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Hayfork Creek drains a basin of 234,000 acres and is the largest tributary of the South Fork of the Trinity River, which flows into the main Trinity River and then to the Klamath River before reaching the Pacific Ocean. The 79,574 acre Middle Hayfork Creek and the 36,328 acre Salt Creek Watersheds (analysis area) drain through Hayfork Valley, and include the Tule Creek, Big Creek, Kingsberry Gulch, Carr Creek, Philpot Creek and Barker Creek watersheds. The middle reach of Middle Hayfork Creek is primarily contained within private land and runs in an approximately east to west direction along the Hayfork Valley floor. The analysis area is located in the Klamath geologic province and is composed largely of Rattlesnake Creek and the Hayfork Terranes and is characterized by late-seral and old growth vegetation, and frequent high gradient and low order steams. Approximately 962 miles of mapped streams are located within the analysis area, of which 109 miles are considered to be accessible to ocean-run fish species. There are 577 miles of roads within the analysis area.

The analysis area lies within portions of two different management areas (MA) described within the Shasta-Trinity National Forests Land and Resource Management Plan (LRMP); Hayfork MA#18, and Indian Valley/Rattlesnake MA#19. Specific land allocations which are taken from the Northwest Forest Plan, are used to direct management activities and identify Standards and Guidelines for land management activities, are identified in Table 1-1 and Figure 1-1.

**Table 1-1**
**Land Allocation**

| LRMP Land Allocation | Middle Hayfork Creek | Salt Creek |
|---|---|---|
| Late Successional Reserve: Rx VIIF-TE&S Species | 15,733 | 461 |
| Matrix: | | |
| Rx III - Roaded Recreation | 12,783 | 17,325 |
| Rx VI - Wildlife Habitat Management | 8,289 | 4,628 |
| Rx VIII - Timber Management | 12,511 | 8,416 |
| Administratively Withdrawn Area | 0 | 0 |
| Congressionally Withdrawn Area | 0 | 0 |
| Private Parcels | 30,255 | 5,496 |
| Total Acreage | 79,574 | 36,328 |

The LRMP has designated all of the analysis area, outside of Late-Successional Reserves, to be within the Hayfork Adaptive Management Area (AMA). Within the AMA there is to be an emphasis on the development, testing, and application of forest management practices which provide for a broad range of forest values, including commercial timber production and provision of late-successional and high quality riparian habitat.

Native Americans occupied the Hayfork Creek drainage for thousands of years, and dozens of prehistoric archeological sites preserve a record of their activities. Many of the Nor-El-Muk (Hayfork Wintu) still live in the area and have an active interest in the Hayfork Creek Watershed, particularly Dubakella Mountain and the massacre site at Natural Bridge.

Anglo-American settlement of Hayfork Valley began in 1852 and it soon became known as the "granary of the county." Much of the analysis area was public domain and was heavily grazed, predominantly by cattle and horses. The mid-1850's saw the beginning of placer mining on several tributaries of the Middle Hayfork and Salt Creek watersheds, followed later by dragline mining and hardrock mining. The lumber industry developed concurrently with the local need for wood products in ranching and mining operations, and became economically important in national markets after World War II. The 1905 formation of the Trinity Forest Reserves (later the Trinity National Forest) led to changes in forest management practices, particularly in grazing and fire suppression.

Fire is a significant disturbance factor within the analysis area.  The recurrence of fire and the recovery of the ecosystem from fire is an important mechanism for the health of the ecosystem dynamics, and has historically maintained structural diversity and health within the analysis are. A fire history analysis of the Happy Camp Ranger District (Skinner and Taylor, 1998) found that fire return intervals varied greatly with the longest return interval found during the suppression period 1900-1992 with a return interval of 24.5 years and the shortest during the 1850 to 1900 settlement period.  This is an indicator that European settlement had impacted the fire rotation both by increasing the rotation and decreased the rotation through suppression. That includes suppression in the form of animal grazing as well as active suppression.

The Happy Camp study indicates that fire regimes (return intervals and severity) were more frequent, generally less severe and had shorter fire return intervals during presettlement history. More frequent fires of low and moderate frequency killed some overstory trees and thinned or killed understory stems.  These mixed severity fires created multi-aged stands.  This frequency and high variability of the fires may be an important factor contributing to the overall diversity of the stands in the watershed (Skinner and Taylor, 1998).  The primary source of fire in this area is from lightning.  Primarily lightning fires occur in the late summer months.

Vegetation types in this fire regime were dominated by fire adapted, fire resistant species. The exclusion of fire, along with other human caused disturbances, has initiated a transition to a fire regime characterized by more frequent, high intensity fire events and vegetation changes such as greater abundance of white fir.

There has also been a transition in fuel composition. Fuels have changed from primarily surface fuels at a low level of loading to moderate or high levels of surface loading, with a vertical fuel ladder connecting the surface fuels to the crowns of the dominant conifers. This vertical fuel ladder is of primary concern and threatens to cause serious damage to the larger more mature timber as well as young plantations.  Parts of the analysis area dominated by ultramafic soils do not show this fuel loading, or show it to a lesser degree.

The 1964 flood and the 1987 fires that totaled more than 10,700 acres are the largest disturbances in the analysis area.  The 1987 fires included the Peanut Fire, a 6260 acre lightning fire, the Rock Fire 1100 acres, unknown cause and the Friendly Fire, 3400 acres, lightning caused.  In 1992 the 5200 acre arson fire, the Barker Fire, occurred in the Middle Hayfork Watershed.

Suitable habitat for endangered, threatened, sensitive, endemic and survey and manage plant and fungi species exists within the analysis area, but comprehensive field surveys for all these species have not been conducted to determine absence or presence of some of these species.

Two ESA listed species, McDonald's rock-cress and water howellia are not known to occur, but have a marginal potential to occur in the analysis area.

Thirteen Forest Service Sensitive (FSS) and Endemic (FSE) plants have known occurrences or the potential for occurrence in the analysis area. Eight of these species have known occurrences in the analysis area, these being Shasta chaenactis, brownie lady's slipper, mountain lady's slipper, serpentine goldenbush, Brandegee's woolly-stars, Dubakella Mountain buckwheat, Niles madia, and peanut sandwort.

The Survey and Manage (SM) species consider for this assessment are only those designated as Component 2 (surveys to protocol) and Protection Buffer species. Three SM vascular plant species have potential for occurrence in the analysis area. Two of these species have known occurrences in the analysis area and are also FSS species, these being brownie lady's slipper and mountain lady's slipper. Four SM non-vascular plant species have potential for occurrence but are not known to occur in the analysis area, these being green bug moss, Pacific fuzzwort, giant-spored tree moss, and goblin's gold. There are no SM lichen species designated as Component 2 and Protection Buffer species with potential or known occurrence in the analysis area. There are seven SM fungi species with potential for occurrence but no known occurrence in the analysis area, these being mountain bondarzewia, donkey ears, rabbit ears, brown donkey ears, black chanterelle, starving man's licorice, and stalked orange peel fungus.

Steelhead trout, chinook salmon, and coho salmon are known to occur, or have historically occurred, within the analysis area. Steelhead trout are the dominant anadromous salmonid within the analysis area (Chris James, pers. comm.). Spring chinook were recently observed in the analysis area up to Little Creek. Intermittent flow areas, log/sediment jams, and improperly constructed road crossings result in temporary or seasonal barriers to juvenile or adult fish migration within the analysis area. Resident rainbow trout (Oncorhynchus mykiss) populations are also found in the analysis area. Brown trout (Salmo trutta) were historically present but are considered extirpated from the analysis area.

Coho has been listed as Threatened under the ESA. Steelhead trout are currently a candidate species for listing. The listing of chinook salmon in the Upper Trinity River basin was not considered warranted by the National Marine Fisheries Service. Aquatic habitat quality and quantity within and downstream of the analysis area is linked to the condition of riparian areas and the balance of sediment and water. The habitat of downstream species could be modified as the result of disturbance in the analysis area.

The transportation system includes 577 miles of road ranging from state highway to rudimentary jeep roads. The community of Hayfork lies in the center of the analysis area and was a logging industry supported town prior to the mill closing in the late 1990's. Early settlement developed water diversions for domestic and agriculture which persist into today. These disturbances along with timber harvest and associated road development, were additive to the natural disturbance regime. These disturbance processes have been widely distributed and of a persistent nature and have caused sustained alterations of ecosystem structure and function, particularly in riparian areas.

**Table 1-2**

**List of Federally Threatened and Endangered, Forest Service Sensitive, Forest Service Endemic, and Northwest ROD "Survey and Manage" or "Protection Buffer" Plant and Fungi Species Know or with the Potential to Occur in the Middle Hayfork/Salt Creek Analysis Area.**

| Taxa | Common Name | Scientific Name | Status[1] |
|---|---|---|---|
| Vascular Plants | sugar stick | *Allotropa virgata* | SM |
| | McDonald's rock-cress | *Arabis mcdonaldiana* | FE |
| | water howelii | *Howellia aquatilis* | FT |
| | Shasta chaenactis | *Chaenactis suffrutescens* | FSS |
| | Brownie lady's slipper | *Cypripedium fasciculatum* | FSS/SM |
| | Mountain lady's slipper | *Cypripedium montanum* | FSS/SM |
| | Oregon willow herb | *Epilobium oreganum* | FSS |
| | Brandegee's woolly-stars | *Eriastrum brandegeae* | FSS |
| | clustered green gentian | *Swertia fastigiata* | FSS |
| | Niles madia | *Madia doris-nilesiae* | FSS |
| | Stebbins madia | *Madia stebbinsii* | FSS |
| | peanut sandwort | *Minuartia rosei* | FSS |
| | Canyon Creek stonecrop | *Sedum paradisum* | FSS |
| | Red Mountain catchfly | *Silene campanulata* ssp. *campanulata* | FSS/CE |
| | serpentine goldenbush | *Ericameria ophitidis* | FSE |
| | Dubakella Mountain buckwheat | *Eriogonum libertini* | FSE |
| Fungi | mountain bondarzewia | *Bondarzewia montana* | SM |
| | donkey ears | *Otidea onotica* | SM/PB |
| | rabbit ears | *Otidea leporina* | SM/PB |
| | brown donkey ears | *Otidea smithii* | SM/PB |
| | black chanterelle | *Polyozellus multiplex* | SM/PB |
| | starving man's licorice | *Sarcosoma mexicana* | SM/PB |
| | stalked orange peel fungus | *Sowerbyella rheana* | SM/PB |
| Bryophytes | green bug moss | *Buxbaumia virdis* | SM |
| | Pacific fuzzwort | *Ptilidium californicum* | SM/PB |
| | goblin's gold | *Schistostega pennata* | SM |
| | giant-spored tree moss | *Ulota megalospora* | SM/PB |

[1] FT – Federally Threatened, FE – Federally Endangered, CE – State Endangered, FSS – Forest Service Sensitive, FSE – Forest Service Endemic, SM – Survey and Manage, PB – Protection Buffer

## Table 1-3

**List of Federally Threatened, Special Concern, Forest Service Region 5 Sensitive, Northwest ROD "Protection Buffer," and "Survey and Manage" Wildlife Species Known or Suspected to Occur in the Middle Hayfork/Salt Creek Analysis Area.**

| Taxa | Common Name | Scientific Name | Status[1] |
|---|---|---|---|
| Amphibians/ Reptiles | | | |
| | Del Norte salamander | *Plethodon elongatus* | SM/PB |
| | Northwestern pond turtle | *Clemmys marmorata marmorata* | R5S |
| | Foothill yellow-legged frog | *Rana Boylii* | R5S |
| | Southern torrent salamander | *Rhyacotriton variegatus* | R5S |
| | | | |
| Birds | Bald eagle | *Haliaeetus leucocephalus* | FT |
| | Northern spotted owl | *Strix occidentalis caurina* | FT |
| | American peregrine falcon | *Falco peregrinus anatum* | DL |
| | Northern Goshawk | *Accipiter gentilis* | R5S |
| | Willow flycatcher | *Empidonax trailii* | R5S |
| | Flammulated owl | *Otus flammeolus* | PB |
| | White-headed woodpecker | *Picoides albolarvatus* | PB |
| | Pygmy nuthatch | *Sitta pygmaea* | PB |
| | | | |
| Terrestrial Mollusks | Church's sideband snail | *Monadenia churchi* | SM |
| | Klamath shoulderband snail | *Helminthoglypta talmadgei* | SM |
| | Papillose tail-dropper slug | *Prophysaon dubium* | SM |
| | Pressley hesperian snail | *Vespericola pressleyi* | SM |
| | Hooded lancetooth snail | *Ancotrema voyanum* | PG |
| | Oregon shoulderband snail | *Helminthoglypta hertlein* | SM |
| | Tehama chaparral snail | *Trilobopsis tehamana* | SM |
| | Shasta chaparral snail | *Trilobopsis roperi* | SM |
| | | | |
| Mammals | Townsend's big-eared bat | *Corynorhinus townsendii* | SM |
| | Pallid bat | *Antrozous pallidus* | R5S |
| | Fringed myotis | *Myotis thysanodes* | SM |
| | Long-eared myotis | *Myotis evotis* | SM |
| | Hoary bat | *Lasiurus cinereus* | SM |
| | Silver-haired bat | *Lasionyteris noctivagans* | SM |
| | Western red bat | *Lasiurus cinereus* | R5S |
| | Long-legged myotis | *Myotis volans* | SM |
| | Pacific fisher | *Martes pennanti pacifica* | R5S |
| | American marten | *Martes americana* | R5S |
| | California wolverine | *Gulo gulo luteus* | R5S |

[1] FT = Federally Threatened, FE = Federally Endangered, SM = Survey & Manage, R5S = Region 5 Sensitive, PB = Protection Buffer, PG = Protect from Gazing, DL = Recently Delisted

**Table 1-4**
**List of Federally Threatened, Candidate for Federal listing and Forest Service Region 5 Sensitive Fish Species Know to or Expected to Occur in the Middle Hayfork/Salt Creek Analysis Area.**

| Taxa | Common Name | Scientific Name | Status[1] |
|---|---|---|---|
| Fish | Coho salmon | *Oncorhynchus kisutch* | FT |
| | Steelhead trout | *Oncorhynchus mykiss* | FC |

[1] FT – Federally Threatened, FC – Candidate for Federal Listing

The purpose of this chapter is to focus on the key elements of the ecosystem relevant to future land management activities, and to identify data and analysis needed to provide broad direction for future projects.

## Issue - Riparian Management

Past human activities such as mining, road construction, fire suppression and timber harvest have modified vegetation, streamflow, and the dynamic equilibrium of riparian areas in the analysis area.

**Key Questions**

- What management activities have occurred in riparian areas?
- What management activities can be used to enhance riparian reserves and the terrestrial and aquatic species habitat within the reserves?
- What streams would benefit from riparian management activities?

## Issue – Water Quality and Watershed Enhancement/Restoration

Past human activities such as mining, timber harvest, water diversions, road construction, and associated road failures have altered natural erosion processes, the dynamic equilibrium of watersheds, and the quantity and quality of fish habitat in the analysis area placing anadromous fish stocks and water quality at risk.

**Key Questions**

- What are the long-term erosional processes in the analysis area?
- What erosional processes have been accelerated by natural and human induced disturbance?
- What areas of Middle Hayfork and Salt Creek watersheds are highly erodible and require special attention or management?
- What watershed processes are out of equilibrium and require restoration efforts?
- What streams would benefit from implementation of channel stabilization or restoration measures?
- What are the processes that create and maintain anadromous fish habitat over long periods of time? Have these processes been altered? If the natural processes have been altered how have they affected anadromous fish habitat? How have human induced disturbance altered these processes?
- What is the predicted future for anadromous fish habitat if the Standards and Guidelines of the Aquatic Conservation Strategy are implemented?

## Issue – Fuels Hazard Reduction

Years of successful fire suppression and management activities have contributed to an increase in fuel loading and modification of fuel arrangements within the analysis area. These activities may have put late seral stage wildlife habitat, salmonid habitat, water quality, commercial timber, and lives and property within the analysis area at an unacceptable risk of loss by catastrophic wildfire.

**Key Questions**

- What is the present fire regime for the analysis area?
- What is the recent historical pattern in fires causes within the analysis area?
- What are the Hazard/Risk ratings within the analysis area?
- What areas would benefit from fuel hazard reduction treatments?
- What types of fuel hazard reduction would be most effective?

### Issue-The reintroduction of Fire into Ecosystem

Fire suppression has successfully removed the low intensity fire regime that has been a part of the ecosystem for thousands of years. The reintroduction of low intensity fire is important to the health of the ecosystem and to the prevention of catastrophic fire in the analysis area. It is also a means to improve wildlife habitat, particularly deer habitat.

**Key Questions**

- What areas would most benefit from prescribed fire for fire protection and fuels reduction?
- What areas would benefit from prescribed fire for deer habitat improvement?
- Would thinning from below prior to prescribed burning in timber stands provide for a healthier stand after the burn?

### Issue – Protection of the community of Hayfork and surrounding communities from damage caused by large wildfires.

The community of Hayfork and the smaller outlying area have been periodically threatened by large wildfires and that threat has been growing.

**Key Questions**

- Is the community at risk and what is the risk level?
- What fuel treatments are needed to reduce the risk?
- Would a program of community involvement and education to the threat of wildfires help the public better prepare for a large wildfire?

### Issue -- Commercial Wood Production - Forest Vegetative Dynamics

The LRMP identifies timber production as an important objective for the Adaptive Management Area/Matrix lands. A primary goal of these lands is to provide a long-term sustained yield of timber from regulated lands (Rx's VIII, VI and III). The LRMP projected levels of timber harvest (PSQ) and desired condition may conflict with other management objectives for these lands.

**Key Questions**

- As compared to historic conditions, what are the current vegetative conditions within the watershed?
- What is the current vigor/growth of stands in the watershed?
- What is the current level of tree mortality in the watershed?
- Are lands designated matrix currently being regulated to provide predicted outputs?
- What regeneration harvesting opportunities are available to move the suitable timber lands toward a Desired Future Condition (DFC) of a fully regulated timber land base?
- What intermediate cutting opportunities are available to maintain stocking levels that will reduce susceptibility to insect attack and maintaining stand growth?
- How can conifer forests be reestablished in areas that are now brushfields?
- What opportunities are available that will meet Adaptive Management Area (AMA) objectives to test forest management practices, including timber harvest practices?
- What silvicultural treatments meet the objectives of other resource requirements?
- What management strategies should be used employed to meet LRMP expectations?

### Issue – Threatened and Endangered, Forest Service Sensitive, Forest Service Endemic, and Survey and Manage or Protection Buffer Plant and Fungi Species

There are known occurrences of and potential habitat for some of the Shasta-Trinity National Forest plant and fungi species of concern in the analysis area. Most of the surveys for plants and fungi species of concern are project driven and comprehensive inventories have not been performed in the analysis area. In particular, few surveys have occurred for the non-vascular plants and fungi, which are of recent conservation concern. Natural and anthropogenic activities have affected habitat for plant and fungi species of concern, and consequently the abundance and distribution of those species.

**Key Questions**

- What is the relative abundance and distribution of the plant and fungi species of concern in the analysis area?
- What is the distribution and character of their habitats?
- Are there opportunities to enhance habitat conditions?

### Issue- Wildlife Dispersal Habitat

The Middle Hayfork and Salt Creek watersheds lie between two Late Successional Reserves (LSRs) and thus should provide adequate connectivity to fulfill its function in the overall strategy to maintain viable populations of species associated with late successional and old growth forest ecosystems (e.g. northern spotted owl, northern goshawk, American marten, and fisher).

**Key Question**

- Where and in what condition is the connectivity for late-seral associated species in the watershed?

### Issue – Noxious, Invasive and Exotic Weeds

One of the most important environmental problems is the invasion of native ecosystems by exotic and noxious plants. Noxious weeds overrun and alter native ecosystems. Noxious weeds form large and aggressive moncultures that displace native plants, which leads to alteration of the long established native flora and fauna relationships (food, habitat, and genetic losses), soil chemistry, fire frequency, and water table levels.

**Key Questions**

- What is the relative abundance and distribution of the noxious weeds in the analysis area?
- What habitats are affected?
- Are there opportunities to identify and control spread of noxious weeds?

# 3.1 EROSIONAL PROCESSES

## 3.1.1 Geology

### *3.1.1.1 Bedrock Geology*

The Middle Hayfork and Salt Creek watersheds are underlain predominately by the "western Paleozoic and Triassic belt" of the Klamath Mountains Geologic Province (Irwin 1960). The unit is further subdivided by Irwin (1972) into three northwest trending terranes: the Rattlesnake Creek, Hayfork, and North Fork. Of these, only Rattlesnake Creek and Hayfork terranes are found in the study area. More recent age dating of cherts by Irwin and others (1977) has yielded far younger radiolarians than expected. These were of Late Triassic to Middle Jurassic in age. There are also minor amounts of Oligocene nonmarine Weaverville Formation found around the town of Hayfork.

Rattlesnake Creek terrane is a complex tectonic melange formed of ophiolite (ocean crust and mantle) and overlying deep-water sedimentary rocks intermixed with shallow water carbonates (Blake and Jones, 1977). The unit includes serpentinized ultramafics, gabbro diabase, quartz diorite, pillow lava and other mafic volcanic rocks, phyllite, thin-bedded radiolarian chert, discontinuous lenses of limestone, and locally interbedded sandstone and pebble conglomerate (CDWR, 1979). This formation is found on the west side of Middle Hayfork Creek Watershed, as well as, the southern end of Salt Creek watershed and makes up approximately 28.5 percent of the study area. It tends to be unstable and prone to erosion and landslides, especially in the smaller blocks of melange and serpentinized zones.

Hayfork terrane consists of pyroxene meta-andesite with layers of slaty argillite, sandstone, pebble conglomerate, thin-bedded chert and sparse lenses of limestone (Irwin, 1972). The lack of serpentinites in this unit, and the dioritic composition of the Ironside Mountain batholith (Jdi), which is an integral part of this terrane make it generally stable and landslides are a minor feature. This unit occupies most of Middle Hayfork and Salt Creek Watersheds with 55.4 percent of the total basin area.

A few remnants of the Weaverville Formation can be found in the Hayfork valley and consists of weakly consolidated mudstone, sandstone, conglomerate with an impervious dark green clay matrix and sparse interbeds of light colored tuff (Irwin, 1974). This unit tends to be unstable especially around roadcuts and streambanks which have oversteepened slopes, but this terrane comprises less than 10 percent of the total study area.

### *3.1.1.2 Geomorphology*

The geomorphology of each bedrock unit are influenced by fluvial and mass wasting erosional processes. Slopes developed on the Hayfork Terrane and large blocks within the Rattlesnake Creek terrane are primarily influenced by fluvial erosion, resulting in densely dissected mountain sideslopes. Mass wasting has also locally influenced many slopes within these bedrock lithologies. In contrast, areas underlain by the small block melange have been strongly developed almost exclusively through mass wasting processes. Hence, the sediment regimes in the watersheds are determined upon individual terranes and their primary erosional processes.

### 3.1.2 Mass Wasting Features

Each of the major bedrock units has a characteristic mass wasting character, due to the difference in the lithologies and structure of each unit. The following mass wasting features are well represented within the study area.

#### *Translational-Rotational Landslides*

This type of slide is defined as one which moves as a coherent or semi-coherent mass along a concave (rotational) or planar (translational) failure plane. This type of slide is not restricted to the zone of weathering and can have deeply lying failure planes. Movements generally occur in the winter and spring when groundwater content is high. Translational-Rotational slides occur primarily within the both the large block and small block melange within the Rattlesnake Creek Terrane. This type of slide occurs in association with at least one of the following: serpentinized shear zones, lithologic contacts and wet steep zones such as inner gorges. Many of these large deep-seated slides are ancient, having developed under different climatic and tectonic influences. It is unlikely that they would reactivate under current conditions, making this feature of low significance.

#### *Debris Slides and Debris Avalanches*

These types of landslide features are confined to shallow soil or the colluvium zone. The failure surface generally corresponds to the bedrock/soil interface and usually is no deeper than fifteen feet. There is a complete gradation from debris slide to debris avalanche depending on water content, cohesion of material and slope steepness. Generally, debris slides have slump blocks at their head, with the slide mass becoming more broken toward the foot of the slope. Movement rates are moderate to high. Debris avalanches, however, commonly fail rapidly, with the slide mass fracturing and liquefying in part as its mass moves down slope. Failures often occur within low-order stream reaches or zero-order basins (swales), or directly adjacent to higher order stream channels. The scars characteristically are long and narrow in shape. Debris slides and avalanches generally occur in response to significant precipitation events. This mass wasting feature is the dominant type found in the Hayfork Terrane, although uncommon, and only in local occurrences.

#### *Internested Translational-Rotational Slides*

Internested Translational-Rotational slide areas are commonly found in areas overlain by cohesive earth materials. Typically they 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. In the higher hazard types, springs and bogs occur.

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. Small block serpentine melange zones within the Rattlesnake Creek Terrane will commonly exhibit this slide type.

### *Slump Earthflows*

Slump earthflows are complex mass wasting features. They are comprised of various components which have varied processes at work. Slump earthflows generally have a well developed head scarp and lateral scarp which are generally steep and prone to debris slide or internested translational rotational slide processes. The slide mass itself is often highly complex in form and generally broken into many smaller blocks; separated from one another by secondary scarps. Commonly, there are sag ponds, wet areas and floating bedrock blocks on the slide mass. Finally, there is often a well defined toe zone at the lower portion of the slide which is often steep and hummocky. Generally, slump-earthflows are relatively slow moving, deep seated masses of clay-rich materials. These features are complex, involving many components of different types of mass movement. In general, slump-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 deep (greater than 50 feet) with movement rates ranging from gradual to 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 slump-earthflows. Earthflow movement rates are sometimes rapid enough to cause channel abandonment and migration on an annual basis.

Slump-earthflows are well developed in the small block melange of the Rattlesnake Creek Terrane. Many extend from the ridgetop to the streams, encompassing thousands of acres. These slump-earthflows are the dominant topography influencing processes within the small block melange.

### *Valley Inner Gorges*

A valley inner gorge is defined as the slope adjacent to a streamcourse having a slope gradient greater than sixty-five percent which is separated from the upslope area by a pronounced break in slope. Valley inner gorges are formed through channel downcutting that produces an oversteepened slope which periodically fails through debris slides, avalanches or translational-rotational slides which "toe out" in the inner gorge. Active slides are commonly present in these areas.

### *3.1.2.1 Erosion Hazard*

Landslide occurrence on slopes within the Middle Hayfork and Salt Creek Watersheds can be broken down into the different bedrock lithologies. The Hayfork terrane is the most stable followed by the Weaverville Formation and the Rattlesnake Creek terrane. The partial table below from (CDRW, 1979) shows the actual percentage of occurrence (Table 3-1).

**Table 3-1**
**Landslide Occurrence**

| Geologic Unit | Percent area of Unit in active, inactive and ancient landslides | | |
|---|---|---|---|
| | Active | Inactive & Ancient | Total |
| Rattlesnake Creek Terrane | 1 | 13 | 14 |
| Hayfork Terrane | 0.1 | 1.3 | 1.4 |
| Weaverville Formation | 0.2 | 1 | 1.2 |

#### 3.1.2.1.1 Slope Stability Hazards

Slope Stability Hazard, as defined by the U.S. Forest Service (Haskins and Chatoian, 1993) is the division of the land surface into areas and the relative ranking of these areas according to degrees of actual or potential natural hazard from landslides or other mass movement on slopes. Natural hazard means the probability of occurrence within a specified period of time, and within a given area of a potentially damaging phenomenon.

This type of hazard analysis considers the relative hazard of the landform component, such as the valley inner gorge, toe zone of a translational slide, debris slide prone slope and crown scarp, in conjunction with material characteristics, slope steepness, local groundwater conditions, and other local factors including seismicity and climate. Features are given a hazard rating on a scale of 1 to 10, with 1 being stable and 10 being extremely unstable. Slope stability hazards within a major portion of the project area are considered to range from none to highly unstable, according to the geologic and topographic conditions previously characterized.

Slope stability hazards exist within the Middle Hayfork and Salt Creek Watersheds. Some areas such as those underlain by the small block melange of the Rattlesnake Creek terrane have extreme erosional hazards, while other areas have relatively low hazards. Ecological Unit Inventories have been performed for the Salt Creek and Thompson Peak areas.

### 3.1.3 Soils

A Soil Resource Inventory (SRI) was completed on the Shasta-Trinity National Forests identifying 105 different soil types. Soil information was compiled in a database for use in broad land management planning. Tables 3-2 and 3-3 are the results of a synthesis of soil order, mineralogy, and associated erosion hazard ratings (EHR) for soils in the Middle Hayfork and Salt Creek Watersheds. The soil information is limited to Forest Service ownership. Tables 3-2 and 3-3 show that the majority of the study area is inceptisols of mixed mineralogy.

**Table 3-2**
**Characteristics of Soil Orders in the Middle Hayfork and Salt Creek Watersheds**

| Soil Order | Suborder(s) | Percent of Total | Percent Erosion Hazard Rating (EHR) within Soil Order |
|---|---|---|---|
| Inceptisols | Ochrepts | **69** | Low (9%)<br>Moderate (50%)<br>High (39%)<br>Very High (2%) |
| Alfisols | Xeralfs | **23** | Low (45%)<br>Moderate (47%)<br>High (7%)<br>Very High (1%) |
| Entisols | Orthents and Fluvent | **6** | Low (27%)<br>Moderate (1%)<br>High (72%) |
| Mollisols | Xerolls | **1** | Moderate (100%) |

**Table 3-3**
**Mineralogy Characteristics in the Middle Hayfork and Salt Creek Watersheds**

| Mineralogy Categories | Percent of Total | Percent Erosion Hazard Rating (EHR) within Mineralogy Category | Primary Soil Families in Mineralogy Category (with general EHR rating) |
|---|---|---|---|
| Mixed | **90** | Low (15%)<br>Moderate (47%)<br>High (36%)<br>Very High (2%) | Neuns Family (M/H EHR)<br>Holland Family (all classes of EHR)<br>Hohmann Family (H EHR)<br>Hugo Family (M EHR)<br>Deadwood Family (M/H EHR) |
| Serpentinitic | **6** | Low (34%)<br>Moderate (49%)<br>High (17%) | Dubakella Family (L/M EHR)<br>Beaughton Family (M EHR)<br>Weitchpec Family (L/M EHR)<br>Lithic Haploxeralfs (H EHR) |
| Oxidic | **3** | Low (90%)<br>Moderate (10%) | Dunsmuir Family (L/M EHR)<br>Forbes Family (L/M EHR) |
| Vermiculitic | **1** | Moderate (100%) | Parrish Family (M EHR) |

The soil objective in the LRMP is to maintain or improve soil productivity, and greatest threat to soil productivity is erosion. The EHR is a rating system based upon topography and the propensity of a soil type to erode. The study area has relatively stable soils with the overall Erosion Hazard Rating of the Forest Service ownership being 18 percent in Low EHR, 47 percent in Moderate EHR, 33 percent in High EHR, and 2 percent in Very High EHR. The soils in the study area that are more prone to erosion include the soil families of Hohmann, Lithic Haploxeralfs, and portions of the Holland, Neuns, and Deadwood. The soil families of Chawanakee and Chaix both have Very High EHR and both are less than 1 percent of the soils in the study area.

## 3.2 WATER RESOURCES

### 3.2.1 Phyiographic Setting

The Middle Hayfork Watershed drains a 124.3 square mile area from the headwaters of Big Creek along the Hayfork Divide to the Lower Hayfork Watershed (Figure 3-1). The Salt Creek Watershed drains a 56.8 square mile area (Figure 3-1).

The Middle Hayfork and Salt Creek watersheds are drained by a dendritic channel network. Major tributaries in the Middle Hayfork Watershed are Big Creek, Barker Creek, Carr Creek, Kingsbury Gulch, and Tule Creek (Figure 3-1). The major tributaries to the Salt Creek Watershed are Philpot Creek, Ditch Gulch, Dobbins Gulch, Salt Gulch and Deer Gulch (Figure 3-1).

The analysis area contains approximately 962 miles of streams. Table 3-4 displays stream miles and densities for the Middle Hayfork and Salt Creek watersheds.

