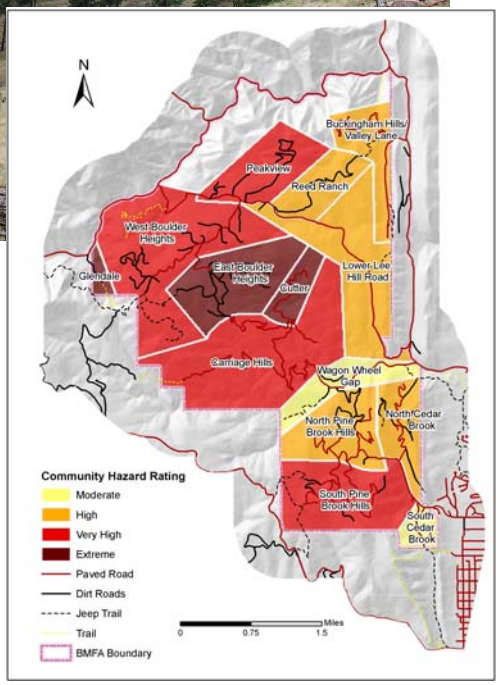
Boulder Mountain Fire Protection District

Wildland Urban Interface

Community Wildfire Protection Plan



Prepared for:

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TABLE OF CONTENTS

List of Figures

List of Tables

PURPOSE

In response to the Healthy Forest Restoration Act (HFRA) and in an effort to create incentives, Congress directed interface communities to prepare a Community Wildfire Protection Plan (CWPP). Once completed, a CWPP provides statutory incentives for the US Forest Service (USFS) and the Bureau of Land Management (BLM) to give consideration to the priorities of local communities as they develop and implement forest management and hazardous fuel reduction projects. In the case of the Boulder Mountain Fire Protection District (BMFPD), the need for a community-based hazard and risk assessment (HRA) was born from an internal need, not a federal directive, over a decade ago.

CWPPs can take a variety of forms, based on the needs of the people involved in their development. CWPPs may address issues such as wildfire response, hazard mitigation, community preparedness, structure protection or all of the above.

The minimum requirements for a CWPP are:

- Collaboration between local and state government representatives, in consultation with federal agencies and other interested parties.
- Prioritized fuel reduction in identified areas as well as recommendations for the type and methods of treatments.
- Recommendations and treatment measures for homeowners and communities to reduce the ignitability of those structures in the defined wildland urban interface area.

The purpose of this Community Wildfire Protection Plan, which includes fire behavior analysis and community wildfire hazard ratings, is to provide a comprehensive, scientifically-based assessment of the wildfire hazards and risks within the BMFPD. The assessment estimates the:

RISK: The likelihood of the occurrence of a significant wildfire event, and

HAZARDS: The potential for undesirable effects resulting from a moderately advancing wildfire, associated with wildland fire in proximity to communities.

This information, in conjunction with values-at-risk information, defines "areas of concern" for the jurisdiction and allows for prioritization of mitigation efforts. From this analysis, solution and mitigation actions are offered that will aid land owners, land managers, the fire protection district and other stakeholders in developing short-term and long-term fuel and fire management plans.

Goals and Objectives

Local Goals for this CWPP project include the following:

1. **Enhance Life Safety for Residents and Responders.**
2. **Mitigate Undesirable Fire Outcomes to Property, Infrastructure and other Values.**
3. **Mitigate Undesirable Fire Outcomes to the Environment and Quality of Life.**

Objectives

In order to accomplish these goals the following objectives have been identified:

1. Establish an approximate level of risk (the likelihood of a significant wildfire event) for the study area.
2. Provide a scientific analysis of the fire behavior potential of the study area.
3. Group values-at-risk into "communities" that represent relatively homogenous hazard factors.
4. Identify and quantify factors that limit (mitigate) undesirable fire effects to the values-at-risk (hazard levels).
5. Recommend specific actions that will reduce hazards to the values-at-risk.

Other Desired Outcomes

1. **Promote community awareness:**
   Quantification of the community's hazards and risk from wildfire will facilitate public awareness and assist in creating public action to mitigate the defined hazards.

2. **Improve wildfire prevention through education**:
   Awareness, combined with education, will help to reduce the risk of unplanned human ignitions.

3. **Facilitate appropriate hazardous fuel reduction:**
   The prioritization of hazardous Fire Management Units (FMU) can assist land managers in focusing future efforts towards the areas of highest concern from both an ecological and fire management perspective.

4. **Promote improved levels of response and coordination:**
   The identification of areas of concern will improve the accuracy of pre-planning and facilitate the implementation of cross-boundary, multi-jurisdictional projects.

UNDERSTANDING THIS DOCUMENT

The Boulder Mountain Fire Protection District Community Wildfire Protection Plan is the result of a community-wide fire protection planning effort which began in the early 1990's which included extensive field data gathering, individual home hazard analysis (Boulder County WHIMS project), compilation of existing fire suppression documents, a scientific analysis of the fire behavior potential of the study area, and input gathered from various stakeholders including homeowners, fire district officials, the Colorado State Forest Service, the United States Department of Agriculture Forest Service, and the Bureau of Land Management. These previous efforts were compiled into this CWPP in response to the federal Healthy Forests Restoration Act of 2003.

The CWPP meets the requirements of HFRA by:

1. Defining the Wildland Urban Interface boundary of the district;
2. Proposing actions designed to mitigate undesirable effects of wildland fire on all lands in the study area regardless of ownership;
3. Identifying fuels reduction across the landscape;
4. Addressing structural ignitability; and
5. Providing collaboration with CSFS, USFS, BLM, Boulder County and local fire officials.

The National Fire Plan

In 2000, more than 8 million acres burned across the United States, marking one of the most devastating wildfire seasons in American history. One high-profile incident, the Cerro Grande fire in Los Alamos, New Mexico, destroyed more than 235 structures and threatened the Department of Energy's nuclear research facility.

Two reports addressing federal wildland fire management were initiated after the 2000 fire season. The first was a document prepared by a federal interagency group entitled "Review and Update of the 1995 Federal Wildland Fire Management Policy" (2001), which concluded, among other points, that the condition of America's forests had continued to deteriorate.

The second report issued by the BLM and the USFS, "Managing the Impacts of Wildfire on Communities and the Environment: A Report to the President in Response to the Wildfires of 2000", would become known as the National Fire Plan (NFP). That report, and the ensuing congressional appropriations, ultimately required actions to:

1. Respond to severe fires.
2. Reduce the impacts of fire on rural communities and the environment.
3. Ensure sufficient firefighting resources.

Congress increased specific appropriations to accomplish these goals.

The following year – 2002 – was another severe season, with more than 1,200 homes destroyed and 7 million acres burned. In response to public pressure, congress and the Bush administration, continued to obligate funds for specific actionable items, such as preparedness and suppression. That same year, the Bush administration announced "Healthy Forests: An Initiative for Wildlife and Stronger Communities," which enhanced measures to restore forest and rangeland health and reduce the risk of catastrophic

wildfires. In 2003, that act was initiated. Through these watershed pieces of legislation, Congress continues to appropriate specific funding to address five main sub-categories: preparedness, suppression, reduction of hazardous fuels, burned-area rehabilitation and state and local assistance to firefighters. The general concepts of the NFP blended well with the established need for community wildfire protection in the study area. The spirit of the NFP is keenly reflected in the Boulder Mountain Fire Protection District CWPP.

Interagency Collaboration

To be successful, community mitigation must be a community-based, collaborative effort.

> *"The initial step in developing a CWPP should be formation of an operating group with representation from local government, local fire authorities, and the state agency responsible for forest management … … Once convened, members of the core team should engage local representatives … to begin sharing perspectives, priorities, and other information relevant to the planning process."*[1]

Primarily nine, federal, state, local and private agencies have participated on this collaborative effort. These stakeholders include:

- Boulder Office of the Colorado State Forest Service
- Boulder County Land Use Department
- Boulder Range District of the United State Forest Service
- Bureau Of Land Management
- Boulder Mountain Fire Protection District
- Pine Brook Hills Home Owners Association (http://www.pinebrookhills.com/)
- Carriage Hills Home Owners Association
- Pine Brook Water District (http://www.pinebrookwater.com/)
- Anchor Point

The BMFPD is currently in daily discussions with the CSFS about several projects funded by the 2005 Western States Wildland Urban Interface grant on Timber Lane, Bristle Cone Way, Cutter Lane, Camp Paul Hummel, and other evacuation routes. BMFPD is also discussing several applications for the 2006 Western States Wildland Urban Interface grant program.

The BLM has been involved with meetings with homeowners from the Overlook neighborhood in relation to mitigating Federal land near Glendale Gulch.

Stakeholders and primarily the BMFPD will have the greatest responsibility for implementing the recommended mitigation projects. The CSFS and the Boulder Ranger District of the Arapaho/Roosevelt National Forest will also continue to be a valuable participant in addressing cross-boundary projects.

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[1] *Preparing a Community Wildfire Protection Plan - A Handbook for Wildland-Urban Interface Communities*, March 2004, p. 5

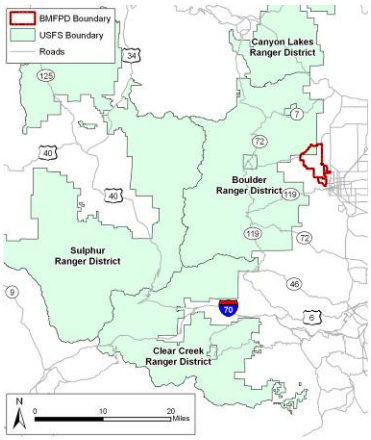
Nearly all of the recommendations from this report affect private land or access roads to private land. As such, their success will be largely dependent on the participation of landowners. The BMFPD is committed to encouraging the participation of as many interested landowners as possible. These outreach efforts began with public meetings after a local wildfire in 1994. Since then meetings have been conducted throughout the years.

The WUI analysis that the BMFPD has now completed will provide this multi-agency stakeholder group with significant data sets to assist in the on-going decision making process for community protection and fuels reduction project prioritization and implementation. By having all the communities in the Fire Protection Districts rated and ranked for wildfire threats, it is possible to prioritize fuels and community projects logically, and with a scientific foundation.

Working together and individually, the BMFPD, in partnership with collaborating agencies, have and will bring resources, accomplishments and opportunities to the table in facilitating the long-range BMFPD wildfire planning process.

Study Area Profile

Figure 1. Location of BMFPD



The Boulder Mountain Fire Protection District is located in Boulder County, on the north side of the City of Boulder, Colorado. The district is bordered on the north and northwest by the Left Hand FPD, south/west by the Sunshine FPD, South by the Boulder Rural FPD and east by the City of Boulder Fire Department. BMFPD covers an area of 11 square miles and has approximately 890 homes. The primary access to the district is via Linden Ave. and Lee Hill Rd. west of North Broadway.

BMFPD is located primarily on the front range of Rocky Mountains. Elevations range from 5,600' to 8,000'. The overall topographic variation is very substantial within the district, steep slopes and ravines exist throughout the district and larger landscape. For the purposes of this report, communities have been assessed for the hazards and risks that occur inside the district boundaries. Rankings and descriptions of communities, as well as hazard and risk recommendations, only pertain to the portions of those areas that lie within the jurisdictional boundary of BMFPD, unless otherwise noted.

Figure 2. Typical Area

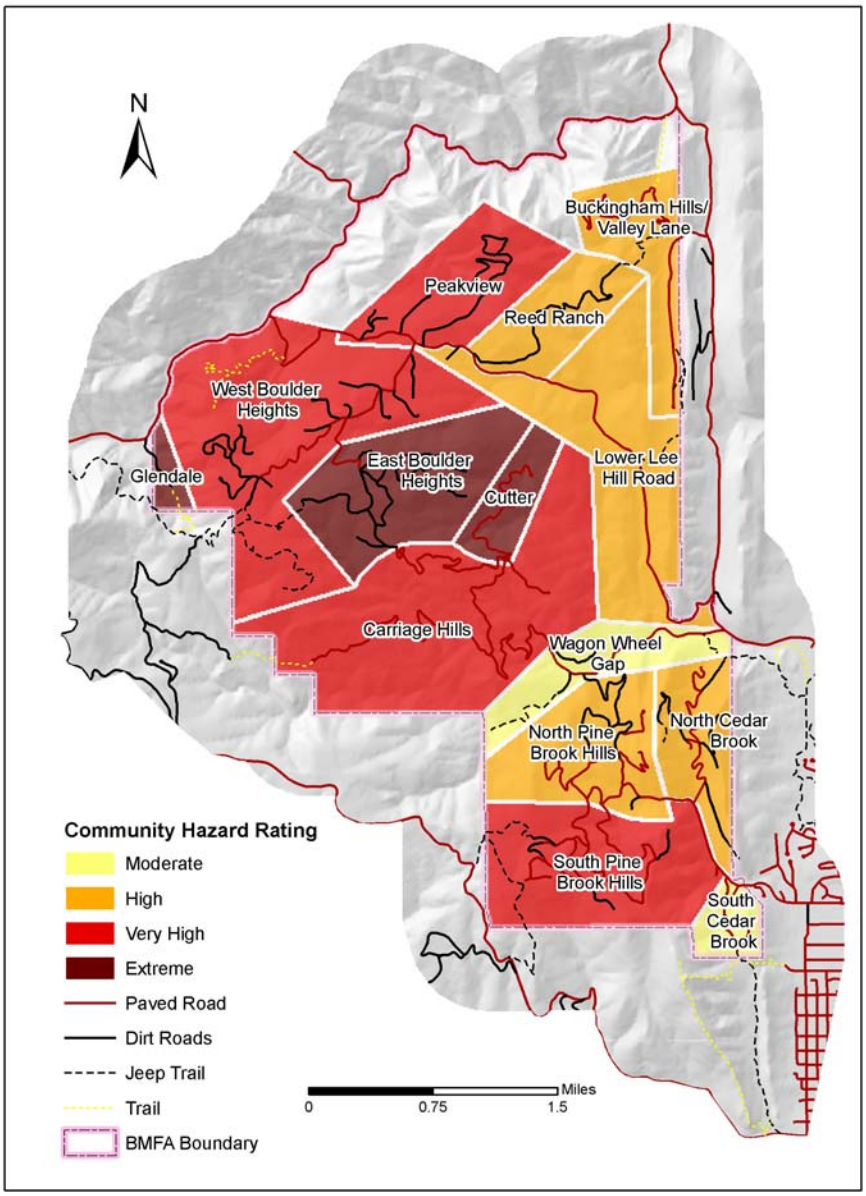
The majority of BMFPD is considered to be in the Montane zone (5,500'- 9,500') of the eastern slope of the Northern Colorado Front Range[2]. The dominant vegetation is composed of conifer forest and aspen stands. These consist primarily of over-mature stands of mixed conifer, mixed conifer and aspen *(Populus tremulodies)* and pure stands of ponderosa pine *(Pinus ponderosa)*, with timber litter or various species of mountain grasses in the understory. These forest stands are

[2] Elevation limits for life zones were based on life zone ranges from: Jack Carter, "Trees and Shrubs of Colorado" (Boulder, CO, Johnson Books, 1998)

broken by primarily short grass meadows and aspen. Canopy coverage within the study area ranges from savanna to dense forest. Various species of riparian shrubs occur in stringers and patches in low-lying areas, particularly along stream corridors and in drainages.

For reference to the rest of this document, **Figure 3** and **Table 1** show the communities that comprise the Wildland/Urban Interface study area and **Figure 4** and **Figure 5** show the general topography of the area.

