FRENCH GULCH AREA FUELS REDUCTION AND MANAGEMENT PLAN UPDATE 2010

This project was funded through a grant from the
Shasta County Title III Secure Rural Schools Program

WESTERN SHASTA RESOURCE CONSERVATION DISTRICT

COUNTY OF SHASTA CALIFORNIA

This project was funded through a grant from the Shasta County Title III Secure Rural Schools Program and updated by the Western Shasta Resource Conservation District,
6270 Parallel Road, Anderson CA 96007
Phone: 530 365-7332
Fax: 530 365-7332
Email: wsrcd@westernshastarcd.org
Website: www.westernshastarcd.org

FRENCH GULCH AREA FUELS REDUCTION AND MANAGEMENT PLAN UPDATE 2010

SIGNATURE BLOCK

NAME	SIGNATURE	ORGANIZATION	DATE
		Chairman, Shasta County Board of Supervisors	
Doug Wenham		**Unit Chief , CAL FIRE, Shasta-Trinity Unit and County Fire Warden, Shasta County Fire Department**	
Steve Anderson		**Field Manager, Bureau of Land Management, Redding Field Office**	
Jim Milestone		**Superintendent, National Park Service, Whiskeytown National Recreation Area**	
		USFS	

FRENCH GULCH AREA FUELS REDUCTION AND MANAGEMENT PLAN UPDATE (2010)

-TABLE OF CONTENTS-

FRENCH GULCH AREA FUELS REDUCTION AND MANAGEMENT PLAN UPDATE (2010)

I. INTRODUCTION

A. THE PLAN

In 2009, Shasta County entered into a consulting services agreement with Western Shasta Resource Conservation District (WSRCD) to update all of the existing strategic fuel management plans in western Shasta County including the *French Gulch Area Fuels Reduction and Management Plan, July 2003* (Plan). The purpose of the update was to meet with the local Fire Safe Council, watershed group, landowners, and agencies to review the existing project list and priorities, move completed projects to a category of maintenance projects, add new projects, identify wildland urban interface areas, conduct risk assesments, and establish a revised list of priorty projects.

The Plan update addresses values at risk, landowner objectives, the types of fuel treatments, the road system, potential funding sources, and fuelbreak locations, which together developed the updated fire safe plan. The recommendations include locating shaded fuelbreaks along key roadways and ridge lines, increasing publicity for the updated fire and community evacuation plan, post the Plan on the WSRCD website, and continue annual neighborhood-based fuel reduction work. Background information from the original Plan was included as well as revisions based on new information.

The planning area includes the community of French Gulch and surrounding rural residential areas occupying about 800 acres between French Gulch and Big Gulch. French Gulch is the only 'town' in the watershed and is a historic mining area with approximately 650 residents. Land ownership is approximately 67% public and 33% private, including Sierra Pacific Industries (SPI) lands and other private land ownership..

The Upper Clear Creek/French Gulch Watershed **(MAP 1)** is located approximately 16 miles west of the City of Redding, California and 235 miles north of San Francisco. Upper Clear Creek is component of the Upper Sacramento River Basin (Hydrologic Unit Code 18020112) and is an important tributary of the Sacramento River. It flows into Whiskeytown Reservoir and then ultimately into the Sacramento River. The watershed is about 35 miles long, ranges from five to 12 miles wide, and covers a total area of about 249 square miles or approximately 127,916 acres. The watershed can be reached from the east and west, along State Highway 299, the major two-lane highway connecting Weaverville and Redding.

The topography of this watershed is steep, with elevations from 976 to 6,209 feet, draining into Upper Clear Creek and flowing into Whiskeytown Reservoir, from which Lower Clear Creek flows to the Sacramento River. The watershed has remained relatively undeveloped over time and is a high quality water supply for the Central Valley Project, which supplies water throughout the state.

B. BACKGROUND

Fire has played a natural part in the evolution of vegetation within the 127,916 acre planning area. The forest ecosystems and the chaparral on the canyon slopes within the planning area evolved with frequent, low intensity fire over thousands of years. Native Americans did not simply use the resources of the forest as they found them. There is growing evidence that they actively managed the land using fire to encourage certain plant and animal species and to create and maintain desirable landscapes. The open stands of trees and diversity of ecosystems encountered by the first Europeans were largely the result of human resource management through the use of fire and frequent accidental and lightning fires. The Native Americans were apparently the most important influence on the timing and location of fires, and therefore contributed to the maintenance of the fire dependent ecosystem.

Successful fire suppression activities for well over eighty years in the western United States and in the planning area in particular, have significantly increased the volume and type of fuels across the landscape. The number and size of devastating wildfires impacting the western United States over the past ten years resulted in the creation of a National Fire Plan for the U.S. Departments of Interior and Agriculture. The result is a recommended Very High Fire Hazard Zone Rating **(MAP 2)** throughout the planning area, by the California Department of Forestry & Fire Protection (CAL FIRE, 2008). Funding has been available through the National Fire Plan, California Fire Plan, and other agencies to assist local communities and watershed groups in identifying, planning, and implementing fuel reduction projects.

II. GOALS AND OBJECTIVES

A. Recognize and protect ecological and landscape values and reduce fire associated impacts to soils and other environmental values within the Upper Clear Creek Watershed.
B. Reduce the rate of spread and resistance to control of wildfire with emphasis on ridge lines, internal routes of travel and modification of large blocks of volatile fuels.
C. Reduce potential fire intensity and duration to levels not likely to kill large trees or damage other highly valued landscape features.
D. Develop an outreach program that will educate the residents on how to: Minimize private property losses and provide for human safety.
E. Minimize the risk of fire starts.
F. Minimize the potential of wildfire burning into the watershed.
G. Develop and maintain effective fire-safe standards and practices around structures, residential areas, and in the vicinity of roads to reduce fire risk and provide effective protection from wildland fire.
H. Prevent structure or yard fires from escaping to surrounding areas.
I. Identify and coordinate agency and landowner fire prevention capabilities.
J. Foster and maintain multi-agency and landowner roles and responsibilities in the implementation and maintenance of this plan.

III. METHODOLOGY

The activities necessary for the development of the Update of the 2002 French Gulch Area Fuels Reduction and Management Plan include:

Activity	Action Taken
Meet with community members, landowners and stakeholders about the scope of a plan.	Met with the French Gulch-Upper Clear Creek Resource Management Group: 10/15/09.
Present data to the Upper Clear Creek Technical Advisory Committee (TAC), which includes representatives from Bureau of Land Management (BLM), USDA Forest Service (USFS), National park Service (NPS), CAL FIRE and the local volunteer fire companies, for review and assistance in prioritization.	Met with the TAC on 12/09/09. Reviewed existing projects, new projects, and priorities.
Evaluate values at risk, such as structures and natural resources.	Met with the French Gulch-Upper Clear Creek Project Team on 11/16/09. Met with TAC on 12/09/09.
Coordinate with agencies on their management objectives in the watershed.	Reviewed discussion of options in the 2003 plan with the TAC and carried forward to this plan update.
Identify long term maintenance options for fuelbreaks.	Reviewed discussion of options in the 2003 plan with the TAC and carried forward to this plan update.
Identify mechanical treatments and possible uses of excess fuels.	Reviewed discussion of options in the 2003 plan with the TAC and carried forward to this plan update.
Develop a priority list of recommendations and potential funding sources.	Reviewed discussion of options in the 2003 plan with the TAC and carried forward to this plan update.
Complete a draft updated fuel management plan for review by the TAC.	
Present a draft fuel management plan to the community through the French Gulch - Upper Clear Creek Resource Management Group (RMG).	

IV. RECOMMENDED ACTIONS

A priority list of fuel reduction and maintenance projects was developed by the Project Team and TAC. Factors considered in developing this list include:

- Fire history for the area, both lightning caused and human caused fires.
- Heavy fuel loading conditions with closed canopies.
- Assets at risk.
- Common wind directions and speed.
- Roadsides overgrown with vegetation.
- Major topographical features important to fire control and weather patterns which influence fire behavior.
- Road access for fire fighters and escape routes for residents.

A. MANAGEMENT ACTIONS

1. Construct and maintain shaded fuelbreaks along key roadways and ridges to create a network of fuelbreaks.
2. Develop a program to provide assistance to elderly, disabled, and disadvantaged residents to make their home and property fire safe.
3. Update and reprint the existing community evacuation plan that includes people, horses, and other livestock.
4. Identify private water storage facilities in the watershed. Seek funding to construct where necessary.
5. Educate homeowners on fire safety by using inspectors to go door-to-door. (CAL FIRE is currently doing this action.)
6. Seek funding to develop a variety of typical neighborhood-scale landscape designs that demonstrate fire safety, increase forest health, and reduce impacts from wind-driven fires while preserving or improving aesthetics and providing for security, privacy, and other values. Link the larger scale projects to individual fuel breaks. French Gulch community members can reduce structural ignitability throughout the planning area by implementing defensible space/Firewise Programs to include the following:

    a. Assess risk/structure ignitability.
    b. Upgrade existing structures to fire safe building codes.
    c. Replace wood roofs with approved fire safe roofing.
    d. Consider fire resistant exterior siding.
    e. Maintain a minimum 100-foot defensible space around structures.
    f. Clean roofs and gutters annually.
    g. Develop a community phone tree in case of a fire emergency.
    h. Develop agreeements with the county to use the reverse 911 system.
    i. Remove ladder fuels.
    j. Clean and screen chimnies.
    k. Maintain green grass and fire resistant plants within 30 feet of structures.
    l. Move all flammable material at least 30 feet from homes.

m. Remove dead, dying, or dieseased shrubs, trees, dried grass, fallen branches and dried leaves 100 feet around structures.
n. Attach a hose that can reach to all parts of the structures.

B. PROPOSED PROJECTS (MAP 7)

Table 1
French Gulch Fuel Reduction Projects

Name of Project	Map Number	Acres	Category	Overall Priority
Niagara St. Fuelbreak	1	18	High	1
Lower Trinity Road Fuelbreak	2	68	High	2
Middle Trinity Rd. Fuelbreak	3	92	High	3
East Fork (BLM) Fuelbreak	4	24	High	4
French Gulch School Fuelbreak	5	37	High	5
Highland Ridge Fuelbreak	6	6	Medium	1
Dutch Gulch Fuelbreak	7	27	Medium	2
Summit Gulch Fuelbreak	8	73	Medium	3
Upper Trinity Road Fuelbreak	9	44	Medium	4
Trinity Mountain Road West	10	89	Medium	5

1. Fire Ingress/Egress Routes (Shaded Fuelbreaks)

a. High Priority

#1 Concern – Threat of wildfire moving from the west into the town of French Gulch

Proposed Solution: Construct shaded fuelbreak from French Gulch Road north around the westside of French Gulch behind the cemetary to Niagra Street: 0.5 miles long x 300 feet = 18.2 acres

Ownership = 100 % private land
Number of dwellings = 52
Value of dwellings = $10,476,440
Number of people = 120

Niagara St. Fuelbreak: Looking south from Niagara Str.

#2 Concern – Fuel accumulation along Lower Trinity Mountain Road

Proposed Solution: Construct shaded fuelbreak along Lower Trinity Mountain Road from Highway 299 to County Park: 1.8 miles long x 100 feet on each side = 33 acres

Ownership = 46 % private land; 54% NPS land
Number of dwellings = 154
Value of dwellings = $31,026,380
Miles of powerlines = 8
Value of powerlines = $2,075,000
Number of people = 354

Lower Trinity Mtn. Rd.: Looking north. Note dead and down fuel from 2004 French Fire

#3 Concern – Fuel along Middle Trinity Mountain Road

Proposed Solution: Construct shaded fuelbreak along Middle Trinity Mountain Road from County Park to Trinity Mountain Road # 2 fuelbreak: 3.8 miles long x 100 feet on each side = 92.1 acres.

Ownership = 100 % private land
Number of dwellings = 88
Value of dwellings = $17,729,360
Number of Schools = 1
Value of Schools = $1,000,000
Number of people = 202
Miles of powerlines = 6
Value of powerlines = $1,500,000

Middle Trinity Mountain Road

#4 Concern – Poor fire access/escape along East Fork Road (BLM section)

Proposed Solution: Construct shaded fuelbreak on the BLM lands along East Fork Road between the two private parcels: 1 miles long x 100 feet on each side = 24.3 acres

Ownership = 100 % BLM land
Number of dwellings = 31
Value of dwellings = $6,245,570
Number of people = 71

East Fork Road: BLM land between two private parcels

#5 Concern – Threat of wildfire to the French Gulch School and nearby residences

Proposed Solution: Construct shaded fuelbreak across the road from the French Gulch Elementary School, the fire house and residences beginning at the mining dredge piles and ending at athe BLM property boundary: 1.0 miles x 300 feet wide = 36.4 acres.