**Table 3-4**
**Stream Miles and Stream Densities**

| Watershed | Perennial Streams (mi) | Intermittent Streams (mi) | Ephemeral Streams (mi) | Stream Density ($mi/mi^2$) |
|---|---|---|---|---|
| Middle Hayfork | 144.0 | 257.2 | 264.1 | 3.23 |
| Salt Creek | 54.9 | 84.4 | 157.8 | 5.23 |

Water uses within the analysis area include withdrawals for mostly domestic, agricultural, and livestock purposes. The town of Hayfork withdraws water from Big Creek for domestic use.

Annual precipitation ranges from 70 inches in the highest elevations of the analysis area to less than 40 inches in Hayfork Valley. Most of this precipitation falls as rain below 4,000 feet and as snow above this elevation.

### 3.2.2 Stream Channel Conditions

Stream channels in the headwaters of the Middle Hayfork and Salt Creek Watersheds are characterized as high energy, low order streams with stream gradients greater than 10% and sideslopes which can exceed 70%. These channels function largely as transport channels, delivering largewoody debris (LWD), fine sediment, and organic material to downstream channels. This type of stream is considered an A type channel (Rosgen 1996). Fish habitat is limited in these channels due to the lack of fish access, intermittent flows, high gradients, absence of spawning gravels, and poor rearing habitat. Inner gorge slides can occur in these channels and are the primary disturbances associated with LWD and sediment delivery.

As streams progress downstream into higher order channels, channels are high to moderately entrenched, with low to moderate sinuosity, and have channel gradients between 0.5 and 10%. This type of stream is classified as a B type channel Tables 3-5 and 3-6 describe channel characteristics of Big and Salt Creeks.

A reach of Hayfork Creek from the base of Hayfork Valley (4.5 mile upstream of Nine Mile Bridge) to 9 miles upstream was habitat typed in 1990 (Frink et al., 1990). The most common channel features by length were low gradient riffles (22%), main channel pools (16%) and glides (15%). Sand and fine sediment comprised 20% of the substrate in all habitat types and 30% in pools.

Current channel conditions have been affected in the last century primarily by mining activities within riparian areas, wildfires and subsequent salvage logging, grazing and the extent and intensity of timber management activities in the past 30 years. Mining activities have included both placer and hydraulic mining in the riparian areas. Big Creek has been heavily mined in the past with much of the large rock and debris removed and as result woody debris was not abundant in Big Creek (USFS, 1990). Mining tailings continue to constrict flows on Hayfork Creek and provide a downstream sediment source.

Timber management activities have occurred throughout the analysis area. Road building and use of tractor yarding harvesting systems in the analysis area have had the effect of increasing overland flow to stream channels and producing increased fine sediment loads. Increased peak flows also occur because of the increase in drainage density resulting from inside road ditches and direct drainage from skid trails. Grazing on Carr Creek, Salt Creek and its tributaries, and Hayfork Creek has caused a loss of riparian vegetation and bank trampling.

**Table 3-5**
**Channel Morphology Characteristic of Big and Upper Salt Creeks**

| | **Watershed** | |
|---|---|---|
| | **Big Creek** | **Upper Salt Creek** |
| Pools (% Area) | 7.2 | 18.2 |
| Step Runs (% Area) | 64.4 | 49.9 |
| Glides (% Area) | 12.2 | 9.3 |
| Riffles (% Area) | 13.4 | 8.9 |
| Width (ft) | 4-55 | 4-30 |
| Average Width (ft) | 15.6 | 11.5 |
| Average Depth (ft) | 0.9 | 0.2 |
| Average Pool Depth (ft) | 1.49 | 0.95 |
| Gradient (%) | 1-8 | 1-8 |
| Average Gradient (%) | 2.8 | 2.9 |

**Table 3-6**
**Channel Substrate Characteristics of Big and Upper Salt Creeks[1]**

| Watershed | Bedrock (% Area) | Boulder (% Area) | Cobble (% Area) | Gravel (% Area) | Sand (% Area) | Fines (% Area) |
|---|---|---|---|---|---|---|
| **Big Creek** | | | | | | |
| Pools | 19 | 15 | 20 | 32 | 6 | 8 |
| Riffles | 12 | 13 | 30 | 37 | 6 | 2 |
| **Salt Creek** | | | | | | |
| Pools | 25 | 21 | 19 | 19 | 14 | 2 |
| Riffles | 10 | 31 | 31 | 19 | 9 | 0 |

| Average Substrate Percentage and Embeddedness | Watershed | | | |
|---|---|---|---|---|
| | Big Creek | | Salt Creek | |
| | Pools | Riffles | Pools | Riffles |
| Bedrock | 19 | 12 | 25 | 10 |
| Boulder | 15 | 13 | 21 | 31 |
| Cobble | 20 | 30 | 19 | 31 |
| Gravel | 32 | 37 | 19 | 19 |
| Sand | 6 | 6 | 14 | 9 |
| Fines | 8 | 2 | 2 | 0 |
| Embeddedness | N/A | 16 | N/A | 16 |

[1] Measurements of substrate composition, percent fines, and embeddedness are ocular qualitative estimates.

### 3.2.3 Hydrology

There is a limited amount of actual streamflow measurements within the analysis area to characterize the magnitude of peak and base flows. The USGS maintained a continuous flow gage on Big Creek within the Middle Hayfork Watershed from 1961-1967. Table 3-7 displays minimum and maximum flows at the Big Creek station for the period of record. Another USGS gaging station is located on Hayfork Creek just downstream of the confluence with Carrier Gulch. Flows were recorded at this station from 1956 to 1965. Table 3-8 displays minimum and maximum flows for the Hayfork Creek station for the period of record. Flow measurements taken in Salt Creek from June through August of 1989 and ranged from 3 cfs to 7 cfs (USFS, 1990).

**Table 3-7**
**Big Creek USGS Flows**

| Water Year | Minimum Flow (cfs) | Maximum Flow (cfs) |
|---|---|---|
| 1963 | 0 | 403 |
| 1964 | 0 | 411 |
| 1965 | 0 | 1,130 |
| 1966 | 0.1 | 191 |
| 1967 | 0 | 484 |

**Table 3-8**
**Hayfork Creek USGS Flows**

| Water Year | Minimum Flow (cfs) | Maximum Flow (cfs) |
|---|---|---|
| 1957 | 7.0 | 1,920 |
| 1958 | 5.5 | 3,260 |
| 1959 | 2.0 | 1,490 |
| 1960 | 3.3 | 2,810 |
| 1961 | 2.5 | 1,180 |
| 1962 | 1.8 | 735 |
| 1963 | 4.0 | 1,910 |
| 1964 | 2.1 | 1,620 |
| 1965 | 2.4 | 5,430 |

The Trinity County Resource Conservation District (TCRCD) and Natural Resources Conservation Service (NRCS) monitored flow at several locations within analysis area in 1995 and 1996 (TCRCD, 1997). Table 3-9 describes the monitoring locations and parameters measured.

**Table 3-9**
**TCRCD/NRCS Monitoring Locations**

| Watershed | Site Number | Location & Legal Description | Data Collected | Period of Collection |
|---|---|---|---|---|
| Middle Hayfork | 02 | Hayfork Creek<br>T31N; R12W Sec. 9 NE of NW | Temperature, Chemistry, Flow | 1995-1996 |
| Middle Hayfork | 21 | Carr Creek<br>T31N; R11W Sec 3 SW of SW | Temperature, Chemistry, Flow | 1995-1996 |
| Middle Hayfork | 22 | Carr Creek<br>T32N; R11W Sec 35 NE of NE | Temperature, Flow | 1995-1996 |
| Middle Hayfork | 23 | Carr Creek<br>T32N; R11W Sec 35 NE of SW | Temperature | 1995 |
| Middle Hayfork | 25 | Carr Creek Riparian Zone<br>T31N; R11W Sec 35 NE of SW | Ambient Air Temperature | 1995 |
| Middle Hayfork | 31 | Big Creek<br>T31N; R11W Sec 8 NW of SW | Temperature, Flow | 1995-1996 |
| Middle Hayfork | 32 | Big Creek<br>T32N; R11W Sec 30 | Temperature, Flow | 1995-1996 |
| Middle Hayfork | 51 | Barker Creek<br>T31N; R11W Sec 4 | Temperature, Flow | 1996 |
| Salt Creek | 41 | Tule Creek<br>T31N; R12W Sec 10 NE of SW | Temperature, Flow | 1995-1996 |
| Salt Creek | 15 | Salt Creek<br>T30N; R11W Sec 19 NE of NE | Temperature, Flow | 1995-1996 |
| Salt Creek | 14 | Salt Creek<br>T30N; R11W Sec 18 SW of SE | Temperature, Flow | 1995-1996 |
| Salt Creek | 12 & 13 | Salt Creek<br>T31N;R12W Sec 13 NE of NE | Temperature, Flow | 1995-1996 |
| Salt Creek | 11 | Salt Creek<br>T31N;R12W Sec 10 SE of SE | Temperature, Chemistry, Flow | 1995-1996 |

Flow was measured by TCRCD/NRCS from July through October in 1995 and June through October in 1996. Table 3-10 summarizes the results of the flow measurements.

**Table 3-10**
**TRCD/NRCS Flow Monitoring**

| Watershed | Site No. | 1995 Flow Range (cfs) | 1996 Flow Range (cfs) |
|---|---|---|---|
| Middle Hayfork | 02 | 18.0-76.0 | 7.3-127.4 |
| Middle Hayfork | 31 | 0.8-14.5 | 1.8-23.0 |
| Middle Hayfork | 21 | 2.0-9.5 | N/A |
| Middle Hayfork | 22 | 0.9-2.5 | N/A |
| Middle Hayfork | 32 | N/A | 5.5-29.6 |
| Middle Hayfork | 51 | N/A | 1.6-2.5 |
| Salt Creek | 11 | 1.4 -13.0 | 0.1-23.9 |
| Salt Creek | 15 | 0.8 -7.0 | 0.7-8.4 |
| Salt Creek | 41 | N/A | 0.4 |

Minimum flows are relatively low for forested watersheds. With the analysis area at an overall low elevation, mostly below 4000 feet most precipitation falls as rain and is quick to runoff into the stream system, leaving little water storage for low flows. The summers are hot and dry for several months running through the summer and into the autumn of the year. The accumulated effect of these factors results in very little water flowing during the late summer and early autumn months of the year.

Maximum or peak flows occur in response to rainfall events, primarily in the months of December and January. The analysis area is susceptible to rain on snow events occurring between the elevations of 4000 and 5500 feet. These events result when warm wet storms saturate existing snow packs causing greater than normal peak runoff events.

Water diversions in the lower reaches of Hayfork Creek have been recognized as being a detriment to downstream water quality and fish habitat, (Trinity County, 1987). It is generally recognized that the supply of water in the Hayfork Valley in dry years is not sufficient for current users and beneficial uses in Hayfork Creek (Trinity County, 1987). Trinity County declared the Hayfork watershed (from Little Creek to its headwaters) to be a Critical Water Resource area in 1987. The effect of this declaration was to prevent sub-division of parcels unless water rights could be secured by means other than riparian rights. In a report prepared in 1988 Trinity county also identified the East Fork Ranch Diversion of Hayfork Creek below Wildwood as the cause for significant water supply problems (Trinity County, 1988). In 1987 this diversion had completely dewatered Hayfork Creek downstream of its dam. Subsequent cooperative efforts with the NRCS and TCRCD have resulted in improvements to prevent a repeat of such conditions.

### 3.2.4 Water Quality

#### *Temperature*

Water temperatures vary depending on location. In general, the lower reaches tend to have higher water temperatures than the more confined upstream reaches. This may be due to the lower reaches having less riparian vegetation and shade canopy, higher air temperatures, wider stream channels being exposed to solar radiation, and less topographic shading. Large scale mining activities along the Hayfork Creek channel removed most of the vegetation decades ago.

The TCRD and NRCS monitored temperature at 12 stations on private land in 1995 and 1996 (Table 3-6). All of the data collected included daily high and low water temperatures between the months of June and October. Based on data from TCRCD and NRCS (1997) the relatively low elevation of the watershed contributes to low water temperatures ranging from 61-64°F (16-18° Celsius) during the summer months and daily high water temperatures exceeding 68°F (20° C) were common both years. Farber (Farber et al., 1998) recorded maximum weekly average water temperatures in 1996 that ranged from a low of 63°F (17.3°C) in the upper reaches of the Salt Creek Watershed to 75°F (24.1°C) on Salt Creek at its confluence with Hayfork Creek. Maximum water temperatures in Hayfork Creek commonly exceed 24°C during the summer. Studies have shown that water temperatures exceeding 24°C can be lethal unless salmonids can find areas of cooler water during summer low flow conditions.

#### *Chemistry*

Data for total dissolved solids (TDS), specific conductance, pH, total coliform and fecal coliform were collected at Hayfork Creek Site 02 and Salt Creek Site 11 (Table 3-9) within the analysis area, two upstream sites on Hayfork Creek, Deep Gulch (T31N; R11W Sec 15 SW of NE) and Wildwood Mad River Road above Highway 36 (T29N; R11W Sec 11 SW of SW), and one downstream site Bar 717 Camp (T3N; R7E Sec 22 SW of NE) from 1994-1996 (Table 3-11). Generally these parameters suggest that the sampling at the upstream location, Wildwood Mad River Road, has the lowest TDS and specific conductance values. This site is most representative of water quality conditions on National Forest land.

pH values of 8.0 and 8.5 are commonly recorded in streams within the South Fork Trinity River watershed (USFS, 1990). The level of pH indicates that there has been no reduction of water quality from acid mine drainage from the old mining sites in the analysis area.

Coliform counts (both total and fecal) vary widely as can be expected with such infrequent and time dispersed sampling. Fecal coliform counts fall within the range of acceptable limits for primary contact recreation waters.

**Table 3-11**
**TCRCD/NCRS Water Quality Monitoring**

| Watershed | Monitoring Location | TDS (mg/l) | Specific Conductance @ 25°C (umhos/cm) | PH (units) | Fecal Coliform (MPN/100 ml) | Total Coliform (MPN/100 ml) |
|---|---|---|---|---|---|---|
| Middle Hayfork | Hayfork Creek Site 02 | 127-572 | 180-860 | 7.9-9.1 | 30-490 | 75-885 |
| Salt Creek | Salt Creek Site 11 | 127-600 | 190-740 | 7.8-8.4 | <5-490 | 45-1600 |
| N/A | Deep Gulch | 130-450 | 200-810 | 8.1-9.4 | <5-170 | 20-900 |
| N/A | Mad Road | 100-680 | 130-330 | 8.1-8.6 | <5-220 | <5-30 |
| N/A | Bar 717 Camp | 105-420 | 180-340 | 8.0-9.2 | <5-10 | <5-400 |

### *Sediment*

Sources of sediment within the analysis area include:

- Road surface erosion - Surface erosion of road tread, ditches, cutslopes, and fillslopes.
- Mass wasting – Debris slides, debris torrents, deep-seated landslides, slumps, or talus.
- Road washouts and gullies – Stream crossing failures, small cutslope and fillslope failures, and gullying of road tread, ditches, and fillslopes.
- Hillslope surface erosion – Surface erosion of timber harvest and fire areas.
- Streambank erosion – Erosion of streambanks.

The South Fork Trinity River and Hayfork Creek Sediment Total Maximum Daily Loads (US Environmental Protection Agency, 1998) estimated the following sediment delivery for the Hayfork Creek Watershed (Table 3-12).

**Table 3-12**
**Hayfork Creek Sediment Delivery Summary, 1944 to 1990**

| Source | Hayfork Creek | |
|---|---|---|
| | Tons/yr | Tons/mi²/yr |
| **Management-related Sources[a]** | | |
| Harvest-Mass Wasting | 1,123 | 3 |
| Harvest-Surface Erosion | 3,435 | 9 |
| Roads-Mass Wasting | 836 | 2 |
| Roads-Surface Erosion | 21,120 | 55 |
| Roads-Washouts, gullies, small slides | 14,680 | 38 |
| Cumulative/Other—Mass Wasting and Bank Erosion | 30,453 | 79 |
| **Total Management Sources** | **71,647** | **185** |
| | | |
| **Non-Management Sources** | | |
| Mass Wasting | 6,262 | 16 |
| Surface Erosion (grasslands, fire, chaparral) | 5,813 | 15 |
| Bank Erosion[b] | 56,221 | 145 |
| Total Non Management Sources | **68,296** | **176** |
| **TOTAL SEDIMENT SOURCES** | **139,942** | **361** |
| Sub-basin Land Area (mi²) | | |
| | | |

[a] Agriculture and mining not included.
[b] Bank erosion is probably overestimated relative to other estimates

Source: (EPA, 1998), (Raines, 1998)

## 3.3 HUMAN USE AND HERITAGE RESOURCES

The analysis area is rich in heritage resources including archaeological sites, both historic and prehistoric, and ethnographic sites. Chanchelulla Peak is the most important of the ethnographically recorded sites and is considered sacred by the present-day Nor-Rel-Muk. Traditionally it was used as a place where shamans and others went to seek power and communicate with the spirit world. Members of the Nor-Rel-Muk continue to journey to the top of the peak to gain personal inner balance and harmony. The Peak has been determined eligible for the National Register of Historic Places, and the tribe was instrumental in gaining wilderness area status for the mountain.

The Natural Bridge is also considered important to many of the Nor-Rel-Muk because of the 1852 massacre that resulted in the death of about 150 men, women, and children. This site, which contains prehistoric and historic components as well as a spectacular natural formation, has been nominated for the National Register of Historic Places

Most of the public lands within the analysis area have been extensively surveyed for archaeological resources, documented in 49 Archaeological Reconnaissance Reports (ARR) and addenda.  All 50 sites have been formally recorded. Many are located along Hayfork Creek and its tributaries, but others are found on ridgelines and mid-slopes. The distribution of recorded sites by sub-area is given in Table 3-14.

Of the 50 total sites, 29 are prehistoric, 17 historic and 4 sites contain both prehistoric and historic components. Of the 2 sub-areas, both contain historic sites, and include mining sites, some with habitation debris, cabins or other habitation debris, ditches, and trails. Four sites have both prehistoric and historic components. Twelve of the sites have been determined eligible for inclusion on the National Register of Historic Places, 13 have been found to be not eligible, and the remainder has not been evaluated.

**Table 3-13**
**Distribution of Sites**

| Watershed | Number of Sites | Prehistoric/Historic | % of ARR |
|---|---|---|---|
| Middle Hayfork | 39 | 22 Prehistoric<br>14 Historic<br>3 Both Components | 98% Coverage |
| Salt Creek | 11 | 7 Prehistoric<br>3 Historic<br>1 Both Components | 100% Coverage |

## 3.4 VEGETATION

Current vegetative conditions are the result of past natural occurrences and human management activities.  A primary influence has been timber harvesting activities.  The first major harvesting took place following World War II when the  typical entries were selection cuts (partial cutting) and ponderosa pine was the only species replanted.  The 1960’s through the 1980’s saw a silvicultural shift to clearcutting and mixed species were used to replant the harvested areas. Harvesting in the past decade has been very limited utilizing sanitation-salvage cuts yarded by helicopter.

Both the Middle Hayfork Creek and Salt Creek watersheds are dominated by forest type vegetation.  Less than 5% of the USFS ownership in these watersheds is classified as non-forest strata.  There are 5,394 acres in the Middle Hayfork Watershed, and 3,706 acres in the Salt Creek Watershed that are plantations.  The plantations are classified by age class in three categories: 1 – 10 years old, 11 – 20 years old, and 21+ years old.  The Middle Hayfork Watershed has 5.8% of its total USFS acreage in plantations 1 – 10 years old, 3.6% of its acreage in plantations 11 – 20 years old, and 1.5% of its acreage in plantations 21 years or older.  The Salt Creek Watershed has 9.3% of its total USFS acreage in plantations 1 – 10 years old, 2.7% of its acreage in plantations 11 – 20 years old, and 0.1% of its acreage in plantations 21 years or older.

Current conditions were analyzed with the use of timber inventory data collected for the LRMP. Delineated stands were classified according to the LRMP timber stratification, and seral stage (Table 3-14).

**Table 3-14**
**Vegetative Strata, Size Classes and Densities by Acre, Excluding Private Land**

| Vegetation Type | Size | Density | Hayfork Creek | Salt Creek |
|---|---|---|---|---|
| Mixed Conifer | 2 | P | 715 | 927 |
| | | G | 1,147 | 1,150 |
| | 3 | P | 16,284 | 14,781 |
| | | G | 17,949 | 5,299 |
| | 4 | G | 4,086 | 406 |
| | 6 | G | 100 | 0 |
| Plantations | 1-10 Years | | 2,873 | 2,857 |
| | 11-20 Years | | 1,799 | 818 |
| | 21+ Years | | 722 | 31 |
| Hardwoods | | | 530 | 0 |
| Knobcone Pine | | | 38 | 359 |
| Non-commercial Conifers | | | 540 | 685 |
| Non-commercial Hardwoods | | | 1,293 | 1,210 |
| Non-forest Shrubs and Brush | | | 1,242 | 2,228 |
| Grass and Herbaceous | | | 55 | 42 |
| Non-vegetated | | | 14 | 27 |
| TOTAL | | | 49,387 | 30,820 |

Acreages of timber types available for commercial timber production are shown in Table 3-15.

**Table 3-15**
**Acreages Available for Timber Production***

| Vegetation Type | Size | Density | Middle Hayfork Creek | Salt Creek |
|---|---|---|---|---|
| Mixed Conifer | 2 | P | 270 | 728 |
| | 2 | G | 593 | 903 |
| | 3 | P | 10,594 | 11,523 |
| | 3 | G | 7,212 | 3,515 |
| | 4 | G | 1,199 | 209 |
| | 6 | G | 55 | 0 |
| Plantations | 1 – 10 years | | 1,493 | 2,281 |
| | 11 – 20 years | | 1,023 | 688 |
| | 21+ years | | 276 | 20 |
| **Totals** | | | 22,715 | 19,867 |

*Includes commercial forest types within matrix areas. Excludes grasslands, noncommercial forest types, late successional reserve areas, 100-acre designated owl circles, and riparian reserves.

### 3.4.1 Landscape Ecology

The Middle Hayfork and Salt Creek watersheds are characterized by medium to dense mixed conifer communities. Forest type designations cover 95% of the typed polygons in the watersheds (USFS lands). Ponderosa pine and Douglas-fir comprise the predominant species with lesser amounts of sugar pine, incense-cedar and white fir. Higher elevation stands are predominantly white fir with some stands almost pure white fir.

Areas of special concern within these watersheds include the portions of the grass areas that are wet areas and areas of serpentine outcrops that provide unique habitat.

### 3.4.2 Description of Vegetative Types

Grass areas represent a very minor portion of this watershed. These areas were once somewhat larger than they are currently; however, efforts toward fire exclusion over the past century have allowed conifer encroachment into the grass types.

#### *Riparian Vegetation Communities*

Forest vegetation and stream classification GIS layers were used to assess current riparian conditions within the analysis area. Riparian areas make up 23,344 acres of the 81,969 total typed acreage of the watersheds (Figure 3-2 ). Over 75% of the riparian areas are in mixed conifer size class 3 or larger, with about 60% of those stands with dense crown closure (> 40%), and with patchy crown closure (20 – 39%). (Table 3-16.)

**Table 3-16**
**Riparian Acreages by Vegetative Stratum***

| Stratum | Hayfork Matrix | Hayfork LSR | Salt Cr. Matrix | Salt Cr. LSR | Totals for Watersheds |
|---|---|---|---|---|---|
| MC2P | 88 | 35 | 188 | 0 | 311 |
| MC2G | 187 | 59 | 260 | 0 | 506 |
| MC3P | 2,922 | 557 | 3,306 | 43 | 6,828 |
| MC3G | 3,382 | 2,120 | 1,713 | 34 | 7,249 |
| MC4G | 617 | 908 | 149 | 7 | 1,681 |
| MC6G | 2 | 4 | 0 | 0 | 6 |
| Plantations | 462 | 442 | 678 | 9 | 1,591 |
| NC Conifers | 193 | 0 | 276 | 0 | 469 |
| Hardwoods | 454 | 30 | 396 | 0 | 880 |
| Brush | 270 | 31 | 470 | 0 | 771 |
| Grass | 8 | 13 | 25 | 0 | 46 |
| Non Forest | 0 | 0 | 6 | 0 | 5 |
| Totals | 8,585 | 4,199 | 7,467 | 93 | 20,344 |

*Acreages of intermittent and ephemeral watercourse riparian areas have been increased by 15% to account for unmapped watercourses.

Riparian vegetation composition within the watersheds is influenced by channel aspect, gradient, geomorphology, and hydrologic regime, as reflected by stream order. Upland plant communities located on the valley bottom floor or toeslope positions contribute shade and large wood to the system. Many riparian areas host relatively high numbers of large trees as compared with the adjacent uplands, presumably due to a favorable topographic position (protected from intense stand replacing fires) and environment. Communities well-adapted to the moist conditions of the riparian zone are present and often consist of species that are tolerant of saturated soils associated with frequently flooding or a high water table. Additionally, opportunistic “pioneer” species may colonize in these areas characterized by repeated disturbance.

Insulation appears to influence the distribution of riparian plant communities. The degree to which a channel is incised determines to some extent the amount of solar radiation received by, and the relative humidity of, that channel environment. Due to microclimatic factors at channel confluences, riparian vegetation may persist for several hundred feet up a tributary that would otherwise not support hydrophytic species.

## 3.6 WILDLIFE HABITAT

### Late Successional Reserves (LSR)

The objective of the LSR is to protect and enhance conditions of late successional and old-growth forest ecosystems which serve as habitat for late-successional and old-growth related species including the spotted owl (USDA and USDI 1994). The Shasta-Trinity National Forest has published a Forest Wide LSR Assessment, dated August 26, 1999. The document is stored in the wildlife office of the Hayfork Ranger Station and in the wildlife program manager's office in the supervisor's office in Redding. Please refer to this document for information regarding the existing, historic, desired, and future conditions of all the LSRs on the forest, as well as treatment criteria and recommendations for implementation and monitoring. Below is a discussion on the portions of LSR in the Middle Hayfork and Salt Creek watersheds.

Approximately 16,829 acres of LSRs are located in the Middle Hayfork Creek Watershed. This includes 15,729 acres of the Corral LSR (RC-332), which is approximately 18% of the entire 86,778 acre LSR. Additionally, there are 11 one-hundred-acre spotted owl LRSs that are distributed throughout the matrix lands of this watershed. Habitat within the Corral LSR consists of 2,257 acres (14%) of late seral (4N, 4G, and 6G), 9,576 acres (61%) of stands with size class 3 trees, and 3,896 acres (25%) of size class 2 or smaller trees, grassland, rock outcrops, burned over areas, lakes, etc., if present. Of the size class 3 trees, 7,321 acres have crown closure densities greater than 40% (3N and G), and 2,255 acres have crown closure densities less than 40% (3P and S).

Approximately 860 acres of LSRs are located in the Salt Creek Watershed. This acreage includes approximately 460 acres of the Chanchellula LSR (RC-331) that comprises less than 2% of the entire 26,389 acre LSR. There are also four 100-acre spotted owl LSRs that are distributed throughout the matrix lands of this watershed. Habitat within the LSR consists of 56 acres (12%) of late seral (4N and 4G), 347 acres (76%) of stands with size class 3 trees, and 57 acres (12%) of size class 2 or smaller trees, grassland, rock outcrops, burned over areas, lakes, etc., if present. Of the size class 3 stands, 238 acres have crown closure densities greater than 40%, and 109 acres have crown densities less than 40%.

### Late Successional and Old Growth Habitat

Numerous wildlife species, including many species of special status that are known or suspected to occur in these watersheds are associated with late-seral habitats. Late-successional forest includes mature and old growth age classes as defined in the Forest Ecosystem Management Assessment Team (FEMAT) Report Glossary, 1993. The majority of late successional species find suitable habitat in size classes 4-6, with 25 foot or greater crown diameters and crown closure densities exceeding 39% (U.S. Forest Service 1999).

In the Middle Hayfork and Salt Creek watersheds mature stands with late-successional characteristics may also be found in size-density class 3G and possibly 3N. The amount of 3N and 3G that meets mature characteristics for late-successional habitat is subject to field verification. A portion of these acres may meet the criteria of late-successional old growth needed for the 15% retention of Late-Successional Forest in 5$^{th}$ order watersheds. The acres of high quality late-successional and old growth habitat within LSRs and on matrix land are displayed in Table 3-17a. The acres of 3G and 3N stands are displayed in Table 3-17b. The spatial distribution of stands is displayed in Figure 3-3.

**Table 3-17a**
**Acres of High Quality Late-Successional and Old Growth Habitat on LSRs and All Forest Service Lands in the Middle Hayfork Creek and Salt Creek Watersheds.***

| Vegetation Type | Middle Hayfork Creek | | Salt Creek | |
|---|---|---|---|---|
| | LSR | Total | LSR | Total |
| 4N | 34 (<1%) | 276 (<1%) | 8 (2%) | 66 (<1%) |
| 4G | 2,179 (14%) | 3,810 (8%) | 48 (10%) | 340 (1%) |
| 6G | 44 (<1%) | 101 (<1%) | 0 (---) | 0 (---) |
| Total | 2,257 (14%) | 4,187 (9%) | 56 (12%) | 406 (1.5%) |

* Total percentages are based on those acres capable of producing Late-successional /old growth habitat. (Middle HF =45,697, Salt= 26,271)
* * LSR percentages are based on acres of LSR in each watershed (see Table 1-1).

**Table 3-17b**
**Acres of Mid-Sized Stands That May Be Considered Late Successional Forest Habitats***

| Vegetation Type | Middle Hayfork Creek | | Salt Creek | |
|---|---|---|---|---|
| | LSR | Total | LSR | Total |
| 3N | 1,968 (12%) | 6,325 (14%) | 154 (33%) | 3,068 (12%) |
| 3G | 5,353 (34%) | 11,624 (25%) | 0 (---) | 2,222 (8%) |
| Total | 7,321 (46%) | 17,949 (39%) | 154 (33%) | 5,290 (20%) |

* Total percentages are based on those acres capable of producing Late-successional /old growth habitat. (Middle HF =45,697, Salt= 26,271)
* * LSR percentages are based on acres of LSR in each watershed (see Table 1-1).

In the Middle Hayfork Watershed, approximately 9% of Forest Service lands are currently classified as late-successional/old-growth forest habitat; in the Salt Creek Watershed, less than 2% is of the same classification. In the Middle Hayfork Creek and Salt Creek Watersheds, an additional 39% and 20%, respectively, of capable habitats are classified as 3N and 3G stands that must be field checked to determine whether or not they are late successional habitat. Additionally, some stands that are classified as 4G may have been previously harvested by selective cutting leaving only the smaller trees. Errors may work both ways. Field verification will ensure that the Middle Hayfork Creek Watershed will meet the 15% late successional habitat retention standards. However, even with field verification, it is not likely that the Salt Creek Watershed will meet the 15% late successional retention standards. The majority of habitat in both watersheds and LSRs is of crown diameter size class 3. In time, desired late-successional and old-growth characteristics will be created as these younger stands mature and change through successional development.

## Dispersal Habitat and Corridors

Dispersal habitat for forest interior species includes all of the late successional habitat mentioned above in Table 3-17a, plus mid-sized stands of trees with a minimum of 11" dbh and 40% crown closure (size class 3N & G and older size class 2N & G stands). In the Middle Hayfork Creek Watershed, approximately 23,288 acres (46%) of Forest Service lands are classified as dispersal habitat; in the Salt Creek Watershed, approximately 6,850 acres (22%) are of the same classification (Figure 3-4). Dispersal corridors and connectivity within Middle Hayfork and Salt Creek watersheds are lacking. Private lands that consist of primarily meadow and agricultural land in and near the town of Hayfork and along Highway 3 divides the northern portion of the analysis area from the southern portion; the southern portion includes primarily Tule and Salt Creek Watersheds. Connectivity between the two LSRs would be considered a physical bottleneck within the watershed, found connected only by the western edge. The headwaters of West, East and mainstream Tule Creek, as well as several of the tributaries of Hayfork Creek appear to be the important linkages on this western edge. However, there are sections of non-capable dispersal habitat just north of West Tule Creek that could pose as a barrier to dispersal for some slow moving late-successional associated species (e.g. herpetofauna). While these open areas may not be a complete barrier for species such as the spotted owl, the openness of the landscape presents significantly higher risks of predation then is found in more closed canopy habitat.

