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Watershed Analysis

Burnt Ranch and Soldier Creek Planning Watersheds

Trinity River Management Unit, Shasta-Trinity National Forest
Trinity County, California

Big Lake, Burnt Ranch Planning Watershed

Junction City area with burned landscape due to the Eagle Fire of the Iron Complex 2008

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INTRODUCTION

The Purpose of Watershed Analysis

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

Watershed analyses are conducted by teams of journey-level specialists who follow a standard, interagency six-step process described in *Ecosystem Analysis at the Watershed Scale – Federal Guide for Watershed Analysis* (REO, 1995). The analysis is issue driven, focusing on key questions identified by the analysis team.

The watershed analysis is not a decision document. The purpose of watershed analysis is to evaluate the existing conditions in terms of the desired conditions identified in the Shasta Trinity Land and Resource Management Plan (Forest Plan) (USFS, 1995). Comparing the existing conditions to the desired conditions enables identification of project opportunities to move the landscape towards the desired condition.

Focus of This Watershed Analysis

The focus of this analysis is vegetation condition as it relates to fuel loading, water quality, aquatic habitat, wildlife habitat, and soil productivity. The WA will provide information on the current condition in these watersheds as well as the desired condition based on the Forest Plan. This watershed analysis will focus lands within this watershed that are administered by the Shasta Trinity National Forest.

Format of the Document

This document is organized into five chapters.

Chapter 1 – Characterization of the Watershed: This chapter provides a brief overview of the dominant physical, biological and human processes or features of the watershed that affect ecosystem functions or conditions. It includes the most important land allocations, Forest Plan objectives and regulatory constraints that influence resource management in the watersheds. The watershed context is used to identify the primary ecosystem elements that will be analyzed in detail.

Chapter 2 – Issues and Key Question: This chapter provides the key elements of the ecosystem that are most relevant to the management questions or objectives, human

values, or resource conditions within the watersheds. These issues and key questions are developed by the team and District Ranger.

Chapter 3 – Current Conditions: This chapter addresses the dominant physical, biological and human processes or features of the watershed that affect ecosystem functions or conditions relevant to the issues and key questions identified in Chapter 2. The current range, distribution and condition of these ecosystem elements are documented.

Chapter 4 – Desired Conditions: This chapter presents desired conditions of specific ecosystem elements based on the Forest Plan and professional judgment.

Chapter 5 – Management Opportunities to Meet Desired Conditions: This chapter summarizes the opportunities to move from existing conditions to the desired conditions identified in the Forest Plan or this Watershed Analysis.

CHAPTER 1 - CHARACTERIZATION OF THE WATERSHED

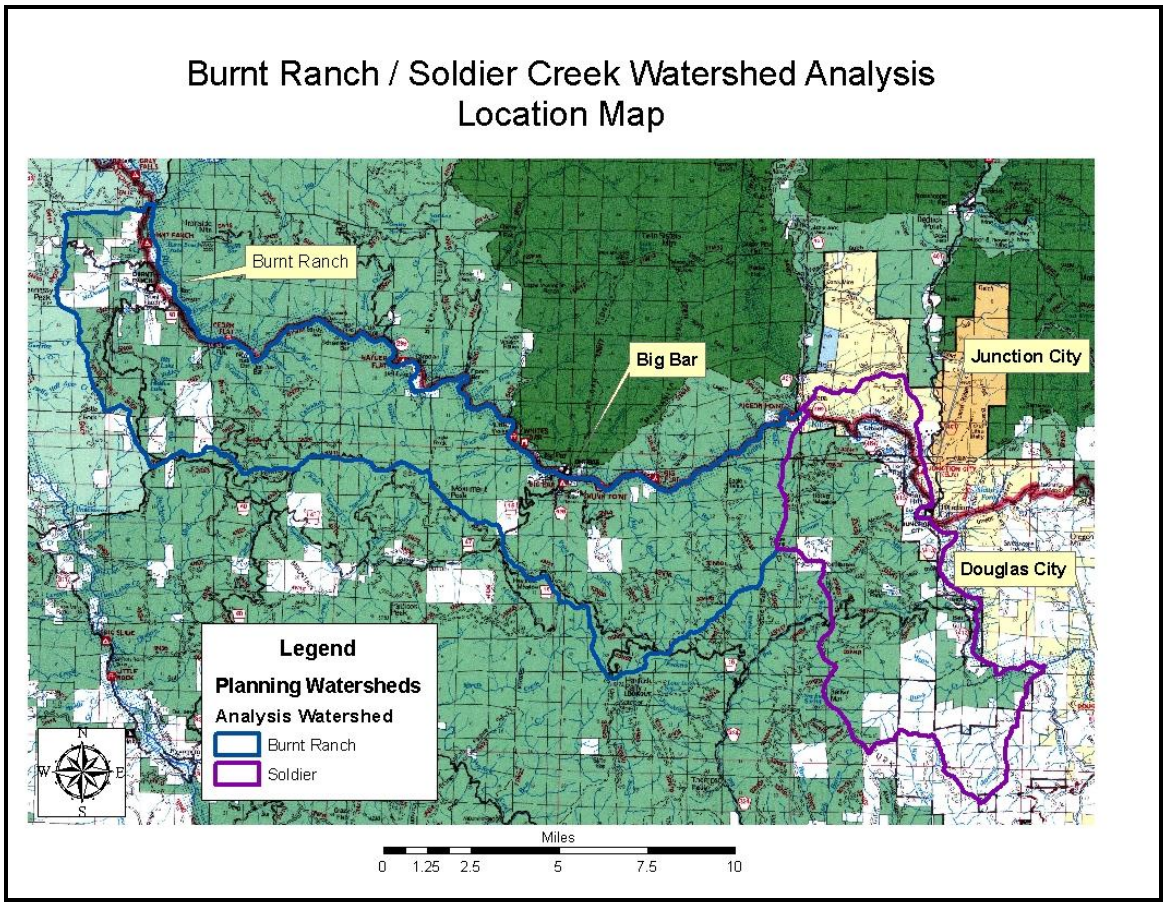
This chapter provides a brief overview of the Burnt Ranch and Soldier Creek planning watersheds in terms of the dominant physical, biological and human processes that affect ecosystem function or condition. These processes will be covered throughout this analysis.

Physical Setting

Location

The Burnt Ranch and Soldier Creek planning watersheds are located on the Trinity River Management Unit of the Shasta-Trinity National Forest, in Trinity County, California. The planning watersheds include the tributary drainages on the south side of the Trinity River, from the communities of Douglas City to Burnt Ranch (Figure 1). The planning watersheds cover about 81, 700 acres, of which approximately 62,600 acres are National Forest System lands.

Figure 1. Analysis Area



Climate

The climate of the Burnt Ranch and Soldier planning watersheds is Mediterranean; characterized by warm dry summers and cold wet winters. Major Pacific winter storms track from the southwest, bringing substantial amounts of precipitation. Precipitation normally occurs as rainfall at the lower elevations and as snow above 4000 feet. Precipitation and temperature varies significantly within the watershed based on topography and elevation. Elevation ranges from 1,000 feet to over 6,000 feet.

Two long term weather stations are located within or near the planning watershed, one at Burnt Ranch and the other at Big Bar. Average summer maximum temperatures at these low elevation stations are in the mid 90° Fahrenheit range, and average minimum winter temperatures are in the low 30° Fahrenheit range. Average total precipitation is approximately 38 inches at Big Bar and approximately 48 inches at Burnt Ranch (WRRC, 2008). Precipitation at higher elevations ranges from 50 to 60 inches (USGS, 2008). Most precipitation occurs between October and May, with snow usually remaining at higher elevations through May or June. Rain on snow events are common in the mid-range elevations.

Terrestrial System

Fire and Fuels

The diversity of species and complex vegetative patterns historically found in the forests of the Klamath Mountains were a result of the effects of frequent low and moderate severity wildfire. The effects of fire exclusion and other land management practices (grazing, logging, human settlement) have resulted in a change in stand composition and fuel loading (Taylor & Skinner 2003).

There is a history of large fires within and adjacent to the analysis area, fire causes are attributed to both lightning and humans. These fires have provided both unwanted and beneficial effects; the type and degree of effects are based on the values at risk, vegetation, fuel loading and fire severity.

Vegetation

The Soldier/Burnt Ranch watersheds, like most of the area in the central part of the Forest, is dominated by conifer forests and mixed conifer/hardwood forests. The primary disturbance agent in this watershed has been the wildfires in 2008. Other disturbances within the watersheds have been road building, mining, logging, urbanization, earlier wildfires, and recreation.

Plant Communities

The majority of the Burnt Ranch and Soldier Creek planning watersheds is composed of Klamath mixed conifer forest or conifer/hardwood (77%) with pockets of red fir (*Abies magnifica*) at the highest elevations. Mid-mature and older conifer forest is distributed fairly uniformly throughout the entire area. Other plant communities that are present

include oak woodlands and hardwood forest found primarily between the North Fork of the Trinity drainage and Barnum Ridge (11%), early-seral conifer plantations distributed adjacent to Forest Road 16 and the Hayfork Divide, montane shrublands located mostly at lowest elevations along the Trinity River (2%), and isolated openings of grass or sand along the Trinity River (<1%).

From Big Bar west, forest communities begin to show more evidence of coastal influence, with lush understories and a species diversity more reflective of coastal plant communities, in part because of the high amount of late-seral habitat present. Fungi diversity is greater. The Corral Bottom and Haypress Meadow area (just south of the planning watersheds) have a high diversity of both common and rare fungi species, including several Forest Service Sensitive and other rare species. Habitat within the Burnt Ranch and Soldier Creek planning watersheds have similar habitat.

Plant community composition within the planning watershed is driven primarily by the dominant north aspect throughout. Variations in soil depth influence the number and location of oak woodlands as well as montane shrublands. Geologic instability has contributed to younger openings and the concentrations of serpentine soils in the Burnt Ranch area.

Wildlife Species

Wildlife species known to occur within the Burnt Ranch and Soldier Creek watersheds include federally listed and Forest Service sensitive species, particularly those species the depend on old growth habitat such as northern spotted owl and pacific fisher.

Aquatic System

Water Quality

The important water quality parameters that most influence the beneficial uses for the Burnt Ranch and Soldier Creek watersheds are sediment and turbidity. Several streams within the watersheds are used as domestic or irrigation water supply for residents in the area.

The Trinity River is listed as sediment limited by Environmental Protection Agency (EPA) under the Clean Water Act section 303(d) and the Burnt Ranch and Soldier watersheds are included within the Maximum Daily Load (TMDL) listing.

Fish Species

The fishes include anadromous fall Chinook salmon, winter steelhead trout, coho salmon, and resident rainbow trout and brook trout. The Southern Oregon Northern California Coastal (SONCC) Coho salmon have been listed as threatened under the Endangered Species Act (ESA). All stream areas accessible to anadromous fish have been listed as critical habitat. Due to the long-term overall decline of Chinook and steelhead runs, the Pacific Southwest Region of the Forest Service has put them on a regional sensitive

species list to help ensure that Forest Service activities do not result in a trend towards listing them under the ESA.

Land Allocations and Management Direction

Planning direction for the Shasta Trinity National Forest is found in the 1995 Shasta-Trinity National Forest, Forest Plan (USFS, 1995). The Forest Plan incorporated the management direction adopted in the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (USDA, 1994), commonly referred to as the Northwest Forest Plan.

Management Direction

The Shasta-Trinity National Forest is divided into 22 management areas. The LRMP defines desired future conditions and management prescriptions within each management area. The Burnt Ranch and Soldier planning watersheds fall within Management Area 15, Trinity River.

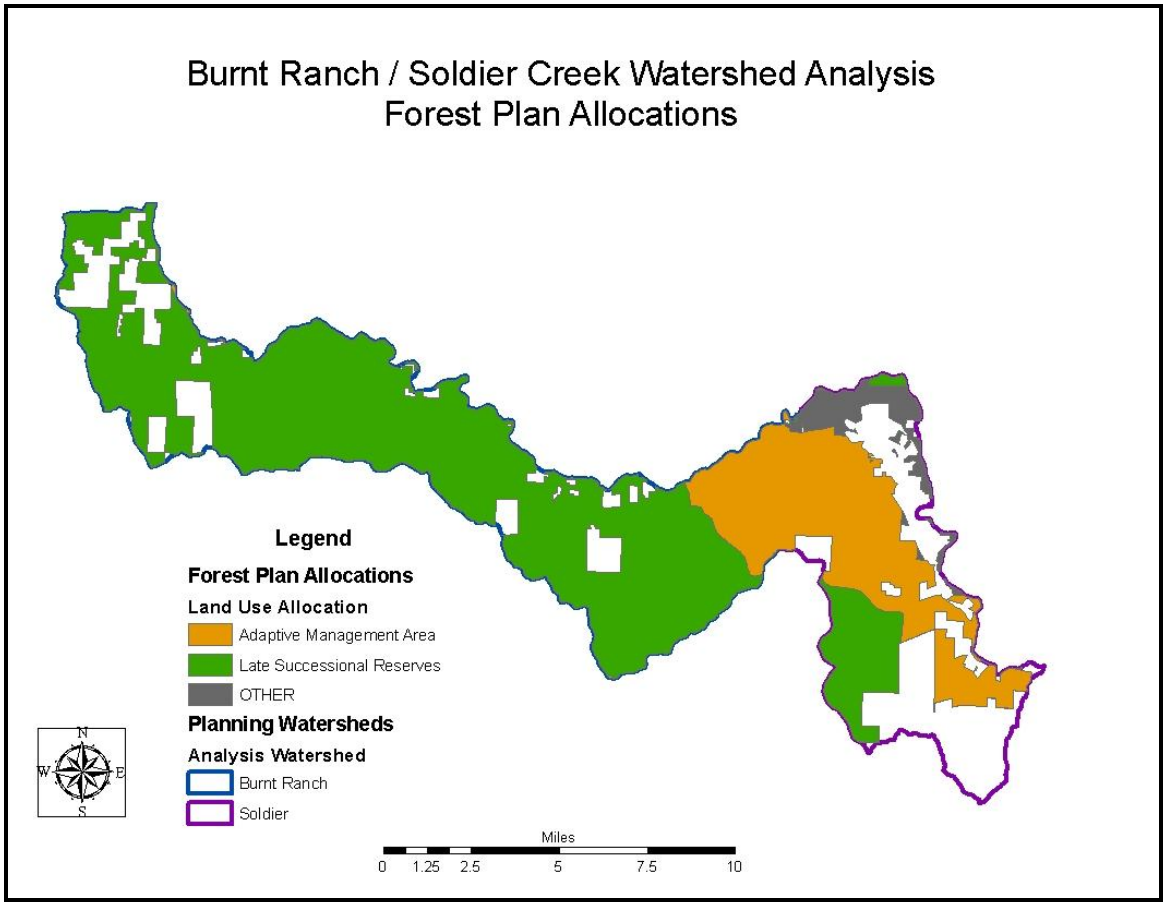
Land Allocations

Table 1 summarizes the mapped land allocations within the planning watersheds and Figure 2 displays the location of the allocations.

Table 1. Forest Plan Mapped Land Allocations

Management Area	Acres
Late-Successional Reserves (LSR)	46,275
Adaptive Management Areas (AMA)	16,320
Other (Private, BLM, outside National Forest)	19,067
TOTAL	81,662

Figure 2. Forest Plan Allocations



Riparian Management Areas are an unmapped allocation that is identified during project planning (Forest Plan, page 4-60) and would override less restrictive mapped prescriptions where riparian areas are present.

Late-Successional Reserves

A portion of the Burnt Ranch and Soldier planning watersheds are located within Late-Successional Reverses (LSR). Late-Successional Reserves are to be managed to protect and enhance late successional and old growth forest ecosystems, which serve as habitat for late successional and old-growth dependent species.

Adaptive Management Areas

A portion of the Burnt Ranch and Soldier planning watersheds are within the Hayfork Adaptive Management Area. The emphasis of this AMA is development, testing, and application of forest management practices, including partial cutting, prescribed burning, and low impact approaches to forest harvest, which provide for a broad range of forest values, including commercial timber production and provision of late-successional and high quality riparian habitat.

Wild and Scenic Rivers

The Trinity River is a component of the National Wild and Scenic River system. Designated on January 18, 1981, the river is classified as Recreational from 100 yards below Lewiston Dam to Cedar Flat, and Scenic from Cedar Flat to Grays Falls.

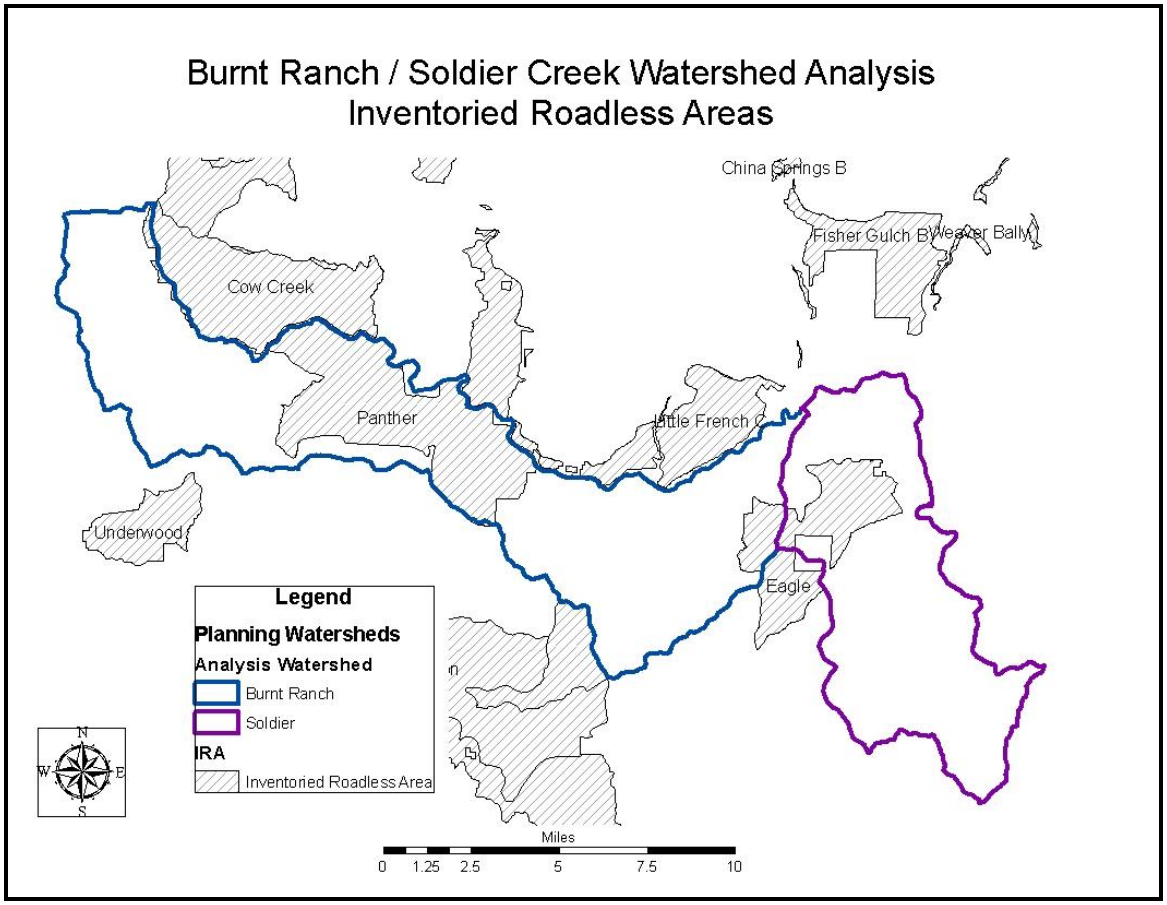
Inventoried Roadless Areas

Inventoried roadless areas (IRAs) were identified in the Final Environmental Impact Statement prepared for the Roadless Area Conservation Rule in November 2000. Portions of three IRAs are located within the planning watersheds as summarized in Table 2 and shown in Figure 3.

Table 2. Inventoried Roadless Areas

Inventoried Roadless Area	Acres
Cow Creek	372
Panther	11,932
Eagle	4,614

Figure 3. Inventoried Roadless Areas



Aquatic Conservation Strategy (ACS) Components

Riparian Reserves

Riparian Reserves are designated under the ACS for all permanently flowing streams, lakes, and wetlands as well as intermittent and ephemeral channels. Riparian Reserves are present along stream channels throughout the analysis area, and occur across all land allocations. Riparian Reserves are to be managed to provide benefits to riparian associated species, improve travel and dispersal for many terrestrial animals and plants, and provide for habitat connectivity within the watershed. The Riparian Reserves also serve as corridors to connect Late Successional Reserves.

Human Uses

Communities

The river communities of Junction City (population approximately 790), Big Bar (Population approximately 190), and Burnt Ranch (population approximately 375) are within and adjacent to the planning watersheds. The primary industries are service and tourism related to river based recreation such as fishing and white water boating. Several gold dredging operations are active during the summer along the Trinity River.