Ownership = 100 % private land
Number of dwellings = 21
Value of dwellings = $4,203,870
Number of people = 48
Number of Schools = 1
Value of School Buildings = $A1,000,000
Fire Station = 1
Number of engines = 2 (including antique engine
Value of station = $200,000
Value of engines = $50,000

French Gulch School Fuelbreak

b. <u>Medium Priority</u>

<u>#6 Concern – Poor fire ingress and the threat of wildfire to residences along Highland Ridge Road</u>

Proposed Solution: Construct shaded fuelbreak behind the homes east of Highland Ridge Road: 0.5 miles long x 100 feet wide = 6 acres

Ownership = 48 % private land; 52% BLM land
Number of dwellings = 28
Value of dwellings = $5,641,160
Number of people = 64

Highland Ridge Fuelbreak: Note extremely dense chaparral and conifers

<u>#7 Concern – Poor fire ingress/fuel continuity along Dutch Gulch Ridge</u>

Proposed Solution: Construct shaded fuelbreak along the east ridge of Dutch Gulch Ridge: 0.75 miles long x 300 feet = 27.3 acres

Ownership = 100 % BLM lands
Number of dwellings = 37
Value of dwellings = $7,454,390
Number of people = 85

Dutch Gulch Ridgetop Fuelbreak: Note extensive chaparral

#8 Concern – Hazardous fuel continuity along Summit Gulch Ridge

Proposed Solution: Construct shaded fuelbreak along the top of the east ridge of Summit Gulch: 2.0 miles long x 300 feet = 72.7 acres

Ownership = 41 % private land, 59% BLM land
Number of dwellings = 134
Value of dwellings = $26,996,980
Number of people = 308

Summit Gulch: Northwest end

Summit Gulch: Ridgetop along which fuelbreak would be constructed

#9 Concern – Poor fire ingress/egress along Upper Trinity Road

Proposed Solution: Construct shaded fuelbreak along the Upper Trinity Road from the north end of the existing Trinity Road # 2 fuelbreak to NAWA:1.5 miles long x 100 feet on each side = 36.4 acres

Ownership = 100 % private land
Number of dwellings = 27
Value of dwellings = $5,439,690
Number of people = 62

Upper Trinity Mountain Road: Note brush and trees to edge of road

#10 Concern – Poor fire ingress/egress along Trinity Mountain Road West

Proposed Solution: Construct shaded fuelbreak along the Trinity Mountain Road from where it leaves the valley and goes west/northwest to the intersection with Trinity Mountain Road Eastside: 4.9 miles long x 75 feet on each side = 89 acres

Ownership = 64 % private land, 36% USFS land
Number of dwellings = 27
Value of dwellings = $5,439,690
Number of people = 62

Trinity Mountain Road West: Note thick brush and trees to road edge.

C. PROJECT MAINTENANCE PRIORITY

Project	Map No.	Completed	Maintenance Priority
Trinity Mountain Rd. # 1 fuelbreak	11	2005	1
Trinity Mountain Rd. #2 fuelbreak	12	2005	2
Meissner Fuelbreak	13	2004	3
Drunken Gulch Fuelbreak	14	2005	4
Cline Gulch Fuelbreak	15	2009	5
East Fork Road # 1 fuelbreak(Private)	16	2009	6
East Fork Road # 2 fuelbreak(Private)	17	2009	7

#1 Maintenance concern: Trinity Mountain Road #1 fuelbreak

Proposed solution: Conduct maintenance on the existing fuelbreak: 1 miles long x 100 feet on the west side = 13 acres

Ownership = 100% Private
Numbe Value of dwellings = 14
Value of dwellings = $2,820,580
Number of people = 33

#2 Maintenance concern: Trinity Mountain Road #2 fuelbreak

Proposed solution: Conduct maintenance on the existing fuelbreak: 0.75 miles long x 100 feet on the west side = 9 acres

Ownership = 100% Private
Number of dwellings = 18
Value of dwellings = $3,626,460
Number of people = 42

#3 Maintenance concern: Meissner Fuelbreak

Proposed solution: Conduct maintenance on the existing fuelbreak: 0.5 miles long x 100 feet on each side = 12 acres

Ownership = 100% Private
Number of dwellings = 62
Value of dwellings =$1,208,820
Number of people = 14

#4 Maintenance concern: Drunken Gulch Fuelbreak

Proposed solution: Conduct maintenance on the existing fuelbreak: 2.8 miles long x 100 feet on each ridge = 34 acres

Ownership = 100% Private
Number of dwellings = 14
Value of dwellings =$2,820,580
Number of people = 32

#5 Maintenance concern: Cline Gulch Fuelbreak

Proposed solution: Conduct maintenance on the existing fuelbreaks: 2 miles long x 100 feet = 25 acres

Ownership = 100% BLM
Number of dwellings = 36
Value of dwellings =$7,252,920

Number of people = 83

#6 Maintenance concern: East Fork Road (Private Land Sections)

Proposed solution: Conduct maintenance on the existing fuelbreak. 2 miles long x 100 feet = 25 acres

Ownership = 100% Private
Number of dwellings = 31
Value of dwellings = $6,245,570
Number of people = 71

D. **OVERALL COMMUNITY WILDFIRE RISK ASSESSMENT** (High, Medium, Low and Prioritization 1, 2, 3, etc.)

BASIC ASSUMPTIONS	
People	2.3 per dwelling
Dwellings	960
Property Value ($244,200 per dwelling)	$234,432,000
Schools	$1,000,000
Power line – 14 miles @ $250,000/mile	$3,500,000

Community, structure or area at risk	Fuel Hazard	Risk of Wildfire Occurrence	Struc-tural Ignit-ability	Preparedness and Firefighting Capability	Overall Risk	Fire Hazard Severity Zone Rating
Niagara Street	High	High	High	Low/High	High	Very High
Lower Trinity Mountain Fuelbreak	High	High	High	Low/High	High	Very High
Middle Trinity Mountain Road Fuelbreak	High	High	High	Low/High	High	Very High
East Fork Road Fuelbreak (BLM)	High	High	High	Low/High	High	Very High
French Gulch School Fuelbreak	High	High	High	Low/High	High	Very High
Highland Ridge Fuelbreak	Medium	High	High	Low/High	Medium	Very High
Dutch Gulch Fuelbreak	Low	Low		Low/High	Low	Very High
Summit Gulch Fuelbreak	Low	Low		Low/High	Low	Very High
Upper Trinity Mountain Road Fuelbreak	Low	Low	High	Low/High	High	Very High

E. OVERALL COMMUNITY HAZARD REDUCTION PRIORITIES

Community, structure or area at risk	Map Number	Overall Risk	Structures at Risk	Cultural Value	Type of treatment	Method of Treatment	Overall Priority
Niagara St. Fuelbreak	1	High	52	Low	Hand Labor	Brush and tree removal, pruning	1
Lower Trinity Road Fuelbreak	2	High	154	Low	Hand Labor	Brush and tree removal, pruning	2
Middle Trinity Rd. Fuelbreak	3	High	88	Low	Hand Labor	Brush and tree removal, pruning	3
East Fork Road Fuelbreak(BLM)	4	High	31	Low	Hand Labor	Brush and tree removal, pruning	4
French Gulch School Fuelbreak	5	High	21	Low	Hand Labor	Brush and tree removal, pruning	5
Highland Ridge Fuelbreak	6	Medium	28	Low	Hand Labor	Brush and tree removal, pruning	6
Dutch Gulch Fuelbreak	7	High	37	Low	Hand Labor	Brush and tree removal, pruning	7
Summit Gulch Fuelbreak	8	High	134	Low	Hand Labor	Brush and tree removal, pruning	8
Upper Trinity Road Fuelbreak	9	High	27	Low	Hand Labor	Brush and tree removal, pruning	9
Trinity Mtn. Road West	10	High	27	Low	Hand Labor	Brush and tree removal, pruning	10

F. ESTIMATED COSTS

Project Type/Category	Project Name	Size	Funding Needs ($)[1]	Community Priority Recommendation
High	Niagara St. Fuelbreak	18	$64,100	1
	Lower Trinity Mtn. Rd. Fuelbreak	68	$104,300	2
	Middle Trinity Mtn. Rd. Fuelbreak	92	$208,900	3

[1] Projected costs for planning only. More precise costs will be determined when grant applications are prepared.

Project Type/Category	Project Name	Size	Funding Needs ($)[2]	Community Priority Recommendation
High	East Fork Rd Fuelbreak (BLM)	24	$86,350	4
	French Gulch School Fuelbreak	37	$94,228	5
Medium	Highland Ridge Fuelbreak	6	$44,200	1
Low	Dutch Gulch Fuelbreak	27	$91,200	1
	Summit Gulch Fuelbreak	73	$195,700	2
	Upper Trinity Mtn. Road Fuelbreak	44	$133,900	3
	Trinity Mtn. Road West	133	$233,800	
	Total		$1,256,678	

V. PLAN UPDATES:

The French Gulch-Upper Clear Creek Resource Management Group and Fire Agencies intend to assess progress annually and invite agencies and landowners to submit additional projects that provide community protection. Additional (new) projects will be displayed in an update appendix to this plan.

VI. VALUES AT RISK

A. RESIDENCES AND MAJOR STRUCTURES

French Gulch is nestled in the valley of the Upper Clear Creek Watershed.
About 250 homes and 650 people make up the community of French Gulch and the surrounding area. Major structures include the store, post office, hotel, school, and bar.

[2] Projected costs for planning only. More precise costs will be determined when grant applications are prepared.

The French Gulch General Store is next to the post office. The general store was the only retail outlet in the village but is now closed.

Modern day French Gulch is home to the historic French Gulch Hotel, established in 1885. The hotel has seven rooms and functions as a bed and

Directly across the street from the hotel is a bar called E. Franck & Co., known to the locals as Johnnie's. Like the hotel, this is one of the remaining historical buildings in French Gulch.

B. VEGETATION (MAP 3)

Eight vegetative communities are found within the Upper Clear Creek Watershed (Upper Clear Creek Watershed Analysis, April 1999). They include grasslands, chaparral, mixed conifer-hardwood, mixed fir, mixed oak woodland, mixed pine, and wet meadow/marsh. Two sensitive plant species have been found in the planning area: Howell's alkali grass (*Puccinellia howellii)* and Canyon Creek stonecrop (*Sedum paradisum).*

Due to forest management practices over the past century, the structure and continuity of vegetation have been greatly affected. Conifer stands have become denser, and fuels have also increased due to dead and down trees form disease, drought, and insect infestation. These conditions contribute to stand replacement as fires burn hotter and longer.

C. FOREST LAND

Private timber production zones occupy about 19,512 acres in the upper portion of the watershed. These lands are operated and managed by commercial timber companies, which are regulated by the California Forest Practice Rules. The intent of the Forest Practice Act is to "create and maintain an effective and comprehensive system of regulation and use of all timberlands so as to assure that: a) where feasible, the productivity of timberlands is restored, enhanced and maintained; and b) the goal of maximum sustained production of high-quality timber products is achieved while giving consideration to values relating to recreation, watershed, wildlife, range, forage, fisheries, regional economic vitality, employment and aesthetic enjoyment."

D. FISH AND WILDLIFE (MAP 4)

In general, the Upper Clear Creek watershed, surrounding French Gulch, provides suitable habitat for a wide variety of wildlife species. A query of the California Natural Diversity Database showed that several "special status" species have been found within the watershed. ("Special status" means that they are afforded some form of state or federal protection, or are candidates for some form of protection.) These species are shown in the following Table.

TABLE 2
CALIFORNIA NATURAL DIVERSITY DATABASE (CNDDB) QUERY RESULTS OF SPECIAL STATUS SPECIES FOUND WITHIN THE UPPER CLEAR CREEK DRAINAGE

Scientific name	Common Name	Status[1]
Accipiter gentilis	Northern goshawk	CSC
Actinemys marmorata	Western pond turtle	CSC
Antrozous pallidus	Pallid bat	CSC
Ascaphus truei	Pacific tailed frog	CSC
Corynorhinus townsendii	Townsend's big-eared bat	CSC
Gulo gulo	CA wolverine	CE
Haliaeetus leucocephalus	bald eagle	Fed. Delisted
Lasiurus blossevillii	Western red bat	CSC
Martes pennanti (pacifica) DPS	Pacific fisher	C-Cand./ Fed.-Cand.
Puccinellia howellii	Howell's alkali grass	CNPS-1B
Rana boylii	foothill yellow-legged frog	CSC
Sedum paradisum	Canyon Creek stonecrop	CNPS-1B
Taxidea taxus	American Badger	CSC

Note: [1]CSC=CA Species of Concern; CE=CA Endangered; C-Cand. = CA Candidate; Fed. Cand. = Federal Candidate; CNPS-1B = Rare in CA.