Dispersal corridors between the Middle Hayfork Creek Watershed and adjacent watersheds in the north are available primarily in the headwaters of Big Creek, East Fork Big Creek, and Barker Creek. LSR RC-332 encompasses the northern portion of these creeks and also includes portions of adjacent watersheds to the east (Dutch and Soldier creeks), and west (Price, Big Bar, and Solider Bar creeks). Dispersal corridors are also available in the southwestern portion of the Middle Hayfork Watershed and the South Fork of the Trinity River Watershed via the headwaters of Tule and Plummer creek drainages. Listed in descending order, habitat in this area consists of mixed conifer 3G, 3P, 4G, and plantations.

Dispersal corridors between the Salt Creek Watershed and adjacent watersheds is lacking in most areas and directions. The primary habitat type along the edge of this watershed is mixed conifer (3P) and plantations. In the southeastern portion of this watershed, the 460 acres of LSR is part of the much larger Chanchellula LSR that encompasses a large portion of the adjacent watershed and partially surrounds the Chanchellula Wilderness Area.

Almost the entire eastern boundary of the two watersheds is adjacent to private and non-Forest Service lands. Dispersal of late-successional species to east of Middle Hayfork and Salt Creek watersheds is not a reliable option.

## Snags and Down Logs

Snags and down logs are two of the key habitat elements of late-seral habitat. Even though snags and down logs are usually associated with late seral habitats, these habitat elements can be utilized by numerous wildlife species, including several species of special status, in early and mid-seral stages too. As described in more detail in Parks et al. (1997) there are three structural stages for snags and down logs. Structure class 1 represents those trees that have died recently and retain most of their bark and branches. These snags are used primarily for foraging by woodpeckers on bark beetles, and by bats that may roost under the loose bark. Structure class 2 represents those snags that have been dead at least several years and have lost some branches and bark (except grand fir and Douglas fir which retain their bark after death), tops are broken and there is evidence of decay. Class 2 snags are typically used by woodpeckers for nesting and foraging. Structure class 3 snags represent those snags that have been dead a long time and lack branches and bark (except grand fir and Douglas fir which retain their bark after death) and are extensively decayed. These snags are useful for foraging and nesting by secondary cavity nesters, such as the flammulated owl. Structure class 1 snags are considered hard snags and structure class 2 and 3 snags are considered soft snags. Soft snags are more useful to most wildlife species. Down logs follow the same decay rating as snags, but they are lying on the ground and will likely be broken and fragmented because of their fall. Soft logs are more useful to wildlife than hard snags.

Snag surveys were conducted over a large portion of the Middle Hayfork Creek Watershed, as part of the Hayfork Forest Health Environmental Assessment, in 1996. An estimated snag density of both hard and soft snags was approximately 1.75 snags per acre; soft snags are distributed at less than one per acre. It is likely that in the older stands snag abundance will exceed 1.75 snags per acre; in tree plantations, snag abundance will likely be lower than 1.75 snags per acre.

## 3.5 FISH HABITAT

Hayfork Creek supports anadromous runs of steelhead and spring chinook salmon. Coho salmon inhabited the watershed in the past (CDFG, 1993), but are now thought to be extirpated. Steelhead are known to spawn and rear within the analysis area. Chinook salmon are known to seasonally occupy the analysis area during upstream adult and downstream juvenile migrations.

The upper reaches of the analysis area have relatively cool water temperatures and provide good rearing habitat for juvenile steelhead. The pool:riffle ratios by length range from 1:4 to 1:9. The upper higher gradient reaches tend to have lower amounts of fine sediment than downstream areas. The USFS (1989) and PWA (1994) reported densities of steelhead were lower in the downstream reaches than upstream. Those reaches flowing through the valley floor tend to be heavily grazed, have higher water temperatures, and subject to water withdrawls for agricultural purposes. The upstream reaches have been adversely affected by historic timber harvesting, road construction, and mining activities. Local landowners have been engaged in an active stream restoration program that includes cattle exclusion fencing, riparian planting, and erosion control activities. These activities should help contribute to recovery of salmonid habitat along the valley floor.

The middle reach of Hayfork Creek flows through the valley in a roughly east to west direction. The pool:riffle ratio is approximately 1:6. However, residents of Hayfork describe this reach as having much deeper pools prior to the 1964 flood. Water quality tends to be lower in Hayfork Creek than its tributaries. PWA (1994) reported population surveys were not conducted in this reach due to the severe water quality. Several dead juvenile steelhead were observed during the course of their stream survey. The Valley floor is primarily in private property, much of which is used for agricultural and residential purposes. As such Hayfork Creek is exposed to a variety of impacts including bank erosion from cattle, road runoff and its associated oil and chemical contamination, poaching of salmonids, and removal of riparian vegetation. As mentioned in the preceding paragraph, local landowners have been involved in stream restoration efforts to improve salmonid habitat.

Removal of trees from riparian areas from timber harvesting, mining, road construction, fire suppression, and channel clearing following flood events has altered the amount and rate of recruitment of large woody debris into Hayfork Creek and its tributaries. The lack of instream LWD has affected the number of pools, complexity of salmonid habitat, sediment routing, and probably decreased smolt production. For example only 7% and 18% of the stream surface area in Salt Creek and Big Creek, respectively is in the form of pools. Raleigh et al. (1984) reported that for all channel types, less than 20% pool area is poor. In addition, Raleigh et al. (1984) determined that conditions were poor if less than 30% of pools were formed by LWD and fair if 30-60% were LWD formed. Approximately 39% and 24% of the pools in Salt Creek and Big Creek respectively were formed by LWD. The USFS has responded to this lack of LWD by placing instream wood structures in an attempt to restore some of the natural function of the stream channels.

### *Fish Species*

Steelhead can be found throughout the analysis area, while chinook salmon utilize middle Hayfork Creek primarily as a migration corridor to and from spawning and rearing habitat in the East Fork Hayfork Creek. Two small fish migration barriers are present in Philpot Creek: a transitory log/sediment barrier and an improperly constructed culverted bridge at the downstream entrance to the Philpot Campground. Thermal barriers to juvenile salmonid migration may exist due to elevated water temperatures in Hayfork Creek and the lower reaches of its tributaries. In addition, a diversion dam with a fish ladder is present on Big Creek. Fish bearing streams are displayed in Figure 3-6.

### *Steelhead Trout*

<u>Life History</u>

Winter run steelhead enter the analysis area in the early fall through spring and begin spawning in December. Preferred water temperatures for spawning migration are 3.9-9.4°C (39-49ºF). Steelhead are capable of repeat spawning. Up to 30% can survive to spawn a second or third time, but in large drainages where fish migrate long distances, the proportion is much lower (Meehan and Bjorn 1991). Steelhead tend to construct redds (spawning nests) for egg deposition in gravels ranging in size from 0.6-10.2 cm. (Bjornn and Reiser 1991). Egg development is temperature dependent and usually takes 31 days at 10°C (50ºF) (Flosi, et al. 1998). Intergravel mortality of steelhead can occur when fine sediments (<0.85 mm.) exceed 13% of the substrate composition (Spence et al. 1996). Upon emerging from gravel, the fry rear in edgewater habitats and move gradually into pools and riffles, as they grow larger. Juvenile steelhead will spend 1 to 3 years in fresh water before migrating to the ocean (Busby et al. 1996). Preferred water temperatures for rearing are reported to be 10-13°C (50-56ºF) with an upper lethal limit of 23.9°C (74ºF) (Bjornn and Reiser 1991). However, juvenile steelhead are known to utilize the lower Mad, Eel, and Van Duzen Rivers in Humboldt County, where maximum daily water temperatures frequently exceed 24°C (75ºF) for several weeks at a time (Halligan, 1998;1999). Most downstream smolting migration takes place in spring and early summer. Most steelhead will spend 1 to 2 years in the ocean before returning to spawn. For more information refer to Busby et al. (1996).

Status within the Project area

Steelhead are a "candidate" species for listing under the ESA in the Klamath Mountain Province Evolutionarily Significant Unit (ESU). The National Marine Fisheries Service (Busby et al. 1996) stated "While absolute abundance of steelhead within the ESU remains fairly high, since about 1970 trends in abundance have been downward in most steelhead populations for which we have data, and a number of populations are considered by various agencies and groups to be at some risk of extinction."

The following information is taken in its entirety from PWA (1994). Local anglers report that the abundance of winter steelhead has declined substantially since the 1964 flood. This observation is consistent with the findings of Rogers (1972, 1973) who compared redd counts from 1964 and 1972 for upper Trinity River tributaries and Hayfork Creek and its tributaries. In 1964 there were over 5000 redds (spawning nests) counted in contrast to 352 in 1972. Anglers interviewed recalled a resurgence in abundance of steelhead in the late 1970's, but a subsequent drop in the 1980's.

It is especially difficult to accurately estimate adult steelhead populations since peak runs occur during periods of highly turbid runoff, flooding, and snow. Traditional counting techniques such as redd counts and weirs are fairly ineffective during these periods.

### *Chinook Salmon*

Life History

Fall-run chinook salmon generally leave ocean waters and enter rivers in late August through late fall as long as sandbars do not block the stream mouths. Spring-run chinook migrate through the Analysis area around May through July on their way to the East Fork Hayfork Creek, where they hold in pools during the summer prior to spawning in the fall. Spawning usually occurs from October through January (Flosi, et al. 1998) when water temperatures are between 5.6-13.9°C (41-57°F) (Bjornn and Reiser, 1991). Chinook are riffle spawners and tend to utilize gravel substrate at the head of riffles or pool tails ranging in size from 1.3-15 cm. Chinook die after spawning. The eggs develop in the gravel for 50-60 days before hatching, depending on water temperatures. Embryo survival rates begin to decrease when the amount of substrate smaller than 6.35 mm. exceeds 20% (Bjornn and Reiser, 1991). Young salmon emerge from gravel after the yolk sac is absorbed 2 to 4 weeks later. Juvenile chinook generally begin their downstream migration soon thereafter. Downstream migration is usually complete by late June, but some fish may remain in estuaries until fall and enter the ocean as yearlings. Chinook will remain in the ocean for 3 to 5 years before returning to freshwater to spawn.

Status within the Project Area

NMFS determined that ESA listing of chinook salmon in the Upper Klamath and Trinity Rivers ESU was not warranted (Myers, et al. 1998). NMFS (Meyers, et al. 1998) found that the fall-run populations are at relatively high abundances, near historical levels, and trends are generally stable. However, NMFS has substantial concern about the spring-run populations, which are at approximately 10% of their historical abundance due to dams blocking access to historical spawning and rearing habitat. Snyder (1931) reported the spring chinook run was once very pronounced and supported a commercial fishery but by 1931 was limited to individual fish and of little economic importance. Jong and Mills (1992) reported spring runs in the South Fork Trinity River exceeding 11,000 fish in 1964. Dean (1995) reported current South Fork Trinity River spring runs appear stable at 400-1,000 fish with 29 chinook being observed in Hayfork Creek. Spring-run chinook are thought to primarily utilize lower Hayfork Creek. However, local residents reported that during the 1950's spring chinook spawned in the mainstem Hayfork Creek and in the lower reaches of Salt Creek, Big Creek, Tule Creek, and the East Fork Hayfork Creek (PWA 1994). PWA (1994) reported that juvenile chinook were observed upstream of East Fork Hayfork Creek in 1990. Since no fall chinook were ever known to spawn in upper Hayfork Creek, it seems likely that the juveniles were of spring chinook stock.

## 3.6 THREATENED, ENDANGERED, SENSITIVE, SURVEY AND MANAGE, AND PROTECTION BUFFER SPECIES

### 3.6.1 Plant and Fungi Species

The analysis area is situated in following geographic subdivisions of California; California Floristic Province, Northwestern California Region, and the transition area between the Klamath Ranges Subregion and the High North Coast Ranges District in the North Coast Ranges Subregion (Hickman, 1993). The California ecological subdivisions of the analysis area are the Mediterranean Regime Mountains Division, Sierran Forest – Alpine Meadows Province, Klamath Mountains Section, and three subsections of this section Trinity Mountain – Hatfork, Rattlesnake Creek, and Oregon Mountain (USDA, 1994). The analysis area is mountainous with an approximate elevation range of 2,000 to 6,000 feet. The climate is cold and wet in the winter season (precipitation in the form of snow and rain), and hot and dry in the summer season. These factors supply the following general vegetation/habitat types for plants and fungi:

- Douglas-fir Forest
- Hardwood and Mixed Evergreen Forest
- True Fir Forest
- Jeffrey pine and incense cedar woodlands
- Knobcone Pine Forest
- Riparian Forest
- Chaparral
- Grassland
- Wetland; meadow, marsh, swamp, bog and fen

There are several sensitive habitat types in the analysis area, serpentine substrates (derived from ultramafic rocks), rock outcrops, and wetlands. The analysis area also contains substrates that frequently have rare taxa associated with them, these being serpentine, granitic, limestone, and volcanic. The serpentine substrates of the analysis area support the most vascular species of concern and are associated with scattered ultramafic rock intrusions in the upper Salt Creek, Philpot Creek and Tule Creek watersheds. In particular, the Dubakella Mountain area is known for its floristic diversity and high number of rare and endemic serpentine plants (Jimerson et. al. 1995). Many of the known occurrences of the vascular plant species of concern are associated with serpentine substrates in this vicinity. The serpentine habitat is both naturally fragmented (scattered intrusions), as well as fragmented from human activities such as roads, skid trails and landings construction, especially in the upper Salt Creek drainage.

Overall fragmentation of plant and fungi habitat has occurred throughout the analysis area due to past development and grazing of the Hayfork valley, and logging of the slopes and riparian corridors, mining, and road building activities.

### *Federal Threatened or Endangered Plants*

There are no known occurrences of any federal T&E species in the analysis area. There is potential habitat for one federally and state listed Endangered plant, McDonald's rock cress (*Arabis macdonaldiana*), and one federally listed Threatened plant, water howellia (*Howellia aquatilis*) (Table 3-18).

There is potential habitat for McDonald's rock cress in the high elevation and rocky areas with serpentine substrates. Although, the potential for occurrence is low due to the known distribution of this species being linked with specific serpentine intrusions south and north of the analysis area (Red Mountain in Mendocino County, and Salmon Mountain in Trinity County).

There is potential habitat for water howellia in ponding wetlands, which are scattered throughout the analysis area. This species has known occurrence south of the analysis area in seasonal ponds on the Mendocino National Forest.

**Table 3-18. Federally Listed Endangered and Threatened Species (FE and FT) with Potential Habitat or Known Occurrence in the Analysis Area.**

| Species | Status | Occurrence | Habitat |
|---|---|---|---|
| *Arabis macdonaldiana*<br>McDonald's rock cress | FE/CE | No | Dry gravelly to bouldery, moderate to steep, semi-stabilized slopes of serpentine or peridotite origin, typically on ridges. Often on rocky sites in Jeffrey pine woodlands. 3,950 to 5,000 feet in elevation (Jimerson et. al., 1995). |
| *Howellia aquatilis*<br>water howellia | FT | No | Lakes, marshes, swamps, and ponds, often seasonal. Mendocino County, Western Oregon, Western Washington and Northern Idaho. |

[1] FT – Federally Threatened, FE – Federally Endangered, CE – State Endangered, FSS – Forest Service Sensitive, FSE – Forest Service Endemic, SM – Survey and Manage, PB – Protection Buffer

### *Forest Service Sensitive Plants*

There are six FSS vascular plant species with known occurrences and potential habitat for an additional five species in the analysis area (Table 3-19). The majority of these species are associated with rock outcrops, wetlands, and serpentine substrates.

It should be noted that two vascular plants have recently been dropped from the FSS species list and have known occurrences in the analysis area. These species are Heckner's lewisia (*Lewisia cotyledon* ssp. *heckneri*) and pale yellow stonecrop (*Sedum laxum* ssp. *flavidum*). The current status of Heckner's lewsia is a California Native Plant Society (CNPS) List 1B (rare, endangered or threatened in California and elsewhere), and a federal Species of Concern. The current status of pale yellow stonecrop is a CNPS List 4 (plants of limited distribution, a watch list) with no federal status.

**Table 3-19**

**Forest Service Sensitive Species (FSS) with Potential Habitat or Known Occurrence in the Analysis Area (Habitat Descriptions Nelson 1999).**

| Species | Status | Occurrence | Habitat |
|---|---|---|---|
| *Chaenactis suffrutescens*<br>Shasta chaenactis | FSS | Yes, 1 occurrence along southern WA ridgeline in the Salt Creek drainage. | Rocky open slopes, cobbly river terraces on ultramafic soils or glacial till with ultramafic rocks. 2,600 to 6,900 feet in elevation. Eastern Klamath Ranges. |
| *Cypripedium fasciculatum*<br>Brownie lady's slipper | FSS/SM | Yes, occurrences in the Philpot Creek and Big Creek drainages. | Mixed conifer or oak forests on a variety of soil types, often associated with streams. 1,300 to 6,000 feet in elevation. Widespread but sporadic. |
| *Cypripedium montanum*<br>mountain lady's-slipper | FSS/SM | Yes, occurrences, in the Philpot Creek and Big Creek drainages. | Mixed conifer or oak forests on a variety of soil types, often associated with streams. 1,300 to 6,000 feet in elevation. Widespread but sporadic. |
| *Epilobium oreganum*<br>Oregon willow herb | FSS | No, but known occurrences in the vicinity of the analysis area. | Wet, gently sloping stream banks, meadows, & bogs, generally on ultramafic soil. 500 to 7,800 feet in elevation. Klamath Ranges and Oregon. |
| *Eriastrum brandegeae*<br>Brandegee's woolly-stars | FSS | Yes, occurrences on the valley floor in the vicinity of Hayfork. | Dry gravelly to loamy soils on flats and benches, closed cone pine forests or chaparral. 1,000 to 2,800 feet in elevation. North Coast Ranges |
| *Frasera umpquaensis*<br>*(Swertia fastigata)*<br>clustered green-gentian | FSS | No, but known occurrences southwest of analysis area in the Picket Peak area. | Cool, moist Douglas-fir/white fir forest margins or openings. 5,000-6,000 feet in elevation. South Fork Mountain in Trinity County and Southwest Oregon. |
| *Madia doris-nilesiae*<br>Niles madia | FSS | Yes, occurrences in Ditch Gulch, Salt Creek and Tule Creek drainages. | Rocky ultramafic ridgetops & slopes with Jeffrey pine, gray pine and shrubs. 2,100 to 5,500 feet in elevation. Southern Klamath Ranges. |
| *Madia stebbinsii* | FSS | No, but known occurrences just | Rocky ultramafic semi-barrens with Jeffrey pine, gray pine and shrubs. |

| Species | Status | Occurrence | Habitat |
|---|---|---|---|
| Stebbins madia | | south of the analysis area. | 2,100 to 6,000 feet in elevation. Southern Klamath Ranges and Inner North Coast Ranges. |
| *Minuartia rosei*<br>peanut sandwort | FSS | Yes, occurrences in the Bridge Gulch and Philot Creek drainages, and the Blue Point Ridge and the Dubakella Mtn. area | Gravelly serpentine barrens and openings in Jeffrey pine/mixed conifer forest. 2,500 to 5,800 feet in elevation. Southern Klamath Ranges. |
| *Sedum paradisum*<br>(*Sedum obtusatum* ssp. *paradisum*)<br>Canyon Creek stonecrop | FSS | No, known occurrences east of analysis area. | Rock outcrops in forest or woodland openings. 960 to 6,500 feet in elevation. Southern Klamath Ranges. |
| *Silene campanulata* ssp. *campanulata*<br>Red Mountain catchfly | FSS/CE | No, known occurrences south of the analysis area. | Dry pine forest or openings, more often on ultramafic soils. 3,000 to 4,500 feet in elevation. Southern Klamath Ranges to Central North Coast Ranges. |

FT – Federally Threatened, FE – Federally Endangered, CE – State Endangered, FSS – Forest Service Sensitive, FSE – Forest Service Endemic, SM – Survey and Manage, PB – Protection Buffer

### *Forest Service Endemic Plants*

There are two known occurrences of FSE vascular plant species in the analysis area (Table 3-20). Both of these species are associated with serpentine substrates in the southern portions of the analysis area.

**Table 3-20**

**Forest Service Endemic Species (FSE) with Potential Habitat or Known Occurrence in the Analysis Area (Habitat Descriptions Nelson 1999).**

| Species | Status | Occurrence | Habitat |
|---|---|---|---|
| *Ericameria ophitidis*<br>(*Haplopappus opohitidis*)<br>serpentine goldenbush | FSE | Yes, occurrences in Ditch Gulch drainage, and the Blue Point Ridge and Dubakella Mtn. area | Serpentine semi-barrens or openings in Jeffrey pine/incense cedar woodland. 2,600 to 5,600 feet in elevation. Peaks of the southern Klamath Ranges. |
| *Eriogonum libertini*<br>Dubakella Mountain buckwheat | FSE | Yes, 4 occurrences, along the southern WA ridgeline in the Salt Creek drainage. | Openings in Jeffrey pine/incense cedar woodland or chaparral, on ultramafic soils. 2,500 to 5,500 feet in elevation. Peaks of the southern Klamath Ranges. |

FT – Federally Threatened, FE – Federally Endangered, CE – State Endangered, FSS – Forest Service Sensitive, FSE – Forest Service Endemic, SM – Survey and Manage, PB – Protection Buffer

### *Survey and Manage Plants and Fungi*

The Survey and Manage (SM) plants and fungi are of recent conservation concern (1994), in particular the non-vascular plants and fungi. Surveys for the non-vascular and fungi species have not been extensive and survey efforts have only recently been initiated. Although overlooked in the past, the non-vascular and fungal species are an integral component of the forest ecosystem serving a variety of functions and occupying a diverse array of habitats (Table 3-21).

There are certain SM plant and fungi species that have been identified in the Presidential Record of Decision-Standards and Guidelines of April 1994 as requiring field surveys prior to implementing ground disturbing activities. These SM plants and fungi are termed Survey Strategy 2 (SS) and Protection Buffer (PB) species. Brownie lady’s slipper and mountain lady’s-slipper are the only two SM SS2 or PB species with known occurrences in the analysis area, due to their double status of being FSS species and vascular plants they have been surveyed for more extensively. There is potential habitat for an additional nine SM SS2 or PB plant and fungi species.

**Table 3-21**
**Federal Survey and Manage Species (SM) with Potential Habitat or Known Occurrence in the Analysis Area. Habitat Descriptions of Bryophytes by Christy (1996) and Habitat Descriptions of Fungi by Arora (1986).**

| Species | Status | Occurrence | Habitat |
|---|---|---|---|
| **Vascular Plants** | | | |
| *Allotropa virgata*<br>sugar stick | SM/SS1/SS2 | No, but known occurrences north of the Trinity National Forest. | Red fir, montane mixed conifer forest, often associated with matsutake fungus, likely with tanbark oak in western Trinity County. |
| *Cypripedium fasiculatum*<br>Brownie lady’s slipper | FSS/SM/SS1/ SS2 | Yes, four occurrences, one in the Salt Creek and three in the Big Creek drainage | Mixed conifer or oak forests on a variety of soil types, usually associated with streams. 1,300 to 6,000 feet in elevation. Widespread but sporadic. |
| *Cypripedium montanum*<br>mountain lady’s-slipper | FSS/SM/SS1/SS2 | Yes, four occurrences, two in the Salt Creek and another two in the Big Creek drainage | Mixed conifer or oak forests on a variety of soil types, often associated with streams. 1,300 to 6,000 feet in elevation. Widespread but sporadic. |
| **Non-Vascular Plants** | | | |
| *Ptilidium californicum*<br>Pacific fuzzwort | SM/SS1/SS2/PB | No, but known occurrences in the Trinity National Forest. | Epiphyte on base of tree trunks or recently fallen logs of large white fir or Douglas-fir. 3,000 to 5,000 feet in elevation. Northern California to southeast Alaska. |
| *Schistostega pennata*<br>goblin’s gold | SM | No, but based on personal communication with Six Rivers Forest SM surveyor, Jeanne McFarland, this is a possibility. | On damp rock, soil and decaying wood in dark places such as openings of caves or mine shafts, rock crevices or overhangs (particular sandstone), animal burrows, shaded banks, crevices of root balls of fallen trees, or around tree roots in dark and dense forests. |

| Species | Status | Occurrence | Habitat |
|---|---|---|---|
| *Ulota megalospora*<br>Giant spored tree moss | SM/PB | No, but known occurrences northwest of the Trinity National Forest. | Epiphyte on conifers and hardwoods, particularly maples, alder and tanbark oak. Low to mid elevations. Northern California to southeast Alaska. |
| **Lichens** | | | |
| None. No Component 2 or Protection Buffer lichen species expected on the Shasta-Trinity National Forest. | | | |
| **Fungi** | | | |
| *Bondarzewia montana*<br>mountain bondarzewia | SM/SS1/SS2/SS3 | No, but known occurrence northwest of the analysis area along the Trinity River. | Tree pathogen of conifers, usually near stumps or trunks. Broad distribution in western U.S. |
| *Otidea leporina*<br>rabbit ears | SM/SS3/PB | No, but based on personal communication with Six Rivers Forest SM surveyor, Jeanne McFarland, this is a possibility. | Hardwoods and conifers. Widely distributed. |
| *Otidea onotica*<br>donkey ears | SM/SS3/PB | No, but based on personal communication with Six Rivers Forest SM surveyor, Jeanne McFarland, this is a possibility. | Hardwoods and conifers. Widely distributed. |
| *Otidea smithii*<br>brown donkey ears | SM/SS1/SS3/PB | No, but based on personal communication with Six Rivers Forest SM surveyor, Jeanne McFarland, this is a possibility. | Conifers in old growth. Pacific Northwest and northern California. |

| Species | Status | Occurrence | Habitat |
|---|---|---|---|
| *Polyozellus multiplex*<br>Black chanterelle | SM/SS1/SS3/PB | No, but based on personal communication with Six Rivers Forest SM surveyor, Jeanne McFarland, this is a possibility. | Associated with roots of spruce, true fir, or aspen. Mid elevations in montane conifer forest. Northern and montane North America. |
| *Sarcosoma mexicana*<br>Starving man's licorice | SM/SS3/PB | No, but based on personal communication with Six Rivers Forest SM surveyor, Jeanne McFarland, this is a possibility. | Rotting wood or duff under conifers. Mountains of Oregon and northern California, western North America and Mexico |
| *Sowerbyella rhenana*<br>Stalked orange peel fungus | SM/PB | No, but within range of species. | Undisturbed, older conifer forests. |

FT – Federally Threatened, FE – Federally Endangered, CE – State Endangered, FSS – Forest Service Sensitive, FSE – Forest Service Endemic, SM – Survey and Manage (SS1 - manage known sites, SS2 - survey prior to activities and manage sites, SS3 - conduct extensive surveys and manage sites, SS4 - conduct general regional surveys), PB – Protection Buffer

### *Other Species of Concern*

There are several vascular plants identified by US Fish and Wildlife Service, California Native Plant Society (CNPS), and/or California Department of Fish and Game (CDFG) as species of concern with known occurrence in the analysis area. These species are Heckner's lewisia (*Lewisia cotyledon* ssp. *heckneri*), Howell's lewisia (*Lewisia cotyledon* ssp. *howellii*), and woolly meadowfoam (*Limnanthes floccosa* ssp. *floccosa*). As mentioned previously the current status of Heckner's lewsia is a CNPS List 1B (rare, endangered or threatened in California and elsewhere), and a federal Species of Concern. The currents status of Howell's lewsia is a CNPS List 3 (plants about which we need more information, a review list) and a federal Species of Concern. The current status of woolly meadowfoam is a CNPS List 2 (plants rare, threatened or endangered in California but more common elsewhere) with no federal status.

### *Noxious Weeds*

Noxious weeds infestation occurs in the analysis area, however the species and extent of these infestation is currently not well documented. Populations of noxious and invasive weeds are found along main travel routes and in areas of frequent ground disturbance. Yellow starthistle is found in excessive concentrations in Hayfork Valley, where habitat is open and subject to agricultural uses. Weeds are much less concentrated within forested plant communities, although Klamath weed is common along many roadsides. Presently, the following noxious weeds are known to occur in the analysis area (pers. com. Erwin 2000).

1. *Centaurea solstitialis* yellow starthistle
2. *Cirsium vulgare* bull thistle

3. *Hypericum perforatum* Klamath weed
4. *Dipsacus sylvestris* teasel

### 3.6.2 Wildlife Species

Because baseline data do not exist for these species, our assessment on species occurrence within the watershed is based no habitat conditions, wildlife surveys that have been conducted in the Middle Hayfork/ Salt Creek watersheds, anecdotal information, and from the California Natural Diversity Database - Rare Find II (1999). Additional information was obtained from the list of references included at the back of this document.

**BALD EAGLE** (*Haliaeetus leucocephalus*)

**Status**: Federally Threatened

**Key Habitat**: The bald eagle requires large bodies of water, or free flowing rivers with abundant fish, and adjacent snags or other perches (Zeiner et al., 1990). The breeding range is mainly in mountainous habitats near reservoirs, lakes, and rivers in the northern quarter of the state (Zeiner, et al. 1990). Nests are located in the top of a large live tree usually near a permanent body of water (Zeiner et al., 1990). Bald eagle populations increase in winter in areas containing suitable habitat and abundant prey items such as fish and waterfowl.

**Occurrence and Status Inside the Watershed Analysis Area**: Bald eagles are not known to occur in the analysis area. The lack of optimal foraging habitat is likely the main reason for the lack of bald eagles in these watersheds. Bald eagles in this region are generally associated with larger rivers, lakes, and reservoir where abundant fish populations are present throughout the breeding season. The Ewing Reservoir, just outside of the town of Hayfork, is a frequent location for foraging eagles. This species is known to occur at Trinity Lake and along the South Fork of the Trinity River. No focused bald eagle surveys have been conducted in the analysis area.

**NORTHERN SPOTTED OWL** (*Strix occidentalis caurina*)

**Status**: Federally Threatened

**Key Habitat**: Northern spotted owls (NSO) require mature forest patches with permanent water and suitable nesting trees and snags (Zeiner et al., 1990). Established nesting pairs are generally associated with late-seral stands of redwood, Douglas-fir, mixed conifer including yellow and white pine, or giant cedar and a significant hardwood component. Spotted owls do not build their own nest. Nests are located in a tree or snag cavity, or in the broken top of large trees (Zeiner et al., 1990).

**Occurrence and Status Inside Analysis Area**:

*Activity Centers*

There are 20 spotted owl activity centers currently identified within the Middle Hayfork and Salt Creek analysis area. In the Middle Hayfork Creek Watershed, five activity centers are located within the Corral LSR (RC-332), and 11 activity centers are located within the matrix habitat. Four activity centers are located within the Salt Creek Watershed, all within the matrix habitat. There are eight spotted owl activity centers located outside the watersheds, but within 1.3 miles, which are dependent to some degree on the two watersheds. All of the above activity centers were first located prior to January 1, 1994. They were located as a result of protocol timber sale surveys, incidental sightings, and historic spotted owl inventory monitoring. Recently (in 1996 and 1997), extensive owl surveys within the two watersheds were conducted by the US Forest Service's Redwood Sciences Laboratory. This study was part of a research project to test spotted owl habitat modeling. New owls and activity centers were located from this recent effort and the data is stored in the Hayfork Ranger District wildlife office. This data should also be consulted when projects occur within these two watersheds.

The Northwest Forest Plan's Record of Decision (USDA and USDI 1994) directs that one hundred acres of the best northern spotted owl habitat will be retained as close to the nest site or owl activity center as possible for all known (as of January 1, 1994) spotted owl activity centers located on federal lands in the matrix and Adaptive Management Areas. Table 3-22 provides information on all activity centers (within Middle Hayfork and Salt Creek) known to occur on federal lands prior to January 1, 1994.