Figure 3. Study Area Communities



Extreme Very High High Moderate Low

1. Glendale	**8. Buckingham Hills/Valley Lane**
2. Cutter	**9. Reed Ranch**
3. East Boulder Heights	**10. North Pine Brook Hills**
4. Carriage Hills	**11. Lower Lee Hill Road**
5. West Boulder Heights	**12. North Cedar Brook**
6. South Pine Brook Hills	**13. Wagon Wheel Gap**
7. Peakview	**14. South Cedar Brook**

Table 1. Hazard Ranking of Communities in the Study Area

Figure 4. Percent Slope

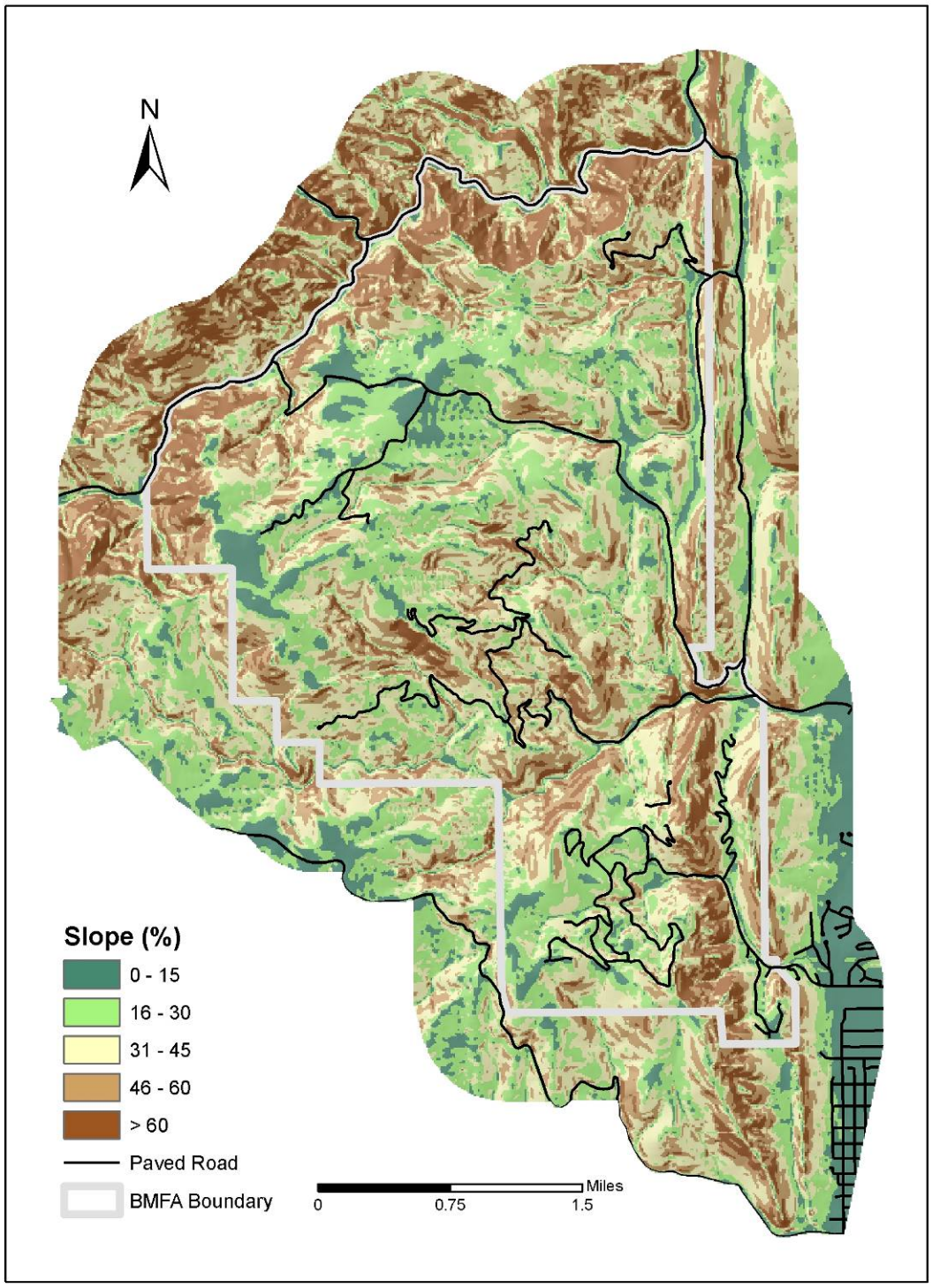
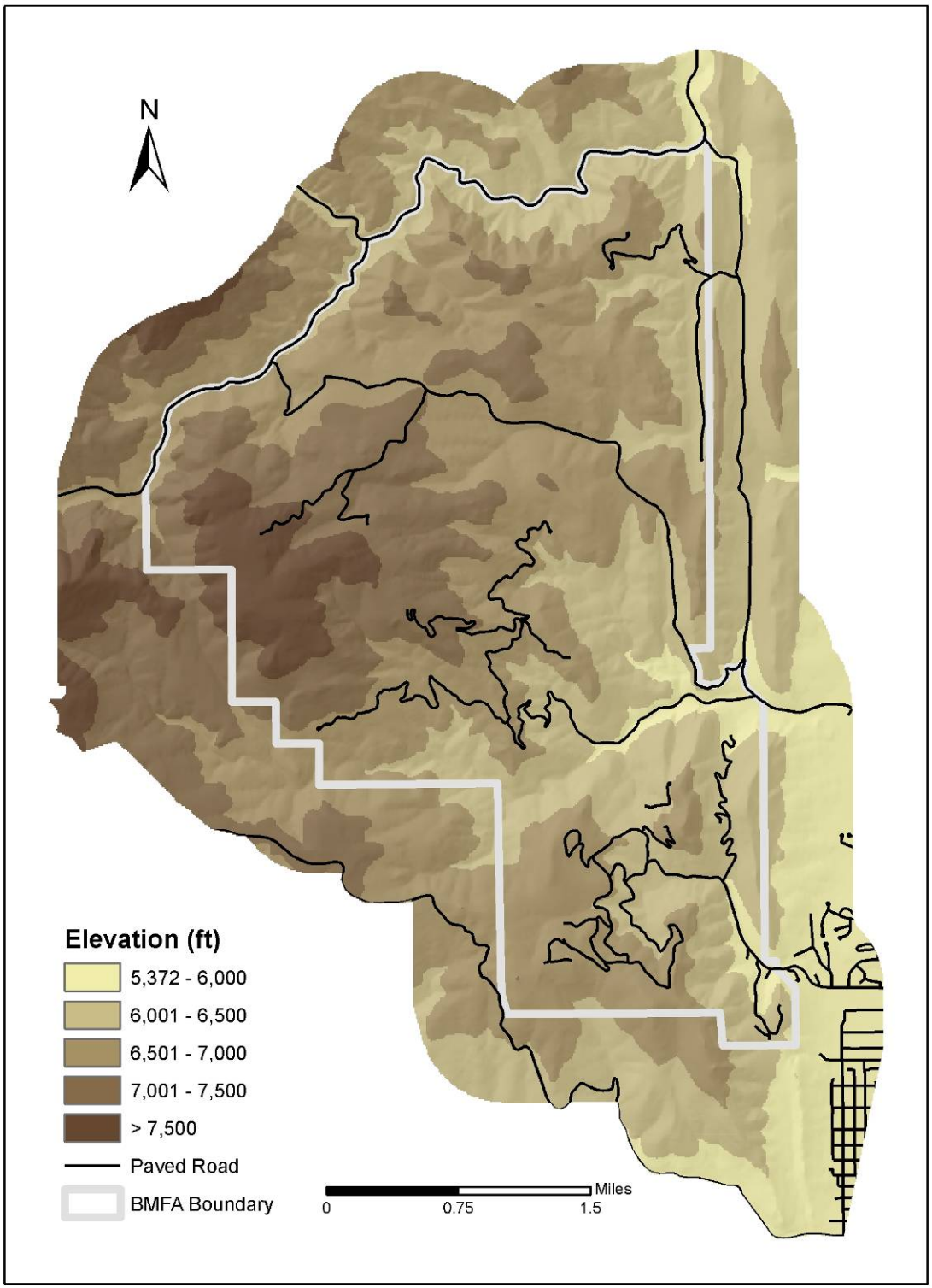


Figure 5. Elevation



VALUES

Life Safety and Homes

In January 2005, Pine Brook Hills Fire Protection District merged with Boulder Heights Fire Protection District to form the Boulder Mountain Fire Protection District. This new entity manages all day-to-day fire protection and emergency medical response for approximately 1,000 homes within the District.[3]

With tens of thousands of people moving to Colorado each year, building in the once inaccessible mountain areas have become a growing concern. Most of Boulder County is vulnerable to some form of natural disturbance. Recent, national, disaster events have focused increased attention at both local and state government levels on the need to mitigate such events where possible and to prepare to cope with them when unavoidable.[4]

Boulder County recognizes the wildland urban interface as an area particularly at risk to wildland fires. Fire should be recognized as a natural and/or human-caused occurrence with certain benefits to the ecosystem. The county should strive towards balancing the natural processes of the ecosystem with development concerns so that residents may co-exist in a fire-dependent ecosystem. [5]

Based on topography, housing density, water available, and access, the communities at risk in the study area include Pinebrook Hills, Boulder Heights, Carriage Hills, Glendale Gulch and the Rembrandt / Valley Lane area. The population of Boulder County is growing at an average rate of 3% per year, and has increased 29% between 1990 and 2000, with increased mountain development and recreational pressures following this increase in population. Over 154,000 people in the county live in wildfire hazard areas, and the county experiences an average of 100 fire starts per year. Over the past 15 years the county has seen a number of major wildland fires, and until 2001, held the Colorado record for structural losses from wildland fires. This was due largely to the 1989 Black Tiger fire, which claimed 44 homes and the 1990 Olde Stage fire, which took 10 homes. The culture of Boulder County emphasizes environmental values and outdoor recreation. Boulder County has intermixed land ownership. Approximately 60% of the land is owned publicly with 40% owned privately. Public land is divided among a variety of local, state and federal managers including the United States Forest Service, Boulder County Open Space, the City of Boulder and Colorado State Parks. [6]

Commerce and Infrastructure

Another significant component in both the county *Comprehensive Plan* and a majority of the municipal plans and programs is recognition of the importance of environmental factors, natural and cultural

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[3] Boulder Mountain Fire Protection Website (http://www.bouldermountainfire.org)

[4] Boulder County Comprehensive Plan - Boulder County Land Use Department (http://www.co.boulder.co.us/lu/bccp/introduction.htm)

[5] Ibid.

[6] "Community Responses to Wildland Fire Threats in Colorado" – T. Steelman, D. Bell, Dept. of Forestry, NCSU (http://www.ncsu.edu/project/wildfire/Colorado/boulder/b_reduce.html)

amenities or "quality of life" issues to the health of the economy. The Boulder County economy has benefited from its legacy of careful land use decisions and its open space lands including national and state parks, National and State Forests as well as city and county open space and parks.[7]

There are limited commercial property and retail businesses within the Boulder Mountain FPD; however, many residents maintain a wide variety of home-based businesses, including real estate, seasonal camps, and a state of the art recording studio. The economy of the area is based largely on the quality of life that attracts professionals to establish residences in the area. Wildfire, therefore, has the potential to cause significant damage to the local economy.

Recreation and Life Style

The idea of a county open space program was initiated in the mid-1960s by Boulder County citizens who were interested in parks and recreation needs of the unincorporated area and in "preserving open space land in the face of rapid county development" (Boulder County Comprehensive Plan, 1978, History of Open Space Program). This was at a time when Boulder County's 750 square miles were home to a population of fewer than 130,000 people. The 1995 population was almost 260,000.[8]

In 1978 the *Boulder County Comprehensive Plan* was adopted, and it included goals and policies for preserving open space, protecting environmental resources (including both natural and cultural resources) and developing a county-wide trail system. The implementation of the open space plan has been based both on private cooperation and on the county's financial ability to acquire an interest in these lands.

By the beginning of 1998 the county open space program comprised more than 52,000 acres of preserved land scattered throughout the county, along with 70 miles of trails. The majority of this land is open for public use; the remainder is under agricultural lease or conservation easements which do not include public access. Most of the properties are well-suited to passive recreation (recreation development is limited to trails, parking areas/trailheads, picnic areas/shelters, outhouses, and simple boat docks or fishing piers where necessary).

Residents who currently live in the study area have a keen appreciation for their natural environment. They like to be in the mountains—it's the context of their quality of life. Recreation and the natural beauty of the area are frequently quoted as reasons local residents have chosen to live in the study area.

Habitat Effectiveness & Environmental Resources

Residents are clear that the preservation of wildlife and the environment is important to the quality of life of the area. Habitat effectiveness is defined as the degree to which habitat is free of human disturbance and available for wildlife to use. Effective habitat is mostly undisturbed land area, which is buffered (at least 300 feet in essentially all situations) from regular motorized and non-motorized use of roads and trails (11 or more people or vehicle trips per week). It is felt that habitat effectiveness should not fall

[7] Boulder County Comprehensive Plan – Boulder County Land Use Department (http://www.co.boulder.co.us/lu/bccp/introduction.htm)

[8] Ibid.

below 50%, and the best wildlife habitats have a much higher percentage.[9] Wildfire, specifically severe wildfire, can have significant adverse effects on habitat effectiveness.

The environmental uniqueness of Boulder County is due in large measure to the abrupt altitudinal variation within a 20-mile east-west gradient. The dramatic landform changes sharply define the native ecosystems and their associations of plant and animal species.

The county's environmental heritage includes non-renewable resources such as natural areas, historic/archaeological sites and natural landmarks. As irreplaceable resources, they warrant preservation from destruction or harmful alteration. Wetlands are a critical environmental resource that functions as wildlife habitat, aquifer recharge areas, linkages in the overall county wildlife system, and aid in smog control.

The goal is to maintain and monitor the forests on open space in accordance with the Boulder County Comprehensive Plan in ways that benefits the ecosystem and the public by:

- Assessing overall forest conditions through forest inventories and surveys.
- Implementing prescriptions based on the results of these inventories and surveys.
- Taking action to change or increase the individual tree's health and vigor.
- Reducing fire danger.
- Improving or maintaining wildlife habitat.
- Maintaining and preserving the aesthetic and ecological value of the forest.
- The BMFPD CWPP process is in concert with these guiding comprehensive plan principles. Through public involvement, local support and a regional perspective, the fuels reduction elements described in this document can and should enhance and protect the vales of the study area.

[9] Peak to Peak Community Indicators Project 2003 Presented by Peak to Peak Healthy Communities Project

CURRENT RISK SITUATION

For the purposes of this report the following definitions apply:

Risk is considered to be the likelihood of an ignition occurrence. This is primarily determined by the fire history of the area.

Hazard is the combination of the wildfire hazard ratings of the Wildland Urban Interface (WUI) communities and fire behavior potential, as modeled from the fuels, weather and topography of the study area.

Boulder County has a history of forest fires dating back to June 29, 1916 when 1,000 acres burned around Bear Mountain. On July 5, 1924, 1,600 acres burned near Nederland. On August 9, 1978, fire caused by lightning burned more than 1,000 acres in the Northwestern part of Boulder County in Rocky Mountain National Park. On October 6, 1980 a fire caused by an arsonist burned 150 acres in the Pine Brook Hills Subdivision and a $150,000 home was destroyed.

Four ***major*** wildfires occurred in 3 consecutive years. They were the Lefthand Canyon and the Beaver Lake Fire (1988), the Black Tiger Fire (1989) and the Olde Stage Road Fire (1990).

Lefthand Canyon and Beaver Lake Fire - September 1988: The Lefthand Canyon Fire and Beaver Lake Fire occurred in September of 1988 in the canyon above Buckingham Park and close to Beaver Lake near Ward. Approximately 1,500 acres were burned in Lefthand and 700 acres at Beaver Lake for a total of 2,300 acres. Houses in the area were threatened, but no structures were lost. The fires were believed to be man-caused.

Black Tiger Fire - July 9, 1989: The Black Tiger Fire destroyed 44 homes on Sugar Loaf Mountain and burned over 2,100 acres. The Boulder County area was experiencing very hot temperatures, low humidity and gusty winds. Conditions were just right for a wildfire. The fire was man-caused.

Olde Stage Road Fire - November 24, 1990: The fourth major wildfire was the Olde Stage Road Fire. The fire started when a man with a history of mental problems threw a burning mattress out his front door. Winds gusting to 80 mph fanned the fire out of control. Ten homes, five out-buildings and approximately 3,000 acres burned.

Walker Ranch/Eldorado Fire - September 15, 2000: The first major fire since the Olde Stage Fire in 1990 occurred on Walker Ranch following a summer with little rain and extreme temperatures. The fire burned approximately 1,100 acres and was probably human caused. Even though there were over 250 homes in the area, no structures were lost. Firefighting costs were estimated at $1.5 million. A FEMA fire suppression declaration was made to help cover firefighting costs.

