# BOULDER MOUNTAIN FIRE PROTECTION DISTRICT

Boulder, CO

2025

# Community Wildfire Protection Plan

# Boulder Mountain Fire Protection District Community Wildfire Protection Plan 2025

Prepared for Boulder Mountain Fire Protection District

1905 Linden Drive, Boulder, CO 80304

Prepared by Boulder Mountain Fire Protection District

with support from The Ember Alliance

The following community representatives and agencies have reviewed and support this 2025 Boulder Mountain Fire Protection District (BMFPD) Community Wildfire Protection Plan (CWPP).

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**Disclaimer**

This CWPP is a voluntary, recommended plan and imposes no obligation of the signatories. Executing this document in no way obligates Boulder Mountain Fire Protection District to take any action requiring the commitment of funds to accomplish the recommendations herein.

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# Abbreviations

| | |
|---|---|
| BMFPD | Boulder Mountain Fire Protection District |
| BP | Burn probability |
| CO-WRA | Colorado Wildfire Risk Assessment |
| CSFS | Colorado State Forest Service |
| CWPP | Community Wildfire Protection Plan |
| FIS | Fire intensity scale |
| HFRA | Healthy Forests Restoration Act |
| HOA | Homeowners association |
| IIBHS | Insurance Institute for Business & Home Safety |
| NFPA® | National Fire Protection Association |
| NWCG | National Wildfire Coordinating Group |
| PSAP | Public Safety Answering Point |
| USFS | United States Forest Service |
| WEA | Wireless Emergency Alert |
| WUI | Wildland-urban interface |

Definitions of the words and phrases used throughout this document can be found in the **Glossary** on page 115.

# 1. Introduction

## Purpose of and Need for a Community Wildfire Protection Plan

A community wildfire protection plan (CWPP) provides communities at risk of wildfire with a structured approach to assess local conditions and hazards, identify and prioritize mitigation projects, and enhance wildfire preparedness. Created in response to the Healthy Forests Restoration Act (HFRA) of 2003, CWPPs have become essential tools for communities in the wildland-urban interface (WUI) to plan for and address the complex risks associated with wildfire. This CWPP for Boulder Mountain Fire Protection District (BMFPD) was developed according to HFRA requirements and in alignment with Colorado State Forest Service (CSFS) standards.

Situated in Boulder County's foothills, BMFPD faces significant wildfire risk due to its rugged terrain, dense vegetation, and expanding population. Updating the district's 2006 CWPP reflects a proactive response to these growing hazards and the changing landscape of wildfire danger. This CWPP not only supports fire operations during wildfire events but also aids in securing grants for fuel mitigation projects, as many funding opportunities require an approved CWPP.

*Boulder Mountain Fire Protection District, west of Wonderland Lake.*

*Photo credit: Bob Olliver (BMFPD)*

The primary purpose of this CWPP is to guide BMFPD, land managers, residents, and community groups in prioritizing actions that make the district more resilient to wildfire. To accomplish this, the following objectives have been identified:

- Produce a CWPP based on a thorough analysis of local fuel conditions, wildfire probability, emergency evacuation, first responder ingress, and values at risk within the district.
- Establish an approximate level of wildfire risk across the study area.
- Provide a scientific assessment of potential fire behavior within BMFPD.
- Identify and quantify factors that help mitigate wildfire impacts on key values at risk, including homes, water supplies, and infrastructure.
- Determine and recommend prioritized actions for fuel reduction, structure hardening, and community education to enhance wildfire resilience across BMFPD.

By fostering a deeper understanding of wildfire risks and outlining targeted mitigation efforts, this CWPP empowers BMFPD and its stakeholders to take informed, strategic actions to protect lives, property, and the environment.

### Why is the CWPP relevant to me?

Becoming a fire adapted community that can safely coexist with wildland fire takes a concerted, ongoing effort by everyone who lives or owns property in the community and who protects or manages land in and around the community. Conditions in BMFPD share some risk factors common to past catastrophic wildfires across the country. This CWPP provides recommendations for how to prepare your family to safely evacuate during a wildfire. It also includes information about how to mitigate your home ignition zone to give your house a fighting chance at surviving wildfire and to protect the lives of firefighters engaged in protecting your community.

Work you do to reduce fire risk on your property can amplify the work that your neighbors do on theirs, resulting in greater protection for everyone. Removing trees from along roadways can increase the visibility of your property to firefighters, increase the accessibility of your property for fire engines, and reduce the chance that non-survivable conditions can develop and entrap residents and first responders during wildfires.

This CWPP is a call to action to do your part to continue making BMFPD a beautiful and safe community. Land management partners and BMFPD are here to support your individual efforts, and they are committed to taking action to reduce wildfire risk and increase emergency preparedness for the benefit of this amazing community.

## Community and Partner Engagement

A successful CWPP is based on collaboration and communication among a diverse set of stakeholders who all play a role in increasing wildfire awareness, preparedness, and hazard reduction. In developing this CWPP and its recommendations, BMFPD representatives engaged community residents, partners from across the district and neighboring areas, and local experts, which included:

### Boulder Mountain Fire Protection District Core Team

Julie Pitney, Primary Author, BMFPD
John Benson, Fire Chief, BMFPD
Mike Palamara, Wildland Division Chief, BMFPD
Maryanne Kurtinaitis, Community Representative
Greg Huckabee, Community Representative and BMFPD Firefighter
Mitchell Lamboeuf, Wildfire Mitigation Specialist, Boulder County
Ben Pfohl, Supervisory Forester, Boulder Field Office, Colorado State Forest Service

BMFPD and 11 federal, state, local, and private organizations, along with district residents, participated in this collaborative effort. BMFPD would like to thank and recognize these stakeholders:

### Stakeholders

Boulder County Fire Management
Boulder County Open Space
Boulder County Wildfire Partners
Boulder Mountain Fire Protection District
Carriage Hills HOA
City of Boulder Open Space
Colorado State Forest Service
Pine Brook Hills HOA
Pine Brook Water District
Reed Ranch HOA
Rembrandt HOA
Residents of Boulder Mountain Fire Protection District
United States Forest Service


### Acknowledgment

Through a partnership with The Ember Alliance, BMFPD utilized its CWPP template, adapting and expanding it to reflect the unique needs and priorities of BMFPD. We gratefully acknowledge The Ember Alliance's commitment to wildfire resilience and its invaluable resources in supporting our community's wildfire preparedness efforts.

# Accomplishments Since the 2006 CWPP

In 2006, BMFPD developed its first CWPP to better understand the risks and hazards that its fire protection district faced from wildfire events. Additionally, the process identified recommendations that could be taken to help lower these risks to residents and first responders. Since that time, BMFPD has successfully implemented a number of the initial 2006 CWPP recommendations.

## Wildfire Mitigation and Implementation Capacity Accomplishments:

- Completed hundreds of acres of fuel breaks throughout the district, both along roadways and within or adjacent to neighborhoods.
- Defensible space and home hardening implemented to hundreds of structures and accessory buildings within BMFPD.
- Strengthened relationships with partnering organizations including Boulder County, the City of Boulder, neighboring fire protection districts, the Colorado State Forest Service, and the United States Forest Service for the purposes of linking cross-jurisdictional fuels treatments.
- Expanded BMFPD's Wildfire Mitigation Program, which employed 23 paid members as of November 2024. Crew equipment was also expanded to include: 6 work trucks, 1 crew bus, 2 wheeled slash chippers, 2 tracked slash chippers, and 2 dump trailers.
- Increased wildfire mitigation financial assistance to district residents to include funding opportunities from the county, state, and federal levels.

## Fire Department Response Capacity Accomplishments:

- Upgraded and replaced old, outdated fire apparatus with new more modern and safer apparatus.
- Replaced all old, outdated handheld radios with new, state-of-the art radios in 2024 to enhance interoperability capabilities during emergency incident responses.
- Increased the number of emergency responders and increased the number of Colorado State certified structural firefighters, paramedics, emergency medical responders, and nationally qualified wildland firefighters. These certified and qualified members provide BMFPD and Boulder County with highly trained and competent responders.
- Designed, developed, and implemented emergency evacuation polygons. Notably, BMFPD was the first agency in Boulder County to do so, and because of this initial effort, the entire county now has emergency evacuation polygons.
- Completed construction of Station 2, a new fire-resistive fire station, in 2022. Station 2 provides enhanced response capabilities, a venue for community meetings, and a center for command and control capabilities during larger incidents. Station 2 is located at 50 Overlook Lane.
- Continued to build and support BMFPD's partnering agencies through incident response, association meetings, and training opportunities.

- Added 10 new 1,000-gallon fire suppression cisterns in the non-hydranted areas of BMFPD.
- Hired additional full-time employees to meet the growing demands of the district, including a wildland division chief, an executive administrator, crew supervisors, and mitigation crew members/firefighters/EMTs to respond to day-to-day incidents.
- Worked for years to increase BMFPD's working relationship with Pine Brook Water District. In the event of a working fire in Pine Brook Hills, water district personnel work closely with the incident command on supplying water.

## Public Education and Outreach Accomplishments:

- Added 5 public information officers to help BMFPD accomplish and increase its education, outreach, and information responsibilities.
- Educated hundreds of residents on the importance of wildfire mitigation, home hardening, emergency evacuation, and mountain living.
- Helped residents replace outdated and non-functioning smoke and carbon monoxide detectors, with support from the BMFPD Auxiliary.
- Trained multiple residents on the use of fire extinguishers to prevent a small fire from growing out of control.
- Encouraged hundreds of residents to install reflective address marker signs at their driveways.

*The 2024 Boulder Mountain Fire Mitigation Crew.*


*Photo credit: Bob Olliver (BMFPD)*

# 2. BMFPD Background

## Overview

Boulder Mountain Fire Protection District (BMFPD) is located in Boulder County, Colorado, on the northwest side of the City of Boulder. BMFPD covers approximately 11 square miles. It is bordered by Lefthand Fire Protection District to the north and northwest, Sunshine Fire Protection District to the southwest, Boulder Rural Fire Rescue to the south and east, and the Boulder Fire-Rescue Department to the east (**Figure 2-1**). Located within the Front Range of Colorado's Rocky Mountains, BMFPD's elevation ranges from 5,760 feet on the east to 7,840 feet on the west. Most of the district is considered to be in the lower and upper montane zones, with an elevation range of 5,500 to 9,200 feet (Addington et al., 2018). The dominant vegetation is ponderosa pine and dry mixed-conifer forests and woodlands. These consist primarily of overmature stands of mixed conifer (*Pinophyta*) and aspen *(Populus tremulodies)* and pure stands of ponderosa pine *(Pinus ponderosa)* and Douglas fir (*Pseudotsuga menziesii*) with timber litter or various species of mountain grasses in the understory. Forest stands are occasionally broken by short grass meadows and aspen trees. The canopy coverage within the study area ranges from savannah to dense forest. Various species of riparian shrubs exist in stringers and patches in the low-lying areas, particularly along stream corridors and in the drainages.

BMFPD encompasses a diverse range of properties and assets, all of which face varying levels of risk from wildfire. The district has a total of 2,219 parcels, including 1,024 residential homes, 57 vacant lots, and 27 agricultural lots, and a population of approximately 3,500. A majority of the approximately 1,024 homes within the district are primary residences, with a small number of second homes and short-term rentals. According to the March 2024 assessment report prepared by the Boulder County Assessor's Office, the total actual value of properties within the district stands at $1,634,221,101, with an assessed value of $137,388,938. This substantial economic value represents a significant risk in the event of a wildfire, with potential losses impacting not only property owners but the broader community as well.