**Table 3-22**
**Reproductive Status, and Land Allocation for Northern Spotted Owl ActivityCcenters Located Prior to 1994, Within Middle Hayfork and Salt Creek Watersheds.**

| Forest AC # | State AC # | Watershed | Status | Year Verified | Reprod Verified | W/in LSR | W/in Critical Habitat | 100 acre LSR |
|---|---|---|---|---|---|---|---|---|
| 700 | TR348 | Mid Hay | Reprod Pair | 1991 | 1991 | Yes | CA-34 | W/in large LSR RC332 |
| 701 | TR342 | Mid Hay | Terr. Single | 1993 | | No | | Drawn, needs field check |
| 702 | TR002 | Mid Hay | Pair | 1990 | | Yes | CA-34 | W/in large LSR RC-332 |
| 706 | TR325 | Mid Hay | Terr. Single | 1992 | | No | | Drawn, needs field check |
| 707 | TR329 | Mid Hay | Terr. Single | 1992 | | No | | Drawn, only available habitat |
| 708 | TR262 | Mid Hay | Terr. Single | 1992 | | Yes | | W/in large LSR RC-332 |
| 709 | TR297 | Mid Hay | Terr.Single | 1989 | | No | | Drawn, needs field check |
| 711 | TR349 | Mid Hay | Pair | 1990 | | Yes | CA-34 | W/in large LSR RC-332 |
| 712 | TR083 | Mid Hay | Pair | 1988 | | Yes | CA-34 | W/in large LSR RC-332 |
| 716 | TR180 | Mid Hay | Pair | 1990 | | No | | Drawn, needs field check |
| 717 | TR322 | Mid Hay | Pair | 1992 | | No | | Drawn, needs field check |
| 718 | TR261 | Mid Hay | Pair | 1992 | | No | | Drawn, needs field check |
| 730 | TR263 | Mid Hay | Reprod Pair | 1992 | 1991 | No | | Drawn, needs field check |
| 732 | TR092 | Mid Hay | Pair | 1993 | | No | | Drawn, needs field check |
| 733 | TR089 | Mid Hay | Pair | 1992 | | No | CA-35 | Drawn, needs field check |
| 734 | TR264 | Mid Hay | Reprod Pair | 1992 | 1991 | No | | Drawn, needs field check |
| 752 | TR295 | Salt | Pair | 1993 | | No | | Drawn, needs field check |
| 761 | TR146 | Salt | Pair | 1992 | | No | | Drawn, needs field check |
| 762 | TR265 | Salt | Terr. Single | 1992 | | No | | Drawn, needs field check |
| 763 | TR204 | Salt | Pair | 1993 | | No | | Drawn, needs field check |

*<u>Suitable Habitat</u>*

Suitable nesting/roosting (NR) and foraging (F)habitat for spotted owls was calculated for both the Middle Hayfork Creek and Salt Creek watersheds**.** The U.S. Fish and Wildlife Service using the Shasta-Trinity Land Management Plan timber typing information mapped available nesting/roosting habitat. The following definition of suitable habitat was used which was developed by a federal interagency task group for the western Klamath province:

Nesting Roosting

- 0-6000’ elevation; all aspects; Douglas fir (D) Westside Mixed Pine (M) and Ponderosa Pine (P); 4-6 (size class) with N & G (crown closure), and 3(size class) G (crown closure).

- 0-4500’ elevation; D, M, P; size class 4-5 with crown closure P excluding SW, S, SE aspects.

Foraging

- 4,500-6,000’; D, M, P; 5P, 4P, 3N, 2G excluding SW, S, SE aspects
- 0-4500’; all aspects; D, M; 3G;
- 0-4500’; D, M; 3P, 2G excluding SW, S, SE aspects

In the Middle Hayfork Creek Watershed, there are approximately 16,390 acres of nesting-roosting habitat, 12,364 acres of foraging habitat, and 8,902 acres of habitat that are not currently classified as spotted owl habitat but are capable of becoming suitable habitat in the future. In the Salt Creek Watershed, there are approximately 4,000 acres of nesting-roosting habitat, 9,368 acres of foraging habitat, and 6,589 acres of habitat that are not currently classified as spotted owl habitat but are capable of becoming suitable habitat in the future (Table 3-23).

**Table 3-23**
**Acres of Spotted Owl Roosting-Nesting, Foraging, Potential, and Non-potential Habitat within the Middle Hayfork Creek and Salt Creek Watersheds.**

| Habitat | Middle Hayfork Creek | Salt Creek |
|---|---|---|
| Nesting/Roosting | 16,390 (29%) | 4,000 (11%) |
| Foraging | 12,364 (22%) | 9,368 (26%) |
| Potential | 8,902 (16%) | 6,589 (18%) |
| Non-potential | 18,935 (33%) | 16,224 (45%) |
| Total Acres of Watershed | 56,591 | 36,451 |

Critical habitat for the northern spotted owl is a legal designation under the Endangered Species Act, having been designated on January 15, 1992 (57 CFR 1796). The intent of critical habitat is to provide the physical and biological features essential to the conservation of the species. Those physical or biological features are referred to as “primary constituent elements”. When projects occur within critical habitat an analysis of the effects to critical habitat and its primary constituent elements must be conducted. Critical NSO habitat within the analysis area includes #CA-35 and #CA-34 totaling 15,729 acres in the Middle Hayfork Creek watershed and 460 acres in the Salt Creek watershed.

**AMERICAN PEREGRINE FALCON** (Falco peregrinus anatum)

**Status**: Delisted (1999)

**Key Habitat**: Peregrine falcons breed near wetlands, lakes, rivers, or other water on high cliffs, banks, dunes, or mounds (Zeiner et al., 1990). Johnsgard (1990) describes the most common nesting habitat characteristic of nesting peregrines is the presence of tall cliffs (typically over 50m in height) which serve as both nest and perch sites, and provide an unobstructed view of the surrounding area.

**Occurrence and Status Inside Analysis Area**: Two known nest sites are located in the LSR (RC-332) of the Middle Hayfork Creek Watershed. These two nest sites are monitored annually by the US Forest Service (Sue Sniado, pers. comm.). No surveys, other than monitoring surveys, have been conducted in the analysis area. Management practices include protection of the nesting territory from disturbance and maintenance and/or enhancement of foraging areas, especially riparian areas. Within an approximate ½ to ¾ of a mile zone around the nest some management activities may be restricted.

**NORTHERN GOSHAWK** (*Accipiter gentilis*)

**Status**: Federal Special Concern Species (nesting)

**Key Habitat**: Hall (1984) examined 10 nest sites in northwestern California to determine suitable habitat for goshawks. Mature Douglas fir stands within a young-growth tract, with a scattered hardwood component appeared to be optimal habitat for this species. Additionally, goshawk nests were found in dense, single stage stands with an open understory, typical of stand conditions commonly found in higher elevations and in eastern California. Several other studies have identified the following consistent nest site characteristics: north-facing moderate slopes, located beneath the canopy and associated with streams and larger mature trees (Shuster, 1980). Bloom et al. (1985) assessed the status of goshawks in California by investigating 114 nests. Their work throughout the state indicated that in general nests were located in monotypic tracts above 6000 ft. Of the nest trees identified, none were redwood and only 28 were in Douglas fir. Goshawks in this region tend to be associated with large contiguous blocks of unmanaged timber.

**Occurrence and Status Inside Analysis Area**: There are four known goshawk nest sites in the analysis area. Two are located in the LSR (RC-332) of the Middle Hayfork Creek Watershed and two are located in the matrix lands of the Salt Creek Watershed.

**WILLOW FLYCATCHER** (*Empidonax traillii)*

**Status**: Forest Service Sensitive Species

**Key Habitat**: Key summer habitats for the willow flycatcher include wet meadow and montane riparian habitats where dense willow thickets are required for nesting and roosting (Zeiner et al., 1990). This species is associated with riparian woodland vegetation, primarily willow and alder, but is known to use upland shrub-type vegetation (LRMP). Locally, this species is extremely rare and occupies willow-alder thickets in riparian or dune hollows; most records (95%+) are from coastal lowlands (Harris 1996).

**Occurrence and Status Inside Analysis Area:** No focused willow flycatcher surveys have been conducted in the analysis area. However, mist netting surveys were conducted on the Big Bar Ranger District and Hayfork Ranger District near the town of Hyampom, and Indian Creek (USDA Forest Service 1999). Juvenile willow flycatchers were caught in the mist netting efforts in late summer and fall; these were assumed to be dispersing birds and no conformation of nesting at or near these locations has been confirmed (USDA Forest Service, 1999). Small pockets of potential willow flycatcher habitat are available in the analysis area.

**FLAMULATED OWL** (*Otus flammeolus*)

**Status**: Forest Service Protection Buffer Species

**Key Habitat**: The flammulated owl occurs in higher elevation montane forests, especially ponderosa pine; favors small openings, edges, and clearings with snags for nesting and roosting

(Zeiner et al., 1990). This species does not excavate its own nest cavity. Rather, this species uses an existing cavity or woodpecker hole in aspen, oak, or pine snags or trees (Zeiner et al., 1990).

**Occurrence and Status Inside Analysis Area:** No focused flammulated owl surveys have been conducted in the Hayfork Ranger Districts (USDA Forest Service 1999). However, according to Harris (1996), surveys made by the U. S. Forest Service and others have identified 100 + territories in the northcoast region. According to the USDA Forest Service (1999), there have been several sightings in the Hayfork Ranger District, but available information does not confirm the presence of this species in the analysis area. Due to the large amount of suitable habitat present in the analysis area, it is likely that flammulated owls do occur there.

**WHITE-HEADED WOODPECKER** *(Picoides albolavatus)*

**Status**: Forest Service Protection Buffer Species

**Key Habitat**: The white-headed woodpecker is restricted to mixed coniferous forests dominated by mature pines (with large cones and abundant seed production), relatively open canopy (50-70%), and availability of snags and stumps for nest cavities (Garrett et al., 1996). This species excavates nest cavity in large (>24"dbh) snag or stump usually in open coniferous habitats often near edges of roads, natural openings, or on the edge of small clearings (Zeiner et al., 1990). This species tends to shun pine forests dominated by small-coned or closed-coned species, e.g., lodgepole (*pinus contorta*), knobcone pine (*Pinus attenuata*) and singleleaf pinyon (*Pinus monophylla*) (Garrett et al. 1996).

**Occurrence and Status Inside Analysis Area:** No focused white-headed woodpecker surveys have been conducted in the analysis area, nor are there any known nesting territories. It is likely that this species occurs in areas of suitable habitat in these watersheds.

**PYGMY NUTHATCH** (*Sitta pygmaea*)

**Status**: Forest Service Protection Buffer Species

**Key Habitat:** The pygmy nuthatch is a common resident in mature ponderosa pine, Jeffery pine, mixed conifer, eastside pine, and pinyon juniper habitats in the Sierra-Nevada, Cascades, Trinity, Warner, and White Mts. (Zeiner et al., 1990). This species excavates a nesting cavity in a snag or stump.

**Occurrence and Status Inside Analysis Area:** No focused pygmy nuthatch surveys have been conducted in the analysis area, nor are there any known nest sights. . According to Harris (1996), pygmy nuthatches' seem to be absent from pine/fir forests at high elevations in Humboldt, western Trinity, and Siskiyou counties where it occasionally occurs as a vagrant. However, suitable habitat is present in the analysis area.

**PACIFIC FISHER** (*Martes pennanti pacifica*)

**Status**: Federal Special Concern Species and Forest Service Sensitive

**Key Habitat:** Suitable habitat for fishers consists of large areas of mature, dense forest stands with snags, logs, rock areas, and greater than 50% canopy closure (Zeiner et al., 1990). Mullis (1985) found adult fishers to strongly select for mature closed conifer timber group, but all other fisher groupings did not. Mullis (1985) found den and rest sites located mostly in trees, but also located underground, under slash piles, and in the cavities of downed logs. Tracking surveys conducted by Mullis (1985) indicated that fishers use open areas such vegetated clearcuts for hunting, especially in winter. Schempf and White (1977, in Mullis 1985) found only 8% of 206 fisher sightings in California occurring in forests composed of greater that 80% pine species.

**Occurrence and Status Inside Analysis Area**: Suitable habitat for fishers is abundant in both watersheds. Even though no focused surveys have been conducted for this species, 27 incidental fisher sightings have been recorded in the analysis area. Mullins (1985) study area was located just west of the analysis area, near Hayfork Bally, California.

**AMERICAN MARTEN** (*Martes americana*)

**Status**: Forest Service Sensitive

**Key Habitat:** Optimal habitats for the marten are various mixed evergreen forests with a greater than 40% crown closure, with large trees and snags (Zeiner et al., 1990). This species uses cavities in large trees, snags, stumps, logs, or burrows, caves or crevices in rocky areas for denning cover and rest sites (Zeiner et al., 1990).

**Occurrence and Status Inside Analysis Area**: One incidental sighting of a marten has been recorded in the analysis area. This sighting was in the LSR (RC-332) Middle Hayfork Creek Watershed. Abundant suitable habitat is available in both watersheds; therefore it is likely that martens do occur elsewhere in the analysis area. No focused surveys for this species have been conducted in the analysis area.

**CALIFORNIA WOLVERINE** (*Gulo gulo luteus*)

**Status**: Federal Special Concern and Forest Service Sensitive Species

**Key Habitat**: Little information is available on the occurrence and habitat of the wolverine in California. According to Zeiner et al. (1990), this species uses a wide variety of habitats including: alpine habitats, subalpine conifer, wet meadow, and riparian and other mid-high elevation habitats. Open areas are used for hunting and dense areas are used for resting and cover (Zeiner et al., 1990).

**Occurrence and Status Inside Analysis Area**: No focused wolverine surveys have been conducted on the Hayfork Ranger Districts (USDA Forest Service 1999). A single observation of a wolverine in the Salt Creek watershed is on record, and other sightings occurring elsewhere on the ranger district have been reported. This species travels long distances and occurs at very low populations (Zeiner et al., 1990). Habitat for this species is available in both watersheds.

**BATS: Townsend's big-eared bat** (*Corynorhinus townsendii*), **Pallid bat** (*Antrozous pallidus*), **Fringed myotis** (*Myotis thysandodes*), **Long-eared myotis** (*Myotis evotis*), **Hoary bat** (*Lasiurus cinereus*), **Silver-haired bat** (*Lasionyteris noctivagans*), **Western red bat** (*Lasiurus cinereus*) and, **Long-legged myotis** (*Myotis volans*)

**Status:** There are eight species of bat that are Forest Service Sensitive, "Survey and Manage" Species and/or listed as Federal Special Concern Species, which have the potential to occur in the analysis area (For Listing Status, Refer to Table 1-3).

**Key Habitat**: Critical habitat for bats is the availability of roost and maternity sites that receive little or no human disturbance. The Townsend's big-eared bat, pallid bat and fringed myotis are very susceptible to human disturbance and may abandon their roost site after a single disturbance (Zeiner et al 1990). The fringed myotis and long-legged bat form large roost and maternal colonies that make these sites very important to the species. The hoary bat roosts in dense foliage (Zeiner et al 1990). The pallid bat and hoary bat prefer more open habitats for foraging; the Townsend's big-eared bat and silver-haired bat prefer riparian and/or mesic habitats; and the other listed bat species forage in woodland and forested habitats. However, all of these species of bat forage in a wide range of habitats.

**Occurrence and Status Inside Analysis Area**: Very little information is available on the availability of potential roost and maternal sites for these bat species in the analysis area. No known bat surveys have been conducted in the Hayfork Ranger District. There are no known roost sites for any of these bat species within the watersheds, but it is likely that suitable roost sites are available. Foraging habitat for all of these bat species is abundant in these watersheds.

**DEL NORTE SALAMANDER** (*Plethodon elongatus*)

**Status**: Survey and Manage, and Protection Buffer Species

**Key Habitat**: The Del Norte salamander is usually found within rock slides, beneath rotten logs, and under slabs of bark in damp, but not wet situations in open-to-dense, sapling-to-mature stages of valley-foothill riparian, montane hardwood conifer, Douglas fir and redwood (Zeiner et al., 1990).

**Occurrence and Status Inside Analysis Area**: According to Jennings and Hayes (1994), the range and distribution of the Del Norte salamander does not include this portion of Trinity County. It appears that this species is restricted to more coastal xeric environments. No focused Del Norte salamander surveys have been conducted in the analysis area. The analysis area is more than 25 miles from the nearest known population of this species. Rocky areas, rotten logs, woody debris, and other microhabitats are not lacking in the analysis area, thus providing potentially suitable habitat for this species.

**SOUTHERN TORRENT SALAMANDER** (*Rhyacotriton variegatus*)

**Status:** Federal Special Concern and Forest Service Sensitive

**Key Habitat:** Typical habitat of the southern torrent salamander includes small, cold, headwater streams, springs, and seepage's from sea level up to 1,402 m (4,600 ft) in elevation in mostly redwood or Douglas fir forests (Brode 1995). This species prefer high gradient stream microhabitats with relatively loose gravel and cobble, open interstices, and minimal fine sediments (Diller and Wallace 1996). This species is closely associated with seep habitats in coastal old-growth (Jennings and Hayes 1994).

**Occurrence and Status Inside Analysis Area**: There are no known occurrences of southern torrent salamanders in the analysis area. No focused surveys for this species have been conducted in these watersheds. According to Jennings and Hayes (1994), the range and distribution of the southern torrent salamander does not include this portion of Trinity County. Water sources that meet the aforementioned criteria are found in the analysis area, thus providing potentially suitable habitat for this species.

**FOOTHILL YELLOW-LEGGED FROG** (*Rana boylii*)

**Status:** Federal Special Concern and Forest Service Sensitive Species

**Key Habitat:** Foothill yellow-legged frogs are found in or near rocky streams in a variety of habitats, including valley-foothill hardwood, valley-foothill hardwood-conifer, valley-foothill riparian, ponderosa pine, mixed conifer, coastal scrub, mixed chaparral, and wet meadow types (Jennings et al., 1990). In Humboldt County, this species is found in association with gravel-cobble substrates of rivers and creeks containing little or no canopy cover.

**Occurrence and Status Inside Analysis Area**: No focused surveys for this species have occurred in the analysis area. However, incidental sightings of foothill yellow-legged frogs have been recorded in association with Salt Creek and Middle Hayfork Creek.

**NORTHWESTERN POND TURTLE** (*Clemmys marmorata marmorata*)

**Status:** Federal Special Concern and Forest Service Sensitive Species

**Key Habitat**: Pond turtles are found associated with permanent or nearly permanent water in a wide variety of habitats below 1830 m (6000 ft) elevation (Zeiner et al., 1990). They require basking sites, such as submerged logs, rocks, mats of floating vegetation, or open mud banks, associated with ponds, lakes, streams, irrigation ditches or permanent pools along intermittent streams that have. Pond turtles nest in riparian and upland habitats up to 402 m from water (LRMP).

**Occurrence and Status Inside Analysis Area**: No focused pond turtle surveys have been conducted in the analysis area. However, two incidental observations of this species were recorded in association with Salt Creek and Salt Gulch. Suitable pond turtle habitat is available in both watersheds, especially in association with the larger watercourses and permanent ponds. It is likely that pond turtles occur in suitable habitat elsewhere in these watersheds.

**TERRESTRIAL MOLLUSKS** Eight terrestrial mollusk species are Forest Service "Survey and Manage" species (Table 3-24).

**Table 3-24**

**Survey and Manage Mollusk Species and Their General Habitats (USDI BLM 1999).**

| Species | Habitat |
|---|---|
| Church's sideband snail (*Monadenia churchi*) | Riparian habitats, brush and pine-oak woodland, limestone outcrops, caves, talus, lava rockslides with heavy shading. |
| Klamath shoulderband snail (*Helminthoglypta talmadgei)* | Stable talus and rockslides in limestone substrate usually near springs or streams. |
| Papillose tail-dropper slug *(Prophysaon dubium*) | Associated with hardwood logs and leaf litter, and the fungal fruiting bodies of *Suillus* and *Lactaria*. |
| Pressley hesperian snail (*Vespericola pressleyi*) | Conifer/hardwood forests in permanently damp areas within 200m. of water. |
| Hooded lancetooth snail *(Ancotrema voyanum*) | Near streams or intermittent permanently damp stream channels with late successional habitat elements (e.g. woody debris and leaf mold); limestone. |
| Oregon shoulderband snail (*Helminthoglypta hertleini)* | Talus and other rocky substrates, large woody debris, rock fissures. Usually associated with damp conditions but is somewhat adapted to short-term dry |
| Tehama chaparral snail (*Trilobospsis tehamana)* | Talus, leaf litter, and woody debris within 100m of limestone outcrops. |
| Shasta chaparral snail (*Triobopsis roperi*) | Within 100m of shaded limestone rockslides, draws, with oak or shrub cover; caves. |

## 3.7 FIRE AND FUELS

In the Salt Creek and Middle Hayfork Watersheds fire has and will continue to play a major role in the ecosystem. Fire is a significant disturbance factor within the analysis area. The recurrence of fire and the recovery of the ecosystem from fire is an important mechanism for the health of the ecosystem dynamics, and has historically maintained structural diversity and ecosystem health within the watershed.

Fire return intervals have varied greatly with the longest return interval found during the suppression period 1900-1992 with a return interval of 24.5 years and the shortest during the 1850 to 1900 settlement period (Skinner and Taylor, 1998[1]) (Table 3-25). This is an indicator that European settlement had impacted the fire return interval both by increasing the return interval through suppression and decreasing the return interval because of settlement activities (i.e., railroads). That includes suppression in the form of animal grazing as well as active suppression.

[1] Although it is not a study in the Hayfork area it does provide similarities to Carl's unpublished study of the Hayfork Ranger district, as per conversation with Carl Skinner. December, 1999. Preliminary indications are that the frequency extent and severity of the fires are very similar between the studies. The difference is the Hayfork study indicates a greater number of fires.

**Table 3-25**
**Fire Return Intervals**

| Time Period | Fire Return Interval (years) |
|---|---|
| 1626-1699 | 19.2 |
| 1700-1799 | 19.1 |
| 1800-1850 | 15.1 |
| 1850-1900 | 12.3 |
| 1900-1992 | 24.5 |

Skinner and Taylor (1998) found study indicates that fire regimes (return intervals, severity and fire rotations) were more frequent, generally less severe and had short fire rotations during presettlement history. More frequent fires of low and moderate frequency killed some overstory trees and thinned or killed understory stems. These mixed severity fires created multi-aged stands. This frequency and high variability of the fires may be an important factor contributing to the overall diversity of the stands in the watershed (Skinner and Taylor, 1998).

Vegetation types in this fire regime were dominated by fire adapted, fire resistant species. The exclusion of fire, along with other human caused disturbances, has initiated a transition to a fire regime characterized by less frequent, high intensity fire events and vegetation changes such as greater abundance of white fir.

Historically the Salt Creek and Middle Hayfork Watersheds developed under a low-severity fire regime. Through 90 years of fire suppression the historic fire regime has been altered to one of infrequent, high intensity, stand replacing fires. Currently stand density, species composition, fire return intervals, fuels levels as well as tree mortality levels have contributed to the increase in fire size and intensity. The cumulative effects of altering the historic fire regime in the watershed will result in the occurrence of large, high intensity, stand replacement fires, that fall outside the natural range of variability (Clark, 1995).

### *Suppression Era 1911 – 1998*

From 1911 until 1998 there have been 808 reported fires less than 100 acres and 14 fires larger than 100 acres (Figures 3-7 and 3-8), of the larger fires 7 were lightning caused and 7 were human caused (Table 3-26).

**Table 3-26**
**Large Fires in Salt and Middle Hayfork Watersheds**

| Year | Fire Number | Cause* | Acres | Fire Name |
|---|---|---|---|---|
| 1923 | 0081 | H | 91 | N/A |
| 1924 | 0038 | H | 489 | N/A |
| 1924 | 0088 | L | 577 | N/A |
| 1940 | 0028 | H | 181 | N/A |
| 1953 | 0028 | L | 188 | N/A |
| 1955 | 0180 | L | 3211 | Thompson Peak |
| 1964 | 0355 | H | 18905 | Summit |
| 1974 | 0182 | U | 547 | N/A |
| 1987 | 0281 | L | 6260 | Peanut |
| 1987 | 0283 | L | 3463 | Friendly |
| 1987 | 0282 | L | 994 | Tule |
| 1987 | 0248 | L | 101 | N/A |
| 1991 | 0237 | U | 1108 | Rock |
| 1992 | 0335 | H | 5258 | Barker |

*H – Human Caused L – Lightning Caused U – Unknown

From 1985 until 1995 there were 152 fires less than 100 acres and 6 fires greater than 100 acres. From 1985 through 1995 on the Hayfork Ranger District there have been 393 fires of these fires 15 were larger than 100 acres. This indicates that 40% of the fires and approximately 40% of the larger than 100-acre fires occurred in the Salt Creek and Middle Hayfork Watersheds.

An analysis of the District data is important and shows that out of the 393 fires 225 were lightning caused (See Appendix A for Fire Family Plus data on the Hayfork fires.)

Resources available for fire suppression during the fire season from June through October: 2 engines in Hayfork 1, US Forest Service and one California Department of Forestry and Fire Protection, and a volunteer fire department. These are the closest resources to the analysis area. There are wildland fire fighting resources in Junction City, 1 engine, Harrison Gulch, 2 engines, and Hyampom, 1 engine. During a high lightning season the number of starts increases dramatically (Appendix A).

### 3.7.1 Fire Hazards and Risks

It is important to understand the meaning of Fire Hazard and Fire Risk. Fire “Risk” is defined as fire cause such as lightning, a natural cause, and human caused which can include a variety of causes such as children playing with matches, equipment, powerline, campfires, and escape debris burning and so on . This analysis will use only lightning or humans caused fires and not break the causes down any further. Hazard is a rating assigned to a fuel complex that reflects its susceptibility to ignition, the wildfire behavior, and fire severity and fire suppression difficulty. A fuel complex is defined by kind, arrangement, volume, condition, and location. Hazard ratings are generally subjective, ranging from very low (green grasses and conifer litter) to extreme (cured grass and heavy slash) (Deeming 1990). A fire protection program can include fire suppression, prevention or risk management, and fuels management or hazard management.

### Assessment of Fire Risk

Human caused fires are a consideration in the analysis area although not the primary consideration, lightning fires are of primary concern. The community of Hayfork is located in the middle of the analysis area along with several areas of private property. Recreation is a major source of human impact as well as private timber harvesting.

Lightning caused fires or natural ignitions are impossible to prevent. In order to minimize the impacts from lightning caused fires the fuel hazard needs to be mitigated or suppression resources increased or allow fire to return to a more natural cycle. This will be covered in greater depth later in the document.

### Assessment of Fire Hazard

To assess the fire hazard we will need to look at the fuel models in the watershed and the hazard ratings for the analysis area. A description of fuel models can be found in Appendix B. The fuel models in the analysis area are displayed in Tables 3-27 to 3-30 and Figure 3-9.

**Table 3-27**
**Fuel Model Rating for Middle Hayfork Watershed**

| FM | Acres/fuel model | |
|---|---|---|
| Private | 26,594 | |
| 2 | 7,110 | Grass |
| 4 | 2,305 | Brush |
| 6 | 16,526 | Brush |
| 9 | 1,217 | Timber |
| 10 | 22,132 | Timber |
| 99 | 101 | Water or Barren |
| Sum | 75,985 | |

**Table 3-28**
**Fuel Model Rating for Salt Creek Watershed**

| FM | Acres/Fuel Model | |
|---|---|---|
| Private | 5,493 | |
| 2 | 5,558 | Grass |
| 4 | 3,374 | Brush |
| 6 | 14,859 | Brush |
| 9 | 1,322 | Timber |
| 10 | 5,697 | Timber |
| 99 | 27 | Water or Barren |
| Sum | 36,330 | |

Fuel models 4, 6, and 10 are fuel models that offer considerable resistance to control and are likely to result in severe damage on high fire danger days.

**Table 3-29**
**Hazard Rating for Middle Hayfork Watershed**

| HAZARD | Total acres/rating |
|---|---|
| Barren | 102 |
| HIGH | 11,596 |
| LOW | 174 |
| MED | 37,459 |
| Private | 26,613 |
| Sum | 75,944 |

**Table 3-30**
**Hazard Rating For Salt Creek Watershed**

| HAZARD | Acres/rating |
|---|---|
| Barren | 27 |
| HIGH | 5,579 |
| LOW | 446 |
| MED | 24,743 |
| Private | 5,496 |
| Sum | 36,291 |

### 3.7.2 Effects of Fire Exclusion

All the fire history studies for the Klamath Mountains indicate that the fire regime for the watershed was of frequent fires generally less severe and had shorter fire return intervals. Frequent fires of mixed low and moderate severity killed some overstory trees, initiated recruitment, and thinned or killed understory stems.

The persistence of species in Pacific Northwest forests through time is attributed to vegetation adaptations to fire. Adaptations to fire survival are, in reality adaptations to a particular ecosystem and its specific fire regime. If the fire retime is altered, then the capacity for that species to survive in an environment may be eliminated (Pyne, 1984)

In ecosystems where fire has been frequent the absence of periodic low-intensity surface fire allows relatively rapid changes in species composition and structure. These will, often become predisposing factors to epidemic insect and disease outbreaks, increasing dead and down fuel loading, shade tolerant species in the understory, and severe stand replacement fires. Sustainability becomes difficult to achieve in these ecosystems when periodic low-intensity fire is changed to infrequent high intensity fire, much like the existing condition. (Clark, 1995) By continuing to suppress low to moderate severity fires, insures that the fires that will affect most of the landscape are the high severity stand replacement type fires (Skinner, 1994)

Few forested regions have experienced fires as frequently and with such high variability in fire severity as those in the Klamath Mountains. This highly variable fire regime may be an important factor contributing to overall diversity in the Klamath Mountains (Martin and Sapsis, 1992).

### 3.7.3 Plantations

Plantations comprise the following acreage in the analysis area:

| | |
|---|---|
| Middle Hayfork Watershed | 5,393 Acres |
| Salt Creek Watershed | 3,706 Acres |

Plantations make up 21% of the analysis area timber base. Although the acreage is relatively small the investment in money and time in the plantations is high the loss of these plantations to a wildfire would represent starting over at year 0. These plantations average from 0 to 21 years of age the majority are less than 20 years old.

Plantations are costly to establish current cost estimates are from $1,000 to $3,000 per acre(Clark 1995). A study by Skinner and Weatherspon (1995) assessed the damage fires caused to plantations during the 1987 fires on the Hayfork District. The large scale study was undertaken to determine relationships between (1) degree of damage caused by the 1987 wildfires, and (2) prior management activities, fuelbed characteristics, and site/stand factors that might be expected to influence fire behavior and associated fire effects. The study provided the following results that are important in evaluating the potential for fuels treatment:

Several interesting findings came to the surface as a result of the study that are relevant to the analysis area.

- Fire damage to plantations was strongly associated with damage in the adjacent stand in the direction, which the fire apparently came. The greater the damage in the adjacent stands the greater the damage in the plantation.
- Site preparation method was the only factor related to uniformity of damage and it was highly significant. Untreated plantations burned quite uniformly( Skinner and Weatherspoon, 1995)

The study goes on to analyze other factors affecting damage to the timber resource.

- Stand treatment: uncut stands suffered the least fire damage followed by partial cut stands with fuel treatment and the most damage was found in partial cut stands with no fuel treatment.
- Tree species: stands with ponderosa pine as the primary species sustained more damage then stands dominated by Douglas fir.
- Aspect: the north aspects had the least damage south and flat the greatest.

The study concludes that "for the short interval, low to moderate severity fire regimes studied here, that if fuels are left untreated, damage from wildfires could increase significantly."

## 3.8 TRANSPORTATION

The transportation system for the Middle Hayfork and Salt Creek Watersheds is comprised of over 577 miles of roads and trails (Table 3-31, Figure 3-10).

**Table 3-31**
**Road Miles Middle Hayfork and Salt Creek Watersheds**

| Road Type | Middle Hayfork (mi) | Salt Creek (mi) |
|---|---|---|
| Forest System Roads | 255 | 133.5 |
| Forest Service Non-System Roads and Jeep Trails | 28.5 | 12.3 |
| Private Land Roads | 112.2 | 10.8 |
| State Highways | 13.2 | 11.8 |
| Total | 409.3 | 168.5 |

Table 3-32 displays the surface types of the Forest Service system roads.

**Table 3-32**
**Surface Types of Forest Service System Roads**

| Surface Type | Middle Hayfork (mi) | Salt Creek (mi) |
|---|---|---|
| Native | 180.9 | 99.2 |
| Gravel | 34.4 | 27.5 |
| Paved | 40.1 | 6.8 |

Each Forest Service system road has been assigned one of four maintenance level designations ranging form Level 4 (high use, paved surface) to Level 1 (prescribed all year closure). Table 3-33 describes the maintenance level for the Forest Service system roads.