Whiskeytown Reservoir and Upper Clear Creek host many species of fish, with many of them being introduced species that were stocked to enhance sports fishing opportunities at Whiskeytown Reservoir. With the construction of Whiskeytown Dam, anadromous fish species were blocked from running into the Upper Clear Creek drainage. The fish species that originally inhabited Upper Clear Creek but have been eliminated by Whiskeytown Dam including Chinook salmon and steelhead trout.

E. SOILS (MAP 5)

The Soil/Vegetation Survey of California, conducted by the Pacific Southwest Forest and Range Experimental Station, describes soil types in the French Gulch area with a moderate-to-high Erosion Hazard Rating (EHR). Information in the Watershed Assessment and shown in color on the Soils Erosion Potential map of the watershed shows three fairly distinct soil groups. The report confirms soil types in the French Gulch area meet the criteria for a 'moderate' to 'high' EHR. The area south of Rt. 299 in the Whiskeytown NRA have significant areas with a 'severe erosion potential' rating, while the area north of French Gulch shows a predominantly 'moderate' rating.

Fuels management activities located on unstable soils or on slopes in excess of 40% can stimulate erosion processes or exacerbate existing erosion problems; therefore, prior to any fuels management activities, all soil types within any future project area will be identified and evaluated to determine the erosion hazard. Projects will be designed to prevent or minimize erosion by reducing soil disturbance, maintaining vegetation where appropriate, avoiding steep and unstable slopes if possible, incorporating the use of grass seed or other fire resistant vegetation as a means to provide soil stabilization. The locations of major soil types have been illustrated on Map **#5;** however, more detailed soils mapping information should be examined once project boundaries have been established.

High intensity wildfire also damages soil by incinerating roots and the humus layer (organic portion of soils) that hold soils together and provides energy dissipation. In addition, the loss of large areas of vegetation can reduce evapotranspiration and increase peak flow, which can result in augmented erosion potential, adversely affecting watershed resources. Many life forms, including invertebrates of phylum Arthropoda that are essential for cycling plant material and fixing atmospheric gases, are unknowingly destroyed. These invertebrates eventually re-establish their populations, but time is lost time in maintaining and building up the soils. Over time, continual burning will result in soil depletion, much the same as continual plowing and crop harvesting will deplete the soil of mineral nutrients and negatively affect the soil structure. Fortunately in this area of California, there exist relatively young volcanic soils in the mountains and recent alluvial soils in the valleys that can tolerate fire without immediately showing negative effects. Continued burning though can have long-term negative effects (Richards, 2002).

Low intensity prescribed fires in light to medium fuels seldom produce enough heat to significantly damage soil or increase the erosion potential within a given watershed. The chemical and physical properties of soil change dramatically after a high intensity fire. Loss of organic matter causes the soil structure to deteriorate, and both the water-storing and transmitting properties of soils are reduced. The living tissues of microorganisms and plants can be damaged by fire if the temperatures are above 1200 degrees F (DeBano 1970).

VII. SUPPORTING PLANS, ORGANIZATIONS AND AGENCIES

A. NATIONAL FIRE PLAN

In 2001 the Chief of the USDA Forest Service published a *National Fire Plan* (U.S. Department of Interior and U.S. Department of Agriculture, 2001), which is a cohesive strategy for improving the resilience and sustainability of forests and grasslands at risk, for conserving priority watersheds, species and biodiversity, reducing wildland fire costs, losses and damages, and to better ensure public and firefighter safety. To achieve these goals, work began to improve firefighting readiness, prevention through education, rehabilitation of watershed functions, hazardous fuel reduction, restoration, collaborative stewardship, monitoring jobs, and applied research and technology transfer.

The objective of the National Fire Plan is to describe actions that could restore healthy, diverse, and resilient ecological systems to minimize the potential for uncharacteristically intense fires on a priority basis. Methods include removal of excessive vegetation and dead fuels through thinning, prescribed fire and other treatment methods. The focus of the strategy is on restoring ecosystems that evolved with frequently occurring, low intensity fires. These fires typically occurred at intervals of between 1-35 years and served to reduce the growth of brush and other understory vegetation while generally leaving larger, older trees intact. The report is based on the premise that sustainable resources depend on healthy, properly functioning, resilient ecosystems. The first priority for restoration is the millions of acres of already roaded and managed landscapes that are in close proximity to communities. More information about the National Fire Plan is available on the Internet at www.fireplan.gov.

B. THE CALIFORNIA FIRE PLAN

The California Fire Plan has five strategic objectives:

- Create wildfire protection zones that reduce risks to citizens and firefighters.
- Assess all wildlands (not just the state responsibility areas) to identify high risk, high-value areas and develop information and determine who is responsible, who is responding, and who is paying for wildland fire emergencies.
- Identify and analyze key policy issues and develop recommendations for changes in public policy.
- Develop a strong fiscal policy focus and monitor wildland fire protection in fiscal terms.
- Translate the analyses into public policies.

A key product of the Fire Plan is the identification and development of wildfire safety zones to reduce citizen and firefighter risks from future large wildfires. Initial attack success is measured by the percentage of fires that are successfully controlled before unacceptable costs are incurred. Assets at risk are identified and include citizen and firefighter safety, watersheds, water, timber, wildlife, habitat, unique areas, recreation, range structures, and air quality. Air quality is a factor because based on the annual average acres burned by wildfires from 1985-1994, CAL FIRE calculates wildfires emit almost 600,000 tons of air pollutants each year.

The safety and asset assessments in the plan enable fire service managers and stakeholders to set priorities for prefire management project work. Prefire management includes a combination of fuels reduction, ignition management, fire-safe engineering activities and improvements to forest health to protect public and private assets. CAL FIRE finds there is a direct relationship between reduced expenditures for prefire management and suppression and increased emergency fund expenditures, disaster funding, and private taxpayers' expenditures and losses.

CAL FIRE is responsible for fire suppression on privately-owned wildlands and provides emergency services under cooperative agreements with the counties.

In 2000 the State Board of Forestry and CAL FIRE the have recently completed a comprehensive update of the state fire plan for wildland fire protection in California. The overall goal of the plan is to reduce total costs and losses from wildland fire by protecting assets at risk through focused prefire management prescriptions and increasing initial attack success. CAL FIRE's statewide Initial Attack Fire Policy is to aggressively attack all wildfires, with the goal of containing 95% of all fire starts to 10 acres or less.

In the Upper Clear Creek Watershed, CAL FIRE shares responsibility for wildland fire protection with the USFS, NPS, and the BLM on all ownerships, except those managed by the WNRA in the southern section of the watershed. CAL FIRE and the WNRA have entered into a cooperative agreement for dispatching and resource sharing on all wildland fires occurring in the "mutual threat zone" near WNRA. The cooperative agreement, in conjunction with the California Cooperative Fire Agreement on Wildland Fire Suppression between CAL FIRE, USFS, NPS, and BLM, outlines the cooperative sharing of resources for wildland fire suppression, since wildfires do not recognize political or ownership boundaries.

In summary, CAL FIRE believes that cooperative fire protection, fuels reduction, and fire prevention must be linked in order to have future success in dealing with the wildfire problems within the Upper Clear Creek Watershed.

C. SHASTA COUNTY FIRE SAFE COUNCIL

The Shasta County Fire Safe Council was formed in May 2002 as part of a statewide effort that began in 1993 to form area Fire Safe Councils across the state to educate and

encourage Californians to prepare for wildfires before they occur. (See www.firesafecouncil.org for more information.) The mission of the Shasta County Fire Safe Council is to be a framework for coordination, communication and support to decrease catastrophic wildfire throughout Shasta County. The group meets quarterly to discuss projects, share information, schedule speaking engagements, develop educational opportunities, and update maps showing fuels reduction projects and maintenance throughout the county.

D. SHASTA TRINITY NATIONAL FOREST

The Forest Service administers about 24,255 acres or 19% of the Upper Clear Creek Watershed (See Map #3). These lands are managed as part of the Weaverville/Lewiston Management Area of the Shasta Trinity National Forest (STNF). A completed *Fuels Analysis and Strategy* provides a basis for managers to make decisions concerning placement and priorities of fuels management projects. It is a forest level analysis meant for forest level considerations. The report states it may also be used as a tool for project level planning.

The analysis characterizes the STNF in terms of hazard, risk and value. Hazard is defined as fire behavior potential, which has implications for resource damage as well as suppression capability. Risk is the probability of a fire occurring based on local fire history. Value refers to the monetary, ecological or political worth of a definable area. All three areas (hazard, risk and value) are quantified by a measure of low, moderate, or high through a combined use of scientific data and technical expertise, and displayed in a GIS map. The three are then combined in an overall rating.

The final step of this analysis prioritizes the forest in terms of critical fire danger areas based on the hazard, risk and value ratings and management needs. These priorities align with the National Fire Plan and the Cohesive Strategy and will guide resource management considerations on the forest, such as natural fuels project priorities and identification of essential road access for protection purposes. The national priorities are wildland-urban interface, readily accessible municipal watersheds, threatened and endangered species habitat, and maintenance of existing low risk Condition Class I areas.

E. BUREAU OF LAND MANAGEMENT

The BLM administers about 30,043 acres or 23% of the land in the Upper Clear Creek Watershed **(Map 1)** as part of the Shasta Management Area (SMA) in accordance with management strategies outlined in the *Redding Resource Management Plan* completed in 1993. Within the SMA are two special management areas, known as the Interlakes Special Recreation Management Area (ISRMA) and the West of French Gulch Management Area (WFGMA). One of the management objectives for the matrix lands in the ISRMA is to provide motorized recreation opportunities. This has been very successful; these BLM lands attract thousands of motorcyclists and off road vehicles and riders each year, adding to potential fire starts.

All BLM lands with burnable vegetation must have an approved Fire Management Plan (FMP), a strategic plan that defines a program to manage the wildland and prescribed fires based on the area's approved land management plan (U. S. Department of Interior, U.S. Department of Agriculture, 2002). The FMP provides for firefighter and public safety; includes fire management strategies, tactics and alternatives; addresses values to be protected and public health issues; and is consistent with resource management objectives, activities of the area and environmental laws and regulations. Until an FMP is approved, BLM units must take an aggressive suppression action on all wildland fires consistent with firefighter safety and public safety and resources to be protected.

The BLM Fire Management Officer is responsible and accountable for providing leadership for the BLM fire and aviation management program at the local level. The BLM strategically focuses fuel treatment activities by placing priority on areas where actions will mitigate threats to the safety of employees and the public; areas where actions will protect, enhance, restore and/or maintain plant communities and habitats that are critical for endangered, threatened or sensitive plant and animal species; and areas where actions will reduce risks and damage from a wildfire.

Although structural fire suppression is the responsibility of tribal, state or local governments, BLM may assist with exterior structural protection activities under a formal agreement with CAL FIRE. There are three categories of structures: those not threatened; those threatened; those lost or too dangerous to protect. In the wildland-urban interface, BLM lists several "Watch Outs" that assist personnel in sizing up a wildfire situation. These "watch outs" may be beneficial to readers of this report in assessing the fire-safe condition of personal property. "Watch out" for:

- Wooden construction and wood shake roofs
- Poor access and narrow one-way canyons
- Bridge weight and size limits when using heavy equipment
- Inadequate water supply
- Natural fuels 30' or closer to structure
- Evacuations of public, livestock, pets, animals (planned or occurring)
- Power lines and poles overhead and fallen lines
- Propane and above-ground fuel tanks with nearby vegetation or wooden improvements
- Local citizens attempting suppression actions
- Level of coordination with multiple agencies

F. WHISKEYTOWN NATIONAL RECREATION AREA (WNRA)

The NPS administers about 31,781 acres or 23% of the Upper Clear Creek Watershed as part of the Whiskeytown Unit of the Whiskeytown-Shasta Trinity National Recreation Area (See Map #3). This acreage includes Whiskeytown Lake, which was formed by impounding Clear Creek after construction of the Whiskeytown Dam in 1962.

To achieve the objectives of the WNRA fire management program, the Upper Clear Creek portion has been declared a fire suppression zone. All lightning and human-

caused wildfires originating from or threatening the area will be suppressed (confined, contained, controlled, or a combination). Mechanical fuel manipulation and management-ignited prescribed fires may be used to reduce fuels and maintain vegetative mosaics and wildlife habitats that approximate natural conditions and ecosystem processes within the area.

Decades of fire suppression have led to a volatile increase in fuels. Excessive amounts of flammable vegetation and dead and downed debris are found throughout WNRA. The fuels buildup problem is getting attention in several ways. The ability of a fuelbreakto slow the spread of a high intensity fire also gives the ability to halt the spread of a low intensity fire.