Transportation

The transportation system in the analysis area is made up of roads and trails that provide access for motorized and non-motorized vehicles, livestock, and foot traffic. The road system in this watershed consists of state highways, county roads, arterial routes, collector routes, and a series of local spur roads. State Highway 299 runs along the northern edge of the watershed and is the primary travel route from the Arcata/Eureka area on the coast to the Redding area in the Sacramento Valley. Several county roads provide access to private lands located along the river, but the majority of the roads and trails in the planning watersheds are Forest Service roads.

Recreation Resources

Although the planning watersheds offer a variety of opportunities, recreation use is predominantly associated with water based recreation along the Trinity River, including whitewater boating, drift boat fishing, bank fishing, and water play. Opportunities within the watersheds consist of driving for pleasure, wildlife viewing, hunting, and camping.

CHAPTER 2 - ISSUES AND KEY QUESTIONS

The purpose of this chapter is to focus the analysis on the key elements of the ecosystem that are most relevant to the management questions, human values, and resource conditions within the Burnt Ranch and Soldier planning watersheds.

Seven issues critical to the future management of this watershed were identified. They are:

- Issue #1: Human Uses, Values, and Expectations
- Issue #2: Access and Travel Management
- Issue #3: Erosional Processes
- Issue #4: Aquatic Systems and Species
- Issue #5: Terrestrial Wildlife Habitat and Species
- Issue #6: Fire, Fuels, and Air Quality
- Issue #7: Plant Communities

The following is a broader description of each issue accompanied by key questions pertaining to the issue.

Issue #1: Human Uses, Values, and Expectations

Recreation

Key Question 1.1 What are the major recreation resources and uses of the watershed? What is the condition of these resources?

Outcome 1.1 Identification of recreation resources and areas within the Watershed. Identification of potential recreation opportunities and determination of proper management practices that would improve recreation opportunities.

Wood Products

Key Question 1.2 What is the current health of stands in the watershed? Are there areas with timber harvesting opportunities that would contribute to ecosystem management objectives?

Outcome 1.2 Identification of areas for applying timber management practices that would result in a benefit to ecosystem management.

Key Question 1.3 Are there existing fuel wood opportunities within the watersheds? Are there areas that fuel wood opportunities may be developed?

Outcome 1.3 Identification of areas that may be opened to fuel wood gathering or areas that fuel wood projects may be developed.

Cultural Resources

Key Question 1.4 What are the ranges of management actions anticipated within the watershed that may affect archaeological properties?

Outcome 1.4 Heritage work needs to be undertaken before proposed actions are initiated to identify known and currently unknown archaeological properties that may be eligible to the National Register. Identification of areas to protect and determination of appropriate protection measures.

Issue #2: Access and Travel Management

Key Question 2.1 What role does the transportation system play in access to the area? Are there areas that would benefit from increased or decreased access?

Outcome 2.1 Identification of roads of concern to local and extended users and identification of the road system necessary to serve management needs.

Issue #3: Erosional Processes

Key Question 3.1 What mass wasting processes are inherent within the watershed? What management actions, if any, would protect soil and water resources.

Outcome 3.1 Identification of predominant mass wasting features, the delineation of priority treatment areas and appropriate techniques to protect riparian and soil resources.

Key Question 3.2 What soil erosion processes are occurring in the analysis area? What is the soils' sensitivity to erosion?

Outcome 3.2 Identification of predominant soil erosion areas and delineation of priority treatment areas and appropriate techniques to protect riparian and soil resources.

Key Question 3.3 What is the current level of Cumulative Watershed Effects? Are there any subwatersheds that area at or near threshold of concern?

Outcome 3.3 Identification of subwatersheds where management actions may be modified to protect watershed function or where restoration actions are needed.

Issue #4: Aquatic Systems and Species

Key Question 4.1 What is the relative abundance and distribution of anadromous fishes in the watershed? What is the condition of aquatic habitat in the watershed?

Outcome 4.1 Identification of locally important aquatic habitats, priority treatment areas and appropriate techniques to protect and/or improve aquatic habitat.

Issue #5: Terrestrial Wildlife Habitat and Species

Key Question 5.1 What is the amount and condition of Late Successional Old Growth (LSOG) habitat within these watersheds?

Outcome 5.1 Identification of the amount and quality of LSOG habitat within these watersheds. Identify priority treatment areas (if any) and appropriate techniques to protect and/or improve LSOG habitat.

Issue #6: Fire, Fuels, and Air Quality

Key Question 6.1 What is the degree of threat from wildfires to local communities? How can the Fire Safe Council recommendations be implemented to reduce the treat of wildfires to local communities?

Outcome 6.1 Determination of the level of threat to local communities and identification of projects to reduce the threat. Identification of fuels management projects that would reduce the threat of wildfires to local communities.

Key Question 6.2 What is the present fire regime for the watershed? What is the recent historical pattern in fires causes within the watershed? What are the fuel hazards and risks within the watershed?

Outcome 6.2 Determination of the level of threat to the watershed and identification of projects to reduce the threat.

Issue #7: Plant Communities

Key Question 7.1 What are the distribution and abundance of unique plant species, communities and habitats?

Outcome 7.1 Identification of unique plant populations and plant communities for planning and protection.

Key Question 7.2 What are the abundance and the distribution patterns of invasive weeds?

Outcome 7.2 Determine invasive weed treatment priorities.

CHAPTER 3 - CURRENT CONDITIONS

This chapter describes the current conditions of the various physical, biological, and human ecosystem elements in the Burnt Ranch and Soldier Creek planning watersheds relevant the issues and key questions identified in Chapter 2. The information provided here will provide a more detailed analysis of the watersheds than did the characterization in Chapter 1.

Issue #1: Human Uses, Values, and Expectations

Recreation

Recreational use of the planning watersheds is concentrated along the Trinity River. Several Developed sites are located within the planning watersheds, as identified in Table 3.

Table 3. Developed sites within the Burnt Ranch and Soldier Creek Planning Watersheds

Site	Units	Other Amenities	Season	Fee Required?
Burnt Ranch Campground	16	Water Vault toilets	All Year	Yes
Big Bar Campground	3	Vault toilets	All Year	No

Several developed sites north of the river are located immediately adjacent to the planning watersheds and support recreation use along the Trinity River.

There is one Forest Service system trail in the planning watershed, and that trail provides access from Burn Ranch Campground to the Trinity River. There is a well used dispersed recreation area adjacent to Big Lake that has some litter and sanitation issues.

Wood Products

Timber Harvest

The Burnt Ranch and Soldier Creek planning watersheds are dominated by mixed conifer timber stands, primarily consisting of Douglas fir. Current timber harvesting opportunities that would contribute to ecosystem management objectives are available on Forest Service land, as displayed on the following table.

Table 4. Current timber-producing National Forest land (excluding Administratively Withdrawn Areas)

Conifer dominated stands	Roaded Recreation Emphasis	Late Successional Reserve (LSR)	Commercial Wood Products Emphasis	Wildlife Management Emphasis	Total Acreage Available
Young conifer plantation or seedling	26 ac.	1,203 ac.	264 ac.	13 ac.	1,506 ac.
Pole-size conifer	778 ac.	5,729 ac.	833 ac.	601 ac.	7,941 ac.
Early or mid-mature conifer	1,281 ac.	11,205 ac.	1,456 ac.	1,547 ac.	15,489 ac.
Mature or old growth conifer	2,212 ac.	22,827 ac.	2,453 ac.	2,724 ac.	30,216 ac.
Total	4,297 ac.	40,964 ac.	5,006 ac.	4,885 ac.	55,152 ac.

Table 4 displays the acreages of National Forest conifer stands existing within the Burnt Ranch and Soldier Creek planning watersheds. The 5,006 acres of Commercial Wood Products Emphasis lands are generally available for harvesting with consideration to other resource constraints. The 40,964 acres of LSR may be harvested to a limited degree where harvesting is expected to enhance desired old growth conditions and/or habitat protection. The 4,885 acres of wildlife management and 4,297 acres of roaded recreation emphasis areas are available for timber harvesting providing consistency with LRMP ecosystem management objectives.

The 1,506 acres of young conifer plantations and seedlings are the result of previous timber harvest activities, which included regeneration harvests followed by planting Douglas-fir and ponderosa seedlings in the clearcut units. These plantations are densely stocked with conifers, averaging over 250 trees/acre. In addition, brush species and grasses have occupied the spaces between the plantation trees resulting in reduced conifer growth due to competition for water and other soil nutrients.

The 7,941 acres of pole-sized conifer stands include both older plantations and natural stands. Generally, these pole-sized stands are very dense, with an estimated 80% of these stands having crown closures of over 70%. Timber production on these stands is reduced due to inter-tree competition.

The early or mid-mature conifer component occupies about 28% (15,489 acres) of the available National Forest timberland within the Soldier/Burnt Ranch watershed. Similar to

the pole-sized stands in that the densities are generally high, about 50% of these stands have crown closures of over 70%. Likewise, timber production is reduced due to inter-tree competition; but unlike the pole-sized stands, these early or mid-mature stands are currently available for timber harvesting opportunities due to the larger (over 12" dbh) size of the individual trees.

Mature or old growth conifers comprise the dominant vegetative type represented within the Soldier/Burnt Ranch watersheds, comprising about 55% of the timbered acreage. These older stands are currently suitable for timber harvest opportunities, but may not be available for timber harvesting due to ecosystem management objectives of other resources.

Table 5. Current timber-producing National Forest land that suffered >50% mortality in the 2008 wildfires

Conifer dominated stands	Roaded Recreation Emphasis	Late Successional Reserve (LSR)	Commercial Wood Products Emphasis	Wildlife Management Emphasis	Total Acreage Available
Young conifer plantation or seedling	26 ac.	132 ac.	15ac.	3 ac.	176 ac.
Pole-size conifer	74 ac.	349 ac.	10 ac.	38 ac.	471 ac.
Early or mid-mature conifer	152 ac.	348 ac.	19 ac.	85 ac.	604 ac.
Mature or old growth conifer	131 ac.	892 ac.	14 ac.	166 ac.	1203 ac.
Total	383 ac.	1721 ac.	58 ac.	292 ac.	2454 ac.

Table 5 displays the acreages of National Forest conifer stands needing to be reforested due to wildfire-caused mortality from the 2008 wildfires within the Soldier/Burnt Ranch Watersheds. The 2,454 acres of timber-producing lands are likely available for harvesting with consideration to consistency with LRMP ecosystem management objectives.

Fuel wood

The Soldier/Burnt Ranch watersheds are adjacent to the communities of Junction City, Big Bar, and Del Loma and have traditionally been heavily used by woodcutters as a prime fuel wood collecting area where road system access and topography allows. Since the area is dominated by mixed conifer timber stands, woodcutters use the existing road system to access dead and down trees whenever the roads are open for travel. In addition, numerous "user-created" roads have been pioneered to access fuel wood since demand for fuel wood apparently exceeds the supply available on the existing road system.

Much of the 55,000 acres of the available conifer forest land is unroaded; however, the strips of land bordering the roads offer reasonable fuel wood gathering opportunities.

Cultural Resources

Heritage Management over the last twenty-five years has focused primarily within areas where land management activities have occurred. Most of the archaeological work has been undertaken to meet section 106 requirements for timber sales, road construction, and special use permit projects. Consequently, only portions of the watershed have been surveyed for archaeological properties.

This watershed boundary contains seventy-one recorded properties with assigned site numbers. Forty-seven of the sites are historic, twenty are prehistoric, and four have a multi-component. Twenty-three of these sites have been evaluated for inclusion to the National Register of Historic Places. Three sites have been determined "Eligible", fifteen sites were determined "Not Eligible", and five sites were "indeterminate". The remaining forty-eight sites have not been evaluated.

Issue #2: Access and Travel Management

Access

This watershed boundary contains two forest primary routes (14.5 miles), eleven forest collector routes (81.7 miles) and many local system roads. The main use of the transportation system within the watershed boundary is for access to rural communities, private property and historic homestead sites.

Rocks and debris falling or rolling onto the road surface are a common occurrence that has been exacerbated by the 2008 wildfires. Maintenance needs are expected to increase over the foreseeable future (10 years) due to fire effects.

The majority of designated forest highway primary system surface within this watershed has been upgraded to a bituminous surface treatment. Along these routes deferred maintenance such as: potholes, surface faults and raveling have developed. These surface treatments were applied in the 1990's and are approaching the end of their design period (20 years).

The secondary collector system has also developed a large deferred maintenance log. The individual networks that have developed outside of seasonal closure by management decisions are in need of surface hardening or spot replacement to maintain these assets in acceptable condition to meet their road management objective and comply with the forest Land and Resource Management Plan.

Issue #3: Erosional Processes

Geology

Bedrock Geology

The Burnt Ranch-Soldier Creek watershed analysis area lies within seven distinct geologic formations of the Klamath Mountain geomorphic province.

From west to east these are: The Galice formation, the Rattlesnake Creek terrane, the Ironside Mountain Batholith, the Hayfork terrane, the Northfork terrane, the Salmon Schist and the Abrams Schist.

The Galice formation is composed of interbedded semi-schist, slaty shale, graywacke, mudstone, and conglomerate showing various degrees of metamorphism. The formation in this area generally strikes northwest with dips ranging from zero to eighty degrees. Strata dipping out of the slope are prone to sliding.

Rattlesnake Creek Terrane

The Rattlesnake Creek terrane consists of serpentinized ultramafic rocks, gabbro, diabase, diorite, bedded chert, volcanic flows and volcaniclastics, phyllite, limestone, sandstone, and pebble conglomerate. The strata are considerably disarrayed by folding, faulting, and shearing and subsequent slope failures (Irwin, 1972). As a consequence this geologic formation presents the highest mass wasting activity for the area.

The characteristic occurrence of these varied rock types is that of blocks ranging in size from a few acres to hundreds of acres. These blocks are separated by a matrix of highly sheared serpentine-rich fault gauge. The prevailing character is that of a melange.

When mapping within melanges, a scheme is applied which identifies the boundaries of the large blocks, and also the boundary of the highly sheared melange zones containing only small blocks of lesser size. A block larger than 200 acres is considered a large block.

The following section deals with specific rock types within the Rattlesnake Creek terrane as mapped within the project area.

Metasediments: The most common metasediment is fine-grained phyllite. Phyllites are interbedded with competent sandstones which have been strongly recrystallized. These sandstone bodies are resistant to weathering and mass wasting and stand out as prominent knobs along ridgetops and within the small block melange zones. The least abundant of the metasediments are conglomerates. Pebble conglomerates are generally associated with the sandstones and are similar in character. They are also competent and resistant to weathering and mass wasting.

Limestone blocks occur sporadically throughout the Rattlesnake Creek terrane. These can range in size from a few meters across up to large blocks that may reach hundreds of

meters. Several large blocks occur as inclusions within interbedded chert, argillite and tuff that likewise occur as tectonic fragments within melange.

Metavolcanics: Both small and large blocks of metavolcanic rocks are found throughout the terrane. Prominent rock types include basaltic breccia, basaltic flows, pillow basalts, and both coarse and fine grained tuffaceous sediments. The character of these rocks varies considerably throughout the terrane in their distribution, association, and grain size. This group of rocks is generally quite massive in expression and resistant to weathering.

Small Block Melange: Areas underlain by small block melange are quite distinctive. Due to the contrast in properties between the sheared matrix and the resistant blocks there is a distinct lack of structural and geomorphic coherence. Drainage networks developed within these areas are poorly organized and highly variable in characteristics such as gradient, width, ordering and density. The terrain has a very "flowing" character, resembling an earthflow with solid resistant blocks sticking up through it. Only one type of small block melange has been delineated within the project area, serpentine melange.

Serpentine melange is characterized as being composed of small blocks of all the previously discussed rock types bounded by large areas of serpentine-rich matrix. This zone generally lacks competency although some of the more resistant bedrock blocks stand out as "knockers". Lithologic variability can be very large within this unit changing on an acre by acre basis.

The unsheared masses of coherent rock embedded within the melange matrix may have high to very high strength characteristics, although they may rarely show evidence of continuity between outcrops. The intensely sheared melange matrix that encloses the coherent rock masses is inherently weak and is moderately erodible. Additionally this matrix commonly weathers to clay-rich, highly expansive soils; soils that swell when wet and shrink when dry. These soils creep downslope as a result of the swelling and shrinking process and low shear strength, and thus contribute to the occurrence of landslides.

The matrix, being the weakest component, controls the overall stability of the slopes underlain by the melange. The sharp differences in inherent strength characteristics of various components of the melange result in irregular topography and highly diverse slope stability characteristics.

The Ironside Mountain Batholith is a large elongate intrusive body immediately to the east of the Rattlesnake Creek terrane. Typically these rocks are composed of hornblende-biotite-pyroxene diorites and syenodiorites.

Hayfork Terrane

Immediately east is the Hayfork terrane which forms a significant portion of the project area. Irwin (1972) divided the Hayfork terrane into three units, *all of which can be found*

within the project area. These are from bottom to the top: (1) the Hayfork Bally Meta-andesite, (2) the middle Hayfork unit and (3) the upper Hayfork unit.

The Hayfork Bally Meta-andesite is composed chiefly of volcaniclastic rocks, with subordinate lava flows and chert. Basaltic lithic fragments tend to be as common as andesitic however. The middle Hayfork unit is gradational with the underlying meta-andesite and consists primarily of slaty argillite, sandstone, pebble conglomerate, thinly bedded chert, tuff, mafic volcanic rocks and minor limestone. According to Irwin the upper Hayfork unit compositionally resembles the middle Hayfork unit, and they are probably gradational.

Wright working after Irwin (1981) instead simply divided the area into two sub-terranes, separated from one another by a major thrust fault. He named these the western and eastern Hayfork terranes. As he defined these, the western Hayfork terrane consists of the Hayfork Bally Meta-andesite and at least in part the middle Hayfork unit of Irwin. The eastern Hayfork terrane consists of an extensive chert-argillite, mafic volcanic and quartzose sandstone *melange* and *broken* formation that is in thrust contact with the western Hayfork terrane, and is at least correlative to the upper Hayfork unit of Irwin.

The western Hayfork terrane was further subdivided by Wright into four distinct lithologic units: (1) a lower volcaniclastic unit (2) a mixed volcaniclastic and black slaty argillite unit (3) an upper volcaniclastic unit (4) a mixed volcaniclastic and epiclastic unit (tuff, argillite, conglomerate, chert and quartzose sandstone). The first three divisions correspond to the Hayfork Bally Meta-Andesite of Irwin. The fourth unit is at least *in part* correlative with the middle Hayfork terrane of Irwin.

In summary, the western Hayfork terrane is composed of a structurally coherent sequence of predominantly metavolcaniclastic rocks. This terrane may be considered to be stratigraphically equivalent to a formation, and the four lithologic units mapped within the terrane may be considered as the stratigraphic equivalents of members. The eastern Hayfork terrane is a melange and broken formation and is therefore a tectono-stratigraphic unit.

The Northfork terrane has been named after the North Fork of the Trinity River, which flows through much of this terrane in the Helena Quadrangle. Regionally, the terrane is composed of serpentinite, gabbro, and diabase to the west, succeeded to the east by pillow-lavas, greenstone, mafic volcaniclastic rocks, thin-bedded chert, limestone lenses, chert-limestone breccia, phyllite, and sandstone. The lithic assemblage is dominantly that of an ophiolite suite.

The Northfork terrane encompasses most of the Soldier watershed and consists mainly of metamorphosed sandstones. Structural character ranges from massive to highly jointed. Relict bedding is sometimes apparent within these rocks.

The Abrams mica Schist is predominantly metasedimentary rock and includes quartz-mica schist, micaceous marble and minor amphibolite.

The rocks of the Salmon Hornblende Schist are commonly fine to medium-grained, well-foliated hornblende-epidote-albite schist, with a moderately good lineation developed by the parallel orientation of hornblende prisms. It was formed from mafic volcanic rocks. The plunge of the foliation is to the east.

Geomorphology/Mass Wasting Processes

A combination of many factors has led to the development of mass wasting features which cover about 75% of the project area. Key factors include rapid uplift rate which contributes to stream channel downcutting, the nature of both the bedrock and derived soils and the seismic history of the area. ***The vast majority of the mapped features within the project area are presently ancient or dormant in character.***

The principle mass wasting processes within the project area are debris slides, debris avalanches, translational-rotational landslides, internested translational-rotational landslides, slump earthflows, valley inner gorges, headwall basins, colluvial hillslopes and stream terraceses.

Debris slides (1070) are usually concave, spoon-shaped areas formed by past sliding. This type of landslide is generally confined to the shallow soil or colluvium zone and is usually no more than a few feet deep. There can be a gradation from debris avalanche to debris slide to debris flow depending upon the water content, cohesion of material and slope steepness. Movement rates along this gradation range from rapid to slow. Failures frequently occur within low-order stream reaches or adjacent to higher-order stream channels due to channel side and downcutting.

Rotational/translational slides (1076/1078) are characterized by movement of a coherent, deep-seated mass over a discrete, concave or planar failure surface. Most *active* slides occur in association with at least one of the following: serpentinized shear zones, faults, lithologic contacts or wet steep zones such as inner gorges (the latter is often associated with active slides). The greatest danger for precipitating further sliding exists where surface or groundwater is associated with at least one of these factors.

