Middle Fork Cottonwood Creek Watershed Analysis

Prepared by
USDA Forest Service
Pacific Southwest Region
Shasta-Trinity National Forest
Hayfork Ranger District

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The preparation of this document was based on existing data and is subject to change through clarification, omission, and/or addition of information. Watershed Iterations will be the manner by which necessary changes to this document will be disseminated.

Reviewed By:
/s/ *Donna F. Harmon*

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INTRODUCTION

Watershed analysis is used to characterize the human, aquatic, riparian, and terrestrial features, conditions, processes, and interactions (collectively referred to as "ecosystem elements") within a watershed. It provides a systematic way to organize, assimilate and disseminate existing information at the watershed scale. Watershed analysis is not a decision making document. Rather it places into context existing information pertinent for planning, project development, and regulatory compliance.

This analysis was issue driven. Rather than attempt to identify and address everything in the ecosystem, respective resource specialists addressed watershed-specific concerns, established how well or poorly processes are understood or functioning, and determined conditions under which management activities should or should not take place. By design, this process is iterative. This document will be updated as needed to address future issues not specifically addressed at this time. An attempt was made to conduct this analysis at a 5^{th} field watershed scale. However, approximately one-half of the Middle Fork Cottonwood Creek 5^{th} field watershed does not occur within the boundary of the Shasta-Trinity National Forest. Thus data sets are incomplete and for the most part, represent only information collected on the Shasta-Trinity National Forest and the analysis included within is specific only to Shasta-Trinity National Forest lands. The Bureau of Land Management is a stakeholder in the Middle Fork Cottonwood Creek watershed; however, they are in the early stages of compiling a resource information database.

CHAPTER I: Watershed Characterization:

Area Overview:

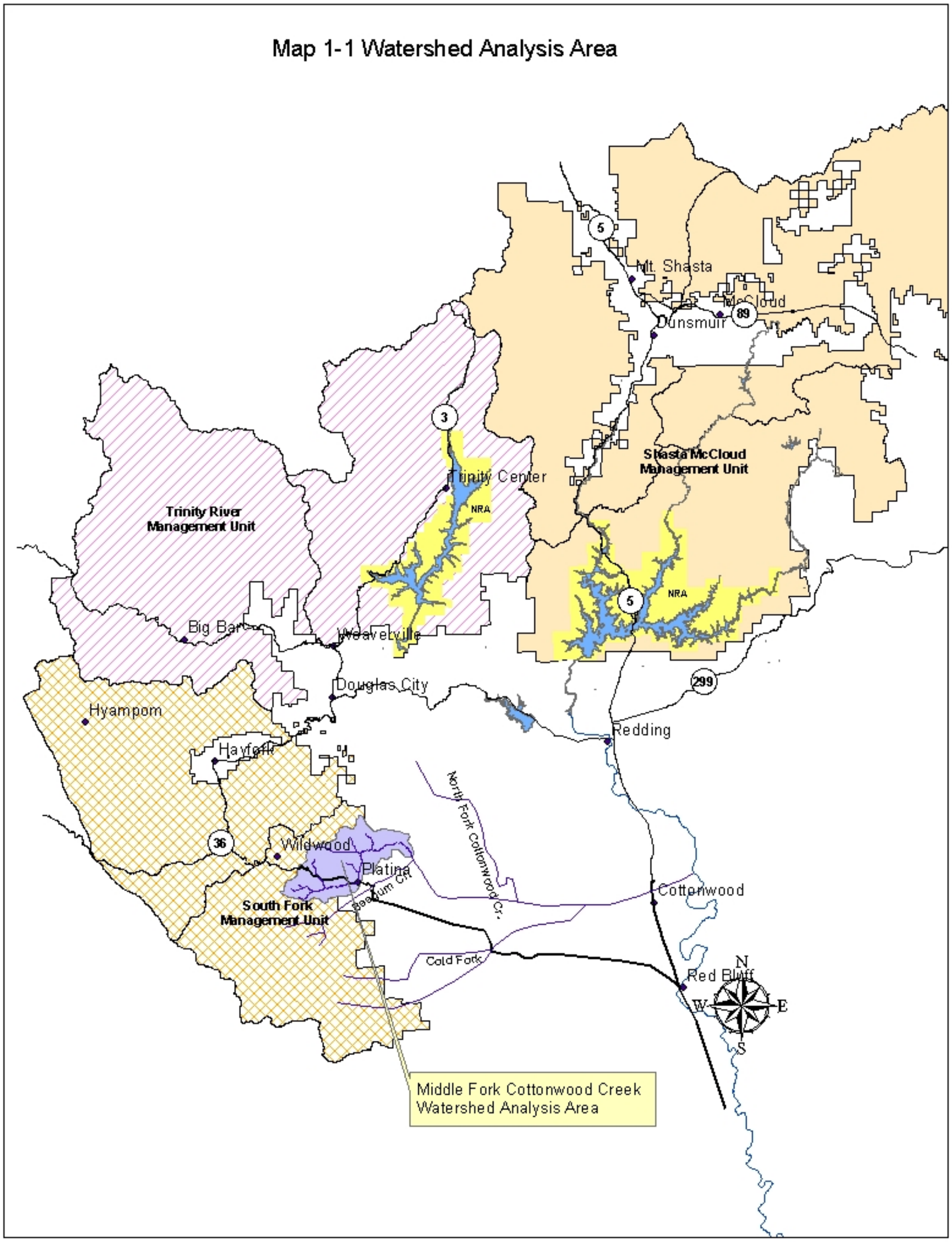
The Cottonwood Creek drainage lies within Shasta and Tehama counties on the northwest side of the Northern California's Central Valley. Cottonwood Creek and its three main tributaries (South, Middle and North forks) drain approximately 938 square miles prior to converging with the Sacramento River near the city of Cottonwood. The city of Cottonwood is approximately 16 miles north of Red Bluff along Interstate 5 (Map 1-1).

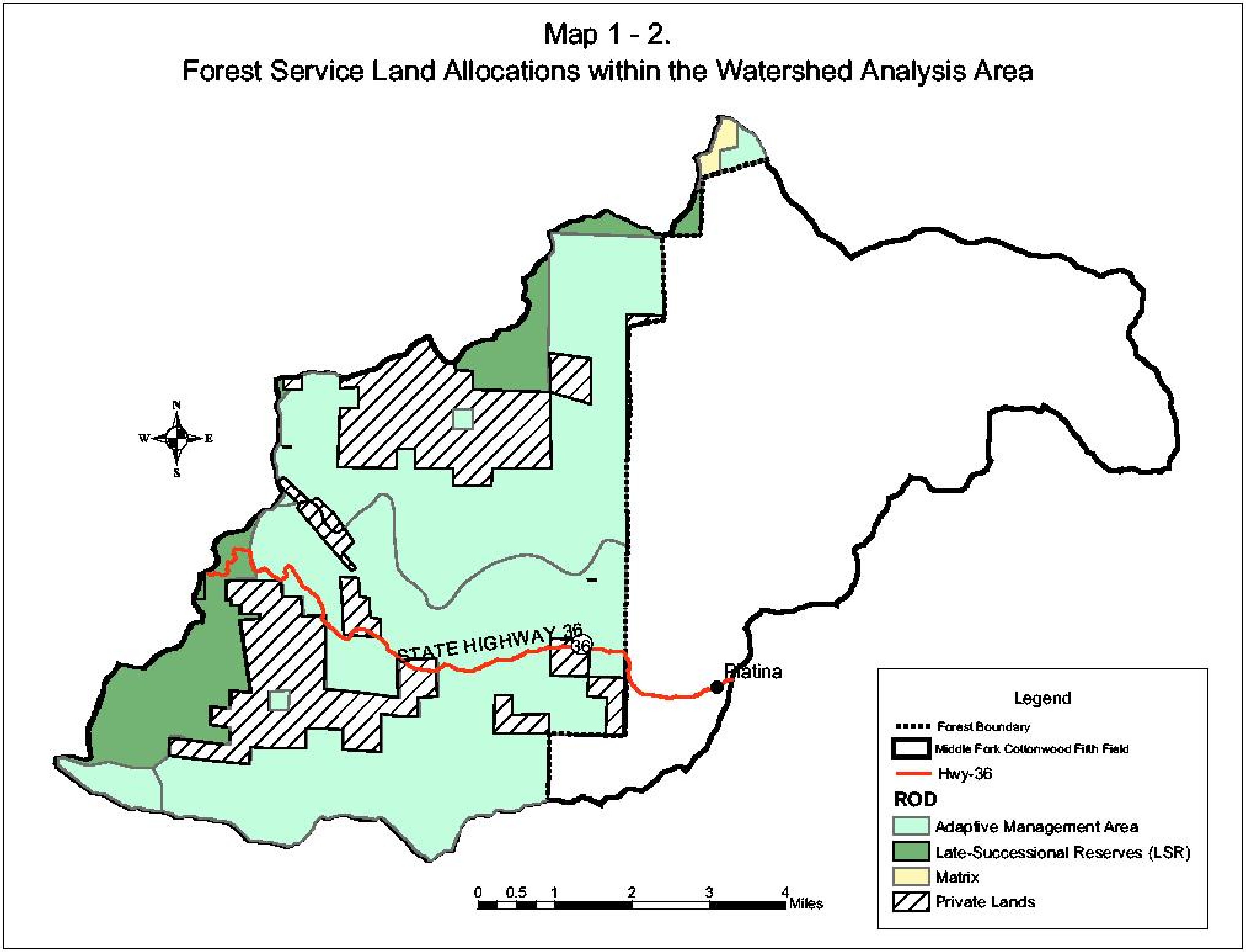
South Fork Cottonwood Creek and its tributary Cold Fork, are the main drainages in the southern half of the Cottonwood Creek watershed. Middle Fork Cottonwood Creek, its tributary Beegum Creek, and North Fork Cottonwood Creek are the other major drainages in the northern half of the watershed. Cottonwood Creek is the third largest watershed on the west side of the Sacramento River, and the largest undammed watershed in the northern Central Valley. The lower two-thirds of the Cottonwood Creek drainage area lies within the Central Valley uplands - the upstream portion includes the eastern slopes of the North Coast and Klamath mountain ranges and southern slopes of the Trinity Mountains.

Cottonwood Creek flows fluctuate greatly, subjecting the system to a wide range of environmental conditions. Cottonwood Creek has historically produced the largest peak flood flows in the Sacramento River system, is the second most turbid stream of all westside Sacramento River tributaries, and is the second largest contributor of gravel in the upper Sacramento River (CH2MHILL, 2001). The three main sediment sources are surface/sheet and rill erosion, head cutting (particularly in gullies located in the upper watershed), and channel erosion. Natural and man-made factors contributing to these sources include: grazing, timber harvest, cultivation, wildfires, off-road vehicular use, urbanization and roads (DWR, 1997).

Middle Fork Cottonwood Creek Watershed:

Middle Fork Cottonwood Creek 5th field watershed is 41,900 acres, of which 23,253 acres (55%) are public lands and 18,647 acres (45%) are private lands. Public lands are located primarily in the middle and upper portions of the watershed and are managed by the Forest Service (18,012 acres) and Bureau of Land Management (BLM) (5,240 acres). Forest Service land area designations within Middle Fork Cottonwood Creek watershed are: 15,839 acres in Adaptive Management Area (AMA); 6 acres in Administratively Withdrawn Area (AWA); 2,861 acres of Late-Successional Reserve (LSR), and (4,388) of Matrix (Map 1-2). The Shasta-Trinity Land and Resource Management Plan (LRMP 1994) designates the Middle Fork Cottonwood Creek watershed within the Beegum Management Area. Management prescriptions include roaded recreation and fish and wildlife habitat management of recreational sport species.


Map 1-1 Watershed Analysis Area
Mt. Shasta
McCloud
Dunsmuir
Shasta McCloud Management Unit
Trinity Center
NRA
Trinity River Management Unit
Big Bar
Weaverville
Douglas City
Redding
Hyampom
Hayfork
Wildwood
Platina
North Fork Cottonwood Cr.
Cottonwood
South Fork Management Unit
Cold Fork
Red Bluff
N
S
E
W
Middle Fork Cottonwood Creek Watershed Analysis Area
5
89
3
299
36



Map 1 - 2.
Forest Service Land Allocations within the Watershed Analysis Area
STATE HIGHWAY 36
36
Platina
Legend
Forest Boundary
Middle Fork Cottonwood Fifth Field
Hwy-36
ROD
Adaptive Management Area
Late-Successional Reserves (LSR)
Matrix
Private Lands
0 0.5 1 2 3 4 Miles
N
W
E
S

From the Sacramento Valley, Highway 36 provides recreational access to the southeast and southwest portions of the Shasta-Trinity National Forest, the Yolla Bolly and Chancelulla Wilderness Areas, and portions of the Six Rivers National Forest. Recreational activities along Highway 36 within the Middle Fork Cottonwood Creek analysis area include U.S. Forest Service (FS) developed camping at Basin Gulch near Harrison Gulch, and camping opportunities at the old Knob Peak Fire Lookout atop Knob Peak. These and undeveloped "dispersed camps" located throughout the analysis area are primarily used during summer and in the fall during the deer hunting season. The Shasta-Trinity National Forest also maintains the Yolla Bolla Ranger Station, fire prevention compound, and road maintenance equipment yard at Harrison Gulch.

Recreational fishing pressure is light and restricted to areas of the Middle Fork Cottonwood and Baker Flat creeks paralleling Forest Service roads and campground. Off-Highway Vehicle (OHV) use is increasing throughout the Shasta-Trinity National Forest. To date, the Forest has not drafted an OHV plan. However, this was a recommendation outlined in the Road Analysis Process (RAP) completed in 2002 for the nearby Knob Peak area, where OHV use is on the increase. Further, the Forest will be conducting RAP on the Middle Fork Cottonwood Creek Watershed in 2003, with a report to be completed in 2004. Thus, the reader is directed to these reports for recommendations specific to Forest Service roads in this analysis area.

The northern portion of the Middle Fork Cottonwood Creek watershed analysis area lies within the Trinity Mountain-Hayfork subsection of the Klamath Mountains Ecological Section of California (USDA, 1994). The watershed borders the Central Valley foothills, which experience a Mediterranean climate of wet, cool winters and hot, dry summers. The mean annual precipitation ranges from 30 to 45 inches with 90 percent falling between October and April. Snowfall is common above 3,000 feet, and rain-on-snow events occur down to 1,500 feet.

The analysis area is dominated by oak woodlands, scrub oak and chamise chaparral at lower elevations and on south-facing aspects, intermixed with a mixed conifer and pine forest at higher elevations, along riparian areas, and on all aspects except south. Large areas of chaparral are present, especially at the lowest elevations and throughout the eastern third of the watershed. Chaparral communities within the analysis area are naturally very dense and considered high fire hazard. Hot, intense fire is natural for chaparral communities as evidenced by having characteristics of prolific decadent branch material, common periodic dieback and top-kill, and possession of volatile oils (Barbour et al., 1987; USDA, 2001).

CHAPTER II: Identification of Resource Issues and Key Questions

Issue - Fire and Fuel Hazard Reduction

Key Questions:

- What are the current fire regimes and the major causes of fire?
- What are past and present vegetation conditions (struture and composition) and patterns? What is the existing fire hazard pattern? Are these a threat to forest health?
- What is the risk of catastrophic fire associated with Late Successional Reserves?
- What are the areas of concern with respect to wildland/urban interface, rural communities, and high value resources at risk to catastrophic fire? Which of these areas are of the highest priority for fuels reduction treatments and assistance for adjacent communities?
- What vegetation treatments are needed to reduce the risk of catastrophic fires? Which areas would benefit most from prescribed fires for fuel hazard reduction and terrestrial habitat improvement? What silviculture treatments are needed to reduce ladder fuels prior to prescribed fire to provide for post-fire stands that are healthier?

Issue – Wildlife Habitat Conditions

Key Questions:

- What are the current Northern spotted owl (NSO) dispersal corridors, are they effective, and can they be improved? How do we meet Standard & Guidelines objectives for 15% Late-Successional and Old-Growth Retention into the future?
- What are the distribution status and trends related to special-status wildlife species (i.e., federally threatened or endangered, federal candidate for listing, federal species of concern, Forest Service sensitive, and Northwest Forest Plan survey and manage) and associated habitats?
- What are current deer herd (and habitat) management strategies? What are the current needs?

Issue – Fisheries and Riparian Management

Key Questions:

- What are the distribution status and trends related to special-status fish species (i.e., federally threatened or endangered, federal candidate for listing, federal species of concern, Forest Service sensitive, and Northwest Forest Plan survey and manage) and associated habitats?
- What are conditions of Riparian Reserves? What is the desired future condition for the riparian vegetation?
- What are the dominant hydrologic characteristics, features and processes in the watershed?
- What are the processes that create and maintain instream habitat over long periods of time? Have these processes been altered? If the natural processes have been altered, how have they affected anadromous fish habitat, especially in relation to fish passage?
- What beneficial uses dependent on aquatic resources occur in the watershed?
- Which water quality parameters are critical to these uses?

CHAPTER III: Current Conditions:

Hydrology:

Base stream flow is from groundwater, and peak flow is from rainfall, spring snowmelt, and rain-on-snow storm events. The Middle Fork Cottonwood Creek watershed has an irregular dendritic drainage pattern, an average drainage density of 4.1 mi/mi^2, and an average relief ratio of 0.24. The average measured bankfull flow is 1,100 cfs, and the largest measured peak flow event is 46,000 cubic feet per second (cfs) on December 22, 1964.

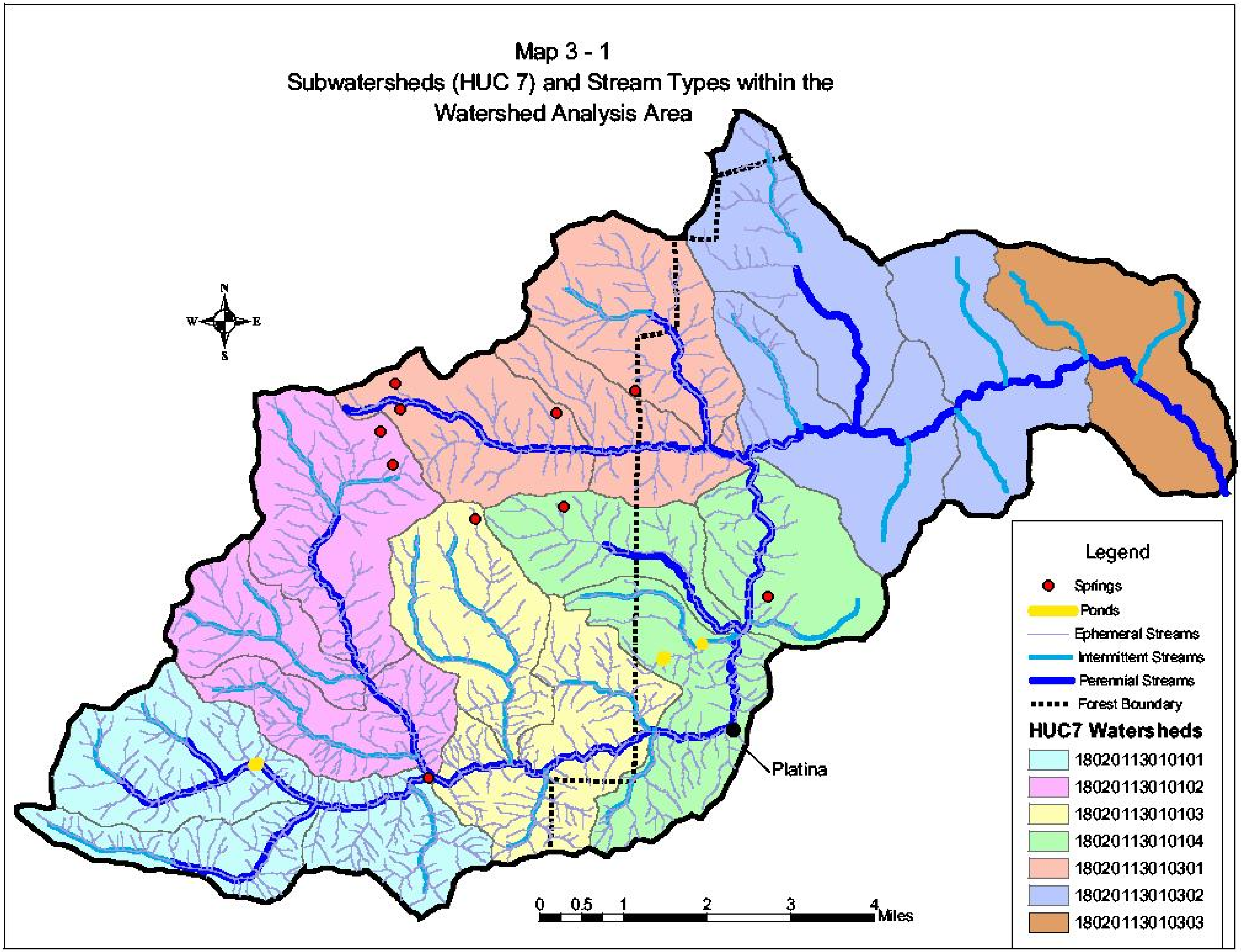
The Middle Fork Cottonwood Creek watershed is within the Klamath Mountains Geologic Province, Coast Range Geologic Province, and the Great Valley Sequence. The majority of the Middle Fork Cottonwood Creek drains the Hayfork geologic terrane within the Western Paleozoic and Triassic subprovince. Metamorphic and plutonic rocks form very steep hillslopes often greater than 60 percent (DWR, 1980).

Within the Middle Fork Cottonwood Creek watershed, hillslopes tend to be source limited with steep slopes and thin soils. Natural surface erosion from hillslopes is highly localized and relatively uncommon (PWA, 1991). Because of the topography and coarse sediment texture, dry ravel is common. Inactive and active large deep-seated landslides are present and deliver hillslope sediment and woody debris to stream channels. The rock formations forming the present watershed morphometry are classified as having low to moderate erosion hazard ratings (Lanspa, 1994). Rock formations of the lower Hayfork Terrane have the highest mass wasting risk.

There are 5 riparian reserve types within the Middle Fork Cottonwood Creek watershed: 1) perennial, intermittent, and ephemeral stream channels; 2) springs and seeps; 3) ponds; 4) meadows; and 5) landslide prone terrane (Map 3-1). Springs and seeps are common throughout the watershed and discharge from the upper, mid, and lower slopes. Intermittent ponds and meadows tend to be present on the upper slopes and on benches formed by dormant mass wasting features. Landslide prone terrane exists throughout the analysis area with inner gorge mass failures near streams and large deep seated failures near the ridgelines.

Subwatersheds

There are seven 7th field subwatersheds within the Middle Fork Cottonwood Creek 5th field watershed. Seventh field subwatersheds areused as the base hydrologic scale from which Cumulative Watershed Effects (CWE) would be conducted if required for project level NEPA and/or ESA section 7 consultation. The CWE model evaluates the potential impacts of land management on the balance between rainfall-runoff (i.e., ERA), erosion, and stream channel response. CWE are defined by Haskins (1983) as the additive or compound effects of land management activities to water quantity and quality and beneficial uses, occurring away from the site of primary development, which are transmitted to the fluvial system. CWE appear to result from the combination of changes in surface and mass failure erosion rates, instream sedimentation rates, and peak streamflows within watersheds in response to management activities (Haskins, 1983).


Map 3 - 1
Subwatersheds (HUC 7) and Stream Types within the
Watershed Analysis Area
N
S
E
W
Platina
0
0.5
1
2
3
4
Miles
Legend
Springs
Ponds
Ephemeral Streams
Intermittent Streams
Perennial Streams
Forest Boundary
HUC7 Watersheds
18020113010101
18020113010102
18020113010103
18020113010104
18020113010301
18020113010302
18020113010303

Traditionally, Region 5 has used the Haskins (1986) ERA model to evaluate and predict the effects of land use on stream channel stability. Table 3-1 depicts the Hydrologic Unit codes for 7th field subwatersheds (HUC 7) watershed identification numbers, name identifiers, acreages and Thresholds of Concern (TOC). The established TOC for the analysis area is 18% per the Shasta-Trinity Land and Resource Management Plan (LRMP), meaning up to 18% of the watershed can be disturbed before negative CWE will occur.

Table 3-1. Middle Fork Cottonwood Creek HUC 7 Subwatersheds .