Whiskeytown's fuelbreaks are part of a growing network of interconnected fuelbreaks. CAL FIRE, BLM, WSRCD, California Department of Corrections, NPS and local residents, are working together to design and implement a system based on interagency partnership and cooperation. The partnerships enable fuelbreaks to stretch across boundaries and, in effect, reduce the chance of significant losses over a greater area.

Before work on a fuelbreak can begin, firefighters and park mangers sit down to pinpoint where the use of a fuelbreakwould be the most effective. The main factor taken into consideration is location. Ridge tops and roadways are typically the primary location for a fuelbreak, since these areas are known to slow the spread of an approaching wildfire. By installing fuelbreaks along ridges and roads, it can lessen the intensity of a wildfire and perhaps even halt its spread. Once the location of a fuelbreak is designated, a supervised crew begins construction. Brush is first cut and then piled in the middle of the fuelbreakfor burning later. Shading from trees left in the fuelbreakhelp reduce the intensity of a fire by lowering the temperature at the fuelbreaksite. The use of prescribed fires can help introduce low intensity fires back into the landscape. Using fuelbreaks in conjunction with prescribed fires can help firefighters' ability to slow or stop a fire from spreading across boundaries into undesirable areas or conditions.

In November 2001, NPS completed the 720-acre Sunshine Prescribed Burn, the first significant burn completed in the WNRA in three years. The burn was an interagency project to help reduce the threat of wildfire to the community of Old Shasta and west Redding and enhance the effectiveness of fuelbreaks already in place outside the WNRA boundary.

The *1993 Whiskeytown Fire Management Plan* was updated in 2002 after completion of an Environmental Impact Statement, and outlines the WNRA fire goals for the next 10 years. A broad range of new issues, improved information and technology, and unforeseeable limitations have emerged, which have the potential to affect the future direction of the fire management program within the park. Some of these issues include a continued decline in ecosystem health due to fire suppression; increased hazardous fuels buildup; expanding use and development in the wildland-urban interface; increased risk and cost associated with fire suppression; increased interest in mechanical manipulation, especially in accessible areas; and more stringent air quality regulations.

G. PRIVATE TIMBER PRODUCTION ZONES

About 19,512 acres or 15% of the Upper Clear Creek Watershed are owned by private forest landowners who manage the lands as Timber Production Zones (TPZs), which are restricted to timber production and certain compatible uses. Sierra Pacific Industries is the largest commercial forest landowner in the watershed.

Typically, all contractors and employees permitted on private forest land are required to make every effort and take all precautions necessary to prevent fires. A sufficient supply of hand tools are maintained on a job site at all times for fire fighting purposes only. Tools include shovels, axes, saws, backpack pumps, and scraping tools. Each forest worker, employee, or person permitted on private forest land is required to take immediate action to suppress and report any fire on or near the property.

On all fires, a sufficient number of people stay on a fire until it is known that adequate action has been taken by CAL FIRE or the agency taking primary responsibility for putting out the fire. All people and equipment remain until released by the agency in charge, or for a longer period, if considered necessary by the land manager.

During fire season, most companies conduct daily aerial patrols covering their forest operations and pay special attention to those areas where work is being conducted, even hours after workers have left the area.

Specific treatments are required for limbs and other woody debris (often called slash) created by harvest operations in order to minimize fire hazards in areas where the public has access. It can include piling and burning slash no later than April 1 of the year following its creation, or within a specified period of time after fire season, or as justified in the associated Timber Harvest Plan. Within 100 feet of the edge of the traveled surface of public roads, and within 50 feet of the edge of the traveled surface of permanent private roads open for public use where permission to pass is not required, slash and any trees knocked down by road construction or timber operations are typically lopped for fire hazard reduction, then piled and burned, chipped, buried or removed from the area. Lopping is defined as severing and spreading slash so that no part of it remains more than 30” above the ground. All woody debris created by harvest operations greater than one inch (1”) and less than eight inches (8”) in diameter within 100 feet of permanently located structures maintained for human habitation are removed or piled and burned. All slash created between 100-200 feet of permanently located structures maintained for human habitation are usually lopped (cut) for fire hazard reduction, removed, chipped or piled and burned. Lopping may be required between 200-500 feet from a structure if an unusual fire risk or hazard has been determined.

H. PRIVATE LAND – OTHER

Other private land in the watershed totals about 22,216 acres or 17% of the Upper Clear Creek watershed (See Map #3). Private land use includes residences, hotels, inns and shops in and around the town of French Gulch and the Whiskeytown Lake area.

VIII. ANALYSIS OF FUEL MODELING AND FIRE CONDITIONS

A. FUEL, WEATHER AND TOPOGRAPHY

Currently, fire protection in the Upper Clear Creek Watershed is managed by three different agencies, each responsible for different areas of the watershed. The USFS is responsible for fire protection north of Brush Creek, and the NPS manages fire protection within the Whiskeytown Unit. CAL FIRE has a cooperative statewide fire protection agreement with BLM, USFS, and NPS for sharing fire protection resources and jointly managing fires that threaten lands on more than one jurisdiction (Soho 1998).

TABLE 3
Incidence of Fires in the Upper Clear Creek Watershed
(from USFS and CAL FIRE data)

Decade	#Fire Starts	# Large Fires	Total Acres Burned
1910	11	No data	No data
1920	6	2	352
1930	17	2	1,990
1940	23	2	138
1950	32	1	3545
1960	6	3	7377
1970	13	No data	No Data
1980	58	1	548
1990	59	2	323
2000	3	3	24668
Total	226	14	38941

CAL FIRE and USFS maintain databases on large fires and fire starts within and around their Forest Protection Zones (FPZ). The CAL FIRE database also includes fires recorded within the NPS FPZ. Both databases include the year of fire start, large fires, and total fire acreage, but cause of fire is included only on CAL FIRE fire start data and USFS large fire data.

According to descriptions of fire history in the *Upper Clear Creek Late Successional Reserve* (Forest Service 1997), USFS records were made only of those fires that received some type of fire suppression action; fires that had no suppression activity or that went out due to natural causes were not recorded. The CAL FIRE database is also historically incomplete because it does not record large fires less than 300 acres and does not contain fire starts prior to 1985. The USFS and CAL FIRE recorded at least 14 large fires and 225 fire starts in the Upper Clear Creek Watershed between 1918 and 1997 **(MAP 6)**.

The three major components of the wildland fire environment are fuels, weather, and topography (National Wildland Coordination Group, 1994). Weather is a major factor and local weather conditions are important in predicting how a fire will behave.

Within the lower elevations of the Upper Clear Creek Watershed the wind blows from the north during the early part of the summer and from the south during the latter part of the summer, and in the western foothills, the wind trends up the canyons on the hillsides east to west. In the valley the wind patterns push wildfire in a northerly or southerly direction and westerly direction in the foothills. From a strategic standpoint, fire spread in lower elevations can most likely be decreased by an east-west fuelbreakor area to set up control lines. To hold valley fires from being pulled up through 'chimneys' in the foothills, strategically placed fuelbreaks near the foothills in a northerly/southerly direction can help.

Topography can affect the direction and the rate of fire spread. Topographic factors important to fire behavior are elevation, aspect, steepness and shape of the slope. When fire crews are considering fire suppression methods, the topography is always critical in determining the safest and most effective plan of attack. When accessible, ridge lines are very important features from which to conduct fire suppression activities and can be a strategic area to conduct fuels management activities.

Fuel factors that influence fire behavior are: fuel moisture, fuel loading, size, compactness, horizontal continuity, vertical continuity, and chemical content. (National Wildfire Coordinating Group 1994)

- Fuel moisture is the amount of water in a fuel, expressed as a percentage of the ovendry weight of that fuel. For example, a fuel sample can be found to have 20-60% moisture content. Moisture content can range from as low as 5 % to a high of 260+%.
- Fuel loading is defined as the ovendry weight of fuels in a given area, usually expressed in bone dry tons. For example, an area can be calculated to have 20 bone dry tons per acre of fuel. A bone dry ton is 2000 pounds of vegetation when rated at 0% moisture content.
- Size refers to the dimension of fuels, and compactness refers to the spacing between fuel particles.
- Continuity is defined as the proximity of fuels to each other, vertically or horizontally, that governs of the fire's capability to sustain itself.
- Chemical content in fuels can either retard or increase the rate of combustion.

All of these factors will influence the quantity of heat delivered, the duration, flame length and the rate of spread of any given fire, and should be considered prior to considering pre-fire projects or initiating fire suppression activities.

B. FUEL INVENTORY

The Upper Clear Creek Watershed Fuel Inventory Report, prepared by WSRCD in 2001, reveals 37 different fuel types occurring in the watershed. The Technical Advisory Committee (TAC), made up of landowners and agency personnel, expressed concern that the inventory needed a Point Fire History (location of fire starts) added to

facilitate the location of fuelbreaks and other pre-fire activities. The TAC agreed to seek out data to show a comparison of past and present fuel conditions in the watershed.

Fuels are made up of the various components of vegetation, live and dead, that occur on a given site. Fuels have been classified into four groups – grasses, brush, timber, and slash. The differences in fire behavior among these groups are basically related to the fuel load and its distribution among the fuel diameter-size class. In 1972, 13 mathematical fire behavior models or Fuel Models were developed by Rothermel (1972) to be utilized in fire behavior predictions and applications for every vegetation type. These Fuel Models represent the types of fuel most likely to support a wildfire.

TABLE 4
FUEL MODEL TYPES

Fuel Model	Fuel Complex
	Grass and Grass-Dominated
1	Short Grass (1 foot)
2	Timber (grass and understory)
3	Tall Grass (2.5 feet)
	Chaparral and shrub fields
4	Chaparral (6 feet)
5	Brush (2 feet)
6	Dormant brush, hardwood slash
7	Southern rough
	Timber litter
8	Closed timber litter
9	Hardwood litter
10	Timber (litter and understory)
	Slash
11	Light logging slash
12	Medium logging slash
13	Heavy logging slash

The fuel models were designed to estimate fire behavior during severe fire hazard conditions when wildfires pose greater control problems and severely impact natural resources. Fuel models are simply tools to help the user realistically estimate fire behavior. The criteria for choosing a fuel model includes the assumption that fire burns in the fuel stratum best conditioned to support the fire. This means that situations will occur where one fuel model will represent the rate of spread most accurately, while another best depicts fire intensity. In other situations, two different fuel conditions may exist, so the spread of fire across the area must be weighed by the fraction of the area occupied by each fuel type.

C. RESULTS OF FUEL INVENTORY

The Upper Clear Creek fuel inventory found 7 of the 13 fuel model types present, as described by Anderson (1982), in the watershed.

- Fuel model 9 is the largest, comprising 49% of the watershed, or approximately 61,906 acres. This is the fuel model type predominant in the upper portion of the watershed, where the majority of the vegetation type is managed for timber value.
- Fuel Model 8, closed timber litter, is the second largest fuel model found, at 26% of the watershed or 32,806 acres. This Fuel Model is found in the French Gulch area interspersed with Fuel Model 4. It is described as slow burning with low flame heights with a rate of spread of 1.8 chains per hour (A chain is 66 feet) and flame length of one foot, although an occasional "jackpot" or heavy fuel concentration may cause a flare up. Closed canopy stands of short needle conifers or hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly needles, leaves, and some twigs, since little undergrowth is present in the stand. This fuel model is predominately Live Oak with secondary Douglas-fir.
- Fuel Model 4 has very high to extreme rates of spread, which makes control efforts difficult. Fire involves the foliage and live and dead fine woody materials in the crowns of a nearly continuous secondary overstory. Besides flammable foliage, there is dead woody material in the stand that significantly contributes to the fire intensity. Dominant stands of chamise or manzanita with chamise are representative of Fuel Model 4. This model has a rate of spread of 75 chains per hour and a flame length of 19 feet.

TABLE 5
ACRES OF VEGETATION TYPE

Fuel Model/ Vegetation Type	Total Acres
2 – grass and understory	4,912
4 – Chaparral 6'	10,555
5 – chaparral brush ~2'	7,000
6 – dormant brush, slash	8,036
8 – Closed timber litter	32,806
9 – hardwood litter	61,906
10 – forest litter, understory	618
TOTAL	**125,833**

To understand the current fuel loading conditions, it is important to understand past fuel loading conditions. Due to the historical fire regime, overall plant densities were most likely lower than those of today. Frequent fires would have drastically reduced vegetation densities and accumulated fuels. Furthermore, it is also very likely that the species composition is much different today due to fire suppression. Fire-adapted species, which thrived in reoccurring fire environments, have probably declined due to competition from non-fire dependent species.