Internested translational-rotational slides (1250) areas are commonly found in areas overlain by cohesive soils. They generally consist of individual slides having volumes ranging from 1,000 to 50,000 cubic yards which occur side by side, above, below and on top of one another over a broad area. Creep indicators such as "pistol butted" and "jackstrawed" trees are commonplace.

Bedrock and structural properties such as downslope oriented bedding or foliation, shear and fault zones or melange areas are often responsible for the occurrence of widespread internested areas.

Slump earthflows (1230/1231A/1232/1232A/1234A/1235) are relatively slow moving masses of clay-rich materials. These failures are complex, involving many components of different types of mass movement. In general, earthflow movement occurs during the winter and spring where under fully saturated conditions, pore water pressures are elevated

and intergranular resistance is reduced. High clay content increases the cohesiveness of the material. Failure planes are generally shallow, that is less than 50 feet, and movement rates can range from gradual or creep to brief, periodic pulses of rapid movement.

Sediment is usually transferred to the fluvial system near the distal end of the earthflow where channels have developed. Channel stability in the form of bank failure, active headcuts, and lateral gullies is common at the distal portion of most earthflows. Earthflow movement rates are sometimes rapid enough to cause channel abandonment and migration on an annual basis**.**

Valley inner gorges (1260) are defined as those slopes adjacent to channel margins having gradients in excess of sixty-five percent. The valley inner gorge is formed through mass wasting triggered by channel downcutting, oversteepening and undercutting. Valley inner gorges occur throughout the project area.

Headwall basins (1255) are steep (>65%) amphitheater-shaped areas that typically extend to ridges at the heads of incised tributaries and are formed by prolonged shallow mass wasting.

Colluvial hillslopes (1152) are a general term for areas predominated by colluviation as a geomorphic process. These areas can be further subdivided into colluvial apron, colluvial trough, and colluvial shoulder. These areas are widespread throughout and by area form the largest unit within the mapped study area.

Stream terrace deposits (135) have been mapped along the Trinity River. These are composed of sediments typically stratified sand, gravel, cobbles, boulders, deposited by the river without distinction between active process zones and higher less active zones.

Soil Resources

Soils within these watershed areas (see Tables 6, 7 & Figure 4 for soil information) have predominantly formed in metasediments, metavolcanics, granitics, and peridotites on mountain sideslopes. Soils formed in metasediments and metavolcanics are generally shallow (less than 20 inches) to moderately deep (20 to 40 inches) loams to gravelly and very gravelly clay loams (Deadwood, Goulding, Marpa, and Neuns soils). Soils formed in granitics (Chaix and Chawanakee series) are located on very steep, mountain sideslopes (60 to 80% slopes) that are shallow to moderately deep gravelly coarse sandy loams. Figure 4 (see below) shows the majority of granitic soils (Chaix and Chawanakee series) are located in the Cedar Flat Creek area of the Burnt Ranch watershed.

Soils formed in nonmarine sediments are deep to very deep (greater than 60 inches) loams and gravelly clay loams (Soulajule). The majority of peridotite soils (Beaughton, Dubakella, and Weitchpec series) are located on mountain sideslopes and dormant landslides above Burnt Ranch and Big Lake area within the Burnt Ranch watershed. These soils are shallow to moderately deep gravelly loam to very gravelly clay loams influenced by serpentines. These areas have numerous dormant landslides and sag ponds.

Areas that are old stable dormant landslides in metavolcanic and metasedimentary rock on slopes less than 40% tend to have more weathered soils that are fine textured, high available water, and are deep productive soils (Hohmann, Holland, and Hugo series). Steep mountain slopes in these metamorphic rocks are moderately deep to deep gravelly loams on forested north and east facing slopes and shallow to moderately deep gravelly loams on brushy south and west facing slopes.

Table 6 shows the physical properties for the major soils in the Burnt Ranch/Soldier Creek watersheds. Soils with the best available water holding capacity (AWC) are Hugo and Holland series and ones with the least are Deadwood and Goulding. Soils with the greatest runoff potential are Beaughton, Deadwood, Etsel, and Goulding series. Table 7 lists the major soil ratings for soils within the Burnt Ranch/Soldier Creek watersheds. This table lists the major soils map units, depth, drainage, and total AWC for the profile. It also lists the major soil ratings for fertility, burn damage, compaction, and erosion.

Figure 4. Soil Map Units within Burnt Ranch and Soldier Creek Watersheds

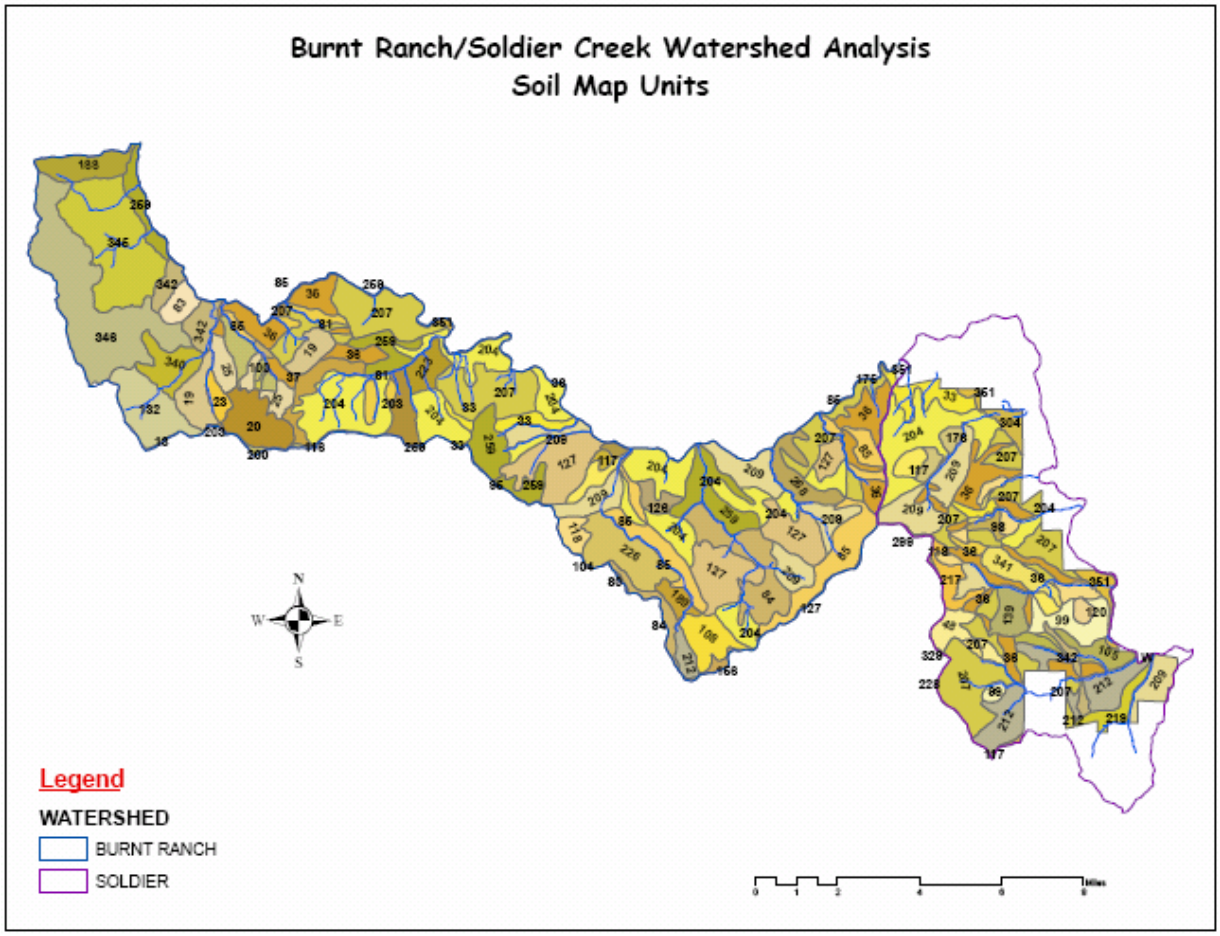


Table 6. Major Soil Physical Properties

Series	AWC (in/in)	Drain	Rock %	Runoff	Particle Size Dis. Topsoil			Perm. (in/hr)	K-Sat (in/h)	Hydro Group
					C	Si	S			
Beaughton	.12-.14	**MW**	**30-60**	**High**	**-**	**-**	**-**	**.2-.6**	**3-9**	**D**
Chaix	.10-.12	**W**	**15-35**	Moderate	**-**	**-**	**-**	.6-2	9-33	C
Deadwood	**.07-.09**	**W**	**50-85**	High	**-**	**-**	**-**	**2-6**	**33-99**	**D**
Dubakella	.12-.14	**W**	**30-60**	Moderate	**-**	**-**	**-**	.6-2	9-33	C
Goulding	**.07-.09**	**W**	**30-60**	High	**-**	**-**	**-**	**2-6**	**33-99**	**D**
Holland	**.13-.15**	**MW**	**15-35**	Moderate	**11**	**27**	**62**	**.6-2**	9-33	**B**
Hugo	**.14-.16**	**W**	**10-25**	Moderate	**5**	**25**	**70**	**.6-2**	9-33	**B**
Marpa	**.12-.14**	**W**	**25-50**	**Moderate**	**13**	**63**	**24**	**.6-2**	9-33	**B**
Neuns	**.09-.11**	**W**	**40-65**	Moderate	**17**	**31**	**48**	**2-6**	**33-99**	**C**
Weitchpec	.12-.14	**W**	**40-55**	Moderate	**-**	**-**	**-**	.6-2	9-33	B

Table 7. Major Soils Information:

Soil Series	Map Units	Depth	Rock Type	Surface Texture	AWC (in)	Fertility Rating	Burn Damage	*Compaction Rating*	Erosion Hazard (bare soil)
Atter	8	VD	AL	csl	1-3	mod-low	low	low	low
Beaughton	13	S	S	vgl	1-2	v-low	moderate	moderate	moderate
Chaix	19, 20	MD	G	sl	2-3	moderate	high	low	very high
Chawnakee	23, 25	S	G	sl	1-2	low	high	low	very high
Deadwood	32, 33, 35, 36, 37	S	MS	gl	1-2	mod-low	moderate	low	moderate
Dubakella	44, 48	MD	P	gcl	2-4	moderate	moderate	moderate	moderate
Etsel	61, 62	S	MV	vgl	1-2	v-low	moderate	low	high
Goulding	80, 81, 83, 84, 85, 259	S	MV	gsl	1-2	low	moderate	low	moderate
Hohmann	95	D	MS	l	3-5	moderate	moderate	high	high
Holland	98-100, 104 -108, 116-120, 126-7	D	MS	gl	3-4	good	low	high	high
Hugo	131-2, 139-40	D	MS	l	4-7	good	low	high	high
Jayar	156	MD	MV	gsl	2-4	moderate	high	low	high
Marpa	175-6, 182,188-9	MD	MV	gl	2-5	moderate	moderate	moderate	moderate
Neuns	203-207, 209, 212, 217-219	MD	MV	vgl	2-5	moderate	moderate	low	moderate
Skymor	299	S	G	sl	1-2	low	high	low	high
Soulajule	304	D	NS	csicl	3-5	mod-low	low	moderate	moderate
Xerofluvents	329, 351	VD	AL	vgs	-	mod-low	high	low	low
Weitchpec	340-42, 345-46	MD	P	gl	2-4	moderate	moderate	moderate	moderate

Depth Classes:	**Parent Material**	**Soil Texture:**	**Compaction:**	**Erosion Hazard:**
S = shallow (10-20”) MD = mod deep (20-40”) D = deep (40-60”) VD = very deep (>60”)	MS = metasediments MV = metavolcanics NS = nonmarine seds G = granitic AL = alluvium S = serpentine P = peridotite	l = loam gl = gravelly loam vg = very gravelly s = sandy c = cobbly sicl = silty clay loam sl = sandy loam	Low = beneficial Mod = slight harm High = mod harm Severe = harmful	low (<4) moderate (4 -12) high (13-29) very high (>29)

Soil Resource Conditions

Resource conditions will be evaluated for the Burnt Ranch and Soldier Creek watersheds within the lower Trinity River. Soil erosion, compaction, and fertility will be evaluated focusing on the most to the least limited areas using Tables 6and 7 above.

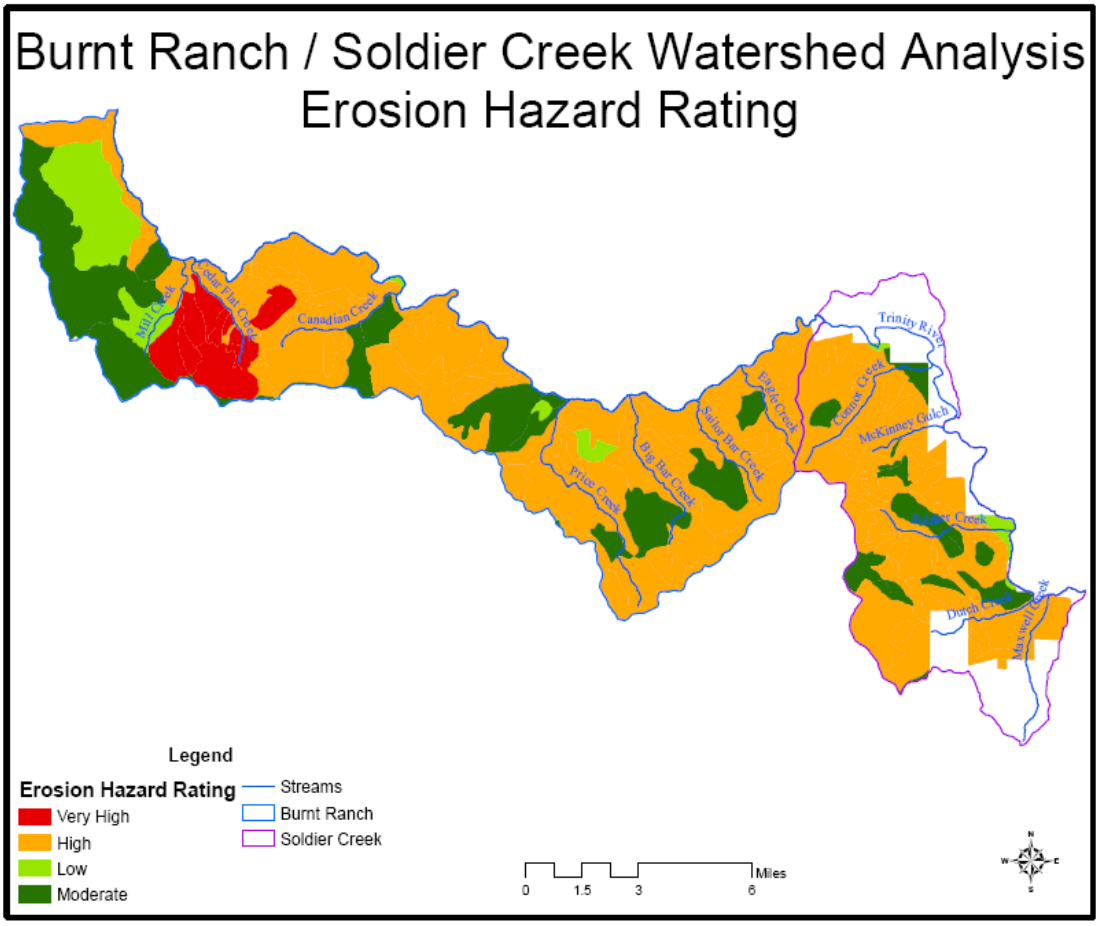
Soil Cover/Erosion

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 (R-5 FSH 2505.22). Many interrelated factors are evaluated in an EHR system to determine whether land use activities would 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 low ratings meaning low probability of surface erosion occurring. 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 degree of vegetative management.

Analysis shows that most of the soil erosion levels are moderate to high on bare mineral soil depending on slope and parent material (see Tables 6 & 7: Major Soils Information and Figure 5: Soil Erosion Hazard Map for Burnt Ranch/Soldier Creek Watersheds). Low erosion hazard ratings insure soil erosion will not exceed the rate of soil formation and high to very high erosion hazard ratings indicate that soil erosion will exceed the rate of soil formation and site productivity will degrade. Most soils in forested conditions have soil cover in excess of 90% across the landscape greater than 2 inches thick insuring erosion hazards in natural conditions are low to low moderates. It is the goal of the regional Soil Quality Standards (USFS, 1995b) to maintain soil cover to keep erosion levels low.

The soil erosion map below shows areas in red that have high to very high erosion potentials (on bare mineral soil) that have granitic parent material and are very steep. On a sub-watershed basis Cedar Flat Creek areas have the greatest potential for erosion. This is due to very steep shallow sandy granitic soils of Chaix and Chawnakee series (see Table x and Figure x areas in red). Soils with the least potential to erode are on flatter (less than 40% slopes) old stable dormant landslides with deep loams of Hohmann, Holland, and Hugo (see Table 7 and Figure 5 areas in dark green).

Figure 5. Soil Erosion Map for the Burnt Ranch/Soldier Creek areas



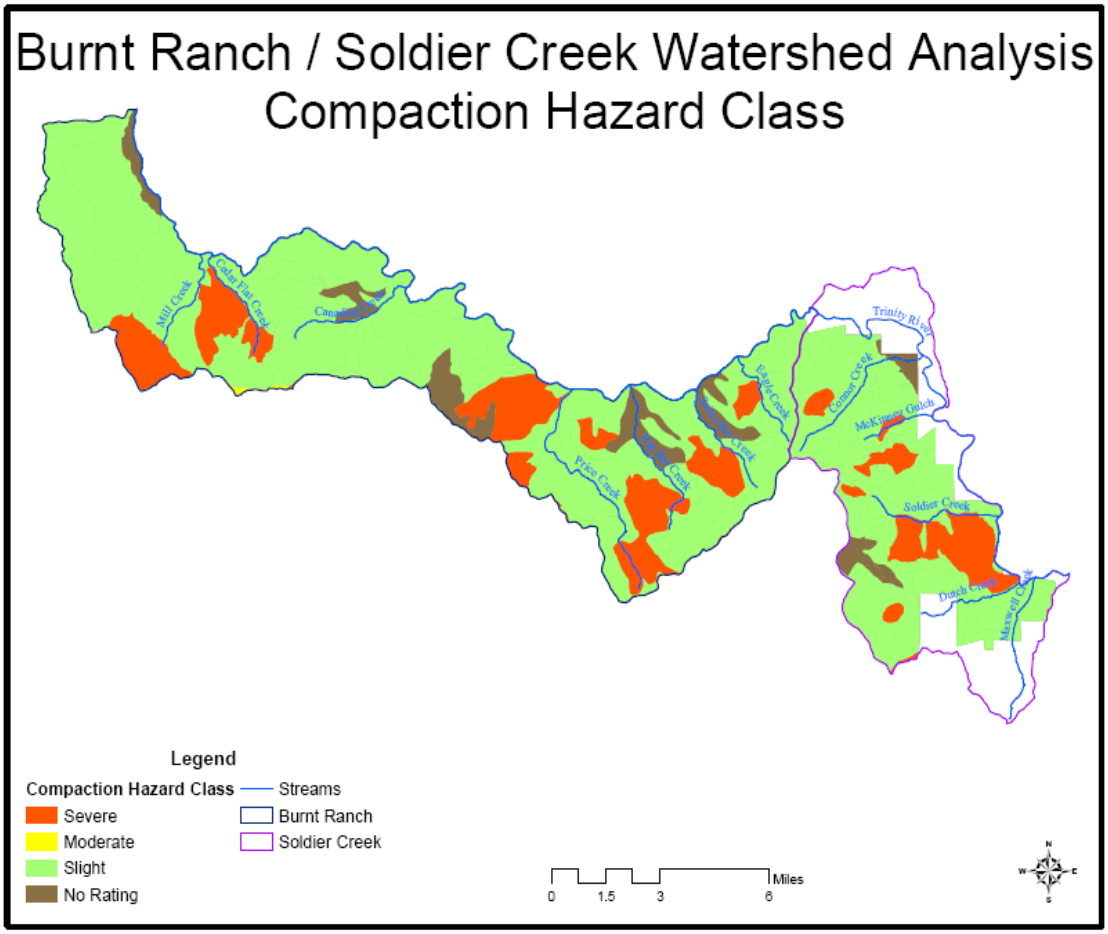
Soil Compaction/Porosity

Compaction reduces infiltration, increases runoff, which increases erosion hazard ratings and decreases down site water quality. Compaction decreases porosity, which decreases tree root elongation during critical growing period thus stressing the tree and decreasing timber site indexes. With stressed trees the stand becomes more likely to develop disease and insect attacks. To deal with the problems of compaction, scientists from the forest service and Pacific Southwest Experimental Station developed a compaction rating criteria and 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 below shows areas in red that have high to very high compaction hazards due to fine textured soils with high clay contents. These soils (Hohmann, Holland, and Hugo series) occur on flat old stable dormant landslides in metamorphic parent material areas throughout Burnt Ranch and Soldier Creek watersheds

(see Table 7 and Figure 6 areas in red). The rest of soils have low compaction hazard due to steep rocky or sandy soil conditions (see Tables 6 & 7 and Figure 6 areas in green).

