Watershed Analysis
Hyampom Watershed

Shasta-Trinity National Forest

South Fork Management Unit

April 2011

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Introduction

The Purpose of Watershed Analysis

Watershed analysis (WA) provides a systematic way to organize and understand ecosystem information by characterizing the human, aquatic, riparian, and terrestrial features, conditions, processes, and interactions (collectively referred to as "ecosystem elements") within a watershed. As a result, the WA improves our ability to estimate the direct, indirect and cumulative effects our management actions may have on ecosystem elements, as well as guide the general type, location and sequence of appropriate management activities within the watershed. Watershed analysis is required in Key Watersheds, for roadless areas in non-Key Watersheds and Riparian Reserves prior to determining how proposed land management activities meet Aquatic Conservation Strategy objectives (Shasta-Trinity Land Resource Management Plan [Forest Plan] pg 4-53).

This landscape analysis is not a decision document; its purpose is to provide guidance and recommendations for land management. This analysis will focus on collecting and compiling information within the watershed that is essential for making sound management decisions. The landscape analysis provides existing condition information to enable identification and prioritization of appropriate project opportunities that would enhance, maintain, or improve the landscape conditions in order to achieve or move toward the desired conditions of the land allocations described in the Forest Plan.

Focus of this Watershed Analysis

The focus of the Hyampom WA is watershed function and vegetative condition as they relate to water quality and fisheries; wildlife habitat; forest health, fuel continuity, fuel loading and the potential for extreme fire behavior. The WA will illustrate the current conditions as well as the desired conditions described in the Forest Plan for the Shasta-Trinity National Forest (the Forest). This analysis will focus on lands within the Hyampom watershed that are administered by the Forest.

Format of the Document

This document is divided into five chapters.

Chapter 1 Watershed Characterization

The purpose of this chapter is to provide a brief overview of the physical setting within the watershed, and to identify, map and describe the most important land allocations and plan objectives that influence management within the watershed.

Chapter 2 Issues and Key Questions

This chapter provides the key elements of the ecosystem that are most relevant to the management objectives, human values, and/or resource conditions within the watershed.

Chapter 3 Current Conditions

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

Chapter 4 Desired Conditions

This chapter presents desired conditions of specific ecosystem elements described in the Forest Plan as well as professional judgment that are relevant to the issues and key questions identified in Chapter 2.

Chapter 5 Management Options to Meet the Desired Conditions

This chapter summarizes the opportunities to move from existing conditions to the desired conditions identified in the Forest Plan or this WA.

Chapter 1 - Watershed Characteristics

Physical Setting

Location

The Hyampom watershed is located on the South Fork Management Unit of the Shasta-Trinity National Forest (Forest). The watershed includes the tributary drainages on the west side of the South Fork Trinity River, west of the community of Hyampom (Figure 1). The planning watershed covers 24,340 acres, of which approximately 11,640 acres are National Forest System lands.

Climate

The climate of the Hyampom planning watershed can be described as Mediterranean with coastal influence; characterized by warm dry summers and cold wet winters. Typically, precipitation is rainfall at the lower elevations and snow above 3,000 or 4,000 feet. Temperatures range from average highs in the mid 90s°F in the summer months, to average lows in the mid 30s°F during the winter months.

Topographic and elevation variations produce significant changes in local temperature and precipitation patterns. Elevations, within the planning watershed, range from approximately 1,000 feet on the South Fork Trinity River, to 5,900 feet on Blake Mountain at the Six Rivers National Forest boundary. Temperatures at the higher elevations may average 15-20° cooler than temperatures at the lower elevations. These temperature differences are more pronounced in the summer months, as coastal influences tend to moderate the low temperatures to a greater degree in the winter months.

Variations in topography and elevation also affect local precipitation patterns with average annual precipitation totals ranging from approximately 35 inches at Hyampom to 65 inches at Sims Mountain (PRISM, 2010). Most of this precipitation occurs between October and May, with snow usually remaining at the higher elevations into June or July. This area has experienced rain on snow events.

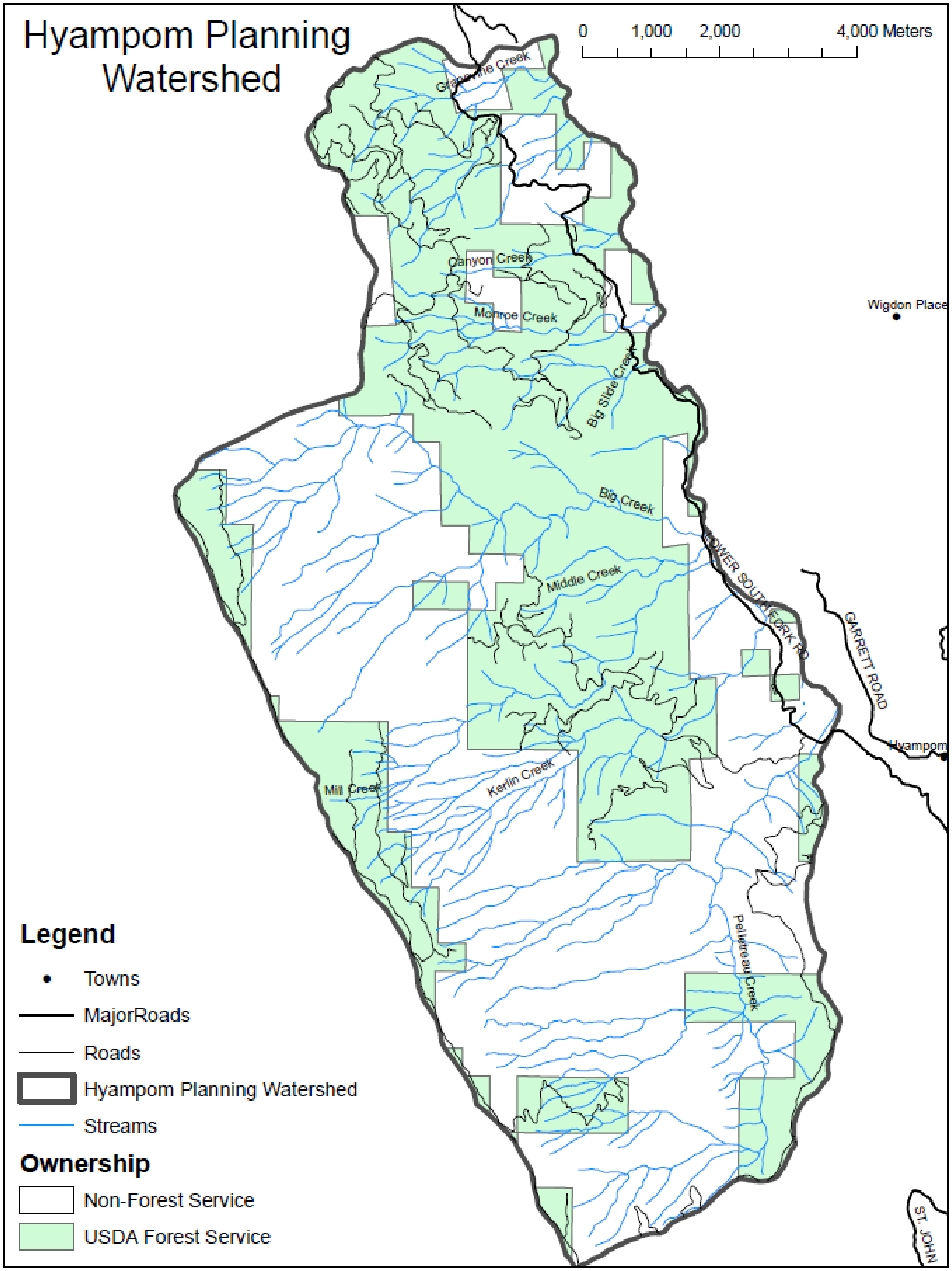

Figure 1. Hyampom watershed analysis area.

Terrestrial

Fire and Fuels

Fire is a consistent ecological process and disturbance agent within the Klamath Mountains. The watershed extends from the South Fork Trinity River to the top of South Fork Mountain and encompasses several ecological zones. Fire regimes in all ecological zones are influenced by steep, continuous slopes, changes in aspect, and summer drought and are characterized by frequent, primarily low- to mixed-severity fires (Skinner et al., 2006). Activities of Native Americans, miners, trappers, and settlers in the mid-nineteenth century and fire suppression in the twentieth century have all influenced fire history and vegetation characteristics such as stand composition and fuel loading (Agee, 1993; Taylor and Skinner, 2003). Today we see a relatively homogenous pattern of small openings scattered throughout a dense forest, however prior to fire suppression there was higher spatial complexity with more variation in opening size with surrounding forests being more open (Skinner, 1995). Active forest management and recent fires have altered these general patterns for some areas of the watershed resulting in larger openings and persistent communities of montane chaparral.

Vegetation

The existing vegetation within the Hyampom Watershed is typical of the mid to upper montane ecological zone of the Klamath Mountains Bioregion (Skinner et al. 2006). This is a vegetation-diverse area dominated by Douglas-fir with lesser amounts of ponderosa pine, sugar pine, white fir, red fir, incense cedar, Oregon white oak, bigleaf maple, giant chinquapin, Pacific madrone, tanoak and grey pine (Table 1).

Existing vegetation conditions within the Hyampom watershed have been primarily identified using available resources including the 2007 Existing Vegetation spatial data of the Forest's corporate database, 2010 NAIP imagery, and field visits.

Table 1. Tree species Composition within the Hyampom watershed.

Species	**Acres**
Douglas-fir	13,955
Mixed Conifer	6,588
True Fir	2,687
Hardwood	538
Non-Forested	503
Water	71
TOTAL	**24,342**

The most abundant and connected vegetation type of the watershed is Douglas-fir (*Pseudotsuga menziesii*). The Douglas-fir type occupies over 80 percent of the watershed in early to late seral stages. Compositions of the Douglas-fir plant associations include moist Douglas-fir, mesic Douglas-fir and dry Douglas-fir. The moist Douglas-fir type characterized by Douglas-fir-bigleaf maple (*Acer macrophyllum*) is found consistently in the lower reaches of several of the major tributaries, including Pelletreau Creek, Mill Creek and Big Creek. The mesic Douglas-fir series is characterized by Douglas-fir - canyon live oak (*Quercus chrysolepis*), and the dry Douglas-fir series is characterized by white oak (*Quercus garryana*). Other hardwoods that can occur in these Douglas-fir hardwood types are black oak (*Quercus kelloggii*), madrone (*Arbutus menziesii*) and giant chinquapin (*Castanopsis chrysophylla*).

White fir (*Abies concolor*) is the second most abundant vegetation type, and is found above 2,800 feet elevation. White fir often occurs as dense stands with little understory. A moist white fir type is associated with stream courses such as the headwaters of Big Creek and Mill Creek, and often have huckleberry oak as an indicator species. White fir stands are found on northwest and west slopes of South Fork Mountain ridge.

Mixed conifer is also an abundant vegetation type found in the watershed. Common components of mixed conifer include Douglas-fir, white fir, ponderosa pine (*Pinus ponderosa*), sugar pine (*Pinus lambertiana*), red fir (*Abies magnifica*), and incense cedar (*Calocedrus decurrens*). Mixed conifer is found primarily along the South Fork Mountain ridge top, Bennett Peak and Pelletreau Ridge.

Red Fir is found over 4,800 feet elevation on the far western boundary of the watershed on the South Fork Mountain ridge-top. Red fir occurs as a component of mixed conifer stands between 4,800 to 5,200 feet along with white fir, Douglas-fir, sugar pine and incense cedar. Red fir occurs in near pure stands over 5,200 feet elevation, especially in the Blake Mountain vicinity. Many red fir individuals in this area are infected with the parasitic plant dwarf mistletoe (*Arceuthobium abietinum*) and associated *Cytospora* canker (*Cytospora abietis*). Red fir is relatively uncommon across the Forest due to its elevational requirements.

Gray pine represents some of the least productive sites in the watershed, occurring in lower elevations near the South Fork Trinity River and on the South end of the watershed. Canyon live oak is characteristically an abundant component in gray pine stands.

Non-forested sites include shrub dominated and herb dominated areas. Shrub dominated sites are common in lower elevation areas near the South Fork Trinity River as well as those areas that have experienced high intensity or frequent fire. The vegetation in shrub dominated areas includes whiteleaf (*Arctostaphylos viscida*) and greenleaf manzanita

(*Arctostaphylos patula*), as well as deer brush (*Ceanothus intergerrimus*) and whitethorne ceanothus (*Ceanothus cordulatus*). Herbaceous communities occur as small wet meadows throughout the watershed.

Current forest health concerns in the Hyampom Watershed

The vegetation in the Hyampom Watershed can be separated into three strata. The far west watershed boundary (and Forest boundary) is South Fork Mountain, consisting primarily of red fir and mixed conifer. A contiguous block of intensively managed private (non-Forest Service) land owned primarily by forest products industry lies immediately adjacent to National Forest Land on South Fork Mountain. The forest industry managed lands consist primarily of managed Douglas-fir and mixed conifer. The eastern half of the watershed, descending to the South Fork Trinity River, is comprised of Douglas-fir, mixed conifer, gray pine and shrubland as elevation decreases. While only the federally regulated National Forest lands will be discussed in this section, it is noteworthy that non-Forest Service land comprises 52% of the watershed.

Forest Health on South Fork Mountain ridge-top

True firs, especially red fir, are readily susceptible to growth stunting effects, weakened virility and possible mortality caused by the parasitic plant dwarf mistletoe (*Arceuthobium abietinum* f.sp *wienzii*) and the associated pathogen *Cytospora* canker (*Cytospora abietis*). On South Fork Mountain ridge line, red fir is present in pure stands as well as a component of mixed conifer stands. In general red fir overstory has moderate to high levels of dwarf mistletoe (Angwin, 2010), red fir understory has varying degrees of infection depending on proximity to infected overstory.

Weins' dwarf mistletoe is a parasitic seed plant which is host specific to red firs, brewer's spruce and occasionally white fir; however, instances of white fir infection is uncommon on South Fork Mountain (Mathiasen, 2009). Dwarf mistletoes are obligate parasites, dependant on their host for support, water and most mineral and organic nutrients resulting in reduced growth, growth abnormalities, mortality and predisposition to other pests including insects and pathogens to the host. Dwarf mistletoe spreads between trees and within crowns of trees by means of small sticky seeds that are forcibly ejected into the air due to a build-up of turgor pressure. Seed dispersal is generally less than 20 lateral feet from the plant. Dwarf mistletoe swellings on red fir provide openings in the host bark for invasion by the secondary pathogen *Cytospora* canker (Kliejunas, 1982).

Cytospora canker is a weak fungus that causes cankers and dieback in true firs. *Cytospora* is responsible for frequent and often severe branch flagging, also known as branch dieback. While *Cytospora* is generally a weak pathogen, other stressing factors such as dwarf mistletoe infection, drought, fire or logging wounds, or twig and/or bark beetles predispose true firs to *Cytospora* infection.

In addition to dwarf mistletoe and *Cytospora*, Annosus root disease (*Heterobasidion occidentale*), fir engraver beetle (*Scolytus ventralis*), and white pine blister rust (*Cronartium ribicola*) are also affecting stressed trees and causing mortality on South Fork Mountain.

Forest Health on the Eastside of the Hyampom Watershed

The watershed analysis area on the eastside of the watershed is characterized by moderate to steep terrain that is dominated by Douglas-fir and mixed conifer communities. Conifer stands generally have moderate to dense canopy cover, with few openings. The predominant species are Douglas-fir and ponderosa pine, with sugar pine, white pine, incense-cedar, and gray pine in lesser amounts. Due in part to successful fire suppression activities and limited timber management, few disturbances have thinned conifer stands resulting in a landscape characterized by moderate to high density conifer stands of varying age classes (Table 2).

Table 2. Vegetation Types on National Forest lands in the Hyampom Watershed[1]

Vegetation Type	Size Class (inches DBH)	Density (% Canopy Closure)	Acres
Douglas-fir	Multi-layered	≥60%	3289
Douglas-fir	≥24”	≥60%	273
Douglas-fir	11-23.9”	≥60%	4151
Douglas-fir	11-23.9”	40-60%	578
Douglas-fir	6-10.9”	≥60%	3618
Douglas-fir	6-10.9”	40-60%	431
Douglas-fir	1-5.9”	≥60%	481
Douglas-fir	<1.0	n/a	1134
Mixed Conifer	11-23.9”	≥60%	2082
Mixed Conifer	11-23.9”	40-60%	2337
Mixed Conifer	6-10.9”	≥60%	783
Mixed Conifer	6-10.9”	40-60%	614
Mixed Conifer	1-5.9”	≥60%	772
White Fir	≥24”	≥60%	441
White Fir	11-23.9”	40-60%	849

Vegetation Type	Size Class (inches DBH)	Density (% Canopy Closure)	Acres
White Fir	6-10.9”	40-60%	1100
Red Fir	11.0-23.9”	40-60%	157
Red Fir	6-10.9”	25-40%	140
Hardwood	6.0-10.9”	≥60%	538
Non-Forested	n/a	n/a	503
Water	n/a	n/a	71

[1] Data extracted from Shasta-Trinity National Forest GIS layer: Existing Vegetation 2007

Dense conifer stands indicate overstocked conditions which causes increased stress of residual trees due to competition for limited resources such as sunlight, water and nutrients. This competition stress reduces annual growth and increases susceptibility to insects such as fir engraver beetles, western pine bark beetles or mountain pine beetle which may lead to mortality (Oliver, 1995; Smith et al., 2005). In addition, a dense, suppressed understory contributes to increased fuel loading causing further vulnerability to high intensity or stand-replacing wildfire (McKelvey et al., 1996).

While only endemic levels of disease are present at this time, there are indications that an increase in individual tree mortality is occurring due to fir engraver beetle and western pine beetle within the eastern portion of the watershed (U.S. Forest Service, Region Five, Forest Health Monitoring Group Aerial Detection Survey Results from 2008-2010).

Sensitive Botanical Species with Known Locations In and Near the Watershed

The only known site record for sensitive botanical species in the Hyampom watershed is for *Iliamna latibracteata* or California globe mallow that was found during surveys in the summer of 2010. Currently these records are at the regional office awaiting input into NRIS which will then update our current sensitive species data layer.

Past site records indicate that the closest and only sensitive plant population within 3 miles of the watershed boundary is *Harmonia doris-nileseae* or Niles’ Madia which is located within 1.5 miles of the western boundary.

Species Accounts

California globe mallow is a perennial herb that is native to California and Oregon. It is ranked as 1B.2 and G3, S2.2. There are 7 populations listed on the Six Rivers National forest and one on the Shasta-Trinity National forest. It often occurs in wet riparian settings in openings of coastal range conifer forests. Its habitat is thought to have been historically sustained by frequent fire intervals creating open canopy with high light levels.

California globe mallow is disturbance-following found most commonly in conifer forest that has burned in wildfires. There is an existing 5-6 acre population of California globe mallow on South Fork Mountain, occupying a portion of the 1987 Blake Fire area. Habitat within and directly around this population was highly disturbed after the Blake Fire; it appears the area of the population was used as a salvage harvest landing where logs were decked. This population is vigorous with a moderate to high density of plants 23 years later. Many of the plants in the population have received repeated grazing in the last 5 years, contributing to a reduction of globe mallow seed in the seed bank. Currently, many populations are afforded some protection under the Aquatic Conservation Strategy. Known threats to this species include fire suppression, post-wildfire activities, and grazing. In 2010, an enclosure fence was built to exclude livestock grazing and allow California globe mallow seed replenishment for 6 years.

Populations of this species have been found in old burned areas on South Fork Mountain and Sims Mountain in similar habitats. Although conclusive information about habitat needs are lacking, it appears to require large-scale soil and canopy disturbance and will fade from a site once forest canopy closes with recovery. Full canopy closure is not expected to occur in less than 50 years, although soil stabilization and surface cover would take place within 10 to 15 years.

Niles' Madia is an annual herb native to California where it is known to have 27 populations (24 in Rarefind; Sept. 2011 data), ranging from 50-15,000. Population size fluctuates dramatically from year to year based on weather conditions. This species is limited to serpentine openings in mixed conifer/oak forest that occur as a series of "islands" in a matrix of non-serpentine substrate. Habitat consists of chaparral with *Ceanothus cuneatus* and other shrubs, and minor components of gray or Jeffrey pine (*Pinus sabiniana, P. jeffreyi*). The species often occupies roadsides and roadcuts in. All populations on the Forest, except for one, are limited to Rattlesnake Creek Terrane (ecological subsection M261Au) of Trinity & Shasta Counties, in northern California. One population occurs on private land just north of Chanchellula wilderness. Several populations are on roadside gravels and are threatened by roadside maintenance.

Other Sensitive Botanical and Fungal Species with the Potential to Occur in the Watershed

Suitable habitat exists for the following species within the Hyampom Planning Watershed:

- *Anisocarpus scabrida*, Rough raillardella

- *Botrychium* subg. *Botrychium* and subg. *Sceptridium* (except *B. multifidum*), moonwort, grapefern
- *Campanula wilkinsiana*, Wilkins' harebell
- *Cypripedium fasciculatum*, Brownie lady's slipper
- *Cypripedium montanum*, mountain lady's slipper
- *Draba carnosula*, Mt. Eddy draba
- *Epilobium oreganum*, Oregon willow herb
- *Eriastrum tracyi*, Tracy's woolly-stars
- *Eriogonum ursinum* var. *erubescens*, blushing wild buckwheat
- *Frasera umpquaensis*, Umpqua green gentian
- *Minuartia rosei*, Peanut sandwort
- *Minuartia stolonifera*, Scott Mountain sandwort
- *Parnassia fimbriata* var. *intermedia*, fringed grass-of-parnassus
- *Raillardella pringlei*, showy raillardella
- *Sedum paradisumm*, Canyon Creek stonecrop
- *Smilax jamesii*, English Peak greenbriar

Species Accounts for Potentially Occurring Sensitive Species

Rough raillardella is a perennial herb native to California. It is ranked by CNPS as 1B and G2/G3, S2/S3. Sixteen documented occurrences range from Trinity and Shasta counties in the north down through Tehama, Colusa, Mendocino and Lake counties in the southern end of its range. It is found on dry talus or scree slopes in white fir/red fir zones at elevations between 5300 and 7500 feet. There is one known occurrence on Shasta-Trinity National Forest, on an inaccessible vertical outcrop within a Special Interest Area, adjacent to a communications facility and a 50 KV power line. A second nearby peak on private land also has a population which is adjacent to a communications facility. There is also a known population on Black Lassic Mountain on Six Rivers National Forest.

The primary threat for this species is from ridgetop fireline or fuel break construction where vehicular trampling can occur. As long as there are wildfires there will be a risk that the ridgetops of some of the high elevation mountains that support *Anisocarpus scabrida* could have fire lines constructed on them.

Moonworts and grapeferns are small, primitive vascular plants that are very uncommon throughout North America. They are ranked by CNPS as G3/G4/G5, S1/S2 and there are less than 20 known populations in California. Their diminutive size has caused them to be overlooked in the field and assumed extremely rare, but recent survey efforts continue to confirm their rare status. Moonworts are found in grassy openings that remain relatively moist throughout the growing season, most often on granitic soils. They frequently remain dormant for one or more years which contributes to their presumed rarity.

Known threats include grazing, recreational overuse, canopy removal and activities that modify soil hydrology. There is one known site of *Botrychium crenulatum* on the west side of the Forest, located in the Granite Creek watershed within the Trinity Alps Wilderness. There are several other *Botrychium* species located on the east side of the Forest near Mt. Shasta.

Wilkin's harebell is a rhizomatous perennial herb that is native to California and is endemic to California alone. It is ranked as 1B.2 and G2, S2.2. There are about 20 occurrences. One population has 5000 plants; the others have 300 or fewer (mostly less than 50). One new population was found in 2002. Most populations are in wilderness areas (Trinity Alps & Mt. Shasta), but this does not afford adequate protection from trampling, as the plants are always near water and so are recreationalists. Several populations along the SE side of Mt. Shasta have disappeared since 1980, perhaps from flooding related to upslope timber harvest on private lands. Suitable habitat includes upper montane or subalpine riparian areas, springs and stream banks.

Brownie lady's-slipper is a wide ranging but rare western North American orchid. It is ranked G4, S3.2 and is found in 8 western states. This rank means there are 21 to 100 populations known from California, but it is considered apparently secure globally. In this drier part of California, populations tend to be small and are usually confined to relatively moist habitats, especially older forests along riparian corridors. There are 42 known populations on the Forest, with most of these in Trinity County. Six Rivers National Forest has 16 documented occurrences, with population size ranging from 2 to 60 plants.

Known threats include logging and fuels reduction activities (due to dramatically increased sunlight), excessive grazing, and exclusion of wildfire.

Mountain lady's slipper is another wide ranging but rare western North American orchid. It is ranked G4, S4 and is found in 6 western states. This rank means there are greater than 100 known populations from California, but it is considered secure globally and statewide. There are 48 known populations on the Forest, with all of these occurring in Trinity County. In this drier part of California populations are very small and usually confined to relatively moist, shady habitats, especially older forests along riparian corridors. Habitat can be drier and more open than for *C. fasciculatum*, but most populations away from riparian areas are confined to north or northeast aspects with filtered sunlight.

Known threats include logging and fuels reduction activities (due to dramatically increased sunlight), excessive grazing, and exclusion of wildfire.

Mt. Eddy draba is a perennial herb that is native to California and is endemic to California alone, specifically the Klamath Ranges. It is ranked as 1b.3 and G2, S2.2.

There are two known occurrences in the vicinity of the Forest, one straddles the Siskiyou Crest between Six Rivers National Forest and Shasta-Trinity National Forest, and the other population is located in the Klamath National Forest at Bear Mountain. Habitat for the species is ultramafic, granodiorite outcrops and rocky settings at elevations between 2000 and 3000 meters.

Known threats to this species include horticultural collecting and recreational impacts on trailside occurrences. Due to their isolation, declines in population health and vigor would be undetected without periodic monitoring.

Oregon willow herb is a perennial herb native to California. It is ranked as 1b.2 and G2, S2.2. Five historic populations of unknown size are documented on the Forest. There are also 14 populations on the Forest known to be extant. There are two populations in the Trinity Alps Wilderness and others in small riparian reserve areas. The habitat on the Forest is very localized and associated with perennial springs and ultramafic soils. Other habitats include bogs and fens in montane coniferous forests.

Known threats to this species are grazing and grazing-related water development, watershed restoration projects, changes in hydrology, recreation (trampling and compaction of meadow wetlands), and road maintenance.

Tracy's woolly-stars is an annual herb native to California, and it is ranked as 1B.2 and G1Q, S1.1. There are five known occurrences on the Forest. These populations range in size from 200 to 10,000 plants. Populations on National Forests are protected by flag and avoid practices. The species does not appear to be habitat specific as it can survive in disturbed areas, but it seems to prefer foothill chaparral.

Known threats to this species include OHV use, grazing, and fireline construction and maintenance. Many populations fall within the same habitats desired for fuelbreak construction.

Blushing wild buckwheat is a perennial herb native to and endemic to California. It is ranked as 1B.3 and G2/G4/T2, S2.3. There are three populations along or near the Shasta-Trinity County Line of 10 to several hundred plants. These sites consist of north-facing rocky ridge tops in openings within montane shrub communities at 4,200 to 6,200 feet on non-ultramafic metamorphic soils.

Potential threats to the populations include ATV use, logging, road and lookout maintenance, and noxious weed spread. These threats depend on the location and elevation of the sites, and there a no known threats to the sites along the Shasta-Trinity County line, though other populations near lookouts are threatened.

Umpqua green gentian is a perennial herb native to California. Synonyms include *Swertia umpquaensis* and *Swertia fastigiata*. It is listed as 2.2 and G3Q, S2.2. The habitat and range of this species is very limited with the only known occurrences in the Pickett Peak area of South Fork Mountain, in openings in the red fir forest. These populations are protected through flag and avoid. The biggest known threat is from grazing by cows that trespass on the Six Rivers National Forest side of the mountain.

Peanut sandwort is a perennial herb that is native to and endemic to California. It is ranked as 4.2 G3, S3.2. There are 34 known populations on the Forest, many of which have less than 100 plants. All populations except one are limited to Rattlesnake Creek Terrane, an ecological subsection of Trinity and Tehama counties. This species is limited to yellow pine forest on serpentine, which does not recover well from disturbance.

Since it occurs on very rocky, unproductive soils, timber harvest is generally not a threat. Road and landing building can cause some impacts if not mitigated. Many populations fall in habitats desired for fuel break construction.

Scott Mountain sandwort is a perennial herb that is endemic to California, specifically on Scott Mountain. It is ranked as 1B and G1, S1.3. There are only two known locations, but it is presumed to exist in more areas that have not yet been surveyed for this species. The known populations reside on the Klamath National Forest. Habitat is rocky ultramafic soils, mixed conifer/Jeffrey pine forest, above 4,500 feet.

Possible threats to this species include highway maintenance. State Highway 3 was probably built through a then undocumented population, destroying some plants. Landslide activity has been a problem there and could potentially affect the population directly or indirectly through highway work.

Fringed grass-of-parnassus is a perennial herb native to California. There is no listing status at this time. There is one occurrence on the Forest. Habitat is wetland-riparian in red fir and sub-alpine forests between 6600 and 9200 feet. There are no documented threats to this species.

Showy raillardella is a perennial rhizomatous herb endemic to California. It is ranked as 1B.2 and G2, S2.2. There are only 20 occurrences remaining in California, but there are 31 historically documented in Trinity County. Habitat for this species includes bogs, fens, and meadows in red fir forests. This species has an affinity to serpentine soil. The threat of most concern is grazing.

Canyon Creek stonecrop is a perennial, succulent herb endemic to California. It is ranked as 1B.3 and G1, S1.3. All known occurrences are on the Forest, with the largest population in the Trinity Alps Wilderness. Habitat is granite rock outcrops in chaparral, mixed evergreen, and sub-alpine forests. This species is not usually threatened by disturbance due to its occurrence on rock outcrops. Possible threats for this species include rock quarry development.

English Peak greenbriar is a vining perennial known only from California and Oregon. It is ranked 1B.3 and G2/G3, S2.3. It is found throughout the Klamath and Coast Ranges. There are 26 known populations on the Forest and more are suspected, especially in the Trinity Alps Wilderness. It occupies moist riparian areas including lakesides, stream banks, alder thickets, and moist slopes in montane forest, between 4000 and 8000 feet. Known threats to this species include logging, mining, trampling, power lines, and fuels reduction.

Noxious Weed Species and Management

Figure 2. Spotted knapweed.

A high-priority weed species is one that is of local management concern because of its currently limited distribution, highly invasive nature, and demonstrated potential to displace large geographic areas of native plant communities. Inadequate funding is available for treatment of all nonnative species, so emphasis is given to high-priority weed species only. High-priority weed species for the west side of the Forest are species that have a documented presence on the Forest and include knapweed species (*Centaurea* species [Figure 2] other than yellow star-thistle, *C. solstitialis*), dyers woad (*Isatis tinctorius*), brooms (*Cytisus* spp., *Genista* spp., and *Spartium* spp.), Canada thistle (*Cirsium arvense*), and fennel (*Foeniculum vulgare*).

As of June 2011, there are no site records of noxious plant species occurring in the Hyampom watershed (Figure 3). There are several noxious plant species known to occur near the watershed that have been treated annually with manual methods. The closest noxious weed population is *Sytisis scoparis* or Scotch broom. It occurs within two miles from the south western boundary of the watershed in proximity to the South Fork River. Diffuse knapweed (*Centaurea diffusa*) is known to occur on South Fork Mountain in southern Trinity County and has been hand-pulled annually by the Forest Service for six years. Historically there have been no noxious weed inventory surveys done in the Hyampom watershed since it usually occurs on a project planning level. It is likely that there are spotted and diffuse knapweed, Scotch broom, Canadian thistle and Yellow Starthistle in the planning watershed due to the proximity of known occurrences and the proximity to water (Figure 4), which acts as a vector dispersing seeds to new locations.

Jason Stanley, project leader for the Watershed Research and Training Center, has been leading crews to manually treat knapweed populations in the South Fork Management Unit for the past six years. He recommends that inventory surveys for spotted and diffuse knapweed be completed in the Hyampom Watershed, and believes that the species would likely be found, especially in the upland riparian habitats and flood plains of the South Fork River and its upper drainages (personal comment June 16, 2011).