HUC 7	Name	Acres	Square mi.	Road mi.	Rd. density (mi/mi²)	TOC
18020113010101	Upper MFCC	5,503	8.6	24.9	2.9	18
18020113010102	Harrision Gulch	6,413	10.0	26.3	2.6	18
18020113010103	Middle MFCC	5,295	8.3	11.2	1.3	18
18020113010104	Cow Gulch	6,537	10.2	17.6	1.7	18
18020113010301	Knob Gulch A	6,518	10.2	12.7	1.2	18
18020113010302	Little Bear Gulch	8,673	13.5	1.6	0.1	18
18020113010303	Knob Gulch B	2,992	4.7	0	0	18
Totals		41,931	65.5	94.3	1.43	18

Riparian Areas

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

Hydrologic regime and stream geomorphology appear to be the most significant factors determining species composition within the riparian area. Riparian vegetation ranges from absent in the dry ephemeral and intermittent streams, to bigleaf maple (*Acer macrophyllum*)/white alder (*Alnus rhombifolia*)/Pacific yew (*Taxus brevifolia*) in first order channels that are moist enough to support perennial riparian species. Where the channel contains an intermittent stream, sclerophyllous species, including prince's pine (*Chimaphila umbellata*) and dwarf Oregon grape (*Berberis aquifolium*) frequently co-occur with more hydrophytic species. Big leaf maple is ubiquitous, occurring in both perennial and intermittent channels, but white alder, mountain dogwood (*Cornus nuttallii*) and Pacific yew appear to be limited to higher-order channels where water availability is greater year-around. Alder occurs most frequently on active channel shelves and floodplains where frequent flooding and high light levels permit establishment. Pacific yew occurs on floodplains, terraces and stream banks at moist locations and is frequently associated with old-growth Douglas-fir and a well established shrub component of dogwood and/or California hazel (*Corylus cornuta*).

Riparian areas where disturbance has affected stand condition include areas burned during the Round (1986), Basin Gulch (2001), and Sunday Gulch (July 2002) fires. These areas are generally dominated by dense overstocked stands and represent areas where conditions are less than optimal for healthy aquatic ecosystems.

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

Beneficial Uses and Water Quality Objectives:
The existing beneficial uses, established in the Water Quality Control Plan for the North Coast Region (1994), within and downstream of the analysis area are: 1) municipal and domestic supply (MUN); 2) agricultural supply (AGR); 3) groundwater recharge (GWR); 4) freshwater replenishment (FRSH); 5) water contact recreation 1 and 2 (REC-1 and REC-2); 6) commercial and sport fishing (COMM); 7) cold freshwater habitat (COLD); 8) wildlife habitat (WILD); 9) migration of aquatic organisms (MIGR); and 10) spawning, reproduction, and/or early development (SPWN).

Suspended sediments in the mainstem of Cottonwood Creek measure 810,000 tons/yr while Middle Fork Cottonwood Creek yields 750-1200+ tons/yr. In the Middle Fork Cottonwood Creek (249 mi^2) suspended sediments measure 260,000 tons/yr or 1040 tons/$mi.^2$.

Geology/Geomorphology:
Dominant geomorphic processes in the analysis are mass wasting and colluviation. Mass wasting is a general term for the downslope movement of soil and rock material under the direct influence of gravity. Colluvium applies to loose and incoherent deposits, usually at the foot of a slope or cliff brought there chiefly by gravity. Within the former category, dormant, nested, translational-rotational landslides debris slides and flows and headwall basins are typical geomorphic features - especially along the Klamath/Great Valley sequence contact. Active debris slides are especially dominant along Middle Fork Cottonwood Creek. Colluvial slopes are found throughout the area and are the most common feature.

Colluvium greatly increases the instability of a site and is the result of soil or rock creep - the imperceptible down slope movement. Often, shallow linear depressions called "swales" or "colluvial hollows" are the result of colluvium collecting on the hillslopes. These are ubiquitous features and form common points of origin for debris avalanches, flows and torrents. Weathering of bedrock along zones of weakness creates such depressions. Subsequent and recurring slope processes result in periodic stripping and infilling of these depressions. Converging flows of groundwater into these depressions during periods of storm precipitation or rapid snowmelt cause the buildup of temporary perched water tables. Later generation of pore-water pressures in the in-fillings of the depressions reduces the strength of the material and greatly increases the instability of the site.

Areas having south-facing aspects and low elevation tend to make these slopes predominantly dry, but unusually wet weather conditions can activate colluvial filled hollows (which are present within many "zero-order" watersheds) along with the larger dormant landslides. An example of the latter has been demonstrated several times over the past fifteen years on the slopes south of Knob peak.

Inner gorges are found along Cottonwood and Middle Fork Cottonwood Creeks, Knob, Cow and Harrison Gulches. Inner gorges are deep gullies with V-notch drainages that dissect the slope and frequently serve as collectors of debris material from adjacent hillslopes. They also tend to have very steep, unstable side slopes with frequent rockslides and small debris avalanches that dump additional soil, rock and organic debris directly into these confined channels. If the quantities of debris are large enough, or if flows are too small to mobilize debris initially, temporary debris dams may develop. During major storms, these dams may fail, producing large volume, high velocity debris torrents. Torrents may also be produced during high-flow periods by the mobilization of stored channel materials. In general, debris torrent activity can be expected to be highest in the areas of increased gully density.

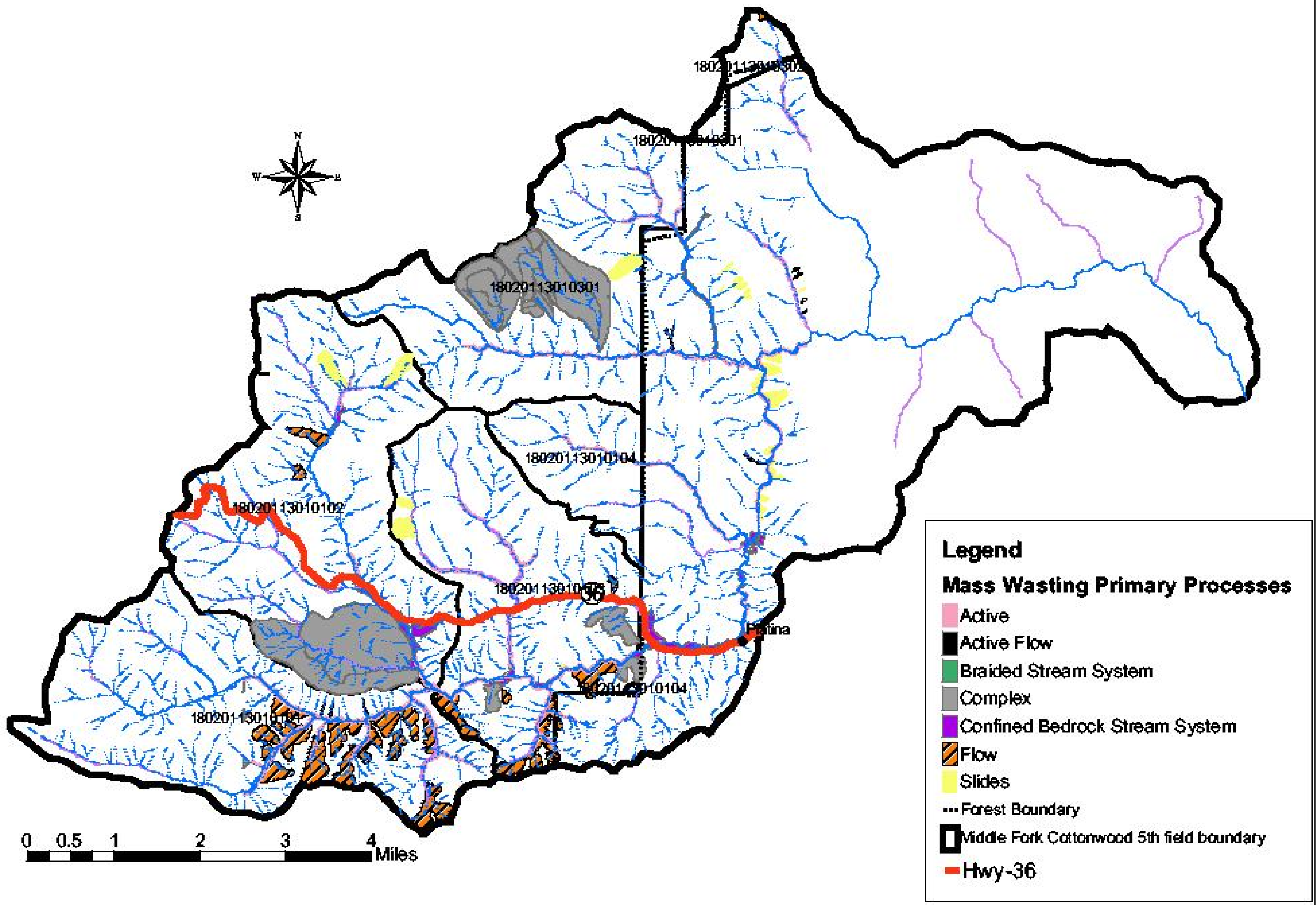
Channel gradient will control the rate at which landslide debris is transported and the dominance of erosion or deposition processes during a particular flow event. Scouring and mobilization of debris in and adjacent to the channel can be expected to occur where channel gradients are greater than 18 percent. Major velocity reductions and significant deposition of materials should occur when channel gradients drop below 12 to 16 percent.

The extensive role that mass wasting has played in forming the present day watershed is evident on the geomorphic data base maps. Mass wasting features occur over the entire watershed area (Map 3-2). A majority of the larger features are presently dormant, but mass wasting is currently active within some critical areas such as inner gorges and potentially within colluvial hollows.

Soils:

Soils within the analysis area have formed in residuum on moderately steep to steep mountain sideslopes and in undulating dormant landslide deposits. Soils on mountain sideslopes formed in metasedimentary residuum are generally moderately deep (20-40 inches) to deep (40-60 inches), with very gravelly loams and very gravelly loam subsoils, and are represented by Neuns, Kindig, Marpa and Hoosimbim series. Shallow soils (<20 inches deep), occurring mainly on ridge tops and south facing slopes, are represented by the Deadwood series and Goulding family. Soils formed in dormant landslide deposits are generally very deep (>60 inches deep) gravelly loam soils with gravelly clay loam subsoils and are represented by Boomer, very deep phase. A small area of diorite

Map 3 - 2
Mass Wasting and Geomorphic Processes Within the Watershed Analysis Area
(data is preliminary and subject to change or update)

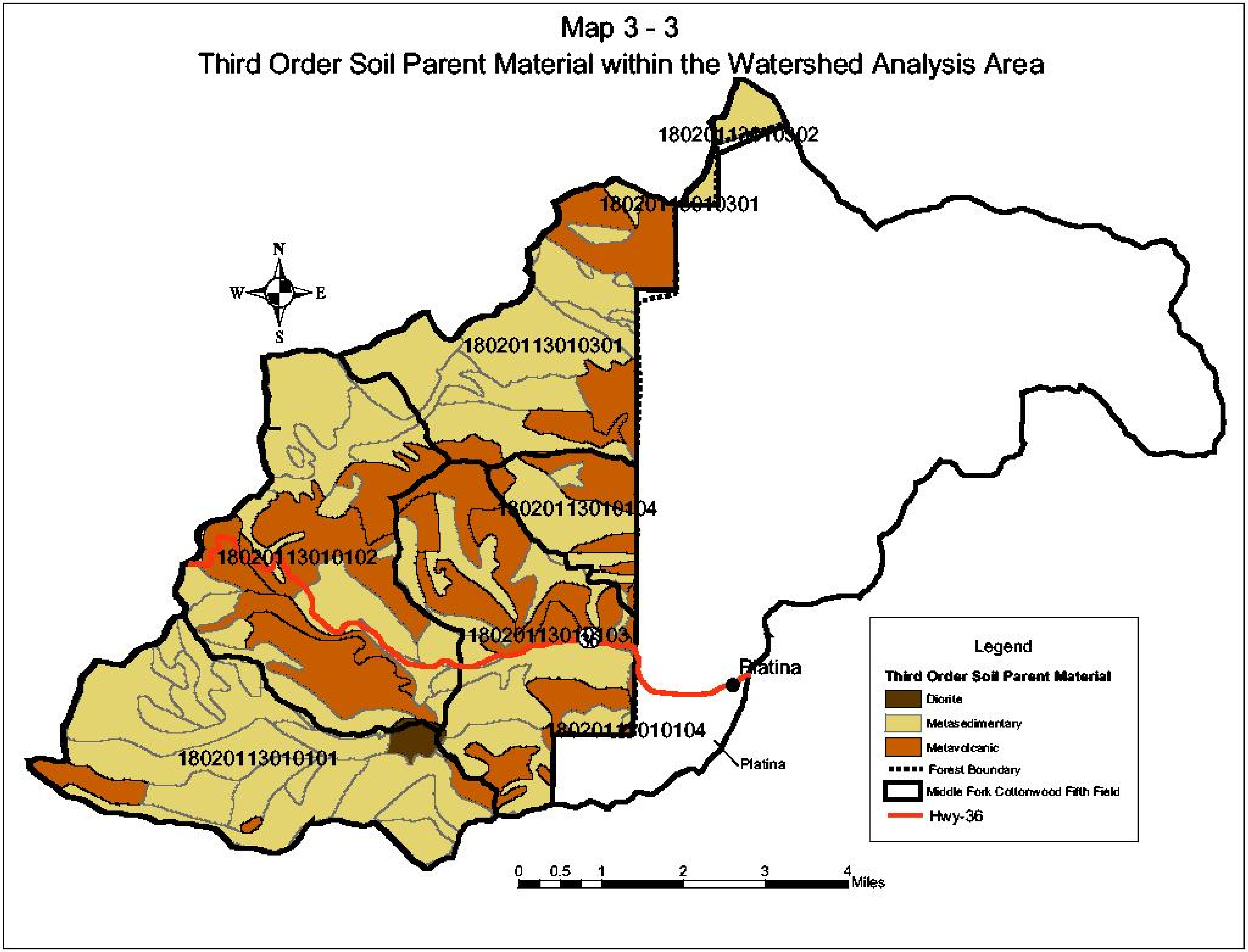


bedrock occurs adjacent to Basin Gulch Campground. Soils in this area formed in dioritic residuum on dissected mountain sideslopes. These soils are generally moderately deep to deep gravelly sandy loam soils. These soils are represented by the Holland series. Soils in the analysis area are described in more detail in Appendix A.

Information on soils and their characteristics is essential for sound land use planning. To provide such information, the FS created an Order 3 soil resource inventory (mapped at 1:63360 scale). The mapping units are associations, complexes, and consociations ofsoils classified to phases of families, family, subgroup, or suborder. The Order 3 soil survey, providing information about the soils, their capabilities and their limitations, is intended for broad scale land use planning. It is not intended for project level investigations without further field investigation, although it does provide sound background information. Minimum map unit delineations can be as small as 10 acres for highly contrasting soils and 40 acres for non-contrasting soils. Map unit delineations are usually 100 to1000+ acres in size.

Soil Erodibility:
Soils formed in metasedimentary or metavolcanic residuum (Map 3-3), are generally of low erodibility for slopes 0-20 percent, moderate erodibility on slopes 21-40 percent, high erodibility on slopes 51-60 percent and very high erodibility for slopes greater than 60 percent. Soil erodibility on soils formed in dioritic residuum is high to very high (Map 3-4).

15% Late-Successional and Old-Growth Retention:
The Middle Fork Cottonwood Creek watershed includes 10,776 acres of federal (USFS and BLM) forested lands. Current conditions within the Middle Fork Cottonwood Creek watershed related to species composition are depicted in Table 3-2 and Figure 3-1. Tree size class and canopy closure are depicted in Table 3-2. Old-growth (4N/G) comprises only 572 acres or roughly 5 percent of this land; the forested portion of the watershed is dominated by 8,321 acres of mature forest (size class 3; 77 percent of the federal forest land) (Figure 3-2). The proportion of old-growth (4N/G), mature forest that has high enough canopy closure (i.e., 3G or 3N) to provide at least that aspect of old-growth habitat as well as the remaining federal forest land within the watershed are depicted in Figure 3-3.


Map 3 - 3
Third Order Soil Parent Material within the Watershed Analysis Area
N
W
E
S
18020113010301
18020113010102
18020113010101
Platina
Platina
Legend
Third Order Soil Parent Material
Diorite
Metasedimentary
Metavolcanic
Forest Boundary
Middle Fork Cottonwood Fifth Field
Hwy-36
0
0.5
1
2
3
4
Miles

Map 3 - 4
Third Order Soil Erodibility Areas within the Watershed Analysis Area

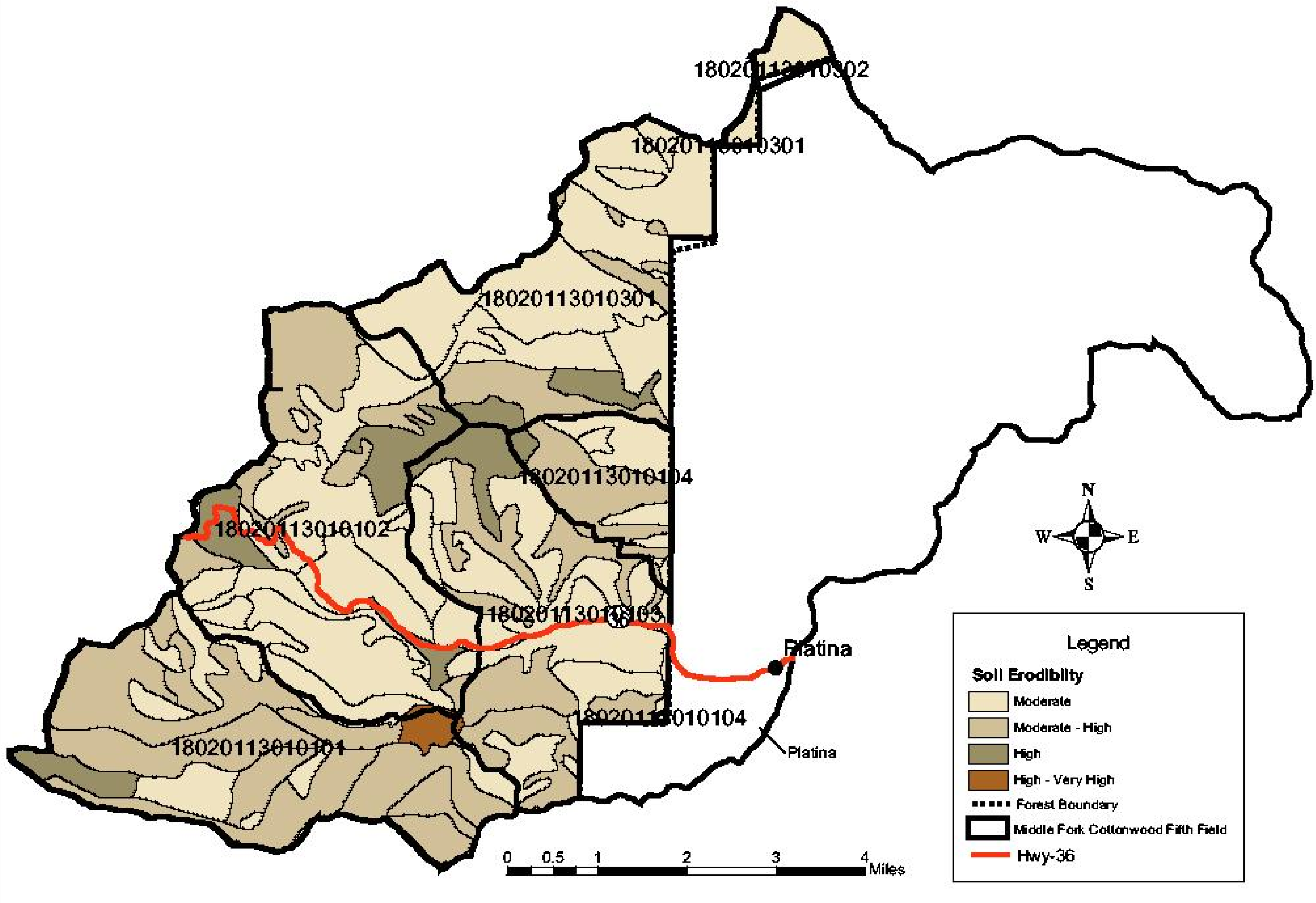


Table 3-2. Size Class and Canopy Closure distribution within the Middle Fork Cottonwood Creek 5th field watershed.

Size Class	Canopy Closure (acres)				
	G	N	P	S	Total
≥4	563	9	49	19	640
3	1,021	3,209	2,540	1,551	8,321
2	775	225	197	69	1,266
1	468	78	3	0	549
Total	2,827	3,521	2,789	1,639	10,776

Includes only 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.

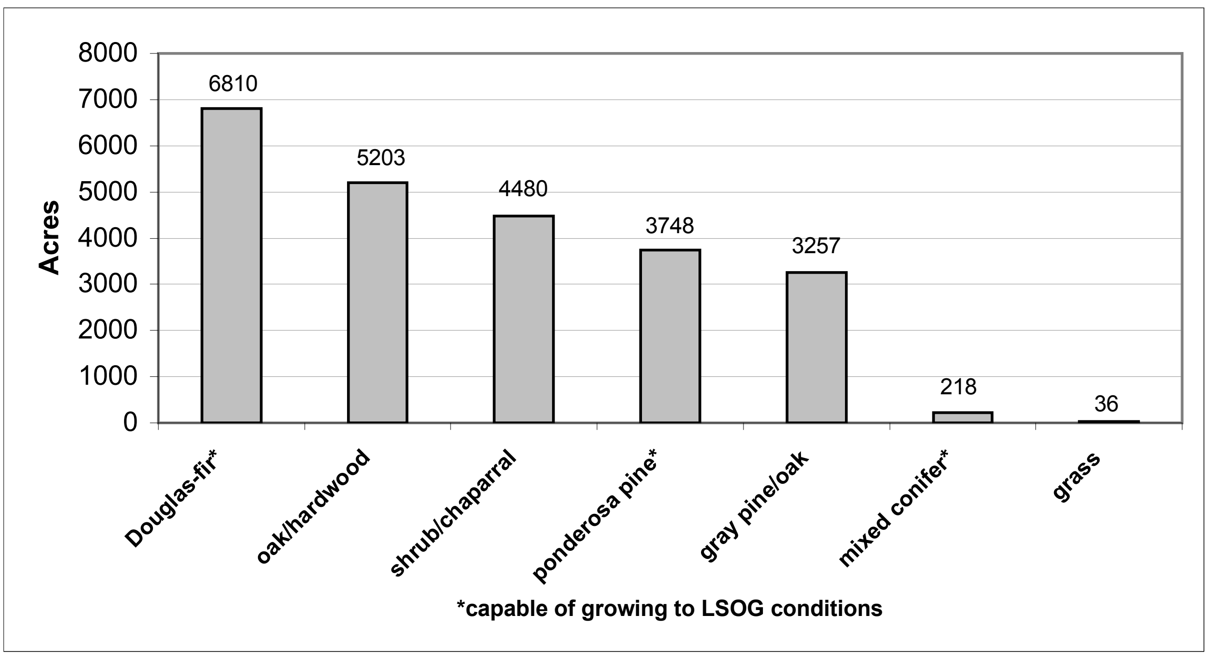


Figure 3-1. Middle Fork Cottonwood Creek 5th field watershed vegetation types. (LSOG= Late-Successional Old Growth).

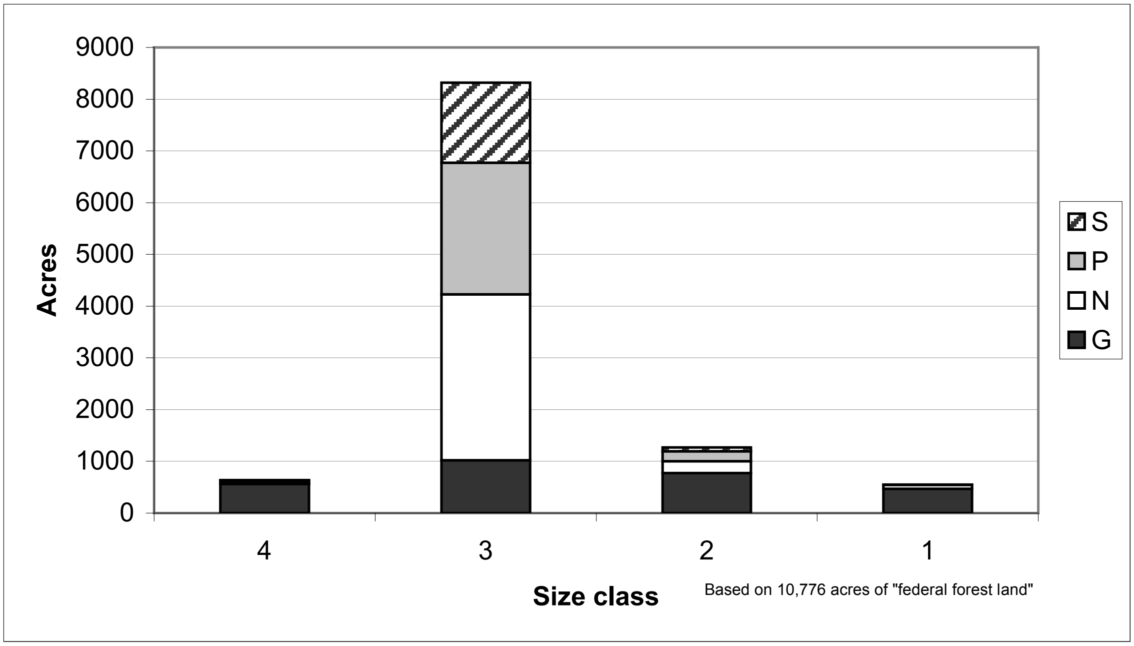


Figure 3-2. Middle Fork Cottonwood Creek 5th field watershed size class and canopy closure. (Canopy Closure Classes: S=<20%, P=20-39%, N=40-69%, G>70%).

