrient Cycling – Soil Fertility and Nutrient Banks Standards
- Adherence to the Region 5, Water Quality Best Management Practices (USDA Forest Service, 2000) i.e.
    - Timber Management Practices – Index 12.11
    - Vegetation Manipulation Practices – Index 12.51
    - Fire and Fuel Management Activities – Index 12.61

Move soil resources toward the following desired future condition:

- Decrease compaction in the Stuart Fork watershed to acceptable SQS levels.
- Increase soil cover on granitic soils by lopping and scattering fuels especially on south and west facing slopes.
- Mastication of brush fields vs. burning to retain soil cover and return nutrients.

Because the Stuart Fork Watershed has the most productive soils for timber regeneration special care should be provided to protect the soil resource during implementation of management activities.

Vegetation management activities occurring in and adjacent to Riparian Reserves

- Allow vegetation management activities to occur within and adjacent to the buffers of Riparian Reserves when they are compatible with Aquatic Conservation Strategy Objectives and management guidelines for Riparian Reserves (USDA Forest Service, 1994).
- Design all fuels management projects so that the activities will maintain and/or enhance water quality, soil stability, fertility and productivity.
- When planning vegetation management activities in or adjacent to Riparian Reserves determine the Desired Future Condition (DFC) for vegetation and riparian/aquatic habitats. Design vegetation management projects to achieve the DFCs tailored for each Riparian Reserve according to its unique characteristics (i.e. aspect, elevation, soils, geology, natural fire behavior, etc.).
- Conduct all vegetation management activities in accordance with Best Management Practices as described in Water Quality Management for National Forest System Lands in California - Best Management Practices, 2000.

Stream Channel Condition Evaluation

There is a need to evaluate the condition of stream channels in the Upper Trinity River. Very little information exists pertaining to the characteristics and health of stream channels in the Upper Trinity River Watershed. A thorough search of existing stream survey information from State and Federal Agencies should be undertaken to compile known information on the Trinity River and its tributaries. Stream condition inventories should be undertaken in areas where future projects are planned. Additional stream condition inventories, habitat typing surveys, and channel stability evaluation should be considered in areas without any existing information.

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Appendix A: HUC 6 and HUC 7 Watersheds in the Upper Trinity River Basin

Main Trinity River (1801021101)

Table 18: HUC 6 and HUC 7 Watersheds in the Main Trinity River 5th Field Watershed.

HUC 6 Name	HUC 6 #	HUC 6 Acres	HUC 7 #	HUC 7 Acres	HUC 7 Name
Trinity River/ Deadfall Creek	180102110101	15,074	01	8,614	High Camp Creek-Deadfall Creek
			02	6,467	Bull Creek-Cedar Creek
Picayune/ Little Trinity River	180102110102	25,348	01	8,974	Picayune Creek
			02	7,089	Little Trinity River
			03	9,280	Sherer Creek-Trinity River
Tangle Blue Creek	180102110103	14,047	01	4,621	Tangle Blue Creek
			02	4,146	Log Lake-Tangle Blue Creek
			03	5,280	Scott Mountain Creek
Ramshorn/ Big Bear Lake	180102110104	22,244	01	6,982	Sunflower Creek-Graves Creek
			02	8,241	Ramshorn Creek
			03	7,021	Bear Lakes
Eagle Creek	180102110105	24,773	01	9,638	Eagle Creek
			02	8,775	Minnehaha Creek-Trinity River
			03	6,359	Scorpion Creek-Trinity River
Carrville/Upper Trinity River	180102110106	15,763	01	4,800	Copper Creek-Trinity Lake
			02	10,964	Buckeye Creek-Hatchet Creek

Coffee Creek (1801021102)

Table 19: HUC 6 and HUC 7 Watersheds in the Coffee Creek 5th Field Watershed.

HUC 6 Name	HUC 6 #	HUC 6 Acres	HUC 7 #	HUC 7 Acres	HUC 7 Name
Upper Coffee Creek	180102110201	28,854	01	7,718	Big Flat-Coffee Creek
			02	8,387	Union Creek
			03	7,365	South Fork Coffee Creek
			04	5,385	Battle Creek-Coffee Creek
North Fork Coffee Creek	180102110202 180102110202	15,598 15,598	01	5,848	Saloon Creek-North Fork Coffee Creek
			02	4,706	Granite Creek
			03	5,044	Lick Creek-North Fork Coffee Creek
Lower Coffee Creek	180102110203	29,074	01	7,143	East Fork Coffee Creek
			02	7,120	Boulder Creek-Coffee Creek
			03	6,426	Sugar Pine Creek-Coffee Creek
			04	9,392	Little Boulder Creek-Coffee Creek

East Fork Trinity River (1801021103)

Table 20: HUC 6 and HUC 7 East Fork Trinity River 5th Field Watershed.