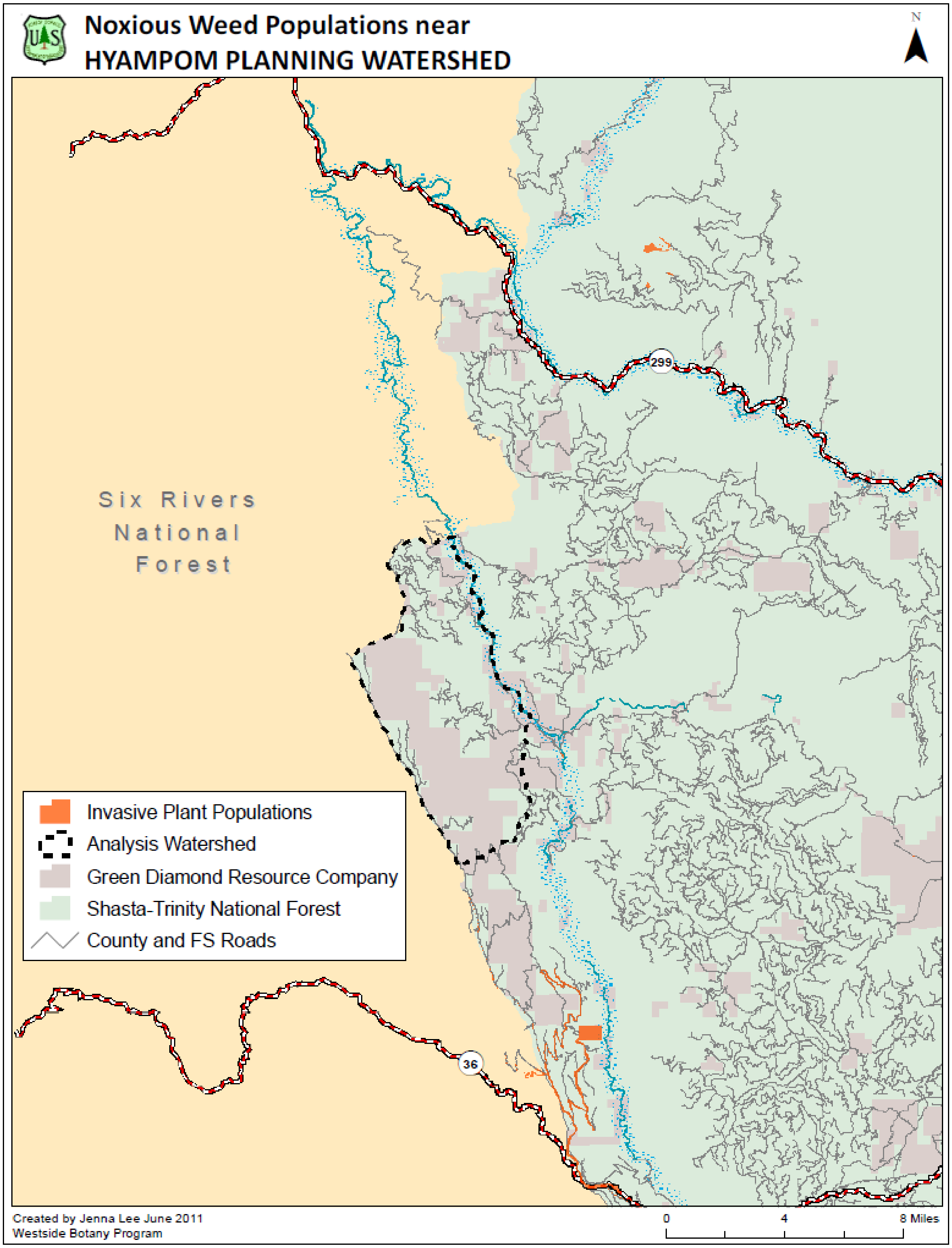

Figure 3. Known noxious weed populations in the vicinity of the Hyampom planning watershed.

Figure 4. Diffuse knapweed rosette found photosynthesizing underwater in the South Fork River in Hyampom. Photo taken by Lusetta Nelson on June 16, 2011.

Wildlife

The Hyampom watershed is over 50 percent privately owned, with timber management being the primary land activity on the privately owned parcels. NAIP imagery (2009) indicates that the preponderance of the private land is coniferous forest habitat that has been heavily harvested. Relatively intense timber management will likely continue on this land into the future. Consequently, the private land is not likely to provide habitat for late-successional habitat dependent species.

This section briefly describes the known or expected occurrence of Federal Endangered Species Act listed, Forest Service Sensitive, and Survey & Manage wildlife species. Project-level surveys for species in these categories may be helpful or required during project development.

Federally Listed Species Occurrence

The threatened northern spotted owl (*Strix occidentalis caurina*) is the only Federally Listed Endangered, Threatened, or Proposed Species[1] that our records show within the Hyampom watershed. The watershed lies outside the known or expected ranges of the marbled murrelet (*Brachyramphus marmoratus*) and California red-legged frog (*Rana aurora draytoni*). Nine 'historic' spotted owl activity centers have been documented in the watershed since 1980. Table 3 presents the activity centers with identification codes,

[1] The Shasta-Trinity National Forest accessed the most recent list of endangered, threatened, or proposed species that may occur in the vicinity of the project (i.e., Trinity County) from the USFWS web site dated January 14, 2011 (http://www.fws.gov/arcata/specieslist).

historic status, and years of first/last documented detections. Because the years of most recent detection are old (ranging from 1990 to 1995) these activity centers give a general indication of owl activity in the watershed, but should not be considered as currently active sites without up-to-date survey information.

To gather up to date information on the spotted owl, the Forest initiated spotted owl surveys in 2010 in the upper roughly 1/3 (elevation-wise) of the watershed, centered on the South Fork Mountain ridge top which establishes the watershed's western boundary. No spotted owls have been detected within the watershed to date. The surveys will continue into 2011. Becky Rogers, Biological Technician on the Trinity River Management Unit (Weaverville) will provide the most up-to-date information as surveys are completed. Additionally, she is gathering documentation on owls and owl surveys on the private property in the watershed.

Forest Service Sensitive Species Occurrence

The bald eagle (*Haliaeetus leucocephalus*) and the Big Bar (or Pressley) hesperian snail (*Vespericola pressleyi*) are the only Forest Service Sensitive Species that have been documented to occur within the Hyampom watershed[2] according to our records. An eagle nest site is located in the northeast portion of the watershed adjacent to the South Fork Trinity River. Pressley Hesperian snails have been found at four sites (Figure 5). While systematic surveys for sensitive species have not been conducted throughout the watershed, forest habitat and vegetation type conditions within the Forest Service portions of the watershed suggest that the Pacific fisher (*Martes pennanti pacifica*) and northern goshawk (*Accipiter gentilis*) likely occur in the watershed in at least modest numbers. The northwestern pond turtle (*Clemmys marmorata marmorata*) and foothill yellow-legged frog (*Rana boylii*) may occur in modest numbers along the South Fork Trinity River and lower reaches of tributaries at the eastern boundary of the watershed. Other Sensitive Species would require project-level surveys or on-the-ground habitat assessments to verify or meaningfully predict their occurrence.

Table 3. Historic Northern Spotted Owl Activity Centers in the Hyampom Watershed.

Forest Service ID Number	State Master ID Number	Historic Status	Year First Detected	Most Recent Detection On Record
600	HU267	Reproductive Pair	1986	1991
601	TR343	Pair	1990	1990
603	TR142	Reproductive Pair	1983	1995
607	HU117	Reproductive Pair	1983	1991

[2] The Regional Forester issued the most recent Sensitive Species list for Region 5 in October of 2007.

Forest Service ID Number	State Master ID Number	Historic Status	Year First Detected	Most Recent Detection On Record
608	TR084	Pair	1980	1995
612	TR252	Reproductive Pair	1990	1995
615	TR258	Pair	1990	1992
616	TR257	Reproductive Pair	1990	1992
617	TR155	Reproductive Pair	1990	1995

Survey and Manage Species Occurrence

The list of species included in the Survey and Manage program is currently in a state of flux and the status of the Survey and Manage list should be referenced prior to project development. Species that will potentially be on the list that occur in the watershed according to our database include the Big Bar hesperian snail (*Vespericola pressleyi*; four sites), Trinity shoulderband snail (*Helminthoglypta talmadgei*; seven sites), and the hooded lancetooth snail (*Ancotrema voyanum*; five sites) (Figure 5). Beginning in 1999, Survey and Manage mollusk surveys have been conducted in the upper, red fir zone of the watershed and none were detected. Contact Becky Rogers, Biological Technician on the Trinity River Management Unit (Weaverville) for documentation if needed.

Late-successional forest habitat (especially old-growth, see discussion below) is and will continue to be limited in the watershed and concentrated on the Forest Service portions. Furthermore, the intensity of private harvest is such that connectivity for species associated with late-successional forest habitat, such as the federally listed northern spotted owl, is and will likely continue to be compromised by the land ownership pattern in the area.

Conifer forest vegetation types, including early, mid and late seral stages, dominate the watershed (Figure 5). Other vegetation/habitat types and habitat components also occur. The Forest Plan establishes a management indicator approach to reduce the complexity of discussing all the wildlife species on the forest and nine wildlife assemblages (groups of wildlife associated with vegetative communities and/or key habitat components) have been selected as management indicators. Management of these assemblages is directed under the Forest Plan standards and guidelines. All nine assemblages are known to or are likely to occur within the Hyampom watershed:

- Late Seral Stage (also referred to as late-successional in this document);
- Openings and Early Seral Stage
- Multi-habitat
- Snag and Down Log

- Riparian (streamside vegetation distinct from adjacent ‘upland’ habitats, not simply Riparian Reserves)
- Aquatic
- Hardwood
- Chaparral (shrub)
- Cliffs, Caves, Talus, and Rock Outcrops

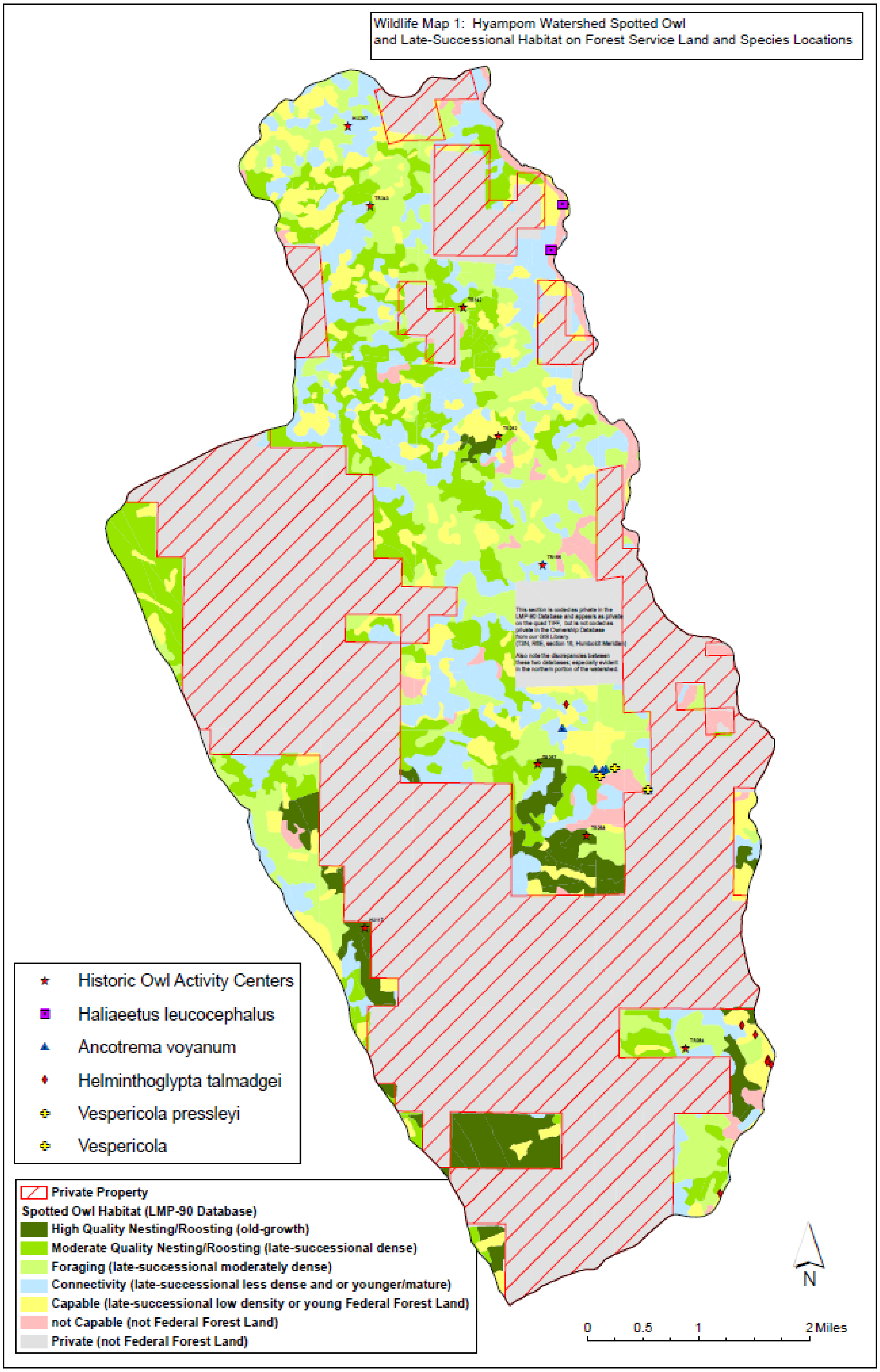

Figure 5. Map of habitat quality and known sites of federally listed, Forest Service sensitive and survey and manage species.

Soils

The Upper Trinity River watershed area is located in the Southern Klamath Mountains (M261As) Ecological Subsection of the Klamath Mountains Ecological Section (M261A) of northern California. This subsection comprises an area of the Western Jurassic Belt of the Klamath Mountains, and is dominated by marine sediment rocks that have been slightly metamorphosed. There are small bodies of serpentinized peridotite and Mesozoic granitic rocks. The climate is temperate and humid. Mass wasting and fluvial erosion are the main geomorphic processes.

Soils within the watershed area have predominately formed in metasedimentary residuum on the upper mountain sideslopes and ridges. Soils formed in these areas are generally shallow (less than 20 inches) to moderately deep (20 to 40 inches) loams to gravelly and very gravelly clay loams (Deadwood, Goulding, Dubakella, Marpa, and Neuns soils). Soils formed in serpentinized peridotite are shallow to moderately deep loams and clay loams (Dubakella and Ishi Pishi soils). Soils formed in marine sediments are deep to very deep (greater than 60 inches) loams and clay loams (Secca) (see Table 4 and Figure 6 for soil information).

Table 4. Major soils information

Soil Series	Depth	Parent Material	Soil Texture	Clay %	Rock Frags	Burn Damage	Erosion Hazard
Deadwood	S	MS	vgsl	10-20	50-85	M	M
Dubakella	MD	SP	gcl	25-45	35-65	M	M
Forbes	VD	S	cl	20-50	5-10	M	MH
Holland	MD-D	MS	l	20-34	10-35	L	MH
Hugo	MD-D	MS	l	20-30	10-30	L	MH
Ishi Pishi	MD	SP	vgl	25-35	35-65	M	M
Marpa	MD	MS	gl	18-30	25-55	L	M
Neuns	MD	MS	vgl	10-25	40-60	M	M
Secca	D	S	l	20-45	10-40	L	L

Soil Series	**Depth**	**Parent Material**	**Soil Texture**	**Clay %**	**Rock Frags**	**Burn Damage**	**Erosion Hazard**
Wetland	VD	mix	vcsl	4-10	50-90	L	L
Parent Material: MS = metasediments S = marine sediments SP = serp/peridotite		Soil Texture: l = loam gl = gravelly loam vg = very gravelly sl = sandy loam vc = very cobbly		Burn Damage: L = low M = moderate		Erosion Hazard: L = low M = moderate H = high	

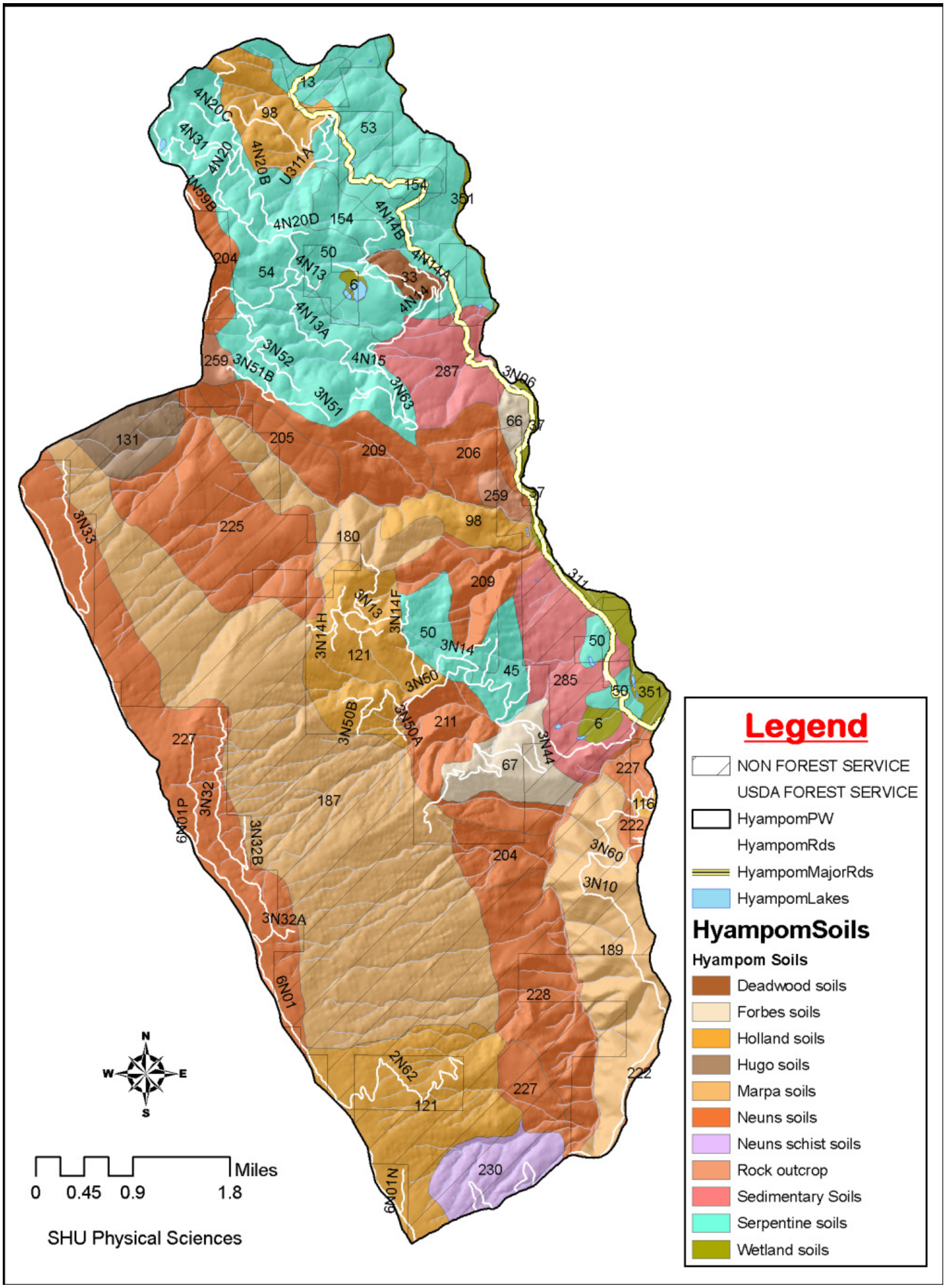

Figure 6. Soil map of the Hyampom watershed.

Geology

The Upper Trinity River watershed area is located in the Southern Klamath Mountains (M261As) Ecological Subsection of the Klamath Mountains Ecological Section (M261A) of northern California. This subsection comprises an area of the Western Jurassic Belt of the Klamath Mountains and the Coastal Range. This subsection is dominated by marine sediments rocks that have been slightly metamorphosed. There are small bodies of serpentinized peridotite and Mesozoic granitic rocks. The climate is temperate and humid. Mass wasting and fluvial erosion are the main geomorphic processes.

Geologic and Geomorphic Setting

Bedrock and Structure

The watershed analysis area is located within the Paleozoic and Triassic Belt of the Klamath Mountains geomorphic province and a portion of the Coastal Range. From west to east the main formations within the analysis area include the Pickett Peak formation, consisting of South Fork Mountain unit, the Galice formation, and the Rattlesnake Creek terrane (Figure 7). The Galice formation and the Rattlesnake Creek terrane are separated from the South Fork Mountain Schist unit by a major thrust fault that parallels South Fork Creek. This fault represents the boundary between the western Jurassic plate and the Costal Range plate.

The Pickett Peak formation consists of the South Fork Mountain Schist unit which consists of fine-grained mica-schist containing quartz pods. Chinquapin Metabasalt, a gneissic meta-basalt, is a member of the Schist and outcrops predominantly along Tomhead Ridge (outside of the analysis area) and smaller units throughout the schist belt. The Schist has a well-defined schistocity which strikes north-northwest and dips eastward. This unit shows high instability especially when adjacent to inner gorges, wet areas and fault zones.

The Galice formation consists of interbedded graywacke, mudstone, and conglomerate which shows varying degrees of metamorphism. It is separated from the Rattlesnake Creek terrane by a relatively sharp, eastward dipping, northwest trending fault. This formation strikes N20W and dips 45 degrees northeast consistently, thus causing two predominate mass wasting characteristics. When the bedded layers dip into the slope, the slides are predominantly debris type slides. When the bedded layers dip away from the slope, rotational slides are the predominate mass wasting process.

The Rattlesnake Creek terrane is named after Rattlesnake Creek, which crosscuts much of the terrane in the Pickett Peak and Dubakella Mountain quadrangles. This terrane is a mélange that predominantly consists of serpentinized ultramafic rocks, gabbro, diabase, pillow lavas and other mafic volcanic rocks, phyllite, thinly-bedded chert, discontinuous lenses of limestone and locally interbedded sandstones and pebble conglomerate. These rocks are generally considerably disarrayed by folding and faulting. The prevailing character of the terrane is that of a dismembered ophiolite suite (mélange).

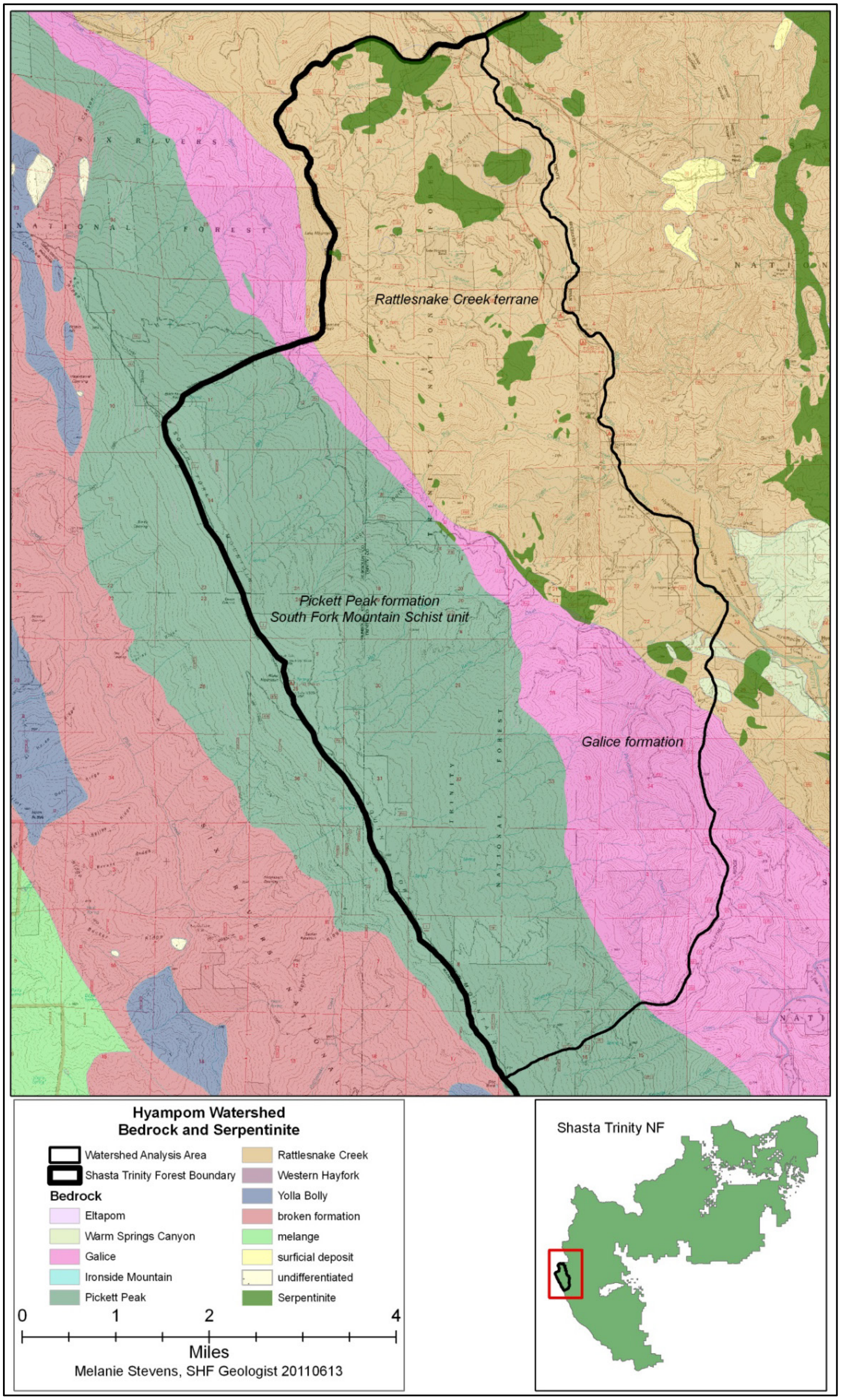

Figure 7. Bedrock and serpentinite locations within Hyampom planning watershed.

Geomorphic Processes and Land Use

Several land uses can affect erosional processes in the analysis area including (in decreasing order of magnitude) roads, timber harvest, mechanized fire suppression, trails, and prescribed fire. Fire suppression in a fire-dependent ecosystem has multiple interrelated effects, such as increased potential for large high severity fires due to decades of fire suppression. As a result, prescribed fire would not be a new or different factor in the ecosystem, provided it occurred within the range of effects and timing associated with natural fire.

Geologic Hazards and Resources

Naturally Occurring Asbestos (NOA):

Bodies of serpentinite that have the potential of containing naturally occurring asbestos (NOA) occur within the analysis area (Figure 7). NOA occurs in six different commercial forms; five belonging to the amphibole group (Tremolite, Actinolite, Anthophylite, Crocidolite, and Amosite) and one belonging to the serpentine group, Chrysotile (Van Gosen, 2007). All of these minerals are of the fibrous nature making them asbestiform (fibers with greater than a 3:1 length to width ratio). In California the most common form is Chrysotile with the five amphibole types in smaller concentrations. The Environmental Protection Agency has issued warnings “that any inhalation of asbestos fibers is potentially hazardous” (Abelson, 1990[3]). The majority of serpentinite soils that could contain NOA are located within the Rattlesnake Creek terrane. Other geologic hazards within the analysis area include mass wasting features, flooding and seismic hazards with emphasis on ground motion.

Resources within the area include groundwater and springs. Additionally, gold has been mined in the past within the Rattlesnake Creek terrane and there are at least two known open-pit mines located within the area. There is a high potential for mining related hazards to exist within past mines, both known and unknown. There are no known cave resources within the area, but pockets of limestone (less than an acre) do exist within the Rattlesnake Creek terrane, thus there is a small potential for unknown caves to exist. On a project scale, limestone outcrops should to be evaluated for their potential of having caves by qualified personnel and/or the local grotto, Shascades.

[3] Abelson, 1990. EPA adopted all forms of asbestos as a hazardous air pollutant pursuant to Section 112 of the Federal Clean Air Act 1990

Aquatic Systems

Hydrography

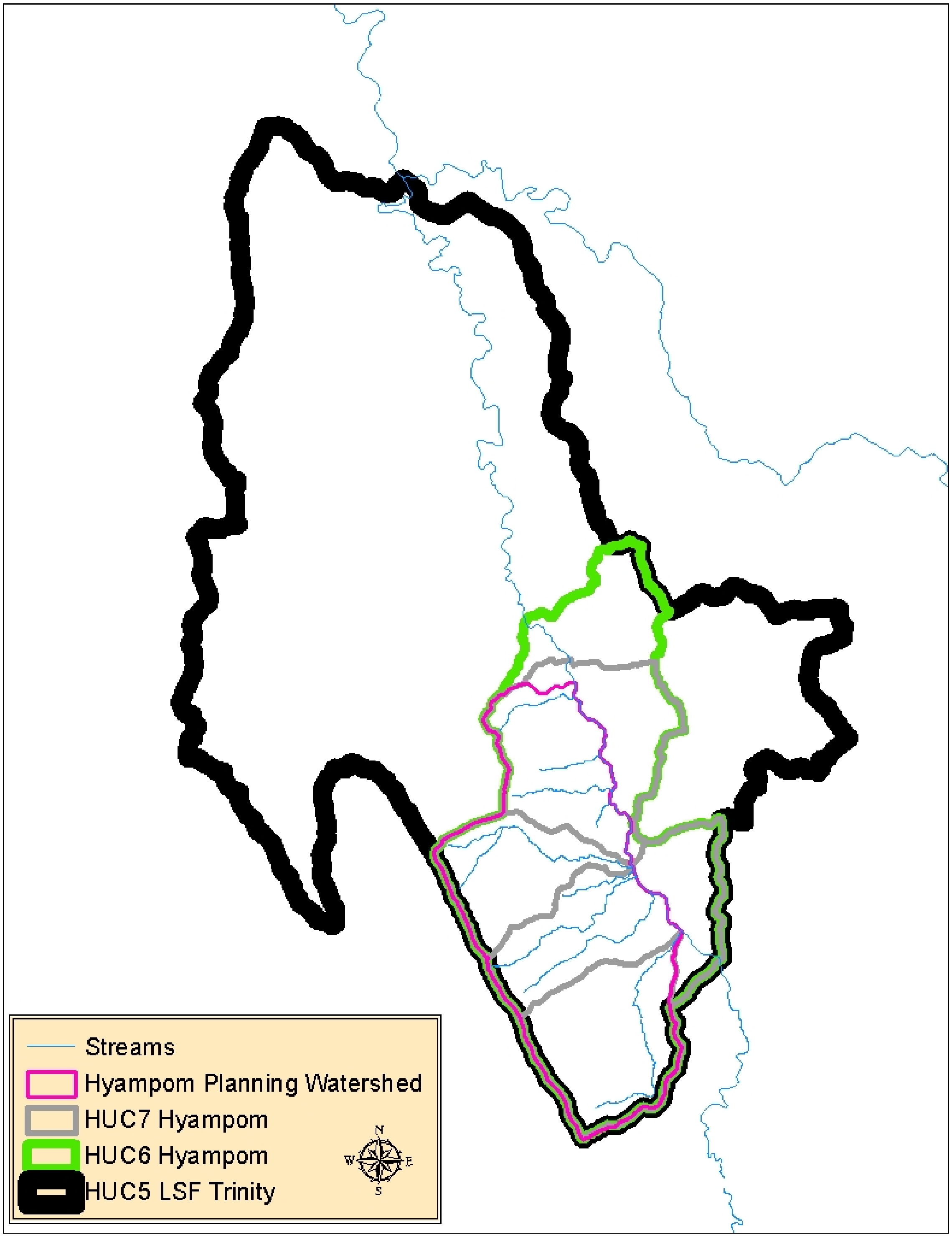

Figure 8. Hyampom watershed and surrounding hydrography.

The Hyampom planning watershed is a composite watershed and boundaries do not follow the natural watershed boundaries (Figure 8). The area completely lies within one Hydrologic Unit Code (HUC) 5 watershed, one HUC 6 watershed and four HUC 7 watersheds (Table 5). HUC watersheds have specific size criteria which are established by USGS.

Table 5. Hydrography in the vicinity of the Hyampom planning watershed.

Watershed HUC 5	Sub-Watershed HUC 6	Drainage HUC 7	Area (acres)	HUC Number
LSF Trinity R			129182.9	1801021205
	Hyampom		36657.7	180102120502
		Pelletreau Cr	7,577	18010212050201
		Hyampom Valley	9,175	18010212050202
		Big Cr-Hyampom	5,292	18010212050203
		Big Slide Cr-SFTrinity R	10,174	18010212050204

The watershed is approximately 24,345 acres. Boundaries mostly follow the HUC 6 Hyampom watershed. The Hyampom HUC 6 watershed completely contains the planning watershed. The South Fork Trinity River forms the eastern boundary of the planning watershed.

The planning watershed has approximately 155 miles of streams. Table 6 shows stream miles based on stream type. All of the streams in the planning watershed are included in the Total Maximum Daily Load (TMDL) which should, when implemented correctly, attain water quality standards for sediment. Figure 9 displays the distribution of these streams in the watershed.

Table 6. Streams within the assessment area

Stream Type	Miles
Perennial	67
Intermittent	35
Ephemeral	57
Total Miles	159

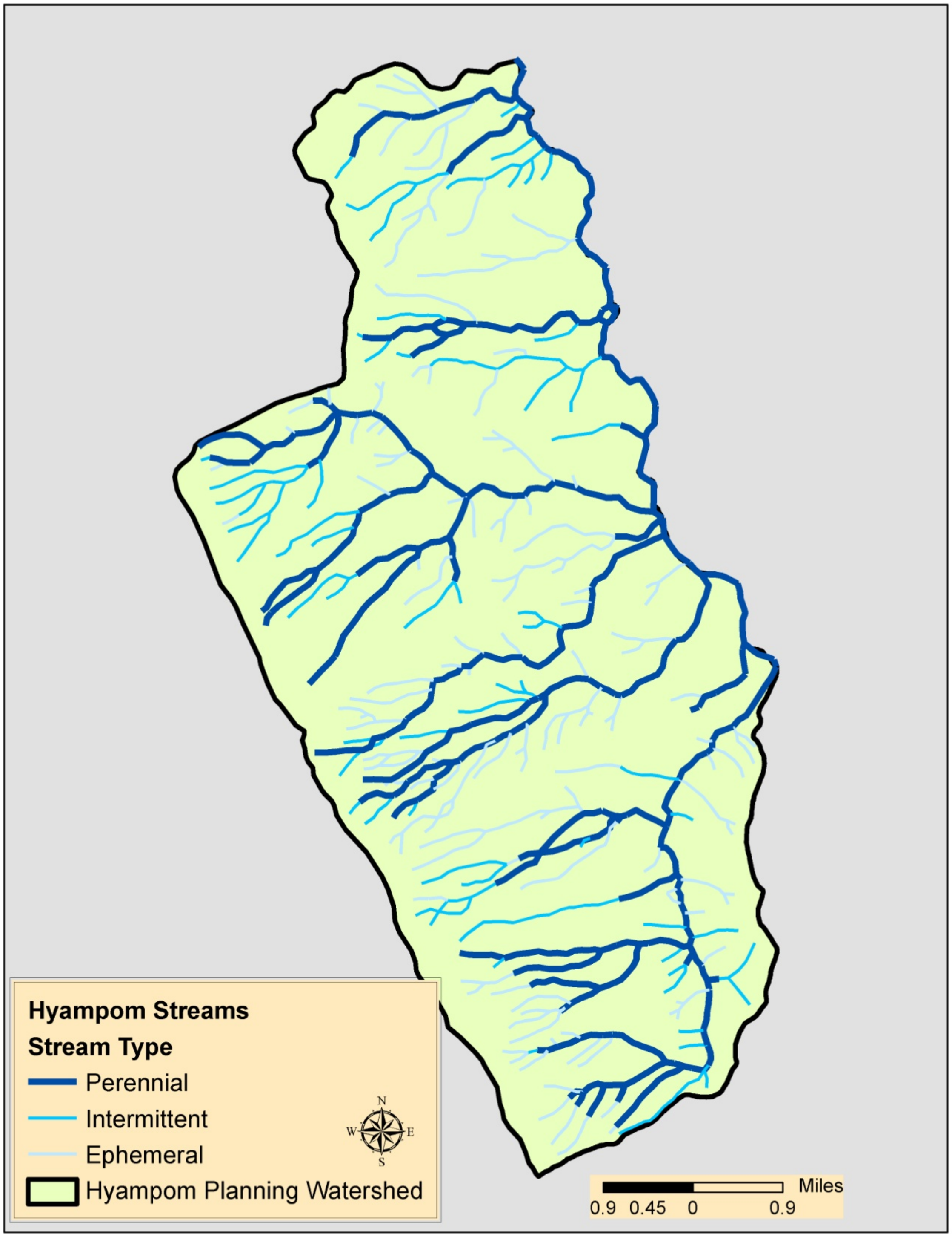

Figure 9. Stream types in the Hyampom watershed.