**Table 3-33**
**Forest Service System Roads Maintenance Level**

| Maintenance Level | Middle Hayfork (mi) | Salt Creek (mi) |
|---|---|---|
| Level 1 | 109.0 | 62.4 |
| Level 2 | 75.3 | 44.3 |
| Level 3 | 40.9 | 18.6 |
| Level 4 | 9.5 | 0.0 |

**Table 3-34**
**Forest Service Road Closures**

| | Middle Hayfork (mi) | Salt Creek (mi) |
|---|---|---|
| Annual Road Closure | 74.5 [1] | 38.4 [2] |
| **Barrier** | 39.1 | 32.9 |
| **Gate** | 35.4 | 5.5 |
| Seasonal | 15.5 | 0.6 |

[1] Total Level 1 road is 109.0 miles. 34.5 miles of Level 1 roads are open and are effectively in Level 2 status.

[2] Total Level 1 road is 62.4 miles. 24.0 miles of Level 1 roads are open and are effectively in Level 2 status.

Due to the decrease in timber harvest activity, and the declining road maintenance budget, maintenance efforts have been focussed primarily on the more heavily used roads. This has contributed to areas of concern due to surface erosion, and possible fill failure, which could affect water quality. These areas occur mainly on native surfaced roads that have been rutted by vehicle traffic, and by the lack of the needed maintenance to correct the problem. Also of concern is the relatively high road density in some areas, which may have a negative effect on both water quality and wildlife (Table 3-35).

**Table 3-35**
**Road Densities**

| Watershed | All Roads ($mi/mi^2$) | Forest Service Roads ($mi/mi^2$) | Private Roads and Highways ($mi/mi^2$) |
|---|---|---|---|
| Middle Hayfork | 3.29 | 2.29 | 1.00 |
| Salt Creek | 2.96 | 2.56 | 0.40 |

## 4.1 EROSIONAL PROCESSES

### 4.1.1 Geology

The degree of erosion and landsliding is largely a function of bedrock geology and land use history. Because of the relatively low sedimentation and erosion rates, the study area falls into a moderate stability and erosion hazard category (CDWR, 1979). The Middle Hayfork and Salt Creek watersheds are generally considered in good condition. Mass wasting has caused local erosion problems, but active landsliding is not widespread. Human activities in the past, such as mining, logging, grazing and road building have all contributed to erosion in the study area. With the practice of land management based on local terrain sensitivity, land use activities have been tailored to site specific conditions.

### 4.1.2 Soils

Soil types change very slowly through time. Natural reference conditions can be found in undisturbed portions of each soil family. Soils with high and very high EHR will be more sensitive to disturbance and surface erosion than soil families with moderate and low EHR. Disturbances to soils include compaction and loss of ground cover, which can be the brought about by wildfire, mining, grazing, and other land management activities that compact or expose the soil.

## 4.2 WATER RESOURCES

### 4.2.1 Hydrology

Due to the lack of a long term streamflow record one can only speculate as to the nature of historical annual flows, peak flows, and minimum flows of the streams within the analysis area. The topography, climatic conditions, geologic conditions and soil conditions would have determined the nature of the watershed's rainfall/runoff response.

Annual discharge from Hayfork Creek has most likely decreased since pre-settlement time. With the imposition of fire suppression policies the resulting increase in vegetation has resulted in more evapotranspiration with less runoff. This trend would have been damped, however, with the increase of roading and logging activity. Another complicating factor is the report that the climate has likely become more wet recently than 1000 years ago (Laudenslayer and Skinner, 1995).

Peak flows under historic conditions were likely influenced by rain on snow events for the largest flows and large frontal rainstorm events for the smaller peak flow events. Lack of any historical evidence precludes any speculation of the actual magnitude of the events.

### 4.2.2 Stream Channels

Historically stream channel conditions within the watershed were controlled by large precipitation/runoff events and mass wasting events triggered by these storms. The stream channels were stable in a state of dynamic equilibrium for long periods of time. That is they were in a state of constantly changing conditions at a low level of intensity for long periods of time with infrequent and irregularly timed peaks of major change.

The upper portion of the watershed and the steep side slopes of the rest of the watershed were sources of sediment for downstream channels.

### 4.2.3 Water Quality

The quality of the water produced from the analysis was most likely excellent during historical conditions. There are no sources of naturally occurring pollutants that would have affected the water quality. Sediment flows and turbidity levels were minimal except during peak discharges. Conditions of impaired water quality would have been infrequent and brief.

### 4.2.4 Riparian Reserves

Natural disturbances, such as, floods, landslides and debris flows, and fire were the dominant processes that influenced riparian reserve conditions. These disturbance processes were distributed across the landscape spatially and their frequency and intensity was variable, with large events occurring only infrequently. These processes were critical to the recruitment of spawning gravels and large wood to stream channels which in turn created complex and diverse channel morphology.

## 4.3 HUMAN USE AND HERITAGE RESOURCES

### 4.3.1 Prehistory

Archaeological research has focused on cultural resource management activity associated with various Forest Service projects. Research in neighboring areas such as the Trinity River, South Fork of the Trinity, and South Fork Mountain; however, indicate a human presence for some 5000 years or more. These people, possibly the distant ancestors of the Chirmariko Indians, hunted, fished, and gathered plant foods, chert, and other natural products, but other than a few stone tools, left no imprint on the landscape.

At historic contact, the Hayfork Creek drainage lay within the territory inhabited and used by the Nor-Rel-Muk or Hayfork Wintu. The name, Nor-Rel-Muk, means southward uphill people, suggesting that they moved into the Hayfork drainage from the Trinity River in recent centuries, perhaps following the heavy anadromous fish runs that were basic to their economy. According to Wintu tradition, salmon traveled up Hayfork Creek as far as a 50-foot high waterfall, recently destroyed, which was located approximately one mile upstream from the confluence with the East Fork of Hayfork Creek. The Wintu developed permanent villages focused on the collecting, preparation and storage of salmon and acorns. They deliberately burned vegetation to improve deer forage food sources and basketry materials. Religious practices included the observance of sacred areas of which the most important to the Nor-Rel-Muk was Chanchelulla Peak.

The first contact between the Nor-Rel-Muk and Anglo-Americans occurred when fur trapper and explorer Jedediah Smith with a party of 18 men and 300 horses and mules crossed from the Red Bluff area into the Hayfork Creek drainage in April 1828. They camped near Wildwood, again farther north on Hayfork Creek, and on the third night camped in the Hayfork Valley at the confluence with Salt Creek. Smith left a record of his encounters with the Nor-Rel-Muk, but little comment on plant and animal populations other than to note “good grass”.

### 4.3.2 Historic

According to local tradition, Hayfork Valley was 'discovered' in 1852 when a party of Weaverville miners tracked some Indians who had killed a local citizen and stolen some cattle to a village at Natural Bridge, where in retaliation they massacred about 150 residents. White settlement began soon after with the establishment of several ranches including Big Creek Ranch, R. B. Wells place, the Rusch Ranch (later called the Carr Ranch and then the Dockery Ranch), Vaughn Ranch, B. M. George Ranch, Williams Ranch and others. Wheat, oats, hay, onions, and potatoes were produced in abundance and sold in Weaverville. Hayfork Valley was referred to as the “granary of the county”. Most of this land is still in private ownership, lining many of the major stream courses throughout the analysis area. Gold mining was introduced in the mid-1850's and Hayfork gained a population of several hundred miners. Placer mining was initiated in 1857 at Carrier Gulch and soon after at other tributary creeks. Settlements such as Staffords Crossing at Carrier Gulch sprang up to service the miners. Hydraulic mining followed in the 1870's, and later many lode mines were developed including several claims in the Hall City area in the 1890's. Evidence of the mining history is preserved in a number of recorded mining sites and settlements, ditches, and tailing piles. Some of the most prominent mining features in the Carrier Gulch area along Hayfork Creek are the neatly stacked Chinese rock work. Their mining efforts date from the late 1860’s up to the 1890’s.

Small saw mills arose to supply wood products for the ranches and miners. A saw and grist mill, A. D. Bayless and Company, operated in Hayfork Valley during the mid- to late 1850’s Using waterpower, it produced 100,000 board feet of lumber per season. Sawmills in the middle Hayfork Creek area included a water-powered mill built by Landis near the Wildwood Inn, a mill with a circular saw powered by steam built by Chambers east of the Wildwood store, and a mill at Gemmill Gulch, probably built around 1900. Many mines had their own sawmills.

The forested lands surrounding the valleys were public domain used as open grazing from around 1860. Stockmen established a pattern of burning the underbrush when the stock was removed to increase accessibility and promote new growth.

Lands in the watershed were surveyed by Government Land Office (GLO) surveyors between 1874 and 1893, opening the area to homesteading, cash entry purchases of previously occupied ranches, Indian allotments, and mining claims. The GLO maps show a number of mining claims, bails and ditches within the area.

#### *1905-1945*

The Trinity Forest Reserve was established on April 26, 1905 and the management of public forested lands transferred to the Department of Agriculture Bureau of Forestry, which became known as the Forest Service. Early Forest Rangers spent much of their time administering grazing allotments, examining homestead claims, building trails, and patrolling and fighting fires. Early Ranger Stations were often private homes of the Rangers. The 1907 Trinity National Forest Atlas shows Ranger Stations on Carr Creek and on East Fork. The Hayfork Ranger

Station was established in 1913 on land donated by Jake Kelly. The 1934 Trinity National Forest map shows Ranger Stations on the East Fork at Bryon Creek, and Red Mountain, and at Shiel Gulch, the latter a recorded archaeological site

Mining and stock raising were the chief industries on the Trinity National Forest in the early years, although timber production increased with time. The important commercial woods were red fir, sugar pine, yellow pine, incense cedar and white fir. A number of hard rock gold mines, located in quartz veins along the edges of the valley and canyon, continued operations in the decades after 1900 such as the Layman Mine, which included a stamp mill. A number of mines, such as the Kelly Mine were very active during the depression. Grazing reached a peak just prior to World War II with sheep a significant factor. Burning on the allotments ceased by around 1920 under Forest Service regulations.

*1945-1990*

Timber production became a major economic interest after World War II with lumber products headed for national and international markets. The percentage of the population of Trinity County, which was employed in lumber and wood products, rose from 2% in 1940 to 36% in 1950. Grazing of public lands continued in the Wildwood allotment with an emphasis on horses and cows. A number of gold mines continued to be operated within the Analysis area such as the Scorpion Mine and the Cope and Johnson Mine.

Environmental concerns of the 1970's gradually changed Forest Service management policies from a focus on timber production to one of ecosystems management.

## 4.4 VEGETATION

### 4.4.1 Forest Health Trends

Vegetation Dynamics in Middle Hayfork and Salt Creek Watersheds Prior to 1850

Much of the following information was taken from the Upper Hayfork Creek watershed analysis (USFS 1998). Prior to 1850, the major force which shaped the vegetation on a landscape level was fire. There were lightning-caused fires, and there was also Native American burning until the discovery of gold and the influx of settlers. Fire scar analysis in mixed conifer stands on the Klamath NF which are similar to mid-elevation stands in the Middle Hayfork and Salt Creek watersheds indicate an average fire return interval of approximately 8 years. The oldest conifers in these watersheds have large fire scars. The size and species distribution of these trees indicates a stand structure prior to 1850 which was generally an open stand consisting of large diameter ponderosa pine, sugar pine, and Douglas-fir. During the period between fires, a woody understory of brush, conifer seedlings and sprouts of hardwoods such as madrone, California black oak, and Oregon white oak would grow.

The serpentine areas are generally so unproductive that they rarely accumulate enough litter to carry a ground fire over a large area. Many of the open conifer stands on serpentine would have looked similar in 1850 to their current appearance. Large fires in adjacent stands on more productive soils will occasionally promote a stand-replacing crown fire in a stand on serpentine.

Some of the younger conifer aggregations on serpentine soils could have been a recent burn, or a brushfield in 1850.

The true fir stands in the higher elevations of the watersheds tend to have irregular periods between fires. Large diameter fir trees have a corky bark which helps to insulate them from a ground fire. Large fir trees will survive ground fires as well, or better than ponderosa pine. When there are long intervals between fires, the fir stands will slowly accumulate biomass and tree mortality will increase. A large accumulation of dead material will set the stage for a stand-replacing crown fire. In 1850, the fir stands would have been a mosaic of aggregations of different ages ranging from recently burned openings to patches with large diameter, older fir trees.

## 4.5 THREATENED, ENDANGERED, SENSITIVE, SURVEY AND MANAGE, AND PROTECTION BUFFER SPECIES

Though the variation in life forms and habitats for the species of concern makes it difficult to generalize reference conditions, old-growth forest and natural lowland habitats were more widespread and all habitats were less fragmented than they are presently. Plant and fungi species of concern evolved in response to natural disturbance regimes that varied in intensity and recurrence depending on climatic events and geologic processes. Currently these species are affected by natural events, but anthropogenic impacts have become significant influences on the species of concern. Anthropogenic impacts from a variety of activities such as grazing, logging, road construction, development, fire suppression, and mining have changed the natural vegetation dynamics in the analysis area. These impacts have resulted in habitat fragmentation and loss, and the introduction of exotic species (domestic animals and noxious weeds).

The habitats associated with many of the species of concern are serpentine substrates, rock outcrops, and wetlands for the vascular species, and mature forests and large woody debris for many of the non-vascular and fungi species.

The habitat quality and population levels of serpentine associated species fluctuated according to broad climate patterns and geologic processes. Succession was very slow on these substrates and dictated by long-term soil weathering and erosion processes. Fire impacts were limited as fuel levels in these open woodlands were too low to carry a high intensity wildfire. Though European activities have caused fragmentation and loss of serpentine habitat, serpentine substrate distribution was relatively unchanged from pre-European times. Naturally occurring islands of ultramafic rock intrusions that support serpentine substrates exist primarily in upper Salt Creek, Philpot Creek and Tule Creek watersheds.

In pre-European times, changes in the vegetation on rock outcrops were influenced by fluctuations in climactic patterns and geologic processes and to a lesser extent with periodic wildfires. Although rock outcrops are relatively impervious to fire, the heat and flames could have resulted in a loss of rock-dwelling species and the consumption of adjacent trees. The loss of adjacent trees may have resulted in a temporal alteration of the habitat qualities of shade and moisture on a rock outcrop. Since European settlement, rock outcrops and associated species were further impacted with logging, road building, and excavation activities. A loss and degradation of habitat for rock-dwelling species resulted from these activities, however, the distribution of rock outcrops on the landscape has not changed significantly since pre-European times.

The distribution of wetlands have naturally evolved and changed significantly throughout time with geologic processes and changes in hydrological regimes. In pre-European times, the habitat and population levels for wetland species fluctuated with the availability and extent of water, temperature and light. Periods of drought and flooding as well as events that restructured topography such as erosion and earthquakes have influenced wetland distribution. After European settlement wetland species were further impacted with alteration or elimination of habitat. Activities such as road building, mining, logging, and grazing affected wetland character. Road building had significant habitat impacts. Roads constructed through wetlands resulted in the concentration or diversion of water. This could have dewatered wetlands or created new wetlands. Mining also diverted water and altered topography, and had similar effects as roads. Logging has affected wetlands and riparian corridors. Canopy removal eliminated shade and increased exposure and water evaporation. Grazing has had impacts to wetland species and habitats. Wetlands often focus grazing impacts due to availability of water and moist vegetation (especially in summer months). This has lead to the consumption of wetland vegetation, the trampling of vegetation, and the structural degradation of the wetlands.

Lastly, there are several non-vascular and fungi species of concern that are associated with mature forests and large woody debris, a common component of mature forests. This habitat was more widely available in pre-European conditions. The absence of high fuel loading yielded lower intensity wildfires that were less destructive to this habitat. Current fire suppression and logging has reduced this available habitat through the introduction of higher intensity fires and the removal of mature forest and associated components.

### 4.5.1 Noxious Weeds

Noxious weeds have become naturalized with European settlement. Importation of noxious weed propagules and disturbance of natural vegetation types associated with European settlement (development, logging, road building, mining, and grazing) has provided opportunities for noxious weeds to obtain a foothold and proliferate in the analysis area. Road building and use has further assisted the dispersal of noxious weed seeds. Currently all the species of noxious weeds present and the extent of infestation in the analysis area is not known.

The noxious weeds were not a vegetation component or problem in pre-European times. Nearly all of the noxious weeds have become naturalized since 1769 when the Spanish colonists arrived in California (USFWS 1999). With European settlement noxious weeds were purposeful or incidental introductions. The disturbance patterns in the analysis area associated with development, road building, logging, mining, and grazing have assisted in the introduction, disperal and establishment of noxious weeds.

## 4.6 WILDLIFE / BIODIVERSITY

Prior to 1850, the major force which shaped the vegetation on a landscape level was fire (Nelson et al. 1999). Historic habitats probably consisted of large expanses of late-seral habitat shaped by frequent low intensity fires coupled with an occasional stand removal fire. Although these fires may have been large, they burned in patches and at various intensities and severity (USDA and USDI 1994). Even though late-seral habitat was more abundant at the landscape level, it is likely that some watersheds experienced high intensity-stand removal fires that may have temporarily removed late-seral habitat at the local level. During the mid-1800s, Europeans immigrated to this region in search of gold. Riparian habitat and watercourses were heavily impacted – as were many of the wildlife resources. The Grizzly bear is one example of a species that became extinct in this area during the late 1800s. Even though miners utilized timber resources, it wasn't until the 1960s that commercial logging began in this area.

The majority of the logging occurred in the analysis area between 1965 and the late 1980s. Along with logging came road building and fire suppression. The construction of new roads not only allowed an increase in the amount of sediment deposited into the watercourses, it provided an avenue for increased access into what were once very remote areas. Roads also allowed better access to combat wildfires. Low intensity fires are an important event in late-seral habitats. However, fire suppression has allowed the amount of fuel to build up in numerous watersheds which make them highly susceptible to high intensity – large-scale stand replacing fires that are more likely to burn out of control and temporarily decimate large areas of wildlife habitat.

Given that late-seral habitat was more abundant in these watersheds prior to the commercial timber era, we can expect that populations of spotted owls, northern goshawks, Pacific fishers, and other late-seral dependent species, were more abundant too. As the native landscape began to change with the increase of European settlement and natural resource extraction, many wildlife populations began to decline. During the gold rush years, game species likely experienced the biggest decline, but as timber harvest became more prevalent, species relying on late-seral habitats began to experience declines. By this time, game species populations began to increase as more habitat was transformed into stands of early-successional habitats.

In addition to late-seral habitat loss, anadromous fish populations suffered major declines during the 1900s. Anadromous fish may have been a significant food source for species such as the bald eagle. Stream conditions were degraded as a result of the mining impacts of the late 1800s and the 1955 and 1964 flood events. Further degradation has occurred since the 1964 flood event as a result of numerous land management activities and natural occurring events. Populations of pond turtle and yellow-legged frog were probably greater prior to European settlement.

### 4.6.1 Fisheries

Native fish populations sustained themselves in numbers sufficient to provide for lucrative commercial fishing enterprises in the mid to late 1800's in the Klamath Basin. Snyder (1931) reported commercial catches of chinook salmon in the Klamath River between 1913 and 1926 ranged from 7,200 to 72,400 fish annually. No data exists for the historical run sizes into the Hayfork drainage prior to the diversions, mining and settlement, but anecdotal information suggests the numbers were substantially greater than today (USFS, 1998). Following the lead of Native Americans, local settlers made use to these returning adult fish annually, capturing them by net, weir, or pitchfork (USFS, 1998).

Prior to the arrival of settlers in the Hayfork drainage, aquatic habitat conditions and fish populations evolved almost entirely in response to natural events such as forest fires, landslides, floods, and drought. These episodes were of a periodic nature and varied in intensity across the landscape. These events introduced a variability in habitat types and conditions that healthy fish populations depended upon. With the arrival of European settlers in the basin came an accelerated level of disturbance that was more of a chronic rather than periodic nature. New disturbance regimes resulting from the effects of road construction, land clearing, mining, timber harvesting, water diversions, and residential development overlayed those already present from natural events. As development and resource extraction increased the ability of the watershed to recover from impacts decreased.

Recent history indicates that the 1964 flood was the most significant event that affected fish populations and habitat in the South Fork Trinity River Basin (USFS, 1999). It is unknown what the effects of the 1964 flood were on Hayfork Creek since there is little or no survey information available for that time. However, local residents reported described Hayfork Creek as having much deeper pools prior to the flood (PWA 1994). Anglers reported that the abundance of winter steelhead declined substantially since the 1964 flood. In 1964 there were over 5000 redds counted in the upper Trinity River and Hayfork Creek compared to 352 in 1972 (Rogers 1972, 1973). The heavy bedload the flood carried filled in deep pools, widened the stream channels, and reduced cool water refugia areas. As a result the South Fork Trinity River spring chinook populations decreased from over 10,000 individuals to between 400 and 1,000.

## 4.7 FIRE AND FUELS

Fire is the most important natural disturbance which has affected vegetation in the analysis area. Fire ring studies from the Klamath Mountain indicate a pre-1850 fire return interval median of 14.5 years; settlement period 1850 to 1904; 12.5 years and suppression period 1905-1992; 21.5 years. Initial data samples from a study by (Skinner and Taylor, Unpublished) on the Hayfork Ranger District indicates a similar fire return interval, but a larger number of fire starts. This is also likely representative of the analysis area.

Fire regime studies in the Sierra Nevada suggest that forest ecosystems are outside their historical range of variability as to fire frequency and severity and associated stand structures (Skinner and Chang, SNEP, 1996). This is primarily the result of fire exclusion due to suppression efforts since the early 1900's. The exclusion of fire has been successful in minimizing low-severity fires and most moderate-severity fires which were characteristic of the pre-1850's. This exclusion has resulted in an increase in shrubs and understory trees. These have become ladder fuels, which can enable a fire to reach the overstory canopy resulting in stand replacement fires. This scenario in the Sierra Nevada’s is also likely to be characteristic of the analysis area.

It was common for Native Americans to set fires for cultural purposes. It is likely that the forests at that time were composed of a relatively open overstory of large mixed conifers with a sparse conifer and hardwood understory and a light shrub layer. There were probably fewer dead and down ground fuels and fewer ladder fuels composed of shade intolerant understory trees. Before fire suppression occurred in the early 1900's, it is likely that there were more annual fires and that they were generally of low severity and stayed on the ground.

Fire history records (1985-1995) for the Hayfork Ranger District show that 60% of the fires are lightning caused and 40% are human caused (See Appendix A Fire Family Plus data). The largest recent fire in the analysis area was in 1987 during a series of lightning fires that struck the Shasta Trinity National Forest. The Peanut fire 6260 acres, the Friendly Fire 3463 acres, and the Tule Fire 994 acres were all lightning caused. The largest fire in the analysis area was the 1964 Summit fire a human caused fire. Two other large fires have occurred, in 1991 the Rock Fire a 1,100 acre human caused fire and in 1992 the Barker Fire, 5258 acres, also human caused. Both lightning and human caused fires have played a major roll in the large fire history of the analysis area. The overall number of starts by lightning exceeds the human caused starts by 20 %.

The fire history also shows that suppression success during the first half of the 20$^{th}$ century was good but as the fuels began to build up suppression success began to decrease. The larger fires became larger and more difficult for the modern suppression resources to keep below 100 acres. The fires also became more damaging.

## 4.8 COMMERCIAL TIMBER

Commercial timber harvesting in the past decade has been very limited. The only recent harvesting has been two helicopter sanitation-salvage sales which totaled approximately 10 million board feet. Sanitation-salvage harvests target dead, dying and diseased trees. The area of these watersheds appears to have a higher than normal incidence of dwarf mistletoe infestation, which in turn exposes the weakened trees to attack by insects. Consequently this area has a higher than normal mortality rate than similar mixed conifer forests. The mortality rate has been recently exacerbated by the long drought which ended in the early 1990’s. Since then the mortality rate appears to be falling, but it is still higher than normal.

The purpose of this chapter is compare existing and reference conditions of the key elements of the ecosystem relevant to future land management objectives.  Existing and reference conditions are discussed in the context of the Issues and Key Questions identified in Chapter 2.  The discussion focuses on identifying:

- Obvious differences between existing and reference conditions,
- Trends and magnitude of change in physical, biological, and human processes,
- Causal mechanisms responsible for the differences between existing and reference conditions,
- Major natural and human-related disturbances or activities that have significantly altered physical, biological, and human processes or ecosystem functions that would affect the ability of the system to achieve the reference conditions described in Chapter 4 or management objectives, and
- Implications of the changes and trends including the capability to achieve management objectives.

## 5.1 RIPARIAN MANAGEMENT

### 5.1.1 General Trends

What are the natural and human causes of change between the historical and current vegetative conditions?

What are the influences and relationships between riparian vegetation and seral patterns and other ecosystem processes in the watershed?

Historic riparian stands may have been composed of large diameter conifer and hardwood species that developed in response to periodic fires, floods, droughts, and other natural events (USFS, 1998).  The current riparian stands are generally composed of relatively smaller diameter trees that were the result of long-term land use activities that commenced with the arrival of European settlement.  These land use activities included timber harvesting, fire suppression, road construction, land clearing for residential and agricultural development, cattle grazing, and mining.

The decline in the riparian vegetative structure, along with stream clearing activities, may have affected the stream channel in a number of ways.   The harvesting of timber removed large diameter conifers thereby reducing the ability of the riparian zone to supply large woody debris (LWD) to the channel.  The removal of riparian conifers and the removal of LWD from the channel during mining and stream clearing activities resulted in a decrease in the number of woody debris-formed pools.  The decrease in LWD and the associated scouring action during high flows reduced the ability of the channel to route sediment downstream.  The reduction in sediment transport resulted in pool filling and an overall decline in fish habitat.  Those fish habitat parameters affected by the reduction in riparian stand conditions and LWD loading included a decline in spawning and rearing habitat quality, increase in water temperatures, and decrease in surface flow due to excessive amounts of sediment in the channel. Such conditions exist in reaches of Tule Creek, Philpot Creek, and Big Creek.

### 5.1.2 Key Questions

What management activities have occurred in riparian areas? (See Section 5.1.1)

What management activities can be used to enhance riparian reserves and the terrestrial and aquatic species habitat within the reserves? Specific management recommendations are discussed in Chapter 6. The analysis in Section 5.1.1 is the basis for the management recommendations.

What streams would benefit from riparian management activities? ? Specific management recommendations are discussed in Chapter 6. The analysis in Section 5.1.1 is the basis for the management recommendations.

## 5.2 WATER QUALITY AND WATERSHED ENHANCEMENT

### 5.2.1 General Trends

#### *5.2.1.1 Hydrology*

What are the natural and human cause of change between historical and current hydrologic conditions?

What are the influences and relationships between hydrological processes and other ecosystem processes?

Hydrologic conditions are for the most part are a function of climate, vegetation, drainage densities and patterns, the infiltration capacity of the soils within a watershed, and water diversions. Climatic conditions within the analysis area, specifically, the pattern of rainfall has the greatest degree of influence upon hydrologic conditions. Long-term rainfall patterns are characterized by periods of above average annual rainfall during El Nino years and droughts characterized by below average annual rainfall. Climatic change data does not exist for the analysis area.

Current vegetation conditions indicate that vegetation densities are higher when compared to historical conditions. Higher vegetation densities are associated with areas of Fuel Model 10 in the East Salt Creek, East Fork Big Creek, and Philpot Creek watersheds, and Fuel Model 6 in the Salt Gulch, Kingbury Gulch, Dutch Gulch, Ditch Gulch, and Dobbins Gulch watersheds. The increased vegetation densities are affecting hydrologic conditions by utilizing more of water available in the vadose zone of the soil in the evapotranspiration process. Consequently, less water is available for shallow ground water and deep ground water recharge. As a result, summer base flows are less when compared to historic conditions. The water temperature of these lower summer flows is also increased relative to historic conditions because there is less water to absorb solar radiation.

Increased vegetation densities are producing localized areas of decreased sediment production. During the historic fire regime fires were more frequent and less intense. However, high intensity pockets did occur and combined with a larger percentage of the watershed burning more frequently produced more frequent sediment inputs to the stream channel system. During periods of above average annual rainfall sediment delivered to channels was transported by the increased flow and deposited in lower energy reaches. During periods of below average rainfall sediment was deposited throughout the stream channel system because flow energy was not high enough to transport the sediment. In the current fire regime, fires are less frequent and as a result sediment inputs are less frequent. As a result flow energy is utilized to erode stream banks and channels to produce a sediment volume that is in equilibrium with the flow energy.

Soil infiltration properties are primarily affected by compaction of the soil, resulting in higher rates of runoff. Soils are primarily compacted by equipment moving over the exposed soils. Skid trails and landings within timber harvest areas tend to become compacted because of the level of equipment traffic. Fine soils, clay soils, are more easily compacted than coarse soils, sandy soils. Soil compaction on skid trails constructed on fine clay soils in the Ditch Gulch watershed and other areas where heavy tractor logging occurred such as Telephone Ridge, is higher compared to historic conditions due. Although compaction decreases with time, some areas do not fully recover.

Drainage pattern changes and increase in drainage density result from road construction. An example of a drainage pattern alteration is a mid-slope road that intercepts runoff from slopes above the road and conveys the runoff down the road into a stream channel that is different than the natural conveyance or stream channel. Drainage density increases can occur as a result of the drainage design of a road. Roads designed with inside ditches or outsloped roads can convey runoff to an area outside of the natural conveyance resulting in the formation of a new channel and an increase in the density of channels within a watershed. Alteration of drainage patterns and drainage densities can produce accelerated stream bank erosion. Stream bank erosion due to increased drainage densities and alterations of drainage density is higher compared to historic conditions because of the increase of road densities within the analysis area.

Water diversions in the analysis area are contributing to reduced flows in areas downstream of diversions. The effects of water diversions are discussed in Section 5.2.1.4 – Water Quality.

### *5.2.1.2 Erosion Processes*

What are the natural and human causes of change between historical and current erosion processes in the watershed?

What are the influences and relationships between erosion processes and other ecosystem processes?

Mass wasting is dependent upon the bedrock geology, soil properties, frequency of tectonic activity, channel downcutting, climate and land use history. Land use activities, such as, road construction and mining have the highest probability of creating slope or soil conditions that can create new areas of mass wasting or re-activate existing or ancient mass wasting areas. Because mining activities and road densities have increased when compared to historic conditions localized areas of increased mass wasting exist throughout the analysis area. The increase in mass wasting is primarily associated with road cut and fill slopes in areas of relatively high road densities, such as the Philpot Creek, Ditch Gulch, and Barker Creek watersheds.

In areas where mining has occurred in stream channels and adjacent slopes are greater than 65% the formation of valley inner gorges and associated slides increased because alteration of the channel substrate by removal and re-arrangement of more resistant channel material increased channel downcutting.

Roads can increase the frequency of mass wasting if roads are constructed on or near to inactive or ancient landslides or known areas of instability. Roads did not exist during the pre-settlement era, began to increase with settlement of the area, and peaked in the 1980's. As a result road related mass wasting has probably increased in areas of high road densities such as Philpot Creek, Ditch Gulch, and Barker Creek watersheds.

During a fire exclusion period surface erosion rates are lower relative to the surface erosion rates of the historic fire regime. When a high intensity fire occurs in the current fire regime most of the biomass and organic debris is removed, exposing the soil to rainfall impact and sheet flow, which increase erosion rates. The complete removal of biomass and organic matter from large areas of a watershed or subwatershed creates flow conditions and sediment conditions that in some cases are outside the natural range of variability of the morphological characteristics of a stream channel. As a result, based upon the position of the channel in the drainage network (e.g., headwaters versus valley) aggradation or degradation of channels occurs. Depending upon the rate and location of aggradation, localized flooding, bank instability, and aquatic habitat degradation occurs. The watershed response described above has occurred in areas where large fires have burned at a very high intensity such as the Peanut Fire in the Salt Creek watershed. The response will occur if a high intensity fire occurs in an area with high biomass levels (Fuel Model 6 and 10). See Section 5.2.1.1 for a list of these areas.

### *5.2.1.3 Stream Channels*

What are the natural and human causes of change between historical and current stream channel conditions?

What are the influences and relationships between stream channel conditions and other ecosystem processes?