Other Fires over 50 acres:

- 11/1/1964: Near Eldorado Springs (100 acres)
- 5/28/1974: Near Gold Hill (160 acres)
- 6/1976: Comforter Mountain (256 acres)
- 8/1979: Coal Creek Canyon (50 acres)
- 9/21/1984: USFS Land near Lyons (60 acres)
- 8/1/1987: Between Boulder and Lyons (50 acres)
- 11/4/1987: Southwest of Highway 36 (100 acres)
- 2/21/1988: Sunshine Canyon (200 acres)
- 9/7/1988: North of Ward (160 acres)
- 7/15/1991: West of Boulder Hills Subdivision
  Six miles North of Boulder (135 acres)
- 7/14/1994: Near Ward (50 acres)
- 9/3/1996: Rabbit Mountain-Lyons (50 acres)

The summer of 1994 was one of the driest on record, causing the wildfire threat to be high. Boulder County's fires were contained before they got too large partly because of a single engine air tanker stationed at the Boulder Airport. Fire bans were put into effect and an Inter-Agency Task Group was formed when the threat of wildfires increased in the county. The summer of 2000 was very dry and hot in the western part of the United States. Many small fires occurred in Boulder County during the summer months. Even though many of them were relatively small, they were in hard to reach areas. Air support was available because of fires in surrounding areas so responders were able to get them under control quickly.[10]

The majority of the district is at a very high risk for WUI fires. This assessment is based on the analysis of the following factors.

1. The communities and towns of Boulder, Boulder Heights, Carriage Hills, and Pinebrook Hills Subdivision, are listed in the Federal Register as communities at high risk from wildfire (http://www.fireplan.gov/reports/351-358-en.pdf). The area is shown in the Colorado State Forest Service WUI Hazard Assessment map to be an area of moderate to high Hazard Value (an aggregate of Hazard, Risk and Values Layers).
2. Significant and major fires (fires greater than 100 acres) have been reported in and adjacent to the district since 1974.
3. The USFS fire regime and condition class evaluation of forest stands in the study area shows that historic fire regimes have been moderately to substantially altered. Please see the *Fire Regime and Condition Class* section of this report (**page 17**) for details.
4. The surrounding federal lands report an active, fire history. Fire occurrences for the Boulder and Clear Creek Ranger Districts of the Arapahoe-Roosevelt National Forest (see **Figure 7**) were calculated from the USDA Forest Service Personal Computer Historical Archive for the ten-year period from 1994-2004. These areas represent federal lands adjacent to the study area, but do not include any data from state, county or private lands. The results have been graphed in the Fire Family Plus software program and are summarized below.

[10] Boulder County Office of Emergency Management Website (http://www.ci.boulder.co.us/oem/)

Figure 6a shows the number of fires (red bars) and the total acres burned (blue hatched bars) in the two ranger districts each year. While the number of annual fires range from approximately 9 to over 30 fires per year, there is little year-to-year pattern to the variation. Acres burned are by far the greatest in 2003 primarily due to the Overland fire in the Boulder Ranger District. Of the 4,571 acres reported burned in these two ranger districts between 1994 and 2004, 3,869 were burned by the Overland fire. Between 1994 and 2004 the only other fire to burn more than 100 acres in the two ranger districts was the Bear Tracks fire in 1998.

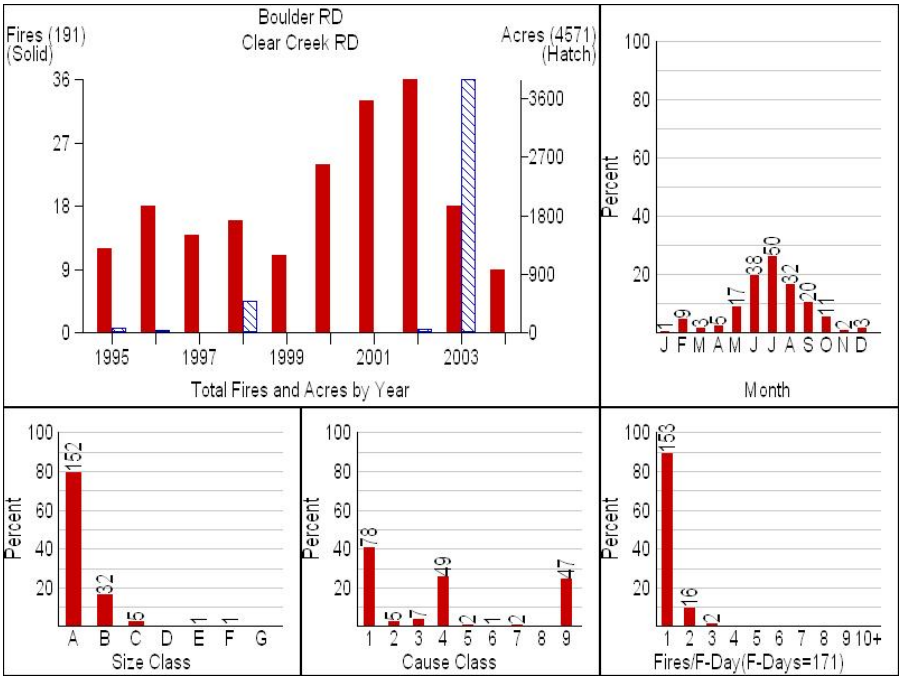
Figure 6b shows the percentage and number of fires between 1994 and 2004 occurring in each month of the year. July had the greatest number of fires followed by June and August. The fewest fires occurred between the months of November and April which reflects the climate conditions for the area.

Figure 6c shows the size class distribution of fires. Approximately 96% of the reported fires (184 of 191) were less than 10 acres in size. These statistics reflect the widely held opinion that throughout the western US the vast majority of fires are controlled in initial attack.

Figure 6d shows the number of fires caused by each factor. As shown in this graph, the most common cause of ignitions is lightning (41%); however, the next most common cause is campfires (26%). If we remove the miscellaneous cause category, natural causes still represent the majority of ignitions (54% natural and 46% human caused), but it should be noted that these numbers are for national forest areas which lack the concentrated development and many other risk factors present in the portions of the study area where private land is dominant.

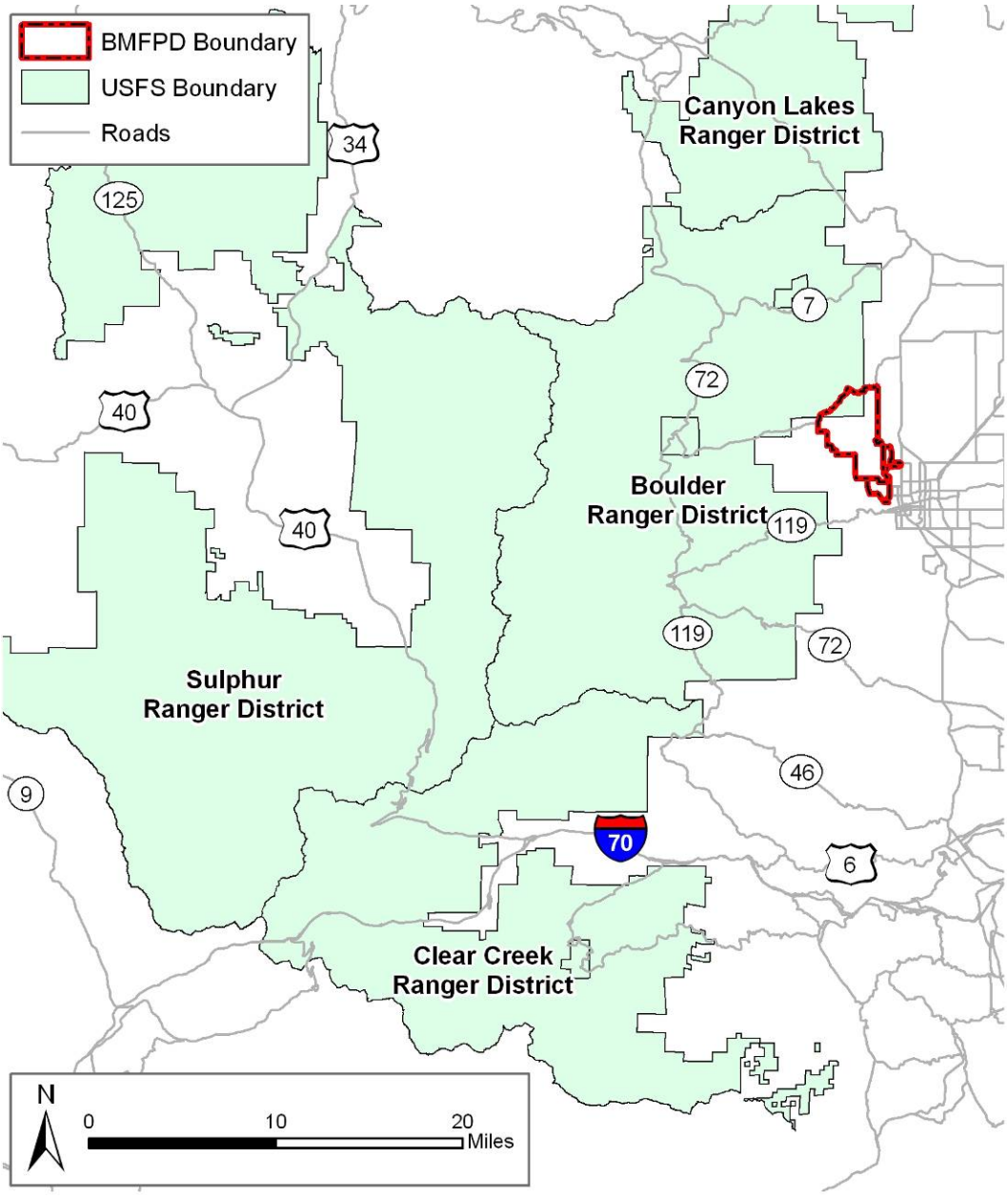
Figure 6e shows the number of fire starts for each day that a fire start was recorded. Most fires (153) occurred on days that only had one fire start. Approximately 8% (16) of fire days had two fire starts recorded and days with three or more fire starts represent approximately 1% of all fire start days. The statistics suggest that multiple start days are a rare occurrence compared to fire days with a single ignition.

Figure 6. Local Fire Statistics



Size Class (in acres)	A < ¼	B ¼ - 9	C 10 – 99	D 100-299	E 300-999	F 1000 - 4999	G 5000 +		
Causes	1 Lightning	2 Equipment	3 Smoking	4 Campfire	5 Debris Burning	6 Railroad	7 Arson	8 Children	9 Misc.

Figure 7. ARNF Ranger Districts



Development is increasing in the study area. As the density of structures and the number of residents in the interface increases, potential ignition sources will multiply. Unless efforts are made to mitigate the potential for human ignition sources spreading to the surrounding forest, the potential for a large wildfire occurrence, although historically low, will undoubtedly increase.

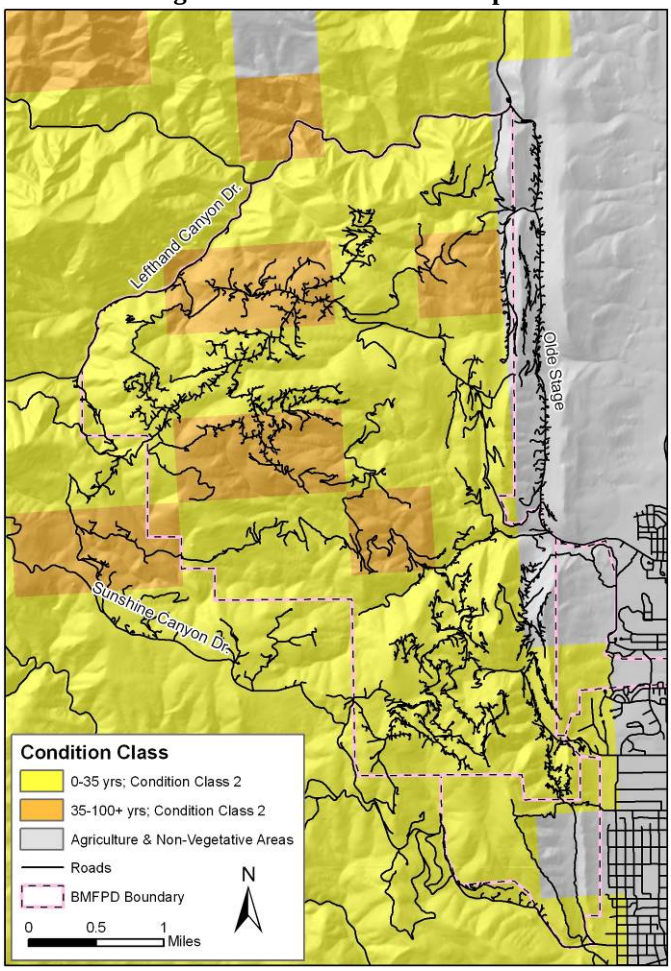
FIRE REGIME CONDITION CLASS

The Fire Regime Condition Class (FRCC) is a landscape evaluation of expected fire behavior as it relates to the departure from historic norms. The data used for this study is from a national level map. The minimum mapping unit for this data is 1 square kilometer. FRCC is not to be confused with BEHAVE and FlamMap fire behavior models, detailed in the fire behavior section, which provide the fire behavior potential analysis for expected flame length, rate of spread and crown fire development.

The FRCC is an expression of the departure of the current condition from the historical fire regime. It is used as a proxy for the probability of severe fire effects (e.g., the loss of key ecosystem components - soil, vegetation structure, species, or alteration of key ecosystem processes - nutrient cycles, hydrologic regimes). Consequently, FRCC is an index of hazards to the status of many components (e.g., water quality, fish status, wildlife habitats, etc.). **Figure 8** displays graphically the return interval and condition class of the study area.

Deriving fire-regime condition class entails comparing current conditions to some estimate of the historical range that existed prior to substantial settlement by Euro-Americans. The departure of the current condition from the historical baseline serves as a proxy to likely ecosystem effects. In applying the condition class concept, it is assumed that historical fire regimes represent the conditions under which the ecosystem components within fire-adapted ecosystems evolved and have been maintained over time. Thus, if it is projected that fire intervals and/or fire severity has changed from the historical conditions, then it would be expected that fire size, intensity, and burn patterns would also be subsequently altered if a fire occurred. Furthermore, it is assumed that if these basic fire characteristics have changed, then it is likely that there would be subsequent effects to those ecosystem components that had adapted to the historical fire regimes. As used here, the potential of ecosystem effects reflect the probability that key ecosystem components may be lost should a fire occur within the BMFPD. Furthermore, a key ecosystem component can represent virtually any attribute of an ecosystem (for example, soil productivity, water quality, floral and faunal species, large-diameter trees, snags, etc.).

Figure 8. Condition Class Map



The following categories of condition class are used to qualitatively rank the potential of effects to key ecosystem components:

Condition Class	*Condition Class Description*
1	Fire regimes are within their historical range and the risk of losing key ecosystem components as a result of wildfire is low. Vegetation attributes (species composition and structure) are intact and functioning within an historical range. Fire effects would be similar to those expected under historic fire regimes.
2	Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components as a result of wildfire is moderate. Fire frequencies have changed by one or more fire-return intervals (either increased or decreased). Vegetation attributes have been moderately altered from their historical range. Consequently, wildfires would likely be larger, more intense, more severe, and have altered burn patterns than that expected under historic fire regimes.
3	Fire regimes have changed substantially from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have changed by two or more fire-return intervals. Vegetation attributes have been significantly altered from their historical range. Consequently, wildfires would likely be larger, more intense, and have altered burn patterns from those expected under historic fire regimes.

Table 2. Condition Class Descriptions[11]

The study area is dominantly classified under Condition Class 2 and 3. By definition, historic fire regimes have been moderately to substantially changed. Consequently, ***Wildfires are likely to be larger, more severe and have altered burn patterns from those expected under historic fire regimes***.

[11] Fire Regime Condition Class, website, http://www.frcc.gov/, July 2005.

FIRE BEHAVIOR POTENTIAL

Fire Behavior Potential

The fire behavior potential of the study area was modeled from the Wildfire Hazard Analysis. This model can be combined with structure density and values-at-risk information to generate current and future "areas of concern". This is also sometimes referred to as a "values layer". **Figure 9** shows the fire behavior potential map for the analysis area given the average weather conditions existing between May 1 and October 31. Weather observations from the Boulder Remote Automated Weather Station (RAWS) were averaged for an eleven-year period (1992-2002) to calculate these conditions. The "extreme conditions" map (**Figure 10**) was calculated using ninetieth percentile weather data. That is to say the weather conditions existing on the eighteen most severe fire weather days in each season for the ten-year period were averaged together. It is reasonable to assume that similar conditions may exist for at least eighteen days of the fire season during an average year. In fact, during extreme years such as 2000 and 2002, such conditions may exist for significantly longer periods. Even these calculations may be conservative compared to observed fire behavior. Drought conditions the last few years have significantly changed the fire behavior in dense forest types such as mixed conifer. The current values underestimate fire behavior especially in the higher elevation fuels because the extremely low fuel moistures are not represented in the averages.