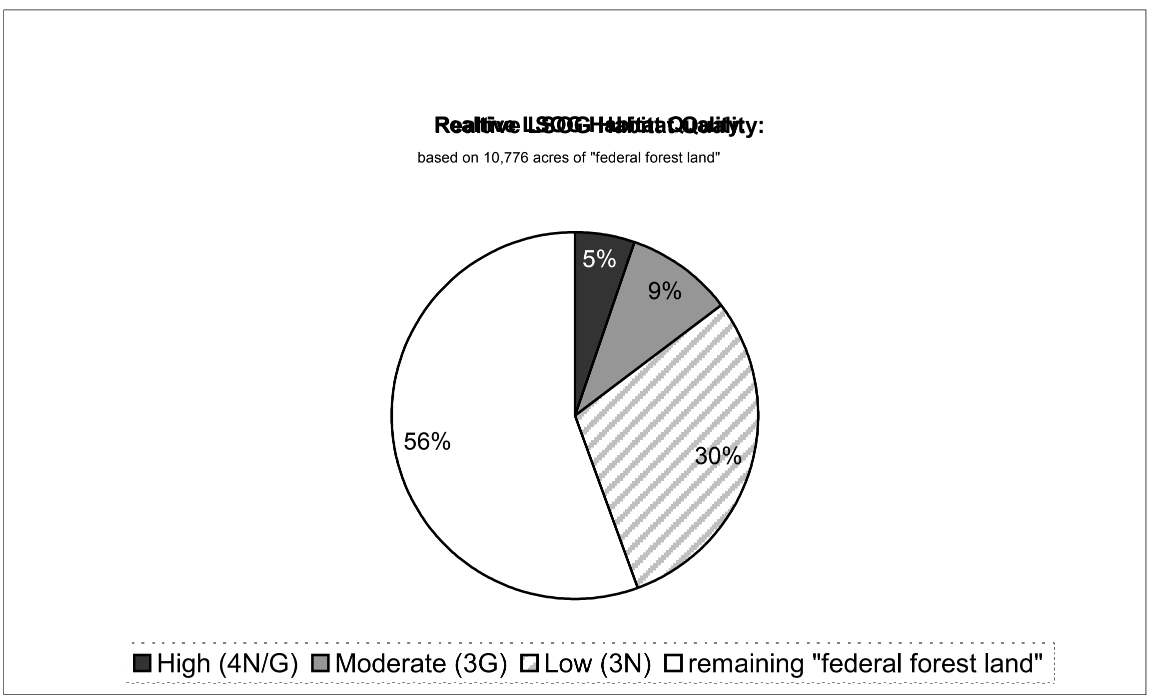


Figure 3-3. Middle Fork Cottonwood Creek 5th field watershed Late-Successional and Old-Growth (LSOG).

Vegetative Landscape:
Medium density mixed conifer and chaparral communities characterize the Middle Fork Cottonwood watershed. Ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) comprise the predominant species at mid-elevation sites, with lesser stocking of sugar pine (*Pinus lambertiana*), incense cedar (*Calocedrus decurrens*), and white fir (*Abies concolor*). Jeffrey Pine (*Pinus jeffreyi*) also occurs. Higher-elevation mixed conifer sites are comprised of predominately white fir, with lesser degrees of stocking of associated conifer species. Lower-elevation mixed conifer sites have reduced stocking levels of white fir, with increased stocking levels of ponderosa pine. California black oak (*Quercus kelloggii*) and canyon live oak (*Q. chrysolepis*) comprise a significant stand element at mid to lower elevation mixed conifer sites. Mixed conifer plantations account for approximately 10 percent of the analysis area. "Front country" chaparral communities are primarily comprised of chamise (*Adenostoma fasciculatum*), greenleaf manzanita (*Arctostaphylos patula*) and whiteleaf manzanita (*A. viscida*), with a lesser component of wedgeleaf ceanothus (*Ceanothus cuneatus*) and mountain mahogany (*Cercocarpus betuloides*).

Commercial Timber Opportunities
Commercial timber opportunities exist primarily on AMA lands within Middle Fork Cottonwood Creek watershed. Suitable timberlands occur primarily within two major commercial forest types: mixed conifer and ponderosa pine. The mixed conifer forest type provides most of the opportunity within the analysis area. The LRMP direction on timber harvest is as outlined below.

Forest Goals

- Provide a sustained yield of timber and other wood products to help support the economic structure of local communities and to supply regional and national needs (Timber E, page 4-27).

Adaptive Management Area (Description)
Substantial portions of the management direction for the Forest were directed by the NW ROD (Introduction, page 4-1).

-Regulated harvest from Matrix (and AMA) lands (NW ROD, table on page A-4).

-Most timber harvest and other silvicultural activities would be conducted in proportion to Matrix within suitable forestlands, according to standards and guidelines. Most scheduled timber harvest (that contributing to the probable sale quantity [PSQ] not taking place in Adaptive Management Areas) takes place in the Matrix lands (NW ROD, page C-39).

Management Prescriptions
-Timber yields from Prescriptions III< VI and VIII are regulated harvests and are chargeable to the Allowable Sale Quantity (Appendix L, page 7).

Prescription VIII – Intensive (Timber) Management is identified as an

Emphasized Management Practice. “this timber management regime assumes a wide range of silvicultural treatments including appropriate final harvest methods including regeneration cutting systems such as clearcutting, green tree retention, and shelterwood cutting” (Appendix l, page l-7).

Tentative Ten-Year Timber Sale Program

- Reasons for Harvest- Stands to be managed intensively-Harvests will be carried out for the following purposes…to regenerate stands to meet regeneration acreage allocations to provide planned future yields (Appendix C, page C-1).
- Harvest Priority- Regeneration is the means by which productivity can be increased and regulation approached. The understocked and poorly-growing strata should receive first consideration. (Appendix C, page C-1).
- Timber Management Controls – The Forest’s goal is to approach regulation through scheduled regeneration harvests over a period of time called the “conversion period”. Regeneration harvests to achieve regulation include 2,000 acres of green tree retention and 1,500 acres of selection cutting 2,000 acres of green retention and 1,500 acres of selection cutting per year (Appendix C, page C-3).

Current vegetative conditions were analyzed with the use of timber inventory data collected for the 1990 Land and Resource Management Plan (LRMP). Delineated stands were classified according to the LRMP timber stratification, wildlife habitat stage (Mayer and Laudenslayer 1988) and seral stage (USDA Forest Service 1994).

Estimated Capable, Available, and Suitable Acres

Table 3-3 itemizes the estimated number of Capable, Available, and Suitable (CAS) acres available within the Middle Fork Cottonwood Creek watershed analysis area, as per the LRMP 93 database. The following components and assumptions were used in constructing this table: 1) prescription III, VI, and VIII lands only by watershed, minus buffered Riparian Reserve acres; 2) productivity class High and Low for density S and P, productivity class High, Low, and Null (un-attributed) for density N and G; 3) plantations are located upon suitable lands only; 4) that an additional 15% of indicated available lands are unmapped Riparian Reserves; and 5) Regenerability must be determined at the site-specific level to ensure adequate regeneration within five years of final harvest. Using these assumptions, an estimated 516 acres would be regeneration harvested per decade on CAS lands within the combined watersheds to move the regulated component lands toward a fully regulated condition.

Table 3-3. Estimated Capable Available and Suitable Landbase and Timber Volume within 5th field Middle Fork Cottonwood Creek Watershed.

WATERSHED Middle Fork Cottonwood	STRATUM	GROSS CAS ACRES	NET CAS ACRES	VOLUME/ACRE (MBF)	TOTAL VOLUME/STR (MBF)
	M1G	89	76	0.0	0.0
	M2P	176	150	8.2	1,230
	M2G	415	353	22.4	7,907
	M3P	3,624	3,080	16.8	51,744
	M3G	2,906	2,470	28.9	71,383
	M4P	7	6	16.8	101
	M4G	68	58	28.9	1,676
Total		7,285	6,193		134,041

M= mixed conifer, 2=pole size timber,3=small sawtimber,4=medium/large sawtimber,
P= Crown density 20 to 39%
G= Crown density greater or equal to 70%

Stands within the watershed with size and density conditions likely to benefit from stocking control (thinning) treatments are depicted in Map 3-5. Thinning would likely improve stand resistance to stand-replacing fire, as well as improve stand vigor, increase stand resistance to insect and disease conditions, and reduce overall stand mortality rates.

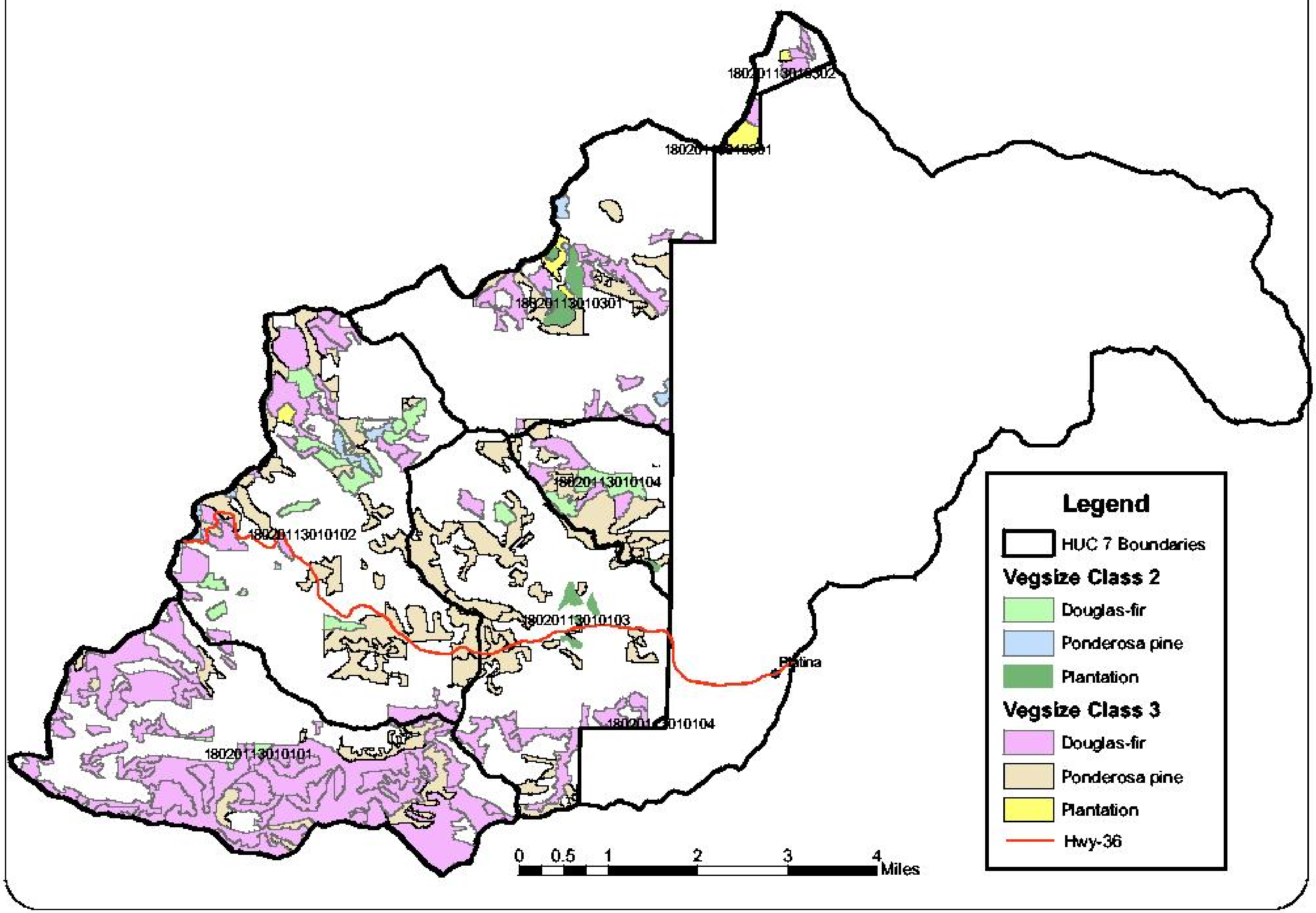
Botany:

There are no known Federally Threatened or Endangered plant species on the Shasta-Trinity National Forest. There are two known Forest Service Sensitive plant populations within the analysis area, Niles' madia (*Madia doris-nilesiae*), and Tracy's eriastrum *(Eriastrum tracyi)* (Table 3-4). There are no documented populations of any Survey and Manage vascular plant, bryophyte, lichen, or fungi species within the analysis area.

Table 3-4. Sensitive and Endemic Plant Species with Suitable Habitat within the Middle Fork Cottonwood Watershed.

Species	Location	Habitat
Niles' madia *Madia doris-nilesiae*	1 mile east of Little Black Rock	Serpentine openings, rarely on non-serpentine substrates
Tracy's eriastrum *Eriastrum tracyi*	South of Knob Peak Lookout	Dry, gravelly flats and benches

Map 3-5. Conifer Vegetation Type 1 and Size Classes 2 and 3



Difficult access, steep terrain, and large areas of thick vegetation, have minimized the amount of botanical survey work conducted in the analysis area. Most focused botanical surveys to date have been restricted to the area south of Knob Peak. Suitable habitat for Sensitive and Survey & Manage plant species is thought to exist based on plant association maps, soil and geology maps, and observations made in the analysis area. Plant species of concern that have potential for suitable habitat within the watershed area are listed in Table 3-5 and Table 3-6.

Table 3-5. Sensitive and Endemic Plant Species with potential for Suitable Habitat within the Middle Fork Cottonwood Watershed.

Species	Habitat
Tracy's eriastrum Niles' madia (very low prob.)	gray pine woodlands
Tracy's eriastrum Niles' madia (very low prob.)	White and Black oak woodlands
Tracy's eriastrum Niles' madia (very low prob.)	Chaparral, montane shrubland
Mountain lady-slipper *(Cypripedium montanum)*	Mixed hardwood openings
Brownie lady-slipper *(Cypripedium fasciculatum)* Mountain lady-slipper *(Cypripedium montanum)* English Peak greenbriar *(Smilax jamesii)* Canyon Creek stonecrop *(Sedum paradisum)*	Douglas-fir or mixed conifer montane forest, riparian-influenced or not
Red Mountain catchfly *(Silene campanulata* ssp. *campanulata)*	Ponderosa pine forest

Table 3-6. Survey and Manage Plant Species With Suitable Habitat Within the Middle Fork Cottonwood Watershed.

Species	Life Form	Habitat
Brownie lady-slipper Mountain lady-slipper	Vascular plant	Montane forest, riparian-influenced or not
Pacific fuzzwort *(Ptilidium californicum)*	Bryophyte/liverwort	Cooler montane forest above 4000 ft.

Invasive weeds:

Invasive weed species have been introduced and dispersed along existing roadways. Annual, non-native grasses have largely replaced native grasses and are prolific throughout the watershed, but especially in open chaparral and oak woodlands. Nevertheless, noxious weeds other than Klamath weed (*Hypericum perforatum*) and yellow starthistle (*Centauria solstitialis*) are not common away from roadsides.

The predominant commercial "non-timber" vegetative resource in the watershed is redbud (*Cercis occidentalis*) which traditionally has been harvested by the Nor-Rel-Muk, Wintu and Wi'laki people for use in basket weaving. In utilizing this plant, these Native American people traditionally burned redbud to remove dead material and to stimulate the growth of young, pliable shoots that are desired for weaving.

Other non-timber products harvested from the watersheds included manzanita burls, mullein and medicinal herbs such as dock (*Rumex sp.*), plantain (*Plantago sp.*), grape (*Vitis california*), raspberry (*Rubus leucodermis*), and horsetail (*Equisetum sp.*).

Fuels:
Fire regimes of the Pacific Northwest have been described by Agee (1993) and others as a function of growing environment (temperature and moisture patterns), ignition pattern (lightning, human), and plant species characteristics (fuel accumulation, adaptations to fire). The Middle Fork Cottonwood Creek watershed historically (prior to organized fire suppression) developed under a low-severity fire regime. Fires were frequent (1-25 years), of low-intensity and had few over-story effects. Through nearly a century of organized fire suppression, select timber harvest, and other human activities, the current fire regime can be classified as high-severity. High-severity fires are characterized as very infrequent (more than 25 to over 100 years between fires of significant size, or frequent fires are extinguished before growing to a significant scale) and are usually high-intensity, stand-replacement fires.

Condition Class 1 thru 3 categorizes the current ecosystem conditions in relation to departure from their historic fire regimes, determined by the number of missed fire return intervals and current vegetation levels and structure and composition conditions resulting from changes to the disturbance regime. The risk of fire-caused losses to key ecosystem components that define the system increases with each higher numbered condition class defined as follows:

- Condition Class 1 - Fire regimes within historic ranges and the risk of losing key ecosystem components are low.

- Condition Class 2 - Fire regimes have been moderately altered from the historical range. The risk of losing key ecosystem components has increased to moderate. Fire frequencies have departed (either increased or decreased) from historical frequencies by more than one return interval. This results in moderate changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns; Vegetation attributes have been moderately altered from their historical range.

- Condition Class 3 - Fire regimes significantly altered from its historic range. There is a high risk of losing key ecosystem components. Fire frequencies have departed from historical frequencies by multiple return intervals which results in dramatic changes to one or more of the following; fire size, frequency, intensity, severity, or landscape patterns;

Vegetation attributes have been significantly altered from their historical range.

The Middle Fork of Cottonwood Creek Watershed is represented primarily by two of the three Condition Class categories. Mixed chaparral brush fields and oak woodlands are best classified as a Condition Class 2 (Map 3-6). Mixed conifer stands within the analysis area primarily represented by Condition Class 3. The watershed is characterized by dense, decadent, and highly volatile mixed chaparral brush fields, overstocked mixed conifer stands, black oak dominated woodlands, and both commercial and pre-commercial sized conifer plantations. Plant and animal diversity is relatively low due to the poor forage palatability of existing vegetation types. Existing overall vegetation conditions create hazardous fire conditions primarily during the summer and fall seasons.

Within the MFCC 5th field watershed, fuel hazard ratings (Low, Medium, High) were used as a surrogate for fuel condition class ratings (1-3). The desired condition class for fuel load is 1 on a scale of 1 to 3. Currently, 3 percent (731 acres) of the MFCC 5th field watershed is in condition class 1, 47 percent (10,845 acres) is in condition class 2, and 26 percent (6,039) is in condition class 3. The remaining 24 percent (5,556 acres) is private property.

Platina CA, and Wildwood CA, are both listed in the federal register (FR Vol 66:160) as urban wildland interface communities at high risk from wildfire. They are classified as Category 2 (Intermix Communities). Urban wildland interface communities, as defined in the federal register, are communities where humans and their development meet or intermix with wildland fuel.

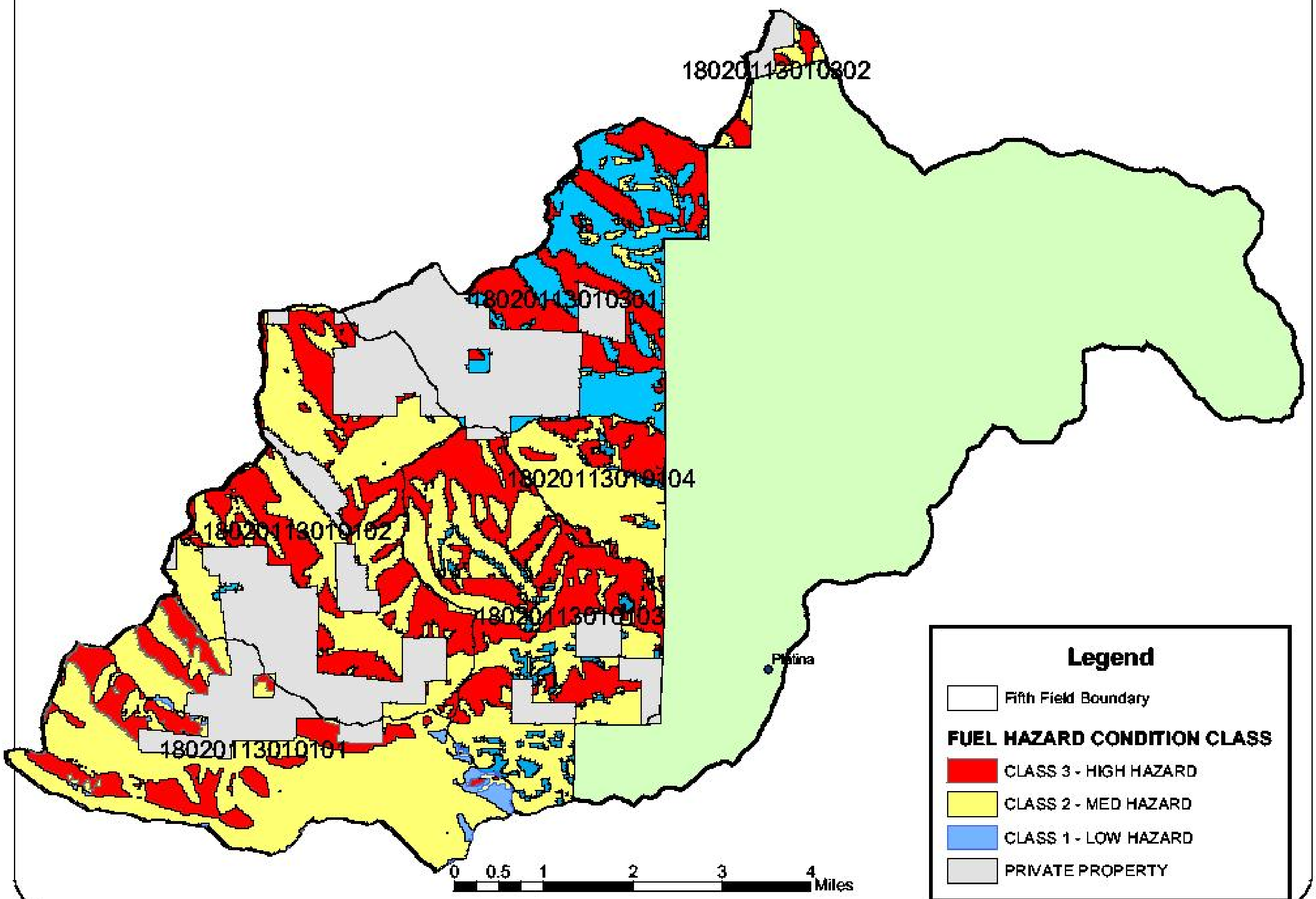
Fuels management activities in the MFCC 5th field watershed have included the construction and maintenance of approximately 40 miles of fulebreaks and road hazard reduction to break up the contiguous fuels or vegetation (Map 3-7). Going forward, there is an additional 14 miles of fuelbreak construction proposed (Map 3-7), 3.4 miles of which, received funding for FY-03 implementation. These funds will target an estimated 400 acres located immediately adjacent and north side of Highway 36.

Fisheries:
Cottonwood Creek supports a wide range of resident salmonids, warmwater game and many nongame fish. Cottonwood Creek has been divided into three main zones of fish habitat (Moyle 1976, as cited in CDFG 997).

