Plumas County Fire Safe Council

Plumas County Communities Wildfire Mitigation Plan

February 2005

Greenhorn 1990

Portola 1988

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Plumas County Fire Safe Council
This project was prepared by members and partners of the Plumas County Fire Safe Council, in collaboration with local, state and federal agencies.

Project Partners:
Plumas County
City of Portola
Plumas County Fire Chiefs Association
US Forest Service
California Department of Forestry & Fire Protection

PREFACE

As part of its basic mission, the Plumas County Fire Safe Council initiated a Community Wildfire Protection Plan to help residents, neighborhoods, and communities mitigate potential threats from wildfire, so they may survive the inevitable event.

The purpose of this plan it to outline the risks and hazards associated with a wildland fire threat to Plumas County communities and to identify potential mitigation measures. The Plumas County Communities Wildland Fire Mitigation Plan is intended to provide documentation of implementing actions designed to reduce wildfire risk to homes and communities through education and outreach programs, the development of partnerships, and implementation of preventative activities such as hazardous fuel reduction, defensible space, land use, or building codes. The emphasis of this plan is to work from the home outward into the forests so that man-made and natural resources survive the eventual intrusion of a wildfire.

The Bureau of Land Management provided funding for this plan through their Community-Based Wildfire Prevention Grants Program, as part of funding for Plumas County's fire safe council coordination and strategy and assessment projects. The successful development of this plan was possible only with the active support and assistance of many people who devoted countless hours to the project. These included citizens, County employees and supervisors, local fire chiefs, US Forest Service employees, and California Department of Forestry and Fire Protection employees.

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A. Purpose

The purpose of this plan is to outline the risks and hazards associated with a wildland fire threat to Plumas County communities, the City of Portola, and to identify potential mitigation measures. The Plumas County Communities Wildland Fire Mitigation Plan is intended to provide documentation of implementing actions designed to reduce risk to homes and communities from wildfire. The emphasis of this plan is to work from the home outward into the forests so that man-made and natural resources survive the eventual intrusion of a wildfire.

This plan is intended to meet the requirements of the Healthy Forest Restoration Act (HFRA) of 2003, make the County eligible for National Fire Plan (NFP) funding assistance, provide information to assist communities in recommending fuel reduction projects on public and (or as well as) private lands, and also serve as the wildfire hazard mitigation portion of Plumas County's Multi-Hazard Mitigation Plan (DMA 2000).

This Community Wildland Fire Mitigation Plan is a collaborative effort by the Plumas County Fire Safe Council, County of Plumas, Plumas County Fire Chiefs Association, California Department of Forestry and Fire Protection, US Forest Service, and community members. This project was funded in part by the United States Department of the Interior, Bureau of Land Management, as part of the National Fire Plan from the Community-Based Wildfire Prevention Grants Program of the Sacramento Regional Foundation.

B. Background

Wildfire Threat - Fire Frequency and History

Wildfire is a frequent and often natural process throughout much of the Sierras. Where fires once frequently and lightly burned the forest floor, they now have become catastrophic stand-replacing events, often threatening communities.

Wildfire Threat - To Communities

While wildland fire is a component of the ecosystem, urbanization of forested lands has placed people, communities, and the natural resources at risk for loss. In Plumas County there have been numerous fires, small and large, that have threatened county residents

and communities in the recent past creating both evacuation preparation and, on rare occasions, an actual evacuation.

Wildfire Threat - To Homes

Wildland fire research indicates that the characteristics of home construction and its immediate surroundings determine a home's ignition potential during wildland fires. Roofing material and the presence of defensible space play key roles in determining whether or not structures will survive. Defensible space can also affect the safety of firefighters.

Wildland Fire Behavior Factors, Influences, and Elements Affecting Property and Resource Damage

Factors that influence wildland fire behavior are: *Fuel, Weather,* and *Topography*. Interaction of these three factors affect the direction of travel, how fast a fire spreads, how intensely it burns, and, consequently, how much effort it takes to control.

Fuel is the common denominator between the fire and fire behavior triangles; it is the only element we can manage. Unfortunately, the fuels in and around our communities and outlying developments continue to build up and increase.

Successful fuel management to reduce fire intensity, extent, and, consequently, damage requires efforts be spent on decreasing the volume and increasing the separation of forest fuel available to burn. There is a substantial amount of research on the effectiveness of treating forest fuels to modify fire behavior.

Wildfire Priorities for Resource Commitment

In wildland fire suppression, resources are allocated on a priority basis and usually are: 1) public and firefighter safety; 2) protection of developed resources, such as homes; and 3) protection of land features such as trees, views, and habitats. These priorities of commitment can obligate limited resources to protect structures rather than stop fire growth.