HUC 6 Name	HUC 6 #	HUC 6 Acres	HUC 7 #	HUC 7 Acres	HUC 7 Name
Upper East Fork Trinity River	180102110301	18,527	01	7,126	Horse Heaven Meadows
			02	5,555	Crow Creek
			03	5,847	Highland Lakes-Upper East Fork Trinity River
Mumbo Creek	180102110302	13,696	01	7,271	Upper Mumbo Creek
			02	6,425	Lower Mumbo Creek
Middle East Fork Trinity River	180102110303	12,732	01	5,806	Pond Lily Creek-Middle East Fork Trinity River
			02	6,926	Grouse Creek-Middle East Fork Trinity River
Lower East Fork Trinity River	180102110304	28,242	01	5,876	Devils Creek-Lower East Fork Trinity River
			02	8,321	Halls Gulch
			03	4,499	Cedar Creek-Lower East Fork Trinity River
			04	10,319	Squirrel Gulch-Lower East Fork Trinity River

Stuart Fork (1801021104)

Table 21: HUC 6 and HUC 7 Watersheds in the Stuart Fork 5th Field Watershed.

HUC 6 Name	HUC 6 #	HUC 6 Acres	HUC 7 #	HUC 7 Acres	HUC 7 Name
Upper Stuart Fork	180102110401	37,392	01	9,015	Morris Meadows
	180102110401	37,392	02	7,440	Deer Creek-Upper Stuart Fork
			03	9,204	Alpine Lake-Summit Lake
			04	6,268	Owens Creek-Upper Stuart Fork
East Fork Stuart Fork	180102110402	23,476	01	6,637	Davis Creek-Hobel Creek
			02	5,412	Bowerman Meadows
			03	5,634	Covington Mill-Strope Creek
			04	5,793	Hayward Flat-East Fork Stuart Fork
Lower Stuart Fork	180102110403	32,736	01	9,003	Van Matre Creek-Trinity Alps Creek
			02	6,976	Slate Creek-Stoney Creek
			03	10,074	Mule Creek-Trinity Lake
			04	6,685	Buckey Creek-Trinity Lake

Trinity Reservoir (1801021105)

Table 22: HUC 6 and HUC 7 Watersheds in the Trinity Reservoir 5th Field Watershed.

HUC 6 Name	HUC 6 #	HUC 6 Acres	HUC 7 #	HUC 7 Acres	HUC 7 Tributaries
Swift Creek	180102110501	37,392	01	5,990	Horseshoe Lake-Swift Creek
			02	6,807	Bear Basin-Swift Creek
			03	7,170	Granite Lake-Preacher Meadow
			04	10,866	Lake Eleanor-Swift Creek
			05	6,562	Swift Creek-Trinity Lake
Jackass Springs	180102110502	23,851	01	6,318	Jackass Spring-Trinity Lake
			02	5,895	Hay Gulch-Trinity Lake
			03	6,457	Bragdon Gulch-Trinity Lake
			04	5,182	Clawton Gulch-Trinity Lake
Van Ness Creek	180102110503	27,655	01	7,366	Feeney Gulch-Van Ness Creek
			02	9,611	Papoose Creek
			03	10,660	Trinity Dam-Trinity Lake
Lewiston Lake	180102110504	16,742	01	9,837	Eastman Gulch-Mooney Gulch
			02	6,907	Baker Gulch-Lewiston Lake

Appendix B: Road Density and Cumulative Risk Rating for 7th Field Watersheds in the Upper Trinity River Basin

Table 23: Road Density and Cumulative Risk Rating.

Huc7	7th-field name	Acres	Road miles	Road density [mi/mi^2]	Risk Rating
18010211010101	High Camp Creek-Deadfall Creek	8,614	28.1	2.09	Low
18010211010102	Bull Creek-Cedar Creek	6,467	29.4	2.91	Mod
18010211010201	Picayune Creek	8,974	57.9	4.13	Mod
18010211010202	Little Trinity River	7,089	30.6	2.76	High
18010211010203	Sherer Creek-Trinity River	9,280	51.6	3.56	High
18010211010301	Tangle Blue Creek	4,621	5.2	0.71	Low
18010211010302	Log Lake-Tangle Blue Creek	4,146	13.8	2.13	Mod
18010211010303	Scott Mountain Creek	5,280	26.6	3.22	Mod
18010211010401	Sunflower Creek-Graves Creek	6,982	48.6	4.46	High
18010211010402	Ramshorn Creek	8,241	30.6	2.38	High
18010211010403	Bear Lakes	7,021	17.5	1.60	Low
18010211010501	Eagle Creek	9,638	15.4	1.02	Low
18010211010502	Minnehaha Creek-Trinity River	8,775	40.3	2.94	Low
18010211010503	Scorpion Creek-Trinity River	6,359	24.7	2.48	Low
18010211010601	Copper Creek-Trinity Lake	4,800	32.6	4.35	High
18010211010602	Buckeye Creek-Hatchet Creek	10,964	73.0	4.26	High
18010211020101	Big Flat-Coffee Creek	7,718	5.1	0.42	Low
18010211020102	Union Creek	8,387	0.1	0.01	Low
18010211020103	South Fork Coffee Creek	7,365	2.2	0.19	Low
18010211020104	Battle Creek-Coffee Creek	5,385	4.0	0.48	Low
18010211020201	Saloon Creek-North Fork Coffee Creek	5,848	0.9	0.10	Low