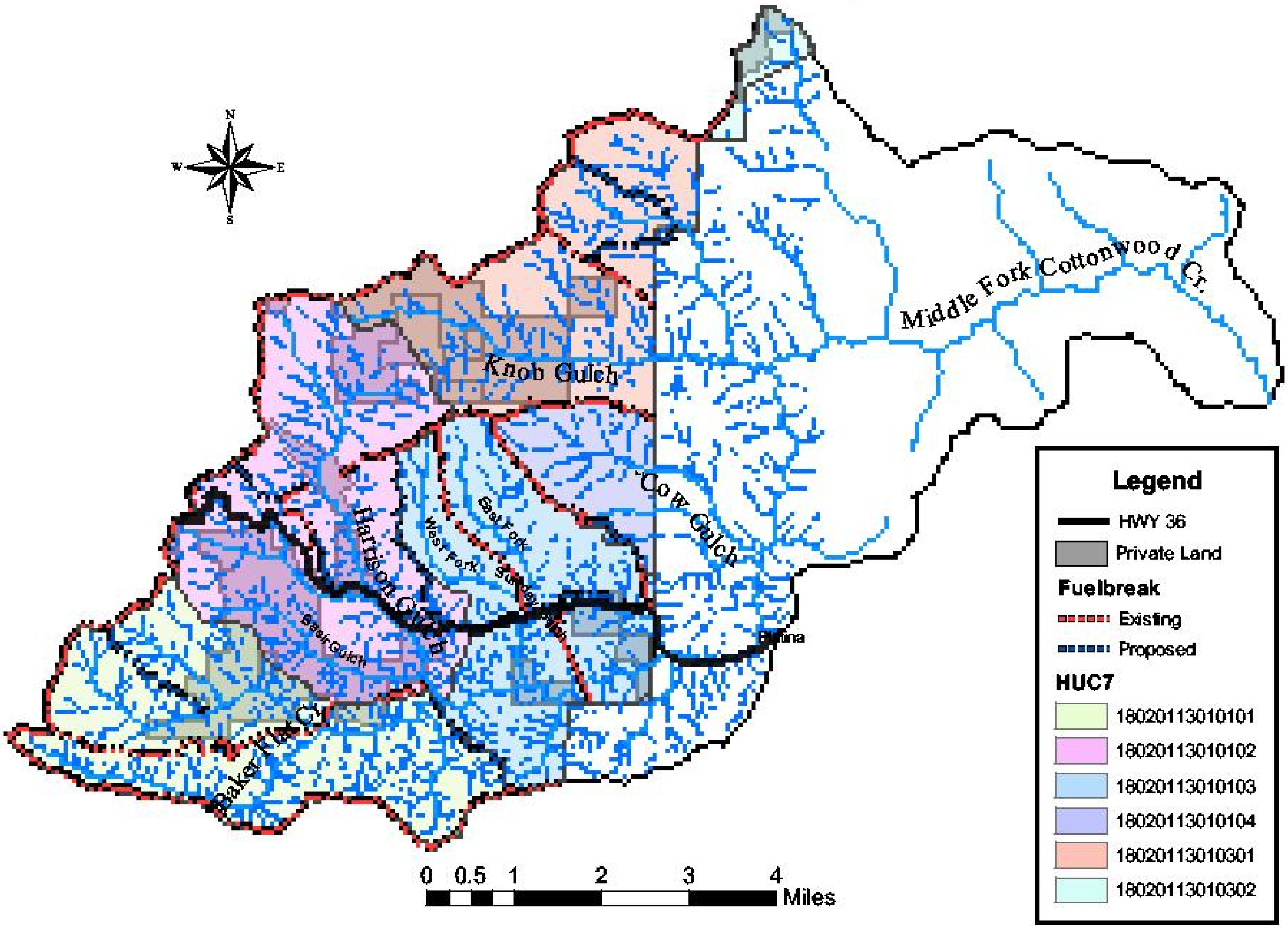
- Pikeminnow-sucker-hardhead zone
- California roach zone
- Rainbow trout zone

Portions of Middle Fork Cottonwood Creek watershed fall within the latter two zones - California roach and rainbow trout zones. California roach (*Lavinia symmetricus*) are

Map 3-6. Fuel Condition Class for the Watershed Analysis Area within Forest Boundary



Map 3-7. Existing and Proposed Fuelbreak Locations in the Analysis Area within Forest Boundary



generally found in small warm streams (tolerant of relatively high water temperatures (30-35°C) and low oxygen levels), and are frequently found in isolated pools in intermittent streams. However, California roach also thrive in cold, clear, well-aerated "trout" streams, and the main stem of larger rivers (Moyle 2002). For purposes of characterizing the Middle Fork Cottonwood Creek 5th field watershed, the California roach zone is defined as a zone of warm tributary streams flowing through open foothill woodlands of oaks and gray pine (*Pinus sabiniana*). Summer flows are often intermittent, and winter flows are swift and subject to flooding. During winter and spring months, this zone provides spawning habitats for anadromous species such as winter-run steelhead, fall and late-fall Chinook salmon, and for resident sucker (*Catostomus occidentalis*) and minnow species.

Perennial and intermittent streams located upstream of Platina are considered rainbow trout zones, characterized as clear, cold, with relatively swift, high-gradient headwater tributary streams. Substrates are usually cobble, boulders, and bedrock, with intermittent areas of gravel. Canopy closure is generally greater than 60% with a riparian community composed of streamside alder, willow, maple, a mixed conifer/hardwood trees, and wild grape. Resident rainbow trout (*O. mykiss*), resident brown trout (*Salmo trutta*), riffle sculpin (*Cottus gulosus*), speckled dace (*Rhinichthys osculus*), and sometimes sucker and California roach inhabit this zone.

Four seasonal runs of Chinook salmon (*Onchorhynchus tshawytscha*) (winter, spring, fall, and late-fall) and winter-run steelhead (*Onchorhynchus mykiss*) exist in the Sacramento River system. Cottonwood Creek is known to host all but the winter-run Chinook salmon, which spawn in the mainstem Sacramento River below Keswick Dam. Approximately 130 miles of Cottonwood Creek and its tributaries, are accessible to anadromous fish (USFWS 1980 *in* CH2MHill 2001), with 79 miles of available habitat on the Middle Fork of Cottonwood Creek.

Numerous low flow barriers exist within the lower Middle Fork Cottonwood Creek watershed which can cause seasonal variations in the range of migration for anadromous species. Present and historical information on anadromous fish were never well established for the analysis area. Most anadromous surveys conducted in the Cottonwood Creek basin occurred lower in the basin. Due to priorities in other Sacramento River tributaries, not much time was spent developing accurate estimates for Middle Fork Cottonwood Creek salmon runs. Past surveys have characterized habitat conditions in the Middle Fork Cottonwood Creek as "good", migration obstacles may be the key factor limiting anadromous fish production (CDFG 1979). There are years when above average flow conditions and salmon migrations have meshed. For instance, adult fall-run Chinook salmon have been observed as far up Sunday Gulch upstream of Platina (CDFG 1979) and late-fall run Chinook salmon have been observed 9 miles upstream (the general area between Knob Gulch and Platina). In general, stream flows are too low and over-summering holding habitat limited on the Middle Fork Cottonwood Creek upstream of Beegum Creek. Beegum Creek (outside the analysis area) does have a remnant self-sustaining population of spring-run Chinook salmon.

Since settlement of the Central Valley in the mid-1800s, populations of native anadromous fishes (i.e., chinook salmon, steelhead) have declined dramatically. Declines have been so dramatic that several runs may be in danger of extirpation. At present, winter-run chinook salmon are listed as endangered under the federal and state Endangered Species acts, and all other races of chinook salmon and steelhead have been listed as Threatened, for either federal or state listing.

In addition to Federal and State ESA determinations, on October 11, 1996, Congress passed the Sustainable Fisheries Act (Public Law 104-297) which amended the habitat provisions of the Magnuson Act. The re-named Magnuson-Stevens Act (Act) calls for direct action to stop or reverse the continued loss of fish habitats. Toward this end, Congress mandated the identification of habitats essential to managed species and measures to conserve and enhance this habitat. The Act requires cooperation among the National Marine Fisheries Service (NMFS), the Fishery Management Councils, and Federal agencies to protect, conserve, and enhance "essential fish habitat" (EFH). Congress defined essential fish habitat for federally managed fish species as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Salmon and steelhead EFH excludes areas upstream of longstanding naturally impassible barriers (i.e. natural waterfalls in existence for several hundred years), but includes aquatic areas above all artificial barriers except specifically named impassible dams.

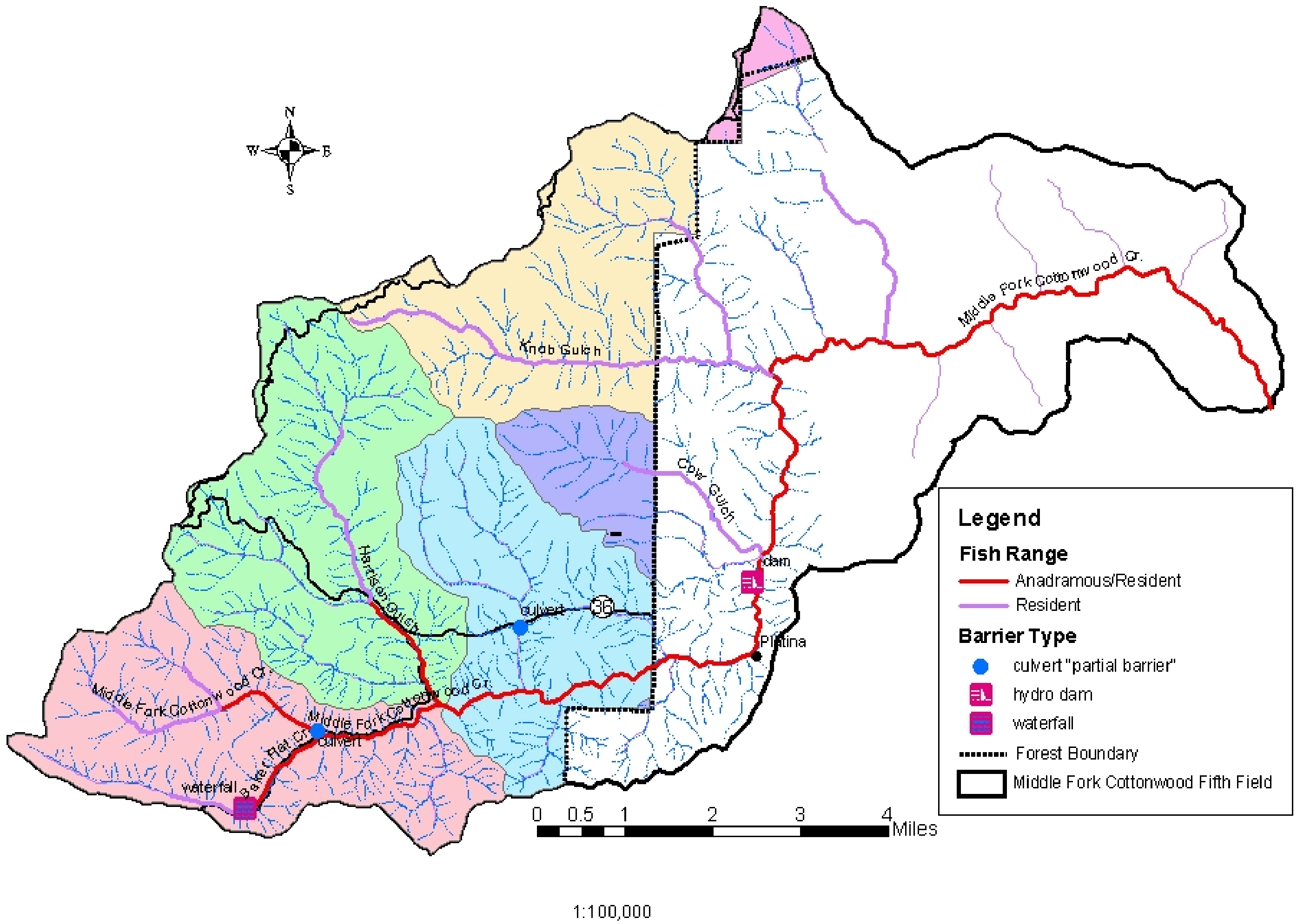
Central Valley spring-run and late fall-run Chinook salmon, and Central Valley steelhead EFH on Middle Fork Cottonwood Creek, extends from the confluence with Cottonwood Creek, upstream to Platina. The justification NMFS used in terminating EFH at Platina is unknown. Historically, no barriers to anadromous fish migration exist at Platina. It is highly likely anadromous (particularly steelhead) habitat extended up into Baker Flat Creek, Oliphant Creek, and Harrison Gulch historically (Map 3-8).

In the early 1980's, Arbuckle Mountain Hydroelectric powerplant was build at a location 2.4 miles downstream of Platina (see photo). The construction design included a Denil Steep Pass fish ladder.

Species Accounts

Central Valley spring-run Chinook salmon, currently listed as *threatened* under the provisions of the ESA (September 16, 1999, 64 FR 50394), typically enter the Sacramento River as immature fish in the spring and early summer, migrate far upriver, and spawn in late summer and early fall (Table 3-7). In northern tributaries like Cottonwood Creek, there may be considerable overlap in spawning timing between the spring and fall runs due to natural and artificial hybridization (Moyle 2002). Spring-run Chinook salmon often hold in their streams several months before spawning. Chinook salmon fry emerge in late winter and early spring from gravels and rear in the streams for 3-15 months prior to emigration, which can be dependent on stream flow (Moyle 2002). In Middle Fork Cottonwood Creek, Essential Fish Habitat for spring-run Chinook salmon opportunistic/intermittent spawning, holding, and rearing extends from the mouth upstream to the Town of Platina.

Map 3 - 8.
Resident and Anadramous Fish Distribution Within the Watershed Analysis Area



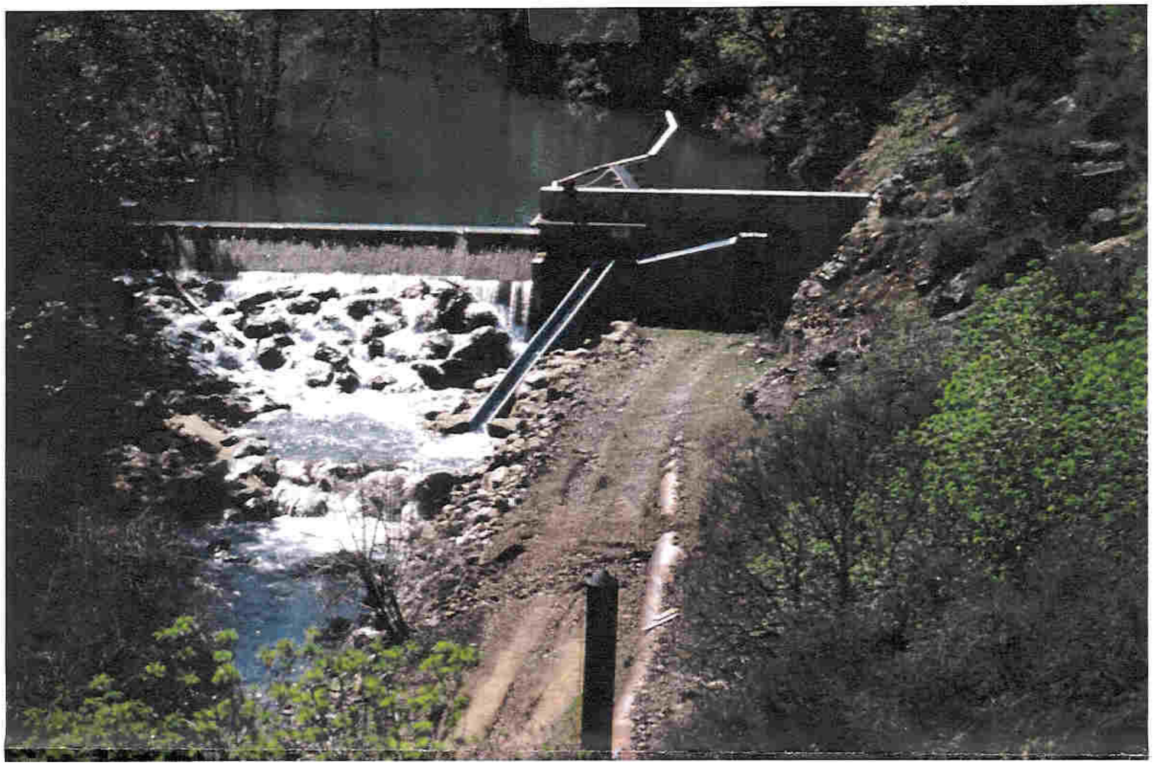


Photo: Arbuckle Mountain diversion and fish ladder.

Table 3-7. Generalized life history of salmonids in Cottonwood Creek.

Chinook	Migration period	Peak migration	Spawning period	Peak spawning	Juvenile emergence period	Juvenile stream residency
[1]Spring-run	Mar-Sept	May-Jun	late Aug-Oct	Mid-Sept	Nov-Mar	3-15 months
[1]Fall-run	Jun-Dec	Sept-Oct	Late-Sept-Dec	Oct-Nov	Dec-Mar	1-7 months
[1]Late-fall-run	Oct-Apr	Dec	Early Jan-Apr	Feb-Mar	Apr-Jun	7-13 months
Fall-run steelhead	Oct-Feb	Nov-Jan	Feb-May	_	April-July	2 years
Rainbow trout			March-May			

Source: [1] Yoshiyama et al. (1998) *in* Moyle 2002

Central Valley fall-run Chinook salmon, currently a candidate for listing under the ESA (September 16, 1999, 64 FR 50394), return from the ocean at a more advance stage of maturity, move rapidly to their spawning areas, and spawn in main-stem or lower tributary reaches within a few days or weeks after freshwater entry. Fry emerge from the gravels in spring and move downstream within a few months to rear in the mainstem of rivers or their estuaries before heading out to sea (Table 3-7). The strategy allows salmon to take advantage of extensive high quality spawning and rearing areas in valley reaches of rivers, which are often too warm to support salmon in summer. An interesting component of this strategy is a high rate of "straying" of adults from natal streams that allows them to take advantage in wet years of favorable conditions in streams not normally used for spawning or to colonize new spawning areas that develop as a result of fluvial processes (Moyle 2002). Based on current information, Essential Fish Habitat for fall-run Chinook salmon opportunistic/intermittent spawning, holding, and rearing extends from the mouth of Cottonwood Creek to the confluence with the North Fork. Middle Fork Cottonwood Creek is not considered Essential Fish Habitat for fall-run Chinook.

Central Valley late-fall-run Chinook salmon, currently a candidate for listing under the ESA (September 16, 1999, 64 FR 50394), are the largest and most fecund salmon in California. Adults enter the Sacramento River from October through April and typically hold in the river for 1-3 months before spawning in late winter and early spring (Table 3-7). They are adapted for spawning and rearing in reaches of mainstem of rivers that remain cold and deep enough in summer for rearing of juveniles. After emergence, fry rear for 7-13 months prior to emigration (Moyle 2002). In the Middle Fork Cottonwood Creek, Essential Fish Habitat for late-fall-run Chinook spawning and rearing extends from the mouth upstream to the town of Platina.

Central Valley steelhead, currently listed as *threatened* under ESA (March 19, 1998, 63 FR 13347), enter streams from the ocean when winter rains provide large amounts of cold water for migration and spawning (Table 3-7). They typically spawn in cool, clear streams with suitable gravel size, depth, and current velocity. They return to the ocean after spawning, if possible. After fry emerge in spring and early summer, they spend 1-3 years in their natal streams before emigrating as smolts to the ocean. Steelhead juveniles are typically found in higher velocity habitats, where riffles predominate over pools, there is ample cover from riparian vegetation or undercut banks, and invertebrate life is diverse and abundant (Moyle 1998). The upper reaches of the Middle Fork Cottonwood Creek are thought to provide spawning and nursery areas for winter-run steelhead (CDFG 1979). However, due to their migration during high flows and the difficulty in distinguishing juvenile steelhead from resident rainbow trout, few steelhead population estimates have been recorded for Cottonwood Creek (CH2MHill 2001).

Environmental Baseline

An environmental baseline checklist was created by the NOAA fisheries in the mid-1990's as a means of summarizing important environmental parameters and their current level of function. The intention is to guide fisheries biologists in making project level ESA "effect" determinations for listed salmonids at a watershed scale. Table 3-8 summarizes the current baseline condition of the watershed in the context of NOAA fisheries matrix indicators.

Table 3-8. Environmental Baseline Checklist of Watershed Pathway Condition Indicators for the Middle Fork Cottonwood Creek.

Indicator	Properly Functioning	At Risk	Not Properly Functioning
Water Quality			
Water Temperature	X		
Sediment		X	
Chemical Contaminants	X		
Habitat Access			
Physical Barrier		X	
Habitat Elements			
Substrate	X		
Large Woody Debris		X	
Pool Frequency		X	
Pool Quality		X	
Off-channel Habitat		X	
Refugia		X	
Channel Cond. & Dynamics			
Width/Depth Ratio		X	
Streambank Condition		X	
Floodplain Condition		X	
Flow /Hydrology			
Peak/Base Flow		X	
Drainage Net Increase		X	
Watershed Condition	Road Density Relatively low		
Disturbance History		X	
Riparian Reserves	X		

Condition categories (Properly Functioning, At Risk, Not Properly Functioning) in Table 3-5 are based on very little empirical data. With the exception of relatively recent water temperature and LWD data, the Middle Fork Cottonwood Creek watershed condition indicators are largely based on professional judgment, and reflect only that portion of the 5th field watershed within the Forest boundary.

Wildlife:
Documented sightings, survey records, and wildlife habitat relationship (WHR) models indicate over 300 species of wildlife are known to occur in, or are associated with the habitat/location parameters of the Middle Fork Cottonwood Creek watershed. Of these, only the following types will be addressed within this watershed analysis: Federal threatened or endangered species, Forest Service sensitive species, management indicator species, Northwest Forest Plan Survey and Manage species, and neotropical migratory birds. For this discussion, species associated with one or more of the habitat associations used in the Shasta-Trinity National Forest Land and Resource Management Plan (LRMP) will be discussed with that assemblage. Species occurring in a variety of assemblages, such as neotropical migratory birds, will be discussed separately at the end of this section.

The management indicator species listed herein are those recommended for monitoring under the LRMP Final EIS, Appendix G, Table G-3. In some cases, animals that are either threatened or Forest Service sensitive species are also management indicators, but may not be described as such in this document.

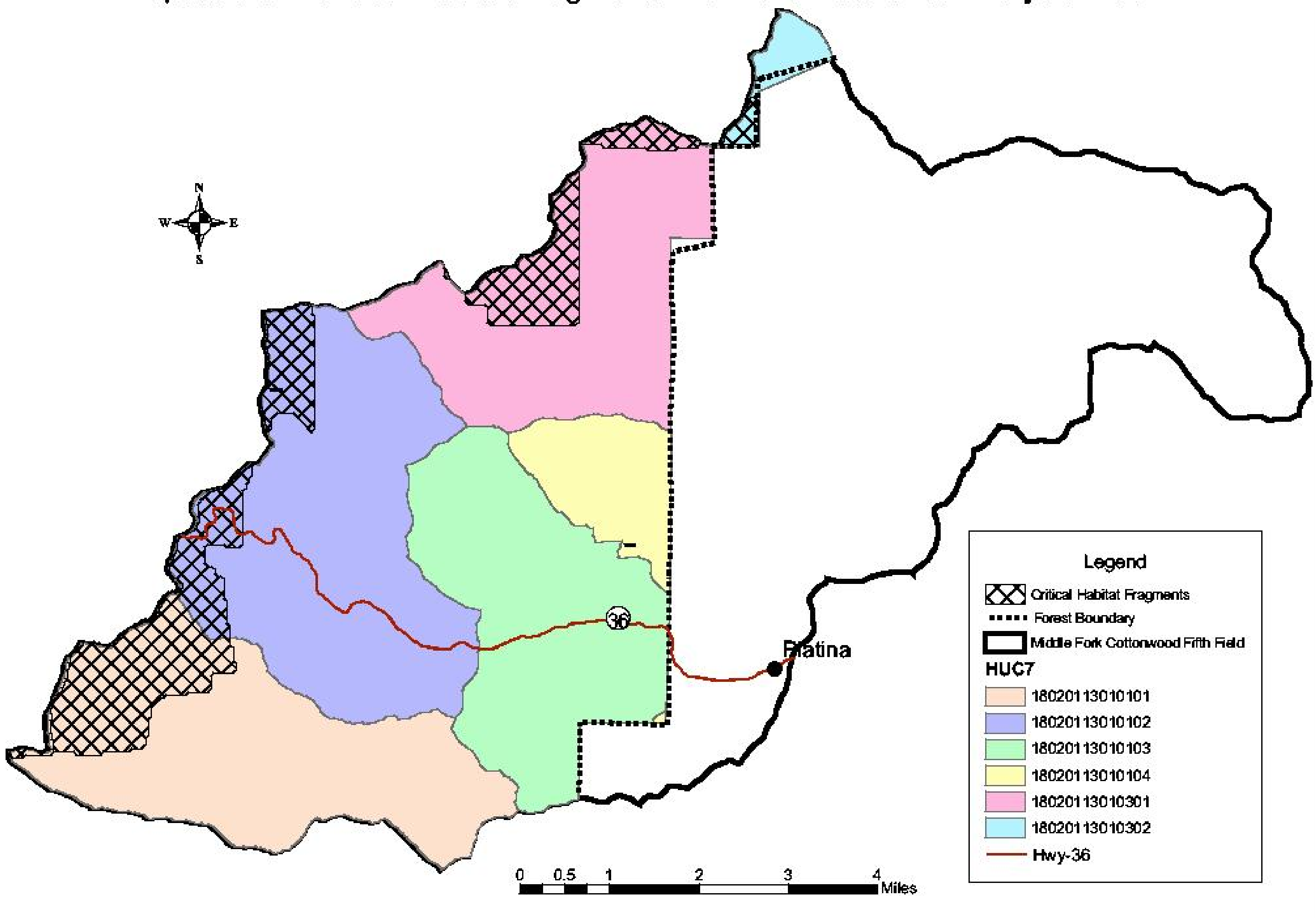
Late Seral Assemblage:
Over 70 species of late-seral forest associated species are known or expected to occur within the watershed. Threatened, endangered, and sensitive species in this assemblage include the northern spotted owl *(Strix occidentalis caurina),* northern goshawk *(Accipiter gentilis),* Pacific fisher *(Martes pennanti pacifica*), and American marten *(Martes americana).* Management indicators suggested for monitoring in this assemblage in the LRMP include the above species, pileated woodpecker (*Dryocopus pileatus*), black bear *(Ursus americanus),* and elk *(Cervus elaphus).* Suitable nesting/roosting/denning and foraging habitat requirements for old-growth dependent species are expected to be provided through LSR, 100-acre owl LSRs, riparian reserves, and matrix "old-growth" retention guidelines.