Figure 6. Soil Compaction Hazard Map for Burnt Ranch/Soldier Creek areas



Soil Fertility/Large Woody Debris

Soil fertility evaluation is based on parent material and weathering age. Depending on age and leaching some soils are more fertile for timber production (see below Figure 7: Soil Fertility Map for Burnt Ranch and Soldier Creek Watersheds). The soil fertility map below shows that the areas in green have the best soil fertility and areas in orange and red with the least.

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 in 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.

Areas with the highest soil fertility are the fine textured soils located on slopes less than 40% on old dormant landslides. These soils are the Hohmann, Holland, Hugo and Marpa series with high soil fertility ratings due to good soil organic matter, deep loamy soils with

high available soil moisture holding capacity located throughout Burnt Ranch and Soldier Creek watersheds.

Figure 7. Fertility Map for Burnt Ranch/Soldier Creek areas

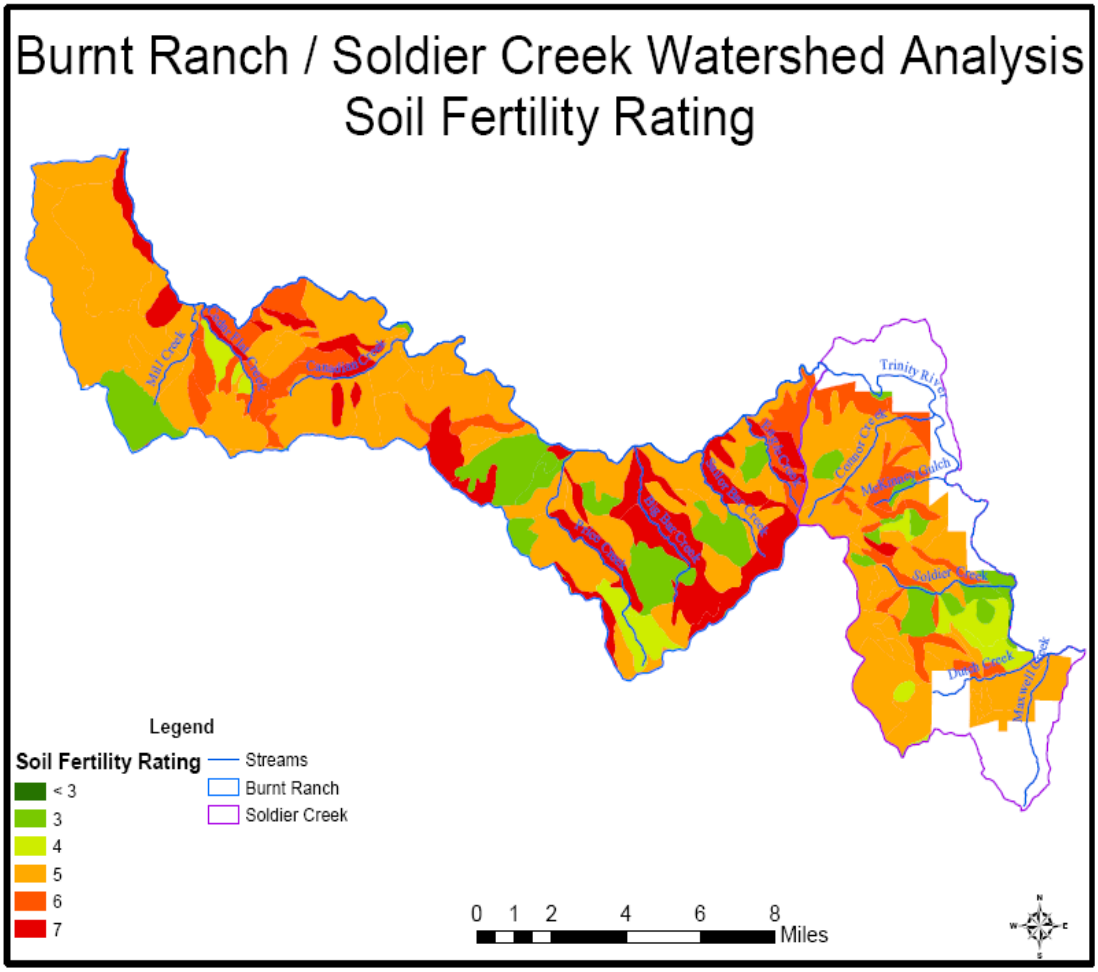
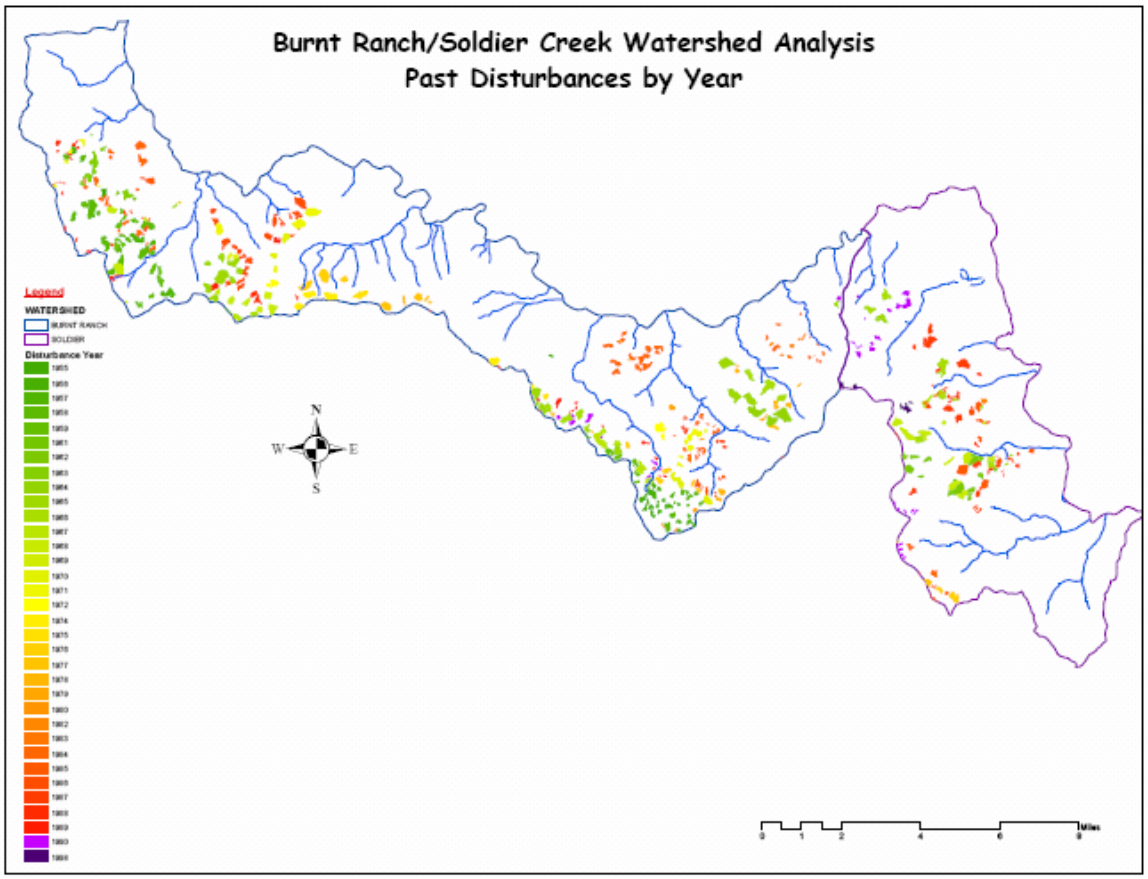


Table 7 shows Chaix, Chawnakee, Jayar, Skymor, and Xerofluvent soils have the greatest potential for burn damage from high soil burn severity. These high ratings are due to their sandy texture since most are in granitics and are located in the Cedar Flat Creek area.

Past Disturbances

Past disturbances are displayed below (see Figure 8) which show high use throughout each watershed of Burnt Ranch and Soldier Creek. Most recent past disturbances are located in the Soldier Creek watershed with activity in the 1990's.

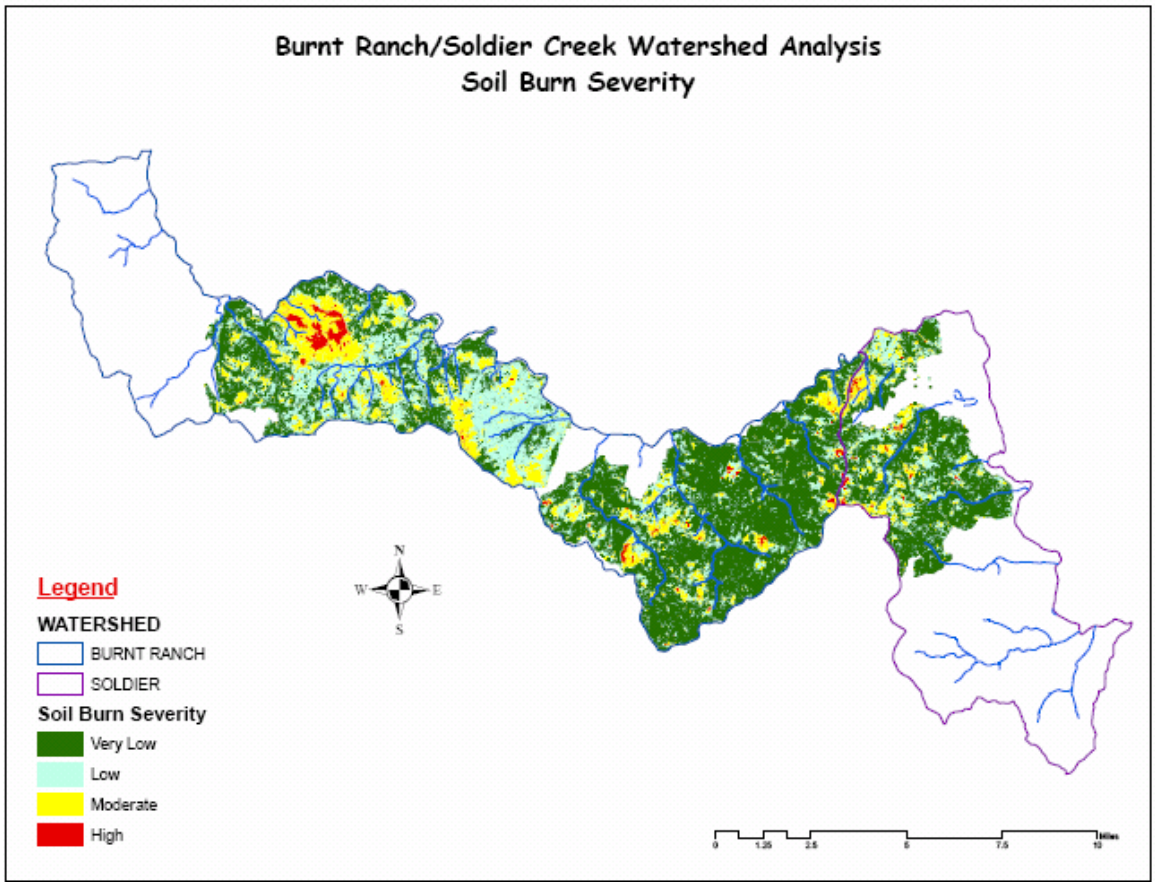
Figure 8. Past Disturbance Map for Burnt Ranch/Soldier Ck. Watersheds



On a cumulative basis both watersheds have had equal past disturbances of logging and fuel treatments from 1955 to 1998 (Figure x above). Areas before 1980 should be fully recovered from all past cumulative soil effects. Areas from 1980 to present varying levels of recovery could be expected with adequate vegetative cover in 3 to 5 years, soil fertility recovery in 5 to 10 years, and compaction recovery in 10 to 30 years depending on soil type and disturbance level.

When the Cedar and Eagle Fires (Rust, 2008) burned the Burnt Ranch and Soldier Creek watersheds, the watershed that suffered the greatest soil burn severity was the Cedar Fire area of Burnt Ranch watershed (see Figure 9 below). The Cedar Flat, Rowdy, and Stetson Creeks have the largest area and greatest concern for accelerated erosion due to the fire intensity in this area (see Figure 9 below). These areas are posed right above the main Trinity River so special care should be given to protect these sensitive soil resources.

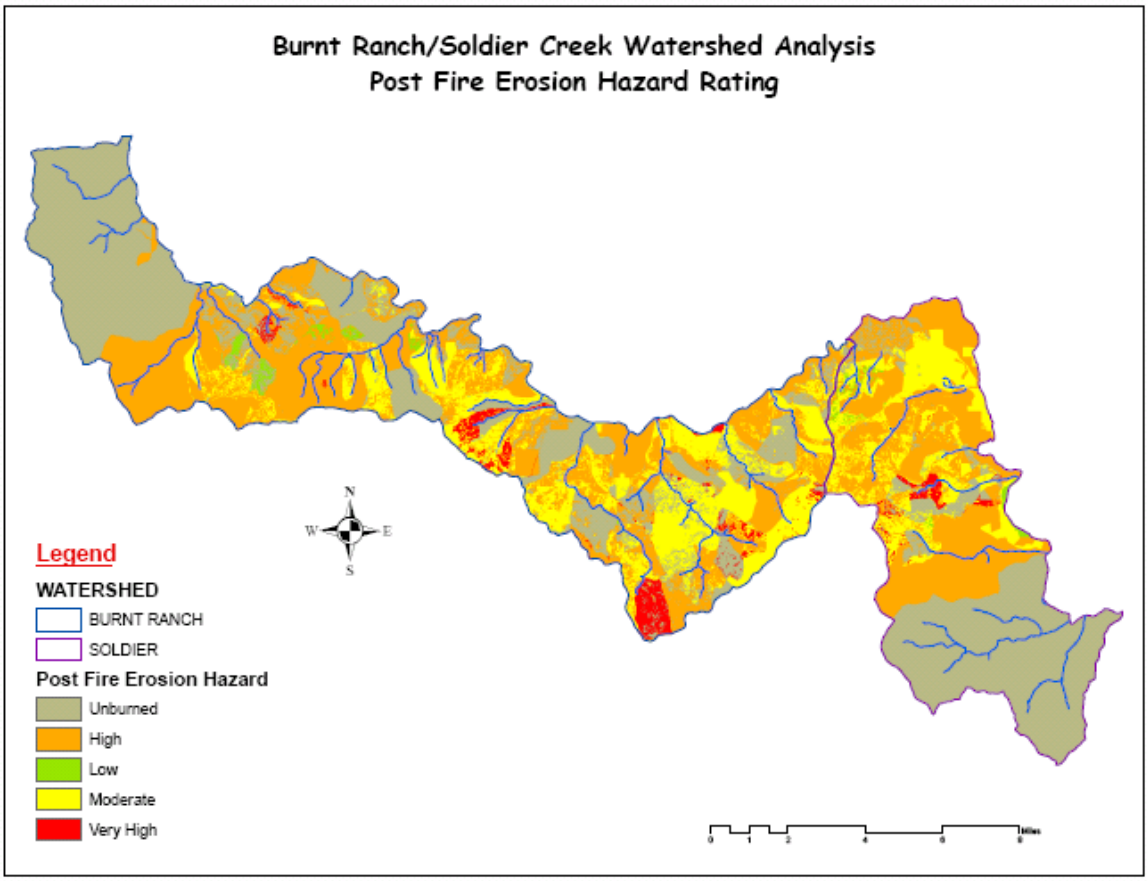
Figure 9. Soil Burn Severity within Burnt Ranch & Soldier Creek Watersheds



The area of Rowdy and Stetson Creeks were rated as high erosion hazard potential before the Cedar Fire are now rated as very high (severe) erosion hazard due to fire intensity in this area. The same holds true for the headwaters of Price and Pattison Creek. These areas were rated as high due to very steep shallow to moderately deep gravelly sandy loams. With these areas burning severely due to the Cedar and Eagle Fires much of the immediate soil cover was removed causing them to have very high erosion hazard ratings (see Figure x below).

The Rowdy and Stetson Creek area also had many soils that have the greatest potential for burn damage from high soil burn severity (see Table 7 and Figure 9 above). Figure 9 above shows this are burned the hottest and had the most soil destruction due to burn damage. The burned area emergency response (BAER) team assessed this area on the ground and found deep soil char, loose friable structure, and deep water repellency throughout. Overlay this with these areas of granitic soils this area was identified as a major priority for BAER emergency rehabilitation of helimulching (see Figure 10 below). Weed free rice straw was flown onto this area covering 400 acres of severely burned landscapes at a rate of 1.5 tons/acre to reduce anticipated erosion.

Figure 10. Post Fire Soil Erosion Hazard Burnt Ranch/Soldier Ck. Watersheds



Hydrology

Water Quality Management

The North Coast Regional Water Quality Control Board (NCRWQCB or "Regional Water Board") implements the federal Clean Water Act and the state Porter-Cologne Water Quality Control Act for waters in their area of jurisdiction. The Water Quality Control Plan (Basin Plan) for the North Coast Region (NCRWQCB, 2007) identifies beneficial uses and sets water quality objectives for waters within the Trinity River Hydrologic Unit. Beneficial uses identified for the two applicable Sub-areas include:

- **Municipal and Domestic Supply (MUN)** Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply. Many streams in the planning watersheds support domestic water supply, including Soldier Creek, Conner Creek, Deer Creek, McDonald Creek, and Price Creek. The State Water Resources Control Board Water Rights Division eWRIMS database lists over 90 active water rights within the planning watersheds, including a 16,600 acre foot per year diversion on Price Creek, a 1,500 acre foot per year diversion on Soldier Creek, and an 868 acre foot per year diversion on Bidden Creek . The Shasta-Trinity National Forest has 5 water right filings in the planning

watersheds. Although many of these diversions are on private land, several of them are on National Forest System lands.

- **Agricultural Supply (AGR**) Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing. Most of the domestic uses include small scale agricultural uses.
- **Industrial Service Supply (IND)** Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well repressurization. The Trinity River supports suction dredging for gold, and the Trinity River is frequently used as a water source for fire suppression.
- **Industrial Process Supply (PRO) (Potential)** Uses of water for industrial activities that depend primarily on water quality.
- **Groundwater Recharge (GWR)** Uses of water for natural or artificial recharge of groundwater for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers.
- **Freshwater Replenishment (FRSH)** Uses of water for natural or artificial maintenance of surface water quantity or quality (e.g., salinity).
- **Navigation (NAV)** Uses of water for shipping, travel, or other transportation by private, military or commercial vessels. The Trinity River is used for white water boating and drift boat fishing.
- **Hydropower Generation (POW)** Uses of water for hydropower generation. Cedar Flat Creek supports a small scale hydropower project operated under a FERC exemption and Forest Service Special Use Permit. The project diverts water from Mill Creek under a permitted appropriative water right that authorizes up to 7,200 acre feet per year of diversion, with required bypass flows for instream resources.
- **Water Contact Recreation (REC-1)** Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, skin and scuba diving, white-water activities, or fishing. The Trinity River is the primary recreational area within the planning watersheds, and the lower portions of tributaries adjacent to the river would also receive contact recreation.
- **Non-Contact Water Recreation (REC-2)** Uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, camping, boating, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.
- **Commercial and Sport Fishing (COMM)** Uses of water for commercial, recreational (sport) collection of fish, shellfish, or other aquatic organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes. The Trinity River is a popular fishing area.
- **Aquaculture (AQUA)** Uses of water for aquaculture or mariculture operations including, but not limited to, propagation, cultivation, maintenance, or harvesting of aquatic plants and animals for human consumption or bait purposes.

- **Cold Freshwater Habitat (COLD)** Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
- **Wildlife Habitat (WILD)** Uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.
- **Rare, Threatened, or Endangered Species (RARE)** Uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened or endangered.
- **Migration of Aquatic Organisms (MIGR)** Uses of water that support habitats necessary for migration or other temporary activities by aquatic organisms, such as anadromous fish.
- **Spawning, Reproduction, and/or Early Development (SPWN)** Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.
- **Shellfish Harvesting (SHELL) (Potential)** Uses of water that support habitats suitable for the collection of filter-feeding shellfish (e.g., clams, oysters, and mussels) for human consumption, commercial, or sports purposes.

The Regional Water Board also adopts water quality objectives necessary for the reasonable protection of the beneficial uses and for the prevention of nuisance in the Basin Plan that are applicable to activities on National Forest System lands. These objectives reflect the beneficial uses and are consistent with the state and federal anti-degradation policy. The Basin Plan lists narrative objectives for:

- suspended material;
- settleable material;
- oil and grease;
- sediment;
- turbidity;
- pH;
- temperature;
- toxicity; and
- chemical constituents.