Weather conditions are extremely variable and not all combinations are accounted for. These outputs are best used for pre-planning and not as a stand-alone product for tactical planning. This model can be combined with the community wildfire hazard rating and values-at-risk information to generate current and future "areas of concern", which are useful in the prioritizing of mitigation actions (please see the *Solutions and Mitigation* section of this report). This is sometimes referred to as a "values layer". It is recommended that whenever possible, fire behavior calculations be done with actual weather observations during fire events. It is also recommended that the most current Energy Release Component (ERC) values be calculated and distributed during the fire season to be used as a guideline for fire behavior potential.

Figure 9. Fire Behavior Potential (Average Weather Conditions)

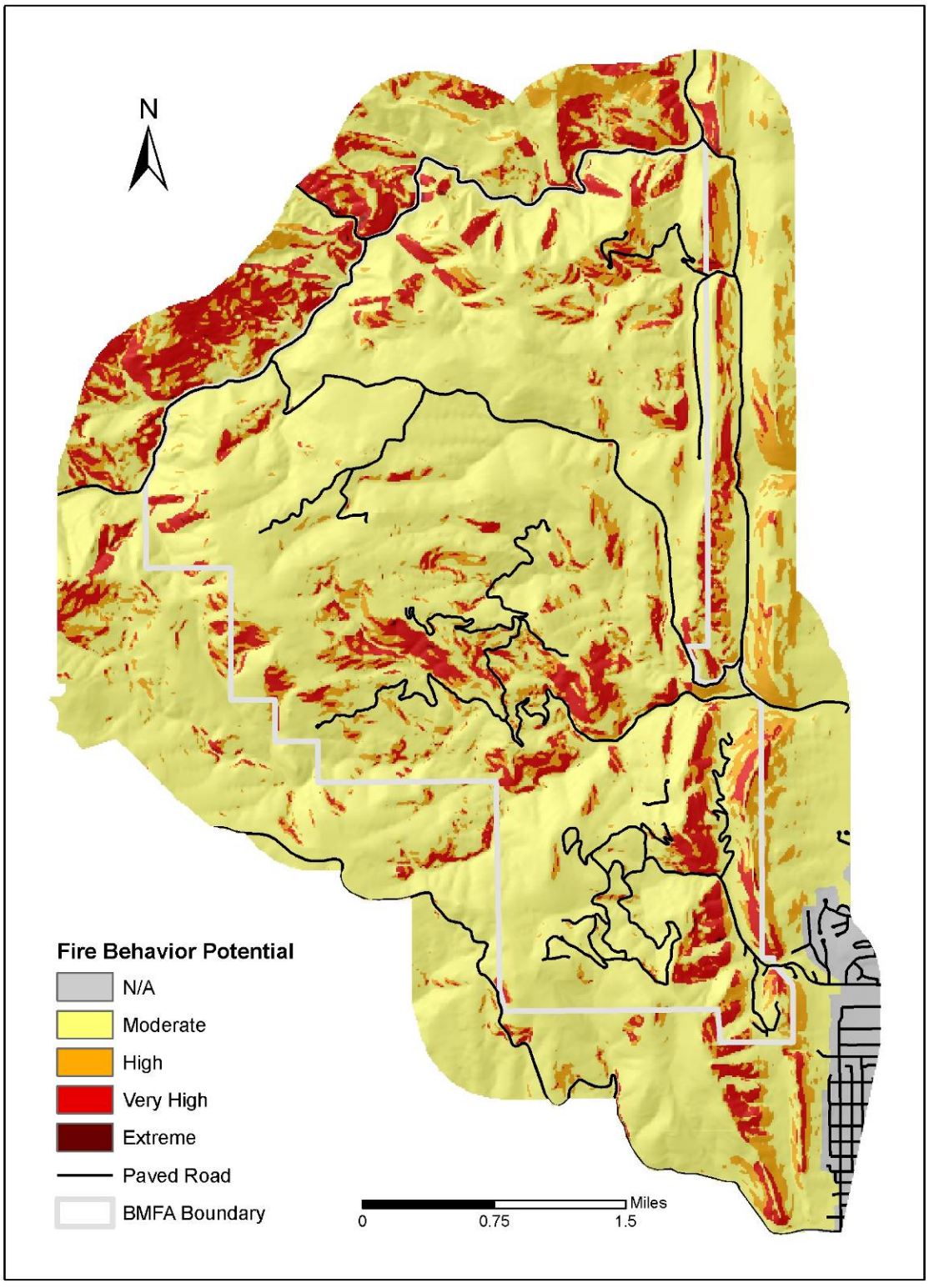


Figure 10. Fire Behavior Potential (Extreme Weather Conditions)

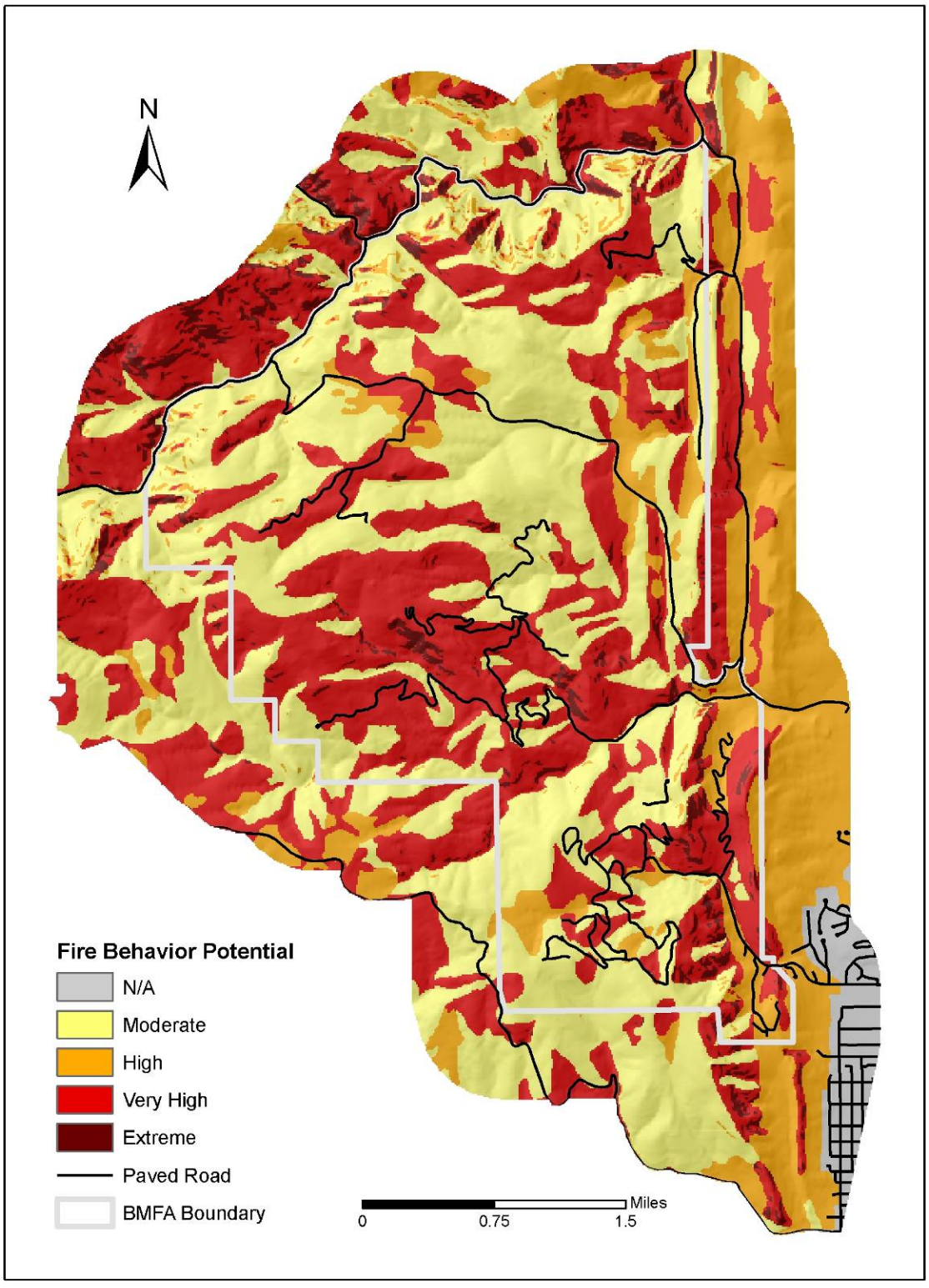


Figure 11. Flame Length Predictions (Average Weather Conditions)

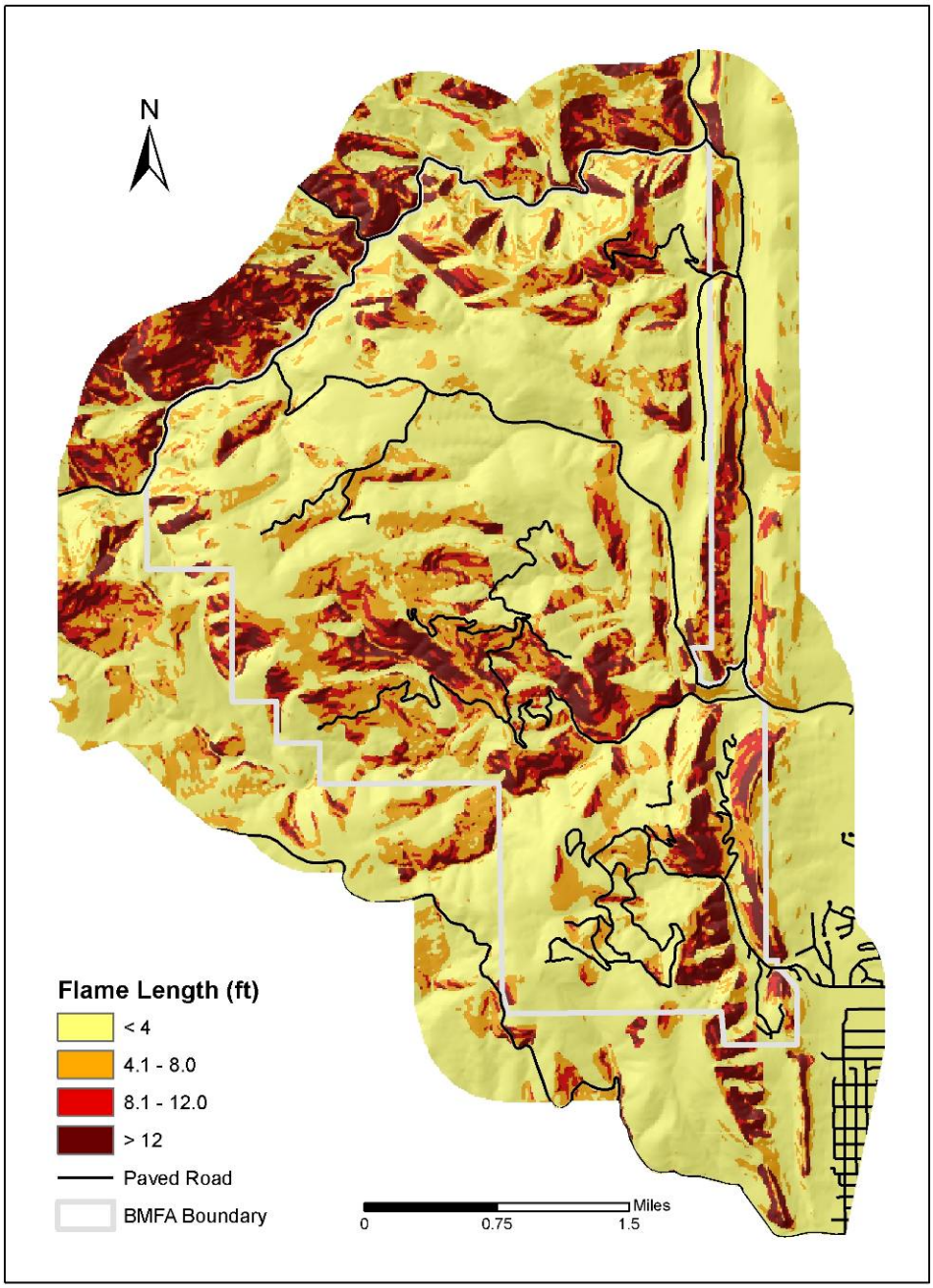
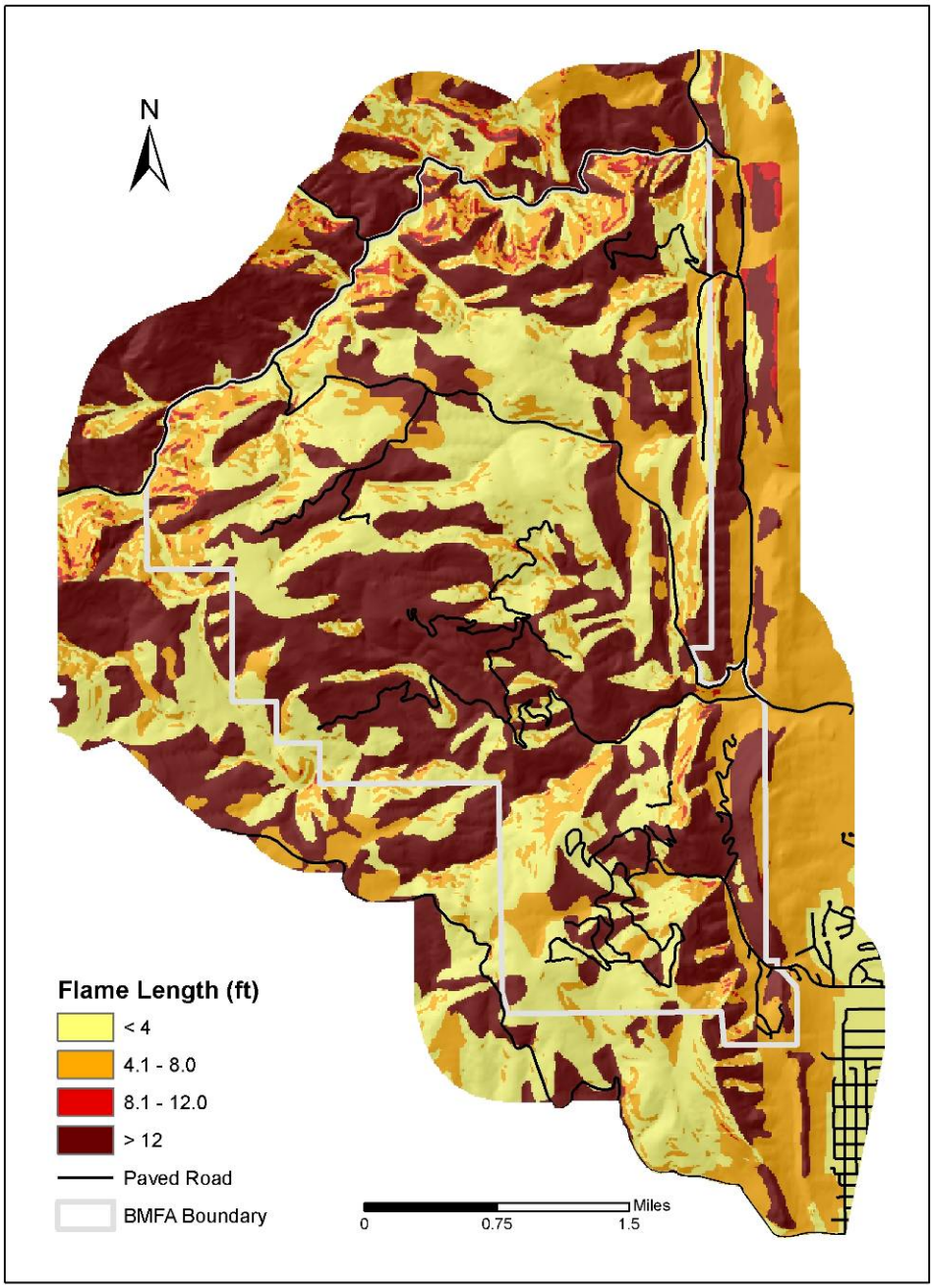


Figure 12. Flame Length Predictions (Extreme Weather Conditions)



(80 chains per hour = 1 mile per hour)

Figure 13. Crown Fire Potential (Average Weather Conditions)