Fish Species

The anadromous fish species present within the Hyampom watershed analysis area include fall- and Spring-run Chinook salmon (*Oncorhynchus tshawytscha*), Coho salmon (*O. kisutch*), steelhead trout (*O. mykiss*), and Pacific Lamprey (*Lampetra tridentata*).

Steelhead trout and Fall-run Chinook salmon are the dominant anadromous salmonids within the Hyampom watershed. Resident species include rainbow trout (*Oncorhynchus mykiss*), Klamath small scale sucker (*Catostomas rimiculus*), speckled dace (*Rhinichthys osculus*) and coast range and prickly sculpin (*Cottidae* spp.).

Approximately 159 miles of mapped streams are located within the Hyampom watershed; of which 67 miles are classified as perennial, 35 miles as intermittent, and 57 miles as ephemeral. Out of the 67 miles of perennial streams within the Hyampom watershed approximately 22.6 miles are occupied by fish with 11.6 miles considered to be accessible to ocean-run fish species and an additional 11.0 miles occupied by resident fish only. Refer to Figure 10 for a map of resident and anadromous fish distribution within the Hyampom watershed.

The following fish found within the Hyampom watershed have been given special management status: Southern Oregon Northern California Coast (SONCC) Evolutionary Significant Unit (ESU), the Upper Klamath-Trinity River (UKTR) Chinook salmon ESU, both winter- and summer-run races of the Klamath Mountain Province (KMP) steelhead ESU, resident rainbow trout, and Pacific lamprey

SONCC Coho Salmon

SONCC Coho salmon have been listed as threatened under the Endangered Species Act (ESA) since February 1997. All stream areas that are accessible to anadromous fish have been listed as critical habitat (CH) for coho salmon.

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), in concordance with the Sustainable Fisheries Act of 1996 (Public Law 104-267), also designated Essential Fish Habitat (EFH) for coho and Chinook salmon (Federal Register, Vol. 67, No. 12). The MSA defined EFH as "...those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (Federal Register, Vol. 67, No. 12). EFH for Coho and Chinook salmon in the Hyampom watershed is identical to SONCC coho CH.

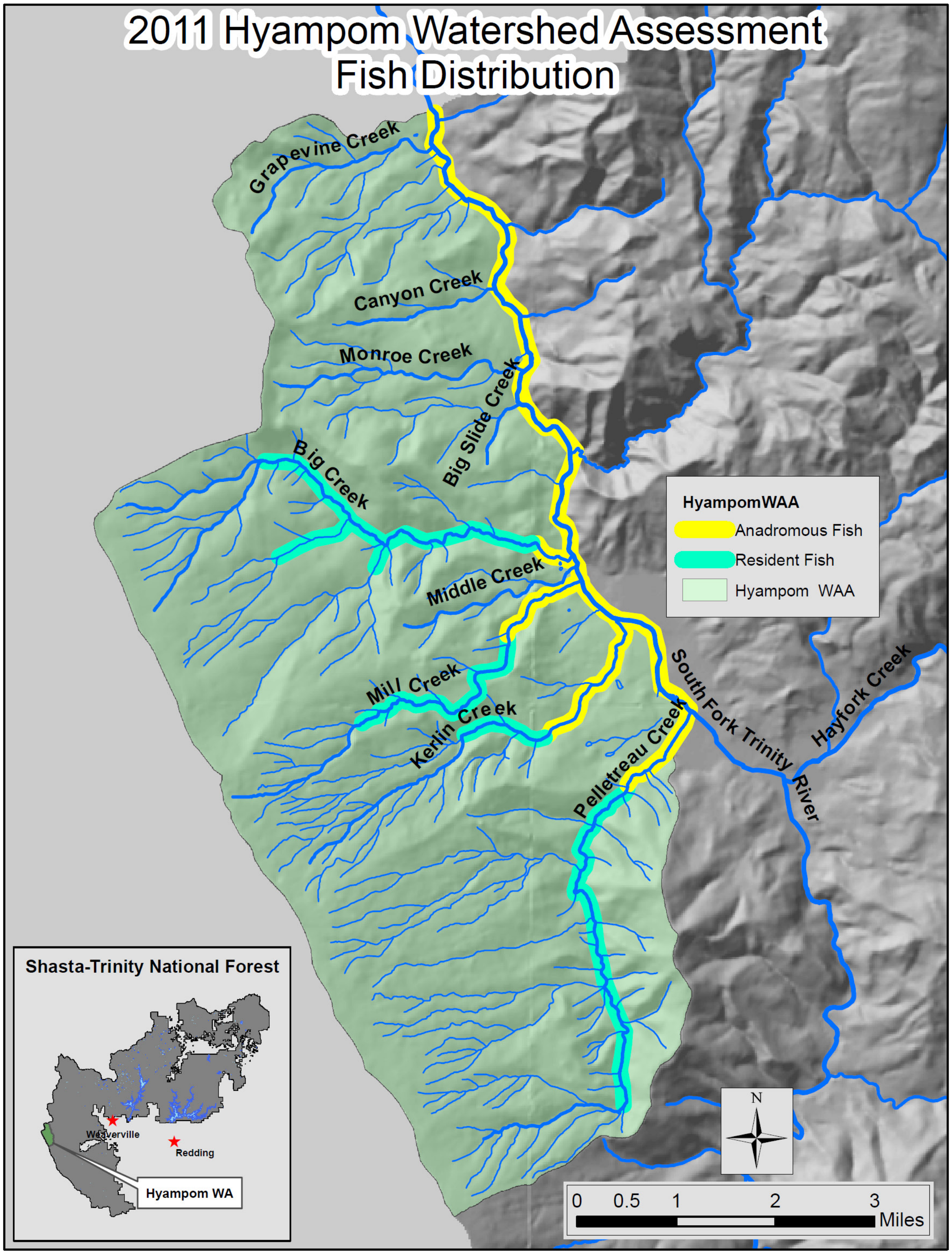

Figure 10. Fish distribution in the Hyampom planning watershed.

UKTR Chinook Salmon

Both spring- and fall-run races of the UKTR Chinook salmon ESU occur within the Hyampom watershed. The UKTR Chinook salmon ESU was petitioned for listing in January 2011. The petitioners have requested that the National Marine Fisheries Service list the UKTR Chinook salmon ESU as a threatened or endangered species under the Endangered Species Act (ESA) under one of the following three alternatives: 1) list spring run Chinook salmon as their own ESU; 2) list spring run Chinook salmon as a distinct population segment; or 3) list the currently recognized ESU containing both spring and fall run Chinook, based primarily on the severe loss of the spring run from the basin. The Petitioners also requested the designation CH for UKTR Chinook salmon.

Both spring- and fall-run races of the UKTR Chinook salmon ESU have also been designated by the USDA Forest Service within Region 5 as Sensitive Species. Sensitive species are defined as "plant and animal species identified by the Regional Forester for which population viability is a concern as evidenced by: (a) significant current or predicted downward trends in population numbers or density, and/or (b) significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.

Both spring- and fall-run races of the UKTR Chinook salmon ESU have also been designated in the Shasta-Trinity National Forest Land Resource Management Plan (LRMP) as species representatives for the Management Indicator Species (MIS) anadromous fish assemblage. MIS are identified in the Land and Resource Management Plans of each national forest and are generally identified to represent habitat types that occur within the national forest boundary and/or because they are thought to be sensitive to National Forest System management activities.

As mentioned above, UKTR Chinook salmon EFH has been designated and is identical to SONCC Coho salmon CH.

KMP Steelhead

Both winter- and summer-run races of the Klamath Mountain Province (KMP) steelhead ESU occur within the Hyampom watershed. They have been divided into Distinct Population Segments (DPS) due to differing life history strategies.

Both the summer- and winter-run DPS of the KMP steelhead ESU have been designated by the USDA Forest Service within Region 5 as Sensitive Species.

Both summer- and winter-run races of the KMP steelhead ESU have been designated in the Shasta-Trinity National Forest Land and Resource Management Plan (Forest Plan) as species representatives for the MIS anadromous fish assemblage.

Resident Rainbow Trout

Resident rainbow trout are known to occur within the Hyampom watershed. Resident rainbow trout essentially represent an alternative life history strategy to their genetically identical counterparts, the KMP steelhead. Resident rainbow trout forego the usual migration to the ocean, found in anadromous fish, and instead spend the entirety of their lives in freshwater. Migration is still an important characteristic of resident rainbow trout as they move in search of suitable habitats.

Resident rainbow trout have been designated in the Forest Plan as species representatives for the MIS inland coldwater fish assemblage.

Pacific Lamprey

Pacific lamprey are known to occur within the Hyampom watershed. Currently, little is known regarding historical abundance or current distribution of this species within the SFTR.

Management Direction and Land Allocations

Management Direction/Aquatic Conservation Strategy

The Hyampom Watershed is within the South Fork Mountain Management Area (MA 20). The South Fork Mountain Area is one of the most valuable Heritage resource sites on the Forest. While the Hyampom Watershed is not a Key Watershed, the South Fork of the Trinity River upstream of the Hyampom Watershed and still within the Management Area is a Key Watershed.

This watershed analysis is being undertaken to implement part of the Aquatic Conservation Strategy. The Forest Plan identifies the Hyampom Watershed as a watershed with high disturbance levels due to past land management activities and fires. It further states that "there is significant risk of initiating additional cumulative impacts within the main channels draining these watersheds."[4] In the Standards and Guidelines section of the Forest Plan (Chapter 4), the Hyampom Watershed is designated as an "extremely sensitive watershed" with a threshold of concern for equivalent roaded acres of 12%. The Hyampom Watershed is one of only three watersheds on the Forest with the extremely sensitive designation. The Forest Plan dictates that watersheds that exceed the threshold of concern, "regardless of ownership, will not be further impacted unless they can be improved with appropriate mitigation measures."[5]

[4] Shasta-Trinity National Forest Land and Resource Management Plan, pg. 3-22.
[5] Shasta-Trinity National Forest Land and Resource Management Plan, pg. 4-25.

Wild and Scenic River Designation

"The South Fork of the Trinity River (SFTR) from Forest Glen to its confluence with the Trinity River was designated as a component of the California Wild and Scenic Rivers System by legislative act in 1972. In 1980, California Governor Edmund G. Brown Jr. petitioned the Secretary of Interior, Cecil Andrus, to designate the South Fork of the Trinity, along with other rivers in the state system, as National Wild and Scenic Rivers pursuant to section 2(a) (ii) of the National Wild and Scenic Rivers Act. Following public involvement, inter-agency consultation, and NEPA documentation, Secretary Andrus approved the river for inclusion in the National system effective January 19, 1981. The evaluation that preceded designation nominated the river based on its outstandingly remarkable anadromous fishery values, and established the classifications of Wild, Scenic, and Recreational along segments of the river."[6]

Wild and Scenic Rivers (WSR) are classified in segments according to the level of development within ¼ mile of the shoreline, presence of impoundments and water quality. The SFTR within the Hyampom WA analysis area is classified as Recreational.[7] The Recreational classification does not mean that it is designated to provide recreation; however, recreation facilities may be present or constructed within this classification. The Recreational classification means that this section of river may have existing impoundments or diversions, some development, be readily accessed by roads and may not meet water quality criteria. The Wild and Scenic Rivers Act provides that the outstandingly remarkable values, (in this case the anadromous fishery), water quality and free flowing condition be protected for the benefit and enjoyment of present and future generations.

Land Allocations

Late-Successional Reserves

There are approximately 93 acres of Late Successional Reserve in the planning watershed in the north eastern corner (Figure 11). It is a small Late Successional Reserve unit. There is no specific management identified in the Forest Plan, and it is not addressed in the Late-Successional Reserve Assessment.[8]

Adaptive Management Areas (AMA)

There are approximately 7,189 acres of AMA in the planning watershed. There are two prescriptions in the AMA: Roaded Recreation and Commercial Wood Product Emphasis. Approximately 1,463 acres of the AMA are Roaded Recreation, and 5,726 acres are commercial wood product emphasis (Figure 11).

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[6] SFTR FEIS, pg S-1
[7] SFTR FEIS, pg 1-2
[8] Forest Wide Late Successional Reserve Assessment, Shasta-Trinity National Forest, 1999.

Administratively Withdrawn Areas (AWA)

There are approximately 4,377 acres of AWA in the planning watershed. The prescription for all 4,377 acres is Limited Roaded Motorized Recreation (Figure 11).

Inventoried Roadless Areas/Wilderness

There are no inventoried roadless areas or wilderness in the planning watershed.

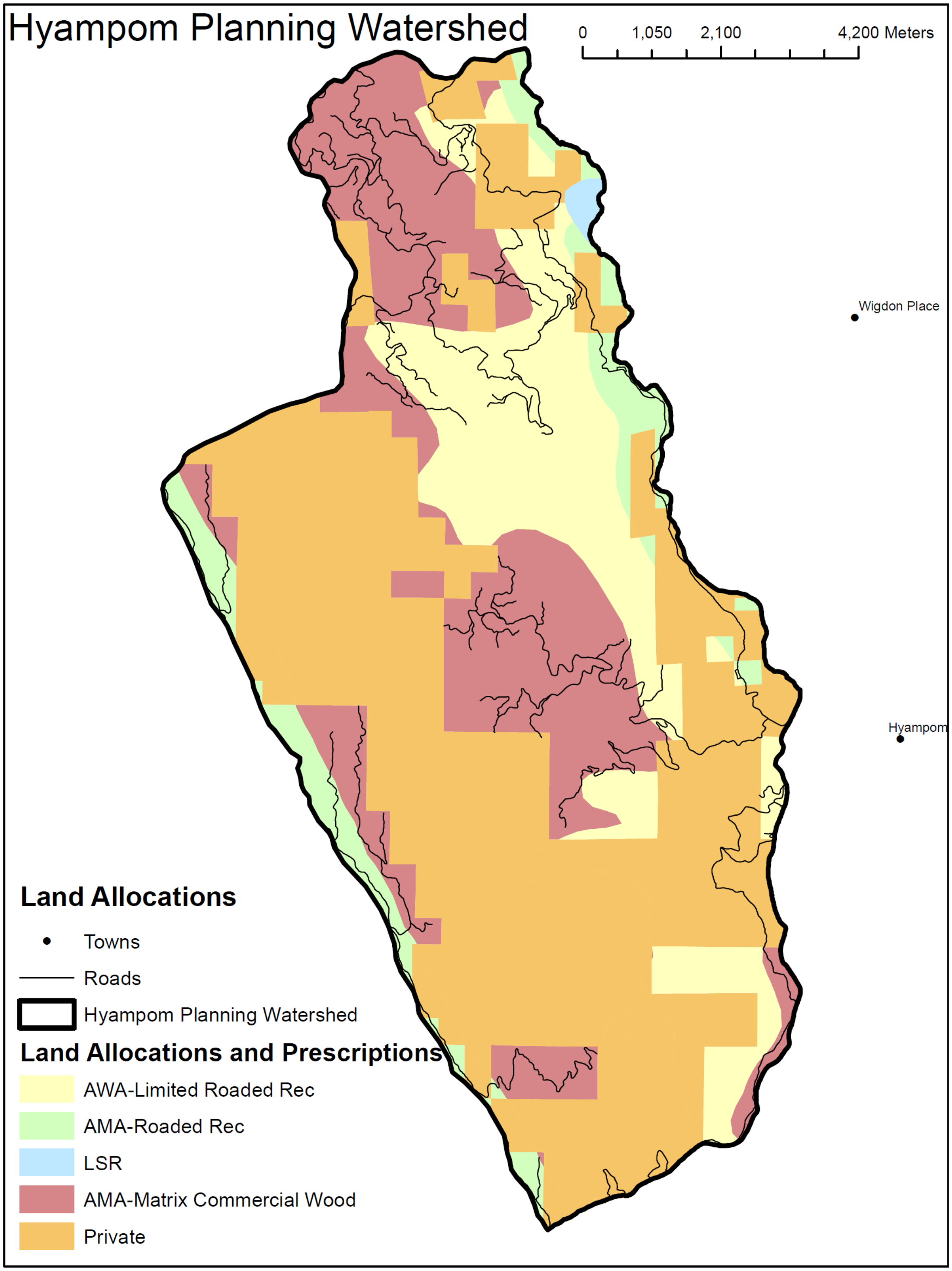

Figure 11. Land allocations and prescriptions in the Hyampom watershed.

Human Uses

Recreation Resources

The South Fork Mountain Management Area 20 is very remote, thus offers a more primitive recreation experience than in areas that are easily accessed. There are a few small, developed recreation facilities on the South Fork of the Trinity River. These include Slide Creek and Big Slide Campgrounds and Little Rock Picnic Area. The town of Hyampom is adjacent to the watershed, and the residents make up the majority of the recreationists in the area. Recreation includes river activities, such as fishing, kayaking and swimming; and non-water related activities, such as cross country hiking, camping, wildlife viewing and hunting.

The Forest manages recreation through the National Recreation Opportunity Spectrum (ROS) classes. The ROS system provides a range of recreation opportunities from Primitive to Rural. This spectrum offers a range of recreation settings, level of development and expected social interactions.

The Forest Plan allocated an ROS class to each Prescription Management Area in the Standards and Guides. The planning watershed has the following prescriptions with the associated ROS class.

The Limited Roaded Motorized Recreation prescription (prescription II) is primarily located in the central portion of the watershed. This area has few roads thus a more primitive character. The ROS class is Semi-Primitive Motorized Recreation (Forest Plan, pg 4-46). It is characterized by a predominantly natural-appearing environment of moderate to large size. Concentration of users is low, but there is often evidence of other users. The area is managed to provide minimum on-site controls and restrictions, but are subtle. Motorized use is permitted.[9]

The Roaded Recreation prescription (prescription III) is located along the South Fork River and the foreground of Road 6N01. The ROS class is Roaded Natural[10] which is characterized by predominately natural-appearing environments with moderate evidences of the sights and sounds of humans. Such evidences usually harmonize with the natural environment. Interaction between users may be low to moderate, but with evidence of other users prevalent. Resource modification and utilization practices are evident, but harmonize with the natural environment.[11]

The Late Successional Reserve (LSR) prescription (prescription VII) is located in one small area on the South Fork River. The LSR has an ROS class of Semi-Primitive Non-

[9] USDA, USFS 1986 ROS Book / Forest Plan Appendix L4-L5
[10] Forest Plan pg 4-64
[11] USDA, USFS 1986 ROS Book / Forest Plan Appendix L4-L5

motorized or Semi-Primitive Motorized.[12] Semi-Primitive Non-motorized ROS class is characterized by a predominantly natural or natural-appearing environment of moderate to large size trees, with low interaction between user, but there is often evidence of other users. The area is managed to provide minimum on-site controls and restrictions, but are subtle. Motorized use is not permitted.[13]

The LSR has either the Semi-Primitive Non-motorized or Semi-Primitive Motorized ROS class depending upon the management objectives of the LSR. Motorized use would not be allowed in areas where it would conflict with LSR management objectives.

The Commercial Wood Products prescription (prescription VIII) is located throughout the watershed analysis area. The ROS class for this prescription is Roaded Natural.[14] The Roaded Natural ROS class is described under the Roaded Recreation prescription above.

The Forest Plan Standards and Guidelines state that: ROS experiences will be compatible with timber objectives. In most cases this will be the Roaded Natural Recreation ROS class.[15]

Visual Resources and Scenery

The visual quality of the Hyampom Watershed is generally high, particularly on public lands. Scenic vegetation ranges from higher elevation red-fir old-growth forests to the South Fork Trinity River riparian area. The river offers attractive views with a variety of colors, textures and complexity. The Forest Plan describes visual quality objectives (VQOs) for each management prescription to enhance scenic quality on the Forest. Additionally, VQOs are determined by the Forest Plan[16] and the Forest Plan VQO map. Direction includes the following:

Manage river corridors to meet Retention VQO (management changes unnoticed) ¼ to ½ mile in the foreground (Forest Plan VQO map and Visual Management System/ Scenery Management System).

Manage the foreground (¼ to ½ mile) from South Fork Mountain Road (6N01) to meet Partial Retention (management activities may be evident, but must remain subordinate to the characteristic landscape).[17]

Management activities that are seen from developed recreation sites will meet a VQO of Retention in the foreground and Partial Retention in the middleground.[18]

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[12] Forest Plan pg 4-4-44

[13] USDA, USFS 1986 ROS Book / Forest Plan Appendix L4-L5

[14] Forest Plan pg 4-67

[15] Forest Plan pg 4-67

[16] Forest Plan pg 4-28

[17] Forest Plan pg 4-28

The existing views within this watershed meet Retention to Modification VQO due to the construction of roads, previous vegetation management, residences and a few recreation facilities. The remoteness of the area provides a landscape character that is primarily undeveloped and natural looking with a wide variety of vegetation, topography and water resources.

Illegal Marijuana Growing

Illegal growing has been occurring in the Hyampom watershed for over thirty years. There is one documented marijuana cleanup site inside of the planning area near Kerlin Creek (Figure 12). Marijuana grow sites typically are recognizable by irrigation pipe and/or drip line, garbage or trash pits, fertilizers and other poisonous chemicals, and a camp kitchen. Marijuana grow sites can cause natural and cultural resource damage by displacing cultural artifacts, damaging and removing native plant communities, and contaminating and displacing water resources.

[18] Forest Plan pg 4-65

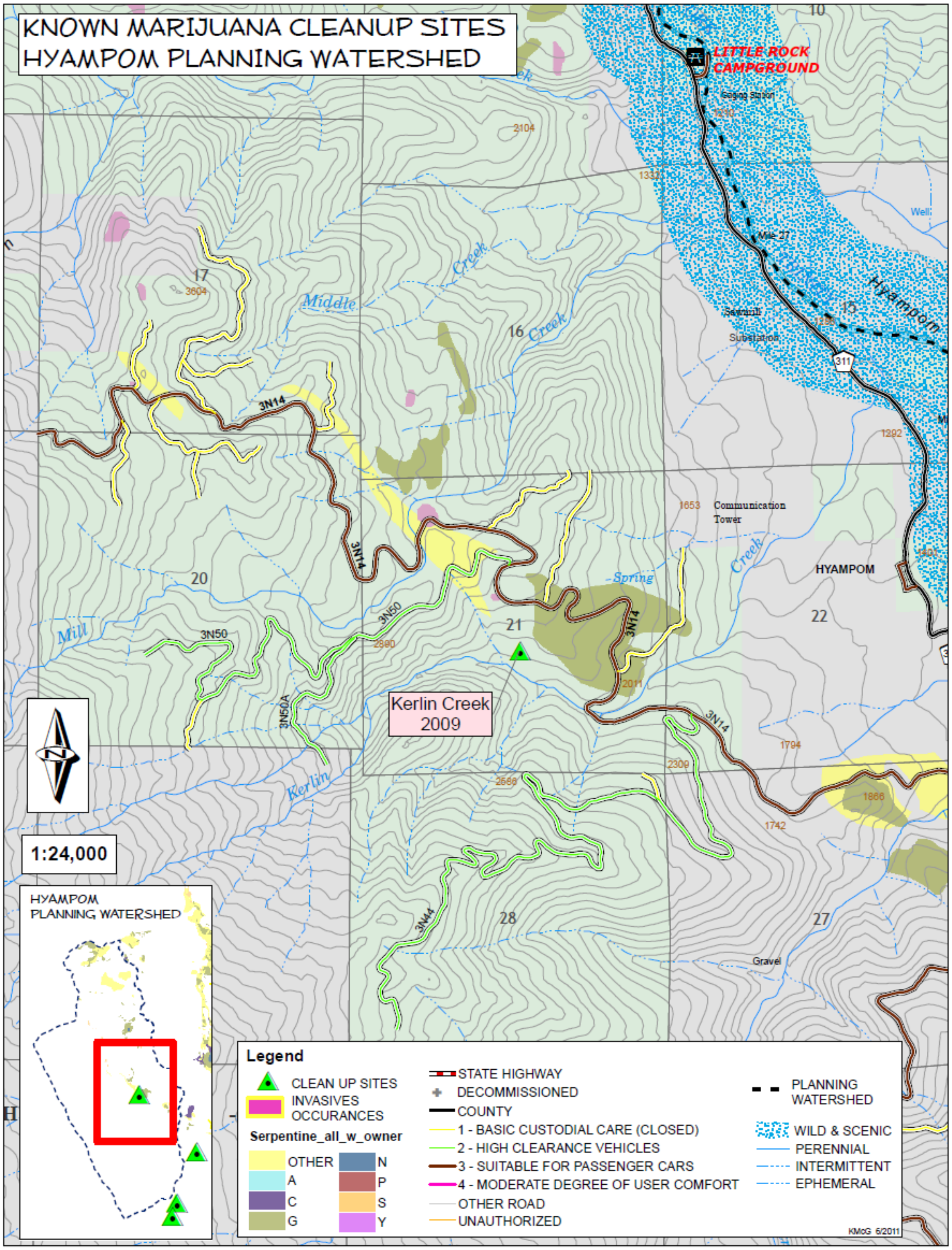

Figure 12. Location of past illegal marijuana grow site where the Forest Service has implemented some cleanup work.

Range

Grazing records on the Forest for the area in and near the Hyampom watershed go back to 1918. Until about 1964, the watershed was within the Big Creek/Pelletreau and the Grouse Creek grazing allotments. Around 1964 there was a realignment of allotment boundaries that resulted in the Hyampom watershed being entirely included in the Eltapom grazing allotment.

It is likely that livestock grazing began in the watershed with the first European-American settlements. Lack of available records from this period make it difficult to quantify the early grazing use. The primary permitted grazing use on National Forest System lands in the watershed was by cattle although, until 1925, the Forest Service permitted swine in this area and periodically the Forest Service permitted a limited number of horses.

Records indicate that some of the highest levels of grazing on National Forest System lands in and near the watershed occurred during the 1920s, 1960s, and 1980s. 1990 was the last year that a Term Grazing Permit for National Forest System lands in the watershed was in place.

Private lands in and around the watershed continue to be used for small-scale, pasture based beef cattle production. Beef cattle production remains a significant portion of the agricultural output of both Humboldt and Trinity Counties (Humboldt County, 2009; Trinity County, 2007).

The Forest Plan directs that lands supporting vegetation that can be used by both domestic and wild grazing animals, without damage to wildlife, soil, or water resource values, will be designated as "suitable for livestock grazing" (Forest Plan, pg. 4-22). Suitability is the appropriateness of a particular area of land for applying certain resource uses (FSM 1905). The process of determining suitability for livestock grazing is a two-step process that involves first identifying lands that are capable of supporting livestock and then identifying which of these capable lands are suitable for livestock grazing. Capability is the ability of a unit of land, based on defined physical and biological attributes, to support a particular use or suite of products while maintaining ecosystem sustainability (FSM 1905).

Suitable lands are capable lands that are available for grazing after examining the land management decisions for site-specific areas. Lands may be capable, but not suitable on a site-specific basis due to land management direction excluding grazing in an area. Within the project area there are no Management Areas, Management Prescriptions, or Administratively Withdrawn Areas that preclude grazing by livestock. Currently, there is no permitted grazing by domestic livestock on National Forest lands in the watershed.

Forage Production in the Hyampom Watershed

Lands that are capable of supporting livestock are lands that are accessible to livestock and produce a sufficient amount of forage that is accessible to livestock and can sustain livestock. Four criteria were used to identify lands capable of supporting livestock:

1. Slopes less than 20 degrees for cattle (Vallentine, 2001 pp. 219 – 222),
2. Vegetation cover types known to produce adequate forage for livestock (i.e., rangeland vegetation types and open-canopy forest vegetation types),
3. Areas accessible to livestock, and
4. Availability of water.

For areas that might not strictly fit these four criteria, the demonstrated ability of particular lands of being capable of supporting livestock historically may also be considered. In particular, cattle are known to graze on slopes greater than 20 degrees, but may tend to avoid these areas when there is adequate forage on gentler slopes. The records of historical use Hyampom watershed demonstrates that it possesses sufficient land capable of supporting livestock. Lands that are capable of supporting livestock are then determined through the analysis of an interdisciplinary team.

Acres of land capable for grazing livestock was determined using slope (from a 30-meter resolution Digital Elevation Model), the California Wildlife Habitat Relation Vegetation classification with a 2.5 acre minimum mapping unit (Existing Vegetation-CalVeg, 2004) for the Shasta-Trinity National Forest, and the roads layer for the Shasta-Trinity National Forest (including non-National Forest System roads). Forest Roads and unauthorized routes were buffered by 12 feet to either side to create a 24 foot road prism (the maximum prism for Forest roads on the allotment) and County and State Highways were buffered 33 feet to either side to create a 66 foot road prism (the typical highway right of way). The calculated road prism area was assumed to be not capable of producing forage. The land cover of the watershed was then classified by vegetation type either as not capable of producing forage, a rangeland type, or a forest type. Forest types were further broken down by canopy cover, with the categories of conifer forest with less than 40% canopy cover, conifer forest with 40 to 60% canopy cover and conifer forest with greater than 60% canopy cover.

Using the forage estimates from the Final Environmental Impact Statement of the Forest Plan (FEIS, 1994, pg. III-64), the forage production on NFS lands by land cover was calculated. Conifer forest with canopy cover of 40 to 60% was reduced by 50% and conifer forest with canopy cover greater than 60% was assumed to produce no forage to account for the effect of shade on forage production (Garrett, 2009, pp. 115 – 116). The forage estimates from the FEIS provide a conservative estimate of forage production, based on field observations. The forage production for the watershed was then broken down into NFS lands and non-NFS lands, and lands with slopes less than 20 degrees and lands with slopes greater than 20 degrees. Tables 7 and 8 provides a summary of capable acres and their estimated forage production as determined from this analysis of the watershed. Estimated forage production on capable acres in the watershed is presented spatially in Figure 13. The forage available to livestock was converted to Animal Unit Months[19] (AUMs) of forage available to livestock using the conversion of 1,100 lbs of forage per AUM.

Table 7. Forage production in the Hyampom Watershed on lands with less than 20 degree slopes by land cover type and land manager.

Vegetation Type	NFS Acres	Non-NFS Acres	Total Acres	Production lbs/acre	Total AUMs
Grassland	606	413	1,020	500	463
Chaparral	89	226	315	475	136
Hardwood / Mixed Hardwood <40% canopy	84	152	236	475	64
Hardwood / Mixed Hardwood 40 – 60% canopy	210	174	384	238	52
Conifer <40% canopy	304	1,369	1,673	475	722
Conifer 40 – 60% canopy	652	2,326	2,978	238	643
Total < 20 degree slopes	4,661	1,945	6,606		2,082

[19] An Animal Unit Month (AUM) is the amount of oven-dry forage required by one mature cow of about 1,000 pounds, either dry or with calf up to 6 months of age, or their equivalent, for a standardized period of 30 animal-unit days (SRM, 2005). For the calculation in this analysis, an AUM is considered to be 1,100 pounds of forage, although the USDA Natural Resources Conservation Service considers an AUM to be equal to about 790 pounds of oven-dry forage or about 912 pounds of air-dry forage (NRCS, 2003, p. 6-8 – 6-9).

Table 8. Forage production in the Hyampom Watershed on lands with greater than 20 degree slopes by land cover type and land manager.