As discussed above stream channels have been altered by changes in the hydrologic and sediment regimes. In addition, mining, roads and grazing have directly impacted stream channels. Mining activities have altered both the composition of the channel substrate and stream banks. These changes have increased both channel degradation and lateral migration of channels (stream bank erosion) in channels where mining has occurred. As a result, channels are wider and deeper, substrate is less complex, stream bank vegetation is less diverse, the frequency of large woody debris is reduced and the shading value of riparian vegetation has been reduced when compared to historic conditions. In many cases the stream channels are no longer connected to their floodplains, resulting in reduced rates of recharge of floodplain areas.

Roads have directly altered stream channels where roads cross channels. The placement of road fill and culverts has altered the longitudinal profiles of stream channels above and below channel crossings. In some cases, the channels adjust to the new longitudinal conditions by accelerating the filling of pools upstream of a crossing or accelerating channel degradation below crossings.

#### *5.2.1.4 Water Quality*

What are the natural and human causes of change between historical and current water quality conditions?

What are the influences and relationships between water quality and other ecosystem processes?

Assessment of changes in water quality parameters is difficult because historic water quality data does not exist and current water quality data is limited, and most of the data is from monitoring locations on private land.

A key water quality parameter for fish survival is water temperature. In the lowest reaches of Salt Creek and Hayfork Valley, low flow temperatures are believed to be higher than historic conditions. This may be a result of riparian management and cumulative water withdrawals in these areas. Removal of riparian vegetation by timber harvest, road construction, mining, grazing and stand replacement fires has reduced the shading of some streams. This change in shading is of higher concern on low gradient channels on valley floors, because topographic shading of the stream is lower relative to headwater streams.

As discussed in Section 5.2.1.2 – Erosion Processes the sediment regime of the watersheds within the analysis area has been altered by the exclusion of fire and stand replacement fires. Total dissolved solids (TDS), the water quality parameter used to measure all solids in the water column, can be correlated with sediment production. TDS data is limited within the analysis area and has not been measured after large high intensity fires have occurred in the analysis area. However, TDS values increase after high intensity fires. It is not known how the increase in TDS affects aquatic organisms or downstream water uses.

### 5.2.2 Key Questions

What are the long term-erosional processes in the analysis area? See Section 3.1 Erosional Processes.

What erosional processes have been accelerated by natural and human induced disturbance? See Section 5.2.1.2 Erosion Processes.

What areas of Middle Hayfork and Salt Creek Watersheds are highly erodible and require special attention or management? See Sections 3.2.1 Mass Wasting and 3.2.2 Soils.

What watershed processes are out of equilibrium and require restoration efforts?

The shift from a historic fire regime characterized by frequent low intensity fires to the current fire regime of less frequent high intensity fires has altered the hydrologic and sediment regimes of the stream channels within the analysis area. The alteration of the hydrologic regime is discussed in Section 5.2.1.1 Hydrology. The alteration of the sediment regime is discussed in Section 5.2.1.2 Erosion Processes. Recommendations for restoring the hydrologic and sediment regimes are discussed in Chapter 6.

What streams would benefit from implementation of channel stabilization or restoration measures?

General stream types and stream conditions that would benefit from channel stabilization or restoration measures are discussed throughout Section 5.2.1 General Trends. Specific recommendations are described in Chapter 6.

What are the processes that create and maintain anadromous fish habitat over long periods of time? Have these processes been altered? If the natural processes have been altered how have they affected anadromous fish habitat? How have human induced disturbance altered these processes? See Section 5.1 Riparian Management

What is the predicted future for anadromous fish habitat if the Standards and Guidelines of the Aquatic Conservation Strategy are implemented? The trend should show improved habitat conditions overtime.

## 5.3 FIRE AND FUELS

### 5.3.1 General Trends

During the fire suppression era, from 1911 until 1998 there were 808 reported fires in the analysis area of which the large majority were lightning caused fires less than 100 acres and 14 fires larger than 100 acres. The causes for the larger fires were 7 lightning caused and 7 human caused. More recently from 1985 until 1995 there were 152 fires less than 100 acres and 6 fires greater than 100 acres within the analysis area (40% of the fires reported on the Hayfork Ranger District between 1985 and 1995). As indicated by the fire history studies mentioned in the earlier chapters of this document the number of lightning caused fires has in pre historic time played an important role in the disturbance history of the analysis area and will continue to play a major role in disturbances in the analysis area.

Fire management programs were effective in containing and controlling the majority of wild fire ignitions within the analysis area up until 1987. From 1987 until 1995, there were 6 fires greater than 100 acres, burning 17,731 acres within the analysis area. From 1923 until 1985, a span of 62 years there were 8 fires greater than 100 acres with a total burned acreage of 24,189 acres. The Summit Fire in 1964 burned 18,905, but only a small part of the fire burned into the northeastern part of the Middle Hayfork Watershed. The fires of the last 15 years in the watershed were more damaging than the previous 62 years, because fire intensities are higher and sizes are getting greater

The fires of concern in this analysis are the 1987 lightning fires the Peanut Fire (6260 ac), Friendly Fire (3,463 ac), and the Tule Fire (994 ac). The Rock Fire in 1987 unknown cause (1,100 acres) and in 1992 the 5,200-acre arson fire, the Barker Fire. The Peanut Fire was in the Salt Creek watershed and burned very intensely. The Peanut Fire burned at very high intensity and in some areas and removed a large part of the old age timber base from the Salt Creek Watershed.

Even though fire suppression resources increased up to 1980 and the technology of fire suppression is improved, the ability to suppress fuel driven fires has been reduced. The early success of fire suppression during the first 75 years of the 20th century has also increased the fuel accumulation in the forest. Fire intensities of the historic fire regime was characterized by low intensity, frequent fires. This has changed since settlement times to less frequent fires, and more intense fires of the last 25 years of the 20th century. This has been a direct result of early fire suppression successes and an increase in the accumulation of burnable biomass and dead fuel loads. Currently when a large number of lighting fire starts or a single start exceeds the capabilities of the initial attack forces the fires get larger. The increase in fire intensities is a direct result of increases in fuel loading, which allows for higher intensity fires and larger fires when compared to the fire intensities and sizes of historic times.

The Fuel Hazard rating within the analysis area at present is moderate to high. The high fuel hazard areas are found in the lower elevation, overstocked timber lands, and in the brush communities. The Forest has begun a process to re evaluate its previous analysis of fire hazard and risk. The risks and hazards will not decrease with the new analysis. Instead it will be a tool to better identify those hazards and risks when it is completed and this mapping process will assist the District in determining fuel treatment priorities

With the diminishing fire management budgets and the reduction in the work force (starting in 1980) to suppress fires, as well as the increase in the fuel loading, the risk of large catastrophic fires will increase.

In ecosystems, that have prior to European settlement had a historic fire regime characterized with low intensity, and frequent fires such as that found in the Middle Hayfork and Salt Creek watersheds, changing these to a less frequent high intensity regime, which exists today, can have catastrophic impacts to the watershed. The absence of low intensity fires to reduce the fuel loading and the reduction of the timber salvage program has caused an increase in the vegetation and the dead fuel component. Fire exclusion has allowed an increase in the growth of fire intolerant species of vegetation and an increase in other biomass growth that adds to the build up of flammable fuels that can add to the fires intensity and difficulty of control. The cause and affect of not allowing fires to burn under low intensities either naturally or under prescribed conditions of control or not trying to reduce the fuel accumulation has increased the probability that stand replacing fires will occur in the future.

Stand replacing fires will increase the loss or alteration of late seral stage wildlife habitat and salmonid habitat, water quality, commercial timber, and lives and property within the watershed.

### 5.3.2 Key Questions

What is the present fire regime for the watershed? See Sections 3.7 Fire and Fuels and 5.3.1 General Trends.

What is the recent historical pattern in fires causes within the watershed? See Sections 3.7 Fire and Fuels and 5.3.1 General Trends.

What are the Hazard/Risk ratings within the watershed? See Section 3.7 Fire and Fuels.

What areas would benefit from fuel hazard reduction treatments? Treatment priorities are discussed in Chapter 6. The analysis in Section 5.3.1 General Trends and LRMP direction are the basis for the recommendations.

What types of fuel hazard reduction would be most effective?

There are several strategies that could be implemented to improve the overall stand conditions and lessen fire impacts, but it will take an aggressive program that will need to employ numerous strategies. Those strategies could include the reintroduction of fire into the ecosystem through the implementation of an aggressive prescribed fire program. Other programs would include thinning of overstocked stands of timber and removing concentrations of standing dead material. The planning, construction, and maintenance of strategic fuel break systems would be very important to the protection of the timber resources as well as protection of private property from wildfires should be an effort that includes participation of private land owners both large and small.

Fire suppression has successfully removed the low intensity fire regime that has been a part of the ecosystem for thousands of years. The reintroduction of fire is important to the health of the ecosystem and to the prevention of catastrophic fire in the analysis area. It is also a means to improve wildlife habitat particularly deer habitat.

What areas of the analysis area would most benefit from prescribed fire for fire protection and fuels reduction? Specific recommendations are described in Chapter 6. Section 5.3.1 General Trends is the basis for the recommendations.

Would thinning from below prior to prescribed burning in timber stands provide for a healthier stand after the burn?

Thinning from below would be very important in those stands that have heavier than usual fuel loading and mid story shade tolerant vegetation. Prescribed fire would be an easier and safer tool if the fuel loads were reduced through thinning before burning. An evaluation of areas before burning using FOFEM or BEHAVE to determine tree mortality would be useful to determine areas of thinning prior to burning.

Is the community at risk and what is the risk level?

The community of Hayfork and the smaller outlying area have been periodically threatened by large wild fires and that threat has been growing as shown by recent fire history in the watershed. The community is at risk and has been put at risk in the past by large wildfires. It will be important for the District fire staff to determine the areas of highest risk around private property and then develop appropriate fuels treatments to reduce that risk. The scope of this document does not allow for on the ground determination for risk on private property adjacent to the forest that will need to be assessed locally.

Would a program of community involvement and education to threat of wildlfires help the public better prepare for a large wildfire?

The development of a program of fuel breaks to protect private property is a program that was started back in 1996 and it involved a community program called the Hayfork Fuels Reduction Demonstration Project and Neighborhood Fuels reduction. Restarting this program would increase community involvement in fuels reduction and provide support for other fuels reduction programs.

What fuel treatments are needed to reduce risks to the community of Hayfork? Specific recommendations are described in Chapter 6. Section 5.3.1 is the basis for the recommendations.

What areas of the analysis area would benefit from prescribed fire for deer habitat improvement? Specific recommendations are described in Chapter 6. Section 5.3.1 General Trends is the basis for the recommendations.

## 5.4 COMMERCIAL WOOD PRODUCTION – FOREST VEGETATIVE DYNAMICS

### 5.4.1 General Trends

What is the historical array and landscape pattern of plant communities and seral stages in the watershed?

What are the current conditions and trends of the prevalent plant communities and seral stages in the watershed?

Historic landscape patterns in these watersheds were primarily larger diameter pine, Douglas-fir, and true fir stands. Much of the watersheds were probably made up of late seral stands with patches of younger stands established following fire events or landslides. Also, periodic lighter burn fires thinned the understory of many stands, preventing buildup of large concentrations of fuel and overstocked conditions.

Current landscape patterns tend toward mid-seral stage stands of smaller diameter trees interspersed with early seral stage plantations and relatively little late seral stage stands. Many of these early and mid-seral stage stands are overstocked and are therefore susceptible to insect attack, especially during periods of drought that may weaken individual trees. These stands are prime areas for intermediate silvicultural treatments including non-commercial and commercial thinning. The late seral classified areas include smaller isolated upland stands, but tend to be more concentrated along riparian areas. Some of these upland stands, which occur outside the LSR's and riparian reserves, exhibit reduced growth, have achieved culmination of mean annual increment (CMAI), and are no longer efficiently contributing to commercial wood production. These areas provide opportunities for regeneration treatments to reestablish more vigorous timber stands.

The changes in the structure of vegetation are attributed to two main factors: large, high intensity stand replacing fires, and timber harvesting. Starting around 100 years ago, the policy approach of fire suppression began to change the landscape patterns by allowing an understory of smaller trees to become established and survive in many areas in the absence of historic periodic fires. This allowed the buildup of smaller understory fuels, setting the stage for the larger and higher intensity fires that have taken place over the last half-century. Some of the higher intensity burn areas suitable to support conifer stands are now dominated by brush. Fire suppression efforts also arrested the culling of weaker, damaged, and insect kill trees that the periodic fires would have helped eliminate.

The first harvest entries into these watersheds were selection cuts targeting only the biggest and most valuable trees. This practice reduced the overall average diameter of the trees in the harvested stands. Later harvests, beginning in the 1960's, utilized clearcut silviculture and those harvests created entire new stands of early seral stage development. The most recent harvests that have taken place over the past decade have been oriented to sanitation-salvage type operations undertaken to improve forest health and stand vigor.

"Silviculture consists of the techniques for manipulating the establishment, composition, structure, and rates of development of forest stands, including both trees and associated other vegetation. These techniques are the product of a long history of accumulated research and experience. Although many of these techniques were originally developed to enhance wood production, they can easily be extended to the broader problems of developing forests, stands, and trees with the characteristics desired for multiple forest objectives. In young stands particularly, stand characteristics can be markedly modified and development rates sharply accelerated within relatively short periods. Details of application must of course be worked out for any specific set of conditions and objectives." (Curtis, et al, 1998)

Matrix lands are currently being managed to provide predicted outputs. Table 3-15 shows the timber type acreages within Middle Hayfork and Salt Creek watersheds available for commercial timber production. Harvesting within the 22,715 acres in the Middle Hayfork Creek watershed and the 19,867 acres in the Salt Creek watershed of capable and suitable matrix lands available for timber production will establish a more diversified landscape. As this land base progresses toward a fully regulated condition, it is anticipated that a well-distributed range of seral stages will occur. Increasing emphasis will be placed on intermediate harvest (thinning) treatments to meet regulated forest objectives. Intermediate harvests can accelerate the growth of the remaining stand and thereby accelerate that stand's progression to more advanced seral stages. These treatments could also benefit other resource requirements. For example, thinning in riparian reserves could restore a desired condition of large diameter trees that would increase large woody debris recruitment and improve instream habitat conditions. Thinning treatments also can be utilized to increase habitat quality for wildlife species of concern.

Reforesting brush areas, which once supported forest types, can increase the producing forestland base. These areas would eventually reestablish through natural regeneration; however, because of competition from the brush present, this process can take a very long time. However, the eastern portion of the Salt Creek watershed contains brushfields growing on lands unsuitable for commercial timber production. Treatments in these areas may be undertaken to enhance wildlife values.

### 5.4.2 Key Questions

As compared to historic conditions, what are the current vegetative conditions within the watershed? See Section 5.4.1 General Trends.

What is the current vigor/growth of stands in the watershed? Historic condition consisted of generally mature to decadent stand types, which exhibited relatively little growth. The current vegetation is represented by younger stand types that exhibit relatively vigorous growth rates. However, no timber inventory data were available for this analysis which included quantitative measures of growth. For further information see Section 3.5; and Chapter 6 Recommendations.

What is the current level of tree mortality in the watershed? See Section 4.7.

Are lands designated matrix currently being regulated to provide predicted outputs? See Section 5.4.1 General Trends.

What regeneration harvesting opportunities are available to move the suitable timber lands toward a Desired Future Condition DFC of a fully regulated timber land base? See Section 5.4.1 General Trends.

What intermediate cutting opportunities are available to maintain stocking levels that will reduce susceptibility to insect attack and maintaining stand growth? See Section 5.4.1 General Trends.

How can conifer forests be reestablished in areas that are now brushfields? See Section 5.4.1 General Trends.

What opportunities are available that will meet Adaptive Management Area AMA objectives to test forest management practices, including timber harvest practices? See Section 6.1.1.

What silvicultural treatments meet the objectives of other resource requirements? See Section 5.4.1 General Trends.

What management strategies should be used/employed to meet LRMP expectations? See Section 5.4.1 General Trends.

## 5.5 LATE SUCCESSIONAL HABITAT PROTECTION AND ENHANCEMENT

### 5.5.1 General Trends

What are the natural and human causes of change between historical and current species distribution and habitat quality for species of concern in the watershed?

What are the influences and relationships of species and their habitats with other ecosystem processes in the watershed?

Prior to the intensive land management that occurred in the 19$^{th}$ and 20$^{th}$ centuries, late successional forest may have been the primary habitat type in these watersheds. The landscape was shaped primarily by natural events such as frequent low intensity fire, drought, floods and an occasional stand removal fire. Native Americans in this region used fire to set back succession and increase the amount of habitat for game species such as deer and elk. Currently, late successional forest habitats are smaller in size than they were historically in the analysis area. This is the result of intensive land management activities such as timber harvest and road building, wildfire, mining, and development.

These management activities have affected the landscape in a number of ways. During timber operations, large diameter trees were removed, snags were felled, roads were constructed, and the soil and ground litter was greatly disturbed and compacted. Many of the previously cut stands have grown back into densely stocked stands of small diameter trees that are of little value to most wildlife species. Fire suppression and timber harvest without fuel treatment has led to an increase of fuel loads in many stands. Densely stocked stands combined with years of fire suppression have contributed to several large stand removal fires that have occurred in these watersheds since the mid 1900's (see Figure 3-7). The end result is a fragmented landscape that is composed of mostly early to mid-successional habitats, with a few stands of late successional habitat. These habitat conditions also exist in the portions of the Corral and Chanchellula LSRs that lie in the Middle Hayfork and Salt Creek watersheds, respectively.

Historically, late successional dependent species were probably not limited by the availability of habitat at the landscape level. Although, at the local level, habitat may have occasionally been a limiting factor for some species due to bug kill/fire. Historically, other factors, such as prey availability, predators, and extreme environmental conditions probably controlled populations.

Currently, habitat availability and fragmentation is one of the most significant limiting factors for late successional dependent species. Therefore, it can be assumed that the distribution and relative abundance of most late successional dependent wildlife species has been significantly reduced and/or altered in these watersheds.

Even though late successional habitat is critical habitat for many sensitive species, other habitats may also be important. Early to mid successional timber stands may support an abundance of mammal and bird populations that are important prey items for species such as the Pacific fisher and northern spotted owl. High quality riparian habitat and stream conditions are important for anadromous fish species, which in turn, are potential prey items for the bald eagle. Key habitat elements, such as snags and LWD, provide micro-habitats for numerous wildlife species such as the American martin and pygmy nuthatch.

### 5.5.2 Key Questions

Where and in what condition is the connectivity for late-seral associated species in the watershed?

Besides the loss of late successional habitat, other negative impacts to late successional species within these two watersheds include habitat fragmentation and a lack of connectivity. In order to synthesize these concerns map layers containing fuel models, vegetation strata, land allocation, and dispersal and suitable owl habitat were overlaid and analyzed. Further field review is required to verify the map analysis.

One condition that has contributed to fragmentation and increased fire hazard within the Middle Hayfork watershed is the 5,394 acres of plantations, including 904 acres within riparian areas. The district should aggressively pursue a thinning program of these plantations. The western tributaries of East Fork of Big Creek, the northern headwaters of Big Creek and Barker Creek, and the western edge of Hayfork Creek would be the priority areas for plantation thinning in the Middle Hayfork watershed. Reasons for treating these areas include: 1) a need to accelerate growth and subsequently increase the amount of late successional habitat and decrease the extent of “hard edges” that now exist around late successional stands 2) there is a need to reduce the potential risk of catastrophic fire to the LSR and late successional habitat 3) there is a need to decommission roads and it is recommended that thinning precede decommissioning 4) a need to increase the ability to function as a dispersal corridor.

Within the Salt Creek watershed there are 3,706 acres of plantations, including 678 acres within riparian areas. Priority areas for plantation thinning would include all riparian areas, as well as plantations in Philpot Creek, and the headwaters of Ditch Gulch. Philpot treatments, accelerating late successional conditions, would increase patch size of existing patches of late successional habitat. Treatment in the upper Ditch Gulch would enhance connectivity toward Dubakella Mountain and south to LSR 330.

The riparian reserves alone, within these watersheds, do not provide adequate connectivity, therefore wildlife corridors should be designated and managed within the watershed. The purpose of a wildlife corridor is to facilitate movement of organisms between and among habitats. Wildlife corridors should be established prior to project planning when 15% retention standards for late successional habitat are also analyzed. Key areas to examine are the weak links in connectivity found along the western edge of Hayfork Creek and the eastern edge between Duncan and Carr Creeks.

## 5.6 THREATENED AND ENDANGERED, FOREST SERVICE SENSITIVE, FOREST SERVICE ENDEMIC, AND SURVEY AND MANAGE OR PROTECTION BUFFER PLANT AND FUNGI SPECIES

### 5.6.1 General Trends

What are the natural and anthropogenic factors contributing to changes in the historical and current populations and habitats of the species of concern?

Overall, historical changes in the habitat and population of species of concern were regulated primarily by natural processes such as climatic and geological processes, and natural low intensity fires. Indigenous people had secondary impacts such as periodic burns and collection of plant material for food, clothing, and housing. The populations of the vascular species of concern associated with rock outcrops, serpentine habitats, and wetlands were naturally fragmented by the scattered geologic occurrences of intrusions of rock, ultramafic rock, and the often scattered occurrence of wetlands.. Although, wetlands associated with riparian corridors were a connected feature throughout the analysis area. Populations of non-vascular species of concern associated with mature forest components (large trees and large down woody debris) had wide spread and available habitat throughout the analysis area.

The European anthropogenic factors have substantially impacted and changed population levels and habitats of the species of concern. These factors include development, logging, road building, mining, grazing, and fire suppression. Development in the Hayfork valley has eliminated many natural vegetation types. Consequently there has been a loss and reduction of habitat available for species of concern such as Brandegee's woolly-stars. Logging has fragmented and reduced mature forest habitats as well as changed the qualities of adjacent habitats such as wetland, rock outcrops, and serpentine substrates. These effects occur through the loss of shade canopy yielding increased exposure and evaporation. Road building throughout the analysis area has diverted or concentrated water affecting wetland species of concern. In addition, road building has fragmented habitat and habitat has been lost for most of the species of concern. Mining has had similar effects as road building. Grazing has impacted some population levels and the habitat quality of the species of concern through trampling and consumption. Wetland species have been particularly thus impacted. Fire suppression has interrupted the centuries old fire ecology in the region and resulted in increased fuel loading and the potential for high intensity fires. This could cause loss of habitat and reduce population levels of many of the species of concern.

The sensitive habitats that support many of the species of concern (rock outcrops, serpentine soils, and wetlands) are highly susceptible to habitat degradation and loss due to the often isolated quality and limited occurrence in the analysis area. In addition, harsh sites such as serpentine substrates and rock outcrops are slow to recover from disturbance.

### 5.6.2 Key Questions

What is the relative abundance and distribution of the plant and fungi species of concern in the analysis area? See Section 3.8.

What is the distribution and character of their habitats? See Sections 3.8 and 4.4.1.

Are there opportunities to enhance habitat conditions? Specific management recommendations are discussed in Chapter 6. The analysis in Section 5.6.1 General Trends is the basis for the management recommendations.

## 5.7 NOXIOUS, INVASIVE AND EXOTIC WEEDS

### 5.7.1 General Trend

What are the natural and anthropogenic factors contributing to changes in the historical and current populations and habitats of the noxious weeds?

What are the influences and relationships between noxious weeds and other ecosystem processes in the watershed?

Noxious weeds overrun and alter native ecosystems and form large and aggressive moncultures that displace native plants and alter long established native flora and fauna relationships (food, habitat, and genetic), soil chemistry, fire frequency, and water table levels. Without combined native plant revegetation and weed abatement programs in the analysis area quality of habitat and habitat loss for both flora and fauna will rapidly accelerate. Main routes of travel enable introduction of weeds and distribution of weeds throughout the analysis area. Fire suppression activities can introduce weeds as equipment moves between national forests carrying weed propagules.

Potential effects of the establishment of invasive and noxious weeds include increased fire hazard, loss of native species diversity, loss of income from agricultural uses (reduced crop and livestock yields), and loss of habitat for wildlife and livestock. Yellow starthistle occupies the Hayfork Valley and epidemic proportions and has a high likelihood of spreading where bordering forest land is opened up with timber harvest and other disturbances. A large portion of the analysis area is privately owned, making management and control of invasive and noxious weeds more complex.

### 5.7.2 Key Questions

What is the relative abundance and distribution of the noxious weeds in the analysis area? See Section 5.7.1 General Trends.

Are there opportunities to identify and control noxious weeds? Specific management recommendations are discussed in Chapter 6. The analysis in Section 5.7.1 General Trends is the basis for the management recommendations.

This chapter generates management recommendations. The goal of the recommendations are to:

- Identify changes in watershed conditions and processes that require management action to achieve desired objectives.
- Identify monitoring and research activities that are responsive to the Issues and Key Questions.
- Identify data gaps and limitations of the analysis.

## 6.1 MANAGEMENT RECOMMENDATIONS

### 6.1.1 Riparian Management

- Improve riparian stand conditions by utilizing timber thinning where appropriate. Thinning is a management tool which may be used to enhance aquatic habitat conditions while at the same time reducing the risk of catastrophic fire in the riparian areas. Thinning programs may be useful in specific timber types to release the remaining trees and achieve a late successional condition at a faster rate. Appropriate timber types for thinning include M2G and M3G. However, such a program should be structured so that large woody debris (LWD) loading, that would have occurred due to density dependent mortality, could continue. Thinning programs could occur in the Big Creek, Tule Creek, and Philpot Creek watersheds.
- Conduct instream LWD inventories and channel typing surveys to determine where it would be appropriate to install wood structures to create pool habitats and enhance sediment routing. Generally, stream reaches with gradients between 1 and 4 percent may be appropriate for these types of structures. However, channel and habitat typing should be employed to determine if site conditions are appropriate for LWD structures. These structures could improve habitat functionality while the riparian stands develop to the point where they can naturally supply adequate amounts of LWD to the stream.
- Explore opportunities to test the reintroduction of low intensity prescribed fire in riparian zones to reduce fuel loading. The West Fork Tule Creek M4G stands may provide potential experimental locations.

### 6.1.2 Water Quality And Watershed Enhancement

- Evaluate riparian reserve vegetation densities in areas where mining occurred in the Big Creek Watershed. Plant riparian reserves that lack sufficient shade producing vegetation with a mixture of hardwoods and conifers.
- Reduce road related hydrologic impacts by reducing the density of roads in the Philpot, Ditch Gulch, and Barker Creek watersheds and other areas where road densities exceed 3.0 mi/mi$^2$.
- Reduce road related sediment delivery to stream channels by:
    - Converting native surface roads to gravel roads,
    - Rocking inside ditches more resistant to erosion by concentrated flow,
    - Stabilizing cut and fill slopes,

- Increasing the frequency of road drainage structures in order to reduce erosion of road surfaces by concentrated flow,
- Armoring road crossing fill slopes and improving drainage from crossings, and
- Armoring drainage structure outlets to reduce erosion of fill slopes.

Focus these activities on roads within riparian reserves (Figure 3-2) and roads adjacent to fish bearing streams (Figure 3-6) in the Philpot, Ditch Gulch, and Barker Creek watersheds.

- Conduct fluvial geomorphology and hydrologic assessments of fish bearing streams (Figure 3-9). Information about flows and channel conditions are currently lacking and are necessary to evaluate channel restoration opportunities.
- Restore the historic hydrologic and sediment regimes of fish bearing streams (Figure 3-6) by implementing a fuels reduction and prescribed fire program to reduce the occurrence of high intensity fires and water use by overstocked stands. This will increase stream discharge during the low flow period, reduce low flow water temperatures, and provide increased channel substrate diversity. Focus these activities in the East Fork Big Creek, East Salt Creek, and Philpot Creek watersheds.
- Evaluate fish bearing streams for opportunities to re-connect the channel with the floodplain. This will have a positive effect on summer low flows because groundwater flow will increase summer flows. Also, fish will be able to access quiescent waters during the winter high flow period. Focus on the Tule Creek and Philpot Creek watersheds.
- Address the water quality data limitation identified in Section 5 by implementing a water quality monitoring program to gain a better understanding of current water quality conditions and to assess water quality changes of management activities.
- Implement water quality, fluvial geomorphology, and hydrologic monitoring in watersheds where large fires have occurred (Figure 3-7) and when they occur in future. This will address the data limitation identified in Section 5.

### 6.1.3 Fires And Fuels

- Fuel hazard reduction treatments should be guided by the following criteria from the LRMP:
  - Public Safety,
  - High investment areas i.e. structural improvements, plantations, private property adjacent to forest land, etc.,
  - Known areas of high fire occurrence. The Middle Hayfork and the Salt Creek Watersheds have 40% of the fires reported on the Hayfork Ranger District from 1985 to 1995, and
  - Resource benefits, such as improvement to stand health through the reintroduction of fire into the ecosystem.
- All Land Allocations: Use prescribed fire to re-introduce low intensity fires back into the analysis area in areas that are deemed appropriate based on getting the most out of the use of prescribed fire and have the least impact on the resources. Use available natural barriers,

existing road systems, existing fuel breaks, natural openings or changes in the fuel type as boundaries for prescribed fires. It is very important to consider the use of thinning or biomass removal prior to doing prescribed fire the growth of understory fuels may be to great to just use prescribed fire as the tool of choice. Focus hazard reduction activities in the Barker Mountain blow down area, and in areas where Fuel Model 10 is present in the East Salt Creek, East Fork Big Creek, and Philpot Creek watersheds, and in timber stands adjacent to plantations.

- Matrix Lands: Biomass reduction to reduce understory fuels should be allowed to assist in removing excess levels of windthrow, insect, or mortality timber that will other wise become a fire hazard if left. Treat all activity generated fuels with removal or prescribed burning. The Barker Mountain blow down area is of primary concern.
- Fire Management Resources: With the large number of human caused fires in the two watersheds an increased effort of fire prevention and law enforcement should be focused to reduce the human caused fire numbers.
- With current reductions in the pre suppression fire budgets of the Forest Service there comes a reduction in the number of personnel assigned to fire suppression duties. There has also been a reduction in the number of other employees that fire management relied heavily on during time of heavy fire activity to augment the fire suppression work force all this requires the search for new sources of suppression support. Consider contracting, pre-positioning of out of area equipment, or using local volunteer organizations during times of high fire indexes.
- Prescribed burn the brush areas in and around Salt Gulch, Kingsbury Gulch, Dutch Gulch, Ditch Gulch, and Dobbins Gulch for fuel hazard reduction and wildlife habitat enhancement.

### 6.1.4 Commercial Wood Production – Forest Vegetative Dynamics

**Noncommercial Forest Vegetation**

- A program of brush conversion using controlled burning, mechanical site preparation and planting should be established and prioritized so that blocks of these areas can be converted as funds become available. An inventory of these areas should be undertaken to gather information on rate of natural site conversion, and suitability for mechanical conversion and planting in order to prioritize future projects.

**Commercial Wood Products**

- Limited harvest opportunities are available within the LSR and Riparian Reserve areas. Harvest activities within these areas have two principal objectives: (1) development of old-growth forest characteristics including snags, logs on the forest floor, large trees, and canopy gaps that enable establishment of multiple tree layers and diverse species composition; and (2) prevention of large-scale disturbances by fire, wind, insects, and diseases that would destroy or limit the ability of the reserves to sustain viable forest species populations.
- **Regeneration Opportunities on Understocked Sites.** Conduct site-specific analysis of understocked stands on commercially suitable and available matrix lands which may be suitable for regeneration harvest through the development of silvicultural prescriptions.

Indicators of stand conditions, which may be candidates, include size/density stands of 3 S or P, or 4 S or P. Subwatersheds currently deficient in connectivity habitat may be priority for treatment. Concentrations of these types occur in the headwaters of Kingsbury Gulch, Salt Creek, and Ditch Gulch.