BMFPD does not have any schools, commercial properties, or state historical sites, but it does include one camp and one religious retreat. In Boulder Heights, Camp Paul Hummel provides a summer camp for children. In Pine Brook Hills, the Star House is a religious retreat that holds regular events. Both of these establishments pose an evacuation concern in the event of a wildfire (**Figure 2-2**).

Land ownership within BMFPD varies, with the majority of the land being privately owned. It also includes properties owned by the City of Boulder, Boulder County, and federal agencies (**Figure 2-3**).

In addition to the homes themselves, the safety of residents and the viability of evacuation routes are crucial concerns. The median age of residents in BMFPD is 57.15 compared to 37.9 for the state of Colorado. In addition, 29.15% of BMFPD residents are 65 or older, compared to the statewide percentage of 16.1% (US Census Bureau, 2023). Demographics of the district make evacuation of residents a significant challenge for emergency personnel, including the additional challenge of responding quickly to those who need assistance evacuating.

Primary routes into and out of BMFPD are Linden Drive and Lee Hill Drive, which are both accessed off of Broadway Street in the City of Boulder. Valley Lane and Rembrandt Drive are both accessed from Olde Stage Road, which can be accessed from Lee Hill Drive or Lefthand Canyon Drive. The district also has a high number of one-way-in and one-way-out roads, meaning roads with only a

single lane available for both entering and exiting. Generally, roads in BMFPD are steep and curvy due to our diverse terrain characteristics. These roads can be a hazard in the event of a wildfire because they can become congested with residents evacuating and emergency responders and equipment trying to respond.

Protecting these assets requires not only fire mitigation efforts but also the ability to respond quickly and effectively during emergencies. The size and distribution of parcels throughout the district add complexity to these efforts, further highlighting the importance of proactive risk management.

Numerous communications towers and support buildings within BMFPD are considered to be critical infrastructure. There are two tower sites in the district. One is located on Bow Mountain and houses the BMF 1 repeater as well as antennas that television stations use to send signals to Denver when critical events are happening in Boulder. The other site is located on top of Lee Hill; this group of towers is much larger. These towers are used for public communications along the Front Range, including communications infrastructure for the Boulder County Sheriff's Office Communications Center.

The Pine Brook Water District is located on the south end of the district. The Water District provides critical drinking water to approximately 408 residents as well as water for firefighting capabilities. Protecting vital watersheds during and after a wildfire event is a key focus of BMFPD.

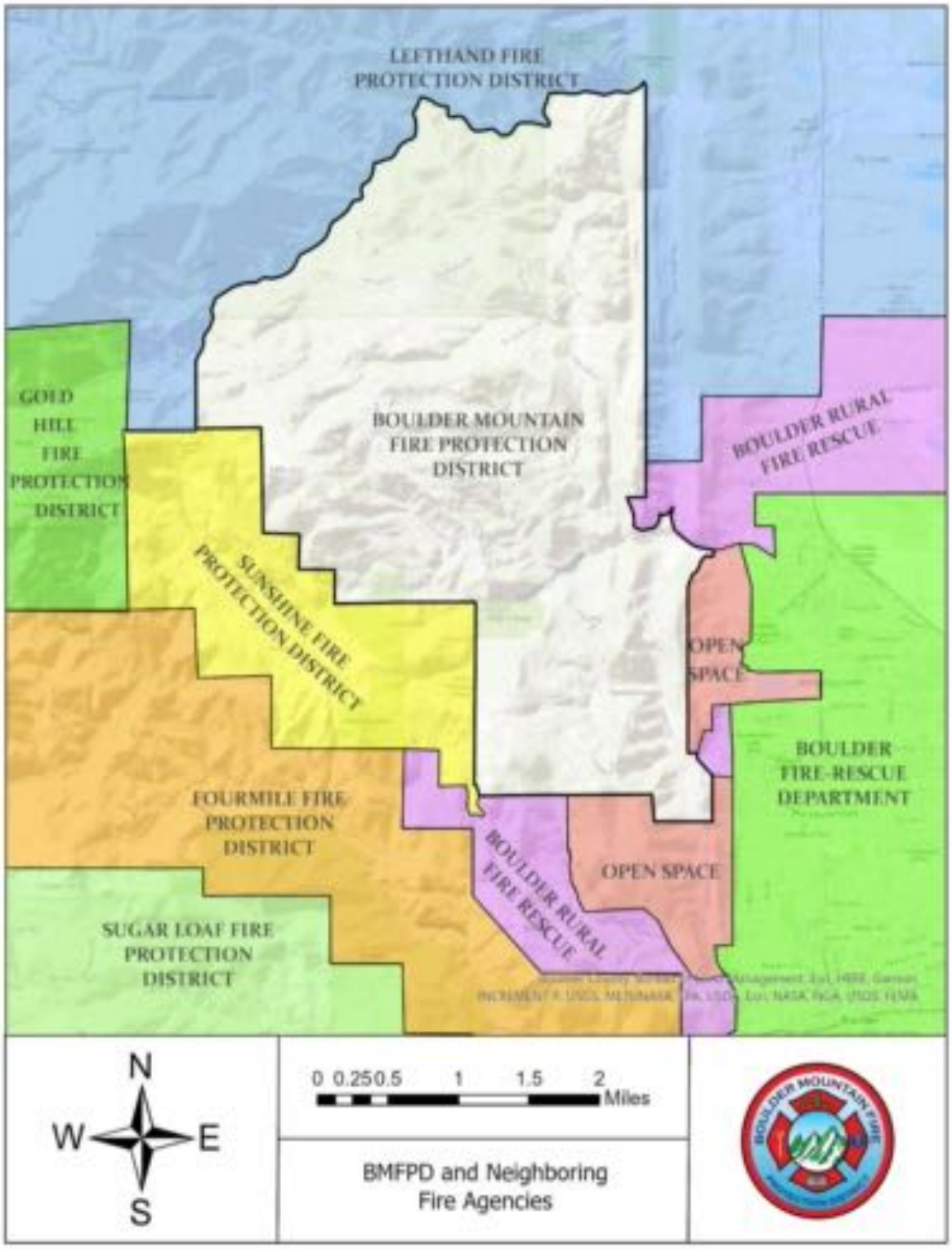
BMFPD has three fire stations located in the district (**Figure 2-2**).

| **Station 1** | **Station 2** | **Station 3** |
|---|---|---|
| 1905 Linden Drive<br>Boulder, CO 80304 | 50 Overlook Lane<br>Boulder, CO 80302 | 3128 Carriage Hills Drive<br>Boulder, CO 80302 |