Forest Service management activities must be in compliance with these objectives. The Forest Service is a Water Quality Management Agency pursuant to Section 208 of the Federal Clean Water Act. The Forest Service fulfills it's obligation as a Water Quality Management Agency by the proper installation, operation, and maintenance of state certified Best Management Practices. These practices are described in "Water Quality Management for National Forest System Lands in California, Best Management Practices" (USFS, 2000). These measures are incorporated during project level design, assessment and implementation.

Impaired Waters

The State of California and the Federal Environmental Protection Agency (EPA) have determined that the water quality standards for the Trinity River are exceeded due to excessive sediment. The EPA, in consultation with the Regional Water Board staff, established a Trinity River Total Maximum Daily Load (TMDL) for sediment pursuant to section 303(d) of the Clean Water Act. The purpose of the TMDL is to identify the total load of sediment that can 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.

The final TMDL allocations were issued by the EPA in 2001 (EPA, 2001). The analysis supporting the TMDL divided the Trinity River basin into several assessment areas, and allocated the total sediment load according to the characteristics identified in the analysis. The Burnt Ranch and Soldier planning watershed fall within the Lower Middle Assessment Area. EPA determined that setting a loading capacity of 125% of background could occur and still meet water quality objectives. Table 8 summarizes the loading capacity and allocations for the planning watershed area.

Table 8. TMDL and Allocations for the Lower Middle Assessment Area

Source Categories	Upper Tributaries	Middle Tributaries	Lower Tributaries
	Dutch, Soldier, Connor	Big Bar, Prairie, and Little French	Canadian, Cedar Flat, Hennessy
Current Total Sediment Delivery (tons/mi^2/yr)			
Total Sediment Delivery	403	291	311
Total Sediment as % of background	150%	139%	141%
Loading Capacity and Allocations			
TMDL	335	263	276
Background Allocation	268	210	221
Management Allocation	67	53	55
Percent Reduction in Management to attain TMDL	50%	35%	39%

Cumulative Watershed Effects (CWE)

The Forest Service evaluates Cumulative Watershed Effects (CWE) at various levels of planning to initiate mitigation measures to minimize the risk of significant adverse impacts on beneficial uses of water (R-5 FSH 2509.22, section 20.3). The Shasta Trinity National Forest CWE analysis process evaluates the potential impacts of land management on mass wasting, surface runoff, erosion, and stream channel response.

Watershed condition was documented in the Final Environmental Impact Statement (FEIS), Appendix H prepared for the Forest Plan (USFS, 1994). That analysis established Threshold of Concern (TOC) values for specific watersheds, and documented an assessment of watershed condition based on comparing the watershed disturbance level measured by the equivalent road acre (ERA) methodology (Haskins, 1983). The ERA methodology is an accounting tool that documents past actions and converts the disturbance levels to "road acres" for comparison and tracking. The ERA method can be used to evaluate and compare proposed future actions be predicting the added level of disturbance that would result from project implementation.

Watershed condition based on the level of ERA to the TOC is defined in the FEIS as:

Class 1
ERA is less than 40 percent of TOC (watershed condition is at or near potential)

Class 2
ERA is between 40 and 80 percent of TOC (watershed condition is between potential and a point near tolerance)

Class 3
ERA is greater than 80 percent of TOC (watershed condition is near or below tolerance)

The analysis completed for the LRMP evaluated the Burnt Ranch and Helena 5th order watersheds and established a TOC of 14% for the Burnt Ranch watershed and a TOC of 16% for the Helena watershed. At the time of the analysis both watersheds were listed as Condition Class 1, with ERA levels of 3.5% and 5.2% respectively.

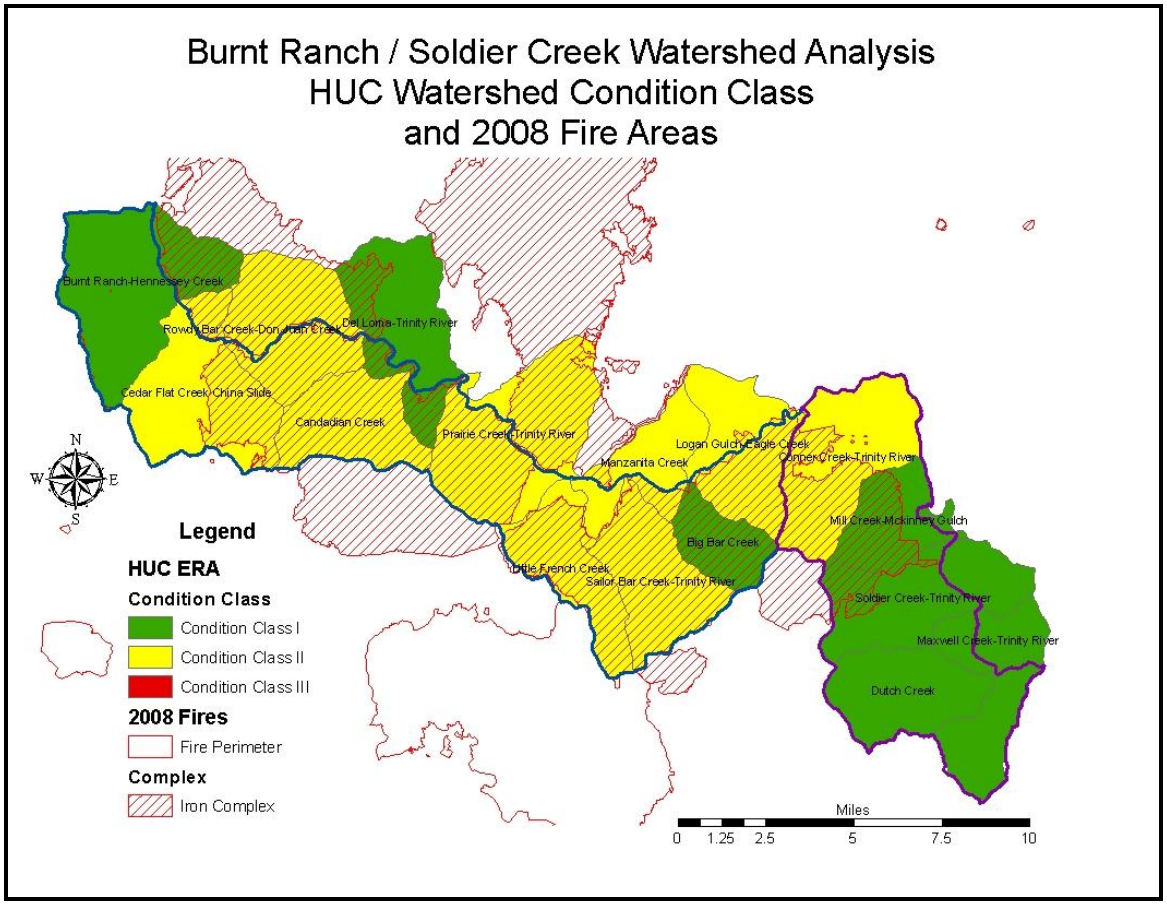
The Shasta-Trinity National Forest completed a more recent CWE analysis for 467 Hydrologic Unit Code (HUC) 7th field level watersheds located across the forest updated in November of 2008 to include the impact of the recent fires on watershed condition (Elder, 2008). The results are summarized in Table 9 with watershed boundaries and watershed condition class shown in Figure 11.

Table 9. HUC 7 ERA values after the 2008 fires.

HUC7 code 1/	Watershed Name (7th-field drainages)	Watershed Size (Acres)	TOC [%] 2/	Fire 3/	Harvest 3/	Roads 4/	Current 5/	% ERA 6/	Current risk ratio [%ERA / %TOC]
18010211110102	Big Bar Creek	8,362	14.0%	101.6	24.6	36.4	162.6	4.9%	0.35
18010211110502	Burnt Ranch-Hennessey Creek	8,062	14.0%	123.1	71.9	143.4	338.3	3.1%	0.22
18010211110401	Canadian Creek	10,775	14.0%	559.7	0.9	31.6	592.2	10.3%	0.74
18010211110501	Cedar Flat Creek China Slide	7,795	14.0%	257.3	256.0	155.8	669.2	7.3%	0.52
18010211080306	Conner Creek-Trinity River	7,808	16.0%	426.6	44.9	164.4	635.9	7.6%	0.48
18010211110402	Del Loma-Trinity River	9,110	14.0%	183.7	4.5	97.4	285.6	3.7%	0.26
18010211080301	Dutch Creek	10,720	16.0%	0.0	25.4	113.2	138.6	2.3%	0.14
18010211110202	Little French Creek	6,716	14.0%	243.6	43.4	92.9	379.9	6.9%	0.50
18010211110101	Logan Gulch-Eagle Creek	5,731	14.0%	426.1	10.9	48.6	485.5	7.2%	0.52
18010211110104	Manzanita Creek	4,545	14.0%	149.7	52.0	56.1	257.8	5.6%	0.40
18010211080302	Maxwell Creek-Trinity River	6,473	16.0%	0.0	68.6	103.6	172.3	2.6%	0.16
18010211080305	Mill Creek-Mckinney Gulch	3,286	16.0%	142.9	33.2	65.8	241.9	5.3%	0.33
18010211110204	Prairie Creek-Trinity River	6,603	14.0%	945.5	27.0	99.0	1071.5	10.0%	0.71
18010211110403	Rowdy Bar Creek-Don Juan Creek	6,081	14.0%	594.6	0.4	54.0	649.0	8.3%	0.60
18010211110103	Sailor Bar Creek-Trinity River	4,678	14.0%	318.4	91.5	74.3	484.2	7.5%	0.53
18010211080303	Soldier Creek-Trinity River	5,476	16.0%	43.2	199.7	136.8	379.7	4.7%	0.29

1/ "HUC7 code" = hydrologic unit code for 7th-field drainages;
2/ From Forest Plan
3/ ERAs from harvest and fire
4/ ERAs from roads
5/ Current or Existing - includes past and present actions; Federal & others
[= sum of + harvest & fire + roads]
6/ = Current ERAs / drainage acres

Figure 11. HUC 7 Watershed Condition Class

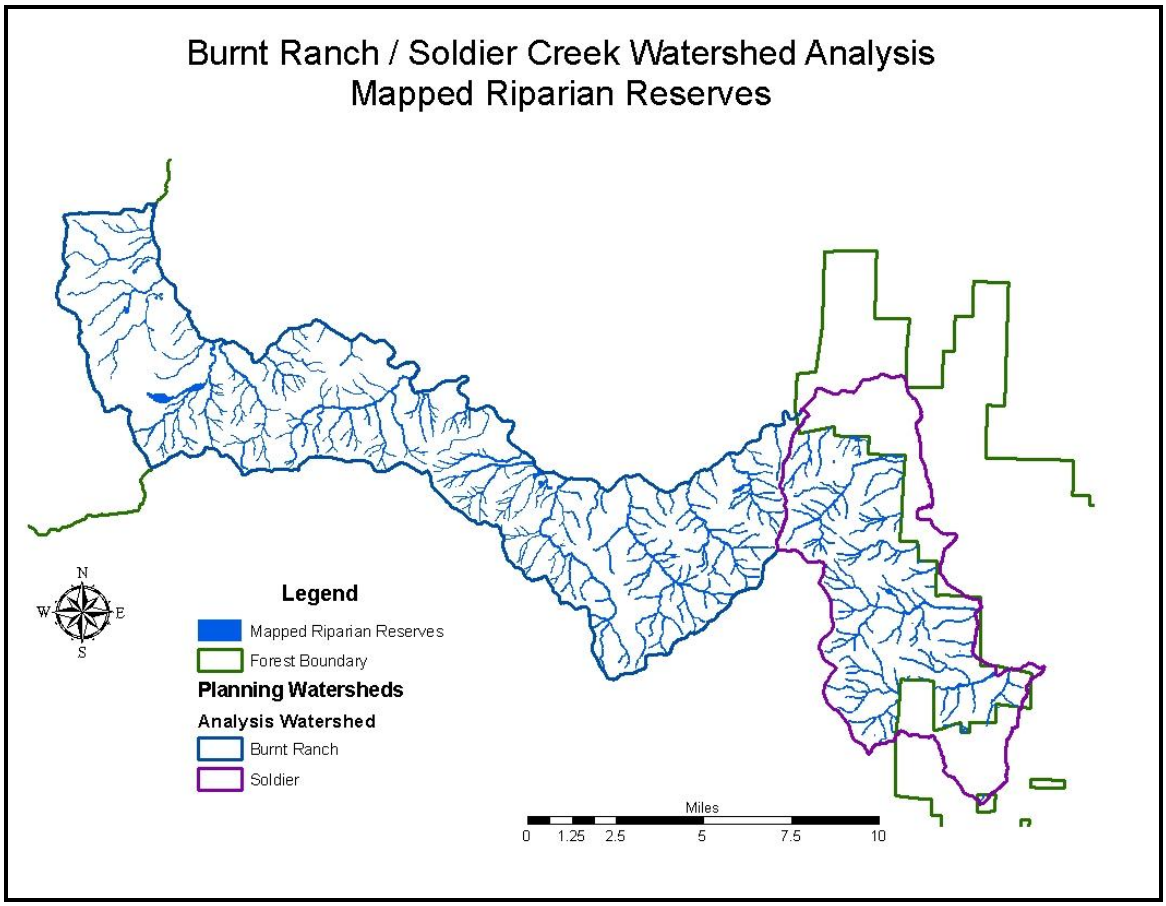


Prior to the fires, watershed ERA levels were low for the area, and all watersheds meet Condition Class 1 criteria. These low ERA values reflected several factors, including a limited timber harvest history within the planning watersheds, large roadless areas, and the lack of large stand replacing fires. The 2008 fires increased ERA levels in many of the HUC 7 watershed and decreased the watershed condition class. Condition class II watersheds have a moderate risk of adverse cumulative effects from project activities. Increased ERA levels from fire impacts would recover to normal within 10 years. Harvest levels recover over a 30 year period and road impacts are permanent unless roads are obliterated.

Riparian Reserves

Riparian Reserves are a Forest Plan allocation based on the characteristics of riparian areas. Riparian Reserves are modeled and mapped (mapped Riparian Reserves) for planning purposes, and refined based on field surveys for project level implementation. There are approximately 10,900 acres of mapped Riparian Reserves in the planning watersheds as shown in Figure 12, occupying approximately 15% of the landscape.

Figure 12. Mapped Riparian Reserves



Although many acres of mapped riparian reserves occurred within the 2008 fire perimeters, only a small percentage of the area was impacted by fire severe enough to kill more than 50% of the stand. Table 10 shows the riparian reserve impacts from the two largest fires within the planning watershed.

Table 10. Impact of 2008 fires on mapped Riparian Reserves

Fire	Fire acres within Burnt Ranch / Soldier WA	Riparian Reserve Acres within Fire Perimeters	% of Fire area in RR	Riparian Reserve acres with > 50% Mortality	% of Riparian Reserve with > 50% Mortality	% of fire area in Riparian Reserve with > 50% Mortality
Cedar	18,020	2,459	13.6%	178	7.2%	1.0%
Eagle	26,419	4,199	15.9%	116	2.8%	0.4%

Lower fire intensity would be expected within the majority of riparian areas, as most streams have north or north-east aspects and are in deep canyons with perennial streams. Vegetation is dominated by mature or old growth conifer forests. Those attributes contribute to cooler, moister conditions within riparian areas, reducing fire intensity even in extreme conditions. Areas that experienced stand replacing fire were typically located in the upper watersheds on steep slopes, where streams are intermittent or ephemeral in flow. Those impacted areas tended to be on slopes that also experienced stand replacing fire.

Issue #4: Aquatic Systems and Species

The Burnt Ranch and Soldier Creek planning watersheds are made up of 16 subwatersheds, several of which span the main stem Trinity River. In general, streams of the Burnt Ranch and Soldier Creek planning watersheds drain the slopes located south of the Trinity River and north of the Hayfork divide. Prior to the 2008 fires, streams in the area were in very good condition in the upper areas of the watershed.

Anadromous fishes found in the Weaverville Watershed include Fall-run Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), Winter-run Steelhead (*O. mykiss*) and Pacific Lamprey (*Lampetra tridentata*). The coho salmon is part of the Southern Oregon Northern California Coast Evolutionary Significant Unit and listed as threatened by the National Oceanic and Atmospheric Administration under the Endangered Species Act. Adult fishes are found in the Burnt Ranch and Soldier Creek planning watersheds during their spawning migrations. Juvenile fish of all species may be found at any time in the watershed, with juvenile steelhead being most abundant. Table 11 summarizes the fish habitat on the major tributaries based on data in the CalFish data base. Figure 13 shows one of the partial barriers on Soldier Creek.

Table 11. Summary of anadromous fish habitat and potential barriers.

Stream	Salmon	Steelhead	Barriers	Barrier Owner
Canadian Creek		Yes		
Price Creek	Yes	Yes	Unknown (2)	FS
Big Bar Creek		Yes		
Conner Creek	Yes	Yes	Yes (2)	Trinity Co.
Soldier Creek	Yes	Yes	Yes (1 partial 1 complete)	FS
Dutch Creek		Yes	Yes (3 partial)	FS
Maxwell Creek		Yes		

Figure 13. Soldier Creek Partially Blocked Crossing

Issue #5: Terrestrial Wildlife Habitat and Species

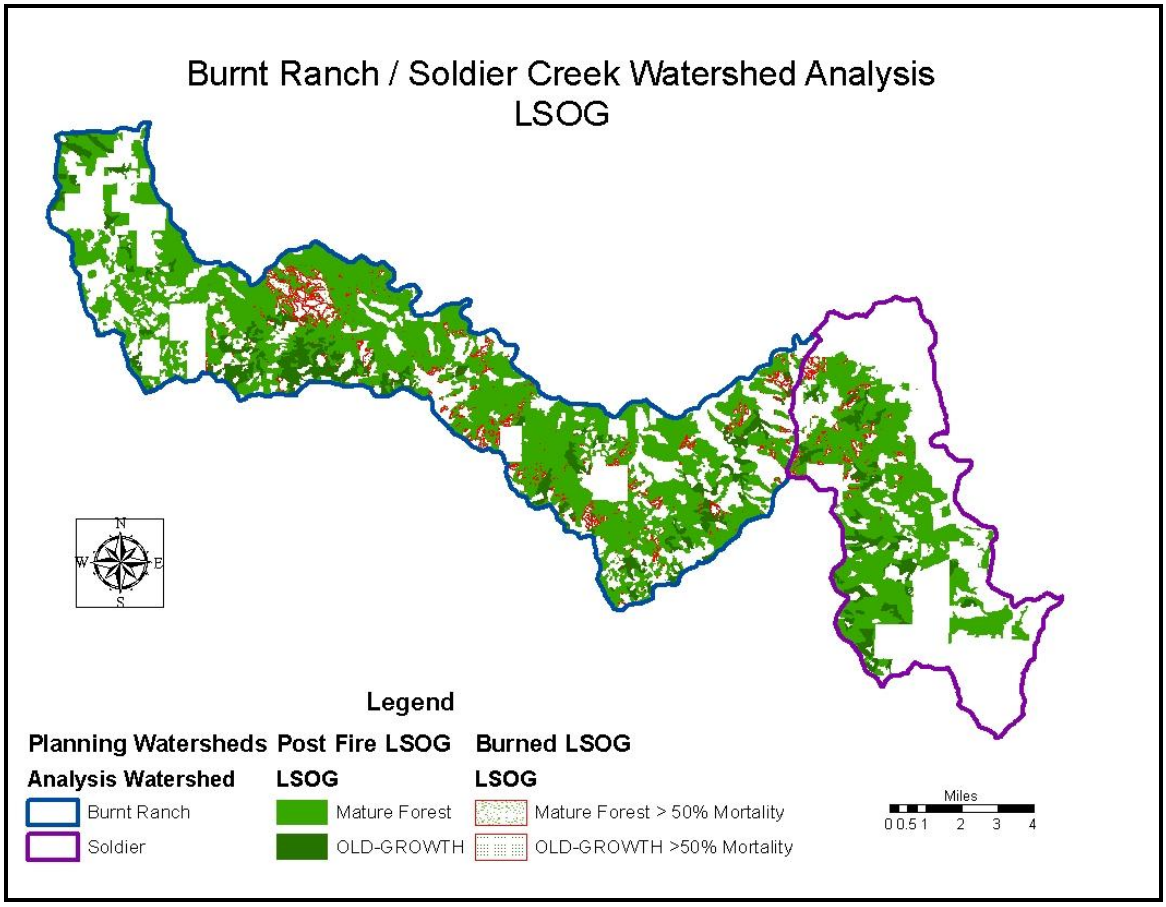
Based on the Forest Plan vegetation layer, the 81,700 -acre Burnt Ranch and Soldier Creek planning watersheds include approximately 56,000 acres of federal forest land (i.e., federal land capable of producing LSOG). This level of vegetation mapping is suitable for landscape analysis but would be refined for project planning. The composition of this federal forest in terms of distribution of LSOG was changed by the fires of 2008. Table 12 compares pre-fire forest acre classification to post-fire acres, based on stands with greater than 50% basal area mortality after the fires.