Huc7	7th-field name	Acres	Road miles	Road density [mi/mi^2]	Risk Rating
18010211020202	Granite Creek	4,706	0.0	0.00	Low
18010211020203	Lick Creek-North Fork Coffee Creek	5,044	0.0	0.01	Low
18010211020301	East Fork Coffee Creek	7,143	0.1	0.01	Low
18010211020302	Boulder Creek-Coffee Creek	7,120	12.0	1.08	Low
18010211020303	Sugar Pine Creek-Coffee Creek	6,426	5.6	0.55	Low
18010211020304	Little Boulder Creek-Coffee Creek	9,392	50.5	3.44	Mod
18010211030101	Horse Heaven Meadows	7,126	45.2	4.06	High
18010211030102	Crow Creek	5,555	46.0	5.30	High
18010211030103	Highland Lakes-Upper East Fork Trinity River	5,847	43.8	4.79	High
18010211030201	Upper Mumbo Creek	7,271	39.0	3.43	High
18010211030202	Lower Mumbo Creek	6,425	45.0	4.48	High
18010211030301	Pond Lily Creek-Middle East Fork Trinity River	5,806	36.0	3.97	High
18010211030302	Grouse Creek-Middle East Fork Trinity River	6,926	20.5	1.89	High
18010211030401	Devil's Creek-Lower East Fork Trinity River	5,876	25.0	2.72	High
18010211030402	Halls Gulch	8,321	69.0	5.31	High
18010211030403	Cedar Creek-Lower East Fork Trinity River	4,499	36.5	5.19	High
18010211030404	Squirrel Gulch-Lower East Fork Trinity River	10,319	75.9	4.71	High
18010211040101	Morris Meadows	9,015	0.0	0.00	Low
18010211040102	Deer Creek-Upper Stuart Fork	7,440	0.0	0.00	Low
18010211040103	Alpine Lake-Summit Lake	9,204	0.0	0.00	Low
18010211040104	Owens Creek-Upper Stuart Fork	6,268	0.0	0.00	Low
18010211040201	Davis Creek-Hobel Creek	6,637	45.6	4.39	High
18010211040202	Bowerman Meadows	5,412	13.1	1.55	Low
18010211040203	Covington Mill-Strope Creek	5,634	42.3	4.81	High
18010211040204	Hayward Flat-East Fork Stuart Fork	5,793	27.3	3.02	High

Huc7	7th-field name	Acres	Road miles	Road density [mi/mi^2]	Risk Rating
18010211040301	Van Matre Creek-Trinity Alps Creek	9,003	25.6	1.82	Low
18010211040302	Slate Creek-Stoney Creek	6,976	49.3	4.53	High
18010211040303	Mule Creek-Trinity Lake	10,074	58.6	3.72	Mod
18010211040304	Buckey Creek-Trinity Lake	6,685	60.7	5.81	High
18010211050101	Horseshoe Lake-Swift Creek	5,990	0.0	0.00	Low
18010211050102	Bear Basin-Swift Creek	6,807	0.0	0.00	Low
18010211050103	Granite Lake-Preacher Meadow	7,170	9.1	0.81	Low
18010211050104	Lake Eleanor-Swift Creek	10,866	53.7	3.17	High
18010211050105	Swift Creek-Trinity Lake	6,562	62.3	6.08	High
18010211050201	Jackass Spring-Trinity Lake	6,318	22.3	2.26	Mod
18010211050202	Hay Gulch-Trinity Lake	5,895	42.6	4.62	High
18010211050203	Bragdon Gulch-Trinity Lake	6,457	41.6	4.13	High
18010211050204	Clawton Gulch-Trinity Lake	5,182	25.0	3.08	High
18010211050301	Feeny Gulch-Van Ness Creek	7,366	50.1	4.35	High
18010211050302	Papoose Creek	9,611	69.7	4.64	High
18010211050303	Trinity Dam-Trinity Lake	10,660	42.9	2.57	High
18010211050401	Eastman Gulch-Mooney Gulch	9,837	53.9	3.50	High
18010211050402	Baker Gulch-Lewiston Lake	6,907	46.3	4.29	High