2) Risk

Risk is considered the potential for wildfires to start and threaten communities. Inherent to that is a display of where those communities are, including a buffer around them defined as "Wildland Urban Interface". Additional information is displayed as to population density, key infrastructures, fire department capabilities, and communities with evacuation plans and assembly areas.

3) Fire Behavior Factors

Fire behavior factors ***are considered to be the factors which contribute to how fast and intensely a fire burns. They are:***

Topography *(slope, aspect, elevation, and features);* Fuel *(type, volume, species, space between layers, surface, ladder & crown fuels, and compactness of the fuelbed); and* Weather *(temperature, humidity, wind, and precipitation). These three factors result in expected fire behavior following an ignition. Fire behavior models are used to predict how fast a fire will burn, how intensively it will burn, and its potential for crowning and spotting.*

A key fire behavior output is flame length. Flame length correlations are used in planning for suppression resource capability and can be related to firebrand production, spotting, and resource damage. The Plumas County Fire Safe Council has set a target flame length of 1 to 4 feet in stands where hazardous fuels are treated. While 4 feet is the upper limit, every effort should be made to reduce it to 2 feet, especially closer in to structures and communities.

4) Fire Risk Mitigation Strategies

The goal of this section is to:

- Identify situations and factors which place residences or communities at risk from wildfire, and suggest appropriate mitigation measure(s) to reduce that risk.

The objectives of this section are to:

- Identify mitigation measures by focus area and prioritize by zone. Focus is on public safety, firefighter safety, reducing structure ignitability, and reducing damage to other manmade and natural resources.

- Identify areas where collaborative efforts of local, state, and federal agencies can mitigate risks of structure ignitability and reduce hazardous fuels and wildfire threats to communities.

- Support efforts of Plumas County, the County Fire Warden, County Fire Chiefs, County Fire Safe Councils, CDF, US Forest Service, and other federal agencies to collaboratively implement mitigation measures and obtain funding assistance.

Fire Risk Mitigation Strategies - This section is divided into four areas of focus. Mitigation strategies are prioritized by zone, with the highest priority being the structure ignition zone and working outward to the Extended WUI.

- **Mitigation strategies areas of focus:**
    A. Information, Education, and Planning
    B. Reducing Structure Ignitability
    C. Enhancing Suppression Capabilities and Public Safety
    D. Hazardous Fuel Reduction

- **Mitigation strategies prioritization by zone:**
    1. Home Ignition Zone: 0-150 feet
    2. Community at Risk Zone: (Plumas County Communities at Risk map)
    3. Adjacent Wildland Urban Interface (WUI) Zone: .5 mile around communities
    4. Extended Wildland Urban Interface (WUI) Zone: 1 mile around adjacent WUI.

Purpose & Background

A. Purpose

The purpose of this plan it to outline the risks and hazards associated with a wildland fire threat to Plumas County communities and to identify potential mitigation measures. The Plumas County Communities Wildland Fire Mitigation Plan is intended to provide documentation of implementing actions designed to reduce risk to homes and communities from wildfire through education and outreach programs, the development of partnerships, and implementation of preventative activities such as hazardous fuel reduction, defensible space, land use, or building codes. The emphasis of this plan is to work from the home outward into the forests so that man-made and natural resources survive the eventual intrusion of a wildfire.

This plan is intended to: 1) meet the requirements of the Healthy Forest Restoration Act (HFRA) of 2003, 2) make the County eligible for National Fire Plan (NFP) funding assistance from the Departments of Agriculture and Interior(by meeting the requirements of HFRA), 3) provide information to assist communities in recommending fuel reduction projects on public and (or as well as) private lands, and 4) serve as the Wildfire Hazard Mitigation portion of Plumas County's Multi-Hazard Mitigation Plan, which is required after November 1, 2004, for counties to be eligible to receive FEMA disaster assistance funding.

This Community Wildland Fire Plan is a collaborative effort by the Plumas County Fire Safe Council, County of Plumas, City of Portola, Plumas County Fire Chiefs Association, California Department of Forestry and Fire Protection, US Forest Service, and community members. This project was funded in part by the United States Department of the Interior, Bureau of Land Management, as part of the National Fire Plan from the Community-Based Wildfire Prevention Grants Program of the Sacramento Regional Foundation.