There are three northern spotted owl activity centers within the Middle Fork Cottonwood watershed on Forest Service lands. Three additional activity centers lie outside the watershed but within 1.3 miles of the boundary. A 1.3 mile radius circle approximates the median home range of spotted owls within the Klamath province, indicating that habitat within the watershed may be utilized by owls from these activity centers. Each of the activity centers within the watershed has a 100-acre Late-Successional Reserve designated for the nest habitat surrounding the activity center.

One activity center within the watershed (ST-831) was surveyed to protocol in 2001 and 2002 in relation to the Knob Peak Fuels project, and is being surveyed in 2003. No responses were detected. Another activity center (ST-802) outside of the watershed but within 1.3 miles of the boundary was monitored in 2001 through 2003. During 2001 and 2002 the owls nested at the same location and produced young, but no nesting has occurred at the time of this writing in 2003. No other activity centers in or within 1.3 miles of the watershed have been surveyed in recent years.

Approximately 3,205 acres of northern spotted owl Critical Habitat Unit (CHU) CA-36 (Chancelulla) acreage occurs along the northern boundary of the watershed, in five separate fragments (Map 3-9). The remainder of the CHU is in adjacent watersheds. The CHU largely coincides with LSR (CA-336 Chancelulla), of which 2,897 acres occur within the

Map 3 - 9.
Spotted Owl Critical Habitat Fragments within the Watershed Analysis Area



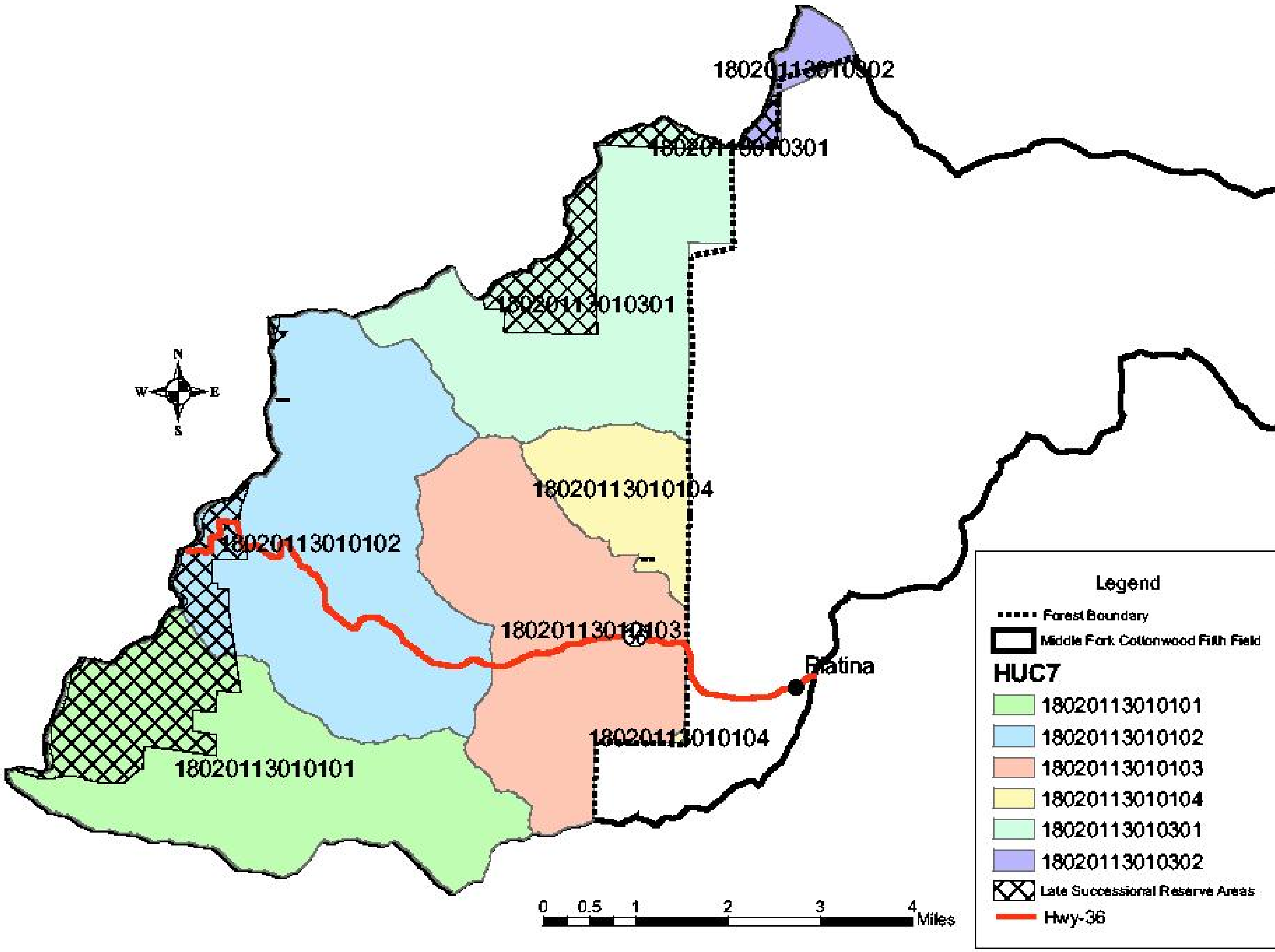
watershed (Map 3-10). The nearest other CHU and late seral habitat occurs south and west of the watershed along South Fork Mountain. The logical dispersal routes between the LSR/CHU within the analysis area and other LSR/CHU are not within the watershed, but occur in adjacent watersheds. Suitable spotted owl nesting/roosting habitat does not occur to the east within the Central Valley. Some suitable nesting/roosting and foraging habitat does occur to the south within the Beegum watershed and owls may disperse between the Middle Fork Cottonwood and Beegum watersheds.

Suitable NSO nesting/roosting and foraging habitat has not been manually mapped within the watershed. Habitat modeling (NSO Baseline) and vegetation maps (USFS LMP_95 vegetation coverage) have been used to determine acreages presented herein. On federal lands within the watershed, 572 acres of "old-growth" (4N/G stands) exist. In addition, 1,021 acres of 3G stands showing most of the characteristics of late seral forests occur. This habitat exists in a pattern of separate stands of up to 300 acres in size across the northwestern boundary of the watershed (corresponding roughly to the LSR and CHU), as well as approximately 160 acres in the Knob Peak area and approximately 70 acres on the southern boundary of the watershed (Map 3-11). Fragmentation of this habitat occurs mainly from intervening areas of south-facing slopes not capable of supporting dense late seral forest types. The eastern portion of the watershed, off of federal land, contains very little forested late seral habitat due to its low elevation and lower rainfall.

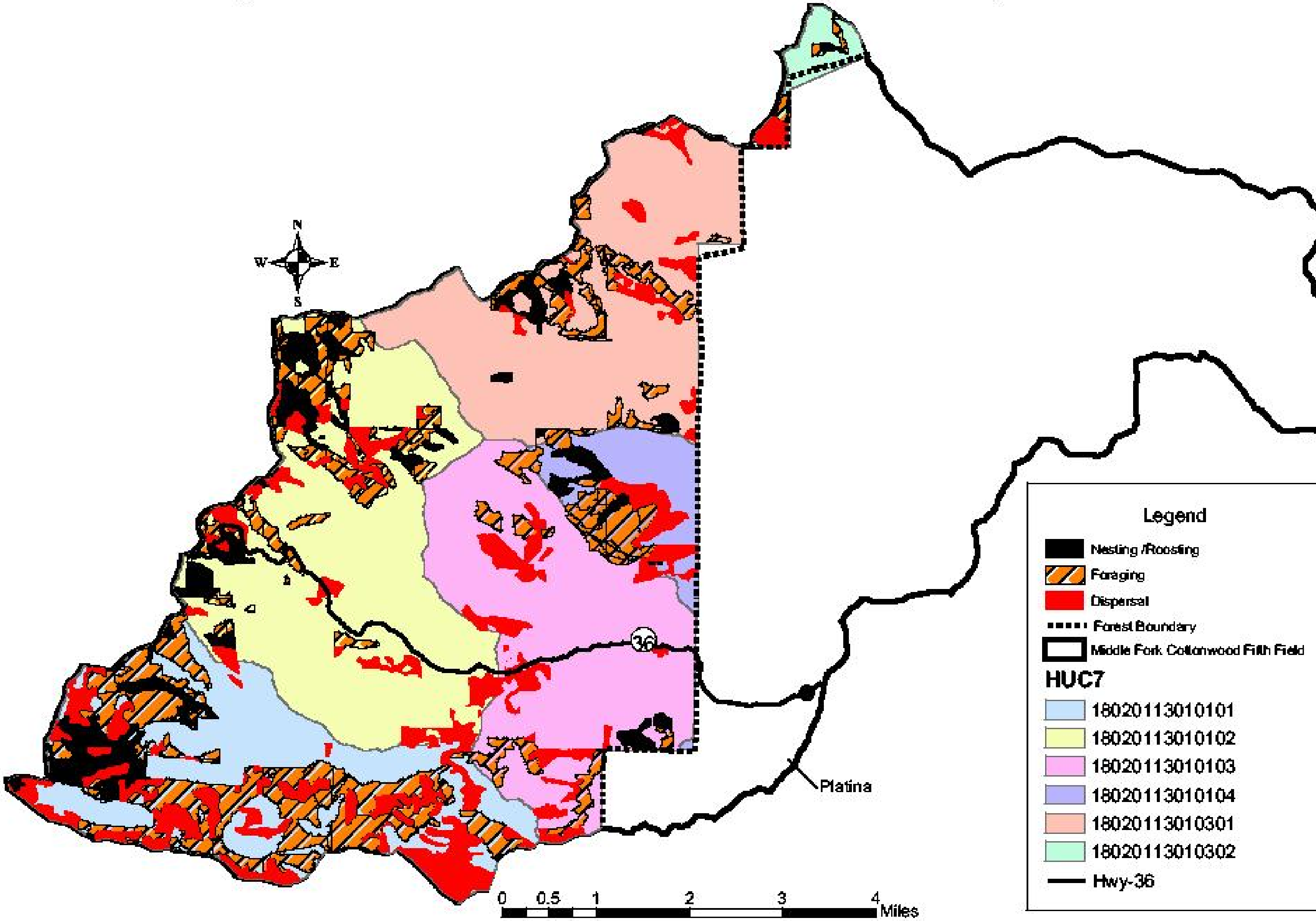
Suitable foraging habitat (3N, 2N/G stands) makes up approximately 4,209 acres of federal lands within the watershed. This habitat occurs between patches of late seral habitat as described above, as well as on numerous north- and east-facing slopes within the watershed. Small portions of this habitat below the mapping threshold are likely suitable for nesting/roosting at this time. This habitat is capable of becoming nesting-roosting habitat either through time, manipulation by humans, or both.

Dispersal habitat is poorly defined within the analysis area. Currently, only 2P, 3P, and 4P conifer stands are suitable dispersal habitat. These stands constitute approximately 2,786 acres within the watershed. The 2P and 3P stands may potentially become stocked sufficiently to transition into foraging or nesting/roosting habitat. The 4P stands are unlikely to increase canopy sufficiently to become suitable foraging or nesting/roosting habitat. In addition, much of the oak woodland within the analysis area (3,621 acres) can function as dispersal habitat during the summer and early fall months, but is largely not capable of functioning as such during the winter and early spring due to a lack of canopy. Approximately 550 acres consist of 1G and 1N stands that will likely become suitable dispersal, then foraging and possibly nesting/roosting habitat, as they mature. Dispersal habitat can be provided through retention of current riparian reserves, 100-acre owl LSRs, and management of young plantations.

Map 3 - 10.
Late Successional Reserve Areas within the Watershed Analysis Area



Map 3 - 11.
Spotted Owl Critical Habitat within the Watershed Analysis Area



There are no known northern goshawk territories within the watershed. High-quality suitable goshawk habitat is limited, and there are no documented sightings of goshawks within the watershed. No surveys for goshawks have been conducted within the watershed, however. Two known territories occur outside of the watershed but within 1 mile of the boundary. Goshawks from these territories may be foraging or dispersing through the watershed.

The Pacific fisher is known to occur within the watershed. In 1994, 18 track plate stations were set up in the Knob Peak / Harrison Gulch area and two fisher tracks were collected (district data). Fishers have also been taken by licensed trappers on Knob Peak in recent years (G. Piggott-personal communication). Approximately 20 incidental sightings of fishers have also been documented within the watershed.

The American marten has not been documented within the watershed, but may occur there. Some suitable true fir habitat occurs at high elevation along the northwest boundary of the watershed, but this habitat is highly localized.

The wolverine, a Forest Service sensitive species, is not known or suspected to occur within the watershed. High elevation suitable habitats are very limited within the watershed.

Of the three remaining management indicator species associated with these habitats, the black bear is known to occur throughout the watershed. Bears are found throughout all habitat types on the forest and could be expected to utilize those habitats within the watershed. No population data is available on bears within the watershed. Bears also frequent the Harrison Gulch transfer station south of Knob Peak, feeding off of waste taken from the site.

Pileated woodpeckers are also expected in the watershed. While there are no documented sightings within the watershed, evidence of pileated woodpeckers is widespread. No population estimates are available for this species within the watershed. Breeding Bird Survey data is inconclusive for this species in California due to the low number of birds per route but shows a very slight increase in the population per year statewide (Sauer et al 2001).

Elk are not known to occur in the watershed, and are not expected to be present at this time. Future introductions of elk are possible but not anticipated.

Openings and early Seral stage habitats:
Early seral stage habitats (vegetation size class 1 areas) comprise approximately 550 acres of federal lands within the watershed. These areas are primarily recent clearcuts, but may include some naturally-occurring stands. Other areas of chaparral, chamise, buckbrush (*Ceanothus cuneatus*), etc., may be in early seral stages. However, since fire suppression activities have largely prevented wildfire in this drainage for many years, most of these stands are at least 15 years old and have achieved some level of decadence.

Management indicator species associated with these habitats include the western screech owl (*Otus kennecottii*), song sparrow (*Melospiza melodia*), black bear, elk, mule deer, western harvest mouse (*Reithrodontomys megalotis*), and California vole (*Microtus californicus*). Elk, bear, and deer are discussed elsewhere in this document. No presence or population data within the watershed is available for the other species. Breeding Bird Survey results for California are inconclusive regarding the western screech owl due to low sample size. Breeding Bird Survey results for the song sparrow indicate only slight changes in population over the past 35 years within California (Sauer et al 2001).

Snag and down log habitats:
These habitats do not exist independent of other habitats within the watershed. No current snag density information is available within the watershed as a whole. Snag levels necessary to meet habitat models for cavity dependent species within the watershed vary from 1.5 to 4 snags per acre depending on the tree species present. It is doubtful that snag levels much above 1.5 per acre exist throughout most of the watershed, except in highly localized areas as a result of wind events and insect infestations. This may be due to previous management of snag levels at 1.5 per acre on commercial lands, reduction of hazard trees along roads and rights-of-way, and to the incapability of large portions of the watershed to produce sufficient large trees per acre to provide recruitment. Snag levels in late seral forested stands (3G, 4N/G) are anticipated to be the highest within the watershed, and may meet current guidelines.

No hardwood stands within the watershed are currently managed commercially. Snag levels in these stands may be at or above suggested levels. Management of these stands, such as underburning for increased deer forage, is not anticipated to alter this level.

Downed large log levels within late seral stands are anticipated to meet standards and guidelines. Downed wood levels in areas of previous harvest, in areas of less than mature commercial timber, and in areas not capable of supporting commercial timber, are expected to be below the levels required to meet standards and guidelines, either because insufficient stems are available for recruitment or those stems that are available are too small to constitute large logs when fallen. However, smaller diameter logs are likely higher than levels required by Standards and Guidelines throughout most forested areas of the watershed.

Management indicator species associated with snags and logs include the western screech owl, northern pygmy owl *(Glaucidium gnoma*), northern spotted owl, northern saw-whet owl *(Aegolius acadicus)*, acorn woodpecker *(Melanerpes formicicorus)*, pileated woodpecker, and tree swallow *(Tachycineta bicolor)*. The northern spotted owl and pileated woodpecker are discussed elsewhere in this document. No presence or population data within the watershed is available for the other species. Breeding Bird Survey data is inconclusive for the bird species listed above except for the acorn woodpecker, which shows a slight increasing population trend but is very susceptible to changes in acorn crops, and the tree swallow, which shows a significant increasing population trend (Sauer et al 2001).

Riparian and aquatic habitats:
Several perennial and numerous ephemeral streams, as well as some small ponds, are present in the watershed. Management of riparian reserves is expected to provide for all riparian-dependent species associated with these habitats.

Species associated with these habitats include the bald eagle *(Haliaeetus leucocephalus)* and California red-legged frog *(Rana aurora draytonii)*, both threatened species, and the foothill yellow-legged frog *(Rana boylii)*, western pond turtle *(Clemmys marmorata)*, willow flycatcher *(Empidonax traillii)*, and southern torrent salamander *(Rhyacotriton variegatus)*, which are Forest Service sensitive species. In addition, management indicators for these habitats include the turkey *(Meleagris gallopavo)*, tree swallow *(Tachycineta bicolor)*, black salamander *(Aneides flavipunctatus)*, and northern red-legged frog *(Rana aurora aurora)*. No presence or population data is available within the watershed on any of the above management indicator species.

There are no known or suspected bald eagle nest sites within the Forest Service portion of the Middle Fork Cottonwood drainage. No perennial streams, ponds, or lakes containing fish populations capable of supporting resident bald eagles are known within the watershed. While anadromous fish do occur within Middle Fork Cottonwood Creek, the creek is too sheltered to provide suitable summer foraging habitat for eagles. Foraging may occur within the watershed, at isolated locations or during the winter months when vegetation is less obscuring.

The California red-legged frog is not known to occur within the Forest Service portion of the Middle Fork Cottonwood watershed. It occurred historically within Shasta County, and has been documented in Tehama County. It is assumed that the species once occurred within the watershed. The California red-legged frog requires dense shrubby or emergent riparian vegetation closely associated with deep, still, or slow-moving water. Although riparian vegetation occurs within the watershed, areas with deep, slow water are very limited, and occur only at isolated locations along Middle Fork Cottonwood Creek and possibly at private ponds within the watershed.

Western pond turtles are known to occur within the watershed. There have been documented sightings in Harrison Gulch, Middle Fork Cottonwood Creek, Philpot Lake, and at the sewage ponds at the Harrison Gulch Ranger Station. Turtles are presumed to occupy the Middle Fork of Cottonwood Creek downstream from the junction of Harrison Gulch, and likely occur in most of the private ponds within the watershed.

No presence or population data within the watershed is available on the foothill yellow-legged frog, willow flycatcher, or southern torrent salamander. Yellow-legged frogs are abundant throughout the district and may occur in the larger perennial streams within the watershed. Willow flycatchers may occur in the watershed but suitable habitat on Forest Service land is very limited and not expected to support any flycatchers. Southern torrent salamanders are not known or expected to occur within the watershed.

Hardwood habitats:
Approximately 3,621 acres of FS lands within the watershed are dominated by hardwoods-primarily white oak (*Quercus garrayana*), black oak, and canyon live oak. These stands are not currently managed commercially. Continued lack of manipulation of hardwood stands is anticipated to maintain populations of hardwood-dependent species within the watershed.

The acorn woodpecker is the only management indicator species within this assemblage recommended for surveying. Acorn woodpecker population levels are not known within the watershed but the species appears to be common throughout oak habitats across the forest.

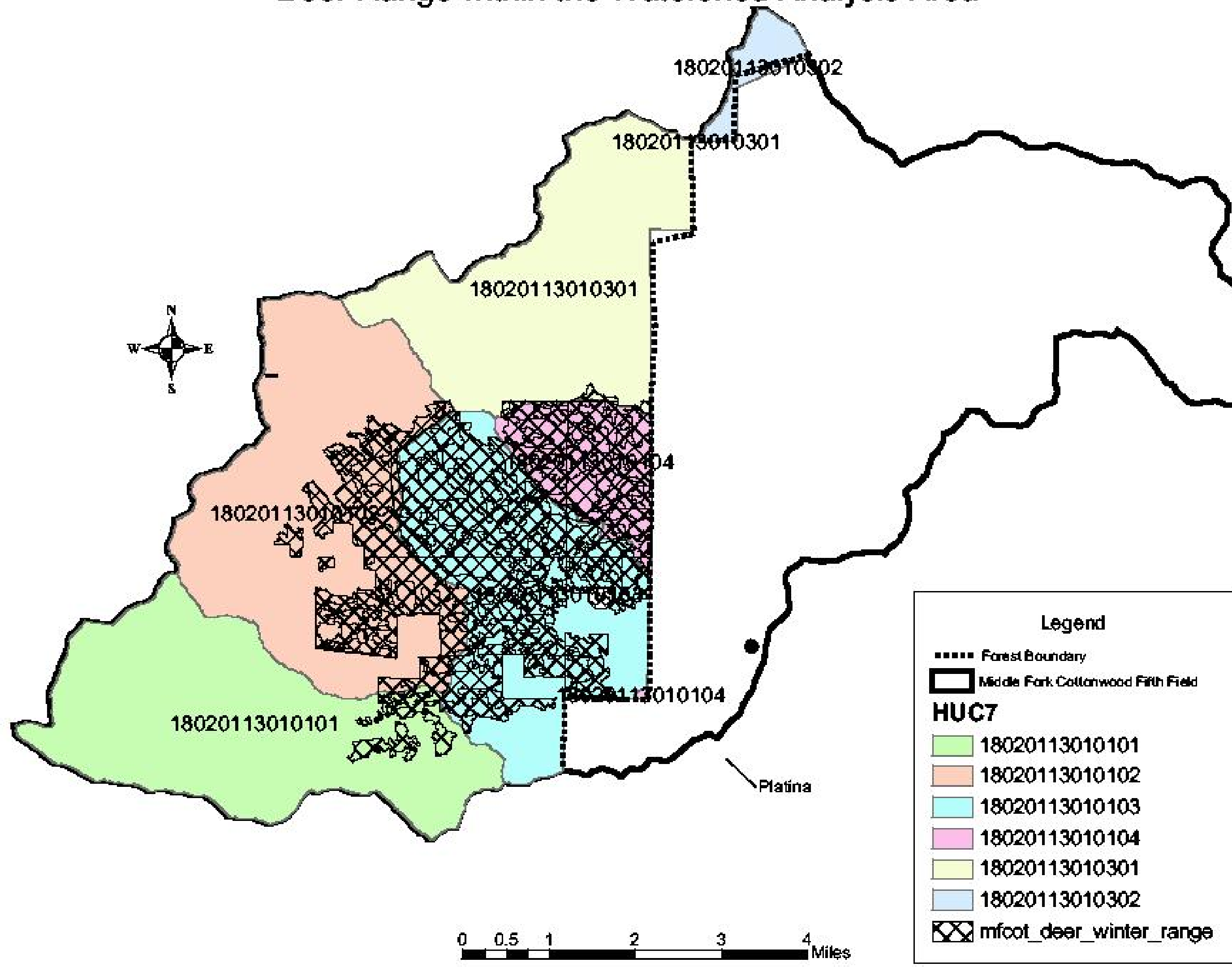
Chaparral:
1,703 acres of FS lands within the watershed are currently classified as chaparral. Another 329 acres are in chamise, buckbrush, whitethorn (*Ceanothus cordulatus*), and other shrubs. 2,149 acres are in gray pine, which typically is very open with a dense brushy understory. Most of these areas have not burned in recent years, and are largely decadent. The proposed Knob Peak project is anticipated to return a substantial portion of this acreage into earlier seral stages through burning, providing improved foraging habitat for deer.

The deer using the Middle Fork Cottonwood Creek watershed are resident and migratory members of the Beegum subherd of the Yolly Bolly Deer herd (CDFG 1982). Migratory portions of the herd summer in higher elevation areas and migrate downslope into the valleys beginning in October. Approximately 6,811 acres within the FS portion of the watershed (Map 3-12) are designated as deer winter range (LMP GIS) and most of the area is utilized as summer range by resident deer. Historically, population estimates for the herd as a whole have varied from approximately 31,000 in 1963 to a low of 3,600 in 1974. Current population estimates are approximately 13,000, and the herd is in a steady decline (D. Smith, personal communication).

Both indirect and direct factors have been identified as contributing to variability in the population of the herd. Primary indirect factors include habitat condition and habitat loss. Habitat condition, specifically decadence of chaparral communities, alters availability of forage and may result in alterations of use patterns on both winter and summer range (CDFG 1982). Currently, CDFG has identified the decadence of summer range habitats, specifically higher elevation chaparral and openings, as being the single most significant factor in low deer numbers for this herd. The recommendations in the current deer herd management plan call for a cover to forage ratio in chaparral stands of approximately 1:1, with 15% of those stands in new brush (1-3 years old) in 10-20-acre patches and 25% in grasses.