*BMFPD's new Station 2, located in Boulder Heights, was completed in 2022.*

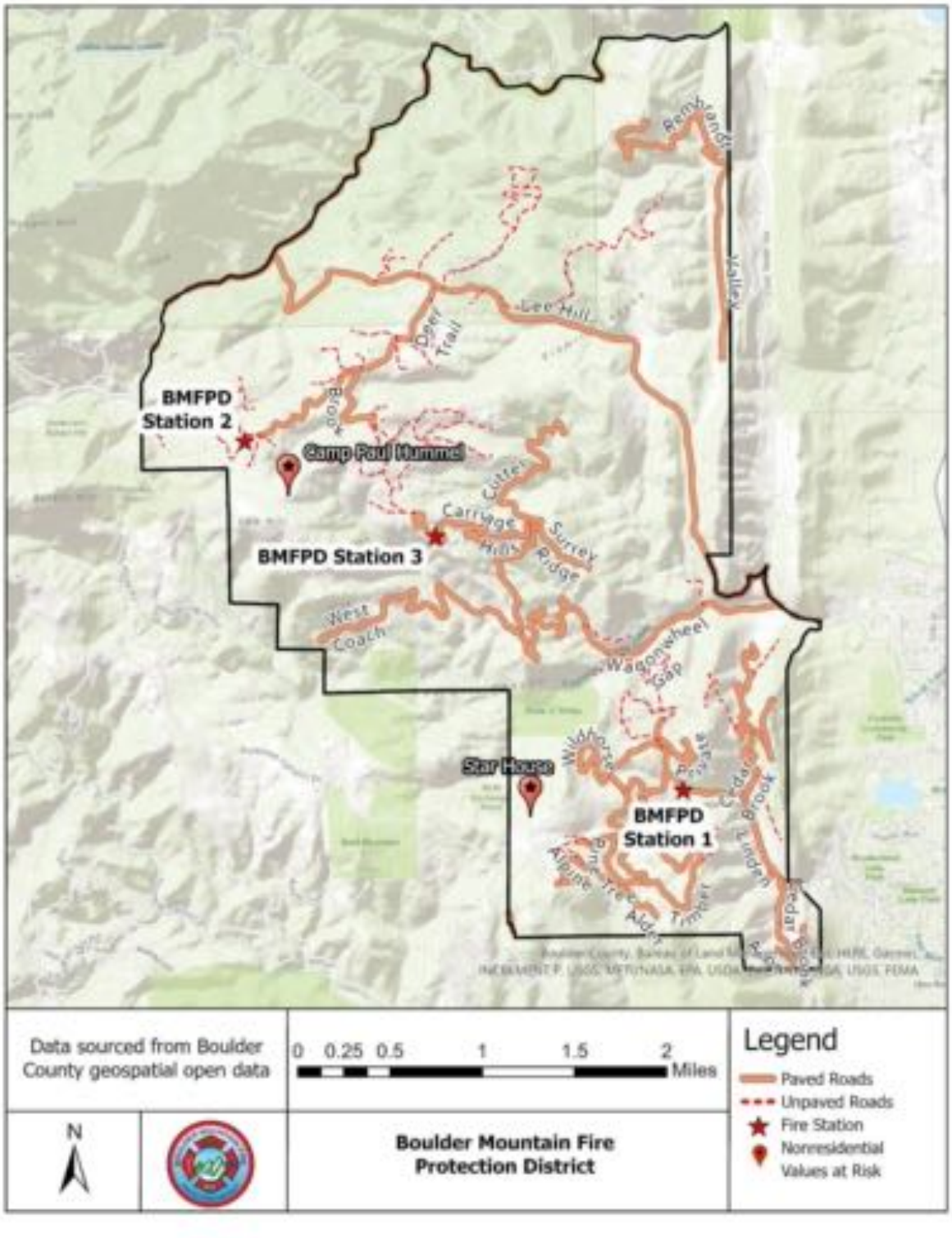
*Photo credit: Taylor Kohrs*

***Figure 2-1:*** *Boundary of BMFPD in Boulder County.*



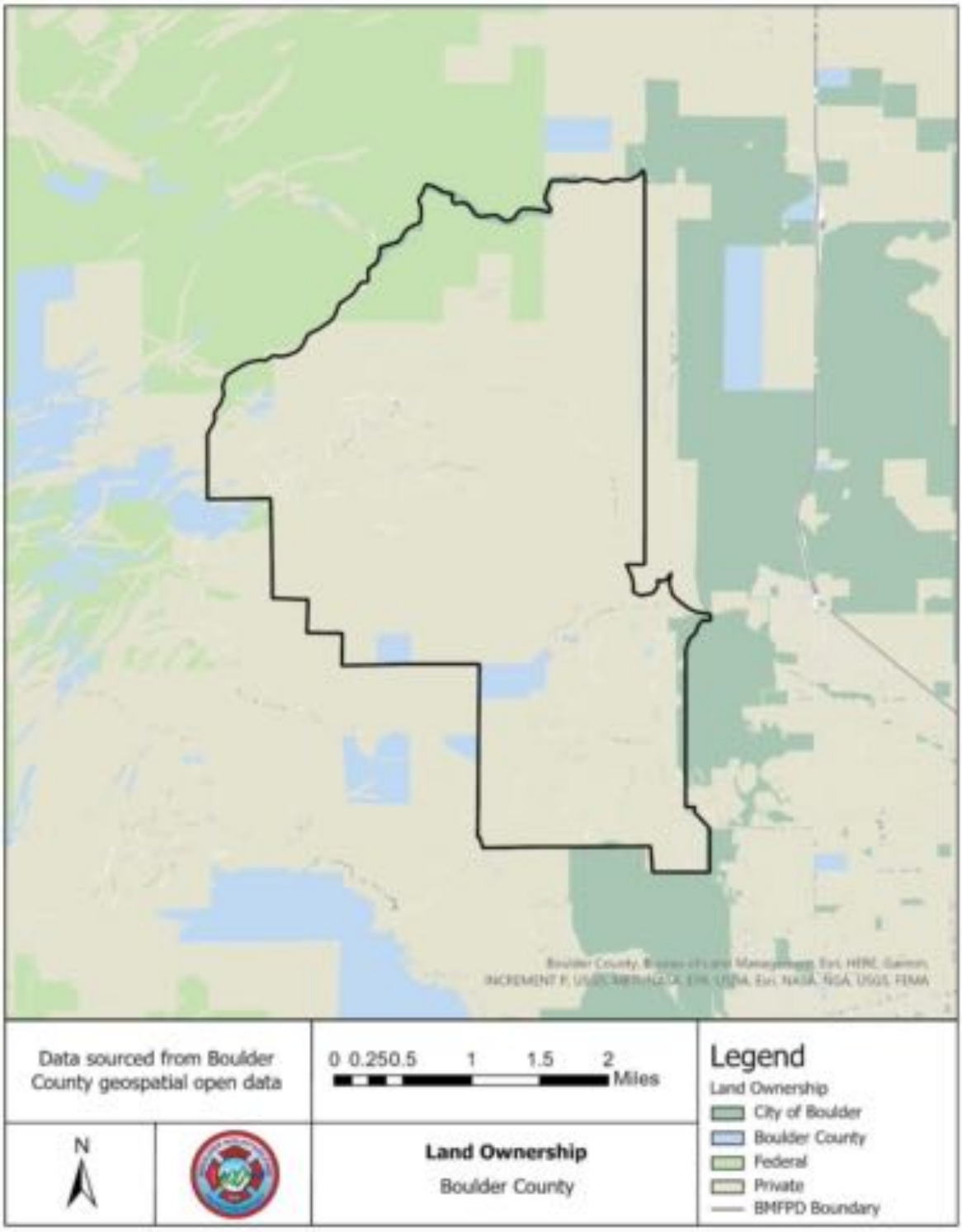

*Source: Created by BMFPD using Boulder County geospatial open data*

***Figure 2-2:*** *The BMFPD map showing the three fire stations and two nonresidential values at risk.*




*Source: Created by BMFPD using Boulder County geospatial open data*

***Figure 2-3:*** *Publicly and privately owned land in and around BMFPD.*




*Source: Created by BMFPD using Boulder County geospatial open data*

## BMFPD's Capacity

BMFPD responds to approximately 150 incidents a year, with call types breaking down roughly as follows: 50% medical, 15% smoke report/wildland fire, 10% automotive accidents, 5% structure fire, 5% search and rescue, 5% citizen assist, and 10% other.

In addition to in-district calls, the department responds to incidents on Boulder County Open Space lands in the Mt. Sanitas and Wonderland Lake areas, provides automatic and mutual aid support to other fire departments in the county, and works on wildland fires across the nation. BMFPD has automatic aid agreements for both wildland and structure fires with Lefthand Fire Protection District, Sunshine Fire Protection District, Boulder Rural Fire Rescue, and Boulder Emergency Squad. BMFPD also has mutual aid agreements for wildland and structure fire response with the Boulder County Sheriff's Office, Lyons Fire Protection District, Fourmile Fire Protection District, Sugarloaf Fire Protection District, Nederland Fire Protection District, Coal Creek Fire Canyon Fire Protection District, Jamestown Fire Protection District, and the United States Forest Service to ensure a coordinated response to emergency incidents.

BMFPD has both paid and volunteer first responders who possess wildland fire, structure fire, and medical qualifications and who respond to incidents together. In 2024, BMFPD's paid staff included 1 fire chief and the following BMFPD wildfire mitigation crew positions: 1 wildland division chief, 1 executive administrator, 1 crew foreman, 1 crew operations specialist, 3 crew supervisors, 4 lead crew members, and 11 crew members. BMFPD had 34 volunteer firefighters in 2024.

BMFPD also has several other volunteer groups that support the department, namely the Auxiliary, the Major Incident Support Team, and the Scene Support Team.

*BMFPD firefighters at the Lakeshore Fire in Boulder County in 2024.*

*Photo credit: Bob Olliver (BMFPD)*

## Apparatus Response and Fire Station Capabilities

BMFPD Station 1 apparatus located at 1905 Linden Drive:

- Type 1 4x4 structure engine
- Type 6 wildland engine
- 2,000-gallon tactical tender
- Type 6 medical/rescue engine

BMFPD Station 2 apparatus located at 50 Overlook Lane:

- Type 1 4x4 structure engine
- Type 3 wildland/urban interface engine
- 1,600-gallon 4x4 support tender
- Type 6 wildland engine
- Type 6 medical/rescue engine

BMFPD Station 3 apparatus located at 2138 Carriage Hills Drive:

- Type 1 4x4 structural engine
- 1,600-gallon 4x4 support tender

*BMFPD's structure engine 4301, located at Station 1.*


*Photo credit: Bob Olliver (BMFPD)*

# Outreach and Education

BMFPD has significantly expanded outreach and education efforts both within and beyond district boundaries. Recognizing the importance of fostering collaboration, BMFPD actively engages residents and external stakeholders alike through community safety events, HOA meetings, one-on-one sessions, and online resources. Outreach and education efforts include the following:

- Attended block parties in Pine Brook Hills to discuss wildfire dangers, the impact of wildfire mitigation on home safety, and the benefits of home hardening.
- Participated in Fire Safety Sales and education seminars hosted by the BMFPD Auxiliary, presenting information about homeowners insurance and providing critical information to new residents about home hardening and wildfire mitigation for improved community safety.
- Provided fire safety education, including equipment demonstrations, for schools and day-care centers upon request.
- Attended Pine Brook Hills HOA meetings to share information about homeowner grant opportunities and community fire safety practices.

*Community Safety Fair (2024)*

*Photo credit: John Benson (BMFPD)*

- Provided over 200 free wildfire mitigation and defensible space site visits and evaluations in 2023. These visits were conducted by touring the property with the landowner.
- Engaged with Carriage Hills community gatherings to discuss fire safety along roads and home protection strategies.
- Educated Larimer County Conservation Corps crews on wildfire preparedness and career paths in firefighting during multiple training sessions.
- Disseminated timely emergency updates and educational materials about red flag warnings, burn restrictions, general fire safety, and weather conditions through dedicated public information officers.
- Offered complimentary home safety assessments, including wildland fire safety and smoke/carbon monoxide alarm guidance, with battery replacements available on request.
- Assisted residents with setting up emergency alert accounts through home visits and in-station support.
- Engaged residents informally in the community to address questions and provide guidance on fire safety topics.

BMFPD remains dedicated to continuous education and support, helping residents stay informed and prepared through proactive engagement in both formal and everyday settings.

## Firewise Community

A Firewise community is a community that meets a set of voluntary criteria on an annual basis and retains an "In Good Standing Status." The Firewise USA program is administered by the National Fire Protection Association (NFPA®) and is co-sponsored by the United States Forest Service and the National Association of State Foresters. While the NFPA administers this program, individuals and communities participate on a voluntary basis.

Some areas within BMFPD have been designated as a firewise community. As of 2024, Carriage Hills has been a firewise community since February of 2021. As of 2025, Pine Brook Hills has been a firewise community since June of 2022. This is a great foundation to build on for planning community outreach and education events.

## Considerations for Vulnerable Populations

Social factors play a critical role in determining how individuals and communities are impacted by wildfire, a concept known as social vulnerability. This vulnerability is often a result of limited access to vital resources such as infrastructure, social support, healthcare, and financial stability (Cutter et al., 2003). Although BMFPD has made significant strides in wildfire preparedness through its Community Wildfire Protection Plan (CWPP), certain populations may struggle to engage fully in mitigation and preparation efforts. These vulnerable populations face heightened risks in the event of a wildfire.

BMFPD's population has a median age of 57.15 compared to the state median of 37.9. Additionally, 29.15% of district residents are 65 or older, nearly double the statewide percentage of 16.1% (US Census Bureau, 2023). This presents unique challenges for emergency response and evacuation efforts because older residents may require additional assistance during an emergency. Residents may also have physical limitations or lack the resources necessary to implement mitigation measures around their homes, further increasing their vulnerability. Indeed, 31% of residents who responded to the BMFPD community survey stated they are not physically able to complete the mitigation work needed on their home. See **Appendix B** on page 126 for complete BMFPD community survey results.

Another factor contributing to social vulnerability in BMFPD is the presence of residents who speak languages other than English at home. Approximately 11.55% of the district's population falls into this category, which can present communication barriers during emergency situations. Although this percentage is lower than the statewide average of 16%, it still highlights the need for inclusive communication strategies that ensure all residents, regardless of language ability, receive critical information during wildfire events.

To address these vulnerabilities, it is essential that BMFPD continues to prioritize the needs of socially vulnerable populations within the CWPP. This includes ensuring access to resources, providing targeted support for older adults and non-English speakers, and fostering a community-wide approach to wildfire preparedness that leaves no one behind.

### *Pre-fire*

Before a fire, it is important to ensure that preparation and potential evacuation communication materials are available in other languages spoken in BMFPD. Sole use of English in materials makes it difficult for people with lower proficiency in English to understand. This includes children, people with low literacy, and people who primarily speak other languages. Materials that use images and diagrams rather than words can make sure the broadest audience can understand any materials that BMFPD distributes about wildfire.

Another major barrier is the ability to do the work recommended in this plan. Populations that may be impacted by this include those in lower income brackets who do not have the resources to harden their homes (i.e., by replacing their roofs, siding, and decks with noncombustible construction materials) and those with physical disabilities or impairments that keep them from doing the physical labor often involved in preparation and mitigation actions themselves. A CWPP is a great way to begin addressing economic disparity because it can provide a basis for BMFPD to apply for grant funding to support mitigation work on behalf of the community.

To truly reduce the economic barrier at a community level, community leaders must design programs that are accessible for all income brackets. For example, providing mitigation services such as a community chipping program that is free for residents who fall within lower income brackets can encourage those residents to mitigate their properties when they may have otherwise found it inaccessible. Similarly, volunteer days can help those who are not physically able to engage in pre-fire protection of their home by connecting physically able community members with them to help do home hardening work.

### *Post-fire*

Following a fire, households are often solely responsible for their own recovery. While challenging for everyone, this is a particular issue for those without equal access to the social aid that is available, such as Federal Emergency Management Agency recovery funds, information on the internet, and claims for insurance (Laska and Morrow, 2006; Méndez et al., 2020). Groups impacted by this can include older adults, undocumented individuals, and those who speak English as a second language or not at all.