IX. FUEL TREATMENTS

Reducing fuel loads is one of the most effective elements of any fire prevention and protection program. Although fire is an integral component of the Upper Clear Creek Watershed ecosystem, managing fire by managing fuel loading is critical to maintaining communities, ranches, grazing lands, riparian areas, and the overall health and function of the watershed. The ability to implement fuels reduction projects typically comes down to the source of funds available, the cost of labor, and the ability to implement the project.

A. PRESCRIBED BURNING

The NPS has been engaging in prescribed burning within the WNRA since 1994. CAL FIRE conducted prescribed fires on private land twice, first in 1983 and again in 1986. Advantages of prescribed fire are: it can be low in cost to implement, it can be implemented over a large area, and it may decrease herbicide use by controlling the timing of sprouting. Some of the negative aspects of prescribed fire are: the potential for erosion, the smoke, the practice has a limited season, there is the risk of escape, it is not feasible in small areas, and it is not a stand-alone tool.

Prescribed fire is used to approximate the natural vegetative disturbance of periodic wildfire occurrence. This vegetative management tool is used to maintain fire dependent ecosystems and restore those outside their natural balance. Generally, low intensity prescribed fire is applied by trained experts to clear ground of dangerous fuels like dead wood and brush. This low-intensity fire is vital to the life cycles of fire-dependent range and forest lands.

Most prescribed fires are lit by crews using a drip torch, a hand-carried device that pours out a small stream of burning fuel. Other fires or burns are ignited by helicopters carrying a gelled fuel torch (helitorch) or a sphere dispenser machine that drops material to ignite the surface fuels in forest and range types. Exactly how each unit is ignited depends on weather, the lay of the land, and the intensity of the fire needed to meet the goal of the burn (USDA Forest Service 2002). The technique can be used to burn piles of cut brush or grass over a designated prepared area (broadcast burn).

Prescribed fire is useful in restoring and maintaining natural fire regimes in wildland areas, but logistic, economic, and social attributes are constraints on widespread deployment. Because of such conflicts, resource managers often employ mechanical fuel reduction, such as thinning, in conjunction with prescribed fire to reduce fuels and the fire hazard (Regents of the University of California 1996) (CAL FIRE 2002). Prescribed fire is not without controversy and risk. A prescribed fire can get out of control and cause damage to watersheds, wildlife habitat, and structures, and can even result in loss of life. It is only an option when this risk can be reduced to manageable levels. Factors closely monitored to mitigate risk include:

- Fuel moisture content
- Ratio of dead-to-live fuel

- Fuel volume
- Size and arrangement of fuel
- Percentage of volatile extractives in the fuel
- Wind speed and direction
- Relative humidity
- Air temperature
- Topography

A successful prescribed burn must account for all these factors to prevent the fire from going out of control. Guidelines for measuring the data and selecting the levels necessary to manage the prescribed fire are available from a variety of sources. One excellent reference for wildland-urban zones is the USDA Forest Service publication, *Burning by Prescription in Chaparral* (USDA Forest Service 1981).

Air quality is another consideration in the use of prescribed burning. Communities in the Urban-Wildland Interface are very sensitive to the presence of smoke. Burn days approved by state and local authorities take into consideration the meteorological effects on both fire severity and smoke dispersion. In the case of chaparral, prescribed burning for range improvement has been practiced by California landowners under permit from CAL FIRE since 1945 (Green 1981). Currently, procedures for prescribed burning require a written plan for each burn. A plan includes such items as an objective, an area map, a description of the burn unit and surrounding areas, a smoke management plan, and the burn prescription (USDA Forest Service 1981).

Prescribed fire is the primary treatment method for all public lands, ranging from USFS land to state parks. According to FRAP, the *Forest and Rangeland Resources Assessment Program* (Regents of the University of California 1996), most prescribed burns were to control brush, especially chaparral. Public agencies feel prescribed burns offer the lowest cost solution when considering the scale of the area requiring treatment. However, prescribed fires can be quite expensive when the true cost of planning, data gathering, reporting, and control and suppression are considered. Other major constraints are the reduction in allowable burn days because of increasing air quality concerns, high fuel load levels found in many forested and urban-wildland areas, and the increased production of pollutants, such as carbon monoxide, nitrous oxide, and particulates. In these situations, a combination of mechanical methods of fuel reduction combined with prescribed fire may provide the best solution.

B. SHADED FUELBREAKS

Shaded fuelbreaks are constructed as a means to create a defensible space in which firefighters can conduct relatively safe fire suppression activities. Fuelbreaks may also slow a wildfire's progress enough to allow supplemental attack by firefighters. The main idea behind fuelbreak construction is to break up fuel continuity to prevent a fire from reaching the treetops, thus forcing the fire to stay on the ground where it can be more easily and safely extinguished.

Fuelbreaks may also be utilized to replace flammable vegetation with less flammable vegetation that burns less intensely. A well-designed shaded fuelbreak also provides an aesthetic setting for people and a desirable habitat for wildlife, in addition to fuels reduction. The typical minimum width of a shaded fuelbreak is 100 feet, but can be up to 300' wide. The appropriate width is highly dependent on the slope, fuel density, fuel type, fuel arrangement, and landowner cooperation.

The California Board of Forestry has addressed the needs to strengthen community fire defense systems, improve forest health and provide environmental protection. The Board rules allow a Registered Professional Forester (RPF) to use a special silviculture prescription when constructing or maintaining a community fuelbreak, exempts community fuelbreaks from an assessment of maximum sustained production requirements and allows defensible space prescriptions to be used around structures.

The WSRCD has developed the following Fuelbreak standards:

- Fuelbreaks should be easily accessible by fire crews and equipment at several points. Rapid response and the ability to staff a fire line is very important for quick containment of a wildfire.
- The edges of a fuelbreak are varied to creating a mosaic or natural look. Where possible, fuelbreaks should compliment natural or man-made barriers such as meadows, rock outcroppings, and roadways.
- A maintenance plan should be developed before construction of a fuelbreak. Although a fuelbreak can be constructed in a matter of a few weeks, maintenance must be conducted periodically to keep the fuelbreak functioning properly.
- The establishment of a shaded fuelbreak can lead to erosion if not properly constructed. Short ground cover, such as grass, should be maintained throughout the fuelbreakto protect the soil from erosion.

A properly treated area should consist of well-spaced vegetation with little or no ground fuels and no understory brush. Tree crowns should be approximately 10-15' apart. The area should be characterized by an abundance of open space and have a 'park like look' after treatment. The Pile and Burn method is most commonly utilized when constructing fuelbreaks. Material is cut and piled in open areas to be burned. Burning takes place under permit on appropriate burn days. Burn rings can be raked out after cooling as a means to decrease their visual effect. In dealing with chaparral, a relatively new technique called "crush and burn" combines mechanical fuels treatment with burning. It is more effective in eliminating chaparral then a low-intensity prescribed burn, which has difficulty competing with the high moisture content of live chaparral. In this method, the chaparral is mechanically crushed, then piled and burned. It is a good technique for areas adjacent to communities and to encourage chaparral regeneration in riparian zones.

C. MECHANICAL TREATMENT

Using mechanized equipment for reducing fuels loads on suitable topography and with certain fuel types can be very effective. Depending on the use of the equipment, it may require environmental review and documentation. Using equipment to remove excess

vegetation may enable the landowner to process the debris to a level where it can be marketed as a product for use in power generation. The debris then becomes labeled as "biomass" or "biofuels" and is further explained in Section IX of this report.

Mechanical methods to remove fuels include, but are not limited to, the utilization of bulldozers with or without brush rakes, excavators, chainsaws or mechanized falling machines, masticators, chippers, and grinders. Mechanical treatments are typically conducted on chaparral landscapes with some type of masticator, which grinds standing brush and reduces it to chips, which are typically left on the ground. Brush may also be mechanically removed and fed into a grinder for biomass production. Mechanical treatments are also utilized on industrial and non-industrial timberlands in which trees are thinned by mechanized tree cutting or falling machines. In most cases, stands of trees are thinned from below as a means to eliminate the fuels that can take a fire higher in the forest into the tree canopy (ladder fuels). However, stands of trees may also be thinned from above to eliminate crown continuity.

Mechanical treatments can be used successfully on stable ground up to 50% slope, but should only be conducted during dry periods when soils are not saturated to minimize erosion and compaction. The drastic visual impacts should be considered when planning projects so that all parties are aware of how the area will look when the project is completed. Initial planning should address mitigation for erosion potential, using measures such as waterbars, ditching, and mulching in critical areas. Furthermore, the impacts on wildlife and archaeological resources must be addressed.

Due to air quality concerns, the mechanical treatment method is fast becoming the acceptable method of fuel reduction in Urban Interface areas. Compared to prescribed fire, mechanical treatment involves less risk, produces less air pollutants, is more aesthetically pleasing, and allows landowners to leave desirable vegetation.

D. BIOMASS ANALYSIS

For thousands of years, people have been taking advantage of the earth's vegetation, also called biomass, to meet their energy needs (www.epa.gov, 2002). Technologies for using biomass continue to improve and today biomass fuels can be converted into alternative fuels (biofuels), such as ethanol, methanol, biodiesel, and as boiler fuel for use in industrial heating and power generation.

When used for generating electricity, biomass is typically burned to transform water into steam, which is used to a drive a turbine and attached generator (www.epa.gov, 2002). Although a majority of the biomass market is associated with energy production, biomass offers a wide verity of uses such as fiber-reinforced composites, fiber-filled thermoplastics, high performance fiberboard, cement board, mulch for landscaping and soil amenities, smoke chips for curing and flavoring meat and bio-oils which are used as asphalt additives or adhesives. Potential markets continue to be explored and developed by the private sector, and the federal government has also demonstrated interest in the biomass industry by the release of Executive Order 13134. On August 12, 1999, President Clinton released Executive Order 13134, designed to stimulate the creation

and early adoption of technologies needed to make biobased products and bioenergy cost-competitive in the large national and international markets (www.bioproducts-bioenergy.gov, 1999).

The utilization and development of biomass technology offers many economic and socioeconomic benefits. However, one of the most widely acknowledged benefits is the development and utilization of biofuels as a means to reduce the world's dependency on non-renewable fossil fuels. Presently, a majority of the electricity in the U.S. is generated by burning fossil fuels such as coal, natural gas, and oil. On the local level, the development of biotechnology also offers both economic and socioeconomic benefits.

The Upper Clear Creek Watershed contains thousands of acres of forestland, which produce a substantial amount of renewable biomass each year. The biomass market associated with wood products production has long been developed, and biomass harvesting for fuel reduction is a common practice within managed forestlands in Northern California. Biomass production not only provides economic support at the local, state, and federal levels, but also reduces the nation's dependency of fossil fuels. The watershed also contains thousands of acres of chaparral, which produce a significant amount of renewable biomass, although only a small portion of the biomass produced from chaparral landscapes is utilized for biofuels.

The potential for biomass production within the Upper Clear Creek Watershed is good given that the watershed contains a substantial amount of raw material (chaparral and forestland species). The closest wood-fired power plant is approximately 50 road miles away in Anderson, California. This is a 50-megawatt wood-fired power plant, Wheelabrator Shasta Energy, which utilizes one hundred semi truckloads (~1,400 bone dry tons) of biomass each day, seven days/week, to produce electricity (Jolley 2002). There are other wood-fired power plants in Shasta County, but this facility is the closest to the Upper Clear Creek Watershed.

The feasibility of any biomass operation depends on the market price of biomass, (also commonly called hogged fuel or hog fuel if it is processed through a hammer hog,) the density or amount of fuel on the ground, and transportation costs. Processing can include harvesting and chipping or hogging and costs are directly correlated with the species, age, size and density of the vegetation being processed as well as the topography of the area. The transportation cost from the project area to the nearest wood fired power plant is directly related to the size of the vehicle, time needed for loading biomass, the road bed system and distance to the plant.

The price a power plant is willing to pay for a ton of biomass vs. the processing and transportation determines the economic feasibility of an operation. However, the value of fuel reduction to the landowner should be included in this calculation to determine the true feasibility of a biomass operation.

Harvesting is usually accomplished with an excavator and/or a bulldozer tractor, which is utilized to remove and pile the brush. Processing can be accomplished with a hammer

hog, tub grinder, drum chipper or some other type of industrial type chipper fed by the excavator or other mechanical means.

Biomass Collection in Action. Tub grinder on right, conveyor moves biomass into the van.

Pursuant to the California Forest Practice Rules, if biomass operations involve the harvest of commercial species, the project requires a permit issued by CAL FIRE. Biomass operations not involving the harvest of commercial species are not subject to the California Forest Practice Rules, but may require county permits or other agency review depending on the physical characteristics of the project area. A Registered Professional Forester should be involved prior to commencement of any biomass operation in order to determine what permits might be required and to estimate the cost and timing of obtaining the permits.