Table 12. Classification of Federal Forest Lands

	Pre-Fire Acres	% of Total Federal Forest	Post-Fire Acres	% of Total Federal Forest
Other Federal Forest	9,726	17%	12,560	22%
Mature Forest	40,046	71%	37,595	67%
Old Growth	6,350	11%	5,968	11%
Total Acres	56,122		56,122	

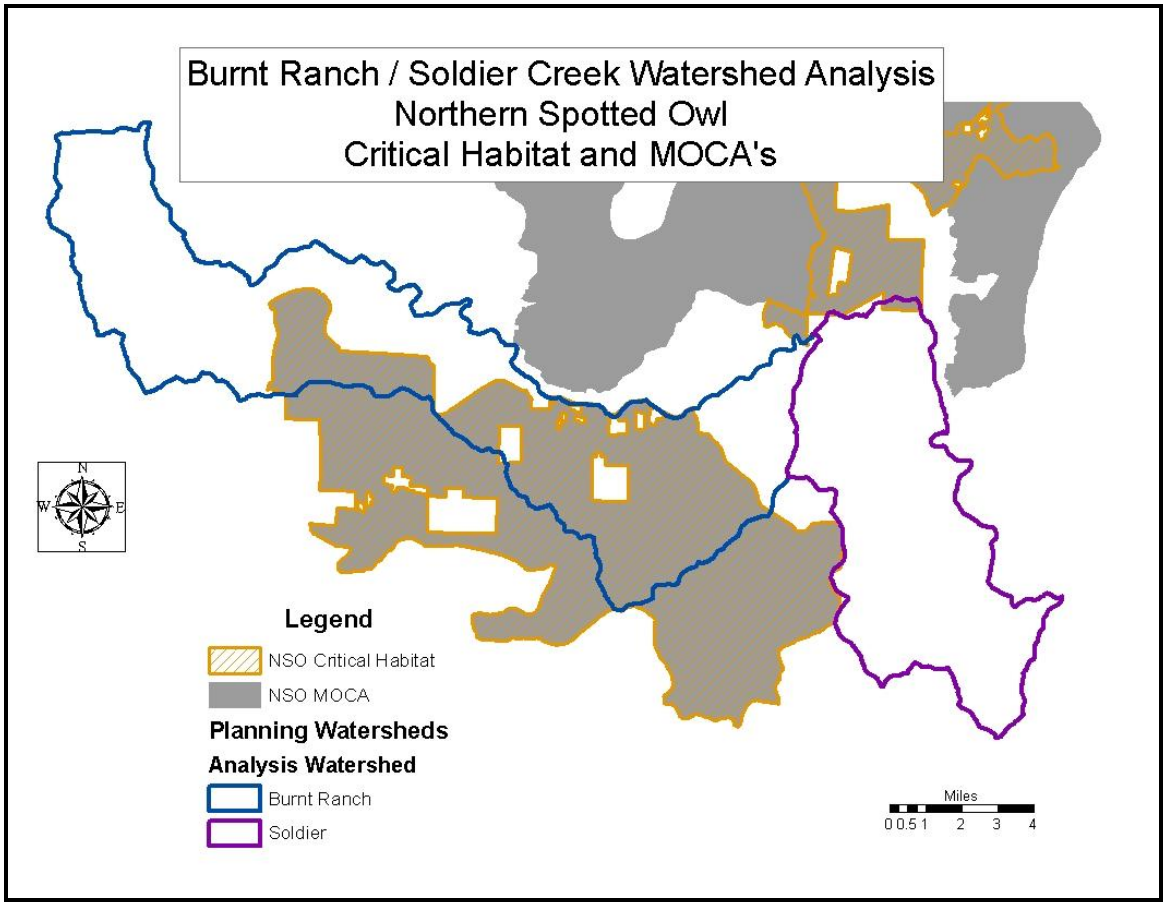
Although the numbers are slightly different from the vegetation strata analysis used in the Wood Products section of the analysis, the results are consistent. The greatest fire related mortality was in mature forests, which lost approximately 2,500 acres. Landscape changes in old growth distribution and patch size were minimal. LSOG exists in scattered patches ranging from roughly 2 to 570 acres as shown in Figure 14, with the largest contiguous stands of LSOG located in the headwaters of the Cedar Flat and Canadian Creek drainages.

Figure 14. LSOG



A significant portion of the planning watersheds are included in Northern Spotted Owl designations as shown in Figure 15. A portion of the area was designated as Critical Habitat in 2008 by the US Fish and Wildlife Service (FWS). That same area was included in the Managed Owl Conservation Areas (MOCA) established in the FWS 2008 Final Recovery Plan for the Northern Spotted Owl.

Figure 15. Northern Spotted Owl Habitat Designations



Issue #6: Fire, Fuels, and Air Quality

Fire Regime

The most widespread fire regime in the Klamath Mountains is one of frequent, low to moderate-intensity fires. The steep slopes that run from low to higher elevations, changes in slope aspect and the influence of summer drought create these conditions (Skinner et al. 2006). Historically forest stands were multi-aged and had a high degree of spatial complexity at the landscape level (Wills and Stuart 1994, Taylor and Skinner 2003). Mean fire return intervals were in the range of 10 to 17 years with fire return intervals being longer on north slopes (Wills and Stuart 1994, Taylor and Skinner 2003). The fire rotation interval, the amount of time it takes to burn an area or the equivalent acreage was 20 years (Taylor and Skinner 2002).

Fire suppression began in the region in 1905 and became increasingly effective over the next 40 years. As fire suppression effectiveness increased shade tolerant species became established in the understory and forest density has increased. This has resulted in a reduction in spatial complexity as vegetation becomes more homogeneous (Skinner et al. 2006). The fire rotation interval has increased from 20 to 238 years (Taylor and Skinner

2002). Over the 400 years prior to effective fire suppression, there are no comparable fire-free periods within the bioregion where large landscapes went decades without simultaneous large fires (Skinner et al. 2006). The fire regime is now shifting towards one of infrequent higher severity fires.

Fire Occurrence

Prior to European settlement a combination of lightning fires and Native American ignitions accounted for all fire occurrences. In the 1820's when exploration of the Klamath Mountains brought non-native cultures to the area this added to the potential ignition sources (Skinner et al. 2006). Fire history studies noted that there was no increase in fire frequency with an increase in settlement (Taylor and Skinner 1998).

A review of 37 years of ignitions within the analysis area (Table 13) show that 50% of fires are human caused and 50% are attributed to lightning. The annual expected ignition frequency is 7 fires per year for the Burnt Ranch and Soldier Creek analysis area.

Table 13. Fire Ignitions 1975-2007

Soldier Creek/Burnt Ranch Ignitions 1970-2007		
Number of Ignitions	**Statistical Cause**	**Percent**
146	Lightning	50
16	Equipment	6
18	Smoking	6
15	Campfire	5
25	Debris Burning	8
15	Arson	5
4	Children	1
56	Miscellaneous	19
295	**Total**	100

Large fire history within the watershed boundaries between 1980 and 2006 accounted for 2,779 acres burned (Table 14). Areas adjacent to and surrounding the watersheds had a much higher occurrence of large fires beginning in 1987 (Figure16). The lack of large fire history within the Burnt Ranch and Soldier Creek watersheds can be attributed to a number of factors. Slope aspect is primarily north facing resulting in cooler temperatures and higher fuel moisture. An adequate road system exists for ground based fire suppression resources. There is a consistent supply of aerially delivered firefighters. These factors combined aided in successful initial and extended attack suppression efforts during this time period.

On June 21, 2008 a series of dry lightning storms ignited numerous fires in the Klamath Mountains. These storms ignited four fires (Bray, Canadian, Eagle and Cedar fires) within the watershed boundaries, eventually burning 44,561 acres. Three other large lightning

fires (Miners, Hell's Half and Ironside fires) spread into the watersheds burning an additional 50 acres (Table 15). Historically in the Klamath Mountains when ignitions outnumber the availability of resources the occurrence of large fires increases. Compounding this problem is steep terrain which limits accessibility and creates conditions favorable to fire spread. The fires of 1987, the 1999 Big Bar Complex and the 2006 Bar Complex are examples of this type of event. The potential currently exists for large fires in the unburned areas in the eastern and western portions of the watersheds and the likelihood of large fires within the boundaries of the 2008 fires will increase as fuels accumulate over time.

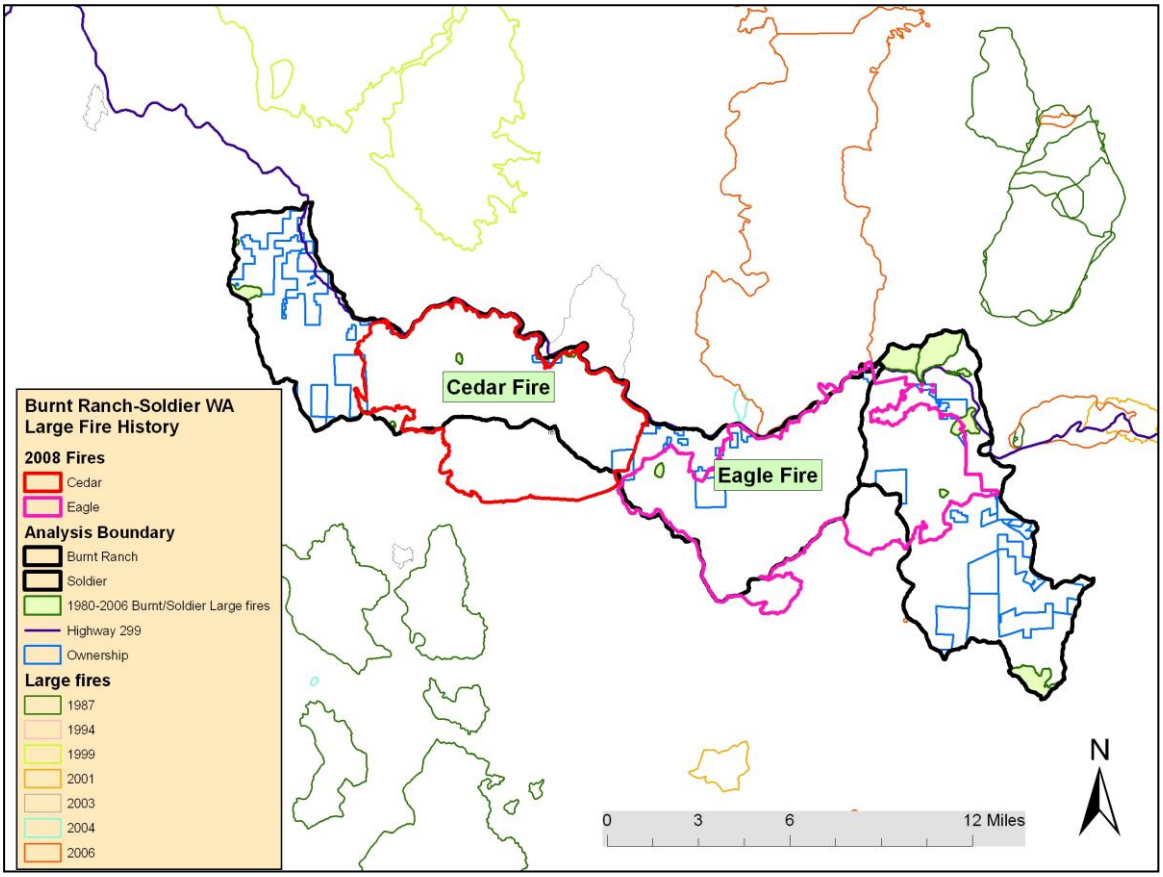
Table 14. Large Fires 1980-2006

Soldier Creek/Burnt Ranch Large Fires 1980-2006					
Fire Name	**Fire Year**	**Cause**	**Reported Acres**	**Watershed**	**Watershed Acres**
	1980	Arson	980	Soldier	1360
Stiner Flat	1983	Equipment	35	Soldier	30
Helena	1984	Unknown	20	Soldier	12
	1988	Miscellaneous	570	Soldier	562
Hennessy	1992	Lightning	0	Burnt Ranch	15
Brock	1992	Unknown	150	Soldier	108
Barker	1992	Arson	5050	Soldier	540
Loma	2003	Miscellaneous	3740	Burnt Ranch	88
Price	2004	Lightning	56	Burnt Ranch	63
Dog	2006	Lightning	12	Soldier	0.4
		Total Acres	**10613**	**Total Acres**	**2779**

Table 15. Large Fires 2008

Soldier Creek/Burnt Ranch Large Fires 2008					
Fire Name	**Fire Year**	**Cause**	**Reported Acres**	**Watershed**	**Watershed Acres**
Canadian	2008	Lightning	71	Burnt Ranch	71
Bray	2008	Lightning	1	Burnt Ranch	1
Cedar	2008	Lightning	25372	Burnt Ranch	18020
Eagle	2008	Lightning	300026	Burnt Ranch /Soldier	26419
Hell's Half	2008	Lightning	15146	Burnt Ranch	45
Miners	2008	Lightning	24856	Burnt Ranch	4
Ironside	2008	Lightning	12824	Burnt Ranch	1
		Total Acres	**378296**	**Total Acres**	**44561**

Figure 16. Large Fire History



Vegetation, Fuels and Potential Fire Behavior

Potential fire behavior was modeled using FlamMap, which is a fire behavior mapping and analysis program that computes potential fire behavior characteristics (spread rate, flame length, fireline intensity, etc.) over a landscape for constant weather and fuel moisture conditions. Weather and fuel moisture values were derived from weather stations located on the Shasta-Trinity National Forest and represent conditions that would occur during the annual fire season.

Unburned Areas- The most common vegetation type in the analysis area is Douglas fir mixed conifer forest which occupies the cool, moist north facing aspects. Fuels consist of compact timber litter and jackpots of woody debris, predicted flame lengths are generally low, 4 feet or less (Figure 17), and rate of spread is less then 2 chains per hour.

Surface fire is the primary fire type, conditions conducive to passive and active crown fire exist where low canopy base height and high canopy bulk density allow for initiation and spread (Figure 17). Stands with shrubs, conifer regeneration and heavy concentrations of surface fuels in the understory will burn with higher intensity aiding in the initiation and spread of crown fire and burn. Resistance to control is a measure of the difficulty to

control a fire based on the elements of fuels, weather and topography. In areas of heavy fuels, where slopes exceed 40% and flame lengths are greater then 4 feet resistance to control increases and fire suppression becomes difficult.

2008 Fires- Within the analysis boundary, the 2008 fires effectively reduced fuel loading and as a result reduced the threat of large fires within the burn areas for the short term. Predicted flame lengths in these areas are generally less 1 foot (Figure 17). In the stands where tree mortality is present snags will fall over time, small diameter snags will fall first with pine snags falling at a faster rate then fir snags (Smith and Cluck 2007). In the absence of management surface fuels will increase and brush, grasses, forbs and hardwoods will occupy the site. Over time the ability for fire to spread will increase as will fire intensity and resistance to control.

Plantations- There is approximately 5,310 acres of conifer plantations in the Burnt Ranch and Soldier Creek watersheds. Of these, 3,533 acres are located within the boundaries of the Eagle and Cedar fires, 870 acres have fire induced mortality that is greater then 50%. Plantations are at risk of damage or loss from wildfire due to fuel conditions within and adjacent to the stands (Skinner and Weatherspoon 1996). Fuel characteristics that affect fire behavior in plantations are low canopy base height and high canopy bulk density which promote passive or active crown fire. Brush encroachment and dead woody surface fuels in the understory increase flame length which aids in the initiation of crown fire and kills or damages trees by scorching crowns. Within the plantations burned in 2008 in the absence of management brush, grasses, forbs and hardwoods will occupy the site. Dead tree stems will fall and increase surface fuel loading, over time this will create conditions that are conducive for fire spread and increased fire intensity.

Figure 17. Potential Flame Length

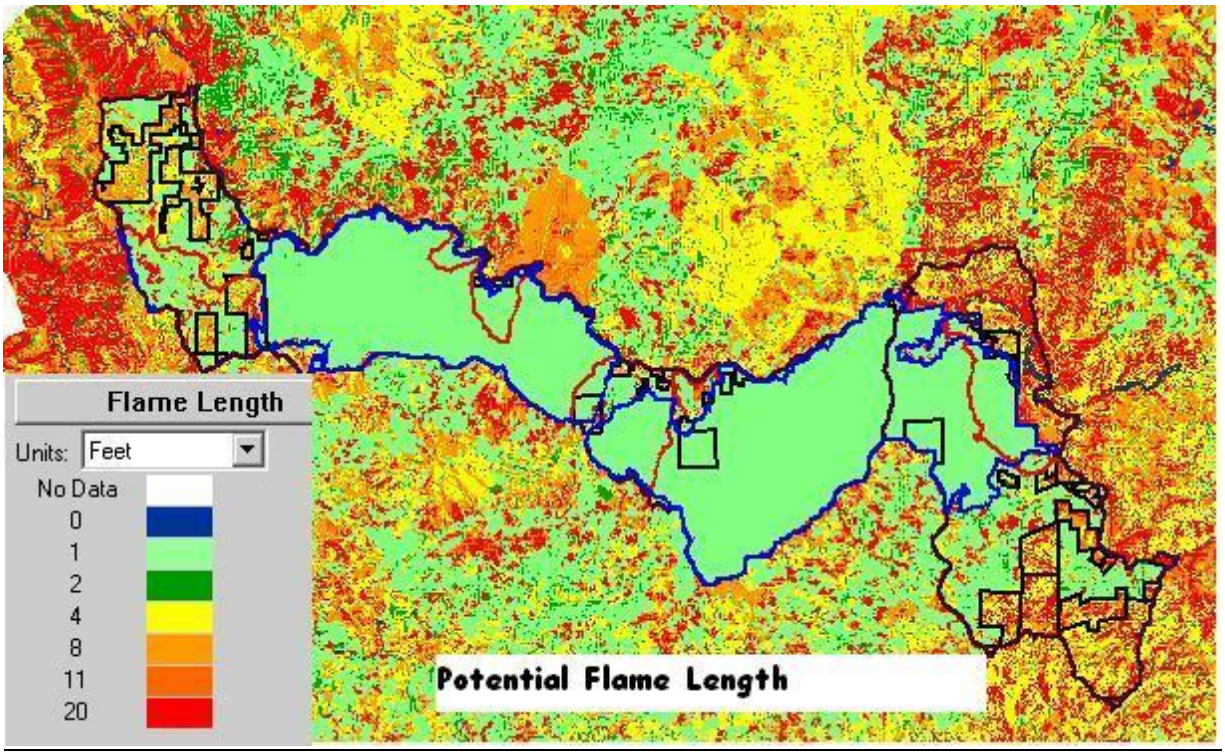
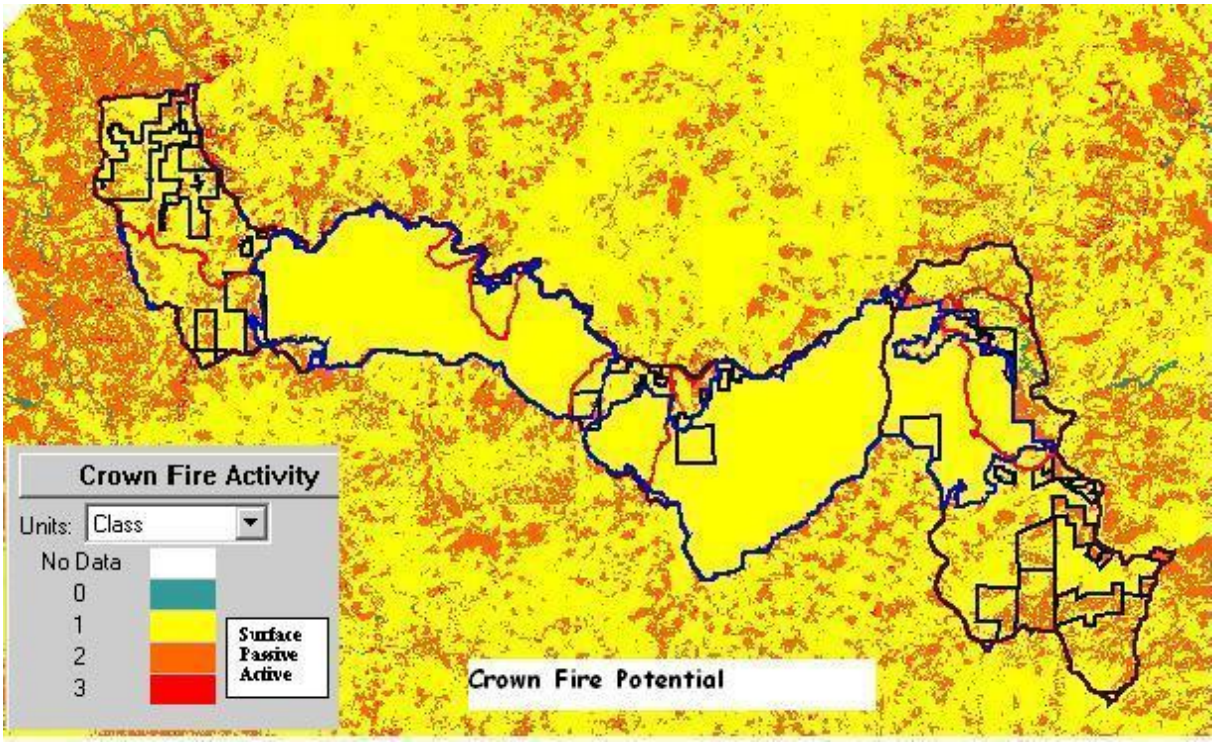