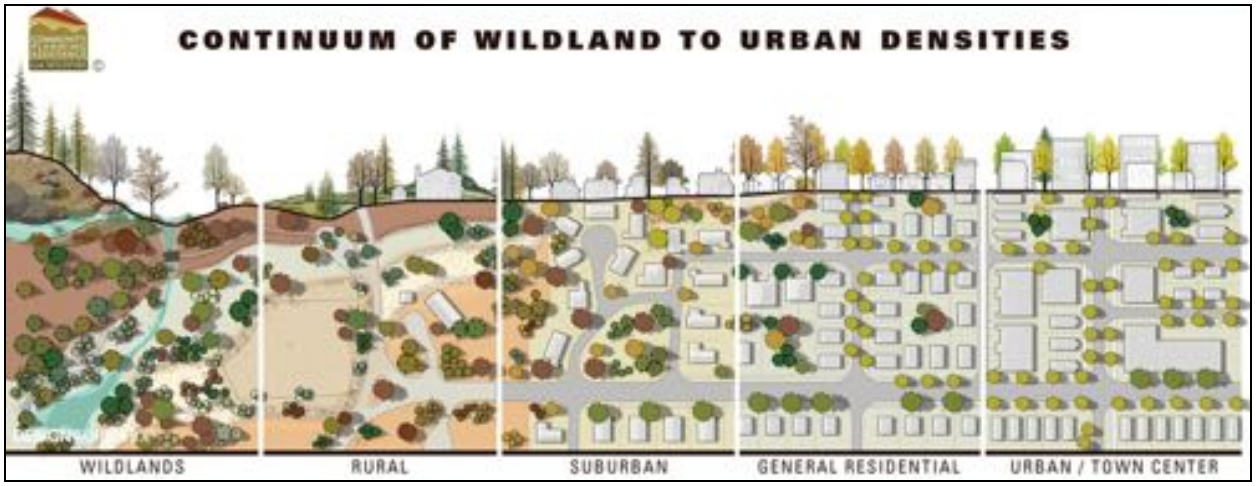
Although planning for post-fire is less of a focus of this CWPP, it is worth mentioning that community ties are as important after a fire as they are in trying to reduce the impact of potential fire. Communities that consider ahead of time who will need the most assistance after a fire are better able to get those folks the help they need quickly.

## Wildland-Urban Interface

The wildland-urban interface (WUI) is any area where the built environment meets wildfire-prone areas—places where wildland fire can move between natural vegetation and the built environment and result in negative impacts on the community (Forge, 2018). During the past few decades, the population in the interface has increased. People who live and work in the WUI must be aware of the effect that ecosystem processes and disturbances, such as wildland fire, have on their lives. WUI exists along a continuum of wildland to urban densities (**Figure 2-4**). Wildland-urban intermix refers to areas where housing and wildland vegetation intermingle, whereas WUI refers to areas where housing is in the vicinity of a large area of dense wildland vegetation (Martinuzzi et al., 2015).

The cost of destruction in the WUI due to wildfires is substantial, encompassing billions of dollars annually in the United States alone. This includes property damage, firefighting expenditures, and associated economic losses. The proximity of human development to flammable wildland vegetation in the WUI exacerbates the risk and potential damage from wildfires. Efforts to mitigate this risk through improved land use planning, vegetation management, and community preparedness are crucial in reducing the economic impact of wildfires in these areas. Despite these efforts, the cost of destruction in the WUI underscores the ongoing need for effective wildfire management strategies to safeguard lives, property, and the environment.

***Figure 2-4:*** *The wildland-urban interface exists along a continuum of wildland to urban densities.*




*Source: Community Planning Assistance for Wildfire*

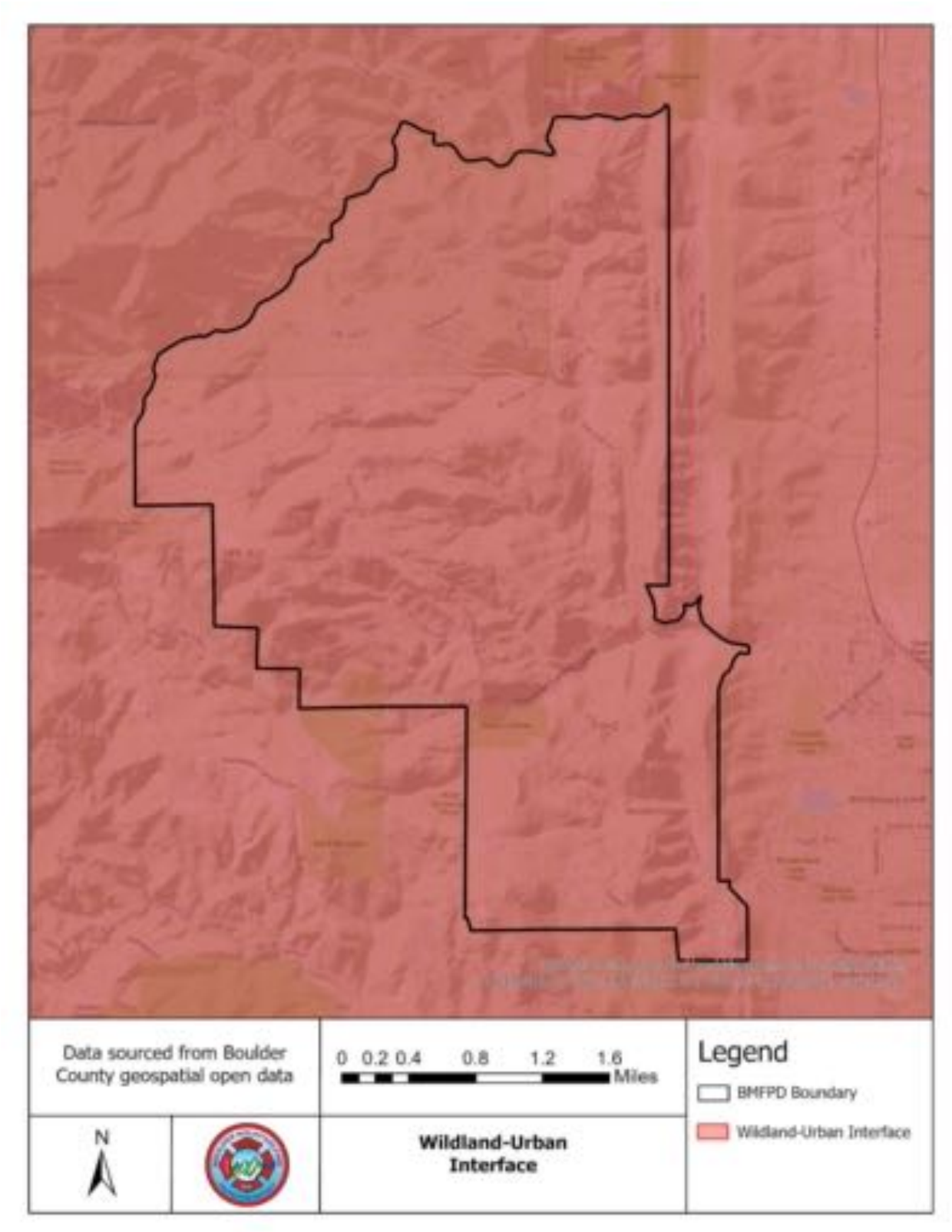
The WUI in BMFPD contains a mix of vegetation types, including grasslands, shrubs, and forests, which can serve as fuel for wildfires. The presence of dense vegetation and accumulation of dead or dry fuels can increase the likelihood of wildfires spreading into residential areas. The rugged terrain and steep slopes in BMFPD can influence wildfire behavior, with fire spreading more rapidly uphill and across canyons. These topographic features can also pose challenges for firefighting efforts and evacuation routes. Residents in BMFPD are aware of the wildfire risk and have engaged in mitigation activities such as creating defensible space around homes, hardening structures against ember intrusion, and participating in community wildfire preparedness initiatives. Overall, the WUI in BMFPD presents both challenges and opportunities for wildfire management, community resilience, and landscape conservation. Effective collaboration, proactive mitigation measures, and

public awareness are essential for reducing wildfire risk and promoting the safety and sustainability of communities in the WUI.

## Defining the Wildland-Urban Interface

For the purpose of this CWPP, the WUI is defined using the Colorado Wildfire Risk Assessment (CO-WRA) definition: "The WUI is described as the area where structures and other human improvements meet and intermingle with undeveloped wildland or vegetative fuels" (CO-WRA 2022). Using this definition, it is estimated that 2,561 people or 100% of the BMFPD population lives within the WUI. The WUI boundary includes all of BMFPD, the surrounding landscape that could transmit wildland fire into BMFPD, and the areas along important evacuation routes (**Figure 2-5**). Strategic wildfire mitigation across the WUI can increase the safety of residents and wildland firefighters and can reduce the chances of home loss.

***Figure 2-5:*** *The WUI boundary includes all of BMFPD, the surrounding landscape that could transmit wildland fire into BMFPD, and the areas along important evacuation routes.*




*Source: Created by BMFPD using Boulder County geospatial open data*

# Fire History

Boulder County has a long history of wildfire events, with some particularly devastating incidents happening in the past 15 years (**Figure 2-6**). Each of these fires presented its own challenges, and provided first responders with valuable lessons in terms of fire behavior, emergency response, and preparedness.

## Recent Large Fires in Boulder County

### *Fourmile Canyon Fire (2010)*

This wildfire started on September 6, 2010, in Fourmile Canyon west of Boulder. It burned over 6,000 acres and destroyed 169 homes, making it the most destructive wildfire in Colorado history at the time. The fire highlighted the challenges of rapid evacuations in steep terrain and the necessity for pre-established defensible space around homes. One lesson from this fire was the need for better communication among fire agencies and residents during fast-moving events.