Although the biofuels industry is the most developed biomass market in northern California, other markets are currently in the developmental stage and may become a commercially viable option for biomass products in the future. These markets are far from becoming a significant force in the market place, but may provide alternative utilization methods and future marketing opportunities.

E. MAINTENANCE TREATMENT

Maintenance plans for all existing shaded fuelbreaks, as well as a maintenance strategy for all planned shaded fuelbreaks needs to be formulated as soon as funding can be made available. A maintenance section should be added to all planned shaded fuelbreaks. Scrub oak re-sprouts and manzanita seedlings on disturbed areas are typical of the vegetation needing control. Control can take many forms including chemical control, mechanical control, or grazing by livestock (such as goats).

The time frame for maintenance is typically two years, five years, and ten years after initial construction of the shaded fuelbreak. Treatment with livestock would need to be repeated more frequently.

Periodic maintenance of a fuelbreak sustains its effectiveness. Seeding the fuelbreak with annual grass cover immediately following its construction will help reduce brush and conifer invasion, but only depending on grass cover will not eliminate invading plants for an extended period of time. Here are several methods to maintain fuelbreaks:

1. Herbicides

The use of herbicides is a very effective and inexpensive method of eliminating unwanted vegetation, but there are many restrictions. Some herbicides are species specific, which means they can be used to eliminate brush species and will not harm grass species. Manual treatment is also a very effective means to eliminate invading vegetation, but is very labor intensive. The cost of fuelbreak maintenance must be balanced with its degree of effectiveness.

2. Herbivors

Herbivore (goat) grazing may be used as a means of maintaining fuelbreaks, since goats will eat brush and weeds. Browse makes up about 60% of a goat's diet, but only about 10-15% of a cow's diet.
Goats used for fuel load reduction are managed to remove dense understory, including brush, shrubs, forbs, and lower branches to remove ladder fuels. It may require giving goats supplements of protein or energy, depending on the class of goats used and the time of year. The choice must be balanced on the type of soil, vegetation and livestock analysis. Monitoring of the herbivore grazing is critical since over-grazing can lead to erosion.

As goats work through an area they also work on the understory, old pine needles and leaves, break lower branches, and split apart old downed branch material. Once an area has been "brushed" by goats, it can be maintained as a living green belt. Fire control or containment with goats takes coordination of the stock owner, land steward, local fire patrol, professional fire abatement teams, CAL FIRE, DFG, and others.

According to a report published by the North Carolina Cooperative Extension Service, grazing goats have been observed to select grass over clover, prefer browsing over grazing pastures, prefer foraging on rough and steep land than over flat, smooth land, graze along fence lines before grazing the center of a pasture, and graze the top of the pasture canopy fairly uniformly before grazing close to the soil level.

Herbivore grazing has been done in the Sierra Foothills by Goats Unlimited, Rickerby, CA. They report the vegetation in the Sierra Foothills grazing area consists of woody plants, shrubs, forbs and grasses. Before entering a new area, the herder develops a landscape goal, completes a vegetative survey and identifies toxic plants. They identify the growth habit and adaptation of each plant species, especially those that are toxic. The objective is to control the invasion of unwanted species and encourage perennial grasses to return. In a report published by Langston University, goats improve the cycling of plant nutrients sequestered in brush and weeds, enabling the reestablishment of grassy species. Portable electric fencing with solar energizers is used to control the goats' foraging area.

A “Rule of Thumb” for the cost of using goats for fuels reduction projects was found in a report on the Internet. A minimum effective goat herd has 500 animals, which will remove fuel from about 3 acres per day at a cost of $1.00 per day per goat. The cost includes the goats, portable fencing, a goat herder, water and all transportation and daily supervision.

Herbivores Used In Fuel Reduction

3. Converting Brush to Oak Woodland

Brush land frequently occurs on soils that are best suited for growing brush. The exception to this are forest soils that have been burned, and have come back to brush. Brushland soils are sloping to very steep loams and are stony or rocky. These soils are usually shallow to bedrock, and available water capacity is low or very low. Vegetation is generally chaparral, which includes such species as chamise, Lemmon ceanothus, buckbrush, toyon, poison-oak, whiteleaf manzanita, and western mountainmahogany. There are few trees occurring on the sites, such as interior live oak and gray pine. At least 80 percent of the surface cover is woody vegetation.

Conversion from brushland to oak woodland will entail a thorough investigation of the site. Soil depth, type, aspect, and exposure will all determine the success or failure of an attempted conversion. With few exceptions, most of the brushy sites are naturally occurring, and represent the native vegetative community.

Natural regeneration of oak species is very difficult to accomplish. A conversion from brush to oak woodland should begin with a thorough investigation of the capability of the site to support oak trees. The second, or next step, should be to secure a reliable source of oak seedlings; and the third step should be to develop a planting plan. A realistic cost estimate should be the fourth step. All this should be accomplished before the existing brush cover is removed.

X. ROADS FOR ACCESS

Roads are an essential part of any fire and fuels management plan, providing the principal access to the communities, homes and wild places in the watershed. Additionally, roads may offer a defensible space from which firefighters can conduct direct attack on wildfires and also provide strategic locations for roadside fuelbreaks.

Roadside fuelbreaks not only provide defensible space for firefighters, but also a safe escape route for residents in the event of a wildfire.

Roads in the Upper Clear Creek Watershed typically branch off from Trinity Mountain Road. The watershed can be reached from both the east and west along State Route 299, which is the major two-lane highway connecting Weaverville and Redding. Trinity Mountain Road is the main corridor road and an important transportation route for residents of French Gulch, as well as others traveling in the watershed. Starting at State Route. 299 near Tower House, Trinity Mountain Road follows the mainstem of Clear Creek before heading west to the crest of the Trinity Mountains, the ridge that divides the Trinity and both Upper and Lower Clear Creek watersheds. Trinity Mountain Road follows the ridgeline, which also defines the western edge of Shasta County, intersecting with Dog Creek Road, which leads across the northern end of the watershed east to I-5. Trinity Mountain Road leads northward out of the watershed near Jackass Peak into the Trinity watershed along the eastern arm of Trinity Lake (formerly called Clair Engle Lake).

All roads are important for providing fire protection and suppression access. This plan will not attempt to identify and map all paved or improved roads. Roads that are vital to future projects will be included in treatment options. Following is a list of fire access roads. For details, see Map #6.

A. MAIN NORTH SOUTH ROADS

- Trinity Mountain Road

B. ROADS GOING WEST FROM TRINITY MOUNTAIN ROAD

- Tom Green Mine Road
- French Gulch Road
- Highland Ridge Road

C. ROADS GOING EAST FROM TRINITY MOUNTAIN ROAD

- Cline Gulch Road
- Drunken Gulch Road
- East Fork Road
- Dog Creek Road

D. OTHER ROADS

- Whiskeytown Road
- American Mine Road
- Lewiston Road
- Sanford Pass Road
- Slate Creek Road
- Mountain Lookout Road

- Main Street (in French Gulch)
- Niagara Street (in French Gulch)

XI. POTENTIAL COST SHARE FUNDING SOURCES

The following table is a list of cost share programs provided by the University of California, Cooperative Extension Service (UCCE).

TABLE 6
FUNDING SOURCES AND COST SHARE PROGRAMS

Program	Goals	Services	Will Fund	Agency	Who	Limitations
Emergency Watershed Protection	Helps safeguard people and property following natural disasters.	Technical and financial assistance	Up to 75%	NRCS	Public agencies, non-profits, community groups	25% cost share. Must obtain necessary permits
Environmental Quality Incentives Program	To address significant natural resource needs and objectives	Cost sharing, technical and educational assistance	Up to 75% set by local working group	NRCS, FSA	Agricultural producers having significant natural resource needs	Approved practices up to $10,000 per producer per year. Must have Conservation Plan approved by RCD.
Forest Stewardship Program	Assist California communities to more actively manage their watershed resources, to keep forests and associated resources productive and healthy	Technical, educational and financial assistance	Cost share up to $50,000. 100% match is required.	CAL FIRE	RCDs, RC&Ds, special districts, Indian tribes, and community non-profit organizations.	Projects that involves activities that may lead to changes in the environment are required to comply with CEQA. Projects must be on NIPF land & address one of the major categories: pre-fire fuels mgmt, forest &woodland health, water quality, or wildlife & fisheries habitat.
Hazard Mitigation Grant Program	Hazard mitigation to reduce risk from future disasters	Cost share	Up to 75%	FEMA	Agencies, governments, non-profits, tribes	Federal Disaster Areas
Vegetation Management Program	To provide incentives for using fire as a tool to control unwanted brush, and other vegetation, which creates wildfire hazards.	Covers liability, conducts prescribed burn	Up to 90% cost share	CAL FIRE	Landowners, individual or group	Agreement to sign, plan required

Program	Goals	Services	Will Fund	Agency	Who	Limitations
California Forest Improvement Program	Forestry, watershed and riparian protection and enhancement	Reforestation, site prep, land conservation, and fish & wildlife habitat improvements	75% up to $30,000 per contract, rehab after natural disaster up to 90%	CAL FIRE	Landowners	Plan (can be cost shared) required, 20-50,000 acres of forestland

Additional funding sources include:

- California Department of Conservation, RCD Assistance Program
- USDA Forest Service State Fire Assistance (SFA)
- Shasta County Regional Advisory Committee, Title II Funds, Secure Rural Schools and Community Self-Determination Act of 2000
- Bureau of Land Management (BLM) Community Assistance
- National Park Service (NPS) Community Assistance/WUI
- U.S. Fish and Wildlife Service (USFWS) Wildland-Urban Interface Grant Program
- California State Fire Safe Council Clearinghouse**,** Fuel reduction project grant funding

XII. FUNDING FUELBREAK MAINTENANCE

Since grant funds are often obtained just to construct the fuelbreak, maintenance efforts are often left to the landowner. Unfortunately, some landowners do not have the physical or financial means to do maintenance. If a fuelbreak is not properly maintained in its entirety, it will not provide adequate fire protection in the long run. Therefore, in some situations it is often best for watershed groups and other conservation organizations to seek funding for maintenance as a means to better ensure fire protection for a given area. The Community Protection Plan was developed as a result of the USFS National Fire Plan. This plan provides grant funding for fuel reduction projects on private lands. In addition, many of the programs listed in Table 5 above also provide funding opportunities for fuels reduction and maintenance.

Information on private sector funding can be found at the following Internet sites:

- www.fdncenter.org
- www.ceres.ca.gov/foreststeward/funding.html
- www.ice.ucdavis.edu/
- www.teleport.com/~rivernet/general.htm
- www.tpl.org/tpl/about/
- www.ufei.calpoly.edu/data/news/grants.html

Funding programs can assist in the development of shaded fuelbreaks, defensible space around structures, roadside fuel reduction, and community fire safe projects.

XIII. GRANT FUNDING OPPORTUNITIES

Funding sources are as varied as the projects listed above. WSRCD has the mechanism in-place to seek funding for any projects generated through this plan. The French Gulch-Upper Clear Creek Resource Management Group is a 501-c-3 non-profit corporation, and can apply for grant funds. There are several sources of funding available through the agencies in the area. Agencies that have or can fund fuelbreak construction include:

- USDA Forest Service
- California Department of Conservation
- USDI Bureau of Land Management
- USDI National Park Service
- Shasta County-Secure Rural Schools & Community Self-Determination Act of 2000.
- FEMA

XIV. REFERENCES

- Anderson, Hal, *Aids in Determining Fuel Models for Estimating Fire Behavior,* 1982, U.S. Department of Agriculture, Forest Service Ogden, Utah, General Technical Report INT-122, 1982
- Andrews, Patricia L., *BEHAVE: Fire Behavior Prediction And Fuel Modeling System,* May 1984
- Brian Bull, NF Ag News Views, *Using Goats for Vegetation Management,* , 2002
- Bureau of Land Management, *Standards for Fire and Aviation Operations,* 2002
- California Department of Fish and Game. 1993. *Restoring Central Valley Streams: A Plan For Action.* Inland Fishery Division
- California Department of Forestry and Fire Protection, *California Fire Plan,* May 2000
- California Department of Forestry and Fire Protection, *Fire and Resource Assessment Program, (FRAP)* 2002
- California Department of Forestry and Fire Protection, *Shasta County Unit Fire Plan, 2002*
- California Department of Water Resources, *Sacramento Valley Westside Tributary Watershed Erosion Study,* Executive Summary.), 1992
- California Board of Forestry & Fire Protection, *California Forest Practice Rules 2002,* California Resources Department
- DeBano, L.F., and R.M. Rice, *Fire in Vegetation Management*: *Its Effect on Soil,* American Society of Civil Engineers, 1970
- Goats Unlimited, *Goats Unlimited: Firebreaking with Meat Goats,* 2002.
- Hart, S. P., Langston University, Journal of Dairy Science, *Recent Perspectives In Using Goats For Vegetation Management In The USA,* 2001
- Hartley, Rick, CAL FIRE (retired), personal communication to Hide Wenham (WSRCD), 2002