B. Background

Wildfire Threat - Fire Frequency and History

Wildfire is a frequent and often natural process throughout much of the Sierras. Suppression of fires and past resource management practices, along with urbanization of forests, has created a situation quite different from what existed before European settlement. Then fires used to burn freely across the landscape virtually unchecked, where now we aggressively seek to prevent and suppress them. Many of the ecosystems and plant species in our area evolved and depended on fire to sustain them. Fire exclusion efforts have created forests that look quite different than those 200 years ago. Where today forests are densely stocked and have less fire-resistant species, in pre-settlement times the trees were larger, forests more open, and stands of timber more fire-resilient. Where fires once frequently and lightly burned the forest floor, they now become catastrophic stand-replacing events, often threatening communities.

Wildland fires usually occur between June and October, a period of time commonly referred to as "fire season". However, it is not uncommon for fires to occur as early as April and as late as November.

Fire occurs naturally and from human activity. Lightning currently accounts for about 60% of Plumas County's ignitions per year. Records show that Plumas County averages the highest incidence of lighting fires in California. Human caused fires usually increase, as once open forested lands become more visited, developed, and habitated. Increasing populations and use of forested lands often bring an increase in person-caused fires. Wildland fire ignitions occur from sources such as children, smoking, campfires, debris burning, off-road vehicles, firewood cutting, discarded ashes, construction, and the railroad.

Wildfire Threat - To Communities

While wildland fire is a component of the ecosystem, urbanization of forested lands has placed people, communities, and the natural resources at risk for loss. California experiences some of the worst fires in the world. California's wildland problem is enhanced by the continual spread of homes and communities into the wildland, often referred to as the "urban/rural intermix". In many cases, these communities become part of the fuel load and add complexities to the fire agencies attempting to provide for their protection. Plumas County is no exception, and there have been numerous fires, small and large, that have threatened county residents and communities in the recent past.

Wildland fire is considered a threat to almost every community in Plumas County. In the initial listing in the Federal Register for "Communities at Risk", 22 were listed for Plumas County. Through a collaborative effort, almost every community in the county is now identified and mapped as such. There are about 116,000 acres of private lands within the County's "Communities at Risk", of which approximately 40% are of parcels with improvements.

Some of the recent large fires that have threatened homes and communities in the county include: Willow Fire-1987, Portola Fire-1988, Layman Fire-1989, Greenhorn Fire-1990, Cemetery Fire-1999, Mt. Hough Complex Fires-1999, Horton Fire-1999, and the Storrie Fire-2000. There have also been numerous small fires that have threatened residences in the early stages of initial attack. Fires in Plumas County have both initiated evacuation preparation by residents and, on rare occasions, prompted an evacuation.

Wildfire Threat - To Homes

Most homes are lost in wildfires for one of three reasons:

1) Burning embers (burning needles, leaves, branches & cones that come with the ember blizzard during a wildfire) landing on combustible roofs, entering attics and crawl spaces, or landing on combustible material adjacent to the siding.
2) Radiated heat from burning vegetation, structures, or materials on the property that cause ignition of the structure's siding or breaking of the windows and ignition to the interior.

3) Combustible fuels (e.g. grass, pine needles, woodpiles, furniture, mats) immediately adjacent to the structure allowing fire spread to burn, igniting siding or decks.

Wildland fire research (Cohen 2000)[1], which includes fire modeling, crown fire experiments, and case studies indicate that the characteristics of a home and its immediate surroundings determine a home's ignition potential during wildland fires. Roofing material and the presence of defensible space plays a key role in determining whether or not a structure will survive the passing of a wildfire. Defensible space can also affect the safety of firefighters and thus their decision on whether or not to commit resources to protect a structure.

Case studies have examined factors related to home survival for two fires that destroyed hundreds of homes. The Bel Air fire, in Los Angeles County, destroyed 484 homes (Howard et al. 1973)[2], and the Painted Cave fire, in Santa Barbara County, destroyed 479 homes (Foote 1994). Analyses of both fires indicate that home ignition depended on the characteristics of a home and its immediate surroundings. Howard et al. (1973) observed 95 percent survival of homes with nonflammable roofs and a vegetation clearance of 30 to 60 feet. Foote (1994)[3] observed 86 percent survival of homes with nonflammable roofs and a clearance of 30 feet or more.

Defensible space was again identified as a critical factor to home loss following the Cerro Grande Fire in Los Alamos, New Mexico, in 2000 (Cohen 2000)[4]. Jack Cohen, Fire Researcher, conducted a post-fire examination of home loss. His findings indicate the fire spread through the area from the evening though the early morning hours, and that it spread through much of the residential area as a low intensity surface fire where tree canopies were variably scorched but not consumed next to totally destroyed homes. According to Cohen, "My examination suggests that the abundance and ubiquity of pine needles, dead leaves, cured vegetation, flammable shrubs, etc. adjacent to, touching, and/or covering the homes principally contributed to residential losses." He went on to say that, "In several cases, a scratch line that removed pine needles from the base of a wood wall kept the house from igniting."