Habitat loss within the Middle Fork Cottonwood Creek watershed is minimal, resulting mainly from changes in human population on private lands and to a small extent on type conversions.

Map 3 - 12
Deer Range within the Watershed Analysis Area



Direct factors include legal hunting, illegal hunting, disease and parasitism, and predation. Legal hunting removes approximate 5% of the total herd (30% of bucks) annually. Illegal hunting is difficult to quantify but likely accounts for several hundred deer per year. Both parasitism and predation are difficult to quantify. CDFG studies in 1980-1982 indicated 16% of total mortality due to disease, 40% through predation. No data was available on deer numbers lost through vehicle accidents, but as Highway 36 passes through the watershed, it is likely that some losses occur.

The green-tailed towhee *(Pipilo chlorurus)* is the only other management indicator species within this assemblage recommended for monitoring. No presence or population data within the watershed is available for this species. Breeding Bird Survey data shows a slight increasing trend for this species within California (Sauer et al 2001).

Cliffs, Caves, Talus, and Outcrops:
Little of this habitat exists within the watershed at any mappable scale. No known natural caves occur within the watershed, but mineshafts do occur. Many of the known mineshafts within the watershed are flooded or blocked, however. Talus and rock outcrops occur in various locations throughout the watershed at very small (<1/10 acre) scales.

There are no known or suspected peregrine falcon eyries within the Middle Fork Cottonwood watershed. Steep, rocky habitat necessary for nesting is very limited within the watershed. The nearest known eyrie is at Beegum Rock, approximately 3 miles SE of the watershed boundary. There are 5 documented peregrine sightings within the watershed, indicating peregrines are likely utilizing portions of the watershed for foraging.

Species with multiple-habitat associations:
To date, one acoustic bat survey has been conducted within the watershed at the Basin Gulch campground in 2002. The only species identified with any certainty in that survey was the California myotis *(Myotis californicus)*. Other recorded calls suggest the hairy-winged myotis *(M. volans)*, the small-footed myotis *(M. ciliolabrum)*, and either the long-eared myotis *(M. evotis)* or the fringed myotis *(M. thysanodes)*. *Myotis evotis* is documented on the Shasta-Trinity National Forest, and *M. volans* and *M. thysanodes* are expected to occur. California WHR information shows that the watershed is outside of the known range of *M. ciliolabrum* (CDFG 1999). Further surveys should clarify species in the watershed. Numerous other bat species are known or expected to occur on the South Fork Management Unit. Of these, the Townsend's big-eared bat *(Corynorhinus townsendii)*, pallid bat *(Antrozous pallidus)*, and western red bat *(Lasiurus blossevillii)* are sensitive species. Townsend's and pallid bats roost in caves, mines, and buildings, while red bats roost primarily in deciduous trees.

Within the watershed, 1,017 acres have been surveyed for Survey and Manage (S&M) terrestrial mollusks. Two former S&M species, Church's sideband snail *(Monadenia churchi)* and the papillose taildropper slug *(Prophysaon dubium*), are known to occur, but no current S&M species have been detected. Specimens of the Trinity sideband snail *(Monadenia setosa)*, a California state threatened mollusk, have been documented during surveys but due to the distance between these detections and any other known *Monadenia setosa* sites, the identification of these mollusks is questionable. The Klamath Shoulderband snail (*Helminthoglypta talmadgei)* is known to occur in the upper Hayfork Creek drainage, and may occur in the westernmost portion of the Middle Fork Cottonwood watershed. This species does not currently require pre-disturbance surveys.

There are 54 species of neotropical migratory birds in California for which sufficient data exists to monitor population changes (Sauer et al 2001). Of those, 49 are either known to or possibly could occur within the Middle Fork Cottonwood Creek drainage. Eleven of these species show significant declining trends from 1966-2000, four show significant increasing trends, and the remainder do not show significant trends in population.

Within the watershed, there also exist 88.5 miles of roads on FS lands and private inholdings, resulting in a road density of 2.44 miles per square mile within the upper portion of the watershed. These roads are mostly level 2 and 3 Forest Service roads, but also include approximately 7.2 miles of state highway. In addition, a PG&E high-voltage power line crosses the watershed. Approximately 44.5 acres of land beneath the lines is managed for the right-of-way and maintained in an early seral condition through mechanical means. Some of this acreage is on private lands.

Heritage:

Heritage Management over the last 25 years has focused primarily on the upper part of the Middle Fork Cottonwood watershed where Forest Service land management activities have occurred. Most of the archaeological work has been undertaken to meet section 106 requirements for timber sales, road construction, and special use permit projects. Consequently, most of the archaeological field survey acreage has been completed in this part of the watershed. To date, this work has identified 31 prehistoric and historic archaeological properties. Four sites have been deemed eligible for the National Register of Historic Places. Twelve sites have been determined not eligible to the National Register of Historic Places, and the other 15 sites with records, have not had their eligibility formally determined. In addition, there are four sites in the area that are within Private lands.

Within the watershed managed by the Forest Service, there are two important prehistoric sites located just west of Platina. One site was excavated in 1990 by Chico State University. The depth of the cultural deposit exceeded 1.5 meters. The second site is a reported village location, located in the vicinity of the Harrison Gulch Station. No evidence has been found to document this site but the local Nor-Rel-Muk Indians have voiced concern about management activities impacting it.

Unfortunately, we have no knowledge of what is within the eastern half of this watershed. The Forest Service does not manage any land there. In addition, Bureau of Land Management lands in this eastern part of the watershed, according to the BLM, have not been surveyed. However, it can be assumed that large year round village sites are located there similar to the Platina site. The focus of habitation along Middle Fork Cottonwood Creek would have been to utilize the historical anadromous fish runs and surrounding oak woodlands.

CHAPTER IV: Reference Conditions

Hydrology:

Unchanneled and channeled colluvial valleys are common throughout the Middle Fork Cottonwood Creek watershed. Within these valleys, upper bank mass wasting is the major natural producer of coarse sediment. Material delivered via debris slides and torrents are rapidly transported via supply limited stream channels to downstream response channels.

The average natural sediment yield from Middle Fork Cottonwood Creek, estimated using the surface and mass erosion rates and a sediment delivery factor, is about 5,500 tons per year. The yield varies by watershed according to the area of erodible soils, mass wasting features, and slope steepness.

The majority of the streams draining Middle Fork Cottonwood Creek are source and transport channel types that efficiently transport and deliver fine and coarse debris. The stream channels tend to be incised and confined by steep “V” shaped valleys. Bedrock outcrops and large woody debris (LWD) help define the stream channel geometry by creating irregular obstructions to flow. LWD also add to channel complexity and help temporarily store instream sediment. Stream channels draining the Middle Fork Cottonwood Creek watershed tend to be supply limited versus energy limited.

Because of the naturally low erosion rates, steep topography, and wet winters, Middle Fork Cottonwood Creek rapidly transports and delivers available debris to the mainstem. At bankfull discharge coarse sand to fine gravel tend to be the dominant bed-materials in transport, whereas, during major flood events cobble to boulder size bed-material is transported. Large pulses of sediment caused by infrequent storm events are rapidly routed through and out of the system.

Geology/Geomorphology:

The present topography of the watershed has been created almost exclusively by a combination of tectonic uplift, mass wasting, fluvial and surface erosion processes. The influence of these processes has been continuous from the beginning of the Klamath Mountain uplift.

During the past 150 years land-use activities occurring within the watershed have influenced the rates, frequency, and magnitudes of occurrence of natural processes but apparently only to a small extent relative to natural occurrences. The interactions between natural processes and land-use activities are complex however and do require further study to fully evaluate than is possible in this analysis. The land use activities that have had the relatively largest impact have been fire, timber harvest, and road construction.

Fire may have played a role in activating the landslide previously mentioned in Chapter III that is located south of Knob Peak (Section 7) by possibly changing groundwater infiltration rates and transpiration. The slide began to move during the wet years of the late 1990's. Morphologically this site is only a small part of a much larger landslide, the dimensions of which are about 1,150 feet long (extending above the upper road; 29N02) and 600 feet wide. The bench is nested throughout. Recent scarps showing a vertical displacement of about five-feet are found up to 500 feet above the road slide. Raw slide debris is found below the road for a distance of about 250 feet. This slide will probably continue to move, albeit at diminishing rates. Should similar weather conditions prevail this slide may progressively fail again, especially since surface water continues to infiltrate into tension and landslide scarps far removed from and high above the road.

Another landslide probably destabilized by undercutting of road 30N12 (Section 6), with sliding precipitated by the wet years of the 1990's. This slide is located near the Eastern Hayfork-Ono formation unconformable contact but itself is within the Hayfork Terrane. Slope orientation is congruent with fracture orientation to the northeast, and thus landsliding appears to be fracture influenced also.

The morphology of the immediate site is one of active, nested, rotational landslides within a larger landslide feature, the dimensions of which are approximately 800 feet long by 350 feet wide. Active, wet slumps are found throughout half of this slide's vertical distance. The area below the road does not show mass wasting activity, but surface erosion is apparent from road culvert drains.

Soils

Soils in the analysis area are in equilibrium with site conditions and vegetation as determined by the fire regime. The amount of organic material on the soil surface is dependent on soil productivity with its corresponding vegetation type, elevation, aspect and fire frequency. Plant communities dominated by ponderosa pine, gray pine, white oak and chaparral with a fire frequency of 8 to 10 years would have a thin litter layer with little to no duff layer. The Douglas fir dominated plant communities, with less frequent fires, would have accumulated a thicker litter layer overlying a 1 to 3 cm thick duff mat. Sites with more frequent fires would also have higher rates of nutrient cycling compared to less frequently burned sites. There would be less large coarse woody debris in the more frequently burned sites due to more consumption of the down material and less large material produced on those sites. The more frequently burned soils would have developed a more dense gravel pavement layer on the soil surface. Erosion processes would be dominated by rilling and dry ravel in the drier vegetation type and mainly sheet erosion in the Douglas fir dominated areas. Appendix A depicts soil parameters within the analysis area.

Commercial Timber Production:

Information regarding reference conditions for these watersheds is limited. Points of reference used for this analysis were 1944 aerial photos. The vegetative characteristics considered for the Middle Fork Cottonwood Creek watershed includes plant community and canopy density.

The Middle Fork Cottonwood Creek watershed was characterized in 1944 by medium density mixed conifer and ponderosa pine communities. In 1944 ponderosa pine and sugar pine comprised a higher component of the mixed conifer type, with white fir a much lesser stand component, particularly in the lower canopy levels. Stand density was higher in the overstory component of the mixed conifer stands, and lower in the understory component. This difference is most likely related to harvest practices between 1944 and today, increasing levels of dwarf mistletoe infection within ponderosa pine and gray pine trees, and aggressive fire suppression efforts. A large contiguous matrix of early seral stands of mixed conifer and ponderosa pine was predominant across the analysis unit. Additionally, because of fire frequency intervals, extensive early-seral chaparral, and gray pine/canyon live oak complexes dominated lower elevation front-country sites.

Botany

Sensitive, Endemic and Survey and Manage Species

Fire suppression policies over the last 100 years have had the greatest impact on plant communities within the analysis area, including those that contain suitable habitat for Sensitive plant species. Communities dominated by ponderosa pine, gray pine, black oak, and chaparral have experienced a fairly regular frequency of wildfires (5-7 fires between 1930 and 1986). Douglas-fir communities have experienced only four fires between 1930 and 1952, remaining unburned over the past 50 years.

Suitable habitats for Tracy's eriastrum and Niles' madia can be found within chaparral, gray pine, and oak woodland communities. Prior to human settlement chaparral communities burned intensely on a frequent, regular basis. Species that occupy these communities are adapted to wildfires, as indicated by reliance on root sprouting, high foliage resin content, or seeds that require heating or exposure to smoke to stimulate germination (Van Dyke et al, 2001). In the absence of fire in chaparral communities, larger shrubs such as manzanita and Brewer's oak (*Quercus garrayana breweri*) will replace smaller shrubs and perennials, shading out the understory and reducing recruitment of native annuals, perennials and smaller shrubs. Fire has occurred on less than 10% of chaparral, gray pine, and oak woodland communities in the analysis area in the past hundred years, indicating a possible loss of habitat for Tracy's eriastrum and Niles' madia, both of which prefer open, gravelly soils with little vegetative competition.

Forested communities dominated by conifers within the analysis area provide suitable habitat for mountain and brownie lady slippers, English Peak greenbriar, and Canyon Creek stonecrop (*Sedum paradisum*) (rock outcrops within forest or woodland). Historically, these communities had fewer stems per acre, but have become denser with regular fire suppression over the last 100 years. Other than for Canyon Creek stonecrop, habitat conditions are likely better now because of the increased shading and surface litter today's forests provide. Habitat for Canyon Creek stonecrop is presumably the same as in reference times because rock outcrops have remained stable over time. In contrast, the potential for significant damage to habitat for these species has increased where high stand densities have created high fuel loadings.

In the absence of fire, some ponderosa pine communities are being increasingly occupied by shade tolerant conifers and shrubs; reducing habitat for Red Mountain catchfly (*Silene campanulata campanulata*), but not to a significant degree. Prior to active fire suppression, these communities would have been more open and parklike, with more sunlight reaching the forest floor. As shade increases over populations, habitat decreases in quality. Currently, litter accumulation on the forest floor and around the base of some trees has increased to a degree that will allow mortality of larger pine trees that previously would have been resistant to fire, and increased the possibility of irreparable loss of Red Mountain catchfly habitat.

Invasive Weeds

Livestock grazing since the late 1800's and vehicle use since the creation of roads have had the greatest influence on the establishment and dispersal of non-native weeds within the analysis area. Yellow starthistle and Klamath weed, the predominant reported weeds, are fairly restricted to roadsides in sunny non-forested areas (starthistle) and shadier forested areas (Klamath weed).

Livestock grazing since the 1750's has had a significant impact on the composition of rangelands in California, particularly the displacement of native grasses and forbs with Mediterranean annual grasses (Jimerson et al., 2000). Loss of native species has increased the threat of loss of biodiversity and soil productivity, increased cover of noxious weeds, increased soil erosion, and potential negative impacts on ecological processes through altered fire regimes (Jimerson and Carothers, 2000). Grazing intensity has been somewhat less in northern California, including the analysis area, because of steep terrain, greater precipitation, and colder winter and early spring temperatures.

The analysis area is within the Harrison Gulch Allotment, but has been grazed since about 1890, predating Forest Service management. The allotment was closed to use in 1970, but grazed up to about 800 head of cattle during the 1920's. It is likely that the majority of noxious weed introductions from grazing occurred in the early part of the 20th century and all current dispersal comes from those plants.

Roads have been well documented as vectors for the introduction and spread of noxious weeds (Mack and Lonsdale, 2001). Road density in the analysis area is limited, helping to slow the spread of weeds throughout the analysis area, but a large portion of road use is in the fall during hunting season after seeds have formed and are ripe for dispersal. The use of off-road vehicles and dirt bikes has increased in popularity since the mid-1960's, enabling the dispersal of weeds to more remote areas than main roads.

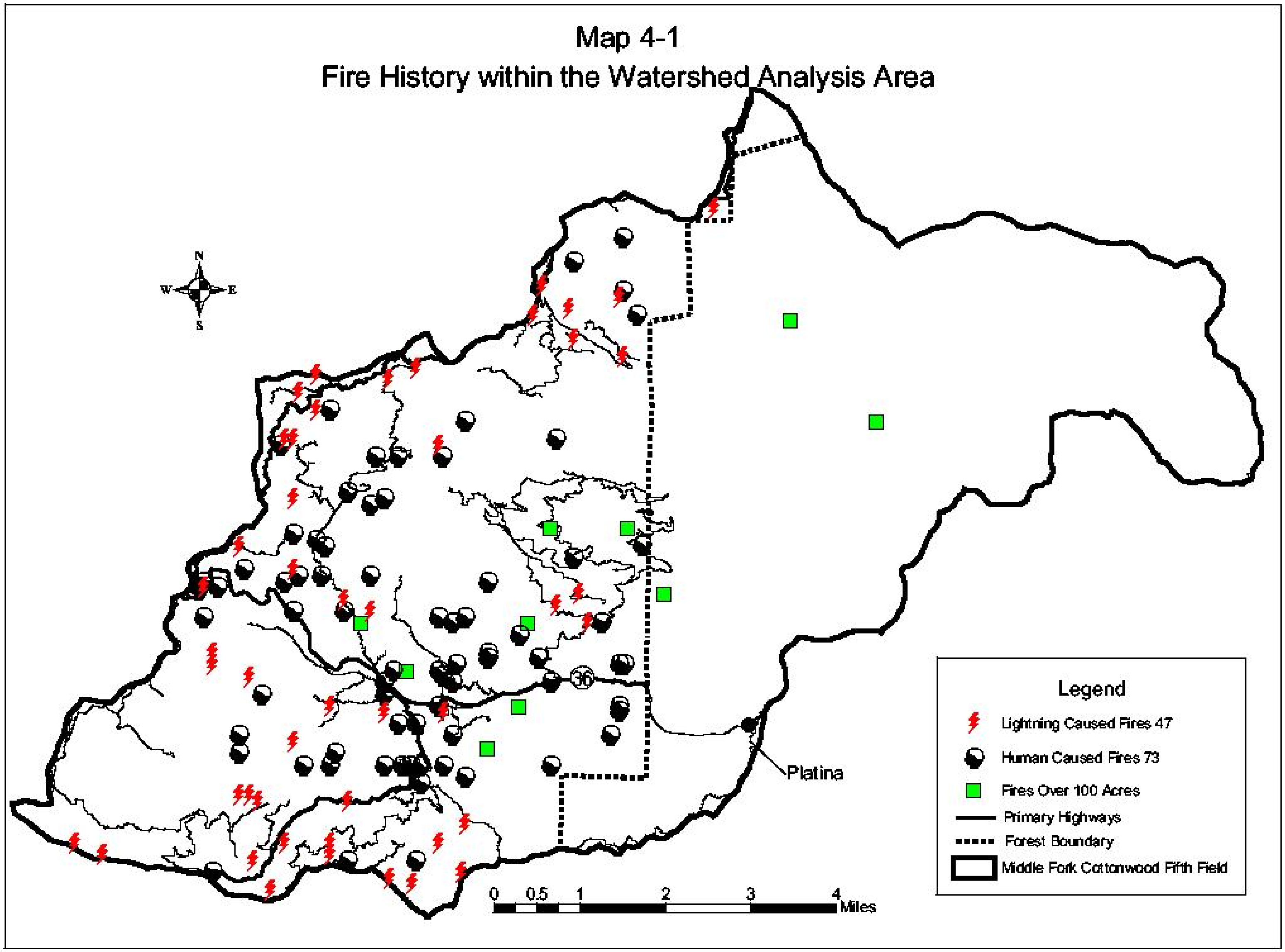
Fuels:

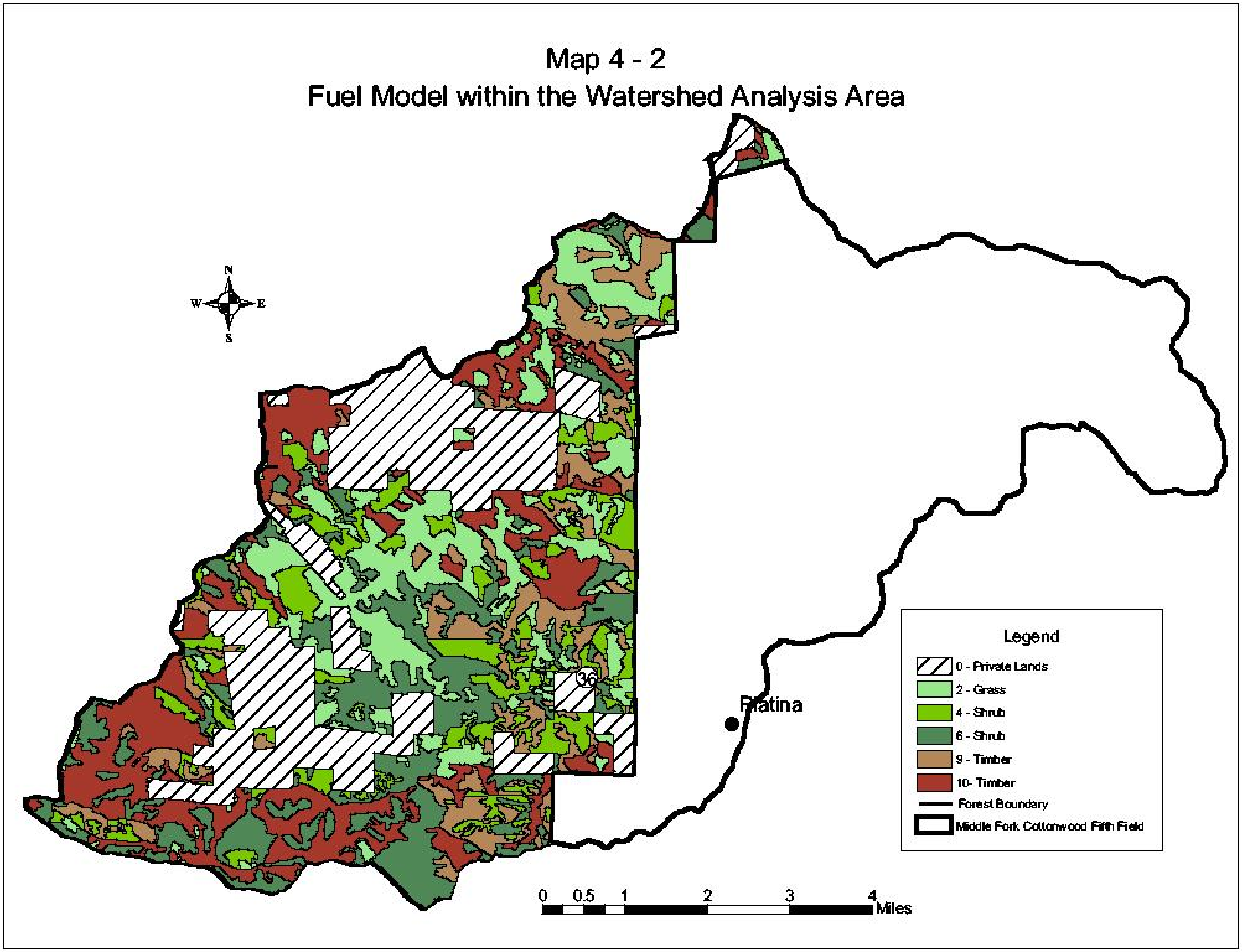
Road building, timber harvest, fires, and fire suppression have occurred in the Middle Fork Cottonwood Creek watershed. Large areas of decadent chaparral brush fields (many without large woody debris having existed previously) have resulted in riparian vegetation conditions that lend themselves to loss by high-intensity wildfires during 90th percentile weather conditions.

Fire regimes of the Pacific Northwest have been described by Agee (1993) and others as a function of growing environment (temperature and moisture patterns), ignition pattern (lightning, human) (Map 4-1), and plant species characteristics (fuel accumulation, adaptations to fire) (Map 4-2). Fire start records show there have been 120 fire starts within the Middle Fork of Cottonwood Creek Watershed. Twenty-nine of these fires were within the Knob Peak project area, where 3 lightning fires and 26 human caused fires have burned approximately 3,000 acres since 1930. Seven fires have exceeded 50 acres. The largest, in 1930, burned 1,524 acres in the Cow Gulch area. Nineteen fires starts have been suppressed before reaching 1 acre in size. The most recent wildfire (arson) was the Sunday Fire (50 acres), in July 2002.

Before organized fire suppression, wildfire starts would have burned until natural barriers were encountered, fuel was no longer available, or an act of nature caused their suppression, which could be over months of time. Frequent fires removed enough fuel that a large high intensity stand replacement fires, could not develop and become sustained. This situation has been changed dramatically; presently any fire not caught by initial attack fire suppression forces can be expected to become a large stand replacement fire.

A fire history study was conducted (Tayler and Skinner 2003) on the Hayfork Ranger District in the area of Jud and Rusch creeks. These data indicate a historic fire return interval of 3 to 5 years, and are reasonably applicable to the Middle Fork Cottonwood area. The historic fire regime for the area was one of frequent low-intensity fires. Before organized fire suppression began, around the turn of the century, low-intensity fires frequently burned unrestricted through the watershed, preventing heavy fuel accumulations from developing. Pre-fire suppression era stands were more open with large trees, less understory, and less ground fuel. Frequent fires prevented the build-up of ground fuel as well as understory fuel ladders, thus high intensity fires were rare, and small in size.