Vegetation Type	NFS Acres	Non-NFS Acres	Total Acres	Production lbs/acre	Total AUMs
Grassland	430	116	546	500	248
Chaparral	25	33	58	475	25
Hardwood / Mixed Hardwood <40% canopy	46	66	112	475	31
Hardwood / Mixed Hardwood 40 – 60% canopy	144	46	190	238	26
Conifer <40% canopy	54	176	230	475	99
Conifer 40 – 60% canopy	209	683	893	238	193
Total > 20 degree slopes	909	1,121	2,030		622

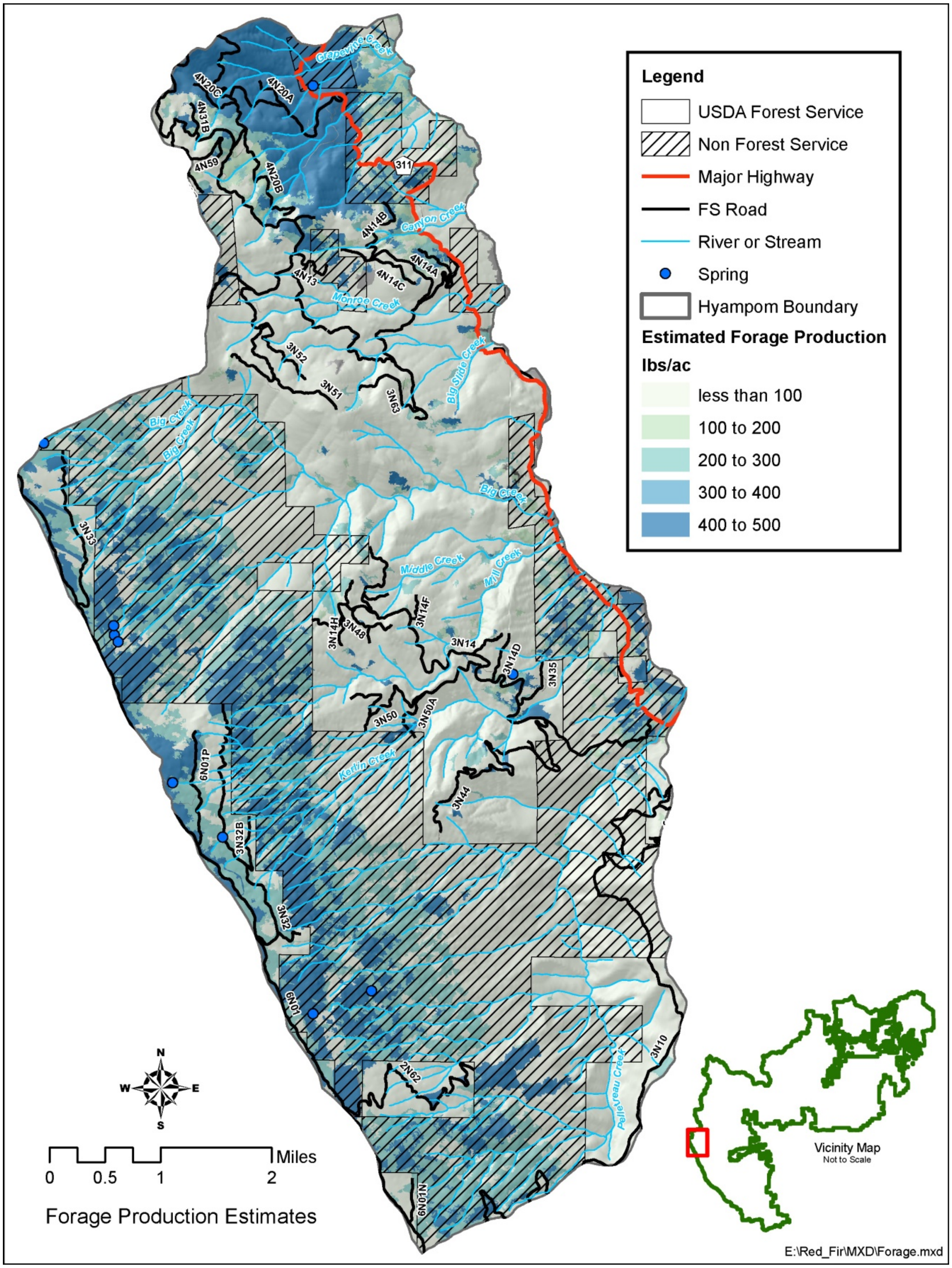

Figure 13. Estimated forage production on capable lands in the Hyampom Watershed.

Rangeland vegetation that offers the most opportunities for grazing livestock exists in the northern portion of the watershed and consists predominantly of grassland and chaparral vegetation with some dispersed conifers. Bare soil erosion hazard is mapped predominantly as low to moderate, with some high bare soil erosion hazard (Figure 23, Soil Erosion Hazard). This area is within the Trinity County WUI and significant portions of this area burned in during the Sims Fire in 2004. The area is mapped as moderate to high fire risk (Figure 28, Fire Risk). This area is in the commercial wood products emphasis and the limited roaded recreation management prescriptions.

There may also be an opportunity for grazing livestock in cooperation with the private landowners along the east side of the South Fork Mountain ridge line, between the 6N01 and 3N14 roads. The vegetation in this area is dominated with conifers. Bare soil erosion hazard is mapped predominantly as low to moderate, with some high bare soil erosion hazard (Figure 23, Soil Erosion Hazard). This area is within the Trinity County WUI.

Water sources available to livestock and wildlife, and its spatial distribution in relation to available forage, have not been assessed. There may be opportunities to develop water sources for livestock and wildlife that offers benefits for wildlife while also improving the ability to manage the watershed for livestock.

Making suitable lands on the National Forest available for sustainable livestock production can supports rural communities through both commercial livestock production and payments for ecosystem services (Huntsinger et al, 2010; Rimby et al 2007; Gentner and Tanaka, 2002). Maintenance of the commercial ranching landscape has been demonstrated to provide improved wildlife habitat across ownership boundaries (Hansen et al, 2005; Maestas et al, 2003). Creating the linkage between sustainable commercial livestock production on National Forest System lands the management of private lands helps to support both the economic base of rural communities and the wildlife habitat values across ownership boundaries.

Heritage

The human history of the Hyampom Watershed reaches back some 7,000 to 8,000 years. The alpine glaciers were still present in the higher realms of the Trinity Alps and the Yolla Bolla Mountains. Big game hunters and gatherers moved into these mountain areas at the end of the Pleistocene age. It has been inferred that these people were drawn to the mountains because of the changing climate at the end of the Ice Age. During this time many of the mega fauna species were becoming extinct due to human pressure and changing vegetation and habitat. Plants that animals and humans relied upon were shifting upward into the mountains. The planning watershed was one of the key areas that drew these early residents.

Based on linguistic studies, the first known tribe in the planning watershed was the Chimariko. Their territory originally extended from Hayfork Valley to Hyampom Valley down river along the South Fork Trinity River to the main stem of the Trinity River. Their presence in the area goes back at least 3000 years if not longer. In the last 2000 to 1000 years Before Present (BP), Wintu peoples moved into the northern Sacramento Valley and the surrounding mountains. The local Wintu tribe is the Nor-Rel-Muk band. Both groups lived in the Hyampom and Hayfork valleys. However, the Nor-Rel-Muk slowly took over the original Chimariko territory. By what means is not known. Many prominent geographic points within the Watershed have both Chimariko and Wintu place names. South Fork Mountain is known in Chimariko as hatcim tceyta (great ridge) and Wintu as tororkhelas (long ridge). Hyampom Valley was called maytsa (flat) in Chimariko and xayinpom in Wintu (Bauman, 1980).

Neighboring tribes that used South Fork Mountain and the Lower South Fork of the Trinity included the Hoopa and Whilkut to the northwest and the Nongatl and Lassik to the west in the Mad and Eel River area.

The planning watershed has two geographical areas that were the focus of human settlement prehistorically and thus high cultural resource sensitivity. First, the top of South Fork Mountain in the Blake Mountain area has a series of habitation sites estimated to go back 7,000 to 8,000 years. This geographical feature has been a focus of human use both as a travel route and resource area. This use continued up into the historic period with the Humboldt Trail that followed the ancient Native American travel way. The trail was the primary access from the coast down into Hyampom Valley, bringing supplies and mail. In reverse, livestock was driven up the trail for grazing along the top of South Fork and moved to market. The livestock included cattle, sheep, turkeys, and pigs. The Humboldt Trail was used both prehistorically and historically to travel east and west from the Upper Sacramento Valley/Red Bluff to the coast in the Eureka/Arcata area.

Twenty five prehistoric sites have been recorded along this stretch of ridgeline. These sites make up the Pilot Ridge/South Fork Mountain National Register eligible district. One of the reasons this district is eligible for the National Register is the age of these sites. A projectile point style has been found in the sites called Borax Lake, which is a large heavy stemmed dart spear point. These dart spears were used with a spear thrower or atlatl. The Borax Lake cultural horizon is dated around 7,000 to 8,000 years BP. These sites also have later projectile point styles providing evidence of continual human use of South Fork Mountain over this time period.

The second area of prehistoric focus is the South Fork of the Trinity River and Hyampom Valley, which is one of the major prehistoric habitation centers between the Sacramento Valley and the North Coast. Several thousand Chimariko and Wintu people resided in this Valley year round. The South Fork was the principal provider of sustenance, producing rich runs of salmon, steelhead, and lampreys. There are five recorded sites in association with the river. The sites located here indicate year round habitations, evidenced by large semi subterranean house pits and smaller summer/fall house pit bark shelters (Heizer, 1978).

Artifacts found at these sites indicate a later period of prehistoric use going back no later than 4000 years BP. The milder climate at this lower elevation, along with the readily available fisheries and other gathering crops, enticed people to reside in the area year round. The major habitation area in the area of the watershed was Hyampom Valley.

The first Euro-Americans documented to have seen this area was the Jedediah Smith fur trapping party in April and May of 1828. However, there may have been earlier passage of Europeans into Trinity County in the early 1820's. These may have been Russian explorers from Fort Ross. The next groups to enter this country may have been small parties of Hudson Bay Company trappers working their way westward from the Upper Sacramento River Valley near Redding (Morgan, 1953).

The major influx of Euro-Americans came in the 1850's following the discovery of gold near Junction City. The Hyampom area did not attract the gold miners, but was soon settled and used for grazing and agriculture starting in the 1860's. This was largely the main economic activity up through the early 20th-century, with limited timber harvesting mainly for local use.

Early in the 20th century, the US Forest Service came into the area managing the area for timber, grazing, and small recreation use. This economy, with a small amount of timber harvesting lasted up to 1945. After World War II the local economy became mainly centered on the timber industry. Several sawmills were established in Hyampom Valley that employed several hundred people along with the local logging operations on private and public lands. Better technology and roads into the area helped this along. Hyampom valley did not get full telephone coverage or electrification until after the war.

Forest Service Heritage Management has surveyed approximately 60% of the Federal land within the watershed. Private timber lands have also been surveyed as part of the State of California's timber harvest plan process. Since these private lands have had timber management done on the majority of the acreage, archaeological survey coverage is at least 80%.

Archaeological sites on Federal lands are managed under the National Historic Preservation Act Section 106 and 110. The condition of previously recorded sites has to be monitored periodically and reported. Further, the eligibility of sites eligible to be registered with the National Register of Historic Places needs to be determined and revisited. The Forest has an ongoing responsibility to manage these sites to preserve their integrity, which allows future study into the prehistory and history of this watershed.

Chapter 2 - Issues and Key Questions

Five issues critical to the future management of this watershed were identified by a team of interdisciplinary resource specialists. They are:

Issue #1: Forest Health

Issue #2: Aquatic Systems

Issue #3: Erosional Processes

Issue #4: Fire and Fuels

Issue #5: Human Uses and Values

Issue #6: Terrestrial Wildlife Habitat and Species

Issue #1: Forest Health

Key Question 1.1 What are the current forest health problems in the watershed and what is the ecological significance of those forest health concerns?

Outcome 1.1 Identify the current forest health problems in the Hyampom watershed. Identify the ecological significance of existing forest health problems in the absence of management.

Key Question 1.2 What natural processes and past management actions have influenced forest health in the watershed? What resource losses have occurred within the watershed due to forest health problems?

Outcome 1.2 Identify the natural processes and past management actions that have influenced forest health in the Hyampom watershed. Identify the resources losses as a result of forest health problems within the watershed.

Issue #2: Aquatic Systems

Key Question 2.1 What is the relative abundance, diversity and distribution of anadromous fish in the watershed? What contributions does the watershed make to the viability of at risk fish stocks?

Outcome 2.1 Identify the abundance, diversity, and distribution of anadromous fish populations and population trends within the watershed. Identify the importance of existing fish stocks and habitat in the watershed to the Trinity Basin, and risks to those stocks.

Key Question 2.2 What is the current condition of in stream habitat to support anadromous and resident fish and other aquatic organisms? What trends in stream condition are apparent compared to historic and desired future conditions? What is the current condition of instream habitat expressed in terms of landscape disturbance, particularly forest health, timber harvest, and wildfire?

Outcome 2.2 Qualify and quantify the condition of specific habitat elements relative to anadromous and resident fish. Identify trends for in stream habitat elements relative to past and desired conditions. Identify how landscape disturbances, particularly forest health, timber harvest, and wildfire, have affected the in stream habitat and Riparian Reserves and their ability to meet the Aquatic Conservation Standards.

Key Question 2.3 What is the current watershed condition expressed in terms of landscape disturbance? What trends in watershed condition are apparent compared to historic and desired future conditions?

Outcome 2.3 Describe the existing conditions and trends in watershed condition within the Hyampom watershed.

Key Question 2.4 How do landscape disturbances, particularly forest health, timber harvest, and wildfire, influence watershed and stream condition? How would landscape treatments such as vegetation manipulation influence the effects of disturbance and trends in watershed and stream condition?

Outcome 2.4 Identify how landscape disturbances, particularly forest health, timber harvest, and wildfire, have affected watershed condition. Describe how landscape treatments such as vegetation manipulation might influence the effects of disturbance and trends in watershed and stream condition.

Issue #3: Erosional Processes

Key Question 3.1 What mass wasting processes are inherent within the watershed?

Outcome 3.1 Identify predominant mass wasting features. Where the information exists, discuss additional unstable features that are not previously identified in the Forest GIS layer that shows unstable features.

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

Outcome 3.2 Identify predominant soil erosion areas.

Issue #4: Fire and Fuels

Key Question 4.1 What is the fire hazard and risk within the watershed, including the threat to local communities and associated wildland-urban interface?

Outcome 4.1 Determine the fire hazard and risk within the watershed, as well as the level of threat to local communities from wildfire.

Key Question 4.2 What is the degree of threat from wildfires to heritage resources?

Outcome 4.2 Determine where heritage resources overlap with higher fire risk areas and describe the impacts to the resource if burned at a high temperature.

Issue #5: Human Uses and Values

Key Question 5.1 What are the impacts of recreation on heritage resources?

Outcome 5.1 Identify the recreational areas that overlap with heritage sites and determine the level of impact on the heritage resource.

Key Question 5.2 How do ownership patterns in the watershed affect our ability to improve conditions in the watershed?

Outcome 5.2 Determine proportion of watershed in private ownership and how the Forest lands are divided by private ownership. Identify the primary use of private lands in the watershed. Discuss how this impacts Forest management effectiveness.

Key Question 5.3 What role does the transportation system, in particularly the decision in Travel Management Subpart B, play in access to the area?

Outcome 5.3 Identify dispersed recreation areas, and determine if the routes that access the areas were added under Travel Management Subpart B. Identify system routes as they relate to recreation opportunities and safe access and egress during wildfire.

Issue #6: Terrestrial Wildlife Habitat and Species

Key Question 6.1 What is the amount and condition of Late Successional Old Growth (LSOG) habitat within the watershed?

Outcome 6.1 Identify the amount and quality of LSOG habitat within the watershed. Identify priority treatment areas (if any) and appropriate techniques to protect and/or improve LSOG habitat.

Key Question 6.2 Did the 2004 and 2008 fires create areas that no longer provide suitable conditions for species associated with LSOG habitat?

Outcome 6.2 Provide an analysis of soil severity and vegetation burn severity effects from the 2004 and 2008 fires on LSOG habitat.

Chapter 3 - Current Conditions

Issue #1: Forest Health

Key Question 1.1 What are the current forest health problems in the watershed and what is the ecological significance of those forest health concerns?

Current forest health concerns in the Hyampom Watershed

The vegetation in the Hyampom Watershed can be separated into three strata. The far west watershed boundary (and Forest boundary) is South Fork Mountain, consisting primarily of red fir and mixed conifer. A contiguous block of intensively managed private (non-Forest Service) land owned primarily by forest products industry lies immediately adjacent to National Forest Land on South Fork Mountain. The forest industry managed lands consist primarily of managed Douglas-fir and mixed conifer. The eastern half of the watershed, descending to the South Fork Trinity River, is comprised of Douglas-fir, mixed conifer, gray pine and shrubland as elevation decreases. While only the federally regulated National Forest lands will be discussed in this section, it is noteworthy that non-Forest Service land comprises 52% of the watershed.

Forest Health on South Fork Mountain ridge-top

True firs, especially red fir, are readily susceptible to growth stunting effects, weakened virility and possible mortality caused by the parasitic plant dwarf mistletoe (*Arceuthobium abietinum* f.sp *wienzii*) and the associated pathogen *Cytospora* canker (*Cytospora abietis*). On South Fork Mountain ridge line, red fir is present in pure stands as well as a component of mixed conifer stands. In general red fir overstory has moderate to high levels of dwarf mistletoe (Angwin, 2010), red fir understory has varying degrees of infection depending on proximity to infected overstory.

Weins' dwarf mistletoe is a parasitic seed plant which is host specific to red firs, brewer's spruce and occasionally white fir; however, instances of white fir infection is uncommon on South Fork Mountain (Mathiasen and Daugherty, 2009). Dwarf mistletoes are obligate parasites, dependant on their host for support, water and most mineral and organic nutrients resulting in reduced growth, growth abnormalities, mortality and predisposition to other pests including insects and pathogens to the host. Dwarf mistletoe spreads between trees and within crowns of trees by means of small sticky seeds that are forcibly ejected into the air due to a build-up of turgor pressure. Seed dispersal is generally less than 20 lateral feet from the plant. Dwarf mistletoe swellings on red fir provide openings in the host bark for invasion by the secondary pathogen *Cytospora* canker (Kliejunas and Wenz, 1982).

Cytospora canker is a weak fungus that causes cankers and dieback in true firs. *Cytospora* is responsible for frequent and often severe branch flagging, also known as branch dieback. While *Cytospora* is generally a weak pathogen, other stressing factors such as dwarf mistletoe infection, drought, fire or logging wounds, or twig and/or bark beetles predispose true firs to *Cytospora* infection.

In addition to dwarf mistletoe and *Cytospora*, Annosus root disease (*Heterobasidion occidentale*), fir engraver beetle (*Scolytus ventralis*), and white pine blister rust (*Cronartium ribicola*) are also affecting stressed trees and causing mortality on South Fork Mountain.

Forest Health on the Eastside of the Hyampom Watershed

The watershed analysis area on the eastside of the watershed is characterized by moderate to steep terrain that is dominated by Douglas-fir and mixed conifer communities. Conifer stands generally have moderate to dense canopy cover, with few openings. The predominant species are Douglas-fir and ponderosa pine, with sugar pine, white pine, incense-cedar, and gray pine in lesser amounts. Due in part to successful fire suppression activities and limited timber management, few disturbances have thinned conifer stands resulting in a landscape characterized by moderate to high density conifer stands of varying age classes (Table 9).

Table 9. Vegetation Types on National Forest lands in the Hyampom Watershed[1]

Vegetation Type	Size Class (inches DBH)	Density (% Canopy Closure)	Acres
Douglas-fir	Multi-layered	≥60%	3289
Douglas-fir	≥24”	≥60%	273
Douglas-fir	11-23.9”	≥60%	4151
Douglas-fir	11-23.9”	40-60%	578
Douglas-fir	6-10.9”	≥60%	3618
Douglas-fir	6-10.9”	40-60%	431
Douglas-fir	1-5.9”	≥60%	481
Douglas-fir	<1.0	n/a	1134
Mixed Conifer	11-23.9”	≥60%	2082
Mixed Conifer	11-23.9”	40-60%	2337
Mixed Conifer	6-10.9”	≥60%	783
Mixed Conifer	6-10.9”	40-60%	614
Mixed Conifer	1-5.9”	≥60%	772

Vegetation Type	Size Class (inches DBH)	Density (% Canopy Closure)	Acres
White Fir	≥24”	≥60%	441
White Fir	11-23.9”	40-60%	849
White Fir	6-10.9”	40-60%	1100
Red Fir	11.0-23.9”	40-60%	157
Red Fir	6-10.9”	25-40%	140
Hardwood	6.0-10.9”	≥60%	538
Non-Forested	n/a	n/a	503
Water	n/a	n/a	71

[1] Data extracted from Shasta-Trinity National Forest GIS layer: Existing Vegetation 2007

Dense conifer stands indicate overstocked conditions which causes increased stress of residual trees due to competition for limited resources such as sunlight, water and nutrients. This competition stress reduces annual growth and increases susceptibility to insects such as fir engraver beetles, western pine bark beetles or mountain pine beetle which may lead to mortality (Oliver, 1995; Smith et al., 2005). In addition, a dense, suppressed understory contributes to increased fuel loading causing further vulnerability to high intensity or stand-replacing wildfire (McKelvey et al., 1996).

While only endemic levels of disease are present at this time, there are indications that an increase in individual tree mortality is occurring due to fir engraver beetle and western pine beetle within the eastern portion of the watershed (U.S. Forest Service, Region Five, Forest Health Monitoring Group Aerial Detection Survey Results from 2008-2010).

Key Question 1.2 What natural processes and past management actions have influenced forest health in the watershed? What resource losses have occurred within the watershed due to forest health problems?

The current vegetative conditions are the result of past forest disturbances, both natural and human caused. Other than wildfire, the primary influence of change has been timber harvesting. Aerial photos indicate that much of the private land within the Hyampom watershed was logged using overstory removal methods by the 1960s. Since that time, most of the remaining private timber lands have had multiple entries, removing forest products. While little mature private timber remains, many healthy plantations and second growth stands are the result of intensive forest management. In general, privately managed parcels have low levels of dwarf mistletoe infection due to the removal of infected overstory.

In the eastern portion of the watershed, the first major commercial timber harvests took place after World War II. Typical harvest entries consisted of selection cuts where some trees were cut and some retained. Replanting following these cuts was restricted to ponderosa pine. A shift to clearcutting was seen in the 1960s through the 1980s. Following these harvests, restocking was established by planting mixed conifer species. In general, few harvests have occurred on National Forest land in this portion of the watershed, and until the last couple decades, few large high-intensity fires over the last 100 years have caused mortality in residual stands. In the absence of disturbance, many stands are experiencing higher densities than is desirable due to competition of limited natural resources. Many stands, especially those in relatively close proximity to the community of Hyampom exhibit high fuel loading due to high density and may begin to decline as a result of secondary agents such as fir engraver beetle (*Scolytus ventralis*), and western pine beetle (*Dendroctonus brevicomis*) as a result of competition stress.

On the South Fork Mountain ridge-top, National Forest lands were generally not managed until after the late 1970s due to lack of access. Since that time, silvicultural treatments included clearcuts, shelterwood, overstory removal and sanitation/ salvage harvests. In the past two decades, treatments have been largely limited to sanitation/salvage cuts. These harvests occurred in areas that had a higher than normal incidence of dwarf mistletoe infestation, which in turn exposed the weakened trees to attack by insects and other pathogens.

While removal of the highly infected trees reduced the infection sources, it also opened up pockets for residual red fir to regenerate naturally. Much of this natural regeneration has subsequently become infected by dwarf mistletoe due to increasing infection levels of residual overstory true firs. *Cytospora* canker has also been an endemic problem for at least 60 years in the red fir stands in the higher elevations of Hyampom watershed, and was exacerbated by the last few drought cycles in the early 1990s and mid 2000s. These factors have driven mortality rate in this area to substantially higher than endemic levels.

While no vegetation resources have been lost in the Hyampom Watershed, dwarf mistletoe and *Cytospora* have severely affected the character of the red fir stands on South Fork Mountain. Where vigorous mature stands of red fir once occupied, now exists degraded stands of infected red fir across all age classes and canopy positions. The infected overstory has resulted in stunted, distorted growth and serves as a source of infection for the red fir understory below (see Figure 14). Eventually, infected red fir succumb to mortality either due to girdling by dwarf mistletoe or *Cytospora,* or by secondary agents such as the fir engraver beetle after being weakened by infection. This contributes to the high fuel loading as branches and dead trees fall to the ground. The cycle of infection will likely continue until a high severity wildfire or alternative vegetation management intervenes to remove sources of infection from the canopy above, allowing a new generation of red fir uninhibited by infection to occupy South Fork Mountain.

Figure 14. Red fir stand on Blake Mountain, South Fork Mountain Ridgetop

Issue #2: Aquatic Systems

Key Question # 2.1 What is the relative abundance, diversity and distribution of anadromous fish in the watershed? What contributions does the watershed make to the viability of at risk fish stocks?

The Hyampom watershed includes a total of ten named streams, including the South Fork Trinity River (SFTR). The Hyampom watershed is comprised of a total of nine 1st to 4th order tributary streams (the Strahler stream order is used to define stream size based on a hierarchy of tributaries) that drain South Fork Mountain from the west into the northerly flowing 8th order SFTR. The nine named tributary streams are Pelletreau, Kerlin, Mill, Middle, Big, Big Slide, Monroe, Canyon, and Grapevine Creeks. Five of the named SFTR tributary streams within the Hyampom watershed are not known to have fish. This is most likely due to their intermittent flow regimes, steep gradients, and/or they are inaccessible due to conditions near their confluence with the South Fork Trinity River. The remaining four tributary streams support both resident and anadromous fish and include Pelletreau, Kerlin, Mill, and Big Creek as well as the mainstem SFTR.

Adult fall-run Chinook salmon are frequently observed within the Hyampom watershed during fall spawning surveys and adult spring-run Chinook are infrequently observed within the Hyampom watershed during summer snorkel surveys. Coho salmon migrate later in the year than fall Chinook and usually migrate upstream into and within tributaries during late fall. Adult winter steelhead migrate upstream during the fall, winter and early spring months while summer-run steelhead migrate upstream during spring and early summer. Adult lampreys migrate upstream in the spring and complete spawning by early summer. Juvenile fish of all species can be observed at any time throughout the limit of anadromy within the Hyampom watershed, with juvenile steelhead being the most abundant. The condition of anadromous fish abundance and distribution of the five anadromous streams within the Hyampom watershed will be addressed individually. Unless otherwise noted, all survey work was conducted by the Weaverville and Hayfork Fisheries Departments (Trinity River and South Fork Management Units, Shasta-Trinity National Forest).

South Fork Trinity River

The SFTR is a relatively large 8th-order perennial tributary that flows in a northerly direction before entering the Trinity River. Anadromous fish have full access to the eight mile section of the SFTR within the Hyampom watershed. The SFTR supports spring- and fall-run Chinook, Coho salmon, summer and winter-run steelhead, and Pacific lamprey.

Fall-run Chinook salmon are regularly observed during annual spawning surveys conducted in the SFTR since 2008. This is a 5.9 mile survey in the Hyampom Valley section of the SFTR, of which approximately 4.9 miles occur within the Hyampom watershed. Table 10 displays spawning survey data and shows that counts are variable and most likely dependent on rainfall patterns and Trinity River Basin Chinook fall-run size. It is thought that the SFTR, including the Hyampom watershed section, contributes significantly to the Trinity River Basin Chinook fall-run but metrics used by the California Department of Fish and Game (CaDFG) differ from those used by USDA Forest Service so a direct comparison is unavailable. Also complicating a direct comparison is the fact that only a 5.9 mile section of river is surveyed for fall-run Chinook spawning activity out of a total of approximately 38 miles of habitat available to them within the SFTR basin.

Table 10. Results of spawning surveys conducted in the Hyampom Valley section of the South Fork Trinity River.

Date	Week	Live Chinook			New Redds			Chinook Carcasses		
		2008	2009	2010	2008	2009	2010	2008	2009	2010
18-Oct-99	8	33	97	3	14	12	0	NA	0	0
25-Oct-99	9	77	84	NA	18	24	NA	NA	0	NA
1-Nov-99	10	NA	143	468	NA	22	60	NA	3	0
8-Nov-99	11	361	NA	201	189	NA	57	NA	NA	29
15-Nov-99	12	403	NA	417	232	N	93	NA	NA	89

Date	Week	Live Chinook			New Redds			Chinook Carcasses		
		2008	2009	2010	2008	2009	2010	2008	2009	2010
						A				
22-Nov-10	13	NA	67	NA	NA	51	N A	NA	4	NA
29-Nov-10	14	10	NA	125	4	N A	40	NA	NA	84
6-Dec-10	15	NA	NA	NA	NA	N A	N A	NA	NA	NA
13-Dec-10	16	NA	62	NA	NA	38	N A	NA	4	NA
Annual Totals		884	453	121 4	457	14 7	25 0	NA	11	202
All Years Averaged		850			285			18		

The upstream distribution limit of Fall-run Chinook salmon is considered to be approximately two miles upstream of the SFTR confluence on Hayfork Creek and three miles upstream of the Hyampom watershed on the SFTR. The bulk of fall-run Chinook salmon spawning activity is believed to occur downstream of Hyampom Valley, but the remoteness of this area precludes formal spawning surveys from being conducted here.

Spring-run Chinook salmon snorkel surveys have been conducted on an annual basis (usually during August) on the SFTR since 1978, but only data since 1990 is displayed due to irregularities in the existing dataset (Figure 15). Spring-run Chinook are infrequently observed during snorkel surveys within the Hyampom watershed and they are not found within any of the tributaries of the Hyampom watershed. The reason they are encountered only infrequently during snorkel surveys in the Hyampom watershed is most likely due to elevated water temperatures found here (Figure 19). Spring-run Chinook salmon use the SFTR in the Hyampom watershed primarily to gain access to suitable habitat in upstream areas such as Hayfork Creek and the upper SFTR. The upstream distribution limit for Spring-run Chinook salmon is considered to be approximately two miles upstream of the SFTR confluence on Hayfork Creek and approximately 40 miles upstream of the Hyampom watershed on the main stem SFTR.

A noticeable correlation that can be derived from Figure 15 is that the SFTR snorkel survey counts roughly track with the overall Spring-run Chinook salmon run size estimate trendline for the Trinity River Basin made by CaDFG. The percent contribution made by the SFTR to the Trinity Basin spring-run Chinook population is minimal and is in a downward trend, ranging from a high of 3.15% in 1993 to a low of 0.23% in 2004 (Figure 16).

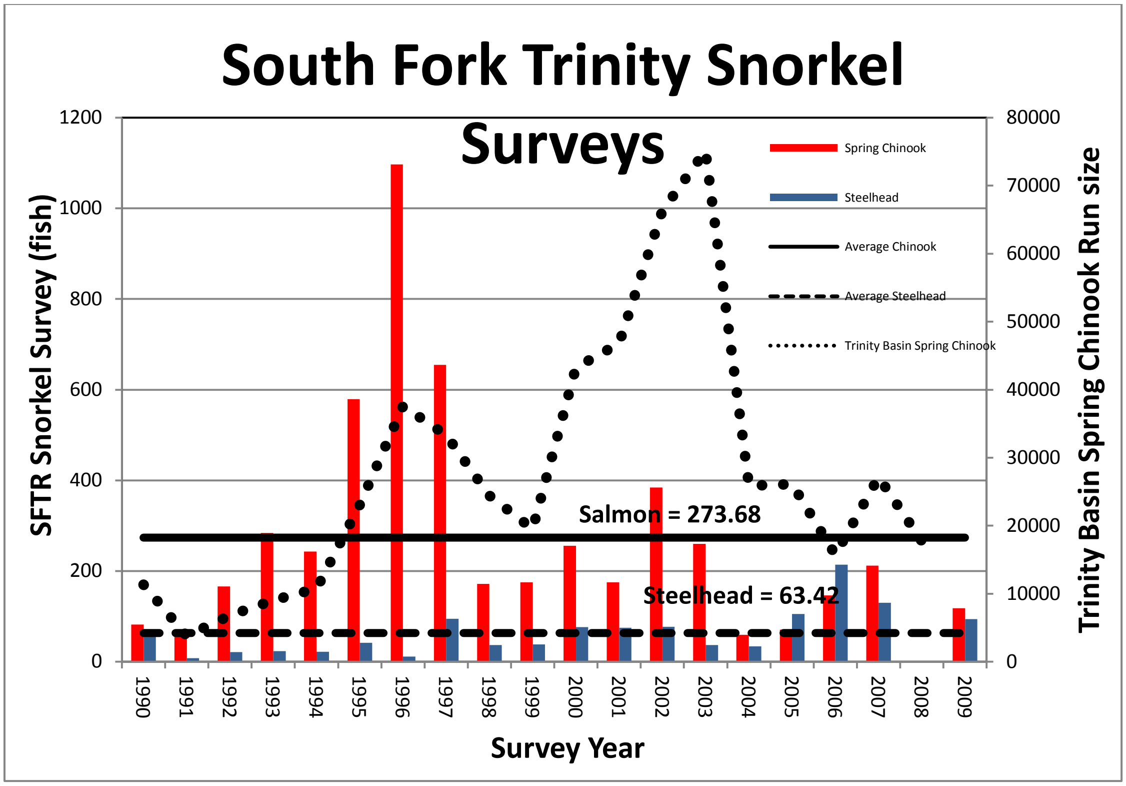

Figure 15. Results of snorkel surveys conducted by CaDFG and Forest Service personnel since 1990 on the South Fork Trinity River. The dotted line represents the total estimated Chinook spring-run and uses the left axis for scaling purposes.