Wildland Fire Behavior Factors, Influences, and Elements Affecting Property and Resource Damage

In order to have an open environment fire, the elements of *Heat, Fuel,* and *Oxygen* are necessary. By removing any one, the fire goes out. These three are referred to as the fire triangle.

1.Cohen, Jack D. 2000, ***What is the Wildland Fire Threat to Homes?*** *Presented at the Thompson Memorial Lecture, April 10, 2000, School of Forestry, Northern Arizona University, Flagstaff, AZ*

[2] *Foote, Ethan I.D. 1996.* ***Structural survival on the 1990 Santa Barbara "Paint" fire: A retrospective study of urbanwildland interface fire hazard mitigation factors.*** *MS thesis, University of California at Berkeley.*

[3]*Howard, Ronald A.; North, D. Warner; Offensend, Fred L.; Smart,Charles N. 1973.* ***Decision analysis of fire protection strategy for the Santa Monica mountains: an initial assessment.*** *Menlo Park, CA: Stanford Research Institute.*[3]

[4] *Cohen, Jack*, ***Examination of the Home Destruction in Los Alamos Associated with the Cerro Grande Fire July 10, 2000,*** *Rocky Mountain Research Station, Fire Sciences Laboratory, Missoula , Montana.*

Factors that influence wildland fire behavior are: *Fuel, Weather,* and *Topography*. These factors are referred to as the fire behavior triangle. Interaction of these three factors affects how fast a fire spreads, how intensely it burns, and, consequently, how much effort it takes to control it and how much damage it creates.

Topography is the shape of the land and the most static, obvious, and predictable, though not easily changed. Topographic features that affect wildland fire are slope, aspect, elevation and terrain features such as canyons, drainages, and ridges.

Weather, while a somewhat predictable force, isn't easily modified. Consequently, wildland fire managers make their strategic and tactical suppression decisions based on what the weather presents them. There are a number of weather factors, such as temperature, relative humidity, precipitation, cloud cover, and wind which affect fire behavior. Wind has the largest influence.

Fuel includes grasses, needles, brushes, trees, and dead limbs or trees (slash) on the ground. Its factors include the amount or volume, particle size, moisture content, species, type, arrangement both horizontal and vertical, and whether it is live or dead.

Fuel is the common denominator between the fire and fire behavior triangles. It is the only element we can manage. Unfortunately, the fuels in and around our communities and outlying developments continue to build up and increase.

Wildfire spreads in three ways: horizontally (across the surface), vertically (into the tree canopy), and by spotting.

Horizontal fire spread is across the forest floor. The more fuel available to burn on the ground increases the intensity at which a fire will burn. Hazardous fuel reduction efforts usually focus on removing fuel and lowering the height so intensities are reduced. The rate of fire spread across the surface can be measured or modeled in feet per minute.

Vertical spread of a fire is into the crowns of the trees, usually through a laddering process. Where ground fuels and aerial fuels are intermixed without separation, they are referred to as ladder fuels. The elevation of a fire occurs when a surface fire is sufficiently intense enough, and where brush and small trees grow into the branches of larger tress, that it creates excellent conditions for crown fires to become established. Crown fires are more likely when there are sufficient surface fuels to generate enough intensity to ignite ladder fuels and/or lower branches of overstory trees. Crown fires then become excellent generators of embers for spotting. Separating ladder and canopy fuels will lessen the ability of a fire to get into trees and spread among the tree crowns that cause torching, crowning, or scorch mortality. Wildland fire managers, in assessing potential for crown fires, consider the "crown to base height" a critical factor. "Crown to base height" is an estimation of how many feet of separation exist between the surface fuels and the base of the live tree crown.

In forested stands it is desirable to have a crown to base height of at least 15-20 feet (where the size of the tree allows), depending on the type and amount of surface fuels. Hazardous fuel reduction efforts to reduce vertical spread of a fire and ember generation usually focus on removing smaller trees and brush, plus increasing tree spacing and pruning branches of the trees to be left. Additionally, forests with more open canopies or space between larger trees reduce scorching and increase their chance of survival following a wildfire.