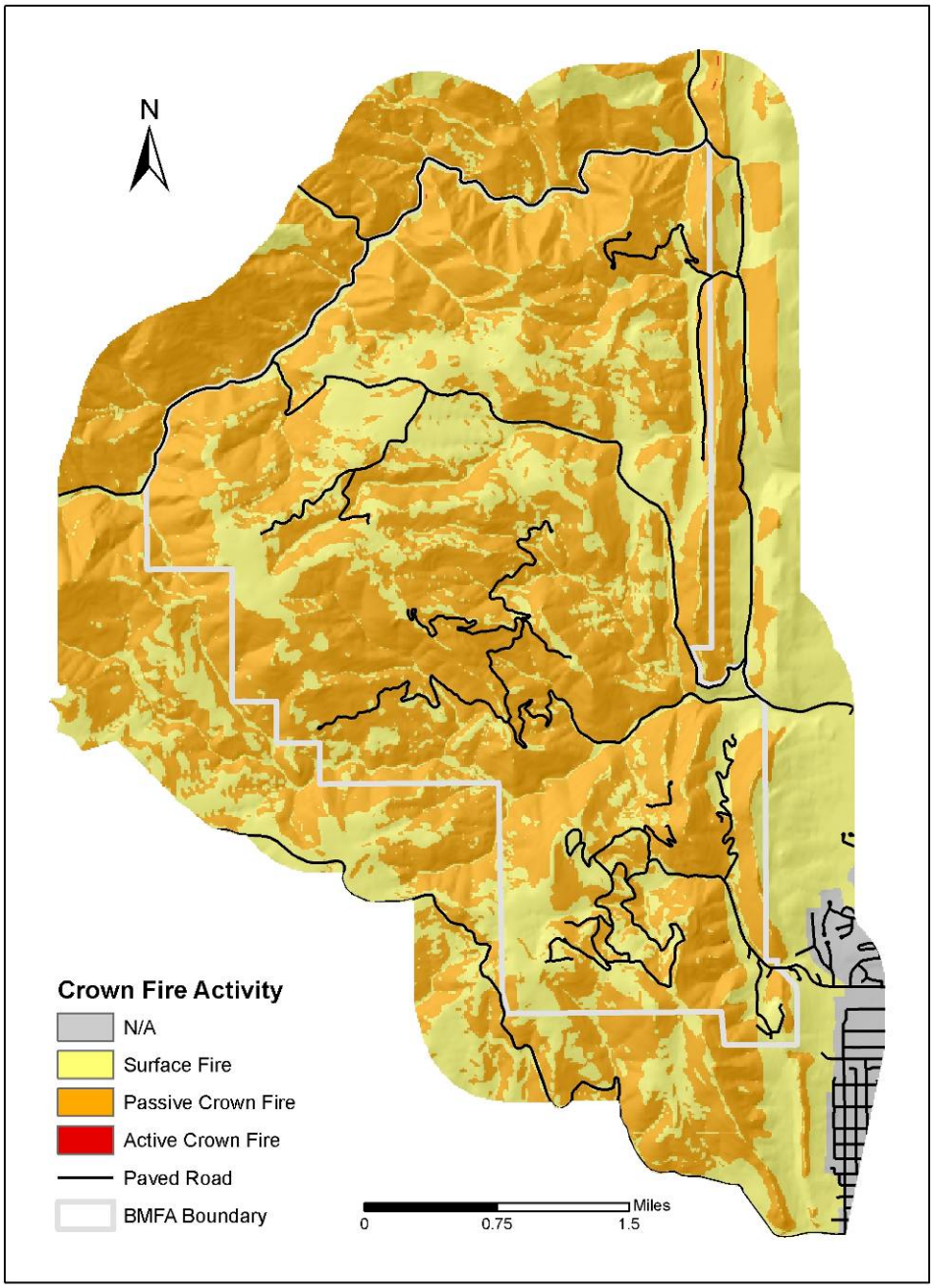
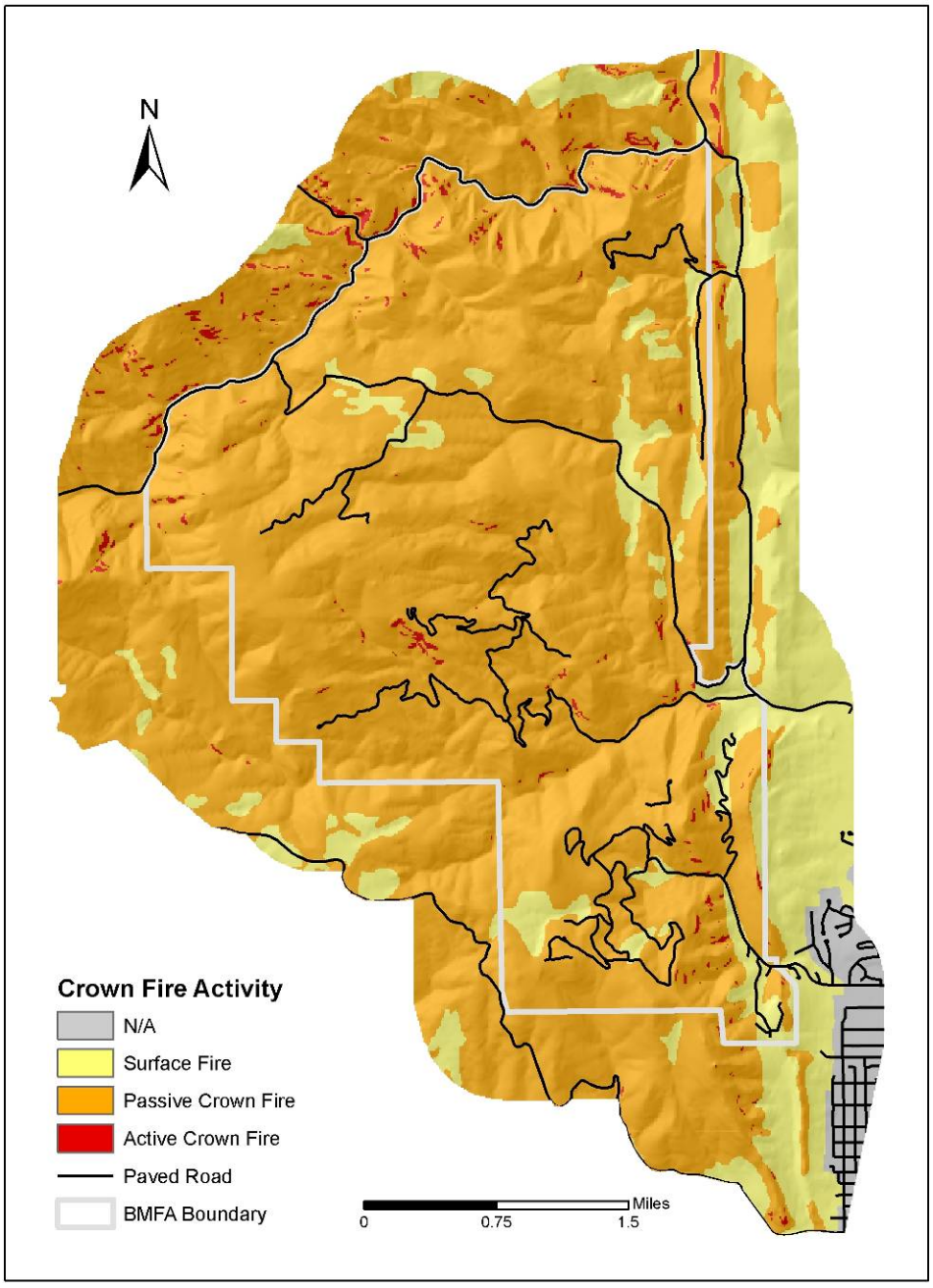


Figure 14. Crown Fire Potential (Extreme Weather Conditions)



Home Mitigation FMU (Structural Ignitability Reduction)

Community responsibility for self-protection from wildfire is essential. Educating homeowners is the first step in promoting a shared responsibility. Part of the educational process is defining the hazard and risks both at the community and parcel level.

The purpose of this study is to examine the potential of damaging wildfire outcomes to the communities within the Boulder Mountain Fire Protection District and to provide specific fuels reduction recommendations for BMFPD. Of the fourteen communities in the study area, three were found to represent an extreme hazard, four were rated as very high hazard, five as high hazard, two as moderate hazard and none as low hazard (**see Table 1. Hazard Ranking of Communities in the Study Area** on **Page 7**). Construction type, condition, age, the fuel loading around the structure and position or location are contributing factors in making homes more susceptible to ignition under even moderate burning conditions. Under extreme burning conditions, there is a likelihood of rapid fire growth and spread in these areas due to steep topography, flammable construction types, natural or manmade hazards, fast burning or flashy fuel components and topographic features that contribute to channeling winds and promotion of extreme fire behavior. These communities may also represent a high threat to life safety due to poor egress, the likelihood of heavy smoke and heat, long response times and/or inadequate response levels.

Figure 16 illustrates the relative hazard rankings for communities in the study area.

- A rating of 5 or less indicates an area of extreme hazard.
- A rating of 6 to 10 indicates a very high hazard.
- A rating of 11 to 19 indicates high hazard.
- A rating of 20 to 30 indicates moderate hazard.
- A rating of 31 or greater indicates a low hazard.

The communities with extreme to high hazard ratings should be considered an FMU where a parcel level analysis should be implemented as soon as possible, if not already completed through the WHIMS program.

Figure 15. Community Groupings by Hazard Class

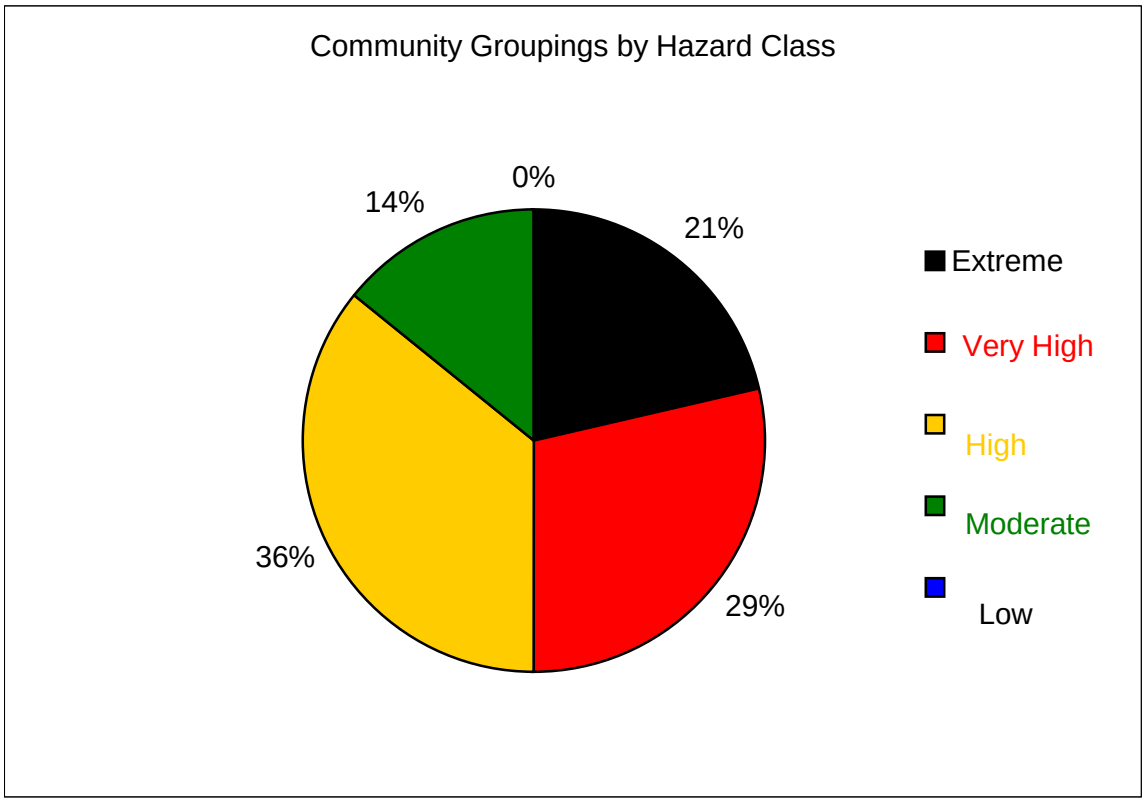


Figure 16. Study Area Community Hazard Ratings

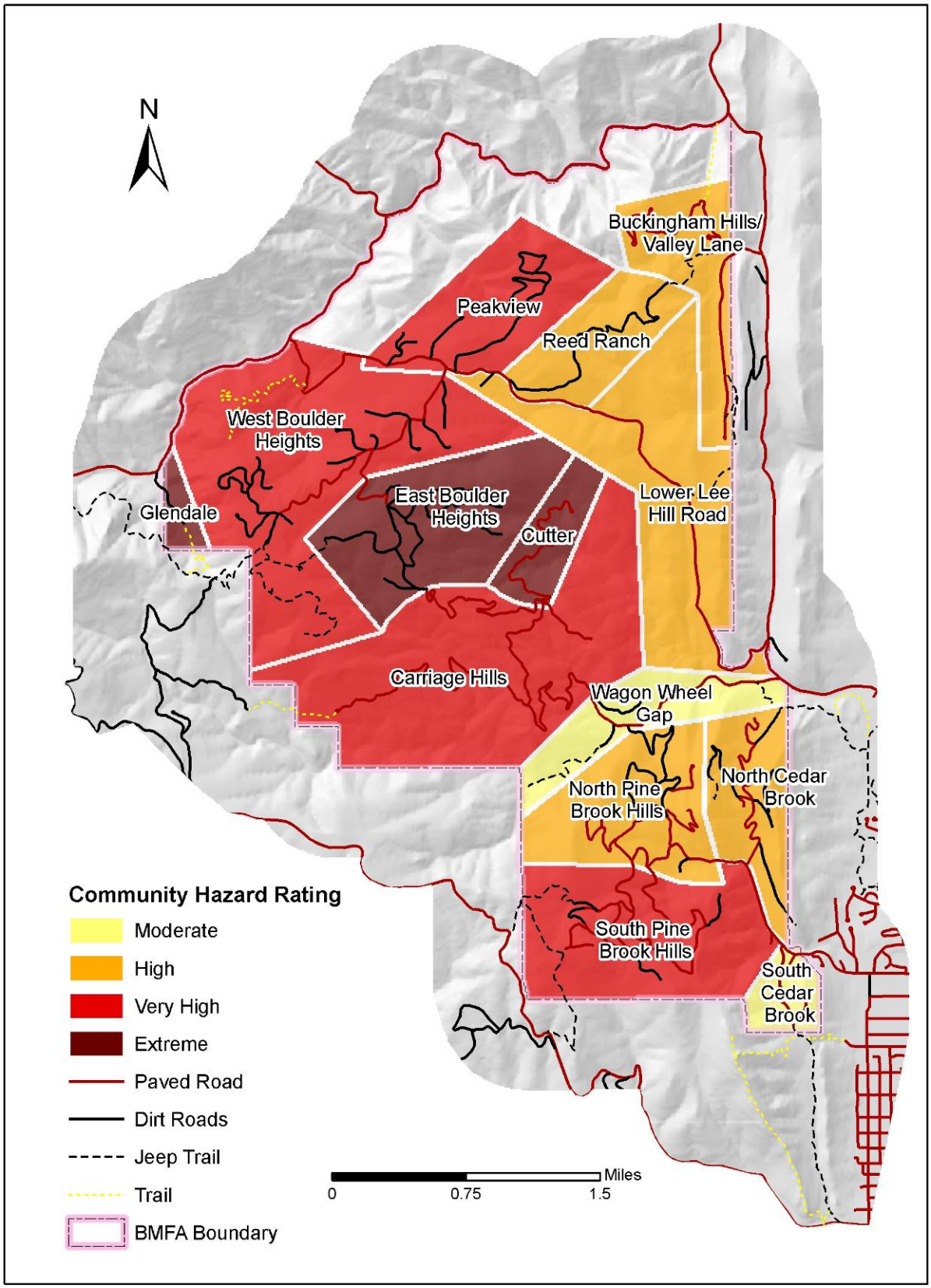
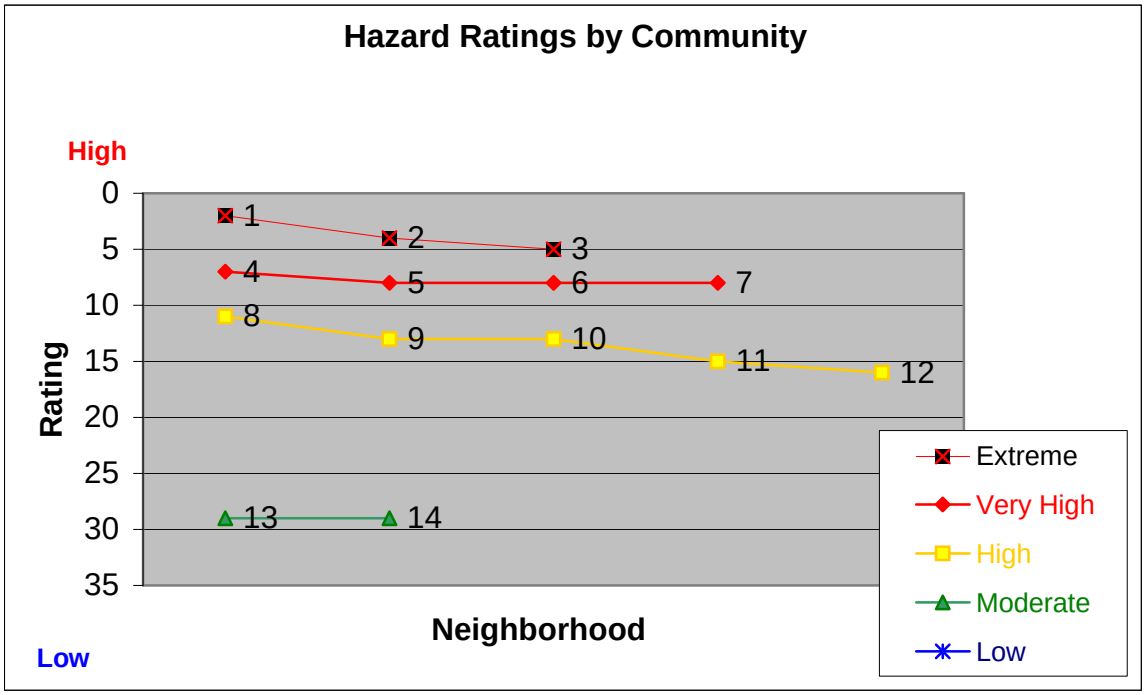