Map 4-1
Fire History within the Watershed Analysis Area
N
W
E
S
36
Platina
Legend
Lightning Caused Fires 47
Human Caused Fires 73
Fires Over 100 Acres
Primary Highways
Forest Boundary
Middle Fork Cottonwood Fifth Field
0
0.5
1
2
3
4
Miles


Map 4 - 2
Fuel Model within the Watershed Analysis Area
N
W
E
S
36
Platina
Legend
0 - Private Lands
2 - Grass
4 - Shrub
6 - Shrub
9 - Timber
10- Timber
Forest Boundary
Middle Fork Cottonwood Fifth Field
0
0.5
1
2
3
4
Miles

The following fire regimes are characteristic of the Middle Fork Cottonwood area:

> Low-severity fire regimes: Fires are frequent (1-25 years); they are low-intensity fires with few overstory effects.
>
> Moderate-severity fire regimes: Fires are infrequent (25-100 years); they are partial stand replacement type fires, including significant areas of high and low severity.
>
> High-severity fire regimes: Fires are very infrequent (more than 100 years between fires); they are usually high-intensity, stand replacement fires.

Through almost a century of fire exclusion, the historical fire regime has changed from one of frequent low-to-moderate intensity fires to one of infrequent high intensity fires.

Fisheries:
Chinook salmon are, and evidently always were, the only salmon species of commercial and recreational consequence in the Central Valley System (Eigenmann 1890; Rutter 1908; *as cited in* Moyle 2002). Historical documentation for Cottonwood Creek salmon populations and distributions are sparse. CDFG compiled available data on Cottonwood Creek anadromous fish dating back to the early-to-mid 1950's (CDFG 2000). Similarly, the environmental consulting firm CH2MHill compiled historical documentation for Cottonwood Creek anadromous runs and distributions. This information is presented in the Cottonwood Creek Watershed Assessment (CH2MHill 2001). Most of the early historical surveys cited in these two documents were in response to proposed water development planning studies, under the assumption a water project would eventually be built. There are no records prior to 1953.

Recent surveys indicate that the majority of spring Chinook migrate up the mainstem, to the Middle Fork and up to Beegum Creek (CDFG 2000). There is anecdotal information indicating that spring Chinook got as far upstream on the Middle Fork as the general area of the Platina store (G. Pigott, personal communication). However, no salmon have been observed there since the mid-1980s. Historical population estimates for Cottonwood Creek are almost exclusively for fall-run Chinook salmon. The average annual fall-run Chinook salmon escapement is estimated at 3,600 fish, although there is great annual variability due to variations in flow and other factors (CDFG 2000). There is very little information for winter steelhead for Cottonwood Creek. CDFG estimated Cottonwood Creek supports approximately 1,000 steelhead (CDFG 1966, *cited in* CDFG 2000). Anecdotal information indicates steelhead utilized Middle Fork Cottonwood Creek within the Forest Boundary prior to the mid-1980s (G. Pigott, personal communication).

CDFG stocking records indicate that 30,000 were introduced to the Middle Fork Cottonwood Creek in 1931 (Table 4-1). Rainbow trout were planted in the Middle Fork beginning in 1935. It is assumed that these plantings were to support or supplement recreational fishing opportunities for the much larger community that once lived and worked in the area. The hatchery source was either Mt Shasta or Darrah.

Table 4-1. CDFG trout planting records for Middle Fork Cottonwood Creek.

Year	Rainbow trout (catchable)	Rainbow trout (fingerlings)	Brown trout
1931			30,000
1935	20,000		20,000
1941	13,000		
1943	15,000		
1946	2,000		
1953	18,200		
1954	3,000		
1957	2,300		
1958		5,000	
1960	1,200		
1962	1,300		
1963	1,500		
1964	1,200		
1965	500	1,500	
1966	625		
1967	500		
1969	500		
1970	500		
1971	500		
1972	500		
1973	1000		
1974	600		
1975	600		
1976	600		
1977	300		
1978	600		
1979	600		

Source: CDFG 2000

Due to the long history of fish plants, lack of creel census information, extensive mining activity historically, the patch-work of private property ownership, and private and federal timber extraction occurring into the early 1990's, it is impossible to develop meaningful environmental reference conditions for fish populations in the Middle Fork of Cottonwood Creek.

Wildlife:
Human presence in the Middle Fork Cottonwood drainage has occurred for approximately the last 5000 years. Until the early 19th century, Native Americans resided

in the area and utilized it for hunting and gathering. They routinely used fire to keep landscapes cleared, and it is highly likely this occurred within this watershed.

The advent of European settlement in the mid-19th century significantly altered human use patterns in the area. Four driving factors (human residence, grazing, timber harvest, and suppression of wildfire) have affected this watershed the most. Farms and ranches were established, primarily in lower-elevation riparian areas. Land clearing and diversion of water resulted in reductions of quantity and quality of riparian habitats along the valley floors. In addition, habitation related to mining and timber harvest also led to alteration and elimination of some areas of various habitats. At one time, several hundred people resided in Harrison Gulch and surrounding areas. Placer mining, while not occurring to the scale of Hayfork Creek or the Weaverville area, may also have altered riparian habitats.

Livestock grazing within the period from the late 19th through mid-20th century helped to maintain early seral conditions in portions of the watershed, replacing wildfire as the means of sustaining early seral conditions within some areas. In addition, grazing contributed to alterations of bank structure, changes in plant communities, and reductions of water quality, contributing to diminished quality and availability of riparian habitats within the watershed.

Timber harvest within the watershed has occurred since the mid-19th century. Timber for local construction, mining, and eventually commercial sale has been harvested within the watershed since that time. Until the mid-20th century, this activity was likely restricted to areas in close proximity to habitation and typically consisted of removal of only select trees from the watershed. During the mid-20th century, however, commercial logging became a widespread practice in the area and logging has occurred within the watershed since then.

Fire suppression has likely had the greatest impact upon wildlife habitat. Suppression influences the amount and degree of downed wood, the amount and distribution of vertical structure of forested lands, and overall stem numbers and diameters within stands.

Increased levels of dead and down material provides an increase in available cover for small mammals, reptiles, mollusks, and other ground-dwelling species. Increased levels of mid- and understory vegetation may increase cover, providing nesting and foraging opportunities for numerous bird and some small mammal species. These in turn represent a prey base for carnivorous birds and mammals, which may lead to increases in their populations.

However, increased densities of mid-and understory trees within late-seral stands may decrease habitat suitability for some species, such as goshawks. Species that prefer more open stands for flight may be reduced in numbers as a result of this condition.

Lower fire frequencies have also contributed to aging and ultimately decadence of chaparral and other non-conifer habitats within the watershed. This may increase cover for animals such as deer and quail, but it also reduces the palatability and availability of forage for those species with time.

Within the watershed, road building has also affected wildlife habitats and populations. Some animals, such as terrestrial mollusks, may find roads significant barriers to travel. Roads also increase both legal, illegal, and accidental human take of game and nongame species and contribute to reduced effectiveness of interior habitats. Roads have contributed to fragmentation of habitats within the watershed.

Heritage:

The Middle Fork Cottonwood area has 31-recorded American Indian and Euro-American archaeological sites. These sites represent over 5,000 years of human settlement in this area. The human occupation of this watershed can be divided into several phases. The first would be the prehistoric, which can be divided further into two general periods. The earliest period extends from 5,000+ to 2,000 years ago. The people of this time were the ancestors or the Chimariko tribe. They spoke a language belonging to the Hokum phylum. Linguistic and archaeological studies suggest these were the first American Indian people to inhabit Trinity River and South Fork of the Trinity River watersheds. Their territory may have extended southeastward into the Middle Fork Cottonwood Creek watershed (Theodoratus 1981 and Silver 1978).

In the next prehistoric phase, Wintu peoples (Penutian phylum speakers) moved into the area taking over much of the earlier culture's territory. These later peoples through peaceful or forceful means reduced the earlier tribal territory down to the Trinity River Canyon (Burnt Ranch Gorge area). This period lasts from 2,000 years ago to the present (Theodoratus 1981 and Silver 1978).

During the prehistoric phase human subsistence was centered on the fisheries and oak woodland resources. In addition, hunting and gathering was carried out at higher elevations, particularly along the ridgelines. The principal landscape effects by the Native peoples were through the use of fire. This tool was used for improvement of plants used for subsistence, improving forage conditions for deer, and for hunting.

Starting around 1820 and lasting up to 1850 is the initial contact phase with Euro-Americans. In this phase the local tribes start receiving information and some trade goods from English, Russian, Spanish, and American fur trading interests. The principal agents of this contact are the Hudson's Bay Company, possibly Russian traders from Fort Ross, and American fur trappers. The only documented expedition through the Trinity County area during this period is the Jedediah Smith party. It was also during this phase that the indigenous peoples start to suffer from the first contact with non-Indian people. Though unintentional, a malarial disease was introduced to Northern California by the Hudson's Bay Company, which decimated Indian tribes throughout the Sacramento River

Valley. It can be inferred that the disease, which was spread by mosquitoes, moved westward into the Trinity Mountains.

Eighteen-fifty (1850) to 1860 was the initial gold discovery phase. During this time Euro-Americans move into this area in large numbers and start to displace the native peoples from their winter villages and traditional fishing locations. There was exploration in this watershed for gold, but no large placer deposits were found as along the Trinity River farther north. In addition, the displacement of Native peoples did not occur here until later in the 19thcentury.

In the next phase, from 1860 to 1880, gold mining became more organized and large scale. The non-Indian population grew and native populations continued to decline. In addition, Chinese started to come into the area to rework older mining claims and take employment with mining companies. The principal communities in the area, along with local governmental structures, were more firmly established. In this watershed timber extraction increased to help support the mining activity, building, and heating. In addition, mining continued to grow with larger placer and hydraulic operations starting. Also, the first hard rock load mining started to take place (Jones 1981).

From 1880 to 1914 the initial gold rush frenzy has subsided and mining starts to take on a more industrial aspect. Larger hard rock enterprises are started which require substantial financing. Although the lone sour dough working his claim by himself or with a few others still existed, the local miner now was more likely to be an employee of a large company. The principal beneficiaries of these gold mining ventures were the owners and stockholders. At this time in the Upper Middle Fork Cottonwood Watershed, several mines were established including Midas, Hall City, and others in and around Harrison Gulch. These mines worked up through the early 20th-century and started to die out after World War I. During the heyday of these mines several thousand people populated this area working as miners, business owners, or workers supplying lumber, firewood, or food commodities to the mines. The last residents left this area in the 1920's after the mines played out.

From 1914 to 1930, the mining subsides especially the large enterprises started to run into cash flow problems. This was caused by a number of factors; one was the impact of World War I, which caused mineral prices to fall. However, the principal reason was the geologic characteristics of the mineral deposits. Although, gold can be found throughout most of the Trinity Mountains there is no one large mother-lode vein containing enough wealth to support a large industrial operation over several decades. Simply put, value of the minerals extracted was not enough to pay for operating costs and debt load. The mine closings around this time were a good example.

During the depression years (1930 through 1941) gold mining operations increased again, especially small ones. Most of this mining was more for subsistence than in the hopes of gaining wealth. The hard economic times forced many people back into the mountains where hunting, fishing, and gardening could provide food for survival. Gold mining helped to provide some hard cash for those items that could not be gathered or grown.

Timber cutting to build and heat the scattered cabin sites was probably the principal effect. Mining was generally small scale and limited to streams already impacted by past extraction.

From 1945 to 1985, the focus shifted to Forest Management and logging. This industry provided many jobs and helped the local communities to grow. However, after 1985, with decreasing timber harvesting on private and Forest Service lands and market shifts in the whole timber industry, logging lost its preeminence in the local economy. Although still important, the overall size of the economic contribution of logging to the local economy has decreased.

CHAPTER V: Synthesis and Interpretation

Fuels and Wildlife

Currently 95% of the fuel loads within the MFCC 5th field watershed are at fuels condition classes 2 and 3, which equates to moderate to high fuel loads (Table 5-1). Condition classes 2 and 3 tend to represent those stands with the greatest decadence in vegetative condition and also represent those areas with the poorest forage quality for deer.

A significant portion (6,807 acres) of the MFCC 5th field watershed has been identified as winter deer range for the Yolla Bolly deer herd. Ninety-five percent of the winter deer range falls within three HUC 7 watersheds, 49.5%, 26.1 % and 19.6% for watersheds 103, 102, and 104 respectively.

Table 5-1. Synthesis of Fuel Condition Class and Winter Deer Range distribution by HUC 7 watersheds.

		USFS	Fuel Condition Class (% area)			USFS Deer Habitat
HUC 7	**Name**	**(acres)**	**3=High**	**2=Med**	**1=Low**	**%**
101	Upper MFCC	4733	6.6	19.4	0.9	3.8
102	Harrison Gulch	4108	8.7	14.6	0.1	26.1
103	Middle MFCC	4254	9.8	12.6	1.8	49.5
104	Cow Gulch	1370	2.0	5.5	0.3	19.6
301	Knob Gulch A	2944	6.8	8.9	1.0	1.0
302	Little Bear Gulch	200	0.5	0.6	0	0.0
303	Knob Gulch B	0	0.0	0.0	0.0	0.0
Totals		**17,608**	**33.8**	**61**	**4.1**	**100**

Shrub species dominant within the identified deer range include chamise, greenleaf manzanita, whiteleaf manzanita, wedgeleaf ceanothus and mountain mahogany. All of these provide forage for deer and a variety of other wildlife, including small mammals, birds and insects. When these shrub species achieve decadence, palatability, availability (for the deer to reach the leaves and edible stems) and overall value as a forage resource decreases greatly.

Historically, chaparral communities were subjected to relatively frequent, high intensity burning. These events typically burned in a landscape level mosaic, with varying levels of intensity and severity within the burn perimieter. Chaparral species are well adapted to fire, with root sprouting initiating within weeks after the burn event. The new growth that develops during this period of renewal is highly palatable, easily accessible and locally abundant. Wildlife populations are quick to colonize these areas of increased food availability.

Chaparral communities also provide cover, further contributing to the value of those areas as wildlife habitat. The mosaic of intensities of historic burn events allowed for rejuvenation of forage in localized areas while still maintaining the cover component over the remaining area. Increased edge was created along these burned/not burned zones, allowing foraging wildlife quick access to protective cover when threatened.

Fire suppression combined with the lack of other ground disturbing activities have facilitated the development of decadent stands of chaparral. This lack of disturbance is also evident within the mixed conifer and oak woodland stands. Accumulations of fine fuels are excessive and deter development of understory grasses and forbs in those areas. Species diversity has decreased as the level of decadence has increased.

The overlap between increasing decadence of deer browse with those areas of the highest fuel loadings is extensive. Treating high fuel loads in chaparral may help to meet deer habitat/forage improvement objectives as well. Treatments within the conifer stands would also contribute to reduced fuel loadings and an increase in grass and forb production, and would increase the health and vigor of remaining trees.

Figure 5-1 displays the distribution of winter deer habitat within the 7th field subwatersheds of the MFCC 5th field watershed. Treatments within HUC 103 could affect almost 50% of the identified deer habitat, while reducing 20% of the high and moderate fuel loadings in the area. Fuels or other treatments within HUC 102 could help to improve deer forage on up to 25% of their range, while contributing to fuels reduction on another 25% of the area. These data as displayed above, can help in prioritizing areas for treatment and in designing the types of treatments most likely to meet landscape objectives.

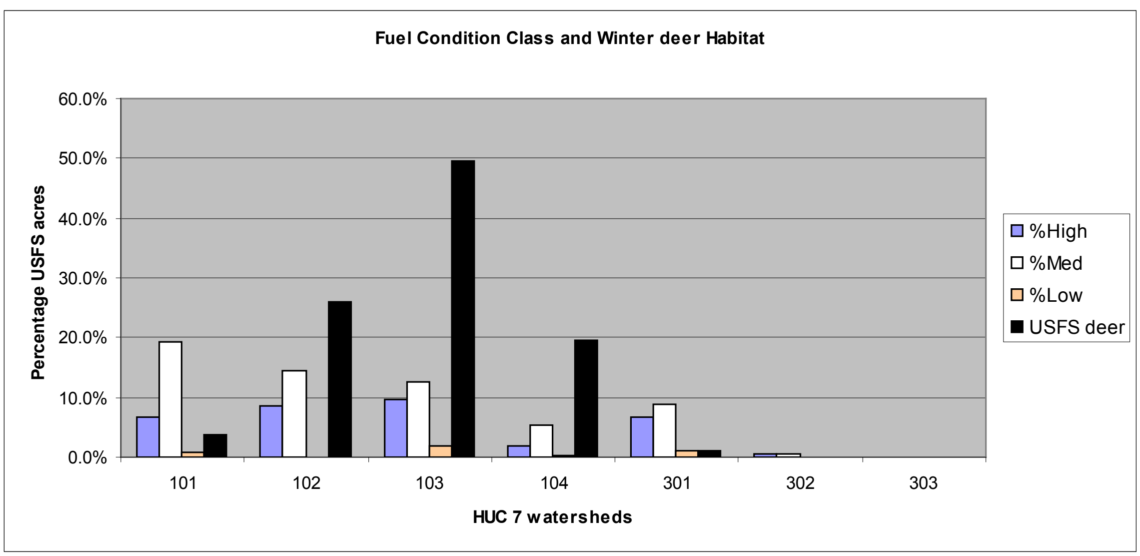


Figure 5-1. Distribution of Fuel Condition Classes and Winter Deer Habitat between HUC 7 watersheds.

Plant Species of Concern
Introduction and spread of invasive weeds has had an impact on habitat for the two Sensitive plant species present within the analysis area, Tracy's eriastrum and Niles' madia. Both species occupy dry, open habitats that are the most conducive for yellow starthistle and annual grasses. Annual grasses are found throughout the analysis area while yellow starthistle is found closer to roads. Any future ground disturbing activities, such as earth moving associated with road or fuelbreak construction, could disrupt soil stabilization and increase competiton for both of these species.

In the absence of fire in Douglas-fir habitats since the mid-century, forested stands have become densely stocked with small-diameter trees, creating high fuel hazards and increased threat of stand-replacement fire. Severe fire could have much more significant impacts on habitat for mountain and Brownie lady slipper orchids, English Peak greenbriar, and Canyon Creek stonecrop. All of these species easily survived fires prior to human settlement because fires were low-intensity and occurred on a regular, frequent basis.

Invasive Weeds
Most annual grasses and invasive weeds were introduced early in the century with intensive livestock grazing. Restoration of California native grasslands and chaparral has been only marginally successful to date, even in the absence of livestock grazing, because of the continued dispersal of weeds and changes to soil and plant community ecology that have occurred. Livestock grazing has been removed from the analysis area through the closure of the Harrison Gulch allotment, but on and off-road vehicle travel continues. Construction of large fuelbreaks with bulldozers has also been considered, but is not necessarily a proposal at this time.

Off-road vehicle travel and fuelbreak construction (with dozers) will accelerate movement of weeds from established roads into new areas, as well as increase the probably of fire starts. Most of the open areas within the analysis area are occupied with non-native annual grasses, and yellow starthistle is common in openings near roadways. Both of these plants are very flammable once they have cured (by late August). Use of off-road vehicles presents a low fire risk where dirt trails are wide, but a high risk for fire ignition where cured grasses and starthistle are close to travel paths. As weeds are introduced into newly disturbed areas created for off-road routes, more of the analysis area will become susceptible to human-caused wildfire.

CHAPTER VI: Recommendations:

Fire/Fuels

The LRMP describes the need to identify the natural role of fire in the ecosystem and recognizes that wildland fuels management presents an opportunity for long-range mitigation of the increasing requirement for the escalating cost of fire protection. It states that future fuel treatments will support ecosystem goals that encourage returning the landscape to conditions that existed before the exclusion of fire. The primary objective of prescribed fire is to reduce the intensity of wildland fires through the reduction of high risk ground and standing fuels.

Riparian Reserves

In Riparian Reserves, desired conditions are: fuel loading at levels that compliment the surrounding areas resiliency to natural fires, fuel loading at levels that reduce the risk of catastrophic fires, vegetative structure that provides thermal protection to streams, sufficient duff layer to control erosion, and sufficient woody material to maintain soil productivity and minimize erosion. "Complimenting the surrounding areas resiliency to natural fires" means that higher fuel loading in Riparian Reserves is acceptable and expected and is often needed to meet Aquatic Conservation Strategy (ACS) objectives. Manual fire ignition will occur in Riparian Reserves only to maintain low intensity burn levels, as approved by a fisheries biologist. Such ignition is done to reduce the potential for material rolling down within a Riparian Reserve and creating increased intensity burn levels. Areas outside of Riparian Reserves may have lower fuel loading than in Riparian Reserves to allow for increased fuels levels in Riparian Reserves, to facilitate suppression needs, and to create diversity throughout the landscape.

Understory Burns

Some burns also include an objective of rejuvenating understory shrubs for wildlife habitat, while not degrading the late successional habitat that is present in the area. Generally, reduced understory vegetation load on an area will allow the overstory trees to be more resistant to insect and pathogen mortality. Underburning in LSRs may be done to increase their resiliency to wildfire. Underburning areas adjacent to existing plantations will help protect the plantations from future intense wildfires that would otherwise be a serious risk to their survival. Underburning that is conducted in the spring when the fine organic material contains more moisture helps assure that duff layers will remain intact after the burning operation. Late summer and fall season burning is more apt to meet Forest Service designated Sensitive Plant objectives and Native American cultural objectives. Late summer and fall season burning is also recommended to minimize impacts to wildlife species such as the Northern Spotted Owl, and some herpetofauna. Therefore, the exact timing of prescribed fire needs to be determined by specific fire objectives and consideration of multiple resource needs.

Fuel moistures and humidity are monitored to assure that the prescription is met. Because conditions are monitored and weather patterns vary, it is possible to burn at a variety of times during the year and meet project objectives. For example, burn objectives may be met through summer season burning at high elevations. Burn prescriptions are designed to prevent severe burn levels within or outside of Riparian

Reserves, maintain a cover of fine organic matter on at least 50% of the burn area (USFS Region 5 Soil Quality Standards and Guidelines), retain large down woody material and snags, and to result in light impacts to the canopy level of conifers and hardwoods. Retention and protection of riparian cover is also a driving objective to maintain a healthy, stable watershed.

The Shasta-Trinity National Forest has a finalized programmatic Biological Assessment (BA) for the Prescribed Fire Program and has received written letter of concurrence from NOAA Fisheries. The following are prescribed burn treatment requirements and expectations for projects tiering to the **Prescribed Fire Biological Assessment**:

- All applicable Management Area standards and guides will be met.
- To minimize the potential for cumulative adverse affects, no more than 10% of a fifth or sixth field watershed will be burned in any one year.

Specific to Riparian Reserves:

- Prescribed fire **is** expected to occur in Riparian Reserves.
- Prescribed fire effects would mimic a low intensity backing fire. In order to maintain soil productivity and large woody material, and minimize erosion potential, only low intensity burn levels should occur in Riparian Reserves. Projects that require moderate or high intensity burning in Riparian Reserves will require additional consultation because the likelihood of adverse affects to anadromous fish habitat is increased with higher intensity burns.
- Ignition will occur in hydrologically defined Riparian Reserves only to minimize the potential of burning material from rolling down into Riparian Reserves and increase the potential for moderate or high intensity burns. Approval by the District fisheries biologist is needed. In Riparian Reserves that do not contain riparian vegetation or wetted areas, the fisheries biologist will work with fuels specialists to designate appropriate no ignition zones. It is expected that due to the increased humidity levels around riparian vegetation and the selected areas of ignition in Riparian Reserves, such a buffer will enable the maintenance of a low intensity burn.
- At least 90% of the large woody debris would be left on site, both standing and on the ground. Large woody debris is defined as 16-inch dbh or greater.
- Fire line construction in Riparian Reserves should be avoided. Roads, ridge tops and other topographical features are normally used to act as fire lines.
- Firefighters and equipment will not enter waterways where anadromous fish were determined to be spawning or eggs would be incubating, as determined and indicated by a fisheries biologist. Restricted time periods are generally October 15 through June 15. This is done to minimize direct impacts to anadromous fish.
- No ground disturbing machinery will be operated in a Riparian Reserves unless it can be demonstrated that entry activities are consistent with ACS objectives (USDA/DOI, 1994). The chief goals of ACS objectives are for the continued maintenance and or enhancement of Riparian Reserves for Riparian dependant species.
- Based on landscape features prevalent in the Middle Fork Cottonwood watershed, the recommendations provided in Table 6-1, should be used as guidelines where

treatments within the established Riparian Reserve buffers (USDA/DOI, 1994) are considered.

Table 6-1. Riparian Reserve Treatment Recommended Guidelines.