- **Regeneration Opportunities on CMAI Sites.** Conduct site-specific analysis of stands on commercially suitable and available matrix lands that may have culminated mean annual increment (CMAI). Such stands are no longer producing at their maximum potential and may be suitable for regeneration harvest through the development of silvicultural prescriptions. Indicators of stand conditions that may be candidates include size/density stands of 3 N or G, or 4 N or G. Much of the area of these stand types occurs in the LSR area of the Big Creek watershed; however, there are blocks of these types in the Tule Creek subwatershed and other areas outside the LSR and riparian reserves that should be reviewed for potential treatment.
- **Plantation Thinning Opportunities.** Conduct site-specific analysis of plantations that may be suitable for stocking-control (thinning) through the development of silvicultural prescriptions. There are 5,781 acres of plantations on lands available for harvesting within the matrix areas of these two watersheds, of this, only about 5% are over 20 years of age. Therefore, commercial harvest opportunities from these areas are limited. However, precommercial thinning operations can be combined with fuel reduction efforts in plantations. These operations would be most effective for stands adjacent to late seral type stands because the fuel reduction would reduce the fire risk to those adjacent stands.
- **Thinning Opportunities on Overstocked Young-Growth Sites.** Conduct site-specific analysis of well-stocked stands which may be suitable for intermediate harvest (thinning) on suitable commercial matrix lands, within late-successional reserves, and within riparian reserves through the development of silvicultural prescriptions. There are 35,338 acres of size class 2 and 3 stands within matrix lands available for commercial harvest. These stands should be evaluated for opportunities to thin overstocked stands to restore vigor and capture expected mortality. Many mature stands in the watershed are beyond the natural range of variability in carrying capacity due to fire suppression and the subsequent encroachment of a shade tolerant understory. This has led to conditions of low vigor and excessive mortality. Much of the lands suitable for this type of treatment lie within the LSR area of the Big Creek subwatershed. These areas should be analyzed for suitability for thinning treatments that would enhance the overall structure of these stands and accelerate their advance toward effective late seral stage.
- **Ponderosa Pine/Jeffrey Pine Thinning Opportunities.** It is recommended that ponderosa pine and Jeffrey pine stands be thinned to reduce the probability of successful bark beetle group kill. Older stands should be thinned, while younger stands could be managed through a combination of thinning and underburning. These treatments may be integrated with fuels reduction activities to achieve mutual benefits. In areas where beetle group kill has occurred, the rapid accumulation of unacceptable levels of fuel buildup should be treated, and risk of further mortality may be reduced through thinning. Thinning pine stands will reduce the probability of a successful beetle group kill by both increasing the amount soil moisture available to each leave tree, as well as by increasing the spacing between leave trees to the

outer limits of effectiveness of the aggregating pheromone. The most suitable stand types for these operations occur in the Philpot Creek and Tule Creek subwatersheds.

- **Sugar Pine Enhancement Opportunities.** Locating Ribes resistant parent trees and outplanting resistant stock are critical to maintaining sugar pine at or near historical levels in these watersheds. Other management activities such as pruning and localized Ribes removal may be used in stands where only non-resistant sugar pine are available and it is desired to recruit sugar pine as a part of the future overstory. Without some management, sugar pine as a part of the mature forests in these watersheds will likely decline.
- **Salvage Opportunities.** Episodic events, both natural and man-caused, occasionally present opportunities for salvage of recently killed trees or to capture expected mortality. Such events include fires, insect infestations, landslides, and windthrow. When such events are known and are significant in size, they should be investigated for opportunities for salvage. Considerations in deciding which course of action should be taken, including taking no action, should include effects on wildlife, fire risk, insect infestation risk, site disturbance, erosion, site occupancy, site productivity, regeneration opportunities, and overall forest health. One known area that should be analyzed for salvage is the recent blowdown in the Barker Mountain area at the head of Barker Creek.
- **Matrix Outputs** There are an estimated 42,582 acres net capable available suitable (CAS) lands within the Middle Hayfork and Salt Creek analysis areas. Of this amount, there are currently only 1,463 acres in the 4G and 6G size classes available for immediate regeneration harvesting. Assuming a 130 year rotation and a 10 year entry cycle, approximately 112 acres per entry cycle would be available for regeneration harvesting from these stands. Intermediate treatments to thin approximately 12,223 acres of size class 2G and 3G stands will move these areas toward a regulated condition as provided for on matrix and AMA lands within the Shasta-Trinity LMP. Assuming a 130 year rotation and a 10 year entry cycle, approximately 3,275 acres would eventually be available for regeneration harvesting. However, utilization of silvicultures such as thinning, group selection, or sanitation/salvage could allow the gross harvest area for each entry cycle to be greater than the net 3,275 acres if just regeneration harvesting were to occur. Other threshold factors, including habitat connectivity, habitat fragmentation, cumulative watershed effects, unmapped riparian reserves, and regeneration potential must be considered during a site-specific analysis prior to proposing specific regeneration harvest treatment units within the analysis area.

### 6.1.5 Late Succession Habitat and Enhancement

- Use thinning and prescribed fire to protect and enhance late successional stand characteristics in the LSRs. Enhancement priorities are as follows: Plantations (Big Creek, Barker Creek, Philpot, and Ditch Gulch), timber stands up to 80 years old (M2G, M3G), older stands that lack late successional characteristics, and other areas where appropriate to achieve objectives.
- New road construction is generally not recommended in LSRs (USFS and BLM, 1994). Analyze existing roads in LSRs to determine priority for decommissioning.
- Prior to planning projects in the analysis area, habitat that through field inspection could be determined to be late-successional, needs to be evaluated to determine whether or not the

15% retention standards are met. Also, attempt to retain the 15% near the existing 15 - 100 acre owl LSRs and the stands of size class 4-6 trees.

- Prior to project planning, determine logical dispersal corridors between the two LSRs located in these watersheds, 100 acre LSRs, and adjacent watersheds and LSRs. Habitat within the adjacent watersheds should also be evaluated prior to determining dispersal corridors. Key areas include: Duncan Creek, Carr Creek, West Tule Creek, and the western section of Hayfork Creek.
- Prior to project planning, field check spotted owl 100 acre LSRs listed in Table 3-22.
- Efforts should be taken to maintain snags and down logs at levels at or above LRMP minimums with an emphasis on the larger diameter sizes and full range of tree species diversity.
- Within the adaptive management areas sivicultural and wildlife habitat enhancement techniques should be developed to test experimental sivicultural and controlled fire prescriptions designed to protect and enhance late successional habitat characteristics prior to implementing them in the LSRs.

### 6.1.6 Threatened and Endangered, Forest Service Sensitive, Forest Service Endemic, and Survey and Manage or Protection Buffer Plant and Fungi Species

- Inventory and map serpentine soils and populations of serpentine endemic plant species. Identify populations which have experienced the greatest fragmentation from past activities, and determine appropriate restoration treatments. Consider following management guidelines developed in the forthcoming Conservation Strategy for Serpentine Endemic Species of the Rattlesnake Creek Terrane.
- Identify wetlands which have experienced localized degradation from grazing activities. Consider following management guidelines developed in the forthcoming South Fork Trinity Grazing Watershed Analysis (April, 2000).
- Decrease roads in high road density areas such as the upper Salt Creek drainage, which contains serpentine substrates. This will reduce impacts associated with habitat fragmentation and loss as well as minimize diversion and concentration of water.
- Identify and map high quality habitat for survey and manage fungi. Concentrate surveys in conifer size classes 4-6 and the drainages of Big Creek, west Tule Creek, and the headwaters of Barker Creek.

### 6.1.7 Noxious Weeds

- Inventory and map concentrations of invasive and noxious weeds. Concentrate surveys in areas of high risk, such as the boundary between national forest and Hayfork Valley, Barker Creek Road, Tule Road, and Summit Creek Road.

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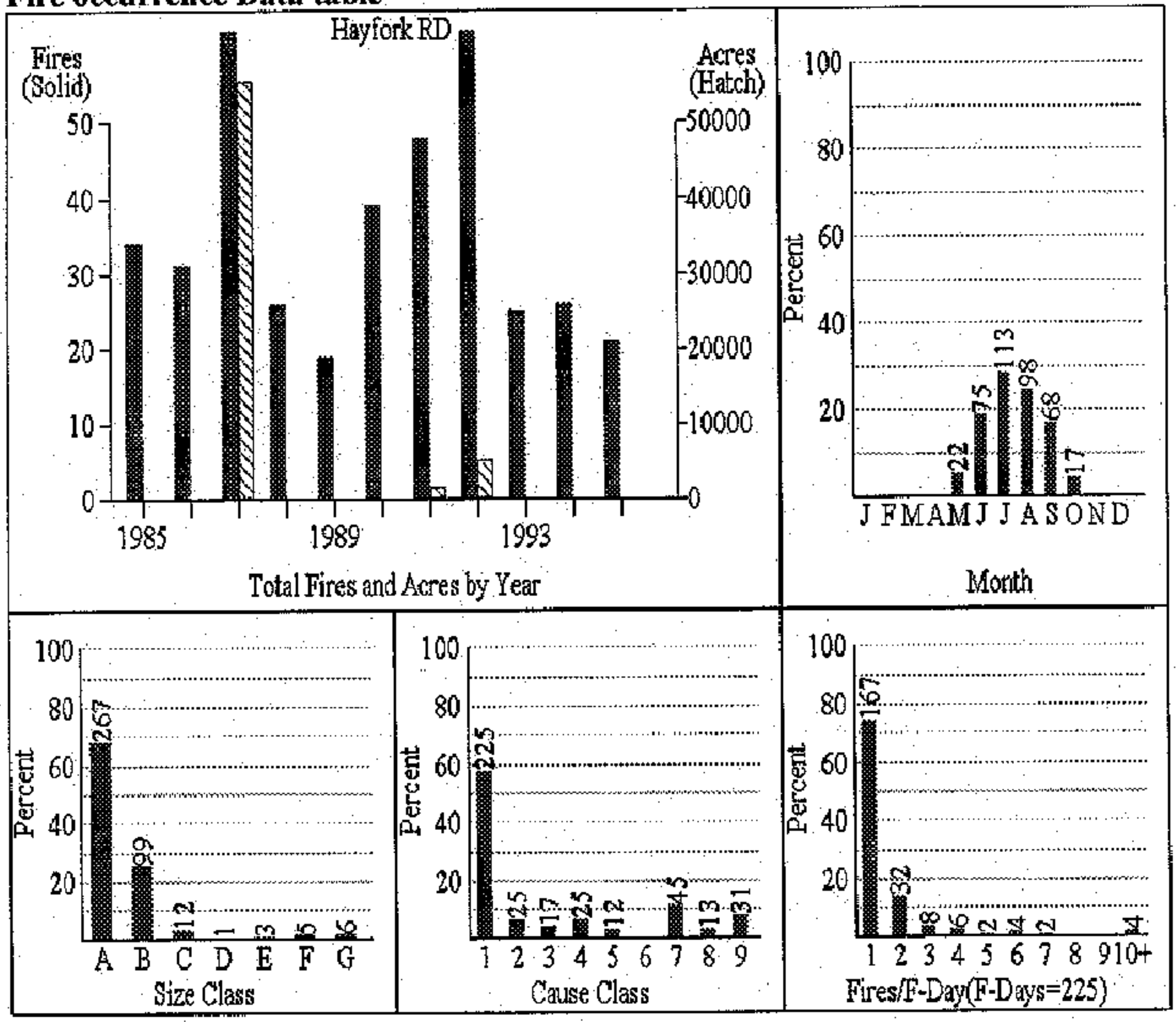
Appendix A

# Appendix A: Fire Family Plus Data

FireFamily Plus is a software system for summarizing and analyzing daily weather observations and computing fire danger indices based on the National Fire Danger Rating System (NFDRS). Fire occurrence data can also be analyzed and cross-referenced with the weather data to help determine the critical levels for staffing and fire danger for an area.

**Fire occurrence Data table**




Size Class: Fires A ¼ acre or less
B ¼ to 10 acres
C 10 to 100 acres
D 100 to 300 acres
E 300 to 1000 acres
F 1000 to 5000 acres
G over 5000 acres

Cause class: 1 Lightning
2 through 9 Human caused

Appendix B

# Appendix B Fuel Model Discription

## FUEL MODEL DEFINITIONS

**The prediction of fire behavior is valuable for assessing potential fire damage to resources. A quantitative basis for rating fire danger and predicting fire behavior became possible with the development of mathematical fire behavior fuel models. Fuels have been classified into four groups - grasses, brush, timber and slash. The differences in these groups are related to the fuel load and the distribution of the fuel among size classes. Size classes are: 0-¼" (1 hour fuels), ¼-1" (10 hour fuels), 1-3" (100 hour fuels) and 3" and greater (1000 hour fuels).**

**Table 1 - Description of Fuel Models Used in Fire Behavior as Documented by Albini (1976)**

| FUEL MODEL<br>Typical Fuel Complex | FUEL LOADING tons/acre | | | | FUEL BED DEPTH feet |
|---|---|---|---|---|---|
| | 1 Hr. | 10 Hr. | 100 Hr. | Live | |
| GRASS AND GRASS-DOMINATED | | | | | |
| 1-Short Grass (1 foot) | 0.74 | 0.00 | 0.00 | 0.00 | 1.0 |
| 2-Timber (Grass and Understory) | 2.00 | 1.00 | 0.50 | 0.50 | 1.0 |
| 3-Tall Grass (2.5 foot) | 3.01 | 0.00 | 0.00 | 0.00 | - |
| CHAPARRAL AND SHRUB FIELDS | | | | | |
| 4-Chaparral (6 feet) | 5.01 | 4.01 | 2.00 | 5.01 | 6.0 |
| 5-Brush (2 feet) | 1.00 | 0.50 | 0.00 | 2.00 | 2.0 |
| 6-Dormant Shrub/Hardwood | 1.50 | 2.50 | 2.00 | 0.00 | 2.5 |
| Slash | 1.13 | 1.78 | 1.50 | 0.37 | 2.5 |
| 7-Southern Rough | | | | | |
| TIMBER LITTER | | | | | |
| 8-Closed Timber Litter | 1.50 | 1.00 | 2.50 | 0.00 | 0.2 |
| 9-Hardwood Litter | 2.92 | 0.41 | 0.15 | 0.00 | 0.2 |
| 10-Timber (Litter and Understory) | 3.01 | 2.00 | 5.01 | 2.00 | 1.0 |
| SLASH | | | | | |
| 11-Light Logging Slash | 1.50 | 4.51 | 5.51 | 0.00 | 1.0 |
| 12-Medium Logging Slash | 4.01 | 14.03 | 16.53 | 0.00 | 2.3 |
| 13-Heavy Logging Slash | 7.01 | 23.04 | 28.05 | 0.00 | 3.0 |

**The criteria for choosing a fuel model (Anderson, 1982) includes the fact that the fire burns in the fuel stratum best conditioned to support the fire. Fuel models are simply tools to help the user realistically estimate fire behavior. Modifications to fuel models are possible by changes in the live/dead ratios, moisture contents, fuel loads, and drought influences. The 13 fire behavior predictive fuel models are used during the severe period of the fire season when wildfire pose greater control problems and impacts on land resources.**

**The following is a brief description of each of the 13 fire behavior fuel models.**

**GRASS GROUP**

**Fire Behavior Fuel Model 1 - Fire spread is governed by the very fine, porous, and continuous herbaceous fuels that have cured or are nearly cured. Fires are surface fires that move rapidly through the cured grass. Very little timber or shrub is present.**

**Fire Behavior Fuel Model 2 - Fire spread is primarily through cured or nearly cured grass where timber or shrubs cover □ to □ of the open area. These are surface fires that may increase in intensity as they hit pockets of other litter.**

Fire Behavior Fuel Model 3 - Fires in this grass group display the highest rates of spread and fire intensity under the influence of wind. Approximately □ or more of the stand is dead or nearly dead.

SHRUB GROUP

Fire Behavior Fuel Model 4 - Fire intensity and fast spreading fires involve the foliage and live and dead fine woody continuos secondary overstory. Stands of a nearly mature shrubs, 6 feet tall or more are typical candidates. Besides flammable foliage, dead woody material in the stands contributes significantly to the fire intensity. A deep litter layer may also hamper suppression efforts.

Fire Behavior Model 5 - Fire is generally carried by surface fuels that are made up of litter cast by the shrubs and grasses or forbs in the understory. Fires are generally not very intense because the fuels are light and shrubs are young with little dead material. Young green stands with little dead would wood qualify.

Fire Behavior Model 6 - Fires carry through the shrub layer where the foliage is more flammable than fuel model 5, but requires moderate winds, greater than 8 miles per hour.

Fire Behavior Fuel Model 7 - Fires burn through the surface and shrub strata with equal ease and can occur at higher dead fuel moisture because of the flammability of live foliage and other live material.

TIMBER GROUP

Fire Behavior Fuel Model 8 - Slow burning ground fuels with low flame lengths are generally the case, although the fire may encounter small "jackpots" of heavier concentrations of fuels that can flare up. Only under severe weather conditions do the fuels pose a threat. Closed canopy stands of short-needled conifers or hardwoods that have leafed out support fire in the compact litter layer. This layer is mostly twigs, needles, and leaves.

Fire Behavior Fuel Model 9 - Fires run through the surface faster than in fuel model 8 and have a longer flame length. Both long-needle pine and hardwood stands are typical. Concentrations of dead, down woody material will cause possible torching, spotting, and crowning of trees.

Fire Behavior Fuel Model 10 - Fires burn in the surface and ground fuels with greater intensity than the other timber litter types. A result of over maturing and natural events creates a large load of heavy down, dead material on the forest floor. Crowning out, spotting and torching of individual trees is more likely to occur, leading to potential fire control difficulties.

LOGGING SLASH GROUP

Fire Behavior Fuel Model 11 - Fires are fairly active in the slash and herbaceous material intermixed with the slash. Fuel loads are light and often shaded. Light partial cuts or thinning operations in conifer or hardwood stands are representative of this model classification. Clear-cut operations generally produce more slash than is typical of this fuel model.

Fire Behavior Fuel Model 12 - Rapidly spreading fire with high intensities capable of generating firebrands can occur. When fire starts it is generally sustained until a fuelbreak or change in conditions occur. Fuels generally total less than 35 tons per acre and are well distributed. Heavily thinned conifer stands, clearcuts, and medium to heavy partial cuts are of this model.

Fire Behavior Fuel Model 13 - Fire is generally carried by a continuos layer of slash. Large quantities of material 3 inches and greater is present. Fires spread quickly through the fine fuels and intensity builds up as the large fuels begin burning. Active flaming is present for a sustained period of time and firebrands may be generated. This contributes to spotting, as weather conditions become more severe. Clearcuts are depicted where the slash load is dominated by the greater than 3 inch fuel size, but may also be represented by a "red slash" type where the needles are still attached because the of high intensity of the fuel type.

# Appendix C

## List of Preparers

| Preparer | Company/Firm | Position |
|---|---|---|
| Michael Parenti | URS Greiner Woodward Clyde (URSGWC) | Team Leader/Hydrology |
| Dennis Halligan | Natural Resources Management Corporation (NRM) | Fisheries |
| Dirk Embree | NRM | Wildlife |
| Sandra Brown | NRM | Geology/Soils |
| Andrew Leven | URSGWC | Soils/Hydrology |
| Barry Callenberger | North Tree Fire | Fire/Fuels |
| Maureen Leddy | URSGWC | GIS |
| Cindy Arrington | URSGWC | Human Use\Heritage |
| Frank Mileham | NRM | Silviculture |
| Clare Golec | NRM | Botany |
| David Glen | NRM | GIS |
| Sherman Garinger | NRM | Geology |

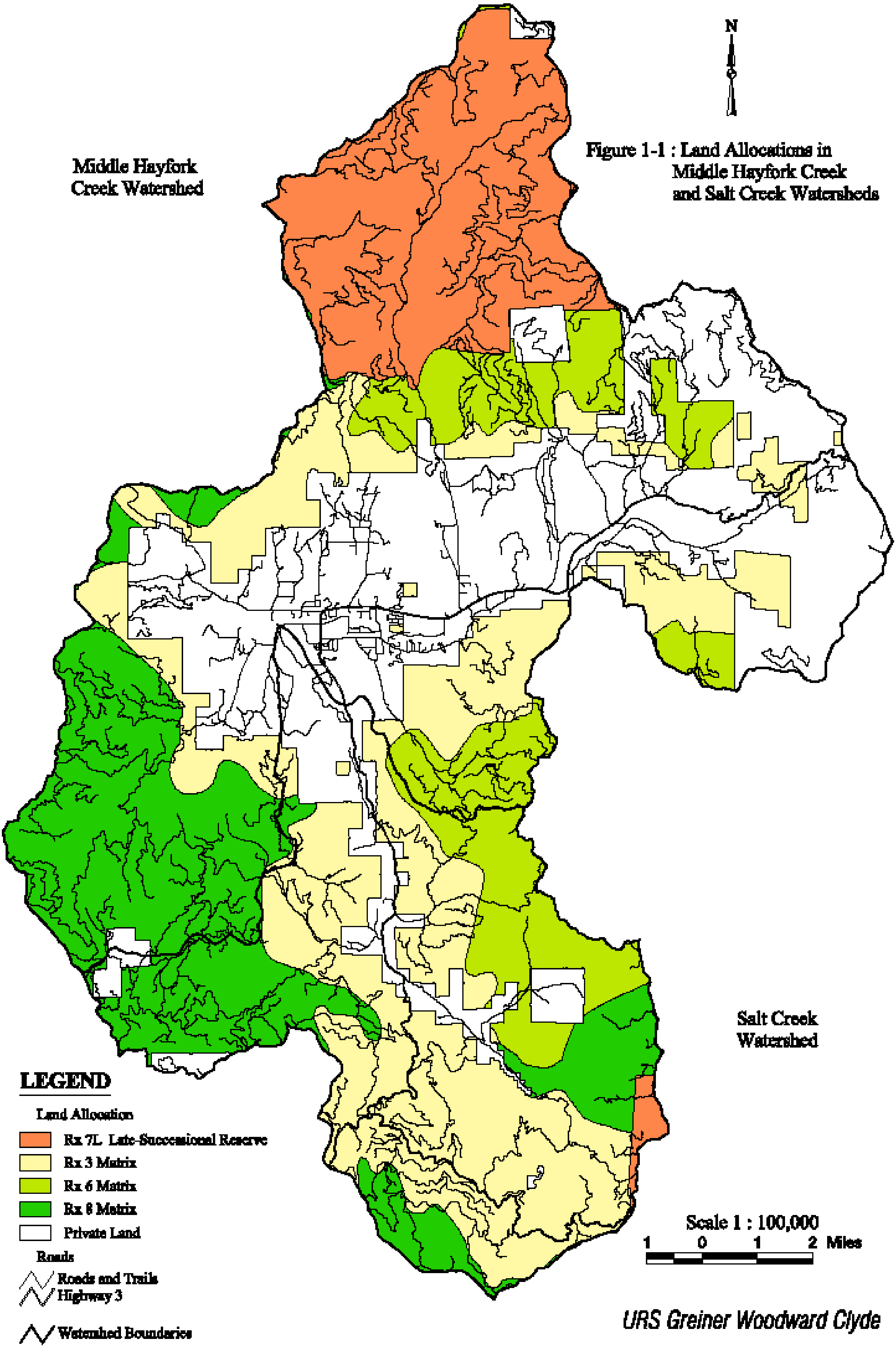



Figure 1-1 : Land Allocations in Middle Hayfork Creek and Salt Creek Watersheds

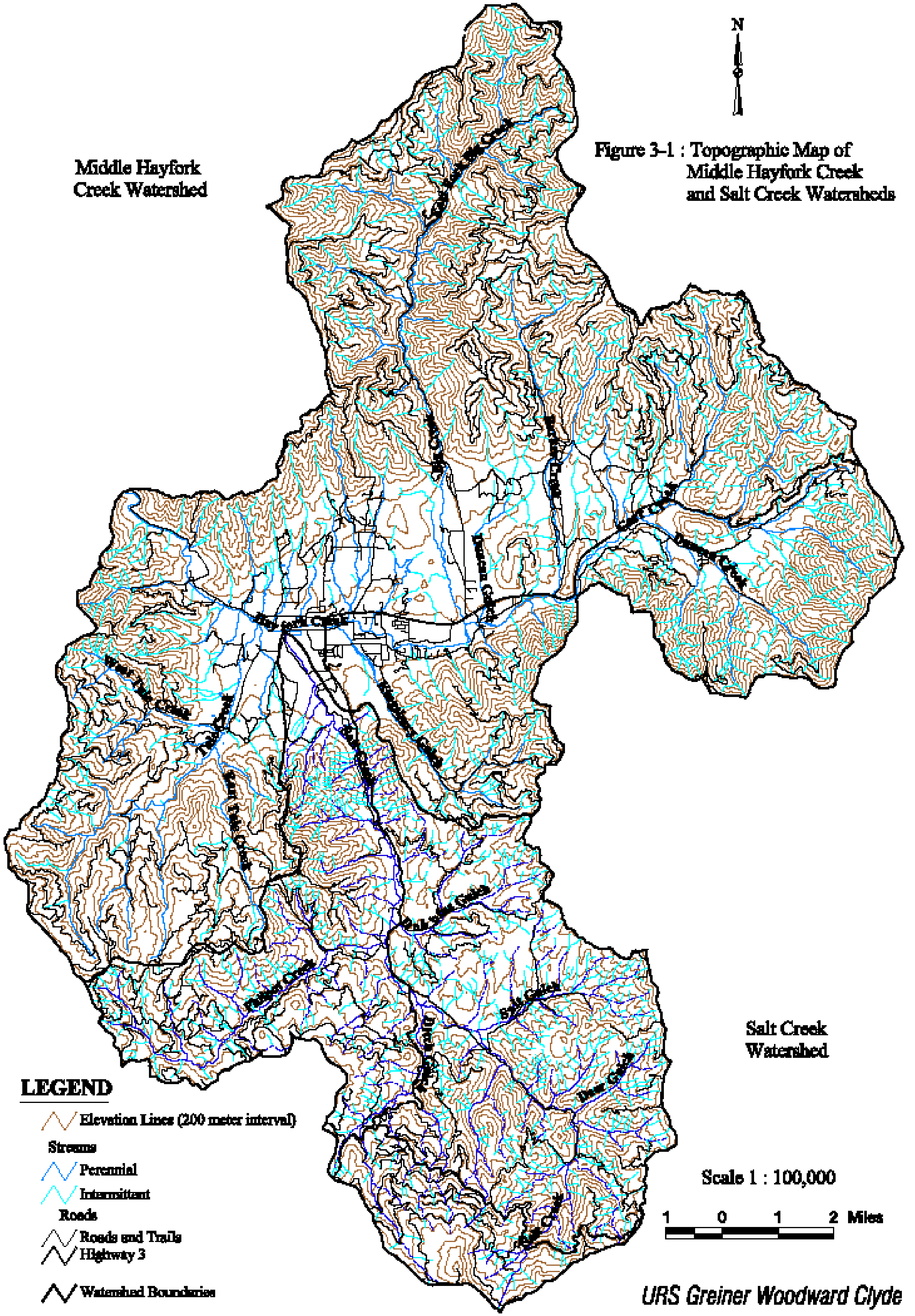



Figure 3-1 : Topographic Map of Middle Hayfork Creek and Salt Creek Watersheds

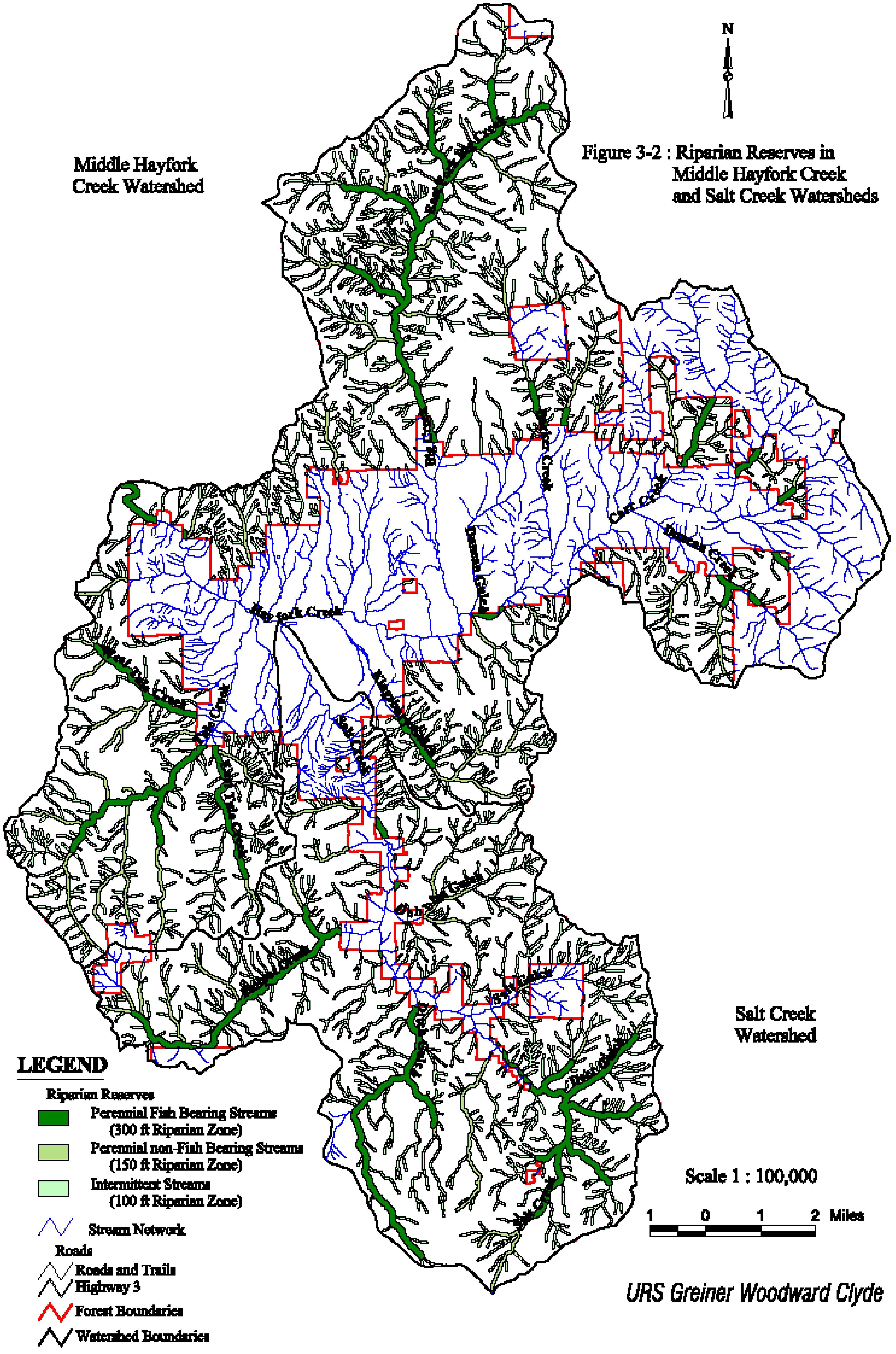


Figure 3-2 : Riparian Reserves in Middle Hayfork Creek and Salt Creek Watersheds
Middle Hayfork Creek Watershed
Salt Creek Watershed
N
Hayfork Creek
Carr Creek
Salt Creek
LEGEND
Riparian Reserves
Perennial Fish Bearing Streams (300 ft Riparian Zone)
Perennial non-Fish Bearing Streams (150 ft Riparian Zone)
Intermittent Streams (100 ft Riparian Zone)
Stream Network
Roads
Roads and Trails
Highway 3
Forest Boundaries
Watershed Boundaries
Scale 1 : 100,000
1 0 1 2 Miles
URS Greiner Woodward Clyde