Figure 17. Hazard Ratings by Community



GENERAL RECOMMENDATIONS

A combination of access, ignition resistant construction, and fuels reduction should create a safer environment for emergency service personnel and provide reasonable protection to structures from a wildfire. These techniques should also significantly reduce the chances of a structure fire becoming an ignition source to the surrounding wildlands.

In addition to the suggested mitigations listed for the individual communities, several general measures can be taken to improve fire safety. The following recommendations should be noted and practiced by all who live in the Wildland-Urban Interface:

- Be aware of the current fire danger in the area.
- Clean roof and gutters at least 2 times a year, especially during cure up in the autumn, after strong winds and in the spring before fire season.
- Stack firewood uphill or on a side contour, at least 30 feet away from structures.
- Don't store combustibles or firewood under decks.
- Maintain and clean spark arresters on chimneys.
- Screen off any openings in attics, eves, siding and foundations to reduce the likelihood of embers and firebrands entering them.
- When possible, maintain an irrigated greenbelt around the home.
- Connect, and have available, a minimum of 50 feet of garden hose.
- Post reflective lot and/or house numbers so that they are clearly visible from the main road. There should also be reflective numbers on the structure itself.

- Trees along driveways should be limbed and thinned as necessary to maintain a minimum 14' vertical clearance for emergency vehicle access.
- Maintain defensible space constantly.
  - Mow grass and weeds to a low height.
  - Remove any branches overhanging the roof or chimney.
  - Remove all trash, debris and cuttings from the defensible space.

SOLUTIONS AND MITIGATION

Addressing, Evacuation and Access

Addressing

An obvious attempt has been made in BMFPD to add reflective addressing to existing address markers. These markers have white reflective lettering on a green rectangle. Some of these markers have been added on existing address posts, some to telephone poles and some on trees. There is no standard as to which side of the driveway, how high or even how close to the driveway these markers are placed. In some areas these markers are missing, broken or covered (**Figure 18**). Many addresses would be difficult to find at night. We consider low-light visible signage to be a critical operational need. The time saved, especially at night and in smoky conditions, is not to be underestimated. Knowing at a glance the difference between a road and a driveway (and which houses are on the driveway) cuts down on errors and time wasted interpreting maps. This is especially true for volunteer firefighters who do not have the opportunity to train on access issues as often as career firefighters. Address markers should be mounted on a non-combustible pole or similar mounting at a consistent height and position relative to the driveway. In areas where multiple residences are serviced by a single driveway, all addresses should be mounted together and then marked again as the driveway splits.

Figure 18. Addressing Concerns - Broken Marker

Evacuation Routes

Four roads have been identified that could serve as alternative evacuation routes to the primary access. There is a fifth route noted that is not suitable for most vehicles, but may be useful to ATVs and foot traffic. These routes are highlighted in the overview of the district shown in

Figure 19.

1. Bristlecone to Sunshine Canyon: This evacuation route runs from the end of Bristlecone to Sunshine Canyon. The road is in good condition and provides an excellent egress from the western portion of Pine Brook Hills in the event that access to Linden is cut off.

2. Reed Ranch to Valley Lane: This escape route runs through private property from the end of Reed Ranch Road to a long driveway that intersects Valley Lane. Permission to use and maintain this route would need to be negotiated with the property owner. In addition to providing escape for the homes on Reed Ranch Road in the event that access to Lee Hill Road is cut off, this route would also provide residents of Valley Lane and Buckingham Hills an escape to Lee Hill Road if the narrow, high clearance vehicle only, exit from Valley Lane to Old Stage is blocked.

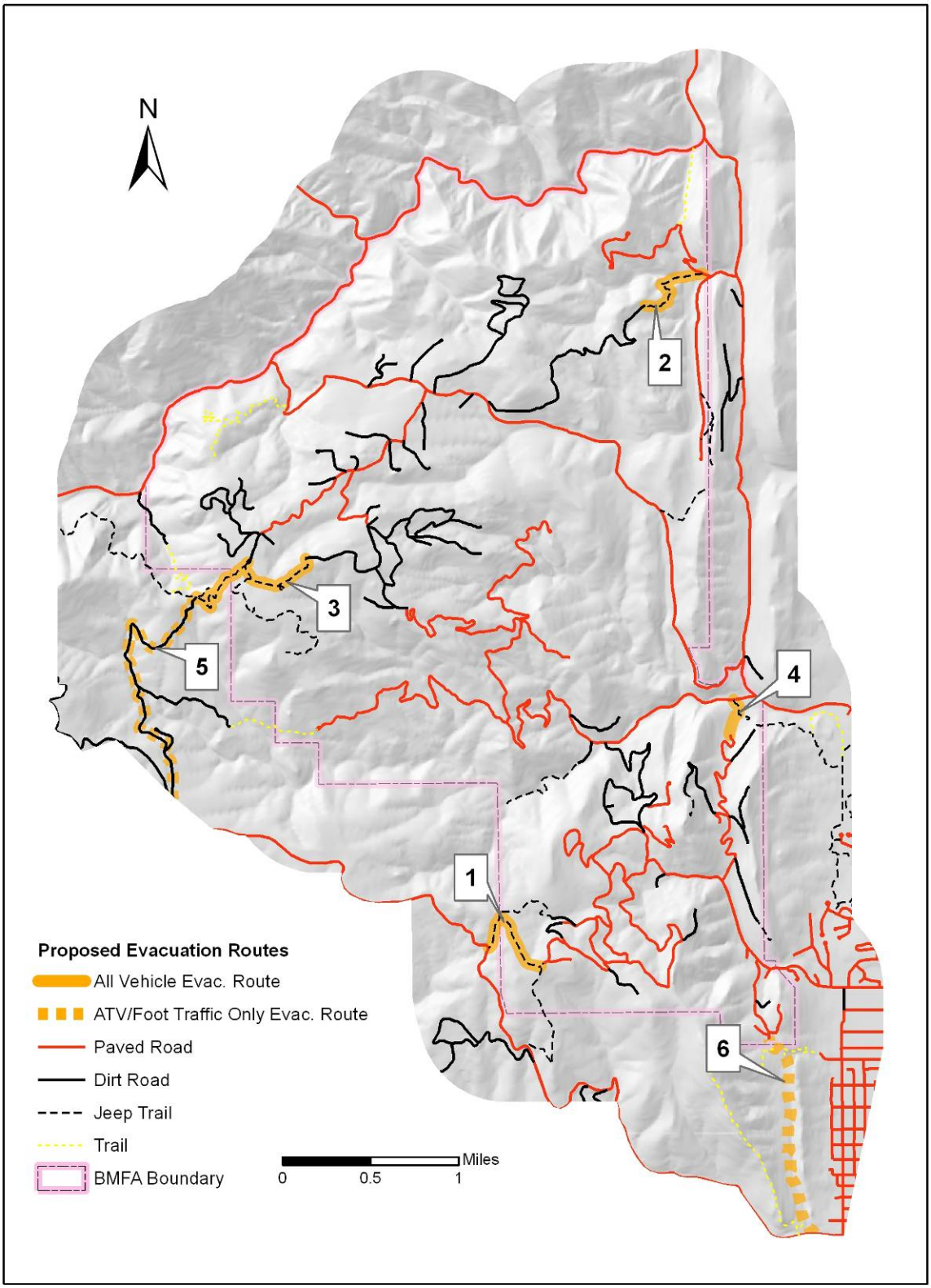
3. Sky Trail to Mine Road: This route connects Sky Trail with Deer Trail by crossing the Camp Paul Hummel property on two-track and improved dirt roads. This route runs through private property and there is a locked gate on both ends. This route may be of some use if the access to Deer Trail via Brook Road (the primary access) were cut off by an ignition occurring in the steep drainage Brook Road crosses. A better escape route would be through Carriage Hills, but the gate into Carriage Hills is much more formidable. If the church camp is amenable, this route is worth pre-planning in case there is a problem with the Carriage Hills gate.

4. North Cedar Brook to Wagon Wheel Gap: Although there is no official connection, it may be possible to drive from the end of North Cedar Brook Road across a meadow to a two-track that connects to Wagon Wheel Gap. There is a locked gate at the Wagon Wheel end and the route was therefore not scouted for this report. Pre-planning of this route would require private property owner cooperation, but is recommended as it would create an escape route for a number of residents into a different drainage should the access from North Cedar Brook to Linden be cut off.

5. Mine Road to Sunshine Canyon: There is a very rough track that leads from a concrete barrier at the end of Mine Road to Sunshine Canyon. Although this road is not passable to most vehicles, it may be useful for ATVs and foot traffic should the western section of Boulder Heights become cut off from both Deer Trail and Carriage Hills Road. Due to the fact that this route is not suitable for vehicles, it should be considered as a last resort if all other options are compromised.

6. South Cedar Brook Road to Sunshine Canyon: This route provides an emergency-only escape route from South Cedar Brook to Sunshine Canyon Road by using the Sanitas Valley Trail. The Sanitas Valley Trail is an old quarry road that has been converted to a hiking trail by the city of Boulder Open Space/Mountain Parks. It is dirt, two track and is more suitable for high clearance vehicles than passenger cars. In wet conditions even 4WD vehicles may have trouble.

Figure 19. Proposed Evacuation Routes



ACCESS (INGRESS AND EGRESS) ROUTE FUELS MODIFICATION RECOMMENDATIONS

In addition to developing escape routes for residents and ingress routes for firefighters, fuel modification projects for primary access corridors should be implemented. Many of the communities in the study area would benefit from fuels reduction along their principal access routes.

Thinning along primary access roads into communities should include an area of at least 100' on either side of the centerline of the access routes where practical. This distance should be modified to account for increased slope and other topographic features that increase fire intensity (see **Table 3**). This is especially important in communities with steep narrow roads and few turnouts. In these areas, safer access for firefighters would make an impact in the number of structures that could be defended in a wildfire. Existing and natural barriers to fire should be incorporated into the project dimensions.

In addition to the evacuation routes suggested on pages 32 and 32; other possibilities should be defined and similar fuels reduction projects employed. In areas where multiple routes exist, consider separating access routes for responders and escape routes for citizens in your preplanning.

Cooperation between adjacent, contiguous homeowners is imperative to achieve the most effective wildfire mitigation. If this is not possible, more intensive thinning may need to occur within the road easement to compensate for gaps in fuels modification. Homeowner participation allows the project to be more flexible in selecting trees and shrubs for removal. It allows greater consideration for the elements of visual screening and aesthetics. Enlarging the project dimensions, allows more options for vegetative selection while still protecting the access/egress corridor.

- Elements of the fuels modification space for access routes should include:
  - Tree crown separation of at least 10' with groups of trees and shrubs interspersed as desired.
  - Crown separation greater than 10' may be required to isolate adjacent groups or clumps of trees.
  - Limb all remaining trees to a height of 8' or 1/3 of the tree height (whichever is less).
  - Clean up ground fuel within the project area.
  - Post placards clearly marking "fire escape route". This will provide functional assistance during an evacuation and communicate a constant reminder of wildfire to the community. Be sure to mount signage on non-combustible poles.

Specific fuels reduction projects along access roads have been identified for BMFPD and are included in the "Landscape Scale Fuels Modification, Recommendations" project list.

OTHER ACCESS ROUTE RECOMMENDATIONS

In order to reduce conflicts between evacuating citizens and incoming responders, it is desirable to have nearby evacuation centers for citizens and staging areas for fire resources. Evacuation centers should include heated/cooled buildings with facilities large enough to handle the population. Schools and churches are usually ideal for this purpose. Fire staging areas should contain large safety zones, a good view in the direction of the fire, easy access and turnarounds for large apparatus, a significant fuelbreak between the fire and the escape route, topography conducive to radio communications, and access to water. Local responders are encouraged to preplan the use of potential staging areas with property owners.

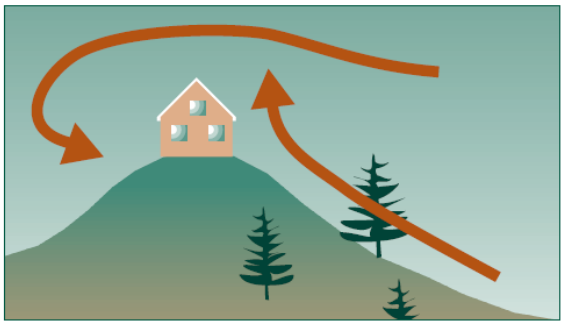
Identify and pre-plan alternate escape routes and staging areas.

- Perform response drills to determine the timing and effectiveness of fire resource staging areas.
- Educate citizens on the proper escape routes and evacuation centers to use in the event of an evacuation.
- Utilize a reverse 911 system or call lists to warn residents when an evacuation may be necessary. Notification should also be carried out by local television and radio stations. Any existing disaster notification systems, such as tornado warnings, should be expanded to include wildfire notifications.
- Emergency management personnel should be included in the development of preplans for citizen evacuation.

Defensible Space

The most important element for the improvement of life safety and property preservation is for every home in the study area to have compliant defensible space. This is especially important for homes with wood roofs and homes located on steep slopes, in chimneys, saddles and any other topographic feature the contributes to fire intensity.

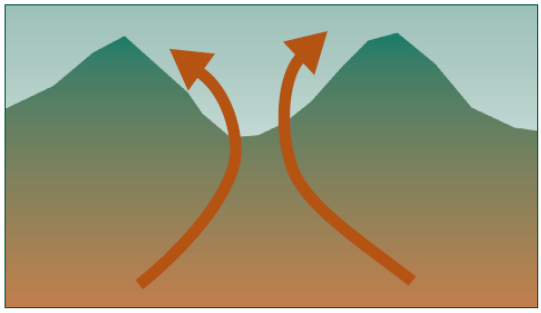
Figure 20. Ridge with Wind Exposure



Continuing an aggressive program of evaluating and implementing defensible space for homes, will do more to limit fire related property damage than any other single recommendation in this report.