Figure 18. Crown Fire Potential



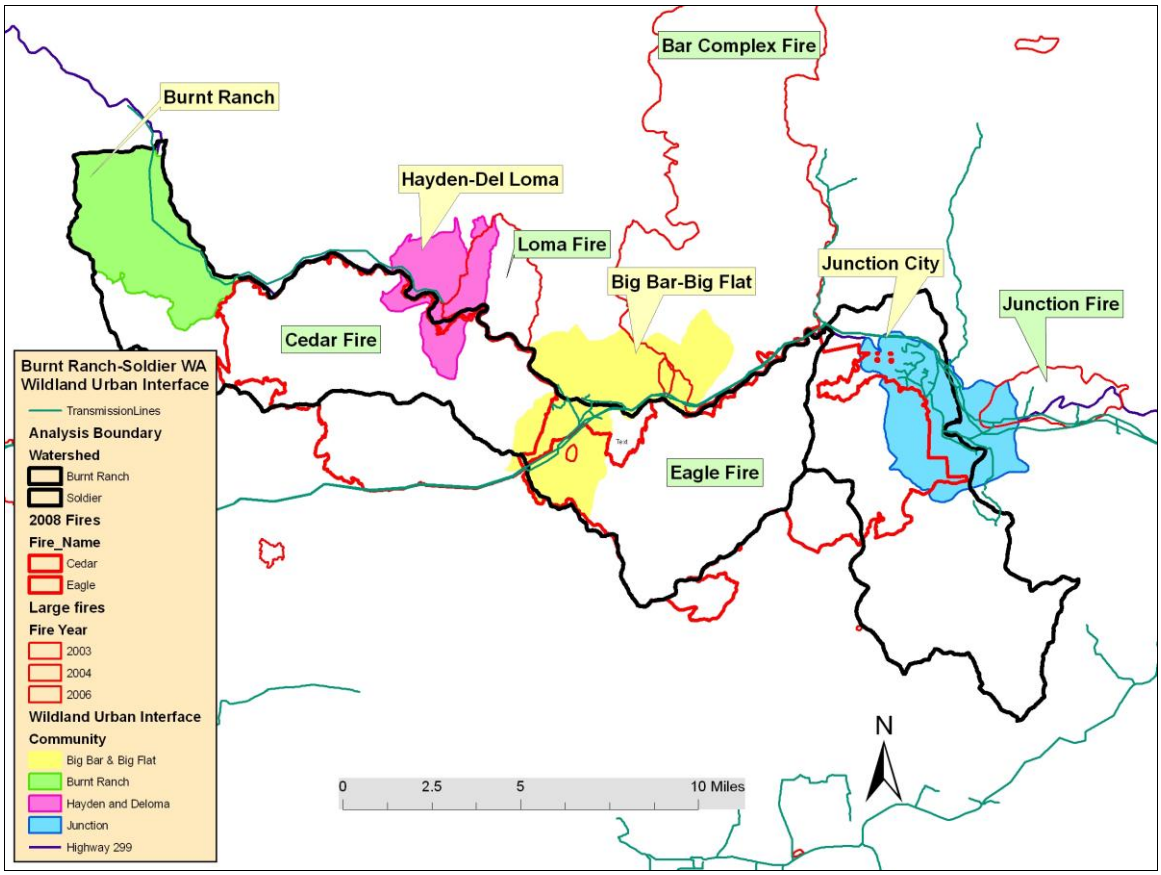
Wildland Urban Interface and Natural Resource Values

Adjacent to and within the Highway 299 corridor there is commercial and residential development on private and federal lands. These developments and associated infrastructure (e.g. powerlines, bridges) are classified as wildland urban interface (WUI), which is the area where structures and other human development meet or intermingle with undeveloped wildland. The potential for damage to these features from unwanted wildfire exists. There are approximately 19,880 acres identified as wildland urban interface within the analysis boundary, of these 7,757 were directly impacted by the 2008 fires. Areas of mapped WUI within the analysis area include Junction City, Big Bar-Big Flat, Hayden-Del Loma and Burnt Ranch (Figure 14). Effective protection of structures from wildfire is best achieved by reducing fuels within 100 feet and utilizing fire resistant materials and design in building construction (Cohen 2008).

There are three identified powerlines in the area the Trinity County PUD 12 kV line, a 69 kV line and the Pacific Gas & Electric Humboldt-Trinity 115 kV line.

Natural resource values include but are not limited to commercial timber, plantations, anadromous fish habitat, domestic water supply and recreational opportunities.

Figure 14. Wildland Urban Interface



The Trinity County Fire Safe Council has completed a Community Wildfire Protection Plan (CWPP) for Trinity County. A CWPP enables a community to plan how it will reduce the risk of wildfire. The plan is developed through collaboration with federal, state and local government entities, identifies and prioritizes areas for hazardous fuel reduction treatments and recommends the types and methods of treatment as well as recommends measures to reduce structural ignitability throughout the at-risk community. http://www.tcrcd.net/pdf/TC_Wildfire_Protection_Plan.pdf

The Trinity County CWPP specifically addresses areas within the boundaries of the Soldier-Burnt Ranch analysis area makes general recommendations (Appendix B) and identifies specific projects in the area. The projects address both federal and private lands and opportunities exist to extend boundaries further onto federal lands for additional benefit.

Issue #7: Plant Communities

Key question 7.1 – Unique Species

There are no known Threatened or Endangered plant species on the Shasta-Trinity National Forest. Little field survey for rare plants has been conducted in the planning watersheds because of the lack of proposed management in the area since botanical concerns were incorporated into project planning in the early 1980's. The watersheds' rugged terrain and relative lack of roads has discouraged recreational searches for rare plants and fungi as well. Consequently the lack of documented populations of rare plants may not fully reflect actual inventories.

There are 4 known populations of 3 Sensitive plant species present in the watersheds as listed in Table 16.

Table 16. Sensitive plant species.

Common Name	Species	Populations	Relative Rarity in California
Howell's montia	*Montia howellii*	1 Burnt Ranch CG	Uncommon
Canyon Creek stonecrop	*Sedum paradisum*	1 Eagle Rock ridge	Very rare
Bug-on-a-stick	*Buxbaumia viridis*	2 Eagle Ranch	Very rare

Howell's montia occupies silty, vernally soils and seems to require regular, superficial disturbance to sustain populations, but the exact disturbance mechanisms are not known. Removing overstory to less than 50% could negatively affect habitat by accelerating the critical gradual drawdown of soil moisture or drying soil before seeds are ready to germinate in the spring.

Canyon Creek stonecrop is found exclusively on larger rock outcrops. It does not respond positively to disturbance, but it grows in habitats that are typically left undisturbed.

Habitat for bug-on-a-stick is moderately well decomposed large logs within perennial riparian areas. Both populations of this species are found on sites within mature conifer forest with an open understory and only low amounts of surface or ladder fuels, but loss of overstory to wildfire could significantly alter the moisture-retention capabilities of both sites.

There are no known Survey and Manage or Forest Plan Endemic plant species in the planning watersheds. There are populations of several other Sensitive plants and fungi just south but outside the watershed.

Potential Suitable Habitat for Plant and Fungi Species of Concern Within the Planning Watersheds

Based on the geographic location, elevation range, soil types, forest type, and other features, there is habitat for 19 of the 41 Sensitive species that occur on the west half of the Shasta-Trinity National Forest. Those species and their habitats can be summarized as follows:

Table 17. Sensitive Plant Species and Habitat

Habitat	Common Name	Species	FS Status
Mature or older conifer forest	Mountain lady's-slipper	*Cypripedium montanum*	Sensitive, S & M*
	Brownie lady's-slipper	*Cypripedium fasciculatum*	Sensitive, S & M
	California globe mallow	*Iliamna latibracteata*	Sensitive
	Veiny arnica	*Arnica venosa*	Sensitive
	Pacific fuzzwort	*Ptilidium californicum*	Sensitive, S & M
	Red-pored bolete	*Boletus pulcherrimus*	Sensitive
	Branched collybia	*Dendrocollybia racemosa*	Sensitive
	Olive phaeocollybia	*Phaoecollybia olivacea*	Sensitive
	Orange-peel fungus	*Sowerbyella rhenana*	Sensitive
	Bay horsehair lichen	*Sulcaria badia*	Sensitive
Riparian	Moonwort	*Botrychium spp. (most)*	Sensitive
	Bug-on-a-stick	*Buxbaumia species*	Sensitive, S & M
	Mountain lady's-slipper	*Cypripedium montanum*	
	Brownie lady's-slipper	*Cypripedium fasciculatum*	
	Red-pored bolete	*Boletus pulcherrimus*	
	Branched collybia	*Dendrocollybia racemosa*	
	Aquatic lichen	*Peltigera hydrotheria*	
	Olive phaeocollybia	*Phaoecollybia olivacea*	Sensitive
	English Peak greenbriar	*Smilax jamesii*	
	Orange-peel fungus	*Sowerbyella rhenana*	

Habitat	Common Name	Species	FS Status
Serpentine uplands	Shasta chaenactis Threadleaf beardtongue	*Chaenactis suffretescens* *Penstemon filiformis*	Sensitive Sensitive Sensitive
Serpentine riparian	Oregon fireweed	*Epilobium oreganum*	Sensitive
Unique rock features	Copper moss Canyon Creek stonecrop	*Mielochhoferia elongata* *Sedum paradisum*	Sensitive Sensitive

*S&M = Survey and Manage

Serpentine Habitats

The Burnt Ranch planning watershed is intersected by a portion of the Rattlesnake Creek Terrane, a geologic area rich in serpentine soils that occupies approximately 375,000 acres spanning a broad area parallel to South Fork Mountain but intersects the analysis area only from Cedar Flat Creek westward. This geologic area supports a high concentration of serpentine soils and a suite of plant species that are restricted entirely to within its boundaries, but most or all of these species have been found only farther south of the analysis area. Despite the absence of comprehensive field surveys, none of the Sensitive plant species that are more common farther south in the Rattlesnake Creek Terrane are known to occur in the serpentine habitats within the analysis area, probably because of the increased coastal influence and resulting plant community composition in the planning watersheds.

Key question 7.2 - Noxious Weeds

A full inventory of noxious weeds has not been completed for the planning watersheds, but areas of concentration have been documented.

Non-native invasive species are common along the Trinity River corridor. Dyers woad (*Isatis tinctorius*) was probably first introduced on equipment at the Junction City maintenance station and has now spread to Hocker Flat, Canyon Creek, and downriver on Hwy. 299. Fennel (*Foeniculum vulgare*) has been found and treated on 2 sites in Junction City. Single, isolated populations of diffuse knapweed (*Centaurea diffusa*) and Canada thistle (*Cirsium arvense*) are known from the FS 33N50 and FS 33N44C roads respectively. Tree-of-heaven (*Ailanthus altissima*) is common in the Junction City area on private property, abandoned historic homesites, and along Hwy. 299 between Junction City and Big Bar.

Brooms of several different species (*Sparium junceum, Cytisus scoparius, Genista monspesulana*) are present in moderate to heavy concentration on developed properties and abandoned homesites in Big Bar and Junction City. Brooms are especially abundant along portions of Soldier Creek, Dutch Creek, and Red Hill Roads within 2-5 miles of Junction City. Roadside brooms here have heavily displaced native roadside vegetation, are often located close to private property structures, and are a high fire hazard from vehicles.

The Bureau of Reclamation Trinity River Restoration Project has been actively modifying the Trinity River channel for fish habitat restoration by aggressively removing large vegetation and bank height in the Hocker Flat and Canyon Creek junction area. Many existing noxious weed populations were in place prior to restoration. Despite recent efforts to restore native plant communities through planting and seeding, noxious weeds, in particular dyers woad, tree-of-heaven, and black mustard, continue to spread and expand along the Trinity River corridor.

Historical and Current Disturbance Agents

Disturbance agents that have had the most influence on current plant community composition are timber harvest, wildfire, geologic instability, and mining, although only timber harvest and mining can be considered human caused. Steep terrain in the central part of the Burnt Ranch and Soldier Creek planning watersheds has minimized potential activity.

The planning watersheds were relatively unaffected by wildfire until 2008 when approximately 82,000 acres in the 2 planning watersheds burned. Northern aspect has been the main driver in the low amount of wildfire; the number of ignitions is similar to other areas, but cool, wet habitat has discouraged fire spread. Prior to 2008, only 2 large fire areas between 1000 and 1500 acres and 22 fires overall had been documented in the watersheds. The lack of fire in this part of the Klamath Mountains has helped develop old-growth forest habitat more quickly over time, but has also resulted in areas of stagnant shrubs and perennial forbs, loss of annual species, and less availability of nutrients in dead, woody material.

The Iron and Cedar fires of 2008 provided abundant beneficial ecological services where they burned at low or moderate severity. Positive ecological impacts occurred even in stand-replacement parts of the fire where decadent and dead vegetation was removed, even if entire conifer stands were killed and soil erosion was accelerated. Areas that have lacked fire would benefit from reintroduction of fire, even if applied in distinct, planned units rather than over a broad, geographic area.

The Burnt Ranch and Soldier Creek planning watersheds have a high degree of geologic instability, particularly in the Burnt Ranch area and between Cedar Flat Creek and Junction City. Geologic instability is probably related to the high abundance of serpentine soils in the Burnt Ranch area, leading to increased plant species diversity. Instability in the central part of the watersheds has caused slides and rotational slumps that expose large areas of bare soil. As noxious weeds increase in abundance on the Forest, these opening continue to provide points of weed introduction and expansion. Alternatively, they provide expanded habitat for native, annual plant species that add to forest diversity.

There are approximately 5,500 acres of harvested conifer stands located along the upper slopes of the two planning watersheds, where the deepest soils are located. Most of this past timber activity took place in the last half of the 20th century and it moved forested communities from late-seral to early-seral or it selectively thinned late-seral forest with only minor modifications to habitat components important to plant or fungi species. Pockets of concentrated harvest north of Hayfork Bally and near Burnt Ranch (three areas

totaling about 2,400 acres) are currently of lower quality habitat for late-seral forest dependent Sensitive plants and fungi. This is because of the lack of overstory and relative reduction in surrounding habitat for reintroduction and dispersal.

Most, if not all, mining activities that had a notable impact on the planning watersheds have been focused on the Trinity River corridor. Dredge mining and hydraulic mining were done primarily in the first half of the 20th century with dredge mining still taking place along the river today. Junction City has abundant tailing piles that line the river and provide little habitat for plant species over a broad area. Riparian plant communities would have occupied these areas before mining.

Prior to historical mining there may have been greater species diversity on the Trinity River, but periodic flooding regimes along the river have always discouraged advanced growth of perennial shrubs and trees. Construction of Trinity and Lewiston Dams in the mid 1960's probably had the single, greatest impact on modifying historical plant communities along this part of the Trinity River by slowing the river and allowing for establishment of perennial species that previously could not be sustained. Unfortunately, noxious weeds have established at a greater frequency than natives because of proximity to Hwy. 299, a major transportation corridor and vector of weed introduction and greater competitive advantages in disturbed habitats.

CHAPTER 4 – DESIRED CONDITIONS

This chapter describes the desired conditions of resources within the Soldier/Burnt Ranch watersheds. The ecological conditions and management objectives pertain to the issues and key questions identified in Chapter 2. The information provided here will be used in Chapter 5 for identification of possible management actions.

Issue #1: Human Uses, Values, and Expectations

Recreation

Key question 1.1 – Recreation Resources

The desired condition for recreation is to provide a high quality outdoor recreation experience, with an emphasis on the components of the Wild and Scenic River System. Developed sites will be managed to meet the Roaded Natural Recreation Opportunity Spectrum Class. Developed facilities should complement river recreation activities.

Wood Products

Key question 1.2 - Timber Harvest

The desired condition of the mixed conifer timber stands within the Soldier/Burnt Ranch watersheds is specific to the management prescription identified in the LRMP. The desired condition within the Matrix lands that include wildlife management emphasis, commercial wood products emphasis, and roaded recreation emphasis (totaling 14,188 acres) could be benefited by reforestation and timber harvest opportunities designed to provide the desired conifer forest conditions on Forest Service land. The 733 acres heavily impacted by the 2008 wildfires could be harvested and/or reforested to meet matrix land objectives.

Late-Successional Reserves are to be managed to protect and enhance conditions of late-successional and old-growth ecosystems, which serve as habitat for late-successional and old-growth related species including the northern spotted owl. Therefore, the 40,964 acres of conifer stands within the Soldier/Burnt Ranch watersheds would be best served as representing the mature or old growth conifer stand condition. Roads to access any timber harvest opportunities such as thinning, silvicultural treatments, or salvage harvesting consistent with LSR Standards and Guidelines would be maintained to allow for access. The 1,721 acres heavily impacted by the 2008 wildfires could be harvested and/or reforested to meet LSR objectives.

Key question 1.3 – Fuel wood

The desired condition for fuel wood opportunities is an area managed for fuel wood supply and access. Periodic timber sales with cull and non-merchantable wood products available to the public for fuel wood would benefit fuel wood collection opportunities. In addition, a well-developed transportation system with road surfaces armored to allow for wet weather

access would provide needed access to both timber sale generated wood and annual "dead and down" fuel wood collection opportunities.

Cultural Resources

Key Question 1.4 – Archaeological Properties

The desired condition is to preserve and interpret significant historic and prehistoric sites for the benefit of Forest visitors, while providing archaeological research opportunities for the professional community.

Issue #2: Access and Travel Management

Key question 2.1 – Access

The desired condition is to implement road management objectives to provide for user safety and resource protection. The majority of this watershed has been designated as prescription VII (LSR designation) within the LRMP. A small portion of the eastern edge of the watershed has been designated Matrix Lands; Rx III (Roaded Recreation) and Rx VIII (Commercial Wood Products Emphasis). The desired condition would develop a limited OHV trail system, in conjunction with education, signing, and law enforcement.

Previous management direction has provided guidance for some networks and local roads to be closed seasonally to protect resources such as: Erosion/Water Quality, Wildlife/Road Density and security.

During the 2008 wildfires, the road system was used for fire suppression access. Portions of the road were used as a fire control line. Other portions of the road were completely burned over with fire consuming all vegetation on both sides of the road surface. Many trees were fire-killed along the roads' edges, leaving a future a future transportation safety problem.

Issue #3: Erosional Processes

Key Questions 3.1 to 3.3 – Mass Wasting, Soil Erosion, and CWE

The desired condition for soil and water resources is to maintain or improve watershed condition and meet water quality objectives. Management should not increase watershed disturbance over established thresholds. Aquatic Conservation Strategy Objectives are met.

Issue #4: Aquatic Systems and Species

Key Questions 4.1 – Anadromous Fish

The desired condition for aquatic systems and species is to have anadromous fish migration unimpeded by culverts, dams or other manmade structures. Streams would provide a complex mix of aquatic habitats including deep pools with adequate cover, riffles with good spawning gravel and adequate flows to allow year round survival. Riparian Reserves would be in good condition to provide large woody debris input, stream shade, and effective filter strips.

Issue #5: Terrestrial Wildlife Habitat and Species

Key Question 5.1 – Late Successional Old Growth

The desired condition is to protect and enhance conditions of late-successional and old-growth ecosystems, which serve as habitat for late-successional and old-growth related species including the northern spotted owl.

Issue #6: Fire, Fuels, and Air Quality

Key Question 6.1 and 6.2 – Wildfire and Fire Regime

The desired condition is to:

- Restore fire to its natural role in the ecosystem when establishing the desired future condition of the landscape.
- Achieve a balance of fire suppression capability and fuels management investments that are cost effective and able to meet ecosystem objectives and protection capabilities.

There is specific direction in the Forest Fire Management Plan that addresses fire management units within the Soldier- Burnt Ranch analysis area. A Fire Management Unit (FMU) is a land management area defined by a unique set of management strategies, objectives and attributes (e.g. constraints, values at risk, fuel types). There are three Fire Management Units within the analysis area:

1. The Late Successional Reserve FMU is the largest within the analysis area. Objectives are focused on protection of habitat values from high severity fire and minimizing damage from suppression activities.
2. In the Wildland Urban Interface FMU the focus is on prevention and aggressive suppression of wildland fire to protect private property and infrastructure. Cooperative efforts to reduce fire hazard through treatment of fuels is also a primary objective.
3. The General Forest FMU includes the full range of management responses to wildfire including managing natural ignitions for resource benefits. Management objectives also include treating fuels to reduce the risk of stand replacing fires and protect Forest investments such as plantations and campgrounds.

Issue #7: Plant Communities

Key question 7.1 – Unique Species

The desired future condition for plant and fungi communities of concern is to maintain or restore ecosystem function in native and rare plant communities so they can be resilient to localized or long-term disturbance events. Reduce fuel loading in habitats that support populations of plant and fungi species of concern and maintain the low fuel loadings in known populations of Howell's montia, Canyon Creek stonecrop, and bug-on-a-stick.