*Fourmile Canyon Fire (2010)*

*Photo credit: Bob Olliver (BMFPD)*

### *Cal-Wood Fire (2020)*

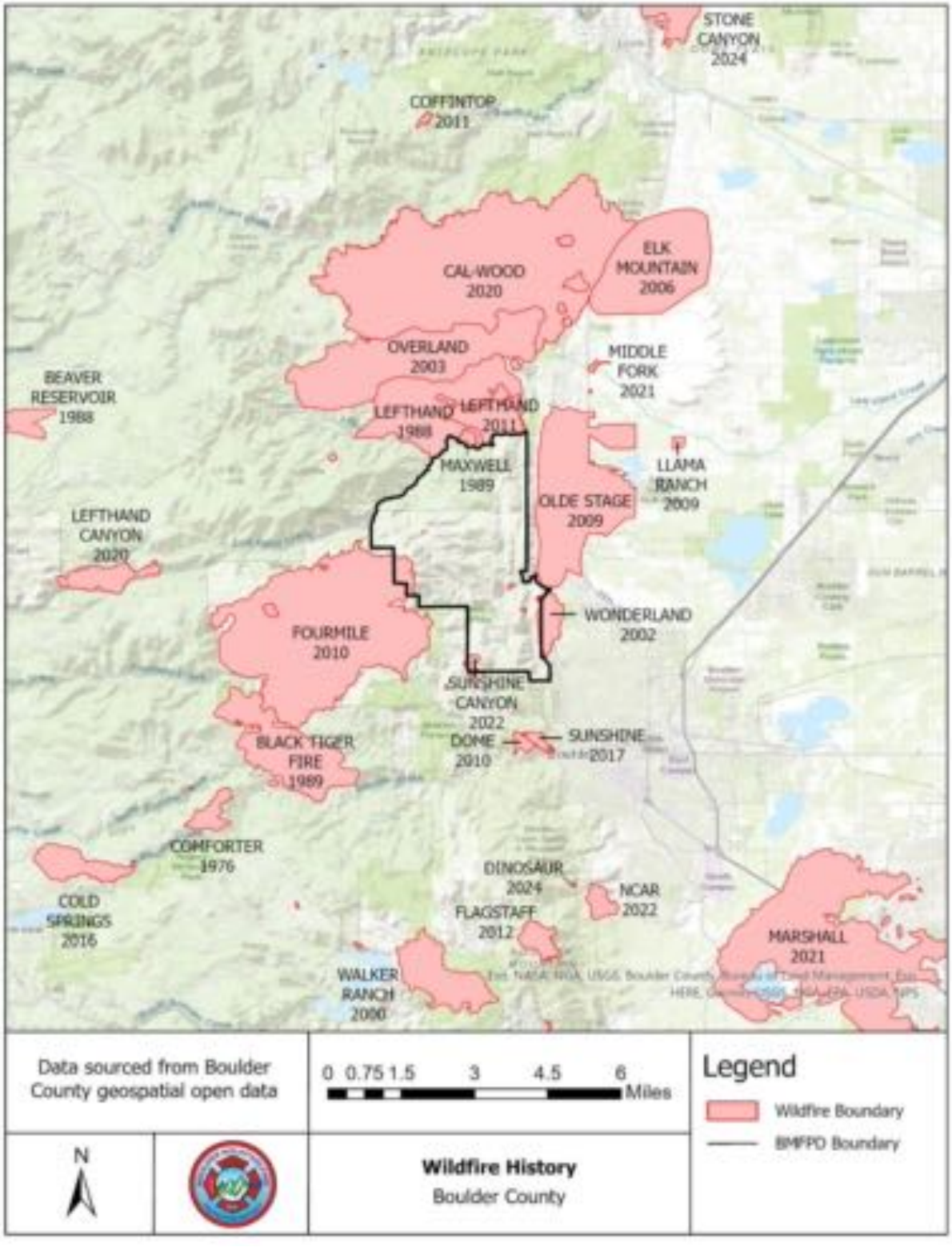
The Cal-Wood Fire started in October 2020 and burned over 10,000 acres northwest of Boulder. It was one of the largest wildfires in Boulder County history. The fire's rapid growth due to dry conditions, combined with wind gusts, demonstrated how extreme weather can lead to unpredictable fire behavior, even late in the season. This fire reinforced the importance of creating evacuation plans and building with fire-resistant materials.

### *Marshall Fire (2021)*

The Marshall Fire, which ignited on December 30, 2021, just south of Boulder, became the most destructive fire in Colorado's history. Burning in the middle of winter, the fire was fueled by strong winds, which spread flames rapidly through suburban neighborhoods in Boulder County. In just a matter of hours, the fire forced the evacuation of tens of thousands of residents and destroyed 1,084 homes and businesses.

What made the Marshall Fire particularly devastating was not only its timing—occurring during winter, when wildfire risk has historically been thought of as low—but also the densely populated areas it affected. Unlike many wildfires in the region that burn through forested or mountainous terrain, the Marshall Fire spread through grasslands and into suburban developments that had previously not been the subject of exhaustive wildfire modeling. This underscored the vulnerability of suburban neighborhoods to fast-moving wildfires, even when those neighborhoods are distant from forests. The Marshall Fire stands as a stark reminder of how destructive wildfires can be, even in urban settings, and the need for increased fire resilience in residential areas across Boulder County.

***Figure 2-6:*** *Boulder County wildfire history.*




*Source: Created by BMFPD using Boulder County geospatial open data*

## Fires within BMFPD

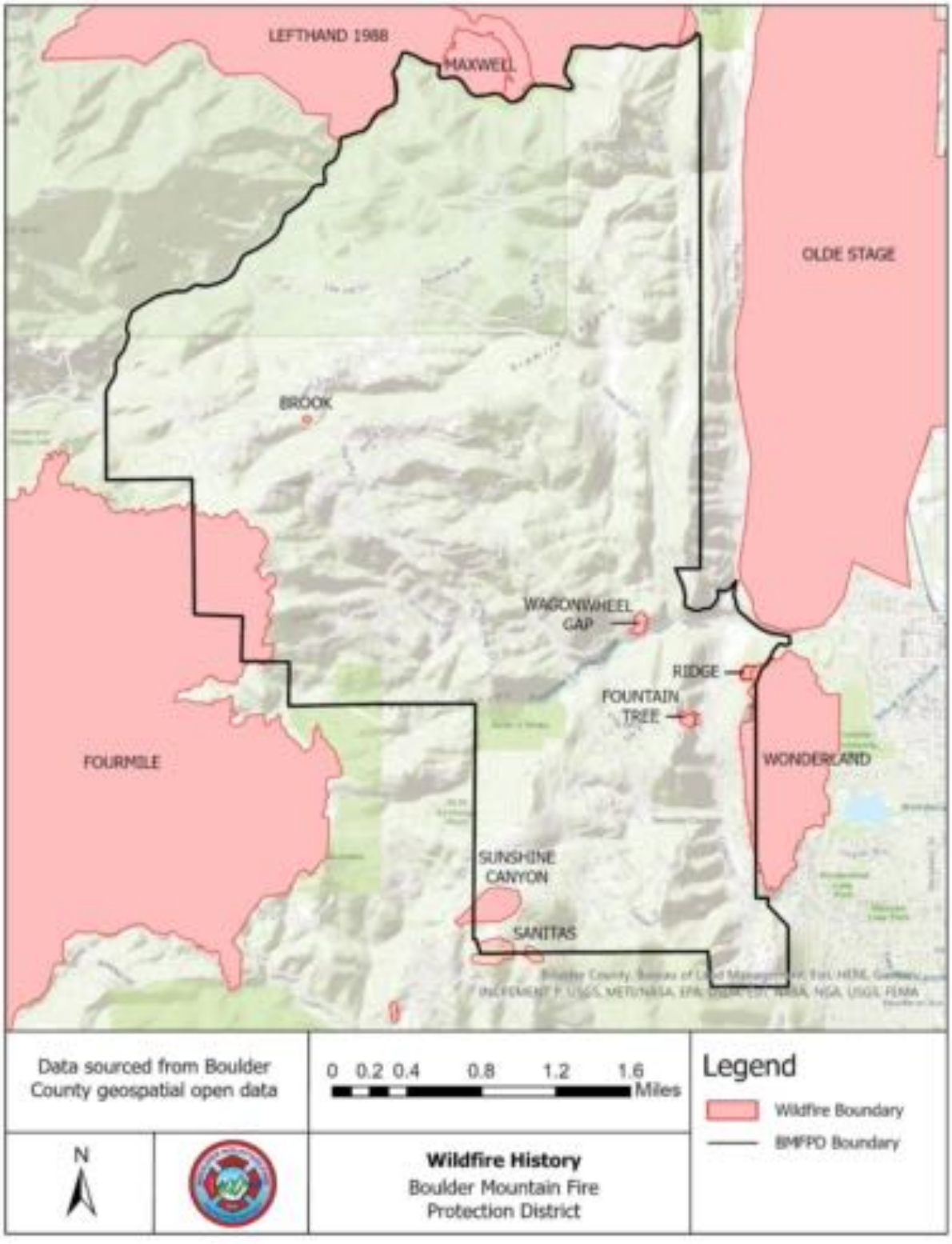
Numerous wildfires have occurred within BMFPD's boundaries (**Figure 2-7**). Some of the more notable of these include the Olde Stage Fires (1990 and 2009), Wagonwheel Gap Fire (2017), Ridge Fire (2019), and Sanitas Fire (2022). BMFPD has responded to fires within the district during every month of the year, and each incident possessed the potential to become a large-scale event.

Between 2014 and 2024, BMFPD responded to 9 wildfires less than a ½ acre in size, 1 wildfire ½ to 1 acre in size, 3 wildland fires between 1 and 5 acres in size, 1 wildland fire greater than 5 acres in size, and 13 illegal campfires.

*Photos from the Fourmile Canyon Fire (2010).*

*Photo credit: Bob Olliver (BMFPD)*

***Figure 2-7:*** *Wildfire history within BMFPD's boundary.*




*Source: Created by BMFPD using Boulder County geospatial open data*

# Potential Fire Behavior and Exposure in BMFPD

Many neighborhoods within BMFPD are at risk of experiencing extreme fire behavior that threatens the lives of residents, visitors, and firefighters. This is due to a combination of steep slopes, dense forests, limited road access, and highly flammable buildings. The situation is further exacerbated by the community's unique topography and weather patterns, which create a need for immediate and proactive measures to mitigate wildfire risk.

## Influence of Local Topography and Weather on Fire Behavior

The steep slopes in BMFPD can increase the intensity and spread of fires. Fire moves uphill rapidly, and in areas with slopes exceeding 60%, fire spread can double in speed. The combination of slope and dense forest fuels allows fire to grow in size quickly, creating the potential for dangerous fire behavior. Additionally, the region's predominant winds, especially during dry, warm periods, can carry embers over long distances, creating spot fires well ahead of the fire front. Seasonal variations in wind direction and speed further complicate containment efforts.

## Changing Fire Behavior and Seasonality

Over the past decade, fire behavior and seasonality in Boulder County and BMFPD have evolved dramatically. Historically, the primary fire season was confined to the late summer and early fall months. However, as evidenced by fires like the Olde Stage Fire, the Sanitas Fire, and the Marshall Fire, wildfires are now occurring during traditionally "safe" periods such as late fall and even winter.

Factors contributing to this shift include prolonged droughts, higher temperatures, and more erratic wind patterns. Additionally, the increasing prevalence of wind-driven fires in the region has caused fires to spread faster and behave more unpredictably. This evolving dynamic requires a shift in both community preparedness and firefighting strategies. Communities must prepare for year-round fires, and firefighting agencies need to adjust tactics to account for unexpected fire behavior and for fires outside of the traditional wildfire season.

## Fuel Characteristics and Potential Fire Behavior

During both moderate and severe fire conditions, the area's fuel types—ranging from dense forests to grassy meadows—play a critical role in fire behavior (**Figure 2-8**). The two most prevalent types of vegetation within BMFPD are ponderosa pine and mixed conifer (**Figure 2-9**).

- **Dense Forests:** Many neighborhoods are surrounded by dense ponderosa pine forests, which can experience active crown fires during severe weather conditions. Active crown fires, where flames move through the canopy, are particularly dangerous because they are difficult to control and often spread rapidly.
- **Grassy Areas:** The region also has significant areas of open grassland. These areas are prone to fast-moving surface fires, especially when combined with strong winds. Although these fires may not have the same intensity as crown fires, they can spread quickly and endanger nearby homes and infrastructure.
- **Home-to-Home Ignitions:** In neighborhoods where homes are closely spaced, embers carried by wind can ignite nearby structures, leading to home-to-home ignitions. Flammable building materials further contribute to this risk, and homes that catch fire may produce strong radiant heat and powerful flames that intensify the wildfire.