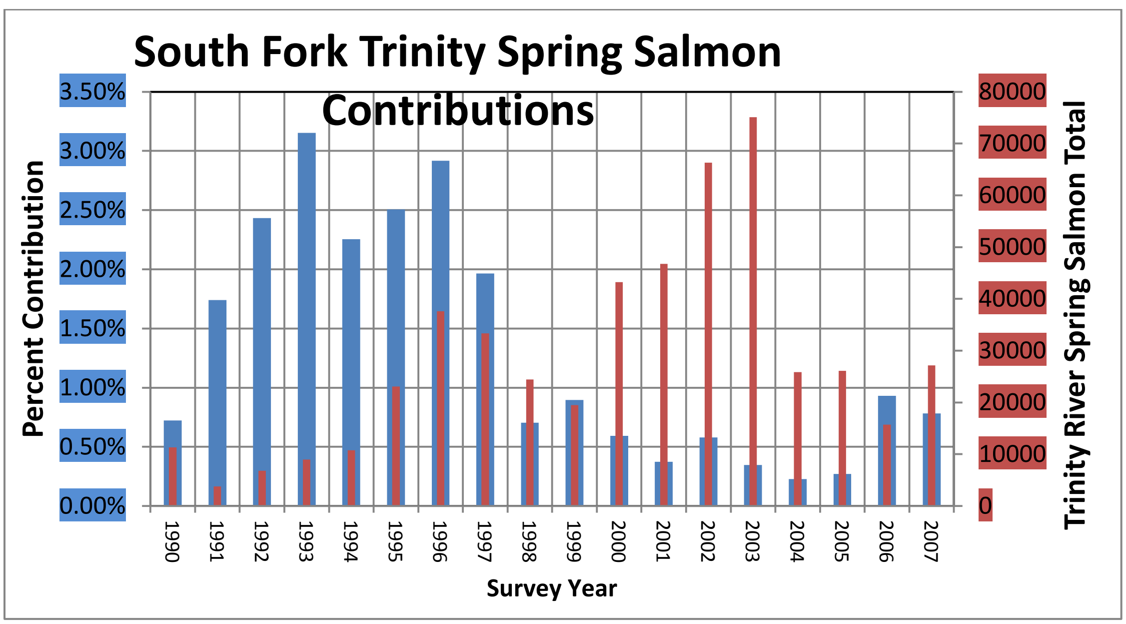

Figure 16. The percent contribution made by the South Fork Trinity River to the overall Trinity River Basin Spring Chinook run size. This data was derived using the "CDFG_Spring-Chinook Megatable_2008.xls" (CDFG, 2008) and South Fork Trinity River Spring-Chinook snorkel survey results (CDFG, 2010).

Adult coho salmon have been documented spawning within the Hyampom watershed in recent years but difficulty distinguishing them from adult Chinook salmon prevents enumeration. Adult SONCC Coho salmon use the SFTR in the Hyampom watershed primarily to gain access to suitable habitat in upstream areas such as Hayfork Creek and the upper SFTR. Coho salmon juveniles are infrequently observed during snorkel surveys, near tributary mouths that provide cold water refugia, in the SFTR main stem within the Hyampom watershed. The upstream distribution limit for Coho salmon, above the Hyampom watershed, is thought to be approximately 5.5 miles upstream of the SFTR confluence on Hayfork Creek (Miners Creek confluence) and 4.5 miles upstream of the Hyampom watershed on the mainstem SFTR (Butter Creek confluence). It is most likely that the SFTR historically contributed substantially to the SONCC Coho salmon population viability. Currently coho salmon populations within the SFTR have been truncated by increased summer water temperature, habitat alteration within tributaries, the 1964 flood event and genetic introgression by hatchery fish. It is not believed that the SFTR, including the Hyampom watershed, contributes substantially to the viability of the SONCC coho within the Trinity River Basin (NMFS, 2010).

Adult summer-run steelhead are seen on an annual basis during snorkel surveys in the SFTR but are noticeably absent from the SFTR section of the Hyampom watershed. This is most likely a result of increased summer time water temperatures here. Summer-run steelhead populations within the SFTR, as a whole, are considered depressed and average less than 64 fish annually (Figure 15). The entire SFTR, including the Hyampom watershed, fails to contribute significantly to the overall population viability of the summer-run KMP steelhead DPS.

Adult winter-run steelhead surveys are not currently conducted within the SFTR section of the Hyampom watershed. The Hyampom Valley segment of the SFTR is a popular place for anglers fishing for winter-run steelhead. The SFTR main stem section of the Hyampom watershed is believed to contribute significantly to the KMP winter-run steelhead DPS as a whole although data is lacking to support this.

Pacific lamprey is known to occur within the Hyampom watershed. Currently, little is known regarding historical abundance or current distribution of this species within the Hyampom watershed or the SFTR as a whole.

Pelletreau Creek

Pelletreau Creek is a 4th-order medium sized perennial tributary that flows in a northerly direction for approximately 6.25 miles before entering the South Fork Trinity River. Pelletreau Creek is currently able to support winter-run steelhead, Pacific lamprey, and resident rainbow trout. Winter steelhead spawning surveys conducted on Pelletreau Creek by CaDFG did not find a single steelhead from 1990-1995 and 2000 (Garrison, 2000). This may be misleading as winter steelhead redds are often obscured and hard to identify following winter storms. Also, it has been noted that the lower 0.5 miles of Pelletreau Creek is a wide and unstable alluvial fan that resulted from the 1964 flood event (USDA Forest Service, 1979). Historically, Pelletreau Creek also had coho salmon but none have been identified since 1952 (Coots, 1952). The limit of anadromy on Pelletreau Creek is at a series of falls which prevents upstream migration approximately 1.0 mile upstream of the confluence with the SFTR (USDA Forest Service, 1975a). The Pelletreau Creek long profile (Figure 17) indicates that there is not a major grade increase until approximately the 4.65 mile mark. Resident rainbow trout are thought to occur in the lower 4.8 miles of Pelletreau Creek. No surveys for Pacific lamprey have been conducted on Pelletreau Creek but they are also thought to occur here.

Previous stream surveys have noted extensive alluvial terraces that occur along Pelletreau Creek resulting from a combination of past management activities on private land, the 1964 and 1997 flood events, and the geologic instability of the watershed. The condition of the lower section of Pelletreau Creek remains the same presently and is most likely the limiting factor concerning anadromous spawning activity and production in the stream.

Kerlin Creek

Kerlin Creek is a fourth order small sized perennial tributary that flows in a northeasterly direction for approximately 4.9 miles before entering the South Fork Trinity River. Kerlin Creek is currently able to support winter-run steelhead, resident rainbow trout, and Pacific lamprey. No winter steelhead surveys have been conducted here due to lack of private landowner permission in the lower portion of the watershed. The extent of anadromous habitat available within Kerlin Creek is unclear. A 1975 stream survey (USDA Forest Service, 1975b) noted an eight foot waterfall approximately 1.0 mile upstream of the SFTR confluence. Four other barriers were noted in the upstream 0.75 mile section including a 30 foot waterfall 1.5 miles upstream of the mouth (USDA Forest Service, 1975b). Resident rainbow trout are thought to occur in the lower 2.5 miles of Kerlin Creek. Fish habitat is considered good in the middle and upper but the lower section has unstable banks and is prone to siltation (USDA Forest Service, 1975b).

Mill Creek

Mill Creek is a third order small perennial tributary that flows in a northeasterly direction for approximately 5.1 miles before entering the South Fork Trinity River. Mill Creek is currently able to support winter-run steelhead, resident rainbow trout, and Pacific lamprey. No winter steelhead surveys have been conducted here. The extent of anadromous habitat available within Mill Creek is limited to the lower one mile before a 25 ft. bedrock falls prevents upstream migration. Resident rainbow trout are found in the lower 3.3 miles of Kerlin Creek. Figure 17 shows that the stream gradient of Mill Creek increases substantially approximately 2.9 miles upstream from its confluence with the SFTR (Figure 17). This same graph also shows that Mill Creek has the steepest gradient of the four larger SFTR tributary streams found within the Hyampom watershed. Fish habitat is considered good in the middle and upper sections of the 3.3 mile accessible reach but the lower section is considered poor due to limited pools and unstable banks (USDA Forest Service, 1975c).

Big Creek

Big Creek is a fourth order perennial tributary that flows in an easterly direction for approximately 5.8 miles before entering the South Fork Trinity River. Big Creek is currently able to support winter-run steelhead, Pacific lamprey, and resident rainbow trout. No winter steelhead surveys have been conducted here. The extent of anadromous habitat available within Big Creek is limited to the lower 0.5 miles before a 50 ft. bedrock falls prevents upstream migration and resident rainbow trout are found in the lower 3.9 miles. Figure 17 shows that the stream gradient of Big Creek increases substantially approximately 3.5 miles upstream from its confluence with the SFTR (Figure 17). Fish habitat is considered good in the middle section of the 3.9 mile accessible reach but the lower section is considered poor due to limited pools, unstable banks, and excessive fine sediments (USDA Forest Service, 1975d).

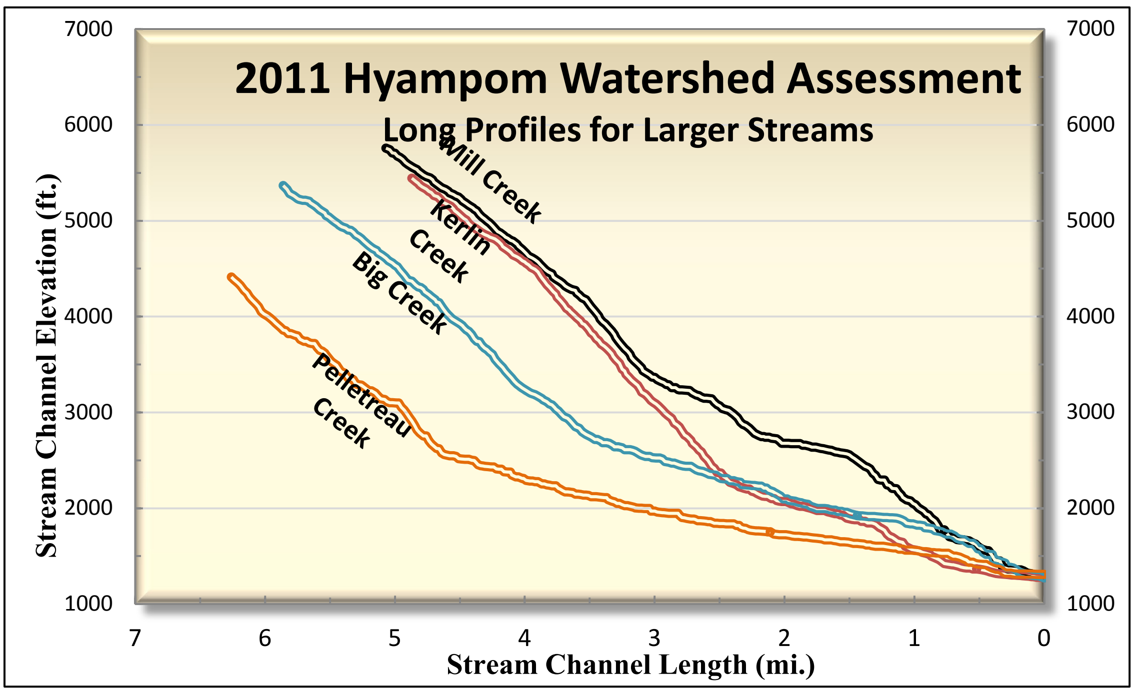

Figure 17. Long profile graph for selected streams within the Hyampom Hyampom watershed.

Key Questions # 2.2 What is the current condition of in-stream habitat to support anadromous and resident fish and other aquatic organisms? What trends in stream condition are apparent compared to historic and desired future conditions? What is the current condition of instream habitat expressed in terms of landscape disturbance, particularly forest health, timber harvest, and wildfire?

Fish habitat and stream surveys have been performed periodically since the mid 1970's for the four streams that contain anadromous fish in the planning watershed. The following is a synthesis of the available data for these streams. Unless otherwise noted, all survey work was conducted by the Weaverville and Hayfork Fisheries Departments (Trinity River and South Fork Management Unit, Shasta-Trinity National Forest). Water temperature data will be discussed separately in the hydrology section.

Stream channels in the headwaters of the watersheds are characterized as high energy, low order streams with gradients greater than 10 percent and side slopes that can exceed 70 percent. These channels function largely as transport channels, delivering large woody debris (LWD), fine sediment, and organic material to downstream channels. This type of stream is considered an A type channel (Rosgen, 1985). Anadromous 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. With the exception of lower Pelletreau Creek, all of the named SFTR tributary streams within the Hyampom watershed fall into this category.

As streams progress downstream into higher order channels, channels are highly to moderately entrenched, with low sinuosity, and have channel gradients between 0.5 and 10 percent. This type of stream is classified as a B type channel (Rosgen, 1985) and anadromous fish habitat becomes more available here. The lower 4.7 miles of Pelletreau Creek and the lower 2.9 miles of the SFTR within the Hyampom watershed are included in this category due to their lower gradient characteristic.

Multiple thread channels that have moderate sinuosity and moderate channel gradients up to 4.0 percent are classified as D type channels (Rosgen, 1985). The upper 5.1 miles of the SFTR, which courses through the Hyampom Valley, can best be described as a D type channel (Rosgen, 1985).

Current channel conditions within the Hyampom watershed have been affected in the past century primarily by the 1964 flood, recent flood events, the extent and intensity of timber management activities in the past 30 years, wildfires, and road construction. All the streams within the Hyampom watershed are in various stages of recovery following the 1964 flood event. The SFTR and Pelletreau Creek continue to erode alluvium deposited during the 1964 flood event. Table 11 displays a summary of the habitat data for the four tributary streams that support fish within the Hyampom watershed.

Table 11. Summary of fish habitat conditions of the four fish bearing tributary streams within the Hyampom watershed.

Stream Name	Pelletreau Creek	Big Creek	Kerlin Creek	Mill Creek
Stream Survey Data				
Survey Section	**lower 6 miles**	**lower 2 miles**	**lower 3 miles**	**lower 4 miles**
Average Stream Width	12-50 ft = lower 20 ft. = middle 6-12 ft = upper.	7-35 ft = lower 10-30 ft. = middle	12-18 ft = lower 0-16 ft. = middle 8-25 ft = upper.	9-11 ft = lower 8-12 ft. = middle 10-21 ft = upper.
Average Stream Depth	1-2 ft.	1.5 - 2.5 ft	1.5 - 3 ft	1-2 ft.
Pools	few	few - common	few-common	few-common
Substrate	Cobbles with fine sediments. Minimal bedrock	Excessive fine sediment	Predominantly gravel/cobble with some bedrock and fine sediment	Boulders and larger cobbles with limited fine sediment
Aquatic Invertebrates	N/D	N/D	common	common
Fish Present	Yes. Anadromous below cascade and resident fish throughout	Yes. Anadromous below falls and Resident fish throughout	Yes. Anadromous below falls and resident fish throughout	Yes. Anadromous below falls and Resident fish throughout
Sideslopes	60-150%	50-80%	35-100%	25 - 100%
Anadromous Barriers	12 ft cascades approximately one mile upstream of mouth	50 ft. falls 0.5 mile upstream of mouth	Thought to be 1.0 mile upstream of mouth at 8 foot bedrock falls. May be 1.5 miles upstream of mouth at a 30 foot bedrock falls.	25 ft. falls 1 mile upstream of mouth

Pelletreau Creek

This is the largest SFTR tributary stream within the Hyampom watershed, covering 7,568 acres and flowing for 6.25 miles from its headwaters to its confluence with the SFTR. This stream was surveyed in 1975 (USDA Forest Service, 1975a) during high spring time flows and again in 1979 (USDA Forest Service, 1979) during low summer flows. The 1975 survey covered over 6 miles, from the stream mouth to the headwaters, while the 1979 survey covered 2.5 miles in the headwater section. Both surveys characterized the fish habitat as poor to fair. Both surveys of the headwaters section noted a lack of suitable pools, steep side slopes, stream gradients of 15-25%, dense riparian canopy and extensive alluvial terraces resulting from the 1964 flood. The 1975 survey of the middle and lower sections also showed a lack of suitable pools, steep side slopes, minimal riparian shading, high levels of fine sediment, and a decreased gradient of 5-7%. Streambed substrate composition was dominated by coarse rubble in the upper section and became gravel dominated in the lower section. The 1975 survey states that the gravel quality in the middle and lower sections is impacted by excessive fine sediments. Stream channel width averages 6-12 ft. in the upper sections, 15-20 ft. in the middle section, and 12-50 feet in the lower section.

Both the 1975 and 1979 surveys mention extensive alluvial deposits and a wide alluvial fan in the lower 0.5 miles of this creek. The old bridge across Pelletreau Creek is located in this alluvial fan and was 20 feet above the channel before the 1964 flood, and has only recently become exposed again (USDA Forest Service, 2001). Thus, the channel of Pelletreau Creek is still in a state of recovery following the 1964 flood and continues to degrade alluvial deposits in the middle and lower reaches.

Pelletreau Creek land ownership is primarily private with only 25% being public lands. Timber harvest on private lands has further destabilized this geologically unstable watershed and made it susceptible to chronic sediment inputs from upslope areas. Fire history here shows a single lightning caused fire occurred in 1987, named the Jesse Fire. Only a small portion of the fire occurred in the Pelletreau Creek watershed and it did not impact riparian conditions.

Kerlin Creek

This perennial tributary stream covers 2,675 acres and flows for 4.9 miles from its headwaters to its confluence with the SFTR. This stream was surveyed in 1975 (USDA Forest Service, 1975b) during high spring time flows. The survey covered 2.5 miles, from the stream mouth to approximately 0.75 miles upstream of Kerlin Creek Road (3N14). The survey characterized the fish habitat as fair. In the upper survey section suitable pools for fish were common, side slopes ranged from 80-100%, stream gradient was moderate and riparian shading was medium. The survey of the middle section showed suitable pools for fish were common, steep side slopes, dense riparian shading, and a steep stream gradient. Streambed substrate composition was dominated by coarse rubble in the upper section and became gravel dominated by the lower section. All three survey sections noted sand and silt levels comprised 15-35% of the overall streambed substrate. The 1975 survey states that the gravel quality in the upper and lower sections is impacted by excessive fine sediments. Stream channel widths average 10-21 ft. in the upper sections, 8-12 ft. in the middle section, and 9-11 feet in the lower section.

Kerlin Creek land ownership includes 49% public lands. Timber harvest on private lands within the headwaters section has further destabilized this geologically unstable watershed and made it susceptible to chronic sediment inputs from upslope areas. The Kerlin Creek watershed has no known fire history.

Mill Creek

This small perennial tributary stream covers 1,472 acres and flows for 5.1 miles from its headwaters to its confluence with the SFTR. This stream was surveyed in 1975 (USDA Forest Service, 1975c) during high spring time flows. The survey covered approximately 2.0 miles, from the stream mouth to approximately 0.25 miles upstream of Kerlin Creek Road (3N14). The survey characterized the fish habitat as very good in the upper section, good in the middle section, and fair in the lower section. In the upper survey section suitable pools for fish were common, stream gradient was steep and riparian shading was medium. The survey of the middle section showed suitable pools for fish were common, steep side slopes were common, riparian shading was medium, and stream gradient was steep. Streambed substrate composition was dominated by coarse rubble and boulders in the upper section and became rubble and gravel dominated by the lower section. All three survey sections noted sand levels comprised 10-15% of the overall streambed substrate, and no mention of silt levels was made. Stream channel widths average 8-25 ft. in the upper sections, 10-16 ft. in the middle section, and 12-18 feet in the lower section.

Mill Creek land ownership includes approximately 69% public lands. Past timber harvest on public lands, in all three survey sections, as well as ongoing harvest on private lands in the headwaters section has further destabilized this geologically unstable watershed and made it susceptible to chronic sediment inputs from upslope areas. The Mill Creek watershed has a very limited fire history with the only known fire occurring there in 1987. This fire did not enter the riparian area of Mill Creek and was confined primarily to the northern ridge of the watershed.

Big Creek

This perennial tributary stream covers 5,287 acres and flows for 5.8 miles from its headwaters to its confluence with the SFTR. This stream was surveyed in 1973 (USDA Forest Service, 1973) during late summer and in 1975 (USDA Forest Service, 1975d) during high spring time flows. The 1973 survey covered the lower 0.25 miles and the 1975 survey covered the lower 2 miles. The 1975 survey characterized the middle section of Big Creek as fair fish habitat. Both surveys characterized the fish habitat as fair in the lower section. In the middle survey section suitable pools for fish were common, stream gradient was steep and riparian shading was dense. Streambed substrate composition was dominated by rocks and rubble in the middle section and primarily rubble and gravel dominated in the lower section. Both the 1973 and the 1975 surveys noted that sand and silt levels in the lower section are impacting the quality of spawning gravels there. Stream channel widths average 10-30 ft. in the middle section and 7-35 ft. in the lower section.

Big Creek land ownership includes approximately 38% public lands. Timber harvest on public lands has further destabilized this geologically unstable watershed and made it susceptible to chronic sediment inputs from upslope areas. Big Creek fire history includes two lightning caused fires, an un-named 950 acre fire that occurred in 1987 and the 1,158 acre Slide Fire that occurred in 2008. Both fires burned into the riparian reserves in the middle section of the Big Creek watershed and negatively impacted the riparian habitat there.

South Fork Trinity River

The SFTR is the single largest tributary to the Trinity River and covers approximately 980 square miles or 38 percent of the 2,853 square mile Trinity River watershed. The SFTR begins in the Yolla Bolla wilderness at an un-named spring where it begins the roughly 81 mile northward journey to the Trinity River confluence. The eastern boundary of the Hyampom watershed is delineated by the SFTR, as it courses through Hyampom Valley and the canyon section below, from river mile (RM) 30 down to RM 22.

The SFTR Hyampom Valley section of the Hyampom watershed occurs in a response reach, as defined by the Montgomery and Buffington (1993) channel classification system. Response reaches are generally low gradient reaches and have a lower sediment transport capacity. This description fits well with the Hyampom Valley section as gradient here is 0.3 percent with a very wide floodplain, often with a meandering channel form. Land ownership along the SFTR within the Hyampom Valley is almost entirely private with only about 70 acres of Forest Service land along a 0.3 mile segment. The SFTR within the Hyampom Valley has been impacted primarily by the 1964 and 1997 flood events as well as timber harvest activities in the upslope areas. The Hyampom Valley section of the SFTR is used extensively by spawning Chinook salmon in the fall and late fall. Extensive gravel deposits and a wide channel structure has created an expansive spawning area. Rearing conditions for juvenile fishes within the Hyampom valley is limited by the thermal regime of the SFTR. Water temperatures routinely become too warm from mid-May to late September, except near select tributary mouths, to effectively provide over-summer rearing areas (see Figure 19). The riparian vegetation within this reach is comprised primarily of willow and alder, and mature vegetation is lacking.

Most of the SFTR channels can be classified as transport reaches according to the

Montgomery and Buffington (1993) channel classification. These reaches have high sediment transport capacity, and tend to have a plane bed morphology, tend to lack free-form bars, have subdued cross-section topography, and consist primarily of riffles (USDA Forest Service, 2000). The section of the SFTR below Big Slide Creek occurs in a transport reach as gradient averages approximately 2.2% and the river is confined by steep canyon walls. Gravels are the dominant bed material in this reach and point bar features are common. Numerous boulder weirs exist in this section of river and are the prominent grade control feature found here. Riparian vegetation within this section is also comprised of Willow and Alder trees as well as more mature shade producing vegetation such as canyon live oak, douglas fir, and madrone trees.

The SFTR within the Hyampom Valley appears to be in a state of recovery following the 1964 and the 1997 flood events. This fish habitat of the SFTR, as well as the habitat downstream, is greatly influenced by sediment inputs from the tributaries within the Hyampom watershed. While wildfire and forest health issues have had minimal impact on the SFTR within Hyampom Valley, timber harvest and the subsequent destabilization of upslope areas has resulted in excessive sediment contributions to the main stem.

Channel conditions and water quality of the SFTR will be discussed in further detail in the hydrology section.

Key Question 2.3 What is the current watershed condition expressed in terms of landscape disturbance? What trends in watershed condition are apparent compared to historic and desired future conditions?

Water Quality

The South Fork Trinity River (SFTR) is listed as sediment and temperature impaired by the United States Environmental Protection Agency (USEPA) under the Clean Water Act section 303(d). In 1998, the USEPA established a Total Maximum Daily Load (TMDL) for the entire SFTR and Hayfork Creek watersheds based on sediment impairment (USEPA, 1998). The North Coast Regional Water Quality Control Board (NCRWQCB) is in the process of developing a document and monitoring guidelines for the sediment TMDL. Temperature was added to reasons for impairment at a later date, but at this time no TMDL or monitoring requirements have been established for this parameter.

Part of the reason for excessive sediment is the result of legacy effects from logging in the 1950's and 1960's. Associated infrastructure, such as road-building, caused high levels of disturbance and water quality problems in this watershed. Flooding in 1955 and 1964, and large fires, have multiplied problems and increased sediment delivery to the SFTR causing high levels of aggradation (USEPA, 1998). This has mainly occurred near the community of Hyampom and at the mouths of many of the smaller tributaries such as Pelletreau Creek.

Several large fires have occurred in the watershed in the past three decades, including a 1987 lightning fire south of Big Creek, the 2004 Sims Fire at the north end of the watershed, and the 2008 Slide Fire north of Big Creek (Figure 18). Generally, a mosaic of varying burn severities limited the sediment and temperature related water quality effects of the fires. Considerable post-fire emergency restoration (BAER) work was performed following the Sims Fire to reduce potential water quality impacts, but very little work has been completed on others in the watershed.

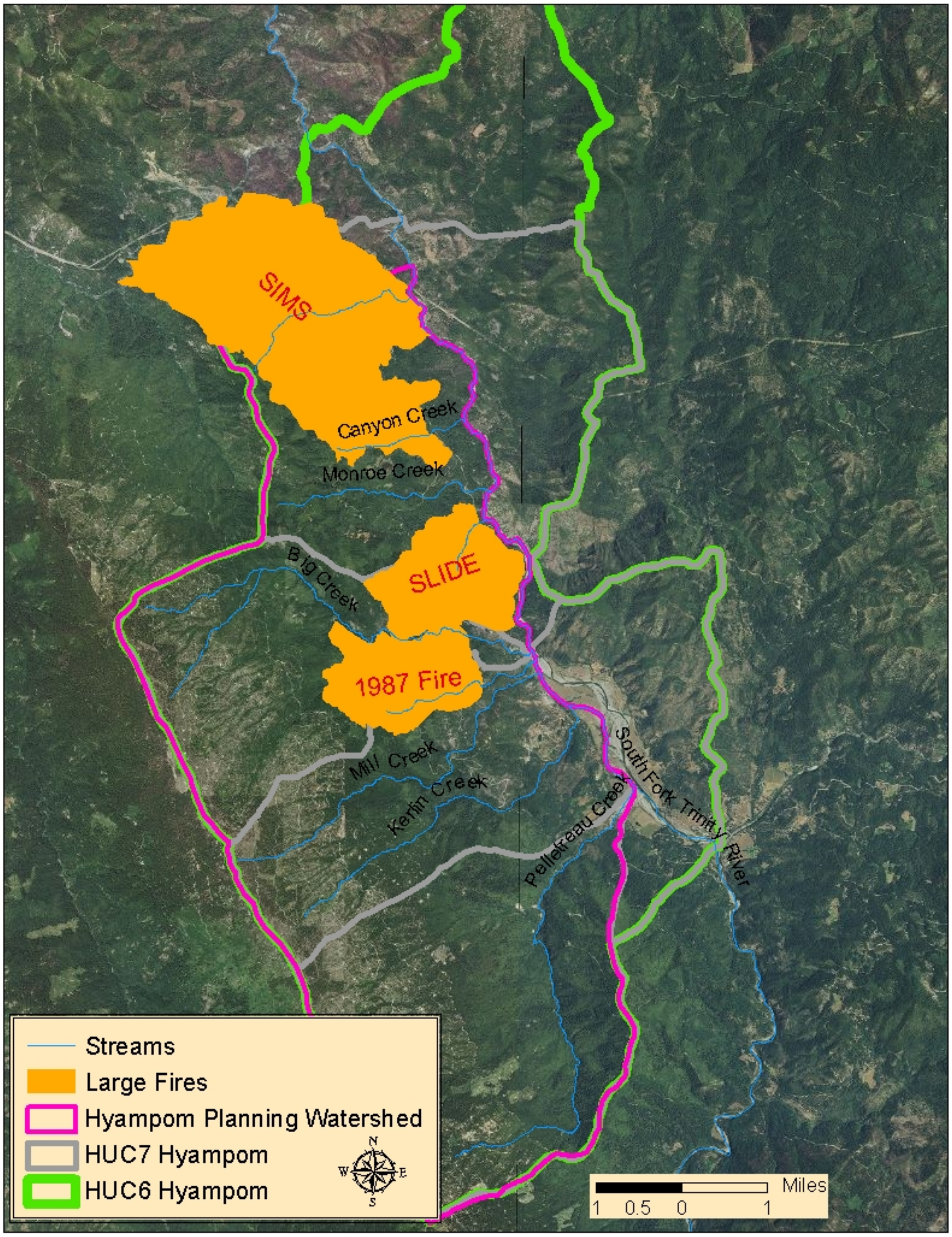

Figure 18. Large fire locations in the Hyampom planning watershed.

An important water quality parameter that influences beneficial uses of water is temperature. Water temperatures remain below thermal thresholds for anadromous fish throughout the critical summer period in most of the tributary streams. This is evident by examining the average weekly maximum temperature trends displayed in Figure 19 for Pelletreau Creek. While other tributary streams do not have similar data records, they share characteristics of relatively short, steep profiles, (Figure 17) and groundwater sources that maintain cool summer stream temperatures. In contrast, the SFTR has substantial temperature excursions above temperature thresholds for adult salmonids for most of the summer and early fall. Those cold water tributaries that enter the SFTR downstream of the Hyampom Valley provide critical thermal refugia for migrating adult and juvenile salmonids in the SFTR. This occurs in areas where deep water is maintained by channel confinement and has large landslide boulders in the channel. However, Pelletreau Creek, the largest tributary in the watershed, is substantially sediment impaired and aggraded at its confluence with the SFTR. The aggraded Hyampom Valley reach of the SFTR at the confluence provides no thermal refuge at the Pelletreau Creek confluence or within the valley.

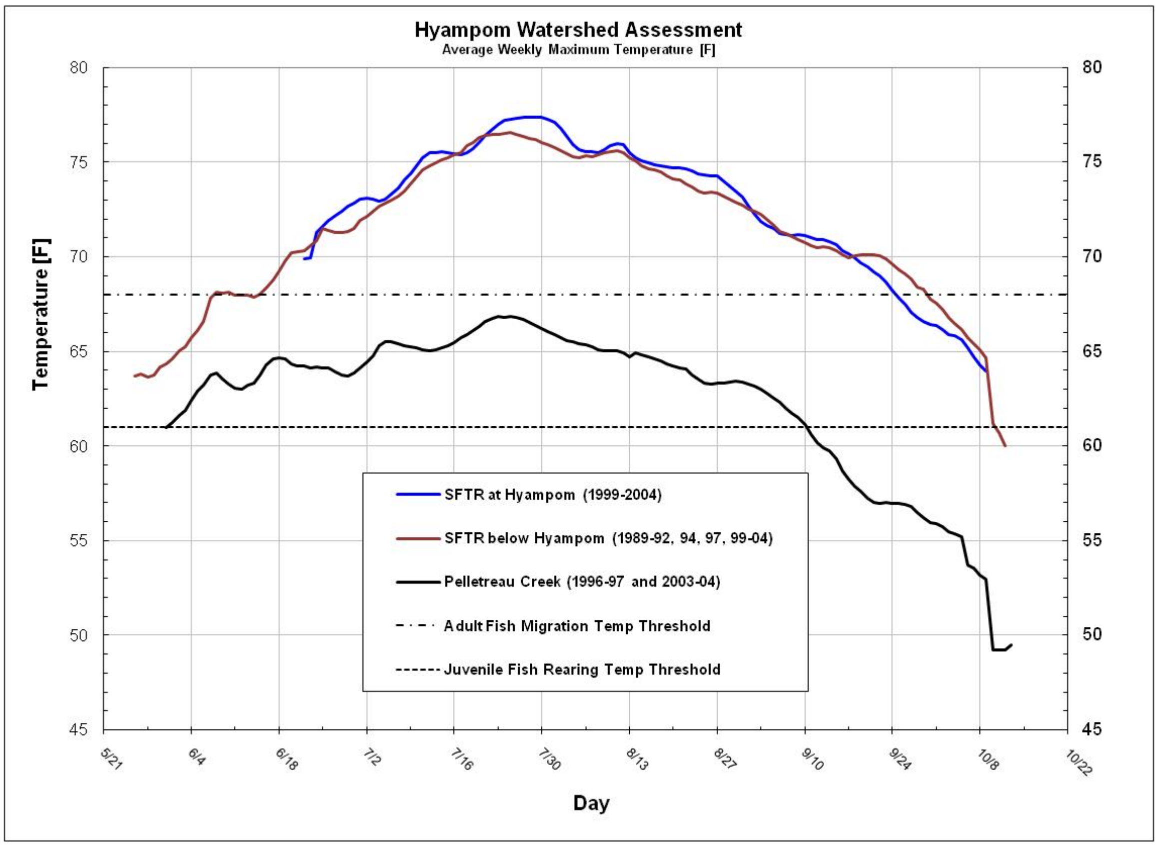

Figure 19. Example stream temperatures within the Hyampom planning watershed.

Long-term monitoring of response reaches in the watershed demonstrates channel recovery in a downstream direction as sediments continue to move through the mainstem SFTR (Cook et al., 1999; Dresser et al., 2001). Recovery from sediment and temperature should continue as long as there is continued emphasis on reducing erosion and sedimentation, reducing road densities and improving roads that remains in use.

The SFTR is a designated Wild and Scenic River for the entire segment in the Hyampom Planning watershed. It was given this designation based on outstanding remarkable fishery values, and by meeting all other criteria for free-flowing natural streams including, length, flow, and water quality.

Cumulative Effects

The Shasta-Trinity National forest uses Cumulative Watershed Effects (CWE) modeling to describe the current future watershed conditions. Watersheds are assessed at a variety of scales using the Equivalent Roaded Area (ERA) method. CWE analyses for this report are based on the ERA assessment conducted in 2005 by the ACT2 Enterprise Team and updated in 2010 for the entire Shasta-Trinity National Forest. This is the most complete analysis for this area. If a project is planned, CWE will be updated and any new information will be incorporated into this document.