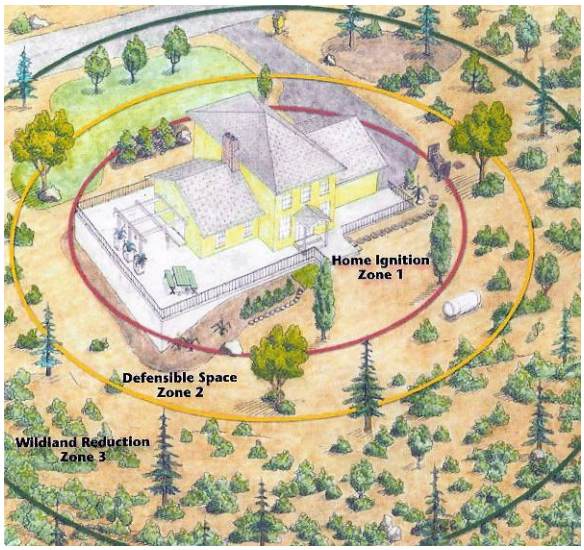
There is no question that dense/flammable vegetation should be removed from around a home in order to reduce the risk of structural ignition during a wildfire. The question is how much to remove. The basic rule is to eliminate ALL flammable materials

Figure 21. Saddle, Low Area on a Ridge



[12]

Figure 22. Defensible Space Zones



[12] FireWise Construction, Peter Slack, Boulder Colorado

(fire-prone vegetation, wood stacks, wood decking, patio furniture, umbrellas, etc.) from within 30 feet of the home. Then for structures near wildland open space, an additional 70 feet should be modified in such a way as to remove all dead wood from shrubbery, thin and trim trees and shrubs into "umbrella" like forms (lower limbs removed), and prevent the growth of weedy grasses. Steep slope and or the presence of dangerous topographic features, as described above, may require the defensible space to be increased.

Unfortunately the term "clearance" is used frequently when referring to this 100 foot zone, leading people to think all vegetation must be removed down to bare soil. This not only unnecessarily compromises large amounts of wildlands and increases erosion, but will lead to the growth of weeds in the now disturbed soil. These weeds are considered "flashy fuels" which actually increase fire risk because they ignite so easily.

Defensible space must be ecologically sound, esthetically pleasing and relatively easy to maintain. Only then will the non-prescriptive use of fuels reduction around homes become commonplace.

As stated above, the most effective wildfire mitigation technique for property conservation will be the widespread utilization of defensible space in combination with ignition resistant construction. Until appropriate construction can be retrofitted on existing homes, defensible space will at least reduce radiant heat and therefore structure ignition from direct flame contact or radiant heat. Ember generation from fires will need to be mitigated by a very refined inspection of each structure for any openings or areas of likely ember collection. These areas should be identified and mitigated as part of every defensible space inspection.

Figure 23. Convective and Radiant Energy From a Fire

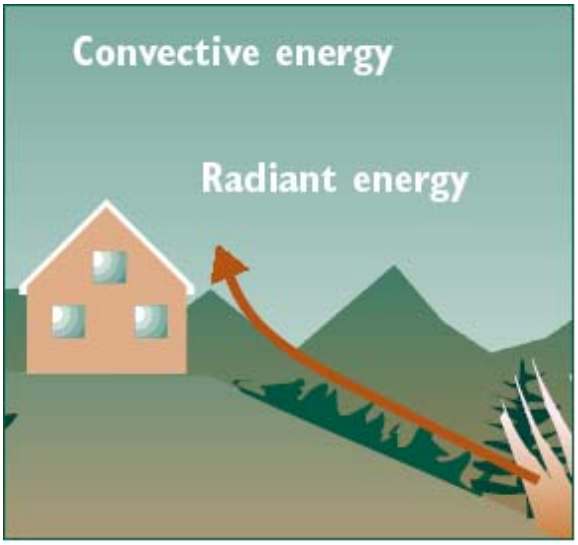
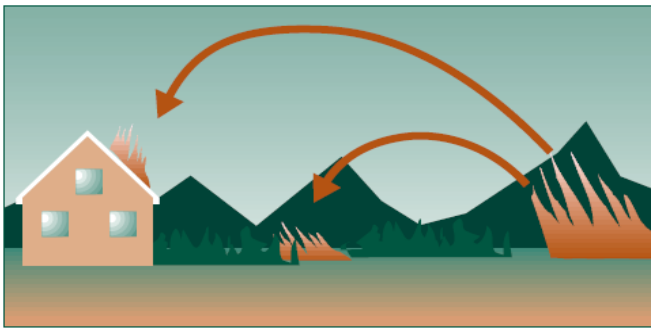


Figure 24. Firebrands, Transported by Convective Lifting Can Create Spot Fires



Landscape Scale Fuels Modification

One of the most effective forms of landscape scale fuels modification is the fuelbreak (sometimes referred to as "shaded fuelbreak"). A fuelbreak is an easily accessible strip of land of varying width, depending on fuel and terrain, in which fuel density is reduced, thus improving fire control opportunities. Vegetation is thinned removing diseased, fire-weakened, most standing dead trees and in some stands healthy trees, as necessary to reduce fire intensity. Thinning should promote the more fire resistant species. Ladder fuels, such as low limbs and heavy regeneration are removed from the remaining stand. Brush, dead and down materials, logging slash and other heavy ground fuels, are removed and disposed of to create an open park-like appearance. Utilization of fuelbreaks can, under normal burning conditions, limit uncontrolled spread of fires and aid firefighters in slowing the spread rate. Under extreme burning conditions where spotting occurs for miles ahead of the main fire and probability of ignition is high, even the best fuelbreaks are not effective. That being said, however, fuelbreaks have proven to be effective in limiting the spread of crown fires in Colorado.[13] Factors to be considered when determining the need for fuelbreaks in mountain subdivisions include:

- Contributions of the fuel reduction to life safety issues such as evacuation route protection.
- The presence and density of property and infrastructure values.
- The presence and density of hazardous fuels.
- Slope.
- Other hazardous topographic features.
- Crowning potential.
- Ignition sources.

With the exception of aspen, all of Colorado's major non-riparian timber types represent a significant risk of wildfire. Increasing slope causes fires to move from the surface fuels to crowns more easily due to preheating. A slope of 30% causes the fire spread rate to double compared with the same fuels and conditions on flat ground. Chimneys, saddles and deep ravines are all known to accelerate fire spread and influence intensity. Communities with homes located on or above such features as well as homes located on summits and ridge tops would be good candidates for fuelbreaks. Crown fire activity values for BMFPD were generated by the FlamMap model and classified into four standard ranges. In areas where dependent or even independent crown fire activity is likely to develop, fuelbreaks should be considered. If there are known likely ignition sources (such as railroads and recreation areas) that are present in areas where there is a threat of fire being channeled into communities, fuelbreaks should be considered.

Fuelbreaks should always be accessible and connected to a good anchor point like a rock outcropping, river, lake, or road. The classic location for fuelbreaks is along the tops of ridges to stop fires from backing down the other side or spotting into the next drainage. This is sometimes not practical from a WUI standpoint as the structures firefighters are trying to protect are usually located at the tops of ridges or mid-slope. Mid-slope positioning is considered the least desirable for fuelbreaks; however it may be easiest to achieve as an extension of defensible space work or an extension of existing roads and escape routes. One tactic would be to create fuelbreaks on slopes below homes located mid-slope and on ridge tops so that the area of continuous fuels between the defensible space of homes and the fuelbreak is less than ten acres. Another tactic that is

[13] Frank C. Dennis, "Fuelbreak Guidelines for Forested Subdivisions" Colorado State Forest Service, Colorado State University [CSFS #102-1083], 1983.

commonly used is to position fuelbreaks along the bottom of slopes. In most of the study area this would require the cooperation of many individual landowners. In some areas, the only way to separate residences from fuels may be to locate the fuelbreak mid-slope above homes. This would provide some protection from backing fires and rolling materials. It would make sense to locate fuelbreaks mid-slope below homes, where this is possible, to break the continuity of fuels into the smaller units mentioned above. Even though this position is considered the least desirable from a fire suppression point of view, it would be the only feasible approach in some portions of the study area.

Fuelbreaks are usually easiest to locate along existing roadbeds. The minimum recommended fuelbreak width, in timber, is usually 200 feet. As spread rate and intensity increases with slope angle, the size of the fuelbreak should also be increased with an emphasis on the downhill side of the roadbed or centerline employed. The formulas for slope angles of 30% and greater are as follows: below road distance = 100' + (1.5 x slope %), above road distance = 100' – slope % (see **Table 3**).[14] Fuelbreaks that pass through hazardous topographic features should have these distances increased by 50%. Since fuelbreaks can have an undesirable effect on the aesthetics of the area, crown separation should be emphasized over stand density levels. That is to say that isolating groupings rather than cutting for precise stem spacing will help to mitigate the visual impact of the fuelbreak. Irregular cutting patterns that reduce canopy and leave behind islands with wide openings are effective in shrub models. This is often referred to as mosaic cutting or clumping.

Another issue in mechanical thinning is the removal of cut materials. It is important to note that in Colorado's dry climate slash decomposes very slowly. One consequence of failing to remove slash is to add to the surface fuel loading, perhaps making the area more hazardous than before treatment. It is imperative that all materials be disposed of by piling and burning, chipping, physical removal from the area, or lopping and scattering. Of all of these methods lopping and scattering is the cheapest, but also the least effective since it adds to the surface fuel load.

It is also important to note that fuelbreaks must be maintained to be effective. Thinning usually accelerates the process of regenerative growth. **The effectiveness of the fuelbreak may be lost in as little as three to four years if ladder fuels and regeneration are not controlled.**

One of the most difficult issues in establishing and maintaining fuelbreaks is securing cooperation and participation of adjoining landowners. Most of the fuelbreaks recommended in this study would require permission to work along road easements as well as the participation of adjacent landowners. Such fuelbreaks would represent a reasonable cost/benefit to BMFPD only if such agreements could be secured.

% Slope	Distance Above Road	Distance Below Road
30	70 feet	145 feet
35	65 feet	153 feet
40	60 feet	160 feet
45	55 feet	168 feet
50	50 feet	175 feet

Table 3. Recommended Treatment Distances for Mid-Slope Roads

[14] Frank C. Dennis, "Fuelbreak Guidelines for Forested Subdivisions" Colorado State Forest Service, Colorado State University [CSFS #102-1083], 1983.

RECOMMENDATIONS

The following recommendations are for fuels treatments in BMFPD. Recommendations are listed by priority level, however recommendations within each priority level are considered to be of relatively equal importance and no further sorting should be implied. The prioritization of recommendations was driven principally by life safety concerns. Conservation of property and operability were considered as secondary factors. These recommendations are designed to reduce threats to ingress/egress and defensibility of the district. These recommendations are not a replacement for defensible space or other recommendations in this report. It is important to understand that defensible space for all homes is a critical element in reducing hazards to life and property. These recommendations will only achieve maximum effectiveness in conjunction with defensible space treatments. Only treatments inside the boundaries of BMFPD have been included in these recommendations. Obviously, fire does not respect administrative boundaries and cooperative efforts with adjoining fire districts are highly recommended.

A. **Thinning where necessary to conform to guidelines for shaded fuelbreaks along Lee Hill Road.** **Priority level - High.** Thinning along four sections of this critical access route is highly recommended. This project will remove many stressed trees in close proximity to the roadway. Not only does this project protect access, it also reduces the potential for human caused ignitions to spread to steep drainages in hazardous areas.

B. **Thinning where necessary to conform to guidelines for shaded fuelbreaks along the access to the Lee Hill antenna site and the church camp.** **Priority level - High.** This important thinning project will slow the progression of an ignition in the hazardous Sunshine Saddle area into Boulder Heights. This project also provides for access protection to the church camp and a fuelbreak to the communication towers.

C. **Thinning where necessary to conform to guidelines for shaded fuelbreaks along Timber Lane and Wild Horse Road.** **Priority level - High.** Removal of the very dense flammable conifer fuels helps protect the primary access route into the densely populated southwest section of BMFPD as well as breaking the fuel continuity on the slopes below many homes. This project also reduces the potential for human caused ignitions along these busy streets to spread rapidly upslope. The northern end of this project can also be tied into an existing fuelbreak north of Wild Horse Road. Priority thinning should begin above ravines.

D. **Thinning where necessary to conform to guidelines for shaded fuelbreaks along Bristle Cone Lane, Alpine Lane and Alder Road.** **Priority level - High**. In addition to protecting access to homes in the densely populated southwestern portion of Pine Brook Hills, this project will also protect an important escape route running from the end of Bristlecone to Sunshine Canyon. The extension of fuels reduction along Alder also ties into the shaded fuelbreak to the south.

E. **Carriage Hills stand treatment and access road fuel reductions.** **Priority level - High**. Removal of flammable conifer fuels helps protect an essential access route into the densely populated northern section of Carriage Hills and the western portion of Boulder Heights as well as breaking the fuel continuity on the slopes below many homes. This project also reduces the potential for human caused ignitions along these busy streets to spread rapidly upslope. The recommended stand treatment is a sanitation cut that will remove dead and diseased trees on the steep slopes below the section of Carriage Hills leading into the southern portion of Boulder Heights. Initial work should be done along the road and then extended into the stand.

F. **Thinning where necessary to conform to guidelines for shaded fuelbreaks along Pine Brook, Wildwood and Bow Mountain Road.** **Priority level - Moderate**. This project removes dense conifer fuels along primary access roads in the densely populated northern section of Pine Brook Hills.

G. **Thinning where necessary to conform to guidelines for shaded fuelbreaks along Deer Trail and Brook Road.** **Priority level - Moderate.** This project removes conifer fuels along primary access roads in the densely populated south and west sections of Boulder Heights. The treatment along Brook Road also creates a fuelbreak across a heavily loaded ravine that threatens this area.

H. **Maintenance cleanup of fuelbreaks #1&2.** **Priority level - Moderate.** This project is necessary to maximize the effectiveness of two existing fuelbreaks. Work should include removing regeneration, limbing, improving openings and reduction of the surface fuel load. The possibility of tying in these fuelbreaks to defensible spaces in order to create an anchor point to roads should also be reevaluated and if possible implemented.

I. **Thinning where necessary to conform to guidelines for shaded fuelbreaks along Antler, Peakview and Elk Ridge Roads.** **Priority level - Low**. Recommended to protect homes in the northwestern portion of Boulder Heights that could be easily cut off by ignitions occurring in the drainages along the road, but rated as low priority because of the relatively small number of homes involved.

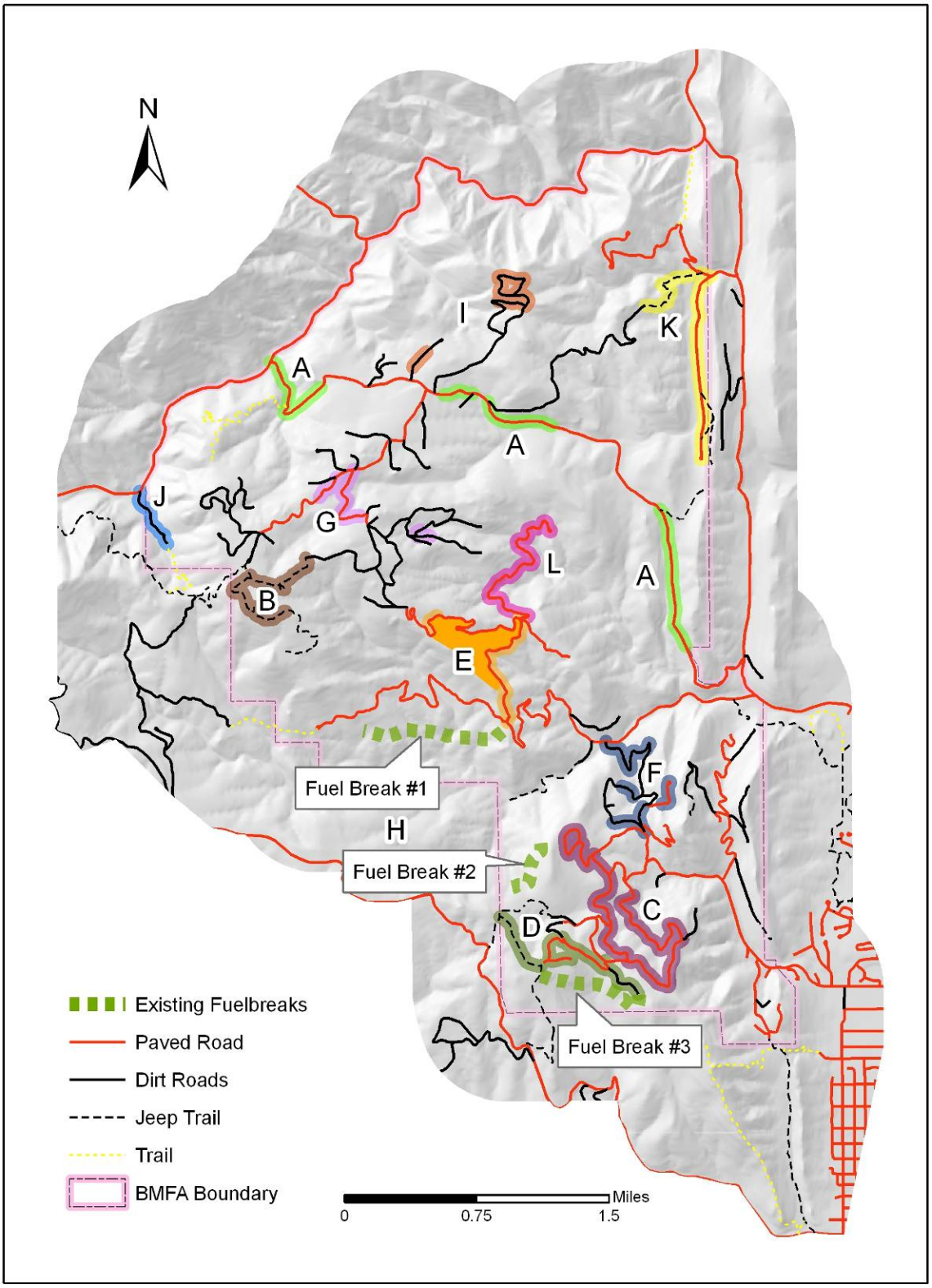
J. **Road improvements and thinning where necessary to conform to guidelines for shaded fuelbreaks along Glendale Gulch.** **Priority level - Low**. Glendale Gulch is the most hazardous community in the study area. Widening and surface improvement as well as extensive fuels reduction along the access road and driveways would be necessary to protect firefighters and residents in the event of an ignition it this area. Turnarounds for apparatus are also necessary, and all of the homes in the community would need extended defensible space to make any defense practical. This project has been rated as low priority due to the small number of homes that would be protected by what would be a considerable resource commitment.