- Lewis, H.T., *Patterns of Indian Burning in California: Ecology and Ethnohistory*, Ballena Press, 1973
- National Park Service, *Whiskeytown Fire Plan*, Whiskeytown National Recreation Area, 1993
- National Park Service, *Fire at Whiskeytown*, Whiskeytown National Recreation Area, 2002
- National Wildfire Coordination Group, *S-290 Intermediate Wildland Fire Behavior*, National Interagency Fire Center, Boise, Idaho 1994
- Regents of the University of California, *Sierra Nevada Ecosystem Project (SNEP)*, 1996
- Rothermel, Richard C. *A Mathematical Model for Fire Spread Predictions in Wildland Fuels*, USDA Forest Service, Ogden, UT, INT-115, 1972
- Schimke, H.E. and L.R. Green. *Prescribed Fire For Maintaining Fuelbreaks in the Central Sierra Nevada*, U.S.D.A. Forest Service, Pacific Southwest Range and Experiment Station, Berkeley, CA., 1970
- Shasta Trinity National Forest, *Land and Resource Management Plan*, 2002
- Shasta Trinity National Forest, *Shasta Trinity Fire Management Plan,* Redding, CA, 2001
- U. S. Census Bureau, U. S. Census 2000
- U.S. Department of Conservation, Division of Mines and Geology. *Mines and Mineral Resources of Shasta County, California.* County Report 6. 1974
- USDI – USDA, *Standards for Fire and Aviation Operations*, 2002
- USDA Forest Service, *Burning By Prescription in Chaparral*, 1981
- USDA Forest Service, *National Fire Plan,* 2000
- USDA Forest Service, *The National Fire Plan*, October 2000
- US Environmental Protection Agency (www.epa.gov), *Biomass*, 2002
- U.S. Fish and Wildlife Service and U. S. Bureau of Reclamation, 2001. *AFRP Final Restoration Plan*
- U. C. Davis, *Natural Diversity Database 2002,* California Department of Forestry & Fire Protection
- The White House, Office of the Press Secretary, *Executive Order 13134, Developing and Promoting Biobased Products and Bioenergy*. www.bioproducts-bioenergy.gov, 1999.
- Western Shasta Resource Conservation District, *Upper Clear Creek Watershed Analysis, April 1999*

APPENDICES

A. GLOSSARY
B. COMMUNITY FIRE SAFE FUEL REDUCTION GUIDELINES

APPENDIX A.

GLOSSARY

BEHAVE – A computer program used for predicting fire behavior.

Chain – A unit of measurement equal to 66 feet.

Fuel Characteristics – Factors that make up fuels such as compactness, loading, horizontal continuity, vertical arrangement, chemical content, size and shape, and moisture content.

Fuel Chemical Content – Substances in the fuels which can either retard or increase the rate of combustion, such as mineral content, resins, oils, wax or pitch.

Fuel Ladder – Fuels which provide vertical continuity between strata. Fire is able to carry from ground, to surface, to crown.

Fuel Moisture Content – The amount of water in a fuel, expressed as a percentage of the ovendry weight of that fuel.

Fuels – Any organic material, living or dead, in the ground, on the ground, or in the air, that will ignite and burn. General fuel groups are grass, brush, timber and slash.

Mechanical Treatment – Using mechanized equipment including but not limited to bulldozers with or without brush rakes, rubber tired skidders, mechanized falling machines, chippers and grinders.

Pile and Burn – Material is cut and piled in open areas to be burned. Burning takes place under permitting environmental conditions.

Prescribed Burning – The burning of forest or range fuels on a specific area under predetermined conditions so that the fire is confined to that area to fulfill silvicultural, wildlife management, sanitary or hazard reduction requirements, or otherwise achieve forestry or range objectives.

Rate of Speed – It is expressed as rate of forward spread of the fire front, usually is expressed as chains per hour.

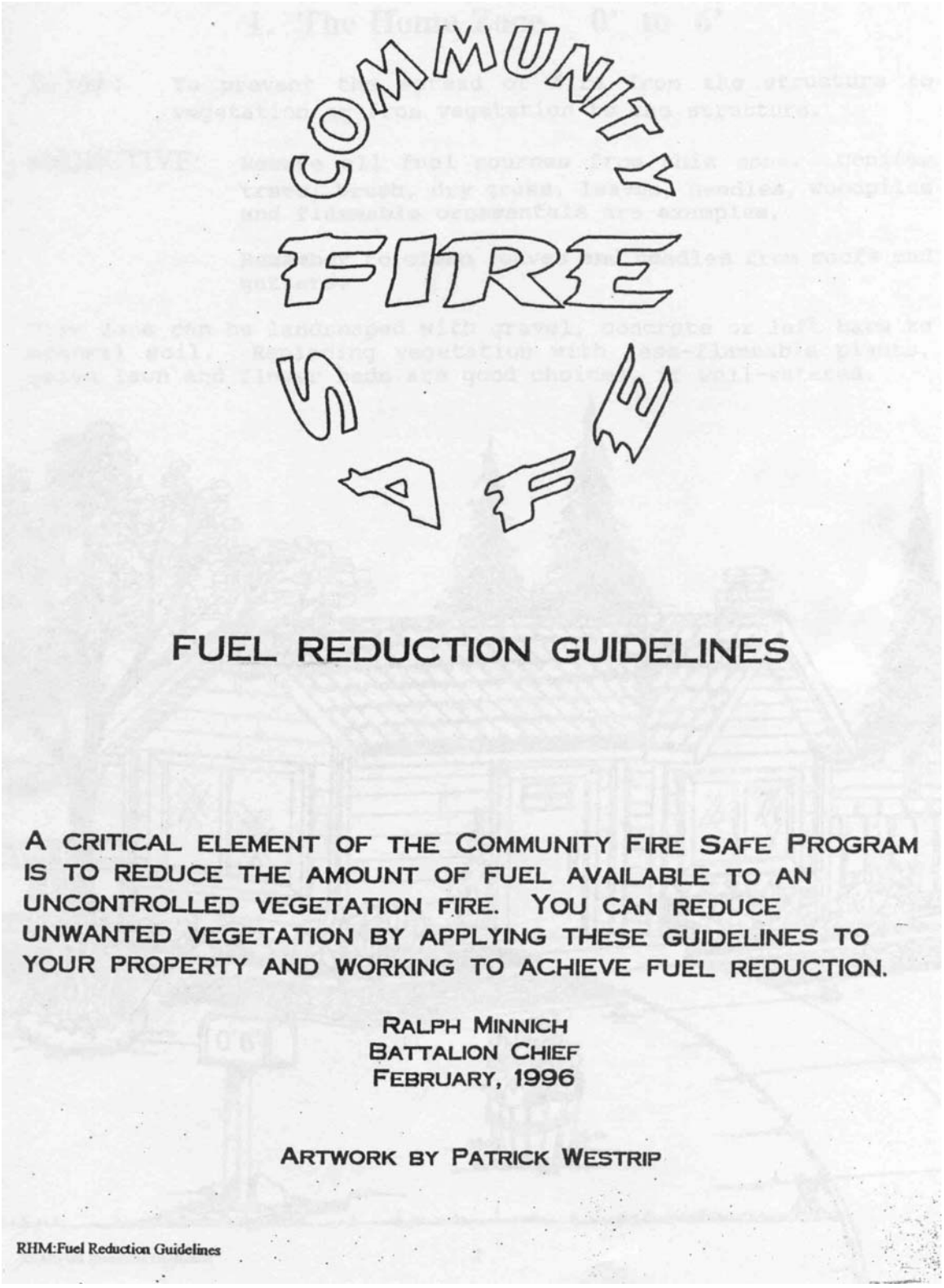
Shaded Fuelbreak– A wide strip or block of land on which the vegetation has been modified by reducing the amount of fuel available, rearranging fuels so that they do not carry fire easily, and replacing particularly flammable fuels with others that ignite less easily and burn less intensely.

Surface Fire – A fire that burns surface litter, debris and small vegetation.

Topography – The configuration of the earth's surface, including its relief and the position of its natural and manmade features.

APPENDIX B.

COMMUNITY FIRE SAFE FUEL REDUCTION GUIDELINES



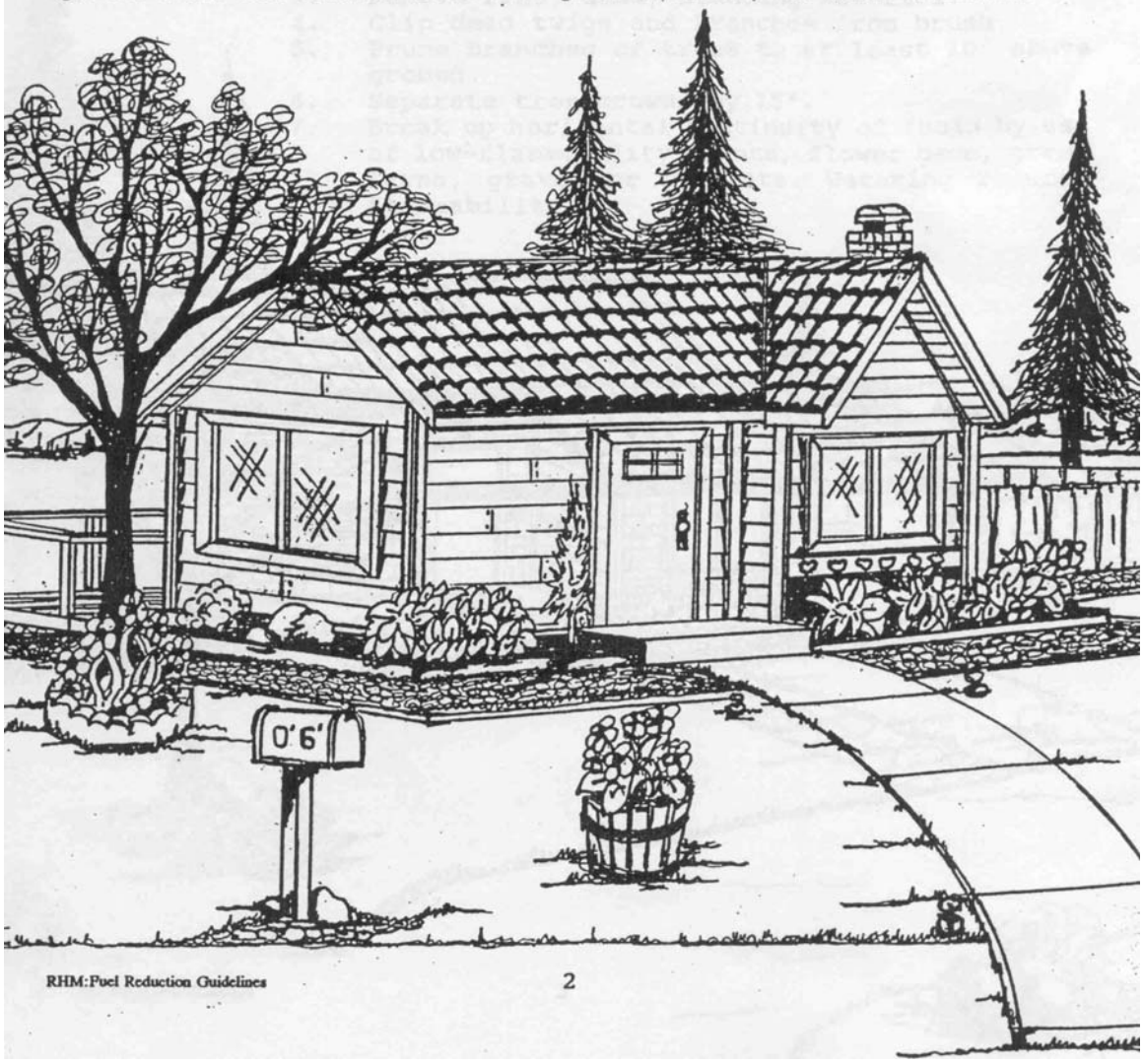
1. The Home Zone 0' to 6'

GOAL: To prevent the spread of fire from the structure to vegetation or from vegetation to the structure.

OBJECTIVE: Remove all fuel sources from this zone. Conifer trees, brush, dry grass, leaves, needles, woodpiles and flammable ornamentals are examples.

Remember to clean leaves and needles from roofs and gutters.

This zone can be landscaped with gravel, concrete or left bare to mineral soil. Replacing vegetation with less-flammable plants, green lawn and flower beds are good choices, if well-watered.