Cumulative Watershed Effects and the disturbance ratios associated with each hydrologic unit are described for the watersheds within the planning watershed in Table 12. All HUC 7 drainages have high or very high disturbance levels except Big Slide Creek. Mitigations of current effects and proper project planning of future projects is essential to ensure disturbance levels are not increased. Disturbance levels can be scale and site dependent. Figure 20 displays disturbance level at multiple watershed levels. Project planning should consider effects at smaller watershed scales to ensure cumulative effects do not increase the HUC 5 watershed beyond their Thresholds of Concern (TOC).

Table 20. Cumulative Watershed Effects

Watershed HUC 5	Sub WatershedHUC6	Drainage HUC 7	Disturbance Ratio [1]	Disturbance Level
LSF Trinity R			0.30	Low
	Hyampom		0.85	High
		Pelletreau Cr	1.40	Very High
		Hyampom Valley	0.85	High
		Big Cr-Hyampom	2.0	Very High
		Big Slide Cr-SF Trinity R	0.49	Moderate

[1]Disturbance Ratio and associated Disturbance levels
(<0.4 =Low, 0.4-0.8=mod, 0.8-1.0=high, >1=very high)

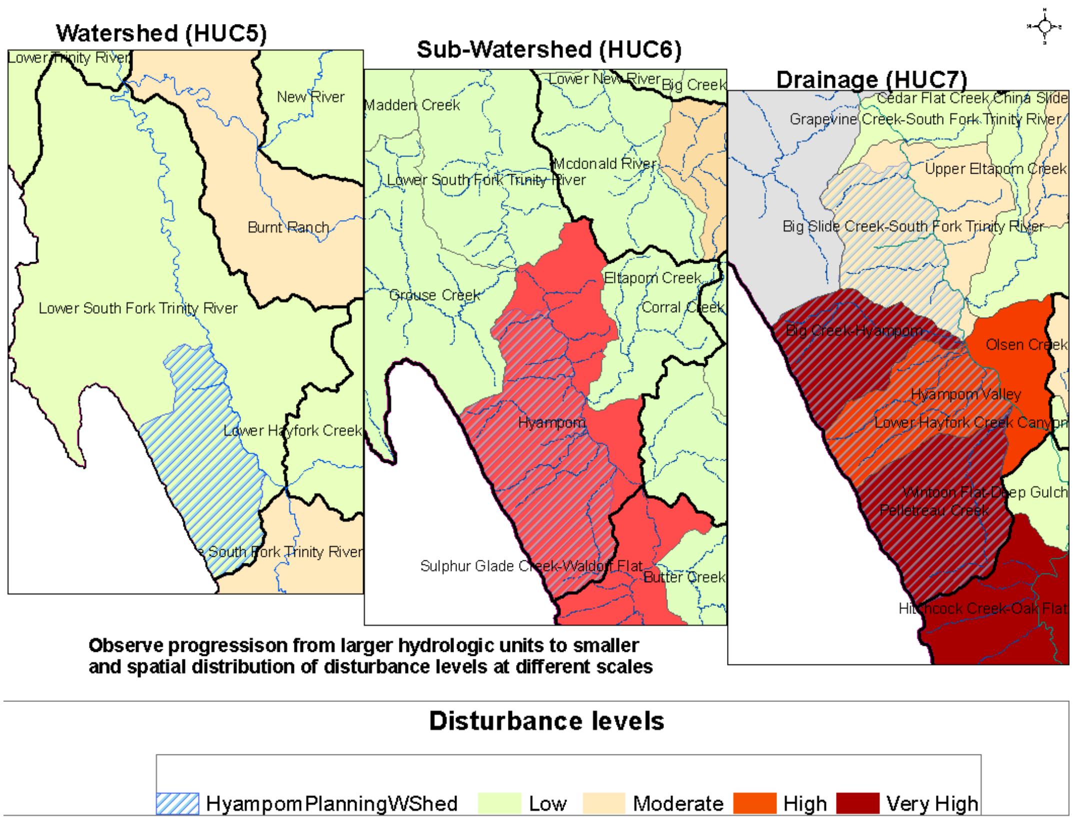

Figure 21. Cumulative watershed effects in the Hyampom planning watershed vicinity

Key Question 2.4 How do landscape disturbances, particularly forest health, timber harvest, and wildfire, influence watershed and stream condition? How would landscape treatments such as vegetation manipulation influence the effects of disturbance and trends in watershed and stream condition?

Landscape disturbance and landscape treatments can impact the condition of a watershed by changing erosion rates, sedimentation rates, and peak stream flows. These changes can accelerate off-site disturbances such as channel aggradation, degradation, bank undercutting, inner gorge mass wasting, and many other impacts to beneficial uses (Haskins, 1983). Impacts from disturbances and treatments can also provide beneficial effects to the watershed.

Roads influence hydrologic flows through a watershed. Road cuts on hillslopes intercept surface runoff and subsurface flow; this interception routes surface flow more quickly to streams. Roads, skid trails, and landings also compact soils, reducing infiltration for potentially long periods of time. This can result in increases in peak flows for floods with frequent return intervals, and decreases in summer low flows by routing water out of the watershed more efficiently and decreasing the amount that infiltrates. Increases in peak flows from roads are related to the connection of road ditches to streams (i.e., they drain hillslopes directly to streams), or long inside ditches that drain through culverts tend to eroded gullies that connect to streams. Reports have shown a 13% to 16% percent increase in flow for one-year recurrence interval events, and a 6% to 9% increase in peak flow for five-year recurrence interval events after timber harvest and road construction in a western Cascade forest.

Land management practices can also affect the water yield from watersheds. One study of runoff response to timber harvest, in a 31 watershed-scale study in the western United States, concluded that there could be up to a one-inch increase in annual runoff from a 10% increase in timber harvest averaged across the Sierra Nevada (Marvin, 1996). Increases in runoff would be greater in years with above average precipitation, and would most likely occur during winter storm events or during spring snowmelt peaks. Soil compaction from timber harvest activities can reduce infiltration rates and increase runoff. However, dense vegetation growth following timber harvest, and dense vegetation resulting from fire suppression practices in the past 100 years, often offset water yield increases caused by timber harvest (Marvin, 1996).

Fire suppression has two consequences that affect hydrologic characteristics of watersheds; higher vegetation densities and infrequent, but more severe fires. Dense second-growth forests under a fire-suppression policy have higher vegetation densities, potentially increasing the evapotranspiration rate over natural conditions. This reduces the amount of water that infiltrates into the soil to recharge aquifers and contributes to baseflow in streams. The extents to which water yields and timing are changed are site specific and difficult to predict for this analysis due to a lack of local data.

Due to the high fuel loads and dense vegetation in the fire-suppressed system, fires that occur tend to be more severe and extensive than those that occurred under historic conditions. In comparison to more frequent, lower severity historic fires, severe stand-replacing fires result in greater changes to hydrologic characteristics and sedimentation rates. Severe fires have been observed to increase water yield and peak flows immediately following burns in western forests (Kattleman, 1996).

The result of all of these factors on hydrologic characteristics is difficult to quantify. Potential changes include lower water yields and summer low flows, which, combined with wider than historic stream widths, could be detrimental to fish habitat. Lower summer flow levels could also stress riparian vegetation, especially since the late summer receives little precipitation. Peak flows may also be higher for higher frequency events, which could cause increased streambank erosion, but would also tend to flush in-stream sediments and large woody debris downstream.

Issue #3: Erosional Processes

Key Question 3.1 What mass wasting processes are inherent within the watershed?

Geomorphic Processes

Due to the nature of the rocks, mass wasting occurs naturally within this area and therefore has played a dominate role in shaping the geomorphology. There are several instances that the processes which contribute to mass wasting are presently active; however, most mass wasting processes are considered dormant within the project area. These instances include uplift rates, local seismicity, bedrock characteristics and climate.

The predominant mass wasting features within the analysis area include rotational and translational landslides, debris slides, avalanches, flows and torrents, slump earthflows, interested translational-rotational slides, and valley inner gorges (Figure 22). These features are discussed below.

Rotational and translational slides are characterized by movement of a coherent mass over a discrete, broadly concave failure surface. Most slides have occurred in association with at least one of the following: serpentinized shear zone, faults, lighologic contacts, or, especially, wet zones such as valley inner gorges.

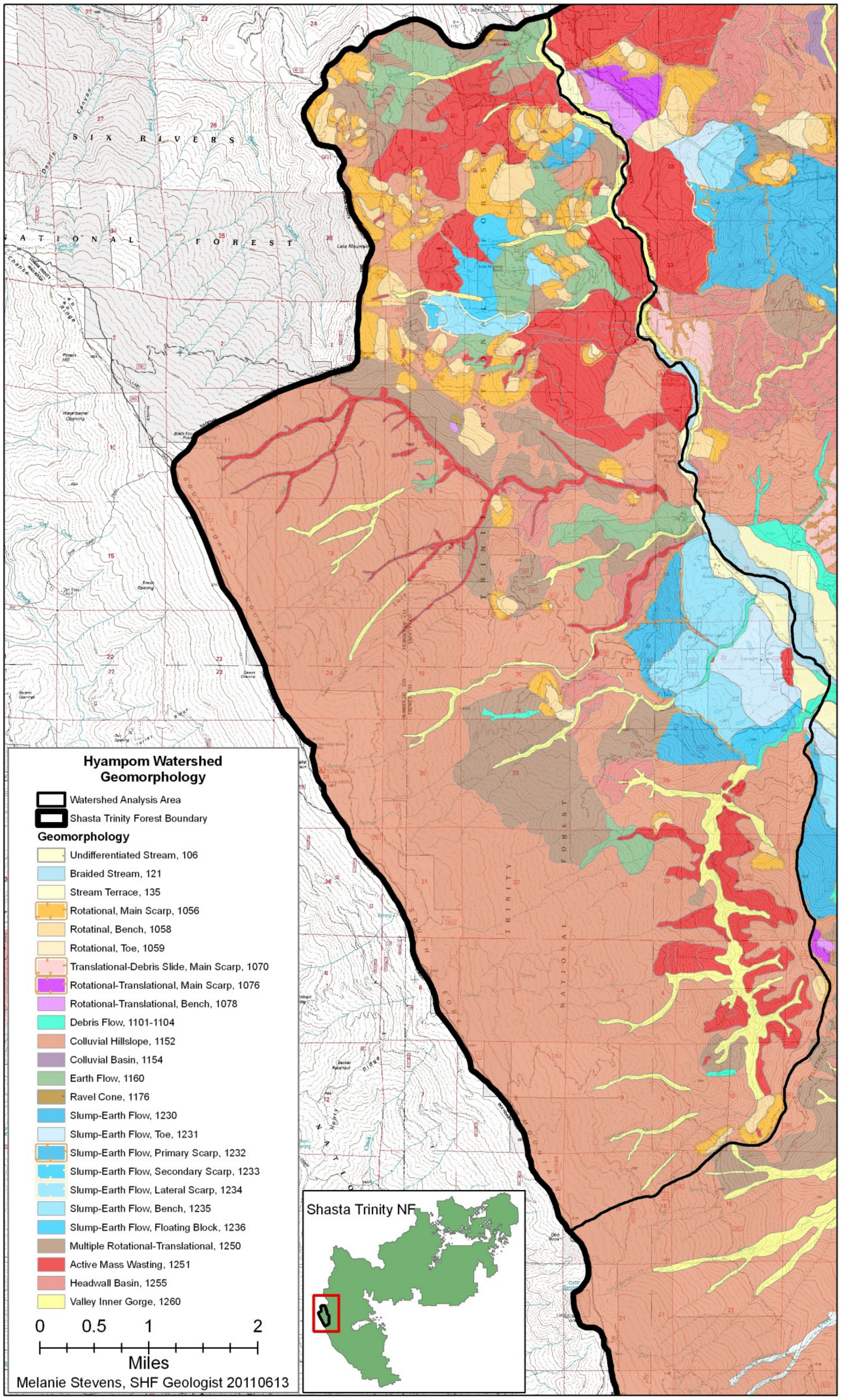

Figure 22. Geomorphology of the Hyampom planning watershed.

Debris slides and avalanches are generally confined to the shallow soil or colluvium zone. The basal failure surface commonly corresponds to the bedrock/soil interface and usually is no deeper than a few feet below the surface. There is a complete gradation from debris flow to debris slide to debris avalanche depending on water content, cohesion of material and slope steepness. Generally, debris slides have slump blocks at their head and the slide mass becomes more broken toward the foot of the slope. Movement rates are slow to moderate. In contrast, debris avalanches generally fail quite rapidly, with substantial disaggregation of the slide mass and some liquefying and water entrainment as the mass moves down slope.

Debris flows and torrents are common in low-order mountain watersheds. These are rapid movements of water-charged soil, rock and organic material down high gradient stream channels. They are generally initiated during extreme discharge events by a streamside debris avalanche which enters a channel and entrains organic debris and sediment through scouring as it moves downstream. The torrent continues to flow and scour until it reaches a lower gradient stream reach or meets a significant obstruction. When its momentum is lost, the slide material is deposited within the channel.

Earthflows are a relatively slow moving mass that consists of clay rich materials. These landslides are complex, involving many components of different types of mass movement. In general, earthflow movement occurs during the winter season where under fully saturated conditions, pore water pressures are elevated and intergranular friction is decreased.

Interested translational-rotational slides are large (1,000 to 50,000 cubic yards) slides that occur within proximity to perennial and some ephemeral drainages. At slope gradients greater than thirty-five percent these slides should be considered potentially unstable. Such slides commonly creep gradually, but where undercut by a road or drainage, the effected landslide will slide out rapidly.

A valley inner gorge is defined as the unbroken slope adjacent to a stream channel which has a slope gradient of sixty-five percent or greater. Debris sliding and avalanching which are the dominant mass wasting processes in this zone are both the result of recent oversteepening of the valley inner gorge zone from stream incision and secondly the result of activation of rotational-translational slides which toe out in the inner gorge. Many active slides are present in this zone which, although occupying a minor portion of the total watershed area, contributes vast quantities of sediment to streams.

The slopes of South Fork Mountain, consisting of South Fork Mountain Schist, are defined by six geomorphic zones by Haskins et al (1980). These zones are defined on the basis of dominant mass wasting process, landslide activity level and the characteristic slope gradient.

The primary inner gorge is the zone that lies adjacent to the South Fork of the Trinity and is characterized by slopes exceeding 65%. Debris slides and avalanches are the dominant mass wasting processes within this zone. Landslide activity is very high and is greatly influenced by management practices.

The tributary inner gorge is found along the majority of third and fourth order tributaries. It is similar in character to the primary inner gorge zone but is less developed. Landslide activity within the zone is high and is sensitive to management activities, particularly roads, stream crossings, and clear-cut harvest.

The peripheral zone is located above the primary inner gorge. It is characterized by slopes greater than 40% and sharply defined by recently active and rotational-translational features. The potential for landslide activation is moderate to high but can generally be mitigated through careful location of roads and harvest units, combined with modified silvicultural prescriptions.

The interdivided zone is located above the peripheral zone, and is characterized by slopes of 20 to 40%. Rotational-translational slides are the dominant mass wasting process but their features are not as sharply defined as the peripheral zone and their activity level is considered lower. Landslide activation in response to management activities can be minimized through careful road and harvest unit locations.

The swale zone is the zone that extends above the interdivide zone to the mountain's crest. It is characterized by slopes generally less than 20%, broadly sloping swale drainages and well-rounded rotational-translational landslide features. Timber harvesting and roading are generally unrestricted in the zone. Landslide activation and erosion due to timber harvesting should be minimal if adequate streamside management zones are maintained around drainages.

The bog zone is the final zone that occurs throughout all levels of the mountain but is most common in the interdivide and swale zones. Bogs range in size from 50 to 500 feet across. These areas should be treated as riparian zones and only select management should occur within these areas. This will aid in preventing compaction and accelerated surface erosion.

Air Photo Investigation

Historical air photos were examined in order to gain insight into reference conditions relative to erosional processes, with emphasis on mass wasting. Due to limited time, a sample of photo years was selected to straddle some of the largest floods which are known to have occurred in the recent past (1964 and 1997). Air photos from 1960, 1970, 1998, and 2004-2005 NAIP imagery were utilized to accomplish this. Methods included examining air photos stereoscopically and identifying active mass wasting features and channels which appeared in the photos to have been recently altered by scour or deposition (usually indicated by lighter color and lack of riparian vegetation). Due to time limitations, notes were taken during photo examination, but no mapping was done during the process.

Assumptions made:

Past harvest units located within the Forest boundary were identified by photo observation and approximant Forest land boundaries.

Mass wasting features that are observed on the 1970 air photos and not on the 1960 are attributed to the 1964 flood event. Mass wasting features that are observed on the 1998 air photos and not on the 1970 air photos are attributed to the 1997 flood event.

A mass wasting feature that intersects or is near a man-made feature, e.g. road and/or harvest unit, is assumed to be caused by that man-made feature.

Summary of Air Photo Investigation

The air photo investigation revealed that most of the active mass wasting, with emphasis on debris slide and channel alterations, can be attributed to road and/or harvest related activities relative to natural[20] areas located within the analysis area. The greatest extent of these events occurred after 1960 but prior to 1970, thus assuming the 1964 flood event triggered the event. Although some debris slides and channel alteration did occur during the 1997 flood event, the alterations were not to the extent of the 1964 event. This can most likely be attributed to allowing revegetation of harvested areas thus increasing local canopy cover[21], evapotranspiration and root strength. The magnitude of the 1964 flood event was greater than the 1997 event, thus magnitude also likely had an influence on the slide and channel alteration. A brief summary of observations from each photo year is located below.

1960: There is extensive tractor logging that occurred in the middle of the analysis area prior to the 1960 air photo date within Forest boundaries. Disturbances consisted of harvested areas (clear cuts and intensive thinning) and roads. There are minimal, obvious active mass wasting features observed. There are relatively small, localized debris slides that occurred within harvested areas or originating from roads. Also several natural debris slides were observed. Natural debris slides originate in high, steep terrain both in forested and naturally bare areas, usually rock outcrops. No obvious stream channel scouring was

[20] Features that were observed that were not located by a man made feature.

[21] Mass wasting frequency increases only slightly as over-story crown cover is reduced to 11%, but crown cover that is reduced to below 11%, a major increase in mass wasting occurs (Megahan et al. 1978).

observed. Valley inner gorges, especially along the South Fork of the Trinity River, contain active mass wasting features regardless if roads or harvest units are present.

1970: The same harvest features can be observed in 1970 air photos as seen in the 1960 air photos. There are more noticeable mass wasting features mostly consisting of debris slides and stream channel scour attributed mostly to roads and some harvest units. The most noticeable scours occurred within Kerlin Creek, Big Creek, Lucy Gulch and a tributary of Pelletreau Creek located in line 22, photo 9-93. Valley inner gorges had increase in larger landslide failures but were localized to the inner gorge.

1998: Revegetation of harvest units was observed in previous clear cut and intensively thinned areas. There are noticeably fewer active mass wasting features within the aerial photos. The most abundant mass wasting features still occur within the valley inner gorges. There are some localized debris slides related to roads and some harvest units. An example is shown in line 3, photo 198-138 where a road related debris slide caused channel scouring in Mill Creek.

2004-2005 NAIP Imagery: The Sims fire, which burned in 2004, burned in the northern portion of the analysis area. Areas that were previously logged have completely revegetated. There were no obvious, recent mass wasting features or channel alterations observed.

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

Soil Erosion Hazard

Many land use activities have the potential to cause erosion rates to exceed natural soil erosion or soil formation rates. In order to assess the potential risk of a given soil to erode, an erosion hazard rating (EHR) was developed (R-5 FSH 2505.22). Many interrelated factors are evaluated in an EHR system to determine whether land use activities would cause accelerated erosion. The EHR system is designed to assess the relative risk of accelerated sheet and rill erosion. This rating system is based on soil texture, depth, clay percent, infiltration of soil, amount of rock fragments, surface cover (vegetative and surface rocks), slopes, and climate. Risk ratings vary from low to very high with low ratings meaning low probability of surface erosion occurring. Moderate ratings mean that accelerated erosion is likely to occur in most years and water quality impacts may occur for the upper part of the moderate numerical range. High to very high EHR ratings mean that accelerated erosion is likely to occur in most years and that erosion control measures should be implemented. These ratings assume varying amounts of vegetative cover depending on degree of vegetative management.

Analysis shows that most of the soil erosion hazard ratings (evaluated on a bare soil cover basis) are mixed ranging from low to high depending on slope and texture of soil

(Figure 23). Low to moderate erosion hazard ratings insure soil erosion will not exceed the rate of soil formation. High to very high erosion hazard ratings indicate that soil erosion will exceed the rate of soil formation and site productivity will degrade if no erosion control measures are enacted. Maintaining soil cover is imperative to reducing erosion (USDA Forest Service, 1995).

The soil erosion map (Figure 23) is based on bare mineral soil, and shows areas that have high to very high erosion potentials that have coarse textures and are very steep (in red). On a sub-watershed basis Pelletreau and Big Creek areas have the greatest potential for erosion followed by Big Slide Creek and Canyon Creek.

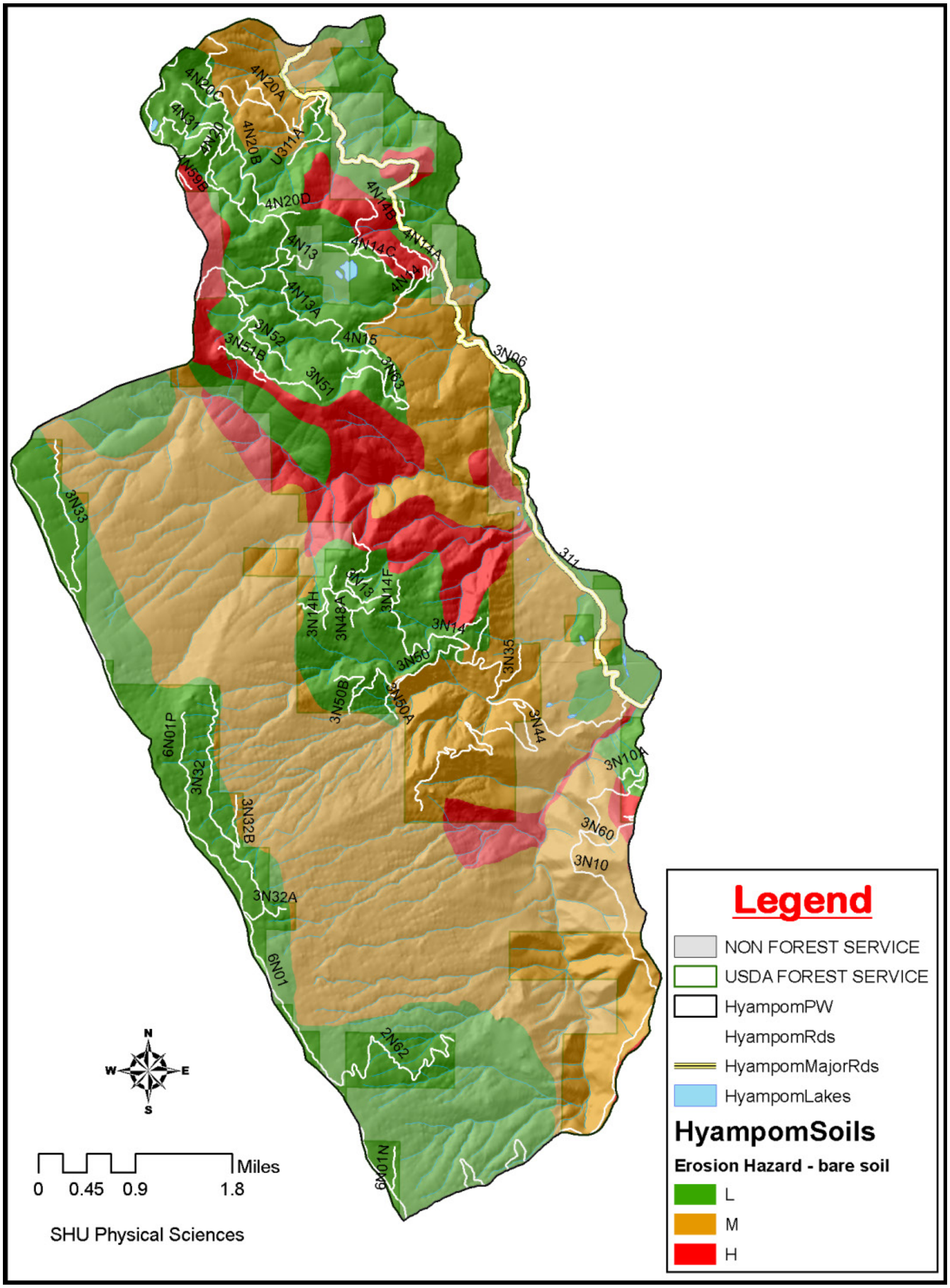

Figure 23. Soil erosion hazard in the Hyampom watershed

If the Hyampom watershed experiences high intensity fires then soil burn susceptibility would be low to moderate depending on textures, rock fragments, and slopes (Figure 24).

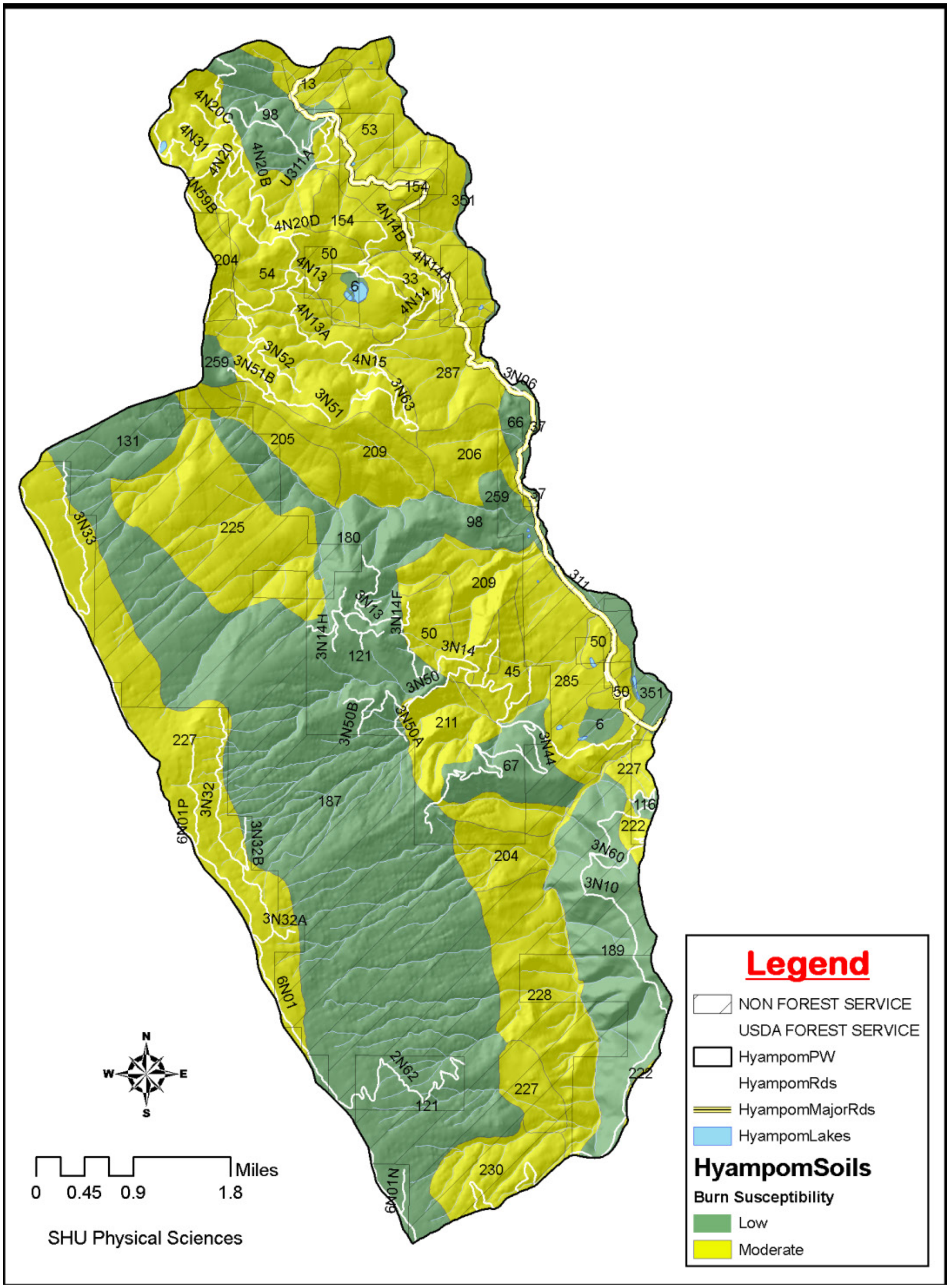

Figure 24. Soil burn susceptibility in the Hyampom Planning Watershed

Hydrologic soil groups are soils that are grouped together that have similar physical and runoff characteristics based on the intake and transmission of water when wet, bare mineral soils, and soils when not frozen. Slopes are not considered when assigning a hydrologic soil group. Current hydrologic soil conditions are predominately hydrologic group B (Figure 25). Hydrologic group B soils have moderately low runoff potential when wet. These soils hold water well and have slow transmission rates.

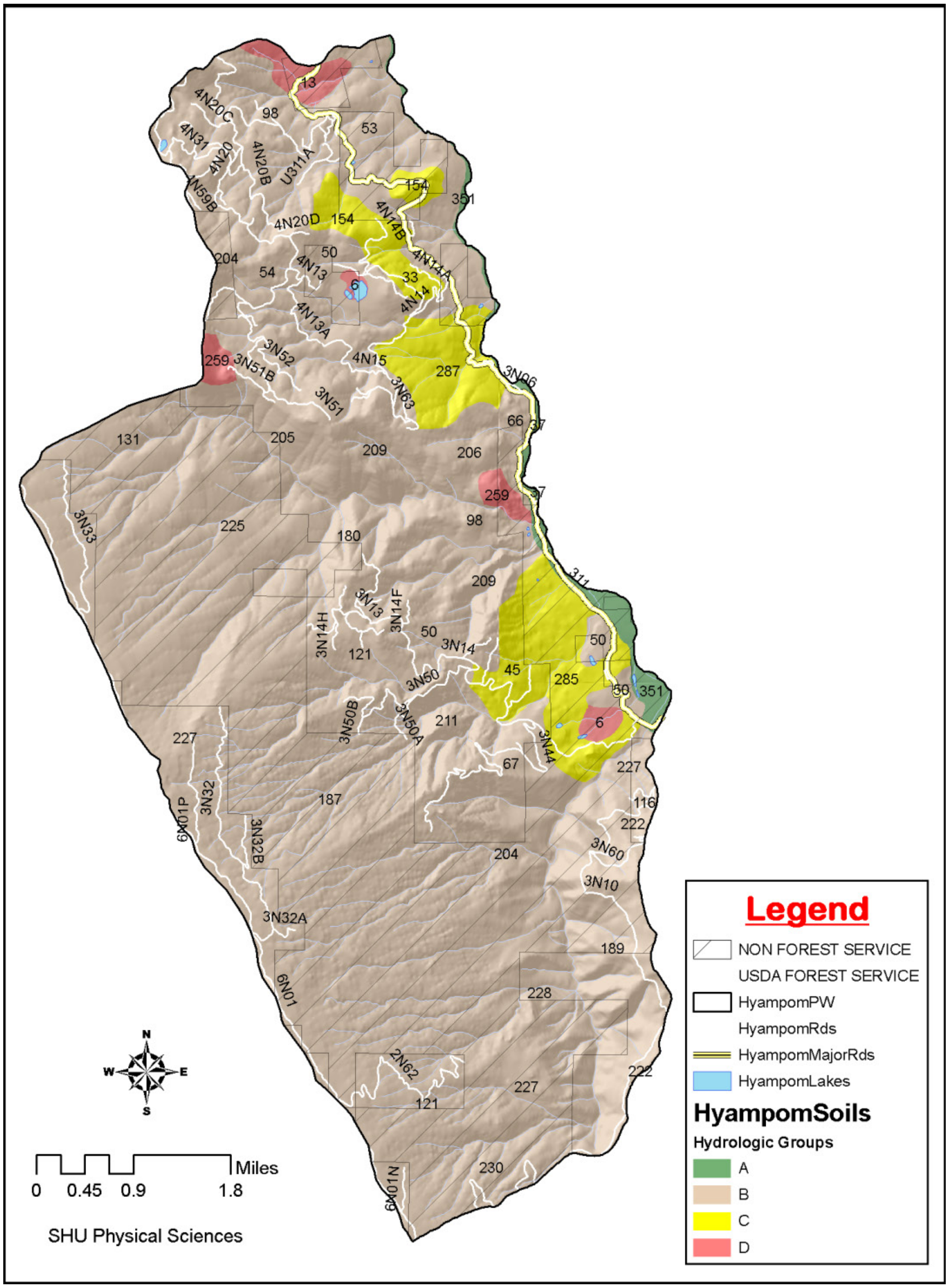

Figure 25. Soil hydrologic group in the Hyampom Planning Watershed

Issue #4: Fire and Fuels

Key Questions 4.1: What is the current fire hazard and risk within the watershed, including the threat to local communities and associated wildland-urban interface?

Fire suppression and past management activities have resulted in areas with dense vegetation and fuel loading at levels conducive to large fire growth. Accumulation of fuels through time has resulted in increased concerns over fire effects to heritage resources. Several homes in the community of Hyampom are located on the lower slopes of the analysis area. Large blocks of private land are spread throughout the watershed with the most contiguous blocks in the middle to upper slopes. In addition to high fuel loadings, weather conditions, rugged terrain and other factors can contribute to large fire growth within this watershed. Fire risk (chance of a fire occurring) and fire hazard (consequences if a fire does occur) have led to concerns over fire behavior throughout the watershed including the wildland urban interface.