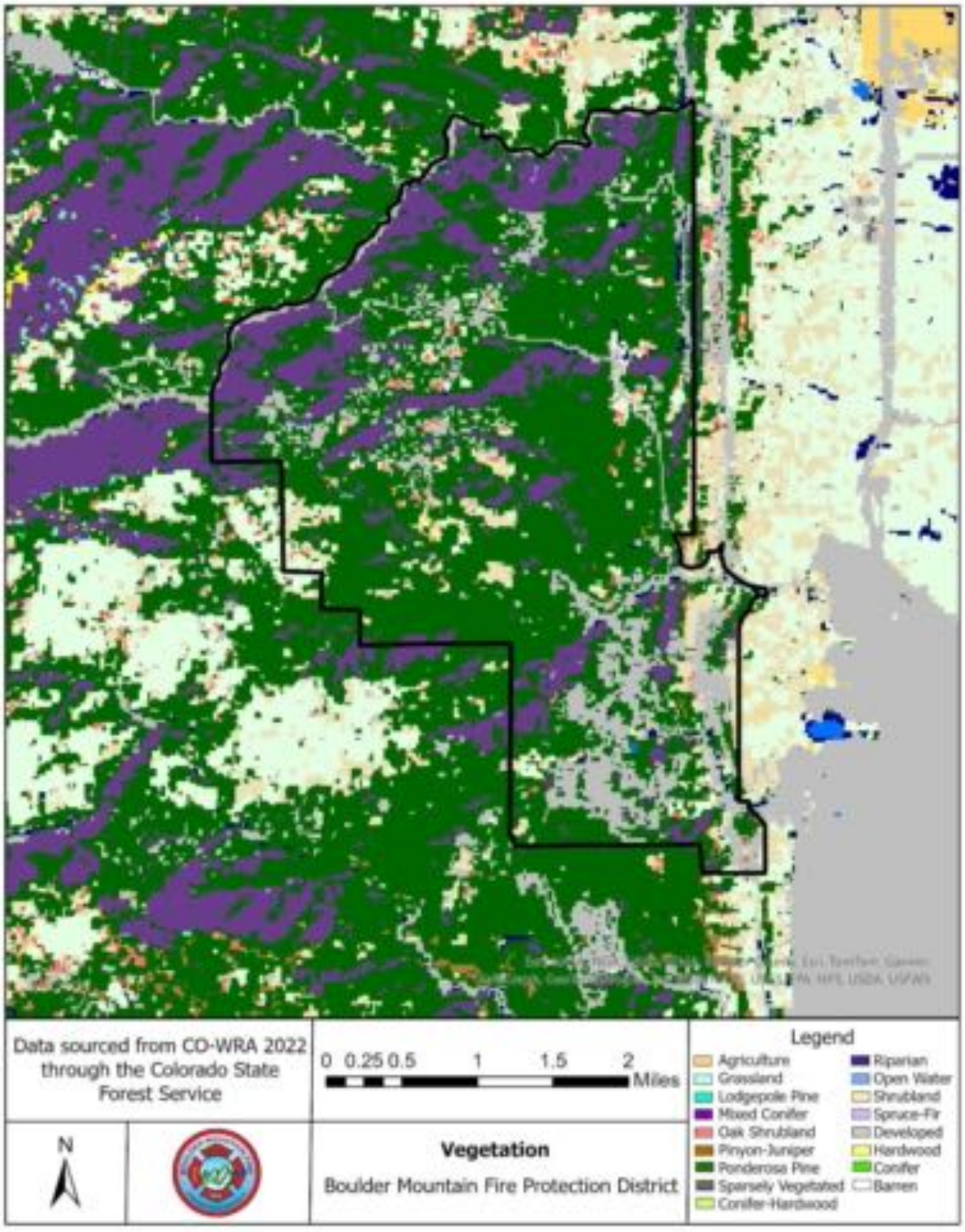
***Figure 2-8:*** *One of the most prevalent types of vegetation within BMFPD is ponderosa pine.*

*Photo credit: Julie Pitney (BMFPD)*

## Takeaway Message

BMFPD is at risk for large, high-severity wildfires due to dense forest conditions, dry and hot weather, and strong, gusty winds. Increasing drought and warming temperatures exacerbate wildfire risk in the area. **BMFPD and residents in the district must prepare for large wildfire events. Proactive work is imperative to protect lives and property.**

***Figure 2-9:*** *Map of vegetation across BMFPD. Ponderosa pine and mixed conifer are the two most prevalent types of vegetation within the district.*




*Source: Created by BMFPD using data from Colorado State Forest Service CO-WRA 2022*

## Fire Behavior Along Roads and Neighborhoods

Roadways within BMFPD are often narrow, and many are unpaved (**Figure 2-10**). During a moderate or severe fire, these roads may become compromised by flames or smoke, making evacuation difficult. The proximity of trees to roadways can also allow fires to jump roads, cutting off evacuation routes. Firefighters responding to these fires may struggle to navigate these roadways, especially if they are blocked by falling trees or debris.

***Figure 2-10:*** *Narrow roadways within BMFPD make it difficult for first responders to navigate while residents are evacuating.*

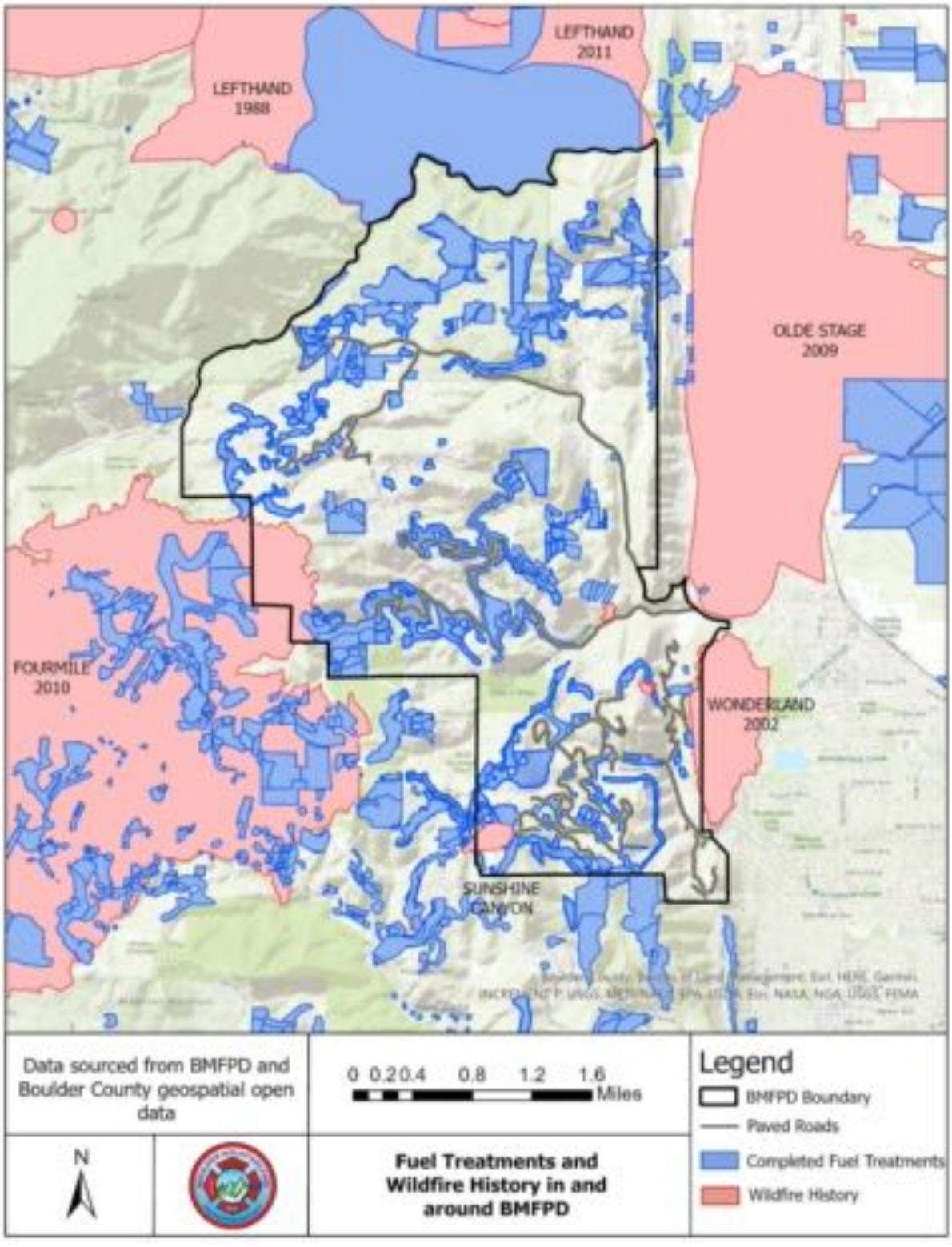
*Photo credit: Julie Pitney (BMFPD)*

## Fuel Treatment History in and around BMFPD

Fuel treatments designed to decrease the amount and continuity of fuels in strategic locations are a critical aspect of wildfire risk reduction. These efforts aim to lower the intensity and spread of wildfires, providing protection for nearby communities and offering tactical advantages for wildland firefighters when they engage with fires (**Figure 2-11**).

A key component of this CWPP is the identification of future fuel treatment locations to continue reducing fire risk. These priority locations, outlined in **Section 4** on page 61, were determined based on wildfire modeling, topography, and community input. In the coming years, BMFPD, alongside other land management agencies, will focus on the high-risk areas of each study area for fuel treatments within the district.

***Figure 2-11:*** *Locations of fuel treatments and wildfires in and around BMFPD.*




*Source: Created by BMFPD using data from Boulder County geospatial open data*

# 3. Wildfire Risk Assessment

## Risk Assessment Overview

The wildfire risk assessment is designed to evaluate the wildfire risk across 12 designated study areas (**Figure 3-1**) within Boulder Mountain Fire Protection District (BMFPD). These study areas are mapped using 2024 evacuation polygons, ensuring that the analysis reflects the real-world geographic and community features relevant to evacuation during a wildfire. Each area is assessed based on 2 sections and 9 risk categories, with each category receiving a score that reflects the level of wildfire risk. A higher score indicates a greater level of risk in that category.

A key resource in this analysis is the Colorado Wildfire Risk Assessment (CO-WRA), a comprehensive statewide tool developed by the Colorado State Forest Service (CSFS) to help communities understand and address wildfire risk. The CO-WRA, which was initially created in 2013 and updated in 2017 and 2022, uses robust datasets, validated fire science, and advanced machine learning to assess wildfire risk throughout Colorado. This resource provides a "snapshot in time" of wildfire risk and offers high-resolution data that helps us evaluate and prioritize risks within BMFPD. By leveraging CO-WRA's quantitative framework, we were able to tailor our risk profile to the district's specific wildfire challenges, supporting more precise planning and proactive risk reduction. Using lessons from significant wildfires, such as the Cameron Peak and Marshall Fires, CO-WRA reflects the latest data on wildfire conditions across the state. This information is accessible through the Colorado Forest Atlas, an interactive mapping tool that allows users to explore various risk factors and prioritize mitigation efforts. (See **Appendix D** on page 159 for the complete BMFPD CO-WRA report.)

A scoring system is used to generate a comprehensive community wildfire risk rating for each study area. Each score correlates with a defined risk level, providing clear guidance for future mitigation and preparedness efforts. To ensure that the risk assessment provided meaningful differentiation between the 12 study areas, the scoring categories were intentionally designed with narrower ranges concentrated toward the higher end of the scale. By adjusting the range sizes and focusing on the upper portion of the scale, we created a scoring system that highlights nuanced variations in risk levels, enabling more targeted planning and resource allocation for wildfire preparedness.