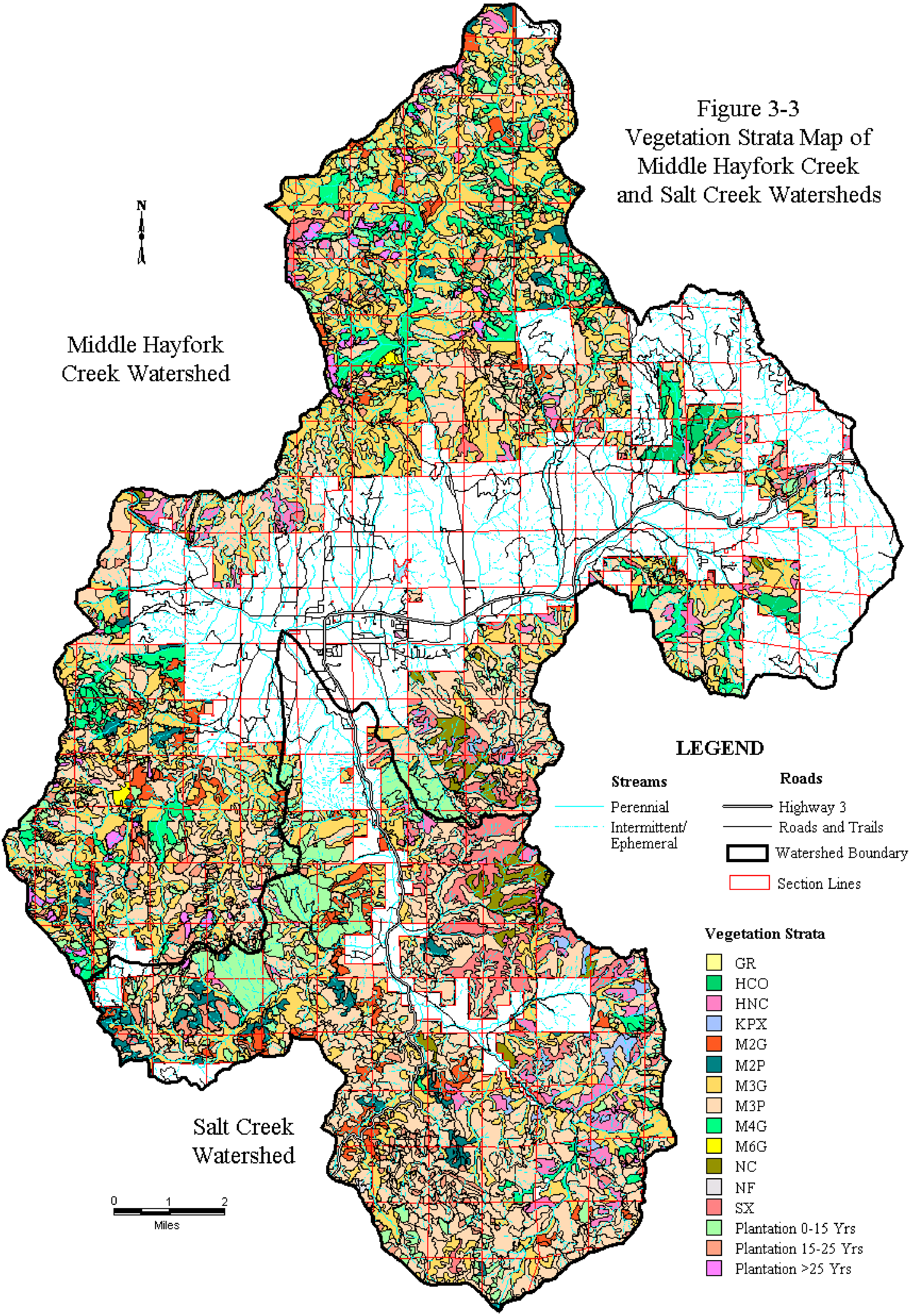
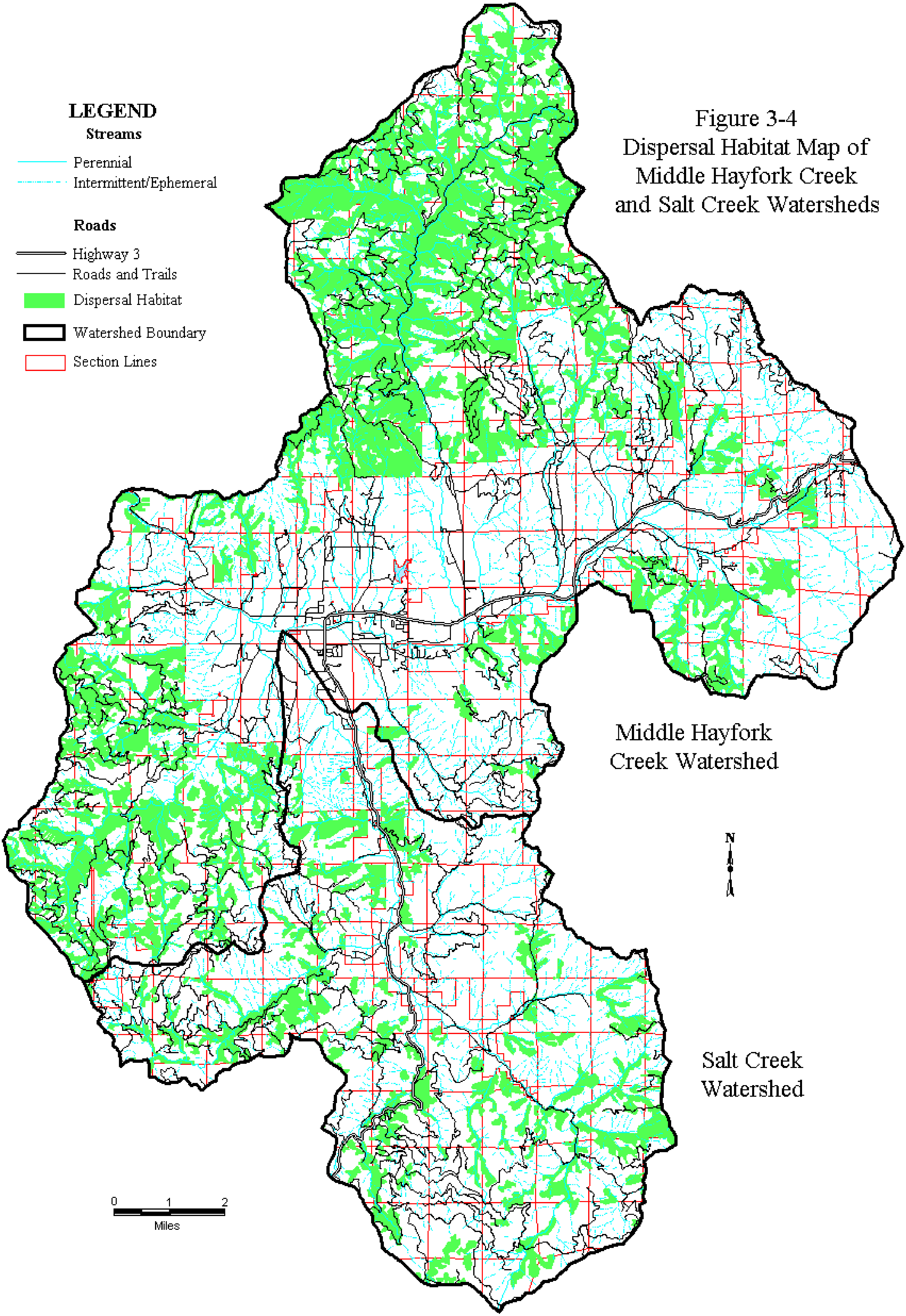
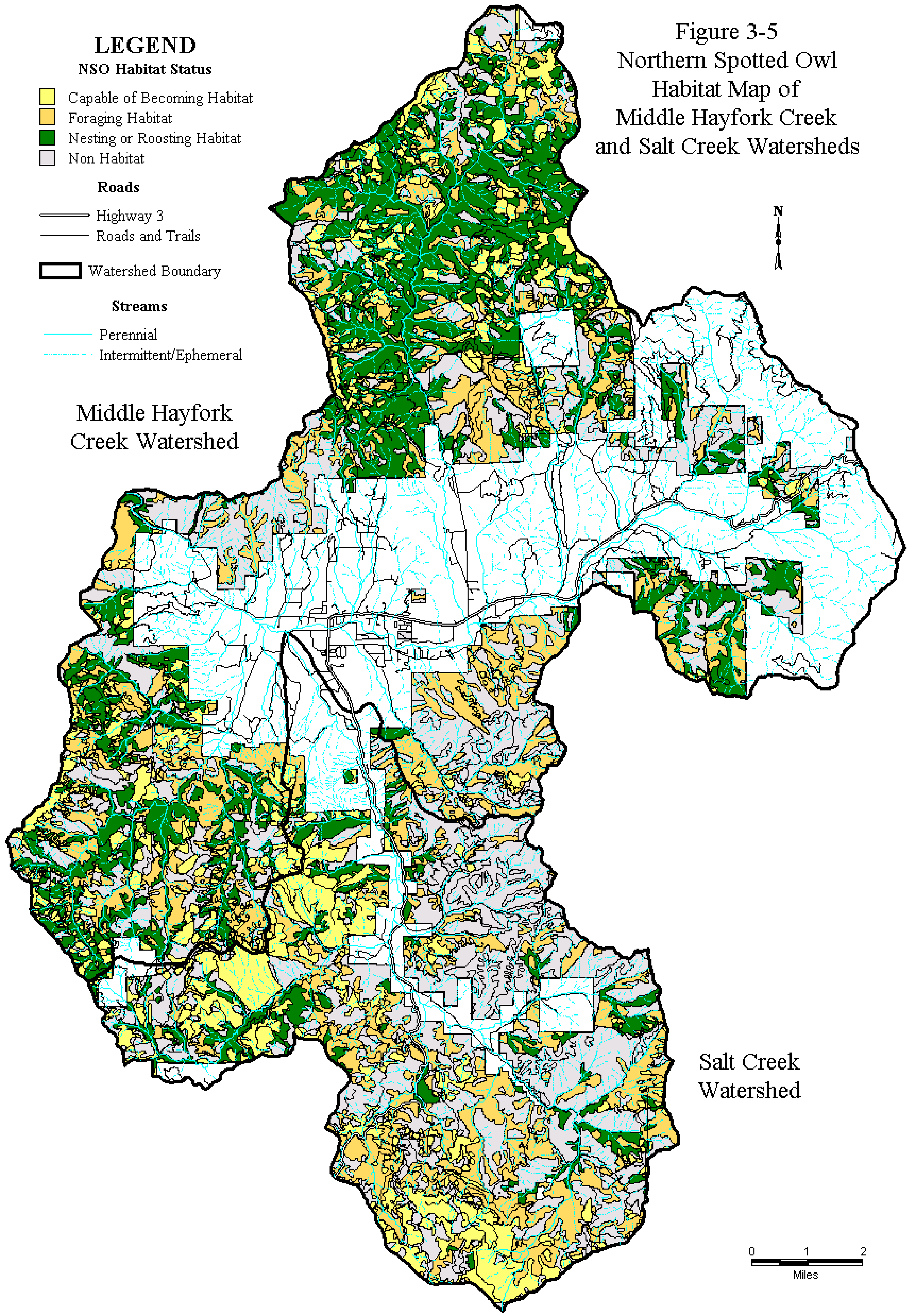


Figure 3-3
Vegetation Strata Map of
Middle Hayfork Creek
and Salt Creek Watersheds
N
Middle Hayfork
Creek Watershed
Salt Creek
Watershed
0
1
2
Miles
LEGEND
Streams
Perennial
Intermittent/
Ephemeral
Roads
Highway 3
Roads and Trails
Watershed Boundary
Section Lines
Vegetation Strata
GR
HCO
HNC
KPX
M2G
M2P
M3G
M3P
M4G
M6G
NC
NF
SX
Plantation 0-15 Yrs
Plantation 15-25 Yrs
Plantation >25 Yrs


LEGEND
Streams
Perennial
Intermittent/Ephemeral
Roads
Highway 3
Roads and Trails
Dispersal Habitat
Watershed Boundary
Section Lines
Figure 3-4
Dispersal Habitat Map of
Middle Hayfork Creek
and Salt Creek Watersheds
Middle Hayfork
Creek Watershed
Salt Creek
Watershed
N
0
1
2
Miles



LEGEND
NSO Habitat Status
Capable of Becoming Habitat
Foraging Habitat
Nesting or Roosting Habitat
Non Habitat
Roads
Highway 3
Roads and Trails
Watershed Boundary
Streams
Perennial
Intermittent/Ephemeral
Figure 3-5
Northern Spotted Owl
Habitat Map of
Middle Hayfork Creek
and Salt Creek Watersheds
N
Middle Hayfork
Creek Watershed
Salt Creek
Watershed
0
1
2
Miles

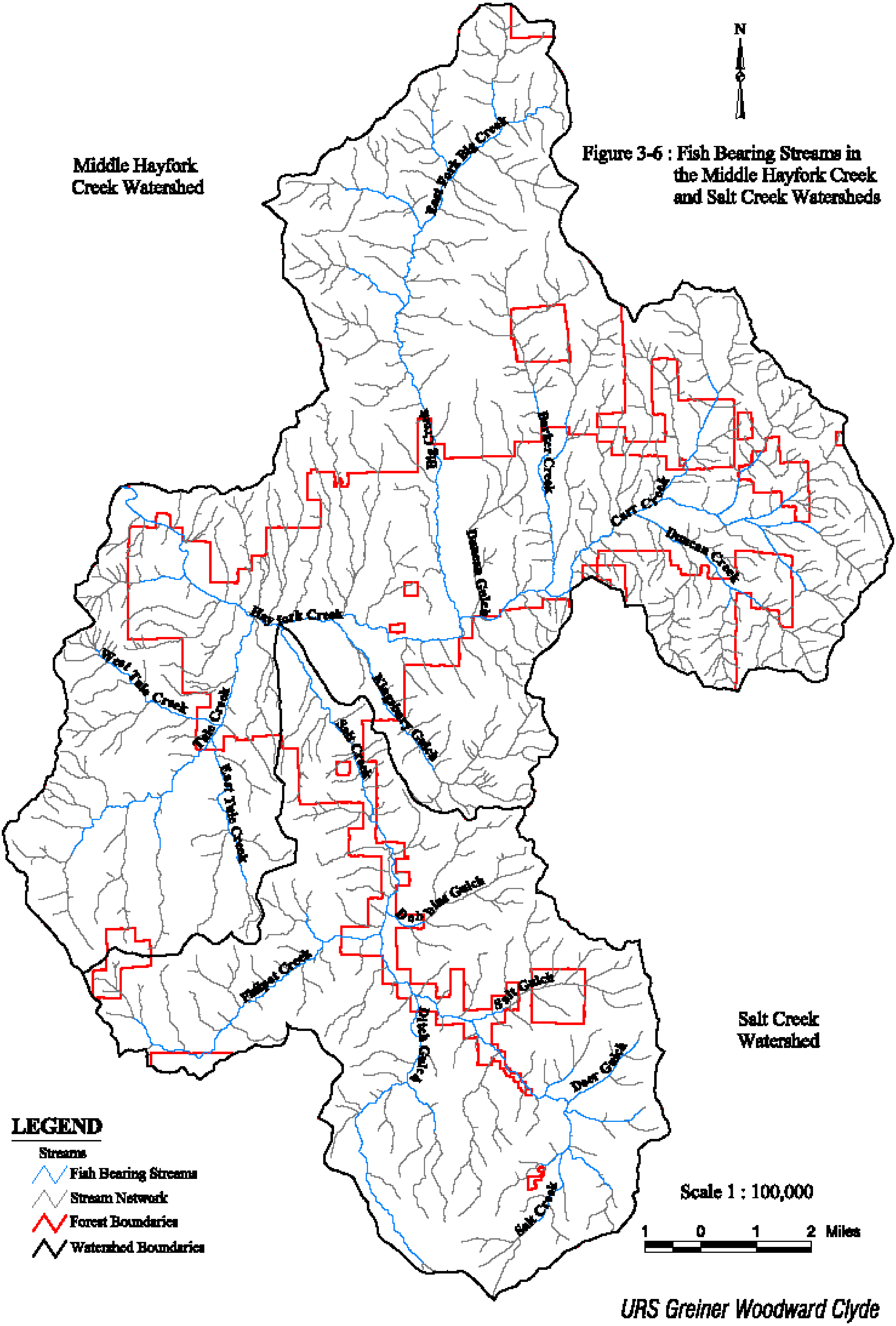
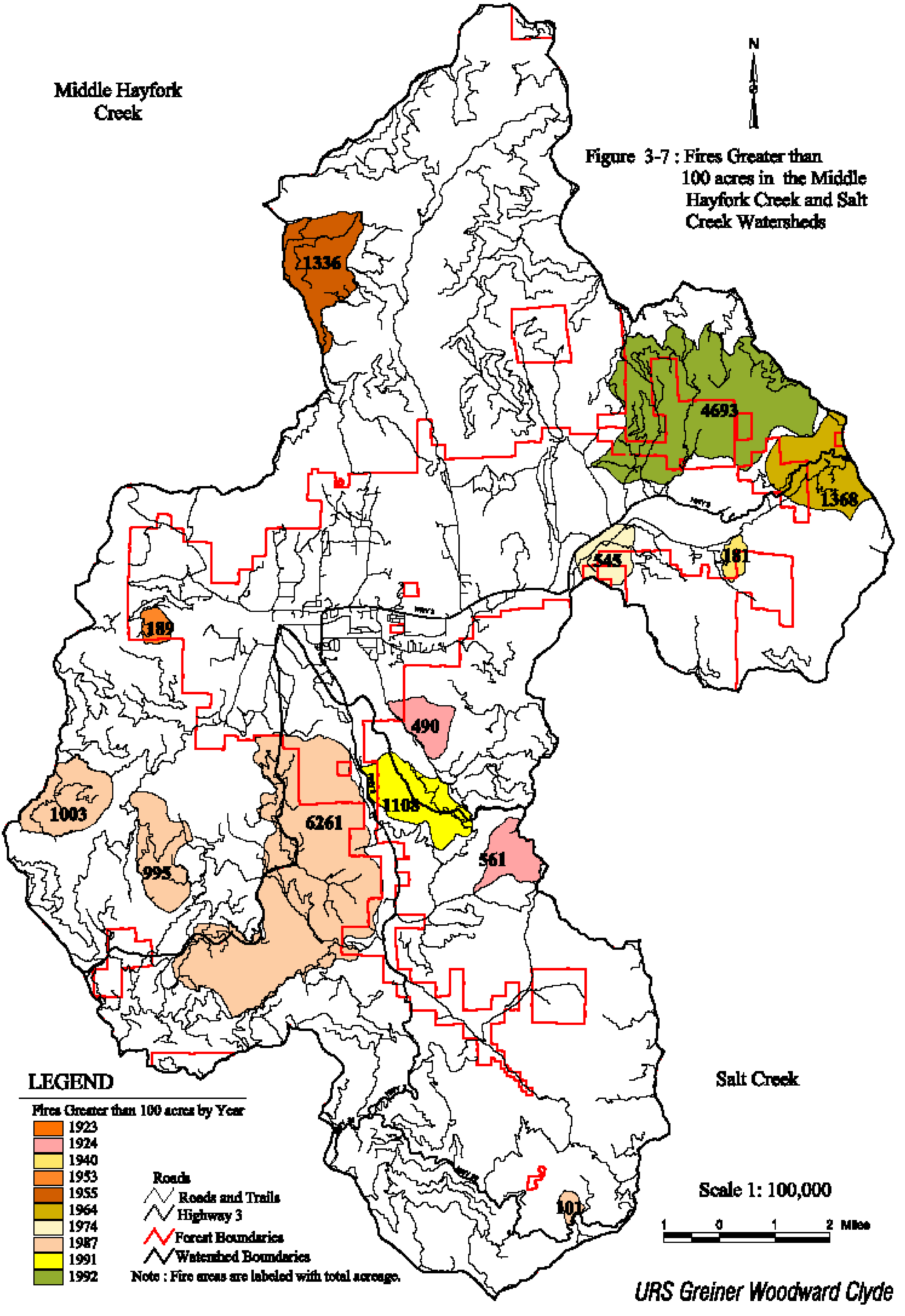
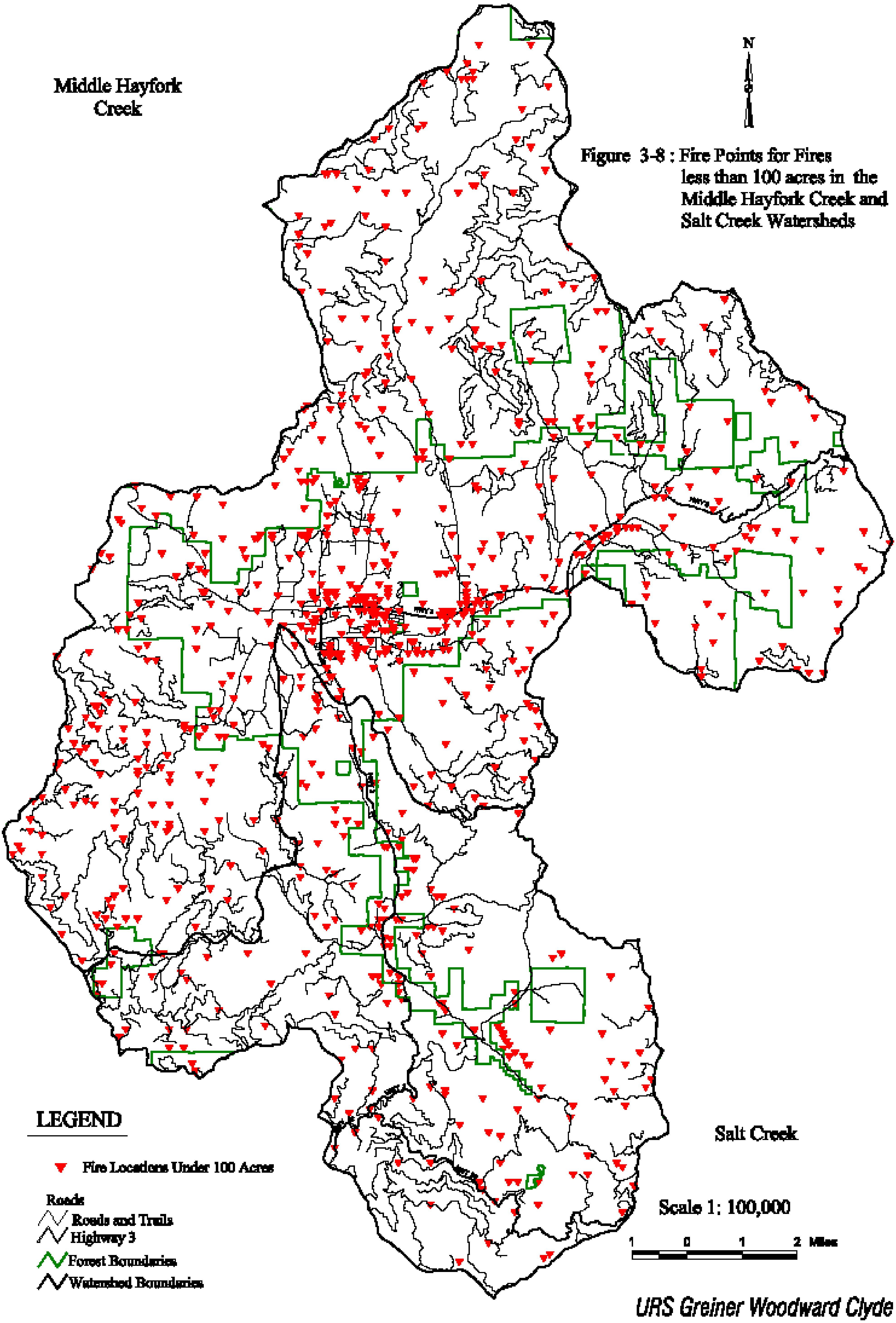
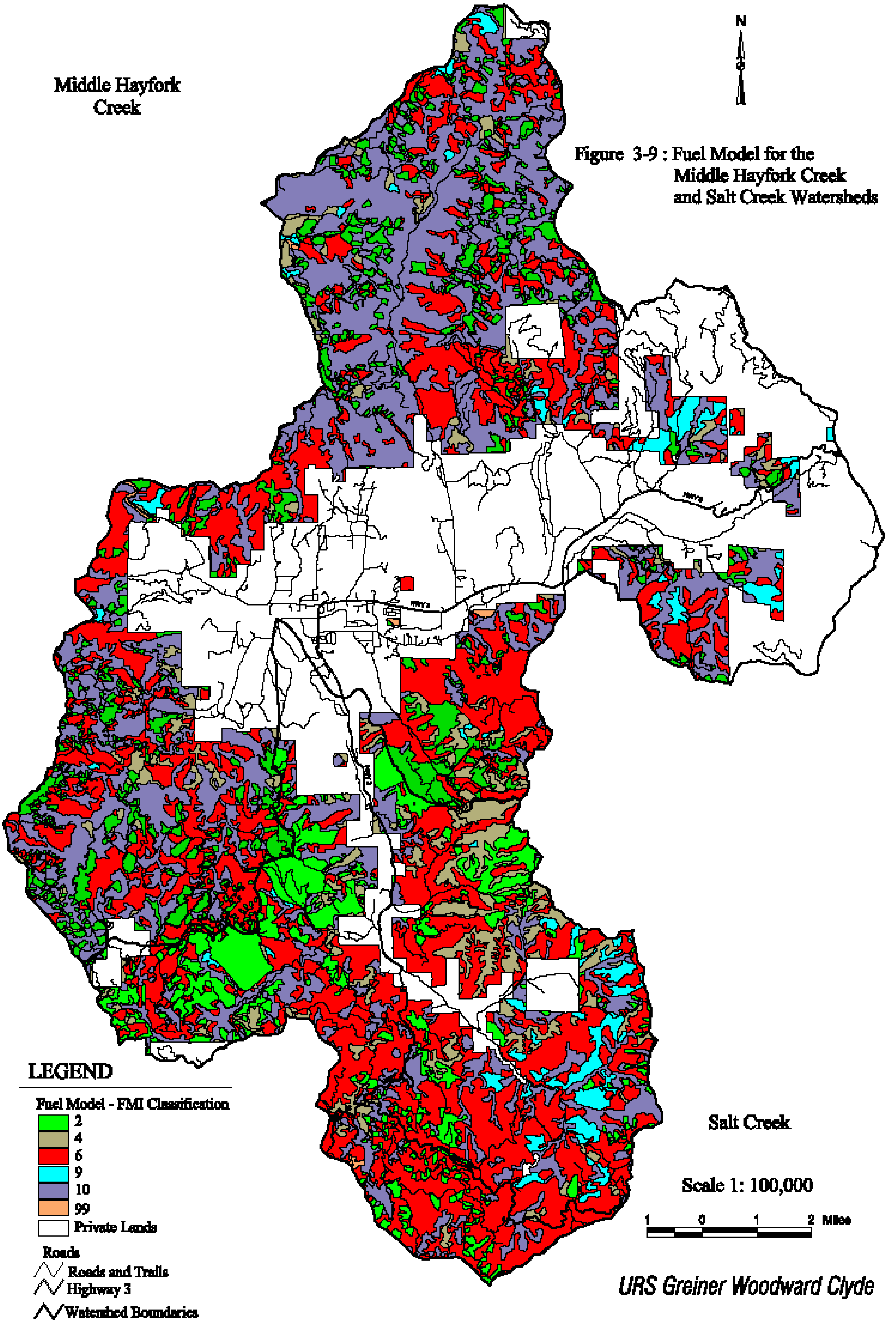



Figure 3-6 : Fish Bearing Streams in the Middle Hayfork Creek and Salt Creek Watersheds



Middle Hayfork Creek
N
Figure 3-7 : Fires Greater than 100 acres in the Middle Hayfork Creek and Salt Creek Watersheds
1336
4693
1368
545
181
189
490
1108
1003
6261
995
561
101
Salt Creek
LEGEND
Fires Greater than 100 acres by Year
1923
1924
1940
1953
1955
1964
1974
1987
1991
1992
Roads
Roads and Trails
Highway 3
Forest Boundaries
Watershed Boundaries
Note : Fire areas are labeled with total acreage.
Scale 1: 100,000
1 0 1 2 Miles
URS Greiner Woodward Clyde


Middle Hayfork Creek
N
Figure 3-8 : Fire Points for Fires less than 100 acres in the Middle Hayfork Creek and Salt Creek Watersheds
LEGEND
Fire Locations Under 100 Acres
Roads
Roads and Trails
Highway 3
Forest Boundaries
Watershed Boundaries
Salt Creek
Scale 1: 100,000
1 0 1 2 Miles
URS Greiner Woodward Clyde


Middle Hayfork Creek
Figure 3-9 : Fuel Model for the Middle Hayfork Creek and Salt Creek Watersheds
N
LEGEND
Fuel Model - FMI Classification
2
4
6
9
10
99
Private Lands
Roads
Roads and Trails
Highway 3
Watershed Boundaries
Salt Creek
Scale 1: 100,000
1 0 1 2 Miles
URS Greiner Woodward Clyde

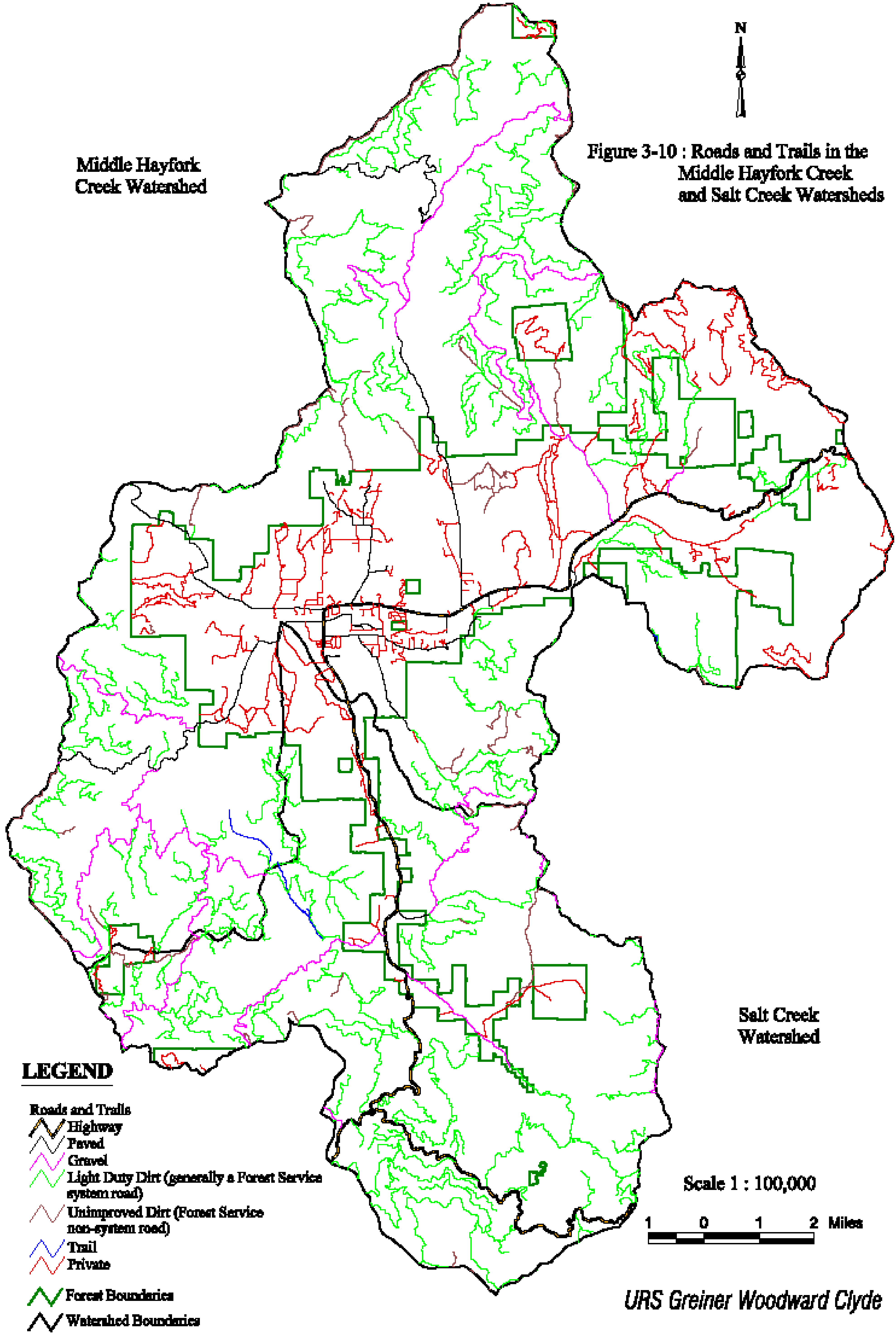


Figure 3-10 : Roads and Trails in the Middle Hayfork Creek and Salt Creek Watersheds
N
Middle Hayfork Creek Watershed
Salt Creek Watershed
LEGEND
Roads and Trails
Highway
Paved
Gravel
Light Duty Dirt (generally a Forest Service system road)
Unimproved Dirt (Forest Service non-system road)
Trail
Private
Forest Boundaries
Watershed Boundaries
Scale 1 : 100,000
1 0 1 2 Miles
URS Greiner Woodward Clyde