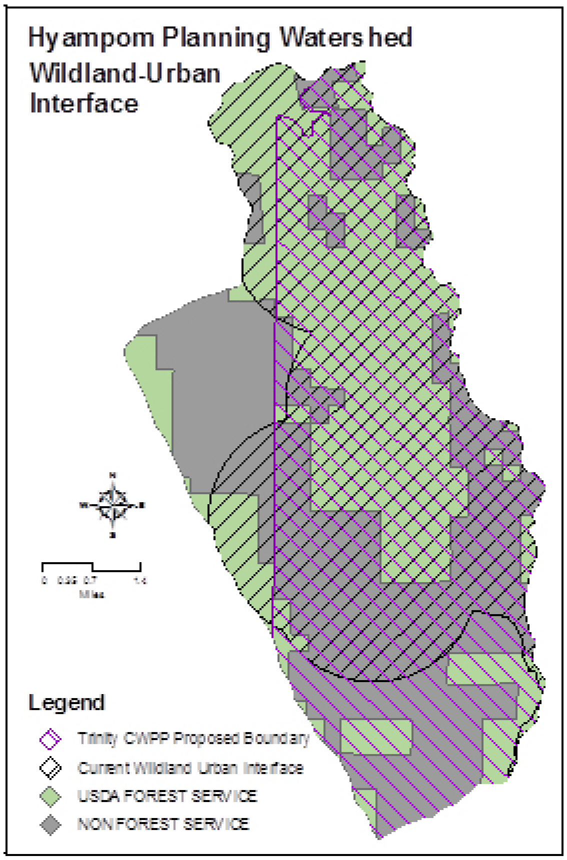

Figure 26. Current and proposed wildland urban interface boundaries in the Hyampom Planning Watershed.

Wildland-urban interface (WUI) is an area where structures or other human development intermingle with the undeveloped wildland. The western edge of the Hyampom community extends into the analysis area. Several structures are located in close proximity to public lands. Within the analysis area there are 9,864 acres of wildland-urban interface on federal land (Figure 26). Approximately 11% of that land is within ¼ mile of a known structure. An additional 7,308 acres of private land is considered wildland-urban interface. When the Trinity County Community Wildfire Protection Plan (CWPP) Update is finalized additional WUI will be added along South Fork Mountain Road (FS Road 1) on the southwestern edge of the analysis area. No WUI will be removed under the new CWPP within this watershed.

Hazard

Fire hazard is related to fire behavior which is an expression of the interaction between the fuels, weather, and topography at a given place and time. Of these three factors, fuels is the only one humans can modify. Fuel amount, arrangement, or even type can be adjusted through human intervention (silvicultural and fuels treatments) as well as natural processes (fire, flood, decomposition, pathogens, etc.). Fire hazard is addressed below in relation to fuel type and associated fire behavior including potential flame lengths and fire type modeled with 90th percentile weather conditions. Fire behavior modeling was conducted using FlamMap version 3.0 (Finney et al., 2006). Weather was analyzed with Fire Family Plus Version 4.0.2 (Brittain, 2008) using data from Big Bar, Mad River, Underwood, and Friend Mountain Remote Automated Weather Stations (RAWS). Analysis period was May1-Oct31 from 1989-2010.

Fire behavior fuel models are used to describe distinct distributions of fuel loading among live and dead surface fuel components, size classes and fuel types (Scott and Burgan, 2005). These fuel models only describe surface fuels and are used when determining potential fire behavior. There are three fuel models that each comprises more than 10% of the analysis area (USDA Forest Service, 2010b). The first is a high load dry climate shrub model which can produce long flame lengths and very high rates of spread. Second, is a low load dry climate timber-grass-shrub model which has shorter flame lengths and low rates of spread. Finally, a long-needle litter model which results in moderate flame lengths and rates of spread. These three models account for 51% of the watershed and 50% of the wildland-urban interface acres. The remaining acres are divided among 21 other fire behavior fuel models ranging from light grass to heavy slash.

Flame lengths provide a measure of how intense or severe a fire may become and can serve as a proxy for the ease of fire suppression. Modeled flame lengths are categorized into low, moderate, and high fire hazard based on information presented in the Fire Management Plan (USDA Forest Service, 2010c) (Table 13, Figure 27). Descriptions of each category are:

Low: Flame lengths 0-4 feet. Persons using hand tools can generally attack at the head or on the flanks of fires.

Moderate: Flame lengths 4-8 feet. Fires are too intense for direct attack by persons using hand tools. Equipment such as dozers, engines, and retardant aircraft can be effective.

High: Flame lengths greater than 8 feet. Fires may present serious control problems such as torching, crowning, and spotting. Control efforts at the head of the fire will probably be ineffective.

Table 13. Acres and percent of Hyampom Watershed and Hyampom Wildland-Urban Interface in each fire hazard category (based on 90th percentile weather).

Category	Description	Hyampom Watershed		Wildland Urban Interface	
		Acres	Percent	Acres	Percent
Low	0-4 feet	13,873	55%	9,690	54%
Moderate	4-8 feet	1,276	5%	860	5%
High	>8 feet	8,992	36%	6,398	36%
Non-Burnable	No Vegetation	1,011	4%	986	5%

Fire type is determined by canopy characteristics, ladder fuels, and surface fuel loading. There are four general fire types; surface fire, passive crown fire, active crown fire, and independent crown fire. The models used for this analysis only characterize the first three types. These are defined as:

Surface Fire: The fire remains on the forest floor. Surface fire intensity and/or ladder fuels are not sufficient to move a fire into the canopy under the defined burning conditions.

Passive Crown Fire: Individual tree or group torching occurs. Surface fire intensity and ladder fuels are sufficient to move the fire from the surface into the canopy. However, the canopy is not dense enough to spread through the crowns under the defined weather conditions.

Active Crown Fire: Fire is sustained and spreads on the forest floor and through the canopy. Surface fire intensity, ladder fuels, and canopy density are sufficient to allow fire to move into and spread through the canopy under the defined weather conditions.

Most of the watershed is projected to burn as a surface fire, however there is still approximately 1/3 of the area that would burn with some type of crown fire (Table 14, Figure 27). All fire types can pose difficult control issues as well as result in severe fire effects.

Table 14. Acres and Percent of each fire type in the Hyampom watershed and the Hyampom Wildland-Urban Interface (based on 90th percentile weather).

Fire Type	Hyampom Watershed		Wildland-Urban Interface	
	Acres	Percent	Acres	Percent
Surface Fire	15,902	63%	11,036	62%
Passive Crown Fire	6,218	25%	4,490	25%

Fire Type	Hyampom Watershed		Wildland-Urban Interface	
	Acres	Percent	Acres	Percent
Active Crown Fire	2,021	8%	1,422	8%
Non-Burnable	1,011	4%	986	5%
Non-Burnable	1,011	4%	986	5%

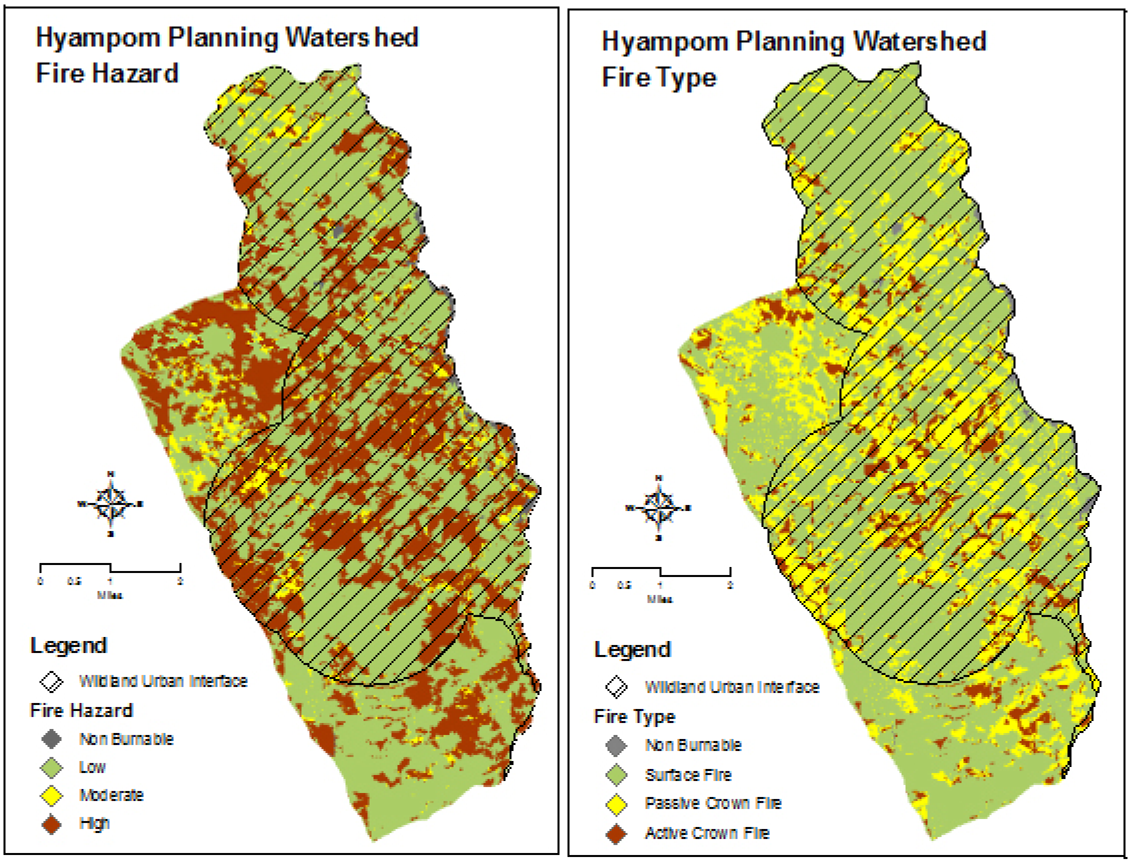

Figure 27. Fire Hazard rating (left) and potential fire type (right) in the Hyampom watershed (modeled with 90th percentile weather).

When combined areas of low fire hazard that would burn as a surface fire make up approximately 57% of the watershed with 70% of those acres within the wildland-urban interface. Roughly 5% of the area has a moderate fire hazard rating and a surface fire type. Over 1/3 of both the watershed and the wildland-urban interface is projected to have either flame lengths too long for suppression actions and/or some type of crown fire (passive or active).

Risk

Fire risk is the probability of a fire starting. This is based on the locations of previous fire starts. This analysis will utilize the fire risk layer developed for the Shasta-Trinity National Forest Fire Management Plan which calculates risk based on the number of fires occurring over a 10-year period for a given 1000 acre area (USDA Forest Service, 2010c). Burn probabilities, large fire history and ignition sources will also be discussed.

The fire risk analysis completed for the Fire Management Plan shows a fairly even distribution between the three risk categories across the entire Hyampom watershed (Table 15, Figure 28). Approximately 38% of the watershed is categorized as moderate, which means over a 10 year period 0.5 to 0.99 fires would be expected to occur. When the data are summarized based on the Hyampom wildland-urban interface boundary the results are skewed with nearly half (47%) of the area categorized as high, which means one or more fires would be expected to occur during that same 10 year period.

Table 15. Acres and percent of land in each fire risk category for the Hyampom Watershed and the Hyampom wildland-urban interface. Data was extracted from the Shasta-Trinity National Forest Fire Management Plan fire risk GIS layer.

Risk Category	Description*	Hyampom Watershed		Wildland-Urban Interface	
		Acres	Percent	Acres	Percent
Low	0 – 0.49	6,638	27%	3,045	18%
Moderate	0.5 – 0.99	9,266	38%	6,112	36%
High	>=1	8,419	35%	8,006	47%

*Values are the number of fires expected to occur per decade for every thousand acres in the area being analyzed.

The overall risk rating for the watershed is moderate with a calculated (Equation 1) value of 0.92. When data is restricted to only the WUI the risk rating increases to 1.14 which is considered high.

Equation 1. Formula and parameters used to calculate overall fire risk rating in the Hyampom watershed and the Hyampom wildland-urban interface.

$$R = \frac{\left\{\left(\frac{x}{y}\right) 10\right\}}{z}$$

Variable	Definition	Hyampom Watershed	Wildland-Urban Interface
X	Fire Starts	90	78
y	Number of Years	40	40

$$R = \frac{\left\{\left(\frac{x}{y}\right) 10\right\}}{z}$$			
Variable	**Definition**	**Hyampom Watershed**	**Wildland-Urban Interface**
	(1970-2009)		
Z	Number of Acres in thousands	24.345	17.172
R Risk	0.92	1.14	
Overall Rating	Moderate	High	

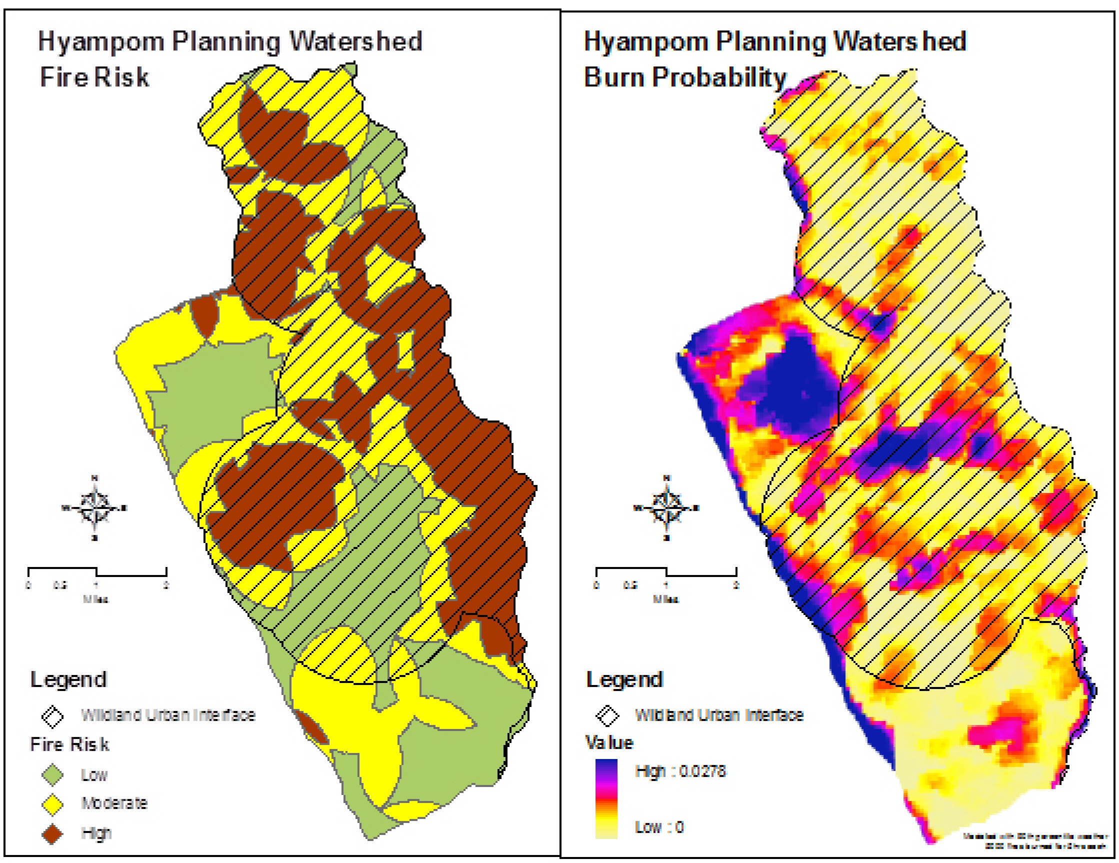

Figure 28. Shasta-Trinity National Forest Fire Management Plan Fire Risk Ratings (left) and calculated burn probabilities (right) for the Hyampom Watershed.

To calculate burn probabilities the model (FlamMap) randomly started 5,000 fires across the watershed, allowed each to burn for five hours, and then tallied how many fires burned each 30m x 30m pixel. The resulting map (Figure 28) highlights those areas that are most likely to burn. Most of the highest probability areas are located outside of the current wildland-urban interface boundary. Burn probabilities appear to increase with increasing slope position. The lower 1/3 of slopes has mostly lower burn probabilities than the upper 1/3 which has a large proportion of the highest burn probabilities.

There have been seven large (>10acres) fires in the watershed since 1970. All of these fires burned within the wildland-urban interface (Table 16). There were three fires in 1987, two in 2004 and two in 2008. The effects from the 1987 and 2008 fires were mostly low severity within the watershed (USDA Forest Service, 2010d). However, 46% of the acres burned during the 2004 Sims fire burned at high severity (Figure 29).

Since 1970 there have been 90 fires in the watershed with 78 of those occurring within the wildland-urban interface (Figure 29). Lightning is the most common ignition source in both areas, with 44% and 41% of fire starts respectively. Regardless of ignition source 71% of fires in the watershed and 70% of fires in the wildland-urban interface are contained at less than ¼ acre in size. July and August have the most fire starts. However, ignitions have been recorded as early as April and as late as October.

Table 16. Large fire history within the Hyampom watershed since 1970.

Year	**Name**	**Total Fire Acreage**	**Fire Acres in Hyampom Watershed**		
			Total	**WUI**	**Non-WUI**
1987	Blake	3,543	112	56	56
1987	Gulch	6,643	16	16	0
1987	Jessie	3,507	427	372	55
2004	Sims	4,113	2,392	2,390	2
2004	Hyampom	13	13	13	0
2008	Half	15,465	34	34	0
2008	Slide	1,219	1,219	1,219	0

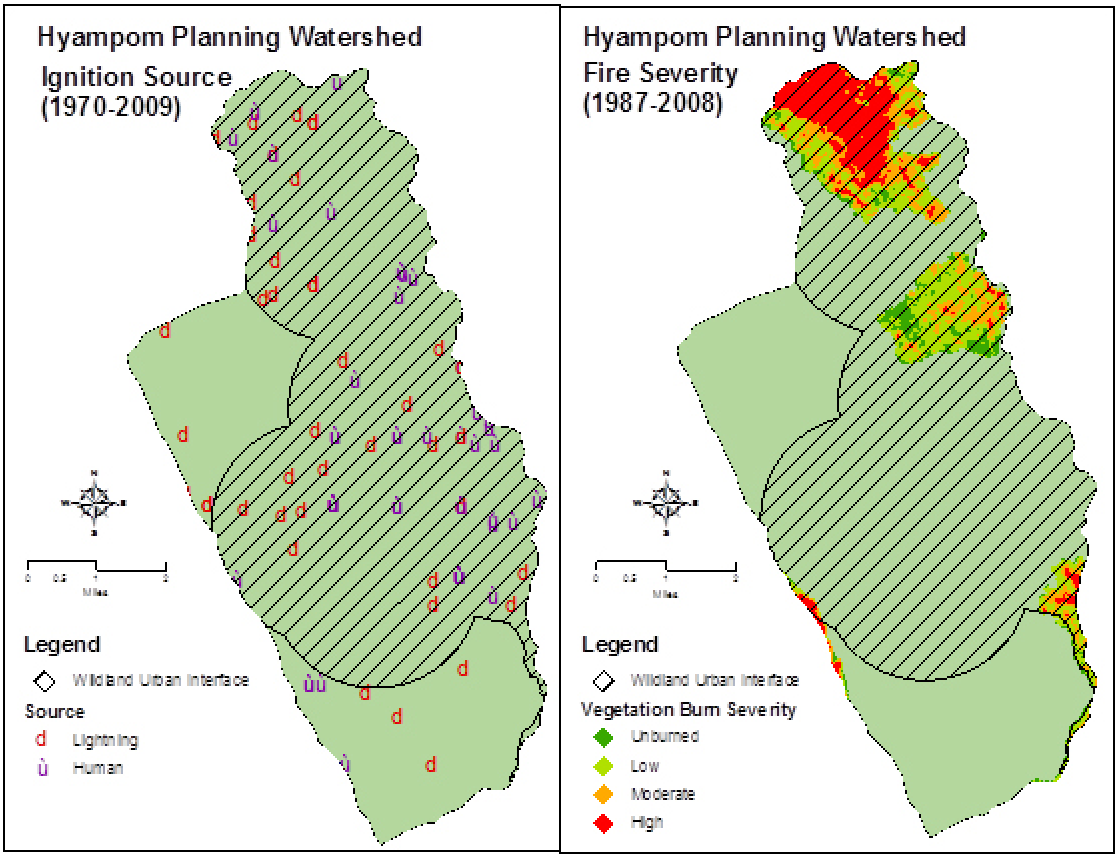

Figure 29. Fire history in the Hyampom watershed including distribution of ignition sources from 1970 to 2009 (left) and vegetation burn severity from 1987 to 2008 (right).

Synthesis

The potential threat to a resource depends on two things: 1) how likely it is for that resource to burn, and 2) the effects to the resource if it does burn. Previous fire history within the watershed and the wildland-urban interface has had the potential for large fire activity. The effects of the large fires that have burned as well as modeled potential fire effects span the full range of possibilities from surface fire that can be suppressed by hand tools to active crown fire or flame lengths greater than 8 feet. Shrub dominated areas in the watershed would likely burn with high intensity accounting for a proportion of the extreme fire behavior modeled. Ecologically this is not devastating since many of the shrubs will re-sprout; however, these types of areas often have rapid rates of spread when they burn which may affect the surrounding stands and nearby community. There is also potential for extreme fire behavior in the timber fuel types. Therefore, the effects to the resources are variable depending on site specific conditions. Overall, the combination of fire risk and potential fire behavior results in a potential threat to the Hyampom community.

Key Question 4.2 What is the degree of threat from wildfires to heritage resources?

The principal threat from wildfire is the potential to have high heat levels over a long period of time on archaeological sites. This poses a risk to lithic artifacts found near or on the ground surface. Fire effects on artifacts will vary depending on the temperature and duration of heat. Longer exposure to high heat increases the probability of damage. Factors that affect temperature and duration are the type of fuels, fuel loading levels, moisture content of fuels, soil type/soil moisture, and weather, along with terrain. The archaeological sites found at the top of South Fork Mountain and down along the South Fork of the Trinity River have cultural deposits made up of chert and obsidian. The former material makes up 60% to 80% of the lithic tools.

Studies have shown that even a few centimeters of soil/duff cover (5cm to 10 cm) can protect artifacts. However, conditions do exist that will carry heat further down into the ground. Burning and smoldering stumps and their root systems can bring heat for long periods deeper into the ground. Smoldering and burning heavy duff cover, large logs, and roots have the potential to damage subsurface stone artifacts. Fires that burn hot and fast through a site are less likely to effect lithic artifacts than heavy duff cover and large logs burning over a long period (Winthrop, 2009; Fowler, 2008).

Studies done after wildfires have shown severe effects to chert lithic artifacts. Large cores and bifaces can explode into many angular debris fragments. Smaller and thinner artifacts such as projectile points, steep end scrappers, and small biface knives show thermal effects even with low severity fires. These artifacts showed patterns of potlid fractures, crack networks, angular fractures, and changes in color, luster, and translucency. Effects like these were seen even when the fire was of short duration, but high in temperature.

High heat affects chert in two different ways. Fracturing can occur as the result of thermal stress. Fracturing occurs when a portion of the artifact is heated to a different temperature resulting in an uneven rate of contraction or expansion.

The second way chert fractures is the explosive release of microscopic water within the material. Water within the chert when heated to 365ºC can no longer remain as a liquid and turns to gas. This results in an explosive reaction creating blocky and angular fracturing. Potlidding and crazing are also evidence of water steam release.

Obsidian can also be thermally altered by wildfires. Archaeologists commonly use obsidian hydration analysis to effectively date obsidian artifacts by quantifying moisture uptake measured in hydration rinds that has occurred since artifacts were flaked. Exposure to heat can adversely affect hydration rinds. Starting around 250ºC rinds start to be altered; at 400ºC the rinds can be significantly altered or totally destroyed. When these rinds are damaged or destroyed the obsidian artifact can no longer be used for dating.

This damage will occur when artifacts are directly exposed to wildland or prescribed fires.

There are other thermal physical effects to obsidian artifacts that have been noted. High heat levels can leave a matte finish or create a metallic sheen on the surface. There can be fine crazing due to differential thermal expansion/contraction and deep surface cracking. Vesiculation is evidenced by interconnected bubbles within the obsidian resulting in a foam-like mass. Fire fracture can also result from rapid thermal fracturing due to differential heat stress that starts near an inclusion. Researchers have observed these effects in the 450-550ºC range, except for vesiculation which occurs only at 800ºC+ (Buenger, 2003).

A fuels analysis was done for the watershed utilizing FLAMAP on which the archaeological sites were overlain. This provided a measure to show potential adverse thermal effects to these sites. The analysis completed using the 90th percentile weather conditions with winds going uphill rather than from a specific direction. Two different but related measures were used. One broke out the watershed into vectors showing varying amounts of BTU's per square foot. The second analysis applied a fuel model to the watershed showing areas of light, moderate, and heavy fuel loading (see the fuels section of the document).

Eleven sites within the watershed had BTU's per square foot ranging from 7,000 to 12,000 and fell within the heavy fuel loading category for the fuel model. Six were within the 500 to 5,000 BTU range and were moderate in fuel loading. Four sites were in the light range with 0 to 500 levels for BTU's per square foot. How this modeling translates into temperature levels and duration time for burning has not been worked out. It can be inferred given these general results that higher BTU levels, which corresponds to heavier fuel loadings, will have the potential to produce high temperature levels for longer periods of time. This could produce the conditions necessary to have adverse thermal effects to chert and obsidian artifacts on sites within the watershed and particularly those along South Fork Mountain.

Issue #5: Human Uses and Values

Key Question 5.1 What are the impacts of recreation on heritage resources?

The portion of South Fork Mountain within the Hyampom Watershed has 20 recorded sites. Six of those sites are being used or have been used as dispersed camping sites. Recreation use on these sites has resulted in physical damage to site integrity, damage to artifacts, and probably some loss of artifacts from collecting. This is an inference and is not based on research using a baseline to show how much damage has occurred. This inference is based on observation at each of the sites in question and professional experience from other sites where recreational use has created adverse effects on heritage resources. However, of the six sites, approximately 30%-50% of the site area has been impacted by recreation. These effects have not reduced the integrity of these sites in a way that would make them ineligible for registry in the National Register.

Key Question 5.2 How do ownership patterns in the watershed affect our ability to improve conditions in the watershed?

The Hyampom watershed is characterized by 52 percent private inholdings managed primarily by the timber industry. National Forest System land in the watershed are primarily on the west and east sides of the watershed, with private timber industry land in the center. There is no connectivity between the National Forest System lands on the west and east sides of the watershed (see Figure 1).

Timber industry land is generally managed on a rotation for optimal wood fiber production. In many ways, timber harvest mimics natural disturbance, by thinning out suppressed or overcrowded trees (pre-commercial thinning, thinning from below, intermediate Shelterwood cuts) or resetting seral stages to early or mid seral (such as a clear cut or final removal cut); however, the intensive level of management on the private timber industry land, and the relatively high proportion of timber industry ownership in the watershed, results in relatively high disturbance levels within the watershed. In addition, the private timber lands are unlikely to provide late seral habitat, causing fragmentation and lack of connectivity between late seral stands on National Forest System lands in the eastern and western sections of the watershed.

The Forest is only able to improve conditions on National Forest System lands, and has little influence over what happens on private timber lands; therefore, the Forest's ability to improve conditions in the watershed is limited. The Forest does not have the ability to improve connectivity between the western and eastern sides of the watershed, and the ability to improve water quality conditions in the watershed is also limited due to the large proportion of lands being intensively managed by private timber industry.

Key Question 5.3 What role does the transportation system, in particularly the decision in Travel Management Subpart B, play in access to the area?

Roads into and within the Hyampom Watershed are limited. Both authorized and unauthorized off-highway vehicle (OHV) use has occurred in the watershed. Travel Management, Subpart B authorized one route. Route SW256 (Mill Creek), adjacent to Road 6N01, is a short spur road used for dispersed camping and was authorized by the Travel Management Subpart B process. This camping area is used primarily by hunters in the fall. Other dispersed camping areas are not currently authorized for use, unless they are within one vehicle length from authorized roads.

Although a low road density provides access challenges for recreationists wishing to enter the watershed, it has an associated beneficial effect of providing non-motorized recreation areas for those seeking this type of outdoor experience. The limited number of roads in the watershed may also pose management challenges regarding access for implementing planned treatments (e.g. timber harvest) or unplanned events (e.g. wildland fire).

Issue #6: Terrestrial Wildlife Habitat and Species

Key Questions 6.1 and 6.2 What is the amount and condition of Late Successional Old Growth (LSOG) habitat within the watershed including the effects from past fire?

The Terrestrial Wildlife Habitat and Species key questions focus on the late-successional wildlife habitat for a number of reasons:

- Conifer forest vegetation types dominate the watershed (see Figure 5).
- Early seral, hardwood, and shrub habitat types recover relatively quickly from disturbance whether anthropogenic or natural. Conversely, late-successional—especially the old-growth subset can take over 80 years to recover from disturbance.
- Our management activities are typically designed to avoid significant impacts to riparian, aquatic, hardwood, chaparral, or cliff/cave/talus/outcrop habitat types.
- Cliff, cave, talus and rock habitats occupy relatively small areas and thus typically require very site-specific assessment and protection/maintenance measures that are most appropriately addressed at the project-level rather than a landscape scale (i.e., watershed).
- Small openings, snags, logs, and hardwoods (individual hardwoods, not hardwood stands) are key habitat components within the larger matrix of late-successional habitat.

Late Successional and Old Growth Habitat Analysis

The analysis of late-successional habitat that follows will focus on the "Provide for retention of old-growth fragments in watersheds where little remains" Standard and Guideline (the 15% old growth retention Standard and Guideline of the Forest Plan page 4-62 and 4-63; Northwest Forest Plan Record Of Decision page C-44 and C-45) for the following reasons:

The 15% old growth retention Standard and Guideline (S&G) is the only Forest Plan direction specific to old-growth outside of areas set aside for species associated with this habitat type (i.e., Late-Successional Reserves).

Like a Watershed Assessment, this S&G applies to the Planning Watershed scale (previously referred to as 5th field watershed under the Northwest Forest Plan).

The analysis of this S&G allows for an efficient assessment of the general habitat conditions for species associated with older forest ecosystems such as the Federal Endangered Species Act listed northern spotted owl.

The 15% old growth retention S&G sets a threshold of concern at 15% of habitat in late-successional[22] stages on Federal Forest Land[23] within a watershed. The first paragraph of the S&G describes the importance of old-growth[24] habitat in providing for biological and structural diversity across the landscape and goes on to state that it is prudent to retain what little remains of this age class (i.e., old-growth) within landscapes where it is currently very limited. Nonetheless, the second paragraph of the S&G makes it clear that late-successional (including both mature[25] and old-growth) constitute the numerator in calculating the percentage of Federal Forest Land (i.e., the denominator) meeting this S&G.

This assessment is based upon the assumption that all size class 3 stands are mature stands. Size class 4 stands with an S or P canopy are classified as mature because it would be misleading to type them as 'old-growth'. Older mature stands with relatively high canopy closure (e.g., "Vegden" G and to a lesser extent N) often provide suitable habitat for species associated with old-growth forests. For instance, 3G stands and 3N stands are considered spotted owl moderate quality Nesting/Roosting habitat, and foraging habitat respectively, and 3P, 4P and some 3S and 4S stands provide spotted owl connectivity (dispersal) habitat.

The Forest Plan database (LMP-90 database) was used to complete this assessment. The analysis is based on this database for a number of reasons, including:

The LMP-90 database is the foundation of the Spotted Owl Baseline Habitat Database which was developed collaboratively with the U.S. Fish and Wildlife Service for analyzing habitat conditions related to the northern spotted owl.

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[22] ***Late-Successional Forest -*** Forest seral stages that include old-growth and mature age classes.

[23] ***Federal Forest Land -*** Federal land that is now, or is capable of becoming, at least 10 percent stocked with forest trees (i.e., conifers) and that has not been developed for non-timber use. This acreage is the base (denominator) used to calculate the 15 percent retention Standard & Guideline. Within the watershed Forest Service land of the forest types (LMP-90 database "*Vegtype1"*) Douglas-fir, plantation, white fir, red fir, ponderosa pine and mixed conifer qualify as Federal Forest Land. Plantations are assumed to be early seral stage Douglas-fir in this assessment rather than a distinct 'vegetation type'. Federal Forest Land that is not currently suitable spotted owl habitat is considered 'capable' owl habitat.

[24] ***Old-Growth*** – A forest stand usually at least 180-220 years old with moderate to high canopy closure; a multilayered, multispecies canopy dominated by large overstory trees; high incidence of large trees, some with broken tops and other indications of old and decaying wood; numerous snags; and heavy

[25] ***Mature Stand*** – A mappable (>10 acres) stand of trees for which the annual rate of growth has peaked; generally greater than 80 years old but not yet old-growth. Mature stands generally contain trees with a smaller average diameter, less age class variation, and less structural complexity than old-growth stands of the same forest type.

As opposed to the Spotted Owl Baseline Habitat Database, the LMP-90 database allows the stratification of old-growth from the more generalized overall owl nesting/roosting habitat.

Other specialists such as silviculture and fire/fuels are familiar with the LMP-90 database and its terminology and can thus use the results of this analysis when integrating with their work.

LMP-90 Database Assumptions

The Forest Plan database (LMP-90 database) is the best existing and available tool for vegetative analysis of Forest Service land within an area as large as the Hyampom Watershed. Using this database to analyze existing vegetative conditions as they relate to LSOG ecosystems requires a number of basic assumptions that long-term local experience suggests are valid for analyses at this scale. The information available in the LMP-90 database represents aerial photo interpretation from 1975 photos. The interpretation was conducted with primarily timber production interests in mind. In 1990 and 1992 the database was updated to include recent harvest units (i.e., plantations) and stand replacing fires. Stand attributes in the database used to infer potential and existing late-successional forest conditions were: vegetation type (LMP-90 database Vegtype1), crown size (LMP-90 database Vegsize), canopy closure (Vegden).