The methodology incorporates a combination of GIS-based data analysis, firefighter surveying, and field assessments. Through this approach, the *BMFPD Community Wildfire Protection Plan* (CWPP) offers a detailed and focused evaluation of wildfire risk at the community level, helping to inform the prioritization of mitigation projects and ensuring that risk reduction efforts are tailored to the unique challenges of each study area.

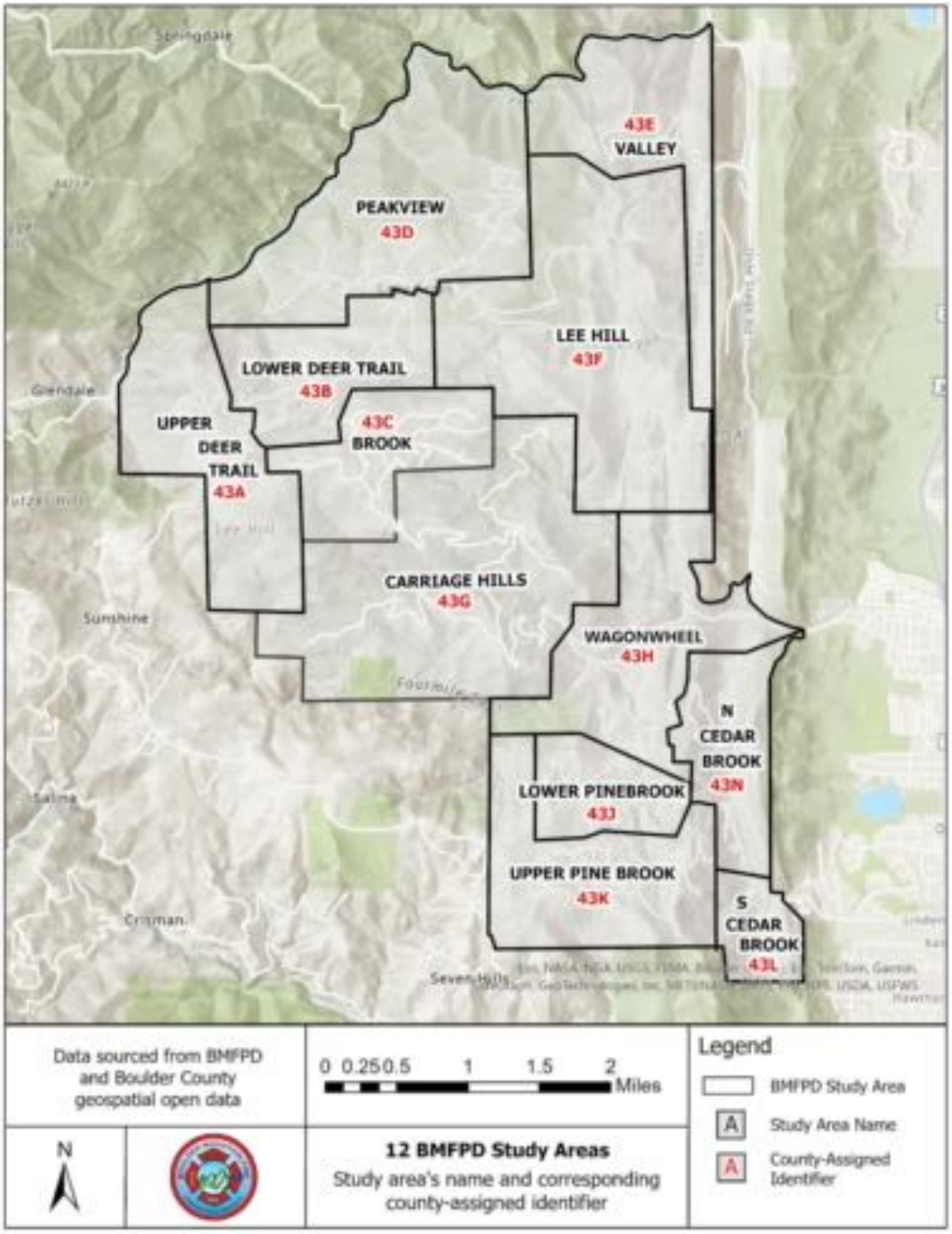
# 12 Study Areas

The BMFPD risk assessment is structured around 12 distinct study areas, each defined by predefined evacuation polygons established by Boulder County (**Figure 3-1**). Known as "all-hazard polygons," these zones were created by Boulder County Sheriff's Office Communications staff in 2021 through collaboration with the Sheriff's Office Law and Emergency Services personnel, wildland fire leadership, local fire districts, and the Boulder Office of Emergency Management. Originally designed to support wireless emergency alert (WEA) compliance, these polygons enable Boulder County's Public Safety Answering Point (PSAP) to efficiently send reverse 911 notifications for wildfire and other hazard emergencies to specific geographic areas. In an emergency, dispatch staff can activate these preset zones for targeted alerts, facilitating timely evacuation and information dissemination.

Each polygon is identified by a unique code from Boulder County (e.g., polygons 43A to 43L), but for clarity and ease of use, BMFPD has assigned descriptive names to each zone, such as the Brook Study Area and the Lee Hill Study Area. This naming system helps residents and community members quickly recognize and reference their respective zones. See **Appendix C** on page 146 for a zoomed in map of each individual study area.

The map below provides an overview of the 12 evacuation polygon boundaries, along with each study area's name and corresponding county-assigned identifier. This dual identification system aims to ensure clarity in communication and coordination, whether through formal county notifications or in BMFPD's outreach and preparedness efforts.

***Figure 3-1:*** *Map of 12 emergency notification all-hazard polygons, with each study area's name and corresponding county-assigned identifier.*




*Source: Created by BMFPD using data from Boulder County geospatial open data*

## 9 Risk Categories

| SECTION 1: Baseline Wildfire Risk (140 Points) | Maximum Points |
|---|---|
| Category 1: Wildland-Urban Interface Risk (CO-WRA) | 40 |
| Category 2: Fire Intensity Scale (CO-WRA) | 40 |
| Category 3: Wildfire Risk to Assets (CO-WRA) | 40 |
| Category 4: Watershed Protection Risk (CO-WRA) | 20 |
| **Section 1 Total Points** | **140** |

| SECTION 2: Supplemental Analysis (60 Points) | Maximum Points |
|---|---|
| Category 5: Cellular Coverage | 12 |
| Category 6: Road Lanes (1.5 vs. 2 Lanes) | 12 |
| Category 7: Road Construction (Paved vs. Unpaved) | 12 |
| Category 8: Water Sources (Hydrants vs. Cisterns) | 12 |
| Category 9: Number of Evacuation Routes | 12 |
| **Section 2 Total Points** | **60** |

| | |
|---|---|
| **Total Points Possible** | **200** |

## Total Risk Scores:

**Highest Risk:** 161–200 Points

**Very High Risk:** 151–160 Points

**High Risk:** 141–150 Points

**Moderate Risk:** 131–140 Points

**Low Risk:** < 131 Points

# Risk Assessment Methodology

## Section 1: Baseline Wildfire Risk

### Category 1 of 9: Wildland-Urban Interface Risk

**(40 Points Maximum)**

**Overview:** The Wildland-Urban Interface (WUI) Risk is a rating of the potential impact of a wildfire on people and their homes.

The key input, WUI, reflects housing density (houses per acre) consistent with Federal Register National Standards. The location of people living in the WUI and rural areas is essential for defining potential wildfire impacts to people and homes. The WUI Risk is derived using a response function modeling approach. Response functions are a method of assigning a net change in the value to a resource or asset based on susceptibility to fire at different intensity levels, such as flame length.

To calculate the WUI Risk for BMFPD, the WUI housing density data was combined with flame length data, and response functions were defined to represent potential impacts. The response functions were defined by a team of experts led by Colorado State Forest Service mitigation planning staff. By combining flame length with the WUI housing density data, it is possible to determine where the greatest potential impact to homes and people is likely to occur. Customized urban encroachment algorithms were used to ensure those fringe urban areas were included in the WUI Risk outputs. Encroachment distances into urban areas were based on the underlying fuel models and their fuel types and propensity for spotting and spreading.

The WUI Risk has been calculated consistently for all areas in Colorado, which allows for comparison of areas across the state. Data is modeled at a 20-meter cell resolution, which is consistent with other CO-WRA layers.

**Methodology:** The CO-WRA produces a WUI Risk analysis for each study area (CSFS, 2024). The analysis includes a table that shows the WUI Risk class and the percentage of that risk class in each study area. For BMFPD's analysis, each risk class is assigned a score, which is multiplied by the percentage to produce the weighted score for that risk class. All weighted scores are added up and divided by 100 to produce a total weighted score for WUI Risk in that study area. Each WUI Risk score is out of a total of 40 points. (See **Appendix D** on page 159 for the complete BMFPD CO-WRA report.)

## Risk Class Assigned Scores:

**Highest Risk:** 31–40 Points

**High Risk:** 21–30 Points

**Moderate Risk:** 11–20 Points

**Low Risk:** 1–10 Points

**Lowest Risk:** 0 Points

## Category 2 of 9: Fire Intensity Scale

### (40 Points Maximum)

**Overview:** The Fire Intensity Scale (FIS) quantifies the potential fire intensity by orders of magnitude. FIS specifically identifies areas where significant fuel hazards and associated dangerous fire behavior potential exist. Similar to the Richter scale for earthquakes, FIS provides a standard scale to measure potential wildfire intensity. FIS consists of five classes where the order of magnitude between classes is tenfold. The minimum class, Class 1, represents the lowest wildfire intensities, and the maximum class, Class 5, represents the highest wildfire intensities.

**Class 1, Lowest Intensity:** Very small, discontinuous flames, usually less than 1 foot in length; very low rate of spread; no spotting. Fires are typically easy to suppress by firefighters with basic training and nonspecialized equipment.

**Class 2, Low:** Small flames, usually less than 2 feet long; small amount of very short-range spotting possible. Fires are easy to suppress by trained firefighters with protective equipment and specialized tools.

**Class 3, Moderate:** Flames up to 8 feet in length; short-range spotting is possible. Trained firefighters will find these fires difficult to suppress without support from aircraft or engines, but dozers and plows are generally effective. Increasing potential for harm or damage to life and property.

**Class 4, High:** Large flames, up to 30 feet in length; short-range spotting common; medium-range spotting possible. Direct attack by trained firefighters, engines, and dozers is generally ineffective; indirect attack may be effective. Significant potential for harm or damage to life and property.

**Class 5, Highest Intensity:** Very large flames up to 150 feet in length; profuse short-range spotting, frequent long-range spotting; strong fire-induced winds. Indirect attack marginally effective at the head of the fire. Great potential for harm or damage to life and property.

FIS is a fire behavior output, which is influenced by three environmental factors—fuels, weather, and topography—and by fire spread itself (i.e., backing, flanking, or head fire influences fire behavior for a given point on a map, referred to as a pixel, for a specific fire simulation). Weather is by far the most dynamic variable because it changes frequently. The modeling software runs various simulations across the landscape, each with different environmental factors and fire behavior. Thus, as various simulations are run, each pixel may "burn" multiple times, at different intensities, depending on the fire spread pattern and the aforementioned factors. FIS maps represent an average fire intensity for the modeled area.

The FIS map (see **Appendix D** on page 159 for complete BMFPD CO-WRA report) is derived at a 20-meter cell resolution. This scale of data was chosen to be consistent with the accuracy of the primary surface fuels dataset used in the risk assessment. Although not useful for site-specific analysis, it is appropriate for regional, county, or local planning efforts (CSFS, 2024).