Riparian Reserve Type	Riparian Buffer Width	Description
Landslide Prone	Site Specific	No mechanical entry, no primary ignition, no backing fires
Colluvial hollow, ephemeral-intermittent, chaparral, fire frequent	50 ft. slope distance from high flow mark	Mechanical entry and primary ignition
Colluvial hollow, ephemeral-intermittent, conifer, fire infrequent	50 ft. slope distance from high flow mark	No mechanical entry, no primary ignition, and allow backing fires
150 ft. slope distance from high flow mark or inner gorge	150 ft. slope distance from high flow mark or inner gorge	No mechanical entry, no primary ignition, no backing fires, and allow fuel reduction by handwork
300 ft. slope distance form high flow mark or inner gorge	300 ft. slope distance form high flow mark or inner gorge	No mechanical entry, no primary ignition, no backing fires, and allow fuel reduction by handwork
Site specific or minimum 100 ft. slope distance	Site specific or minimum 100 ft. slope distance	No mechanical entry, no primary ignition, and no backing fires

Wildlife

Maintain and/or enhance late seral/old-growth stands within LSR/CHU and 100-acre owl LSRs and achieve/maintain 15 percent old growth and late-seral conditions. The following recommendations are provided to meet the intent of the 15 percent Late-Successional and Old-Growth retention standard and guideline currently and into the future within the Middle Fork Cottonwood Creek 5th Field Watershed:

1) The GIS databases used for this analysis are appropriate "coarse grain' tools for landscape level (i.e., 5th field 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.

2) Timber harvesting proposed in healthy 4G and 4N stands should be designed to enhance late seral conditions already present. These stands are likely the highest quality old-growth habitat and currently comprise only 5% of the watershed.

3) More intensive harvesting may be appropriate within 4G and 4N stands on Matrix lands when it can be demonstrated that 3G or 3N stands are meeting the ecological roles of old-growth habitat and contribute comparable acreages.

Locations proposed as fuelbreaks may also require greater levels of overstory removal.

4) Silvicultural prescriptions designed for 3G and 3N stands should be developed so as to promote the development of LSOG conditions for sustained LSOG representation within this watershed.

Use prescribed fire or other means to improve availability and palatability of deer browse in chaparral, gray pine, chamise, and montane areas within the watershed. Consider fire use in hardwood stands as well.

In chaparral stands, maintain a cover to forage ratio of approximately 1:1, as described in the Yolla Bolly Deer Herd Management Plan (CDFG 1982). Maintain 15% of those stands in new brush (1-3 years old), and 25% in grasses. Retain pockets of dense vegetation for thermal and hiding cover.

Maintain or enhance growth of early-to-mid seral stands in LSR/CHU, dispersal corridors, and in proximity to 100-acre owl LSRs.

Maintain snag levels at or above guidelines. Where snags are below desired levels, enhance recruitment/retention where possible.

Reduce open road density within the watershed to increase overall habitat effectiveness for wildlife and to limit seasonal disturbances where warranted.

Consistency with the Shasta-Trinity LRMP:

- ***Shasta-Trinity Forest Plan goals for the chaparral ecosystem*** *is to enhance wildlife habitat, livestock forage, watershed condition, and reduce wildfire hazard.*

- ***Shasta-Trinity Forest Plan goals for Threatened, Endangered, and Sensitive Species (plants and animals)*** *is to monitor and protect habitat for Federally listed threatened and endangered (T&E) and candidate species, and assist in recovery efforts for T&E species. Cooperate with the State to meet objectives for State-listed species. Manage habitat for sensitive plants and animals in a manner that will prevent any additional species from becoming candidates for T&E status.*

Miscellaneous
Within this Watershed Analysis, Fire and Fuels, Wildlife, and Fisheries/Riparian issues were considered the Key issues or "Project Drivers" within the watershed, and form the basis from which a Purpose and Need statement can be derived. All other issues in the watershed are "modifiers" or substantive issues/concerns instrumental to the refinement of a final Proposed Action. The following discipline specific recommendations are presented to be used as a modifier in a Proposed Action.

Geology/Geomorphology
Inventories of slide prone terrain have shown that hundreds of slides may occur during an intense storm. Shallow debris slides and debris flows often occur once threshold rainfall intensity has been exceeded. Regarding prescribed fire, avoid burning activities during periods when intense single storm events can be expected. This would be a prudent measure to lessen landslide risk. Rainfall intensity exceeding 10cm in 24 hours can induce a high probability of landslides (assuming previously saturated soils).

Avoid the unstable areas delineated on data base maps currently being entered into GIS. Unstable areas (especially: 1059, 1079, 1260, 1070, 1251, 1101, 1110, 1120, 1154) should be treated as control areas (undisturbed). On some slopes it may be possible to avoid all the unstable areas and still accomplish project objectives.

Whenever possible, slight changes in management area locations should be considered. For instance, on convex slopes most open slope landslides occur in or near zones of change in slope angle. The slope break can range from sharp to gradual, but most slides occur where the increase in gradient is 20 percent or more. With sharp slope breaks, the edge of the slope break is the most common initiation point. With more gradual slope changes, the landslides tend to initiate below the slope break. On concave slopes landslides usually initiate just above the slope break. For this reason, methods for prescribed fire initiation should be considered which provide for the greatest control of initiation point and spread.

Hydrology
Water quality data gaps exist in the watershed (CH2MHILL, 2001). Attempt to fill known data gaps by collecting needed data to better characterize sediment sources, delivery mechanisms, and transport. Using these data in the context of prescribed fire, road use, and timber extraction will improve project design and ultimately effectiveness.

Known data gaps include: water temperature, sediment yield, channel geomorphology, and LWD. Collecting these data should improve our understanding of watershed processes and our ability to predict and mitigate potential negative impacts to beneficial uses. In addition, the impact of prescribed fire needs to be monitored directly. Factors that need monitoring are: burn severity; erosion rates pre and post fire, and hydrologic recovery times. Some of this monitoring is ongoing (e.g., water temperature), and efforts are being made to measure erosion rates and recovery times post prescribed fire.

It is recommended that a rainfall run-off and sediment source analysis be conducted when planning prescribed fire and other management (e.g., road use). This analysis should inventory the forms of erosion, texture of eroded sediments, types of delivery mechanisms and transport mechanisms, and potential impacts on downstream beneficial uses. This analysis should consider large storm events (winter rain-on-snow) as well as localized thunderstorms.

Commercial Wood Products

1) **Plantation Thinning Opportunities**. Conduct site-specific analysis of plantations that may be suitable for stocking-control (thinning) through the development of silvicultural prescriptions. Indicators of stand conditions that may be candidates include size/density stands of UX (conifer plantation) and XUX (conifer plantation). Subwatersheds currently deficient in connectivity habitat may be priority for treatment. Priority areas include the Round Fire, Harrison Gulch, and Knob areas.

2) **Thinning Opportunities on Overstocked Young Growth Sites.** Conduct site-specific analysis of well-stocked stands, which may be suitable for intermediate (thinning) harvest on suitable AMA lands, within late-successional reserves, and within select riparian reserves through the development of silvicultural prescriptions. Indicators of stand conditions that may be candidates includ size/density stands of 2 or 3, N or G. Thin overstocked stands to restore vigor, prevent mortality, and accelorate development of LSOG conditions. Many mature stands in the watershed are beyond the natural range of variability in carrying capacity due to fire suppression and the subsequent encroachment of a shade-tolerant understory. This has led to conditions of low vigor, resiliency to stressors, and excessive mortality.

3) **Ponderosa Pine/Jeffery Pine thinning Opportunities.** It is recommended that ponderosa and Jeffrey pine stands be thinned to reduce the probability of successful bark beetle group kill. Older stands should be thinned, while younger stands could be managed through a combination of thinning and underburning. These treatments may be integrated with fuels reduction activities to achieve mutual benefits. In areas where the sudden death of a group of pine has resulted in the accumulation of unacceptably high levels of fuel, thinning can lower the risk of mortality. Thinning pine stands will reduce the probability of a successful *Dendroctonus* group kill by both increasing the amount of soil moisture available to each leave tree, as well as by increasing the spacing between leave trees to the outer limits of effectiveness of the aggregating pheromone. The only reliable and effective method to thin existing stands of thick-barked mature pines is to mechanically cut some trees. Prescribed fire can be used to open up some very young pine stands, or to maintain an open condition in an older pine stand after it has been thinned.

4) **Regeneration Opportunities on CMAI CAS Sites.** Conduct site-specific analysis of stands that may be suitable for regeneration harvest on suitable (CAS) lands, which have culminated, mean annual increment (CMAI) through the development of silvicultural prescriptions. Indicators of stand conditions that may be candidates include size/density stands of 3 N or G, or 4 N or G. Provide for retention of "best" LSOG for providing 15% within the watershed prior to identification of regeneration opportunities.

5) **Regeneration Opportunities on Understocked CAS Sites.** Conduct site-specific analysis of under-stocked stands that may be suitable for regeneration harvest on suitable (CAS) lands through the development of silvicultural prescriptions. Indicators of stand conditions that may be candidates include size/density stands of 3 S or P, or 4 S or P. Subwatersheds currently deficient in connectivity habitat may be priority for treatment.

6) **Include Riparian Reserves in "Upland" Prescriptions.** When the logical placement of a regeneration or thinning unit adjoins a Riparian Reserve, include that portion of the RR in the unit boundary. Then develop an appropriate prescription that integrates the Aquatic Conservation Strategy with the upland forested area.

7) **Sugar Pine Enhancement Opportunities.** Locating disease resistant parent trees and planting resistant stock are critical to maintenance of sugar pine at or near historical levels in the Middle Fork Cottonwood Creek watershed. Other management activities such as pruning and localized *Ribes* removal may be used in stands where only non-resistant sugar pine are available and it is desired to recruit sugar pine as a part of the future overstory. Although sugar pine will likely not become extirpated from the watershed, without some actions to protect it and promote regeneration of resistant trees, demographics will change as immature trees will not be available to move into mature and over mature age classes.

Plant Species of Concern

Discourage dozer-created fuelbreak construction of firelines in habitat favorable to Tracy's eriastrum or Niles' madia.

Reduce fuel hazard in Douglas-fir plant communities to reduce the risk of stand-replacement fire in habitat for mountain and Brownie lady slipper, English Peak greenbriar and Canyon Creek stonecrop habitat.

Invasive Weeds

Discourage dozer-constructed fuelbreak construction in areas where roads or trails do not currently exist to minimize creation of habitat suitable for invasive weeds.

Discourage creation of new off-road vehicle trails to reduce creation of habitat suitable for invasive weeds and reduce ignitions of human-caused wildfires.

<u>Heritage:</u>

Traditional plant resource enhancement and gathering opportunities-Archaeological and historical study needs to continue to help establish the historic reference conditions of the watershed over time. This helps in the analysis process to more accurately determine what we want to make the watershed look like in the future. Archaeological and historical studies can help provide the information to better understand desirable native plant management.

1) Survey and document plants used for traditional crafts such as hazel and red bud.
2) Develop management plans to enhance these resources through burning and pruning.

REFERENCES

Agee, J.K. 1993. Fire ecology of the Pacific Northwest Forests. Island Press. Washington D.C., USA.

Barbour, M.G., J. H. Burk, and W. D. Pitts, editors. 1987. Terrestrial Plant Ecology. 2nd ed. Menlo Park: The Benjamin/Cummings Publishing Co.

California Department of Fish and Game (CDFG). 1982. Yolly Bolly Deer Herd Management Plan. Sacramento, CA.

California Department of Fish and Game (CDFG). 1979. Inventory of Fishes of Cottonwood Creek, California. Preliminary Report. Prepared under an interagency agreement between the U.S. Corps of Engineers and the CDFG.

California Department of Fish and Game (CDFG). 1999. CWHR version 8.0 computer program Sacramento, CA.

California Department of Fish and Game (CDFG). 2000. *Draft* – Cottonwood Creek Report. Prepared by Heather Rectenwald. January 3, 2000.

CH2MHill. 2001. Cottonwood Creek Watershed Assessment. Prepared for the Cottonwood Creek Watershed Group.

DeBano, L.F., and C.E. Conrad. 1976. Nutrients lost in debris and runoff water from a burned chaparral watershed. In Fed. Inter-Agency Sediment, Conf. Proc.3, 13-27.

Haig. I.T. 1938. Fire in modern forest management, J. For. 36: 1045-1051.

Lowdermilk, W.C. 1930. Influence of forest litter, run-off, percolation and erosion. J. For. 28 (4) 474-491.

Mack, R.N. and W. M. Lonsdale. 2001. Humans as global plant dispersers: Getting more than we bargained for. BioScience 51:95-102.

Mersereau, R.C.., and C.T.Dryness. 1972. Accelerated mass wasting after logging and slash burning in Western Oregon. J. Soil and Water Conser. 27 (3) 112-114.

Meyer, K.E., W.F. Laudenslayer (Editors). 1988. A Guide to Wildlife Habitats of California. California Department of Fish and Game.

Jimerson, T.M., J.W. Menke, S.K. Carothers, M.P. Murray, V.VanSickle, K.H. McClellan. 2000. Field Guide to the Rangeland Vegetation Types of the Northern Province. Klamath, Mendocino, Shasta-Trinity and Six Rivers National Forests.

Jimerson T. M. and S. K. Carothers. 2000. Northwest California Oak Woodlands: Environment, Species Composition and Ecological Status. Abbreviated version of paper presented at the Oaks in California's Changing Landscape, Fifth Symposium on Oak Woodlands, October 22-25, 2001, San Diego, CA.

Jones, editor Alice Goen. 1981. Trinity County Historic Sites. Trinity County Historical Society.

Pavlik, B.M., P.C. Muick, S.G. Johnson, and M. Popper. 2000. Oaks of California. University of California Press. 184 pp.

Rowe, P.B., C.M. Countryman, and H.C.Story. 1954. Hydrologic analysis used to determine effects of fire on peak discharge and erosion rates in southern California watersheds, Calif. For. and Range Exp. Stn. USDA. Forest Service.

Sauer, J. R., J. E. Hines, and J. Fallon. 2001. The North American Breeding Bird Survey, Results and Analysis 1966 - 2000. Version 2001.2, USGS Patuxent Wildlife Research Center, Laurel, MD.

Silver, Shirley. 1978. Chimariko. Handbook of North American Indians. Smithsonian Institution.

Sinclair, J.D. and E.L. Hamilton. 1955. Streamflow reactions to a fire-damaged watershed. In Proc, Hydraul. Div., Am. Soc. of Civ. Eng., 15p.

Taylor, A.H. and C.N. Skinner. 2003. Spatial patterns and controls on fire regimes and forest structure in the Klamath Mountains. Ecological Applications 13: In press.

Theodoratus, Ph.D., Dorothea J. 1981. Native American Cultural Overview Shasta-Trinity National Forests. Theodoratus Cultural Research, Fair Oaks, California.

USDA (Forest Service), DOI (Bureau of Land Management). 1994. Record of Decision for amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl. Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl.

USDA, Forest Service. 1994. Shasta-Trinity National Forests Land and Resource Management Plan Final Environmental Impact Statement. Shasta-Trinity National Forests, Redding CA.

USDA, Forest Service. 1995. Shasta-Trinity National Forests Land and Resource Management Plan. Shasta-Trinity National Forests, Redding CA.

USDA, 1997. USDA Forest Service. 1997. Ecological subregions of California. Section and Subsection Descriptions. Pacific Southwest Region R5-EM-TP-005. Redding, CA.

USDA, Forest Service. 1998. Regional Forester's Sensitive Species List. Pacific Southwest Region.

USDI, Fish and Wildlife Service, 2002. Endangered and Threatened Species that may be present in or be affected by projects in Trinity County, CA. Arcata Fish and Wildlife Office. August 30, 2002

USDA Forest Service. 2001. Fire Effects Information System. Rocky Mountain Research Station, Fire Sciences Laboratory.

Van Dyke, E., K.D. Holl, and J.R. Griffen. 2001. Maritime chaparral community transition in the absence of fire. Madrono 48:221-229.

Wright, Henry, A., et. al. 1976. Effect of prescribed burning on sediment, water yield, and water quality from dozed juniper land in central Texas. J. Range Management. 29: 294-298.

Personal Communication:

Bill Clark- Fuels Specialist, Shasta-Trinity National Forest, Hayfork Ranger District.

Piggott, George, USDA Forest Service. Personal communication. 17 May 2001, January 9, 2003.

Smith, David. California Department of Fish and Game. Personal communication, 11 Sept. 2002.

APPENDICES

Appendix A. Soil data for the Middle Fork Cottonwood Creek Watershed.

Order 3 Soil Map Unit #	Slope Group %	Parental[1] Material	Soil Depth Groups[2]	FSSC[3]	Conifer[4] Regen. Pot.	Soil[5] Erodibility
32	40-60	Ms	75% sh	6-7	L	M
35	40-60	Ms	60% sh / 30% md	6-7	L	M
79	20-40	Mv	75% sh	7	VL-L	M
80	40-60	Mv	75% sh	7	VL-L	M
84	50-80	Mv	50% sh / 30% md	7	L/M	H
85	50-80	Mv	60% sh / 30% Rx	7	VL-L	M
97	20-40	Mv	80% md	4-5	M-H	M
104	20-40	Mv	60% md / 30% d	3-4	H	M
115	0-20	Ms	75% d	3-4	H	M
121	20-40	Ms	55% d / 35% d	3-4	M-H	M
123	20-40	Ms	50% d / 30% md	3-5	H	M
126	20-40	Ms	50% d / 30% md	3-5	H	M
127	40-60	Ms	50% d / 30% md	3-5	H	M-H
129	20-50	D	75% md	4-5	M	H-VH
137	20-40	Ms	50% d / 30% md	3-5	M-H	M
174	20-40	Ms	75% md	4-5	M-H	M
175	40-60	Ms	75% md	5	M-H	M-H
178	20-40	Ms	50% md / 30% sh	5-7	M-L	M
179	40-60	Ms	60% md / 30% sh	5-7	M-L	M-H
181	0-20	Ms	50% md / 30% d	3-5	M-H	M
182	20-40	Ms	60% md / 30% d	3-5	M-H	M
184	60-80	Ms	60% md / 30% d	3-5	M-H	H
203	40-60	Ms	75% md	5	M-H	M-H
206	40-60	Ms	50% md / 25% sh	5-7	M-L	M-H
215	20-40	Ms	50% md / 30% vd	3-5	M-H	M
216	40-60	Ms	50% md / 30% d	3-5	M-H	M-H
243	20-50	Ms	75% md	6-7	M	M-H
244	20-60	Ms	60% md / 30% sh	6-7	L-VL	M
308	40-80	Mv	90% sh	7	L-VL	M

1 ms-metasedimentary; mv-metavolcanic; d-diorite
2 sh-<20 inches deep; md-20-40 inches deep; d-40-60 inches deep; vd-60+ inches deep; RX-rock outcrop.
3 FSSC- Forest Survey Site Class.
4 VL-very low; L-low; M-moderate; H-high; VH-very high
5 M-moderate; H-high; VH-very high

Appendix B

15% Late-Successional and Old-Growth Retention Analysis and Recommendations For the Middle Fork Cottonwood Creek 5th Field Watershed.

The distribution of old-growth stands throughout the landscape is an important component of ecosystem diversity, and plays a significant role in providing for biological and structural diversity across the landscape. (Record of Decision for the NW Forest Plan, page C-44)

Prepared by ______________________________________ Date________________

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INTRODUCTION

This document presents my analysis of the current condition of late-success ional and old-growth conifer habitat within the Middle Fork Cottonwood Creek 5th field watershed and recommendations for meeting and maintaining future options to meet the intent of the ***provide for retention of old-growth fragments in watersheds where little remains*** standard and guideline (S&G, ROD page C-44).

I used two GIS databases for this analysis:

1) I used the *Shasta-Trinity Land and Resource Management Plan (Forest Plan) database (**LMP-90 database**)* to assess Forest Service land within the watershed. I updated this database to reflect the affects of the Oregon Fire (late summer of 2001) using aerial photographs taken shortly after the fire.
2) I used the *Remote Sensing Lab Database (**RSL database**)* to assess Bureau of Land Management land within the watershed.

Intent of the Standard &Guideline

The intent of this standard and guideline is stated in the first paragraph of the S&G on page C-44 of the Record of Decision for the Northwest Forest Plan; e.g., *to protect ecologically significant patches and fragments of old-growth habitat that provide refugia for old-growth associated species* (memorandum from the Regional Ecosystem Office dated October 24, 1997). Our discretion to retain a variety of stand ages to meet the intent of the S&G should be applied **before** federal forest lands reach the 15 percent level of late-successional forest. Management discretion and options to select stands for retention and protection within a watershed only exist prior to late-successional forest reaching the 15 percent level. Old-growth stands would be retained and protected to meet the S&G in most instances; however, based on an assessment, younger (i.e., mature) stands could be retained while older stands could be harvested (memorandum from the Regional Forester dated September 14, 1999).

DEFINITIONS & ASSUMPTIONS

- *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 nontimber use. This acreage is the base (denominator) used to calculate the 15 percent retention S&G. Within the watershed I assume Forest Service land of the forest types (LMP-90 database "*Vegtype1"*) Douglas-fir, mixed conifer, ponderosa/Jeffrey pine, and white fir and Bureau of Land Management land Wildlife Habitat Relations vegetation types (RSL database "*WHRTYPE"*) Douglas-fir, Klamath mixed conifer, and ponderosa pine qualify as Federal Forest Land.

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

  - ***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 accumulations of wood, including large logs on the ground. **Within the watershed I assume all size class 4 (or greater) stands with a canopy closure of G or N or canopy closure D or M are currently old-growth** (LMP-90 database *"Vegsize"* and *"Vegden"; RSL database "Vegsize" and "whrdensity"*).

  - ***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. **Within the watershed I assume all size class 3 stands are mature stands. Because the definition of "mature" does not include a canopy closure criterion, I include size class 4 stands with an S or P canopy as mature.** Older mature stands with relatively high canopy closure (e.g., *"Vegden"* G or *"whrdensity"* D and to a lesser extent N or M) often provide suitable habitat for species associated with old-growth forests.

LMP-90 Database Assumptions

The Shasta-Trinity Land and Resource Management Plan (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 Middle Fork Cottonwood Creek Watershed. Using this database to analyze existing vegetative conditions as they relate to LS/OG 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 purely 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 (the codes included in the LMP-90 database are included in parentheses) I used to infer potential and existing late-successional forest conditions were: **vegetation type** (LMP-90 database *Vegtype1*), **crown size** (LMP-90 database *Vegsize*), and **canopy closure** (*Vegden*).

- **Vegetation Type**: I assume that within the Middle Fork Cottonwood Creek 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 LS/OG stand structure and composition as described on page B-2 (and the Glossary) of the ROD. Within the watershed these types include Douglas-fir, mixed conifer, ponderosa/Jeffrey pine, and white fir. 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): I assume that the size classes included in the LMP-90 and RSL databases are a reasonable indicator of general stand age and their use is the only currently available tool for estimating seral stage development over large areas. I also use size classes 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 these 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.

Crown Size Classes (both LMP-90 & RSL databases):

- **0** = shrub, forb, grass, noncommercial conifer, hardwood, and nonvegetated (no LS/OG 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).

- **Vegden**: Moderate to dense canopy closure is typical of LS/OG in the Middle Fork Cottonwood Creek Watershed. Local experience strongly suggests that canopy closure classes N & G or M & D typify current LS/OG 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 20 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 LS/OG in the area). Infrequently class P and S stands may also provide LS/OG conditions but would require stand-by-stand field verification.

  "Vegden" Canopy Closure Classes:

- **S** = <20%
- **P** = 20-39%
- **N** = 40-69%
- **G** = ≥70%

RSL Database Assumptions

Existing vegetation coverages were produced by the USDA Forest Service Remote Sensing Lab according to Regional vegetation mapping standards (FGDC compliant at existing definitions). Existing vegetation layers are tiled by ecological section/subsection as defined by the E*cological Units of California* (Goudey and Smith, 1994). Vegetation tiles are aggregated by vegetation zone defined within the original CALVEG document. A statewide tile coverage and a statewide vegetation zone coverage (caltile94_1, calzone98_2) are provided for spatial reference.

Questions concerning the data or method/s of capture should be directed to:

USDA Forest Service
Region 5 Remote Sensing Lab
1920 20th Street
Sacramento, CA 95814

I applied the same general assumptions to the RSL database as used for the LMP-90 database.

- **whrtype**: I used this field to query for Federal Forest Land. The Wildlife Habitat Relations vegetation types that typically achieve the size, canopy closure, or generally complex vertical structure associated with old-growth habitat within the Middle Fork Cottonwood Creek Watershed include: Douglas-fir, Klamath mixed conifer, ponderosa pine, and montane hardwood/conifer. These types thus qualify as Federal Forest Land.

- **Vegsize** (crown diameter size class): I used this field to query for relative stand age. These size classes are the same as those described for the LMP-90 database.

- **whrdensity**: For this analysis "whrdensity" classes were lumped in with the following LMP-90 database "Vegden" classes.

  "whrdensity" Canopy Closure Classes:
  - S = 10-24% lumped in with LMP-90 class S for this analysis
  - **P** = 25-39% lumped in with LMP-90 class P for this analysis
  - M = 40-59% lumped in with LMP-90 class N for this analysis
  - D = ≥60% lumped in with LMP-90 class G for this analysis

Relative LS/OG Habitat Quality

In general old-growth habitat quality can be listed from higher to lower quality as follows:

RELATIVE OLD-GROWTH HABITAT QUALITY RELATED TO SIZE CLASS AND CANOPY CLOSURE

4G 4N 3G 3N 4P 3P 4S 3S remaining federal forest land