Vegtype 1: Within the Hyampom Watershed only "commercial conifer" types typically have the potential to provide habitat for species associated with old-growth conifer forests. That is to say, only these types move through the successional stages resembling those described on pages B-2 through B-4 in the ROD and develop LSOG stand structure and composition as described on page B-2 (and the Glossary) of the ROD. Within the watershed these types (Vegtype1) include: Douglas-fir, plantation, white fir, red fir, ponderosa pine and mixed conifer. These types qualify as Federal Forest Land. Nonconifer and noncommercial conifer types almost never achieve the size, canopy closure, or generally complex vertical structure associated with old-growth habitat.

Vegsize (crown diameter size class): Size classes included in the LMP-90 database are a reasonable indicator of general stand age and their use is an available and reasonable tool for estimating seral stage development over large areas. Size classes are also used as the major indicator of the level of decadence within stands (e.g., snags, logs, broken-top trees, etc.) since decadence is largely a function of stand age. That is to say, stands with larger trees are typically older than stands with smaller trees. Size class 4 (or greater) are typically old enough to have developed attributes of old-growth conifer forests. Stands in size class 3 on sites highly capable of growing trees often are at least 21 inches dbh (diameter breast height) considering growth since 1975. Generally, if these stands are a result of natural regeneration (e.g., having developed after a stand replacing fire as opposed to past clearcutting) they include legacies from the previous stands (e.g., large trees, snags, logs, etc.) and likely provide at least some of the ecological roles of old-growth.

Vegden: Moderate to dense canopy closure is typical of LSOG in the Hyampom Watershed. Local experience strongly suggests that canopy closure classes N & G typify current LSOG habitat. These classes were originally assigned based on predominant crown cover of only commercial conifer overstory species. When the understory component is included along with 30+ years of growth these two classes commonly have a total canopy closure above 60 percent. In addition, the understory increases the complexity of vertical structure (an important attribute of LSOG in the area). Infrequently, class P and S stands may also provide LSOG conditions but would require stand-by-stand field verification (not practicable at a large landscape level).

Amount and Condition of LSOG Habitat Within Watershed

The Hyampom watershed includes a variety of basic vegetation types of which about 10,580 acres qualify as Federal Forest Land (Figure 30). Table 17 presents the current conditions of this land related to size class and canopy closure. Federal Forest Land in the watershed is dominated by 7,722 acres of mature (i.e., crown size class 3[26]) forest. Old-growth (crown size class 4, canopy closure class N/G[27]) comprises only 961 acres or roughly 9% of the Federal land. If moderately dense to dense canopied, mature forest (late-successional) is included, the total rises to roughly 59 percent. Figure 31 displays the proportion of old-growth and mature forest that provides for meeting the 15% old growth retention S&G, and includes effects of fires to late-successional habitat (see discussion below).

[26] **Crown Size Classes:**

0 = shrub, forb, grass, noncommercial conifer, hardwood, and nonvegetated (no LSOG potential).
1 = 0-5 foot crown diameter, seedling sapling; stand establishment stage; includes most contemporary plantations.
2 = 6-12 foot crown diameter, poles; growth and maturation with little or no natural thinning; includes minor acreages of contemporary plantations.
3 = 13-24 foot crown diameter, small to medium timber; continued growth and maturation and beginning natural thinning (current mature forest).
4 or greater = >24 foot crown diameter, large sawtimber; transition stage (current old-growth forest).

[27] **Canopy Closure Classes:**

S = <20%, P = 20-39%, **N** = 40-69%, **G** = $\geq$70%

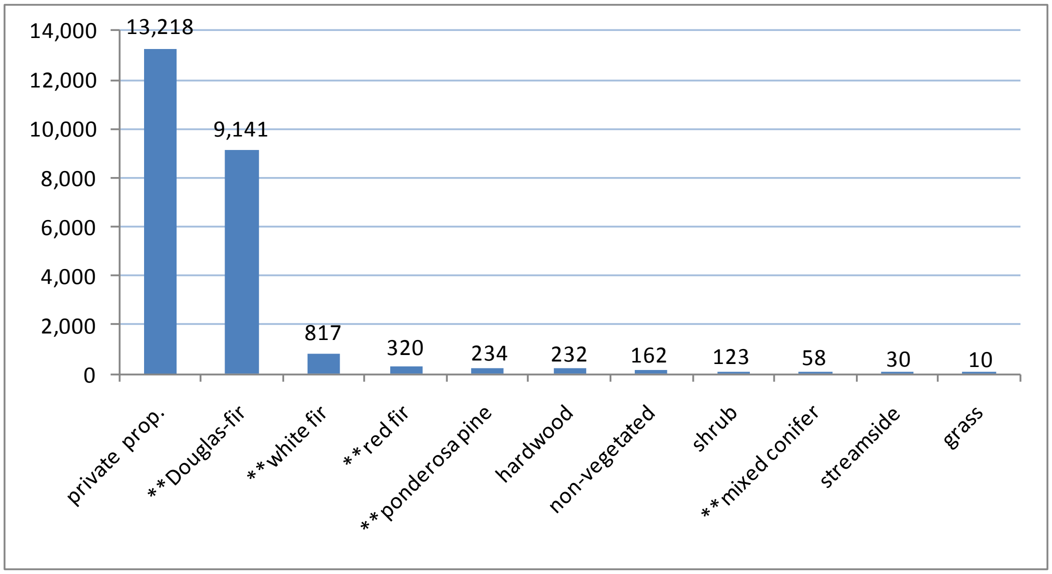

Figure 30. Major vegetation types in the Hyampom watershed. Vegetation types that qualify as Federal Forest Land (double asterisked labels) total about 10,580 acres which is the denominator in calculating the 15% S&G. Private property is included to display its dominance in the watershed even though it cannot be Federal Forest Land and is thus not germane to the 15% S&G.

Table 17. Size Class and Canopy Closure distribution within the Hyampom watershed. Includes only federal land that is now, or is capable of becoming, at least 10 percent stocked with conifer trees (i.e., Federal Forest Land) and that has not been developed for nontimber use (10,580 total acres). The effects of past fire is not included in this table (see below).

Size Class	Canopy Closure				
	G	**N**	**P**	**S**	**Total**
>4	850	111	0	0	**961**
3	2,485	2,821	1,594	822	**7,722**
2	128	737	62	0	**927**
1	25	891	17	38	**971**

4N/G – old-growth; high quality northern spotted owl nesting/roosting habitat;
3G – dense late-successional; moderate quality northern spotted owl nesting/roosting habitat;
3N – moderately dense late-successional; low quality northern spotted owl nesting/roosting habitat (i.e., foraging habitat);
3&4 S/P goes toward meeting the 15% S&G but does not provide northern spotted owl nesting, roosting, or foraging habitat.

Effects of Fire to Late-Successional Habitat

Our fire burn severity GIS database[28] indicates that six wildfires have burned within the Hyampom Watershed in the last 27 years (analysis time frame 1984-2009). These fires include the Blake Fire (1987; 112 acres), Gulch Fire (1987; 16 acres), Jessie Fire (1987; 428 acres), Sims Fire (2004; 2,391 acres), Half Fire (2008; 33 acres) and the Slide Fire (2008; 1,220 acres). Of the roughly 4,200 acres burned, only about 918 burned in late-successional habitat and with high enough intensity whereby late-successional habitat was likely reduced to being Federal Forest Land (earlier seral forest) that does not currently contribute to meeting the 15% S&G. None of the high-intensity fire involved old-growth.

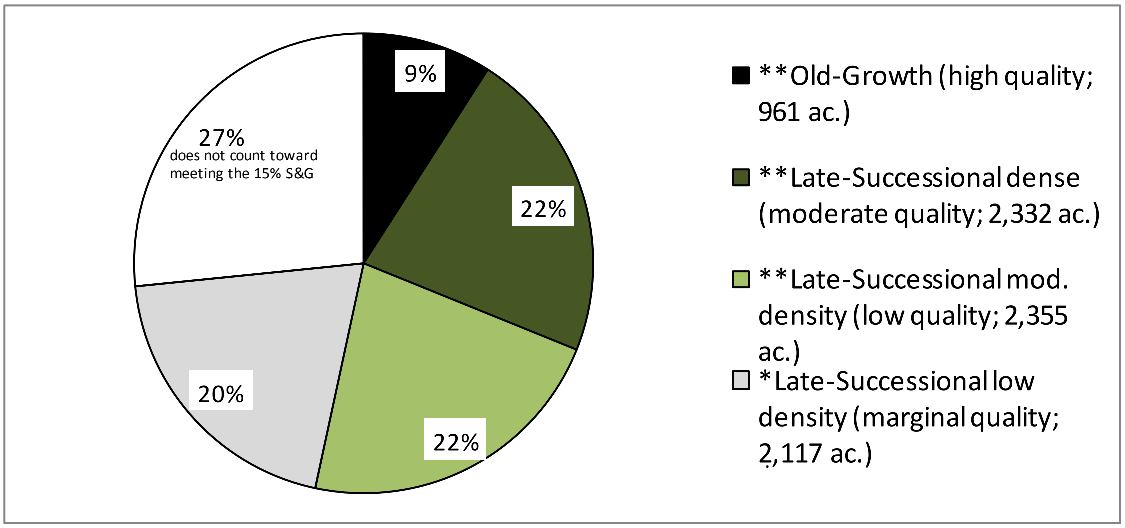

Figure 31. The percentages of Federal Forest Land that is currently late-successional forest in the Hyampom watershed segregated by relative habitat quality (top to bottom from best to worst). The percentages are based upon 10,580 acres of Federal Forest Land. Habitat types that currently contribute to meeting the 15% S&G and provide suitable northern spotted owl habitat are marked with double asterisks. Habitat types that currently contribute to meeting the 15% S&G but do not provide suitable northern spotted owl habitat are marked with one asterisk. The remaining Federal Forest Land habitat includes younger stands that do not yet count as late-successional. This chart includes the effects of high to moderately high intensity fires that likely removed late-successional habitat (i.e., down to Federal Forest Land).

[28] T:\FS\NFS\ShastaTrinity\Program\1900NatlResourcePlng\GIS\Workspace\lshoemaker\VegBurnSev

Chapter 4 - Desired Conditions

Issue #1: Forest Health

Historic forest vegetation condition within the watershed analysis area was primarily dominated by larger diameter pine, Douglas-fir, and true fir stands. Late seral stands probably dominated most of the watershed areas, with patches of younger stands established following fire events or landslides. Periodic surface fires would have burned the understory of many stands, thinning out some stems and clearing accumulating fuel, thus preventing a large fuels buildup.

Changes to structure of the vegetation in the analysis areas can be attributed to two main factors: timber harvesting (primarily on privately owned lands), and high intensity stand replacing fires. About 100 years ago, the policy toward fire suppression began to change forest conditions by allowing development of an understory of smaller trees and brush to become established in many areas due to the absence of the periodic fires that had previously kept such growth in check. 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 few decades. On the north and east portion of the watershed, high intensity burn areas suitable to support conifer stands are now dominated by brush. Fire suppression efforts also allow the buildup of weaker, damaged, diseased and insect-infested trees that the periodic fires would have helped eliminate.

In the South Fork Mountain Management Area (Area 20), forest stand densities should be managed at levels to maintain and enhance growth and yield to improve and protect forest health and vigor recognizing the natural role of fire, insects and disease and other components that have a key role in the ecosystem. Stand understories would be more open with less ingrowth, particularly in stands on sites where wildfire plays a key role in stand development. Stand density targets depend upon species, site quality, stand age and stand objectives (Forest Plan, pg. 4-162).

South Fork Mountain Ridge-top

The desired future condition of forest health conditions on South Fork Mountain includes reduced sources of dwarf mistletoe and *Cytospora* infection and endemic levels of disease in residual mature red fir and mixed conifer stands, as well as a young cohort of red fir and mixed conifer stands uninhibited by excessive levels of disease. In mature forest stands, the desired condition also includes stand densities ranging from 120 to 200 square feet/acre (depending on species composition and site quality, as red fir can withstand higher stand densities before experiencing competition stress than mixed conifer species). In young stands and plantations, the desired future condition includes maintenance of stand densities such that saplings and small diameter trees can increase individual vigor and outgrow infection.

East Side of the Watershed

The desired future condition of forest health on the east side of the Hyampom watershed includes residual stand densities such that endemic levels of disease and insect activities have a low probability of building to epidemic levels. This is achieved when stands have the available resources (water, nutrients, sunlight, etc) to allow individual trees to thrive and defend against infection and infestation.

Commercial timber harvesting in the past decade has been very limited, especially compared to the previous decades going back to post World War II when commercial timber harvesting started on a significant scale. The only recent (last 20 years) harvesting has been sanitation-salvage timber removal on South Fork Mountain. Sanitation-salvage timber sales target dead, dying, and diseased trees. The absence of relatively frequent, low intensity fires in the analysis area has most likely contributed to overstocked conditions and a higher than normal incidence of dwarf mistletoe infestations, which in turn exposes the weakened trees to attack by insects and other pathogens.

Issue #2: Aquatic Systems

Fisheries

The current conditions of the watersheds found within the Hyampom watershed, including the main stem SFTR, do not represent desired conditions for anadromous fishes.

The desired condition for anadromous fish populations would include an increased abundance of Spring-run Chinook salmon, coho salmon, and summer-steelhead to pre-1964 population estimates. Anadromous fish would also have full and unfettered access to areas naturally available to them.

Due to the geologic instability of the upslope areas within and surrounding the Hyampom watershed, combined with timber harvest activities, the channels have excessive fine sediments. The desired conditions for the streams found within the Hyampom watershed include: reduced fine sediment levels to levels that do not impact spawning or rearing conditions for anadromous and resident fish; increased LWD recruitment through enhanced riparian vegetation conditions; increased amounts of mature riparian vegetation to provide ample stream shading in order to provide cover for fish and limit solar heating potential; suitable water temperatures for spawning and rearing fishes during the critical summer period; and reduced timber harvest activities until channel equilibrium is achieved again.

Hydrology

Direction and requirements for desired conditions for water quality and watershed health have been developed in the Forest Plan as amended by the Northwest Forest Plan (USDA Forest Service, 1994),the North Coast Water Quality Control Board (NCWQCB) and the TMDL created by the USEPA in 1998. The desired condition for the planning watershed is a hydrologic system that has no decrease in beneficial uses and improves, or at the very minimum, maintains water quality for multiple objectives.

Desired conditions from the Forest Plan are to maintain or improve water quality and quantity to meet fish habitat requirements and domestic use needs, and maintain water quality to meet or exceed applicable standards and regulations. To attain this condition, beneficial uses as designated by the NCWQCB must be protected or enhanced.

The NCWQCB lists the SFTR and all of its tributaries as having multiple beneficial uses (NCRWQCB, 1994). Table 18 explains the three beneficial uses that are listed in the TMDL and have the greatest sensitivity (USEPA, 1998).

Table 18. Beneficial Uses of Water

Beneficial Water Uses	Description
Cold Freshwater Habitat (COLD)	Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitat, vegetation, fish or wildlife, including invertebrates.
Migration of Aquatic Organisms (MIGR)	Uses of water that support habitat necessary for migration or other temporary activities by aquatic organisms, such as anadromous fish.
Spawning, Reproduction, and /or Early Development (SPAWN)	Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.

Water quality objectives that will help obtain the desired conditions are described in Table 19. Specific temperature objectives have not been established at this time. Typically, a stream with proper sediment regime will have stable and appropriate temperatures.

Table 19. Water Quality Objectives

Water Quality Objective	Narrative Objective Description
Settleable Material	Water shall not contain substances that result in deposition of material that causes nuisance or adversely affect beneficial uses
Sediment	The suspended sediment load and suspended sediment discharge rate of surface water shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.

Issue #3: Erosional Processes

Some management techniques could reduce the risk of erosion:

- Increase soil cover by lopping and scattering fuels especially on south and west facing slopes;
- Mastication of brush fields instead of burning to retain soil cover and return nutrients;
- Limit displacement and burning of critical topsoil that contains the bulk of renewable nutrients.

Issue #4: Fire and Fuels

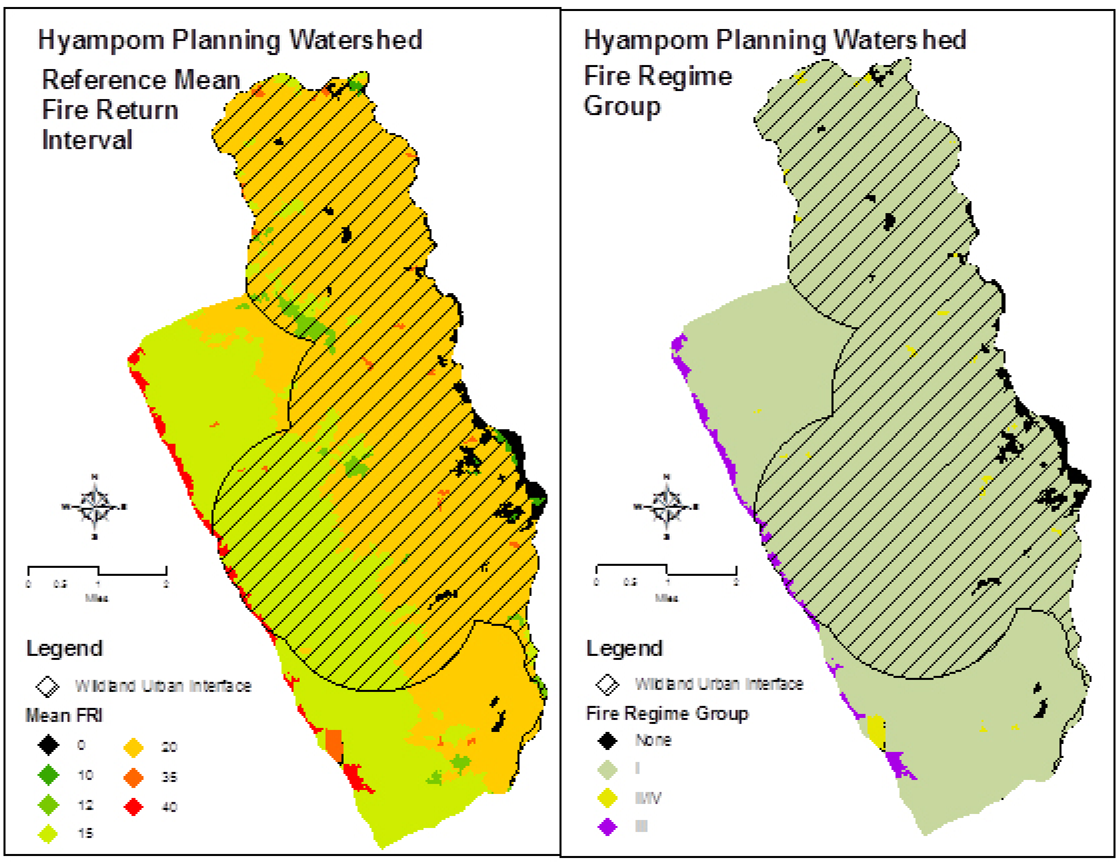

Figure 32. Reference mean fire return intervals (left) and fire regime groups (right) based on vegetation types in the Hyampom watershed.

Fire is a persistent ecological process throughout the Klamath Mountains. Most of the vegetation types within the watershed are classified as Fire Regime I. Prior to fire suppression, Fire Regime I burned frequently with low to moderate severity fire effects (Figure 32). Areas classified as red fir are classified as Fire Regime III, which burns less frequently and has a wider range of fire effects compared to Fire Regime I. Considering all of the fire regimes represented, the mean fire return interval varies from 10 to 40 years (Figure 32) (USDA Forest Service, 2010a).

Research studies have examined the relationships between fire severity and the complex terrain of the Klamath Mountains. The upper third of slopes including ridge tops typically burn with greater frequency and higher severity burns, especially on south and west aspects (Weatherspoon and Skinner, 1995; Taylor and Skinner, 1998; Skinner et al., 2006). Low-severity fires often occur on the lower third of slopes and on north and east aspects. Fire effects in the middle third of slopes are variable between those found on the lower and upper slopes. These conditions often result in persistent montane chaparral, serotinous species, and/or young even aged stands where high-severity effects dominate and multi-aged conifer stands with higher densities of older trees and late-successional forest structure where low-severity effects dominate (Skinner et al., 2006, Taylor and Skinner, 2003). The Mediterranean climate and fire frequency within the Klamath Mountains would have made it unlikely that much downed woody material was able to fully decompose prior to fire suppression (Skinner, 2002). This suggests that fire played a major role in removing downed woody material (Skinner, 2002).

Effective fire suppression has resulted in fire being reduced or eliminated from many areas of the watershed. Current mean fire return intervals range from 33 to 100 years. This has created an uncharacteristically dense forest and high fuel loadings. When recent fires have burned under stable atmospheric conditions, including under thermal inversions, severity patterns were similar to historical patterns (Taylor and Skinner, 1998); however, when fires have burned with high winds paired with low humidities, or after the inversion breaks, large areas can burn at high severity (Skinner et al., 2006). Therefore, the desired condition is a fuel and vegetation condition that would be conducive to restoring fire to its natural role in the ecosystem. The Hyampom community as well as the abundance of private land may prohibit land managers from allowing fire to play a fully natural role in these ecosystems. However, if fuels and vegetation conditions were restored to a condition that would allow fire to burn, it is likely that if a wildfire occurs the fire effects would be similar to the low- to mixed- severity effects of the historic fire regime. Activities which are under the Forest's control will be coordinated with affected landowners and control agencies (USDA Forest Service, 1994).

Issue #5: Human Uses and Values

There are two primary desired conditions for heritage resources in the watershed. One is to limit or mitigate the potential of wildland fire to damage the archaeological sites along South Fork Mountain. The same issue although not as acute applies to the sites located along the South Fork of the Trinity River. Second, the impact of dispersed camping recreation use on the South Fork Mountain sites needs to be addressed. The river sites have not suffered the same impacts from recreation.

Issue #6: Terrestrial Wildlife Habitat and Species

The desired condition for wildlife habitat in the Hyampom planning watershed is late-successional and old-growth stands that are sustainable with natural levels of wildfire or insect/disease outbreaks; and conditions that provide relatively high quality habitat for late-successional and old-growth related species including the Northern spotted owl, Northern goshawk, and Pacific fisher. At a minimum 15% of habitat within the watershed should be retained in late-successional and old-growth habitat. Federal Forest Land within Riparian Reserves should have the highest canopy cover sustainable (or be developing toward that condition) providing and augmenting high quality connectivity habitat for late-successional dependent species.

Chapter 5 - Management Options to Meet Desired Conditions

Issue #1: Forest Health

Current forest vegetation condition tends toward mid-seral stage stands on federally managed lands within the Hyampom watershed. Stands with tree diameters in the 11 to 24-inch range occupy approximately two-thirds of these watershed acreages. These stands are interspersed with somewhat larger diameter trees of late-successional stands, and early seral stage plantations. Many of the plantations are overstocked and are therefore susceptible to insect attack, especially during periods of drought that may weaken individual trees. These stands are prime candidate areas for intermediate silvicultural treatments including precommercial thinnings. Some of the larger diameter timber stands are exhibiting reduced growth characteristics, increased stress due to competition, and high fuel loading. These areas may provide opportunities for thinning from below in order to reduce risk of habitat loss due to high intensity wildfire and increased resources to residual trees.

The reintroduction of low intensity, more frequent fires that more closely mimic the naturally occurring fire regime could benefit the health of existing forest by culling out weakened or diseased trees and reducing moisture competition in overcrowded stands. This can also be accomplished through prescribed burning or through hand/mechanical thinning and piling in areas where wildfire risks are high or where commercial timber can be successfully harvested in the operation.

South Fork Mountain Ridge-top

In the absence of management, pure red fir stands will continue to degrade due to dwarf mistletoe and *Cytospora* infection in the canopy, which in turn will infect the understory, impairing growth and maturity of replacement trees. It is likely that high fuel loading due to ongoing mortality will lead to stand replacing wildfire. In the event of a stand replacing wildfire, large brush fields (especially *Ceanothus* sp. and manzanita sp.) will likely dominate for decades before natural fir regeneration can be re-established (Burns and Honkala, 1990).

In order to improve forest health conditions on South Fork Mountain ridge-top, there must be a reduction in levels of dwarf mistletoe within residual red fir trees. Reduction in dwarf mistletoe levels will in turn lead to a reduction in the impacts of *Cytospora* canker and fir engraver beetle attacks, thus increasing stand diversity and vigor. Specific prescriptions should depend on the current species composition and structure of stand, and level of dwarf mistletoe present (See Table 20).

Table 20. Silviculture Treatments Appropriate in Dwarf Mistletoe Infected Stands

Level of Dwarf Mistletoe Infection	**Recommended Stand Treatments**
High	Clearcut with site preparation and regeneration Group selection
Moderate to High (overstory) with low to moderate levels in understory	Overstory removal or shelterwood treatment Group selection Understory precommercial sanitation thin
Low to Moderate	General sanitation thinning

The objective should not be to completely eradicate the dwarf mistletoe, but rather to reduce the mistletoe to a level that will promote stand growth and vigor and prevent the stands from unraveling in the future. General recommendations for treatments are as follows (Angwin 2010):

- Treatments should promote species diversity and non-host species wherever possible. In areas where red fir is infected and white fir is not, white fir may be retained as a non-host species. Where white fir is infected and red fir is not, red fir may be retained.
- To reduce spread of dwarf mistletoe from infested upper to uninfested lower stand levels, promote single-storied stands wherever possible.
- To minimize spread of dwarf mistletoe into treated stands, treated areas should be as large as possible and adjacent (as much as possible) to uninfested or non-host type areas, or along natural barriers such as roads or meadows. Concentrated planting (reforestation) of non-host species within 25 to 50-feet of adjacent infected residual stands.
- Thinning in the overstory should concentrate on removing trees with the highest dwarf mistletoe ratings (DMRs) and lowest crown ratios. Whenever possible, strive to retain mostly 0-2 DMR firs while maintaining adequate stocking. When this is not possible, planting may be considered.
- Thinning should be done to a level where the resulting vertical growth of remaining host species is faster than the vertical spread of the dwarf mistletoe. In general, vertical tree growth should be at least three inches per year (preferably more).
- As Heterobasidion root disease (*Heterobasidion occidentale*) has been observed on South Fork Mountain, treatment of freshly cut stumps 14-inches diameter or larger with a borate compound immediately after cutting is recommended to avoid the creation of new Heterobasidion root disease centers.

- Precommercial thinning of existing plantations should be accomplished to reduce developing stand densities and promote stand health and vigor.
- Recognize multiple entries will be necessary (~20s apart) to sustainably improve forest health on the ridgetop while maintaining native residual seed sources.

East Side of the Watershed

While portions of the east side of the Hyampom watershed is allocated to AMA with a Commercial Wood Products emphasis and consists stands classified as overstocked, the sensitive nature of the watershed and the impacts in the mid to upper slope due to vegetation management on privately owned timber lands present a low-priority for wood product commodity vegetation management. However, management opportunities are present, and reducing stand density to more historic levels generally improves forest health by increasing resilience to insect and disease.

Plantations

Some of the plantation tree plantings in the analysis area have been very successful to the extent that they are currently overstocked. These areas would benefit from pre-commercial thinning in order to reduce developing stand densities thereby improving overall health and resiliency to insect and disease as well as stand replacing wildfire.

Mature forest

Many of the mid-late successional forest areas are comprised of a single story canopy. In order to promote the development of late-successional habitat and improve resiliency to wildfire and insect and diseases, intermediate timber harvests and individual selection harvesting would speed the development of larger diameter trees, promoting multistoried stands. Prescribed burning can also be used to reduce fuel loading and promote biological diversity through disturbance. Some areas that have understory growth and accumulated high quantities of fuel may need pretreatment before prescribed burning. In these areas thinning or biomass removal may be required.

Issue #2: Aquatic Systems

Fisheries

The Hyampom watershed, covering 24,336 acres, is comprised of approximately 48% public lands while the remaining 52% is held privately. The high levels of private lands limits the management opportunities to increase fish populations or improve habitat conditions. The anadromous waters within the Hyampom watershed occur primarily on private lands in the southern portion of the Hyampom watershed, with the exception of the reach of the SFTR below Big Slide Creek. There are some management opportunities that could improve existing conditions and move them more towards desired conditions.

One opportunity would be to increase the existing Riparian Reserve widths along tributary stream channels of the Hyampom watershed to limit disturbance to these geologically unstable areas. This would benefit those tributary streams within the Hyampom watershed as well as the main stem SFTR within the Hyampom watershed as well as downstream. Ideally, private landowners would be approached to gauge their response towards a stewardship approach to watershed management within the Hyampom watershed. Because water temperatures and water quantity are a continuing concern within the SFTR basin as a whole, the Forest Service should also seek to secure water rights where feasible within the Hyampom watershed to ensure adequate water for aquatic organisms.

Hydrology

1) Recommendations related to physical components (land and water) include the following:

- Develop a watershed recovery plan utilizing the detailed road inventories (the last remaining roads on federal lands were completed by North State Resources 2010). Collect data on road traffic levels and type of use.
- Consistent with the results of the roads analysis procedure and other management objectives reduce road densities with the goal of achieving densities less than three miles per square mile.
- Reduce road densities within riparian reserves and restore riparian reserves to properly functioning conditions consistent with ACS objectives. Evaluate opportunities to reconnect stream channels to the floodplain to reduce instream sediment storage, reduce channel widths, increase habitat complexity, and reduce impacts from flood events.

2) Reduce road-related erosion and sediment delivery to streams by:

- Closing unnecessary roads within the riparian reserves (target subwatersheds with high density of riparian roads).
- Upgrading segments of roads that have been identified as those which are potentially delivering sediment to streams.
- Eliminate or upgrade stream crossings in areas with high road-stream crossing densities.
- Evaluate the stability of roads on Galice Formation or South Fork Mountain Schist with slopes greater than 35%.

3) Road improvement considerations include:

- Convert native surfaced roads to gravel.

- Increase the frequency of drainage structures.
- Design roads to minimize interception, concentration, and diversion potential. Including measures to reintroduce intercepted water back into slow (subsurface) pathways by using out-sloping and drainage structures rather than attempting to concentrate and move water directly to channels.
- Evaluate and eliminate diversion potential at stream crossings.
- Design road-stream crossings to pass all likely watershed products, including woody debris, sediment, and fish, not just water. Current design specifications require stream-road crossings to accommodate a 100-year flood event.
- Consider landscape location, hillslope vulnerability, and orientation of roads when designing, redesigning, or removing roads.
- Design with failure in mind. Anticipate and explicitly acknowledge the risk from existing roads and from building any new roads, including the probability of road failure and damage to local and downstream resources that would result.

4) In areas burned in the 1987, 2004, and 2008 fires:

- Monitor, identify, and restore areas that are delivering sediment to streams.
- Target areas with roads in sensitive geology and high erosion hazard ratings

5) Update or develop the layers and GIS products to facilitate better and more efficient CWE.

Issue #3: Erosional Processes

Management options to meet desired soil resource conditions include the following treatment techniques:

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

Issue #4: Fire and Fuels

- Work with the local Fire Safe Council to implement recommendations made in the Trinity County Community Wildfire Protection Plan.

- Treat Forest Service land within ¼ mile of structures creating a defensible buffer between the structure and the surrounding wildland.
- Reduce surface and ladder fuels.
- Work with Six Rivers National Forest to establish a fuelbreak along South Fork Mountain ridge top.
- Reintroduce fire into the ecosystem.

Issue #5: Human Uses and Values

The potential adverse effects from wildfire along the South Fork Mountain sites should be addressed ideally by some sort of fuels reduction project. This may involve a larger vegetation management project treating the entire area along the ridgeline or directed specifically at each site. Excess fuel removal on these sites could utilize a combination of mechanical and hand work. The sites down along the South Fork of the Trinity River would benefit from a similar management plan.

Impacts from recreation to archaeological sites will require a different set of actions. The Forest has developed a motorized travel management plan that will help restrict vehicle movement off of designated routes. This action, if enforced, should reduce vehicle impact to several sites. Additional management actions could include test excavations and reevaluation of the sites being impacted by recreation. This work could identify if the areas damaged still have enough integrity in the cultural deposits to merit eligibility in the National Registry of Historic Places. Portions of the sites may be damaged to the point that they no longer contribute to the overall significance of the site and could be managed less intensively. Sites that have not yet been evaluated for registration eligibility should be evaluated, including the sites by the South Fork Trinity River. Protection level of the sites would be determined in this evaluation, thus potentially simplifying their management.

- Identify opportunities for long-term sustainable commercial livestock production on National Forest System lands with local livestock producers.
- Assess surface water resources and identify opportunities for water developments that benefit livestock production, wildlife, and improve riparian area protection.
- Consider opportunities for use of livestock for fuels reduction as a means to achieve fuels targets while also providing additional economic opportunities for rural communities.
- Consider opportunities for use of livestock for invasive plant species control as part of integrated pest management strategies while also providing additional economic opportunities for rural communities.

Issue #6: Terrestrial Wildlife Habitat and Species

The GIS database used for this analysis is an appropriate "coarse grain" tool for landscape level (i.e., planning watershed) analyses. At the project level, individual stands proposed for treatment should be examined to determine what ecological role they are filling related to old-growth habitat.

Consider silvicultural treatments designed to accelerate the development of old-growth habitat conditions in younger stands (e.g., plantations and size classes 2 & 3).

Consider silvicultural and/or fuels treatments designed to maintain and protect existing and developing old-growth habitat.

Apply prudence when considering any treatments in 4G and 4N (old-growth) stands. These stands are likely the highest quality old-growth habitat and currently comprise only about nine percent of the watershed. Prescriptions should be designed to maintain LSOG conditions to the extent practicable.

Determine the ownership of T3N, R6E, section 16. The LMP-90 database, the Forest 'visitor's' map, and the quad map (6521) show it as private while our GIS ownership coverage shows it as Forest Service.

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