K. **Thinning where necessary to conform to guidelines for shaded fuelbreaks along Valley Lane.** **Priority level - Low.** Valley Lane is a dead end road with a heavy continuous fuel load on both sides. This project has been rated as low priority, because like Glendale Gulch, only a few homes would benefit from a large commitment of resources. Unlike Glendale Gulch, safety of the individual structures could be greatly improved simply with defensible space treatments.

L. **Thinning where necessary to conform to guidelines for shaded fuelbreaks along Cutter Road.** **Priority level - Low.** Cutter Road is a relatively steep dead end road with a heavy continuous fuel load on both sides. This project has been rated as low priority, because like Glendale Gulch, only a few homes would benefit from a large commitment of resources.

There are some communities in the study area that have a notable amount of standing dead trees. We recommend an annual insect and disease inventory of stands in these areas be conducted between October and May.

Figure 25. Large Scale Fuelbreaks



Current Projects

In order to protect the Boulder Mountain Fire Protection District (BMFPD) from the catastrophic effects of wildland fire it is necessary to outline a district-wide strategy for mitigation of fire hazards through tree thinning and fuel reduction. To date BMFPD has been very proactive with wildland fire mitigation efforts by providing mitigation services to homeowners; BMFPD provides a lower cost service than local area contractors. Additionally, BMFPD continues to inform area residents about the hazards of living in the wildland urban interface area. BMFPD's educational programs provide the homeowners with the knowledge and information needed in understanding how to reduce the danger to their lives and property from wildland fire. The objectives for the BMFPD mitigation program include:

- Encouraging individual homeowners to develop defensible space around their homes that facilitate an enhanced ability for BMFPD to protect their homes,
- Highlighting tree thinning outside the defensible space to facilitate forest health, and
- Performing community level projects like implementing shaded fuelbreaks in high hazard areas to protect the entire district.

BMFPD had 71 requests for defensible space inspections in 2005 and 51 in 2004. The mitigation department of BMPFD mitigated 65 defensible spaces in 2005 (approximately 86 acres) and completed 49 defensible space projects (approximately 61 acres) in 2004. The mitigation program provided chipping for 127 properties in 2005 and 110 in 2004. BMFPD uses the funds generated from these individual homeowner mitigation projects to obtain matching funds from grants to complete community level projects.

The community level projects completed to date include the following 3 shaded fuelbreaks and one clear cut:

- Sunshine Fuelbreak
- Ann U. White Fuelbreak (clear cut)
- Carriage Hills Road Evacuation Route Fuelbreak
- West Coach Fuelbreak

Community Level projects that are currently being performed include shaded fuelbreaks along:

- Timber Lane
- Bristlecone Way
- Cutter Road
- Camp Paul Hummel Evacuation Route Fuelbreak

Proposed community level projects include shaded fuelbreaks:

- Above Glendale Gulch
- Along Deer Trail Road
- Along Peakview and Antler

While all of these projects substantially improve the defensibility of individual neighborhoods, the defense of the entire fire district was not their focus. Since the defense of the entire fire district is the priority of BMFPD, it is now time to focus on intermeshing these individual projects to create a continuous fire break that extends along the entire western boundary of the District from

Lefthand Canyon to the north and Mount Sanitas to the south. Where possible, shaded fuelbreaks should be placed such that large tracks of unmitigated forest are on the opposite side from residences. Recommended project to achieve this goal include:

- Extending the Bristlecone Evacuation Route fuelbreak and add to the fuelbreak south of the Ann U. White open space park.
- Merging the existing fuelbreaks north and south of Ann U. White with a shaded fuelbreak on the eastern boundary to exclude this area from the rest of the district
- Creating a fuelbreak that extends from the Camp Paul Hummel to West Coach
- Extending the proposed fuelbreak above Glendale Gulch from Roxbury to Lee Hill Road.
- Creating a fuelbreak west of Peak View and Antler to Peak View Circle.

While there are substantial threats from large unmitigated areas within the district and potentially from the east, emphasis should be on placing shaded fuelbreaks along the western portion of the district because it is the predominant up wind direction and contains the highest potential fire threat. Once BMFPD has achieved the goal of securing the western boundary of the district with a continuous shaded fuelbreak, the emphasis should shift to eliminating large pockets of unmitigated forest within the district while maintaining all existing fuelbreaks.

Public Education Efforts FMU

The study area is experiencing continuing development. Increasing property values have resulted in recently constructed high-value residences mixed in with older residences, ranch properties and out-buildings. Although there have been significant public education efforts throughout the district for many years, there is likely to be a varied understanding among property owners of the intrinsic hazards associated with building in these areas. An approach to wildfire education that emphasizes safety and hazard mitigation on an individual property level should continue to be stressed, in addition to community and emergency services efforts at risk reduction. Combining community values, such as quality of life, property values, ecosystem protection and wildlife habitat preservation, with the hazard reduction message will increase the receptiveness of the public.

In 2005, several public meetings were conducted in response to the report generated by Anchor Point entitled *Wildland Urban Interface Community Vulnerability Analysis and Landscape Fuels Modifications Recommendations* (2005) including:

Neighborhood	Date	# of Attendees
North Pine Brook	May 5, 2005	16
West Boulder Heights	April 17, 2005	12
Glendale	April 4, 2005	18
Peak View	February 27, 2005	17
Carriage Hills and Cutter	February 17, 2005	14
North Cedar Brook	February 8, 2005	12
South Pine Brook Hills	February 3, 2005	25
South Cedar Brook	February 1, 2005	2
Lower Lee Hill Drive	February 22, 2005	4
Wagon Wheel Gap	February 24, 2005	9
Reed Ranch	February 23, 2005	11
East Boulder Heights	May 26, 2005	2

Other subjects covered at these meetings included the consolidation of Boulder Heights and Pine Brook Hills Fire Districts, new fire board members, and the wildfire information booklet that was handed out or delivered to each resident.

In addition to these public meetings, the "On Fire" newsletter, containing information on the wildfire mitigation program, was delivered to all residents of the district. Please see the referenced web page to view the entire document.

http://www.bouldermountainfire.org/OnFireSpring05.pdf

The BMFPD web site is http://www.bouldermountainfire.org and has a great deal of information for citizens as well as a way to contact department members for any and all local information.

RECOMMENDATIONS

- Utilize these web sites for a list of public education materials, and for general homeowner education:
  - http://www.nwcg.gov/pms/pubs/pubs.htm
  - http://www.firewise.org
  - http://www.colostate.edu/Depts/CSFS/fire/interface.html
  - http://www.bouldermountainfire.org/

- Provide citizens with the findings of this study including:
  - Levels of risk and hazard.
  - Values of fuels reduction programs.
  - Consequences and results of inaction for planned and unplanned ignitions within the community.
- Create a Wildland Urban Interface citizen advisory council to provide peer level communications for the community. Too often, government agency advice can be construed as self-serving. Consequently, there is poor internalization of information by the citizens. The council should be used to:
  - Bring the concerns of the residents to the prioritization of mitigation actions.
  - Select demonstration sites.
  - Assist with grant applications and awards.

Fire Department Capabilities

Boulder Mountain Fire Protection District provides fire suppression services for the study area. The department has three fire stations.

BMFPD Vehicles

Station 1 (Pinebrook Hills)

4301 - **Attack Pumper**
500 gal, 1250 gpm, 4WD, Foam

4321 - **Medical/Rescue**
500 gal, 250 gpm, 4WD, Foam

4331 - **Wildland**
200 gal, 250 gpm, 4WD, Foam

4332 - **Wildland**
300 gal, 150 gpm, 4WD, Foam

4341 - **Tender**
1800 gal, 750 gpm, 4WD

4351 - **Command**

4352 – **Mitigation Truck**

Vermeer 10” Chipper

Station 2 (Boulder Heights)

4302 - **Attack Pumper**
1000 gal, 750 gpm, 4WD, Foam

4322 - **Medical/Rescue**
250 gal, 4WD, Foam
Pump Tutorial for this vehicle

4334 - **Wildland/Urban Interface**
1000 gal, 750 gpm, 4WD, Foam

4344 - **Tender**
1800 gal, 750 gpm, 4WD

Station 3 (Carriage Hills)

4303 - **Pumper/Tender**
1250 gal, 1000 gpm, 2WD, No foam

4304- **Pumper/Tender**
2000 gal, 1250 gpm, 2WD, No Foam

Training

All 37 of BMFPD's firefighters have NWCG (National Wildfire Coordinating Group) S-130/190 training (Basic Wildland Fire Fighter Training and Fire Behavior); two personnel are qualified as NWCG Engine Bosses; and, two others have advanced wildland fire training. The district sent five firefighters to the Colorado Great Planes Wildfire College in 2006 and nine in 2005.

RECOMMENDATIONS

- Training: Provide continuing education for all firefighters including:
  - NWCG S-130/190 for all new department members.
  - Annual wildland fire refresher and "pack testing" (physical standards test).
  - S-215 Fire Operations in the Urban Interface.
  - S-212 Wildfire Power Saws.
  - S-290 Intermediate Fire Behavior.
  - I-200 and I-300 – Basic and Intermediate ICS.

- Equipment:
  - Ensure that all apparatus are equipped with porta-tanks or pumpkins to assist in water supply.
  - Provide minimum wildland Personal Protective Equipment (PPE) for all firefighters.
    - (See NFPA Standard 1977 for requirements).
  - Provide gear bags for both wildland and bunker gear to be placed on engines responding to fire calls. This will help ensure that firefighters have both bunker gear and wildland PPE available when the fire situation changes.
  - Provide and maintain a ten-person wildland fire cache at each fire station in addition to the tools on the apparatus. The contents of the cache should be sufficient to outfit two squads for handline construction and direct fire attack. Recommended equipment would include:
    - Four cutting tools such as pulaskis or super pulaskis.
    - Six scraping tools such as shovels or combis.
    - Four smothering tools such as flappers.
    - Four backpack pumps with spare parts.
    - Two complete sawyer's kits including chainsaw, gas, oil, chaps, sawyer's hard hat, ear protection, files, file guides, spare chains and a spare parts kit.
    - MREs and water supplies sufficient for 48 hours.

GLOSSARY

The following definitions apply to terms used in the Boulder Mountain Fire Protection District Community Wildfire Protection Plan.

1 hour Timelag fuels: Grasses, litter and duff; <1/4 inch in diameter.

10 hour Timelag fuels: Twigs and small stems; ¼ inch to 1 inch in diameter.

100 hour Timelag fuels: Branches; 1 to 3 inches in diameter.

1000 hour Timelag fuels: Large stems and branches; >3 inches in diameter.

Active Crown Fire: a crown fire in which the entire fuel complex – all fuel strata – become involved, but the crowning phase remains dependent on heat released from the surface fuel strata for continued spread (also, a running crown fire or continuous crown fire).

ArcGIS 9.x: Geographic Information System (GIS) software designed to handle mapping data in a way that it can be analyzed, queried and displayed. ArcGIS is in its ninth major revision and is published by the Environmental Systems Research Institute (ESRI).

Crown Fire (Crowning): The movement of fire through the crowns of trees or shrubs more or less independently of the surface fire.

Defensible Space: An area around a structure where fuels and vegetation are modified, cleared or reduced to slow the spread of wildfire toward or from the structure. The design and distance of the defensible space is based on fuels, topography, and the design/materials used in the construction of the structure.

Extended Defensible Space (also known as Zone 3): A defensible space area where treatment is continued beyond the minimum boundary. This zone focuses on forest management with fuels reduction being a secondary consideration.

Fine Fuels: Fuels that are less than ¼ inch in diameter such as grass, leaves, draped pine needles, fern, tree moss, and some kinds of slash which, when dry, ignite readily and are consumed rapidly.

Fire Behavior Potential: The expected severity of a wildland fire expressed as the rate of spread, the level of crown fire activity, and flame length. Derived from fire behavior modeling programs utilizing the following inputs: fuels, canopy cover, historical weather averages, elevation, slope and aspect.

Fire Danger: Not used as a technical term in this document due to various and nebulous meanings that have been historically applied.

Fire Hazard: The likelihood and severity of Fire Outcomes (Fire Effects) that result in damage to people property and/or the environment. Derived from the Community Assessment and the Fire Behavior Potential.

Fire Mitigation: Any action designed to decrease the likelihood of an ignition, reduce Fire Behavior Potential, or to protect property from the impact of undesirable Fire Outcomes.

Fire Outcomes (aka Fire Effects): A description of the expected effects of a wildfire on people, property and/or the environment based on the Fire Behavior Potential and physical presence of Values-at-Risk. Outcomes can be desirable as well as undesirable.

Fire Risk: The probability that an ignition will occur in an area with potential for damaging effects to people, property and/or the environment. Risk is based primarily on historical ignitions data.

Flagged Addressing: A term describing the placement of multiple addresses on a single sign, servicing multiple structures located on a common access.

Flame Length: The distance between the flame tip and the midpoint of the flame depth at the base of the flame (generally the ground surface); an indicator of fire intensity.

FMU (Fire Management Unit): A method of prioritizing fire mitigation work efforts. Units may be functional or geographic.

Fuelbreak: A natural or constructed discontinuity in a fuel profile utilized to isolate, stop, or reduce the spread of fire. Fuelbreaks may also make retardant lines more effective and serve as control lines for fire suppression actions. Fuelbreaks in the WUI are designed to limit the spread and intensity of crown fire activity.

Jackpot Fuels: a large concentration of fuels in a given area such as a slash pile.

Passive Crown Fire: a crown fire in which individual or small groups of trees torch out (candle), but solid flaming in the canopy fuels cannot be maintained except for short periods.

Slash: Debris left after logging, pruning, thinning or brush cutting; includes logs, chips, bark, branches, stumps and broken understory trees or brush.

Spotting: Behavior of a fire producing sparks or embers that are carried by the wind and start new fires beyond the zone of direct ignition by the main fire.

Structural triage: the process of identifying, sorting and committing resources to a specific structure.

Surface fire: a fire that burns on the surface litter, debris, and small vegetation on the ground.

Timelag: Time needed under specified conditions for a fuel particle to lose about 63 percent of the difference between its initial moisture content and its equilibrium moisture content.

Values-at-Risk: People, property and ecological elements within the project area which are susceptible to damage from undesirable fire outcomes.

WHR (Community Wildfire Hazard Rating - aka Community Assessment): A fifty-point scale analysis designed to identify factors that increase the potential and/or severity of undesirable fire outcomes in Wildland Urban Interface communities.

WUI (Wildland Urban Interface): The line, area or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

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