2. The Yard Zone 6' to 30'

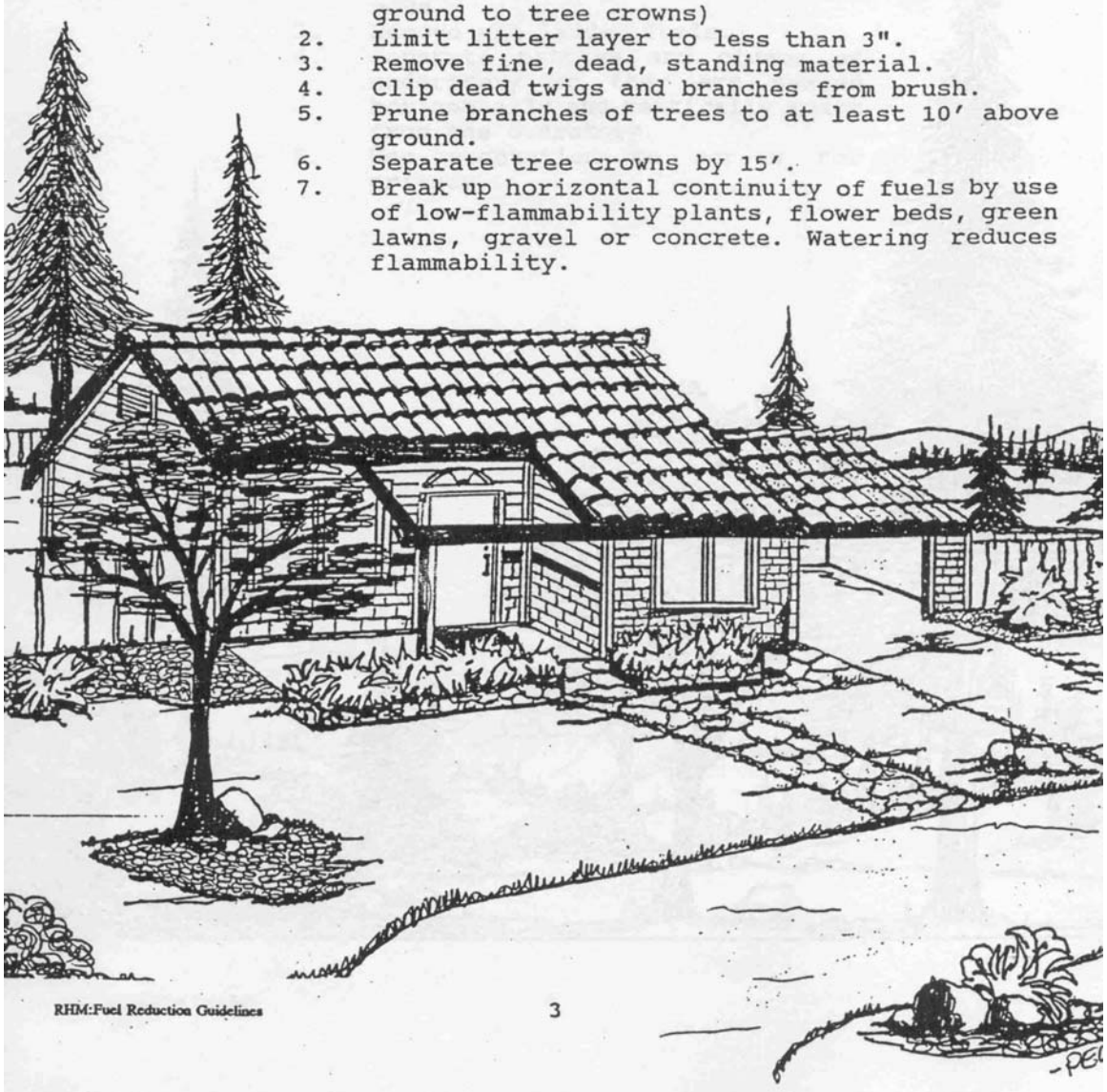
GOAL: To prevent a fire from moving from ground fuels to brush or tree crowns and to slow the rate of fire spread.

> reduced fuels means reduced fire intensity
> reduces potential exposure problems
> preserves overstory vegetation

[This zone should be sufficient for grasslands and is integrated into fuel reduction for brush and timberlands.]

OBJECTIVE:

1. Eliminate fuel ladders (continuous fuel from ground to tree crowns)
2. Limit litter layer to less than 3".
3. Remove fine, dead, standing material.
4. Clip dead twigs and branches from brush.
5. Prune branches of trees to at least 10' above ground.
6. Separate tree crowns by 15'.
7. Break up horizontal continuity of fuels by use of low-flammability plants, flower beds, green lawns, gravel or concrete. Watering reduces flammability.



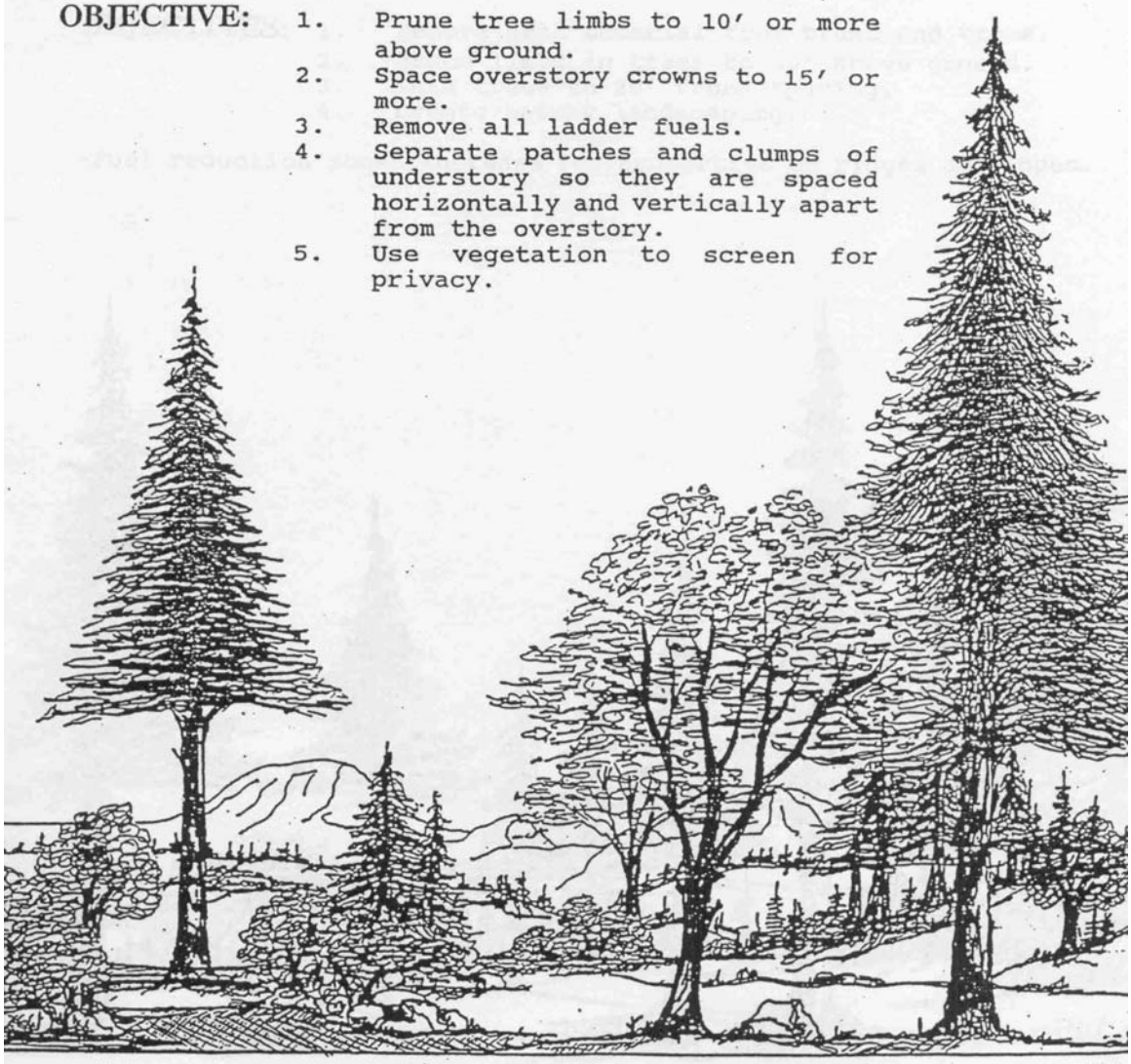
3. The Brush / Screen Zone 30' to 75'

GOAL: To keep a wildland fire on the ground thereby minimizing intense burning and damage to overstory vegetation.

[This is the primary zone for fire suppression. Although 75′ of fuel reduction appears adequate for brushcovered lands, further effort is necessary in timberlands.]

OBJECTIVE:

1. Prune tree limbs to 10′ or more above ground.
2. Space overstory crowns to 15′ or more.
3. Remove all ladder fuels.
4. Separate patches and clumps of understory so they are spaced horizontally and vertically apart from the overstory.
5. Use vegetation to screen for privacy.



4. Woodland / Forest Zone 75' to 150'*

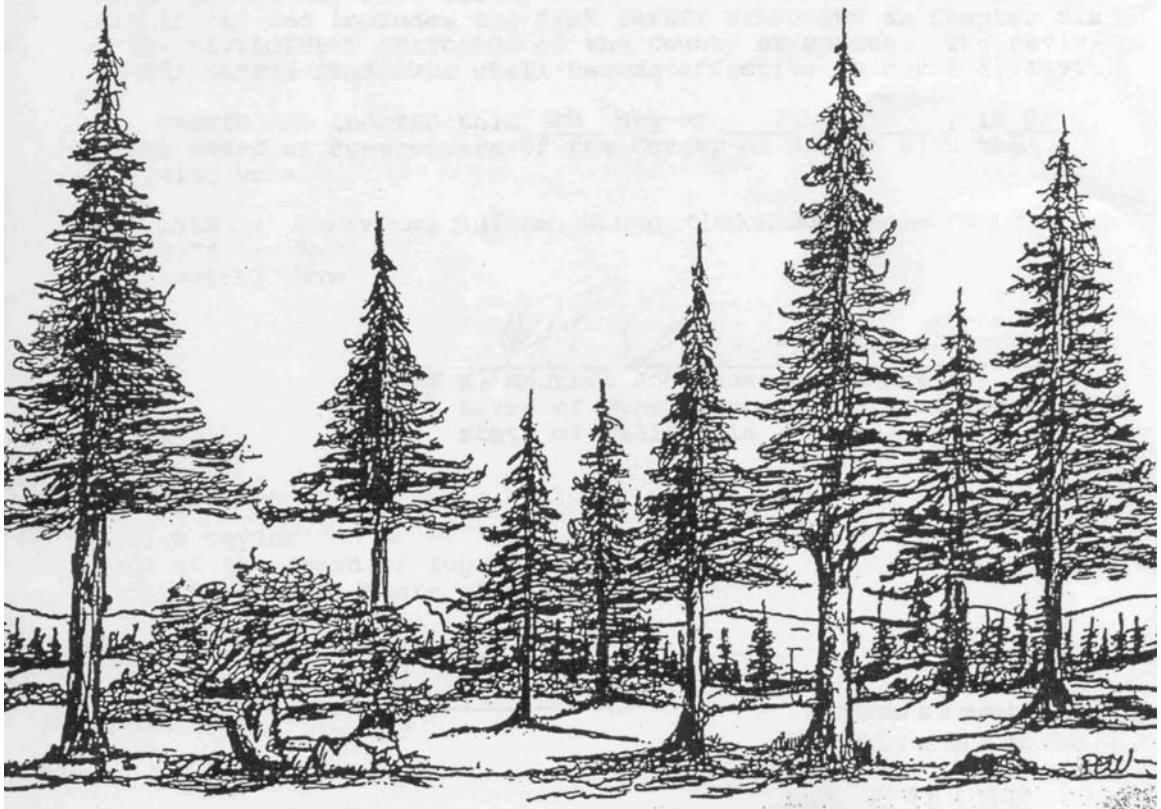
GOAL: To provide a space in which a fire will "cool down, slow down and stay on the ground" thereby maintaining fire safety in forest communities.

[This zone can provide cover for wildlife. Views within this zone can be enhanced to be more aesthetically pleasing.]

OBJECTIVES:

1. Remove dead material from brush and trees.
2. Prune limbs in trees to 10' above ground.
3. Thin trees to 20' trunk spacing.
4. Create patchy landscaping.

*Fuel reduction zones increase for properties on ridges or slopes.



MAPS

1. FRENCH GULCH PLANNING AREA
2. FIRE SEVERITY RATING
3. VEGETATION
4. SPECIAL STATUS SPECIES & HABITAT
5. SOILS
6. FIRE HISTORY
7. PROPOSED PROJECTS