Prior to the 2008 fires, plant and fungi communities in over half of the planning watersheds may have been similar to current conditions to some degree. The lack of wildfire in the analysis area has less to do with fire suppression over the past 100 years

than with the inability of fire ignitions to be sustained in an isolated portion of the Klamath Mountains. North aspect maintains cooler, wetter conditions through the summer and the low road density discourages human sources of ignition. Presumably, this area burned in a similar fashion over a broad area before European settlement, but in less frequent events than in surrounding areas.

Timber harvest has contributed a notable amount of forest stand modification at the upper elevations where soils are deeper and more productive. Because of this higher productivity, harvested stands may have been more resilient to disturbance. Most or all of these stands are recovering and progressively developing habitat characteristics that will encourage reintroduction of any Sensitive plants or fungi that may have occupied those areas.

Mined areas along the Trinity River have changed most significantly since European settlement and most riverine riparian areas in the planning watersheds are altered to greater or lesser degree. There is still a strong component of native vegetation (alders, cottonwoods, sedges) that is very resilient to disturbance, but has decreased in dominance with increasing introduction and spread of noxious weeds.

Key question 7.2 - Noxious Weeds

The desired future condition for noxious weeds is to maintain or restore native plant community composition, reduce occupation of noxious weeds and prevent introduction of new populations of weeds. The isolated populations of Canada thistle and diffuse knapweed are eradicated through continued removal treatments. Roadside broom populations in Junction City are eradicated or reduced to very low densities and do not present a high fire hazard.

Noxious weed establishment and spread along the Trinity River has been increasing at an accelerated rate because of ever-increasing resident source of weeds, the proximity of Hwy. 299 as a source of new introductions, and the inability to use effective tools to control weeds in Trinity County.

Noxious weeds were non-existent in the planning watersheds prior to European settlement, but were introduced over time with human activity. Many weed populations may have been introduced on machinery used for timber harvest in the past 50 years. Some weeds were introduced in hay used for gathering livestock. Other weeds were introduced as landscaping plants.

For many years weeds have been low to moderate in abundance and restricted primarily to roadsides, but rates of spread are increasing as more people drive through the area and additional resident populations are established. Equipment cleaning provisions in service work contracts help reduce weed introductions and these provisions have become standard for all new contracts.

CHAPTER 5 - MANAGEMENT OPPORTUNITIES TO MEET DESIRED CONDITIONS

This chapter identifies possible management actions that would move the current condition identified in Chapter 3 closer to the desired condition identified in Chapter 4. Actions identified here are for a specific resource element and need to be taken in context with other resource needs. The presence of an opportunity in this chapter does not constitute a decision that must be implemented; they are specific areas that resource specialists wish to bring to the line officers attention. Not all opportunities are feasible and some may be mutually exclusive. The line officer is responsible for deciding which action may be taken forward and analyzed as "proposed actions" in a NEPA analysis.

Issue #1: Human Uses, Values, and Expectations

Recreation

Key question 1.1 – Recreation Resources

- Improve trail and boater access to the Trinity River in cooperation with other agencies.

- Reduce the impacts of dispersed camping adjacent to Big Lake.

Wood Products

Key question 1.2 and 1.3 – Timber Harvest and Fuel Wood

- Use commercial timber sales to meet both wood product needs and vegetation needs of other resources (e.g. fuels objectives or wildlife habitat objectives).

- Improve the road transportation system to provide maximum access within resource constraints. Surface the road surfaces with gravel or shale to allow for wet weather public access.

Heritage Resources

Key Question 1.4 – Archaeological Properties

- Cultural Resource inventories need to be undertaken before proposed actions are initiated to identify known and unknown archaeological properties that may be eligible to the National Register of Historic Places. If impacts are anticipated to eligible sites, necessary management actions need to be identified and carried out.

Issue #2: Access and Travel Management

Key question 2.1 – Access

- Improve arterial road surfaces to meet resource access needs and provide user safety and comfort.

- Develop and maintain a sign plan for access control and regulation of vehicle use of collector routes.

- Rehabilitate and restore OHV impact areas and user-created trails. Provide access control in those areas designated for roaded recreation by maintaining safety signage, road barriers/gates and approved vehicle use entry points.

- Harden / rock segments of routes designated for long term public uses such as: 5N09 (first 3.5 miles), 5N11 (1.6 miles), 5N25 (first 2.5 miles), 33N44 (3.6 miles), 33N45 (first 5.0 miles).

- Improve road stream crossings to improve water quality and to prevent erosion thereby maintaining existing infrastructure investment. Maintain signing at dispersed camping sites to protect natural resources.

Issue #3: Erosional Processes

Key question 3.1 – Mass Wasting

- Avoidance of land disturbing activities is probably the most practicable scheme for large dormant landslide areas.

- Any on-site erosion and sediment control measures that increase infiltration and subsequently soil moisture should not be used on slopes that have a high probability of landslide failure.

- Channel cleanout should be performed on *strategic* areas. Because channels, culverts or basins designed to contain a given volume of debris will become blocked by an irregular mass of trees or other debris unless removed, resulting in an overtopping or destruction of the structure and diversion of the flow.

- For larger intermittent and perennial channels, more significant measures may need to be employed. In alluvial channels, there may be a need to try to establish some local base levels and sediment catchments in order to control lateral cutting and bed load transport of sediment, especially within gutted channels. Measures such as log and rock check dams, bank stabilization, head cut structures, planting of riparian vegetation and placement of large organic material can all be used to aid channel stabilization. These measures could most appropriately be employed along tributary streams underlain by granitics.

- For bedrock-controlled channels, artificial structures may not be as important or practical as in alluvial type channels (since these are usually avalanche chutes for debris flows). However, structures may be necessary in gutted channels where sediment is now available for transport. Structures may be feasible in certain reaches of these channels, which will aid in sediment stabilization, help restore or maintain pool habitat and provide needed cover. Planting riparian vegetation may also contribute to sediment stabilization and will also help provide shading for critical reaches.

- When planning structures at particular locations it must be remembered that channelized debris flows have enormous amounts of energy. It is nearly impossible to try to stop them in the channel. Virtually all debris flows begin to stop flowing naturally when two conditions are met: (flow becomes nonchannelized on at least one side (2) the stream channel gradient is less that 10-15 degrees. The destructive scouring phase of the flow will not usually extend more than 200 meters past this point. Deposition can occur well beyond this point however, depending on the volume and water content of the flow. Another method of predicting runout is to look at fan deposits from old debris flows. Debris flows out of the same valley tend to have similar volumes and runout distances. Future debris flows usually will not extend far beyond the old fans.

- For roads that are contributing sediment to creeks, consider a regular maintenance program. Other possible measures include: armoring the road and drainage ditch, out sloping, enlarging culverts, installing rolling dips and waterbars, or relocation and reconstruction. Road closure should also be considered where roads are needed only for a short term.

- Since the geomorphology and bedrock geology of the Analysis area has been fully mapped this specific information can be used in detailed land management applications:
    - Stratification of the landscape into different erosional regimes (landslide-prone or highly erodible terrain) for a wide variety of purposes, in particular the delineation of riparian reserves.
    - Identification of watershed restoration opportunities and problems.
    - Predicting the distribution of special habitats.
    - Establishing priorities for road decommissioning or long-term road maintenance.
    - Provide recommendations for timber harvest practices.

Key question 3.2 – Soil Erosion and Key question 3.3 – Cumulative Watershed Effects

- Reduce erosion hazard ratings to low values throughout the Burnt Ranch and Soldier Creek watersheds.

- Reduce soil compaction in Hocker and Eagle Ranch meadows.

- Reduce road and roadside erosion and sedimentation into downstream habitats, with attention to road crossings.

- Reduce roaded acres to reduce ERA levels below TMDL levels and improve watershed condition class.

- Reduce fuel loading and ladder fuels within Riparian Reserves adjacent to intermittent or ephemeral streams to reduce the potential for stand replacing fires.

- Identify in-stream flow and fish passage needs when reviewing applications or authorizations for water diversions.

Issue #4: Aquatic Systems and Species

Key Question 4.1 – Anadromous Fish

- Remove the partial barriers to fish passage along Soldier and Dutch Creeks.

Issue #5: Terrestrial Wildlife Habitat and Species

Key Question 5.1 – LSOG

- Manage federal forest land and mature forests to increase LSOG characteristics.

- Treat mature forest stands to reduce the risk of stand replacing fires.

Issue #6: Fire, Fuels, and Air Quality

Key Question 6.1 and 6.2 – Wildfire and Fire Regime

- Support efforts that will implement the recommendations of the CWPP and provide additional benefits to federal lands.

- Treat plantations that are currently overstocked, losing vigor, and at increased risk of loss due to wildfire. Treatments could consist of thinning, pruning, sectioning and scattering, hand piling and burning, chipping and/or yarding. Collectively, these activities are designed to maintain plantation health, reduce the risk of adverse effects from insect and disease, and minimize or reduce the potential for stand-replacing wildfires.

- Develop fuelbreaks, thin wild stands and plantations, and create roadside buffers to reduce fuel loading and enhance fire protection capability.

- Develop firelines from the 2008 wildfires into permanent fuelbreaks. The Forest Service may provide additional support to private land efforts through assisting in grant efforts, treating adjacent federal lands and providing technical expertise.

Issue #7: Plant Communities

Key question 7.1 – Unique Species

- Reduce fuel loading in riparian areas through thinning and/or prescribed fire to minimize the impacts from wildfire on potential bug-on-a-stick and Sensitive fungi habitat.

- Reduce fuel loading in upland conifer habitats to reduce potential for high-intensity wildfire and subsequent loss of overstory in native plant communities and habitats supporting Howell's montia.

Key question 7.2 - Noxious Weeds

- Reduce fuel loading in upland conifer habitats to reduce potential for high-intensity wildfire and subsequent loss of overstory in native plant communities. Noxious weeds have a competitive edge in disturbed habitats.

- Actively remove roadside broom populations in Junction City to reduce fire hazard from vehicles.

- Remove dyers woad plants on National Forest and private lands to prevent continued expansion downriver into Humboldt County

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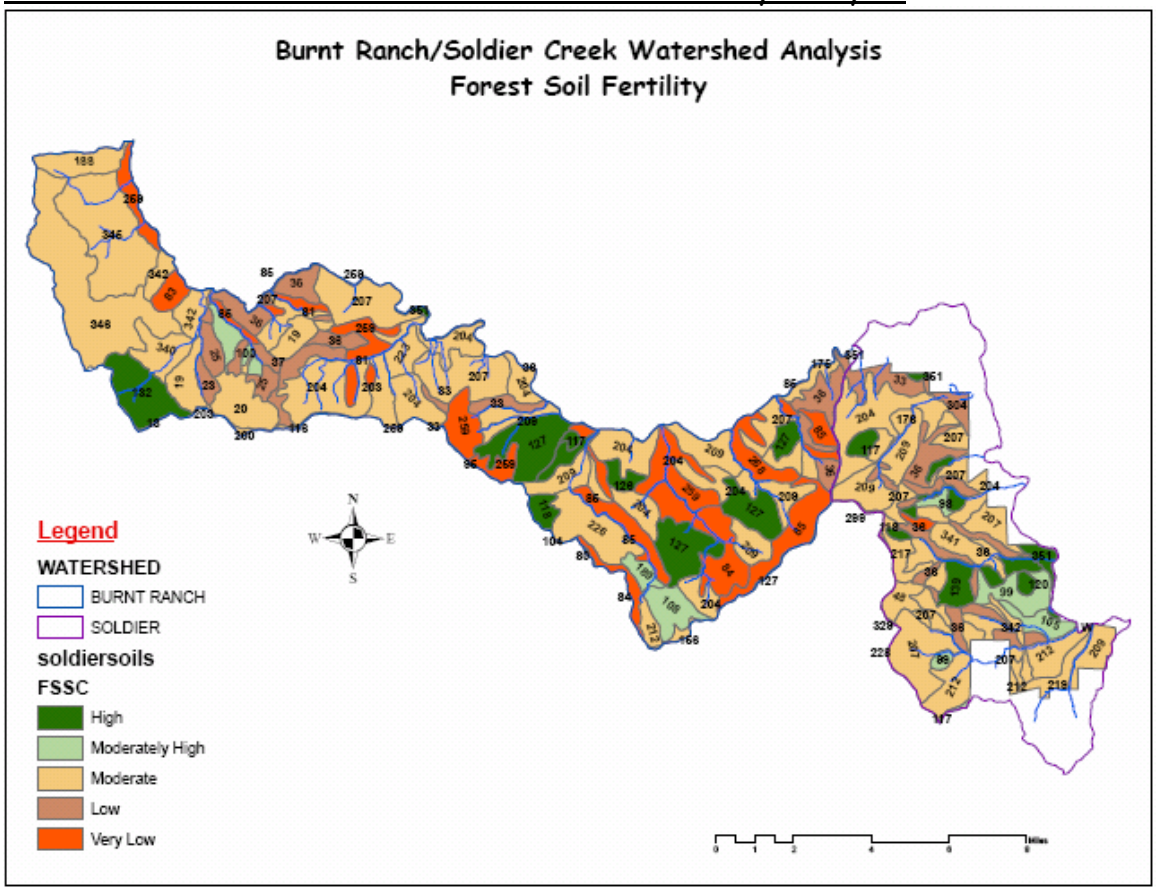
APPENDIX A – SUPPLEMENTAL SOILS INFORMATION

Burnt Ranch/Soldier Creek Forest Soil Productivity Analysis



R5 Soil Interpretation
Forest Survey Site Class

Definition: Forest Survey Site Class (FSSC) is a measure of site productivity in cubic feet of wood per acre per year. This cubic measurement is converted from site index measurements using a crosswalk table, (Silvicultural Handbook Chapter 9 (9.32), Stand Management Records. Figure 2, Page 5. 5/13/83). The purpose of this conversion is so that various site indices can be compared. Soil productivity can then be related to FSSC.

Valid Values:
Valid values are: 1,2,3,4,5,6,7

Units:

FSSC	Cubic feet/acre/year
1	Greater than 225
2	165 to 224
3	120 to 164
4	85 to 119
5	50 to 84
6	20 to 49

7 less than 20

Example/Comments:
(FSSC) 3

Source for the Data Standard:
USDA Forest Service, Pacific Southwest Region, Silviculture Practices Handbook, Chapter 9 (9.32).

Scale of Application:
Individual site or soil taxonomic unit.

Rating Table:
Use Silvicultural Handbook Chapter 9 (9.32), Stand Management Records. Figure 2, Page 5. 5/13/83 to determine Forest Survey Site Class.

Burnt Ranch/Soldier Creek – Past STNF Soil Compaction Results

Soil Compaction Monitoring on Shasta-Trinity National Forest							
Project	Soil	Disturbance			Decrease in Porosity		
		U	D	ST	U	D	ST
		----------%----------					
Iron Cyn 1- moist	Boomer	34.0	32.0	34.0	5.6	8.7	11.1
Iron Cyn 2	Boomer	16.0	60.0	24.0	0.0	1.2	7.0
Campgrounds	Forbes	9.0	44.0	47.0	0.6	3.2	5.7
	Holland	15.0	15.0	70.0	0.6	4.5	3.2
Professor	Neuns (Pre)	96.0	0.0	4.0	0.0	0.0	3.0
	Neuns (Post)	55.0	17.0	18.0	0.0	4.7	4.7
Browns - moist	Forbes	51.0	29.0	20.0	0.0	9.0	11.0
Pettijohn - moist	Forbes	55.0	23.0	22.0	0.0	3.8	9.7
Gemmil	Hugo	66.0	17.0	17.0	0.0	3.4	8.2
Salt	Holland	53.0	27.0	20.0	0.0	2.0	2.0
Reynolds - moist	Boomer (Pre)	68.0	25.0	7.0	0.0	1.2	5.4
	Boomer (Post)	39.0	26.0	18.0	0.0	4.6	12.0
McCloud BS - moist	Shasta	12.0	39.0	19.0	0.0	5.1	9.0
	Holland-A	48.0	31.0	21.0	0.0	2.6	10.3
Beegum-C - moist	Holland (Pre)	60.0	28.0	12.0	0.0	2.0	4.0
	Holland (Post)	48.0	32.0	20.0	0.0	8.0	13.0
E. Fork 2	Holland	52.0	33.0	15.0	0.0	4.3	2.1
Rattlesnake	Holland	63.0	26.0	11.0	0.0	1.0	7.1
(where U = undisturbed, D = disturbed, ST = skid trail; moist = operations occurred when soils were moist)							

The table above shows the soil compaction monitored projects from 2002 to 2007. Soil types are listed from fine-loamy soils (Boomer, Forbes, and Holland) to coarse soils (Neuns and Shasta). Disturbance levels are noted as undisturbed sites, areas with moderate levels of displacement, and areas that have definite skid-trails.

Soil porosity is the standard to measure compaction and it puts change on a relative basis per soil type. Soil porosity is the area of the soil matrix that is occupied by soil voids (maco-pores) that air and water circulate through the soil. Compaction causes a decrease in porosity and for management purposes porosity is a better indice to measure impact changes. The SQS states that soil porosity should be at least 90 percent of total porosity found under natural conditions. Therefore a 10 percent reduction in total soil porosity corresponds to a threshold soil bulk density that indicates detrimental soil compaction. The major zone for measurement is 4 to 8 inch below the soil surface to evaluate the potential for detrimental soil compaction from mechanical harvesting.

Past project activities on the Shasta-Trinity (see table above) has shown when fine-textured soils are operated on with tract based equipment when dry, compaction levels never exceeded 10% decrease in soil porosity vs. when soils were moist compaction levels on fine-textured soils was exceeded over the 15% aerial extent of the Shasta-Trinity Land Management Plan.

Soil information for this watershed is available in the *Soil Survey of Shasta-Trinity Forests Area* report (Lanspa, 1994) that was completed in 1980 (field work) and published in 1994. This survey mapped the soils at 1:63,360 scale. This survey provides information about the soils, their capabilities and their limitations. The soil information contained in the Soil Survey of the Shasta-Trinity Forests Area, while not intended for project level work, does provide a sound background for project level work with further field investigations (Lanspa, 1994).

The following laws, regulations, management plans, Forest Service Manual (FSM) and Forest Service Handbooks (FSH) provide the overall direction for soil resource investigations, standards and guidelines and reasons for conducting field investigations: National Environmental Policy Act of 1969, Forest and Rangeland Renewable Resources Planning Act of 1974; National Forest Management Act of 1976; Soil and Water Conservation Act of 1976; Land and Resource Management Plan-Shasta-Trinity National Forests; FSH 2509.18 Soil Management Handbook R5 Supplement No. 2509.18-95-1; FSH 2509.18 Ch. 3 Pacific Southwest Soil Interpretations; FSH 2509.22 Soil and Water Conservation Handbook, Ch. 10 Water Quality Management For National Forest Lands in California (BMP); FSH 2509.22 Soil and Water Conservation Handbook Ch. 50 Soil Erosion Hazard Rating R5 Amend. 2 1990; and FSM 2552 Soil Management Support Services (1990).

APPENDIX B – GENERAL RECOMMENDATIONS FOR THE BURNT RANCH – SOLDIER WATERSHED ANALYSIS AREA FROM THE TRINITY COUNTY COMMUNITY WILDFIRE PROTECTION PLAN (CWPP).

Listed below are general recommendations for the Burnt Ranch – Soldier Watershed Analysis area from the Trinity County Community Wildfire Protection Plan (CWPP). Specific treatments for private property and federal lands for the Downriver area of Trinity County are described within the CWPP.
http://www.tcrcd.net/pdf/TC_Wildfire_Protection_Plan.pdf

1. Work to integrate fire management planning explicitly into the National Forest Management Act mandated planning process on the national forests and across jurisdictional boundaries to allow for landscape scale prioritization and implementation of pre-fire treatments.

Immediate areas for coordination include:
• Linking the Six Rivers and Shasta Trinity National Forests' Road Management Plans to ensure that roads critical for access in case of fire are being maintained. Further, encourage cooperation among all jurisdictions (Caltrans, Trinity County, USFS, etc.) along any and all roadsides to reduce fuels.
• Coordinating Six Rivers National Forest and Shasta Trinity National Forest Fire Management and Trinity Alps Wilderness Management Plans.

2. Identify and publicize for each community safety zones in case of catastrophic fire.

3. Review the economic value of plantations (e.g., through cost-benefit analysis). Participants noted that considerable expense has already gone into planting the trees and whether one wishes to pursue this type of silviculture in future or not, the existing plantations are both important resources and, if untended, fire hazards. Too often scheduled maintenance thinning is neglected. Consider proactive thinning and fuels reduction of plantations during their period of greatest vulnerability to fire (around year 7).

4. Develop methods for managing vegetation occurring next to or around old growth forest to better protect it from crown fires. It was suggested that there are examples of this type of management working well on South Fork Mountain.

5. Check with USFS-PSW about location of progeny test sites and other long term research areas and map their locations. These resources should be more widely recognized and valued.