Spotting is when firebrands or embers are produced when brush and trees burn rapidly, lofting burning particles such a needles, leaves, bark, cones, and small branches into the convention column. Burning embers are transported by the wind and start new fires in receptive fuel beds, including forests and homes in front of the main fire. Spotting up to ¼ mile is common and may occur for a number of miles under extreme burning conditions or wind conditions. Spotting can have a dramatic affect on suppression effectiveness and fire size, as new fires can start well in advance of the main fire and across firelines being constructed. Spotting is one reason many homes perish before the main fire actually arrives.

Like in a fireplace, adding more fuel increases the intensity. In wildland fire the intensity measurement scale is referred to as "Flame Length". Flame length correlations are used in planning for suppression resource capability and can be related to firebrand production or spotting. Flame lengths are also used to project expected post-fire effects, including timber stand mortality. Wildland fire managers consider four-foot flame lengths the upper end of the scale for fire suppression success by hand crews. Flame lengths above four feet are expected to require heavy equipment and/or air support. Flame lengths above eight feet are expected to require substantial suppression efforts with fire behavior that includes torching, crowning, and spotting. Additionally, fuel profiles that generate flame lengths greater than eight feet usually create the more severe post-fire effects. Trees often die from scorching, even if the needles do not catch fire.

Successful fuels management to reduce fire intensity, extent, and, consequently, damage requires efforts be spent on decreasing the volume and increasing the separation of forest fuel available to burn. This is usually best accomplished by thinning and treating surface fuels. There is a substantial amount of research on the effectiveness of treating forest fuels to modify fire behavior.

An example of a success story is the Cone Fire burning into forested areas on the Blacks Mountain Experimental Forest in adjacent Lassen County. (Nakamura 2003) [5]
The Cone Fire tested the fuels treatments applied at Blacks Mt. Experimental Forest under severe fire behavior conditions of wind, low humidity, and low fuel moisture. Units which received both thinning of ladder fuels (biomass harvest) and a follow up prescribed fire to further reduce surface fuels had the wildfire drop to the ground where they extinguished, or could be safely suppressed, while units which were just thinned of

[5] *Gary Nakamura, UC Cooperative Extension,*
http://ucce.ucdavis.edu/files/filelibrary/5098/5200.pdf

ladder fuels had sufficient surface fuels to severely scorch trees. Untreated forest burned the most severely, with total tree kill, forest floor consumption, and canopy consumption.

A recent study (Graham, et al. 2004)[6] states that while their examples show that it is difficult to generalize the effects of thinning forests to alter fire behavior due the variability in weather, physical setting, and forest fuels, a key point was that thinning treatments that were followed by a reduction of surface fuels can significantly limit fire spread under wildfire conditions.

Hazardous fuels management projects must be deployed across the landscape if they are to change wildfire intensity and spread, and thereby protect watershed values. While clearance around structures as required by PRC 4291 is highly effective in saving structures from a wildfire, that same fire burning through untreated vegetation can lead to severe watershed damage. Landscape level treatments, such as shaded fuelbreaks or area treatments, complement structure clearance treatments by slowing the rate of spread and lowering intensity and, therefore, resource damage.

The following is the potential list of treatments to reduce hazardous fuel beds.

1. Mechanical (biomass) thin
2. Hand thin
3. Hand/machine pile
4. Mechanical mastication
5. Underburning
6. Biological

For a complete description of fuel treatment methods in forested lands refer to *Plumas County Hazardous Fuel Assessment and Strategy,* Developed for the Plumas County Fire Safe Council By Barry Callenberger, WILDLAND Rx; Zeke Lunder, NorthTree Fire International; Aaron Stafford and Kent Lundberg, Upstate CA.

Wildfire Priorities for Resource Commitment

In wildland fire suppression resources are allocated on a priority basis. In order of priority they are usually: 1) public and firefighter safety; 2) protection of developed resources such as homes; and 3) protection of land features such as trees, views, and habitats. Society generally accepts these priorities; however, some argue that without the aesthetic value, especially in rural areas, the value of the developed property is diminished. This hierarchy of resource commitment obligates sometimes-limited suppression resources to protect structures rather than stopping a fire's growth. In the aftermath, communities are often left with standing homes and blackened forests.

[6] *Graham, Russell T.; McCaffrey, Sarah; Jain, Theresa B. 2004,* ***Science Basis for Changing Forest Structure to Modify Wildfire Behavior and Severity.*** *Gen. Tech. Rep. RMRS-GT-120 Fort Collins, CO. SDA FS, Rocky Mountain Research Station. 43p.*

However, there are numerous examples where homes and forests have survived the intrusion of a wildfire when proper construction methods, defensible space, and sound vegetation management practices were employed prior to the fire.