The FIS has been calculated consistently for all areas in Colorado, which allows for comparison of areas across the state. For example, a high fire intensity area in Eastern Colorado is equivalent to a high fire intensity area in Western Colorado.

**Methodology:** The CO-WRA produces a FIS analysis for each study area (CSFS, 2024). The analysis includes a table that shows the FIS risk class and the percentage of that FIS risk class in each study area. For BMFPD's analysis, each FIS risk class is assigned a score, which is multiplied by the percentage to produce the weighted score for that risk class. All weighted scores are added up and

divided by 100 to produce a total weighted score for FIS in that study area. Each FIS risk score is out of a total of 40 points. (See **Appendix D** on page 159 for the complete BMFPD CO-WRA report.)

**Risk Class Assigned Scores:**

**High Intensity:** 31–40 Points

**Moderate Intensity:** 21–30 Points

**Low Intensity:** 11–20 Points

**Lowest Intensity:** 1–10 Points

## Category 3 of 9: Wildfire Risk to Assets

### (40 Points Maximum)

**Overview:** The Wildfire Risk to Assets is a composite risk map that combines two key CO-WRA components: the Values at Risk Rating and the Burn Probability layers (see **Appendix D** on page 159 for detailed explanations). Wildfire Risk to Assets identifies areas that face the greatest potential impacts from a wildfire by evaluating locations most vulnerable to wildfire damage when considering a set of key values.

The Values at Risk Rating is a crucial element of Wildfire Risk to Assets because it integrates several risk layers that represent different types of assets. These layers include Wildland-Urban Interface (WUI), which indicates housing density in areas prone to wildfires; Forest Assets, which assess forested areas at risk; Riparian Assets, focusing on valuable river and stream ecosystems; and Watershed Protection areas essential for water resources. Each of these layers reflects assets in need of protection, and they are weighted to produce the Values at Risk Rating, which highlights areas with higher asset concentrations and potential loss.

Burn Probability (BP), the second key component of the Wildfire Risk to Assets map, represents the annual likelihood of any given location burning due to wildfire. The BP was calculated by simulating over 2.3 million fires across Colorado, focusing on high and extreme weather conditions that account for most annual burned areas.

The Wildfire Risk to Assets map is derived at a 20-meter cell resolution. This scale of data was chosen to be consistent with the primary surface fuels dataset used. Although not useful for site-specific analysis, it is appropriate for regional, county, or local planning efforts (CSFS, 2024).

**Methodology:** The CO-WRA produces a Wildfire Risk to Assets analysis for each study area. The analysis includes a table that shows the Wildfire Risk to Assets risk class and the percentage of that risk class in each study area. For BMFPD's analysis, each risk class is assigned a score, which is multiplied by the percentage to produce the weighted score for that risk class. All weighted scores are added up and divided by 100 to produce a total weighted score for Wildfire Risk to Assets in that study area. Each Wildfire Risk to Assets risk score is out of a total of 40 points. (See **Appendix D** on page 159 for the complete BMFPD CO-WRA report.)

**Risk Class Assigned Scores:**

**Highest Risk:** 31–40 Points

**High Risk:** 21–30 Points

**Moderate Risk:** 11–20 Points

**Low Risk:** 1–10 Points

**Lowest Risk:** 0 Point

## Category 4 of 9: Watershed Protection Risk

### (20 Points Maximum)

**Overview:** Watershed Protection Risk assesses the potential negative impacts on watersheds from wildfire. In areas that experience low-severity burns, fire events can serve to eliminate competition among plants for water, rejuvenate growth, and improve watershed conditions.

In contrast, in landscapes subjected to high- or even moderate-severity burns, the post-fire threats to public safety and natural resources can be extreme. High-severity wildfires remove virtually all forest vegetation, from trees, shrubs, and grasses down to discarded needles, decomposed roots, and other elements of ground cover and duff. This plant matter stabilizes and protects forest soils and disperses water during heavy rainstorms, giving it time to percolate into the soil. A severe wildfire also can cause certain types of soil to become hydrophobic by forming a waxy water-repellent layer that prevents water from penetrating the soil, dramatically amplifying the rate of runoff.

The loss of critical surface vegetation leaves forested slopes extremely vulnerable to large-scale soil erosion and flooding during subsequent storm events. In turn, these threats can affect the health, safety, and integrity of communities and natural resources downstream. The likelihood that such a post-fire event will occur in Colorado is increased by the prevalence of highly erodible soils in several parts of the state and by weather patterns that frequently bring heavy rains on the heels of fire season. For example, in the aftermath of the 2002 fire season, the Colorado Department of Health estimated that 26 municipal water storage facilities were shut down due to fire and post-fire impacts (CSFS, 2024).

To calculate the Watershed Protection Risk for BMFPD, watershed protection data was combined with a measure of fire intensity using a response function approach. Those areas with the highest negative impact (-9) represent areas with high potential fire intensity and high importance for ecosystem services. Those areas with the lowest negative impact (-1) represent areas with low potential fire intensity and low importance for ecosystem services. The response function outputs were combined into five qualitative classes.

**Methodology:** The CO-WRA produces a watershed protection risk analysis for each study area. The analysis includes a table that shows the watershed protection risk and the percentage of that risk in each study area. For our analysis, each watershed protection risk is assigned a score, that score is then multiplied by the percentage to produce the weighted score for that risk class. All weighted scores are added up and divided by 100 to produce a total weighted score for watershed protection

risk in that study area. Each watershed protection risk score is out of a total of 20 points. (See **Appendix D** on page 159 for the complete BMFPD CO-WRA report.)

## Risk Class Assigned Scores:

**Highest Risk:** 16–20 Points

**High Risk:** 11–15 Points

**Moderate Risk:** 6–10 Points

**Low Risk:** 1–5 Points

**Lowest Risk:** 0 Point

# Section 2: Supplemental Analysis

## Category 5 of 9: Cellular Coverage

### (12 Points Maximum)

**Overview:** The results of the BMFPD community survey revealed a significant concern among residents regarding the reliability of cellular coverage when receiving evacuation notifications. A substantial portion of the district experiences inconsistent cellular service, which poses a serious challenge during emergencies. In areas where cellular connectivity is unreliable, residents who are not connected to Wi-Fi may not receive critical evacuation alerts or timely updates about ongoing incidents. The survey highlighted a particular anxiety about power outages, which could sever Wi-Fi connections entirely, leaving residents without any means to receive urgent notifications. This underscores the vulnerability of the community in emergency situations where immediate communication is paramount.

**Methodology:** To comprehensively evaluate the risks associated with limited cellular coverage within the district, we conducted a detailed analysis of supplemental data. This involved collecting and integrating data from three major cellular service providers: Verizon, AT&T, and T-Mobile. By overlaying this data with the specific geographic boundaries of each study area, we were able to assess the extent of cellular coverage for each study area. Our analysis included data collected from five central locations in each study area, for a total of 60 locations across the district. The data-collection points are well representative of each study area as a whole. In each location, data was collected from the cellular carriers. The cellular coverage from each carrier was averaged and totaled for each data-collection point and then further totaled for each study area. These totals were used to calculate the relative risk for each study area from the lack of cellular coverage and to generate a risk score for each area. We then classified each study area to be either low risk, moderate risk, high risk, or highest risk. This assessment provides a clear understanding of which areas are at higher risk of communication failure during critical moments.

**Risk Class Assigned Scores:**

**Highest Risk:** 12 Points

**High Risk:** 9 Points

**Moderate Risk:** 6 Points

**Low Risk:** 3 Points

## Category 6 of 9: Road Lanes (1.5 vs. 2 Lanes)

### (12 Points Maximum)

**Overview:** The width of roads within BMFPD is a critical factor influencing the response times of first responders and the overall efficiency of evacuation procedures. A notable concern is the prevalence of roads that are only 1.5 lanes wide, rather than the standard 2 lanes. These narrower roads present significant challenges because they restrict the ability of vehicles to pass side by side. In an emergency scenario, where residents are urgently evacuating while first responders are simultaneously moving toward the wildfire, these constrained roads can severely impede the flow of traffic. The bottleneck effect caused by 1.5-lane roads can drastically slow down both the evacuation of residents and the arrival of emergency services, thereby increasing the risk to life and property.

In this assessment, BMFPD classified road widths to clarify their impact on emergency response and evacuation flow. Roads classified as 2 lanes provide sufficient space for 1 fire apparatus to safely pass another without needing to use shoulders, ensuring safer and more efficient operations during wildfire evacuations. In contrast, 1.5-lane roads are defined as any roadway where fire apparatus or other large vehicles cannot easily pass side by side without using shoulders or reversing to find a pullout. This configuration can be hazardous in high-stress situations involving fire and smoke because it restricts movement and increases the risk of delays for both evacuating residents and incoming first responders.

**Methodology:** To assess the risks posed by road widths across the district, we conducted a thorough analysis of supplemental data. This analysis incorporated mapping data and insights gathered from surveys of firefighters familiar with the terrain. By integrating this data, we were able to accurately determine the road width for each study area. The evaluation employed a binary classification system, whereby each area was categorized based on whether the majority of its roads are 1.5 lanes or 2 lanes wide. This approach allowed us to identify areas where road width may significantly hinder emergency response and evacuation efforts, thereby highlighting zones of increased vulnerability.

### Risk Class Assigned Scores:

**High Risk:** 12 Points

(A majority of the study area has 1.5-lane roads)

**Low Risk:** 0 Points

(A majority of the study area has 2-lane roads)

## Category 7 of 9: Road Construction (Paved vs. Unpaved)

### (12 Points Maximum)

**Overview:** Much like road width, the construction quality of roads significantly affects the response times of first responders and the overall efficiency of evacuations within BMFPD. A notable issue is the presence of unpaved dirt roads throughout the area. These unpaved roads present multiple challenges; they not only restrict the ability of vehicles to pass side by side, but they also slow down both emergency response and evacuation efforts. Their rough, uneven surfaces can hinder the speed and maneuverability of emergency vehicles, delaying their arrival at critical scenes. Concurrently, as residents attempt to evacuate rapidly, these unpaved roads can exacerbate congestion and delay their safe departure. The cumulative effect of these delays poses a significant risk during emergency situations, when quick action is crucial.

**Methodology:** To assess the risks associated with road construction across the district, we conducted an in-depth analysis of supplemental data. This process involved integrating detailed mapping data with insights gained from firefighter surveys, which provided firsthand knowledge of road conditions in each study area. The analysis employed a binary classification system, whereby each area was classified based on whether the majority of its roads are paved or unpaved. This approach enabled us to pinpoint areas where the quality of road construction could significantly impede both emergency response efforts and evacuation processes, thereby identifying regions with heightened vulnerability.

**Risk Class Assigned Scores:**

**High Risk:** 12 Points

(A majority of the study area has unpaved dirt roads)

**Low Risk:** 0 Points

(A majority of the study area has paved roads)

## Category 8 of 9: Water Sources (Hydrants vs. Cisterns)

### (12 Points Maximum)

**Overview:** Water is a crucial element in the ability of first responders to protect property, control wildfires, and safeguard lives. In urban settings such as the city of Boulder, the abundance of fire hydrants provides firefighters with readily accessible water sources, thereby enhancing their capacity to combat fires effectively. However, in smaller, more rural districts such as BMFPD, the availability of hydrants and other accessible water sources is often limited or entirely absent. Although some areas within BMFPD are equipped with hydrants, a more common feature is the presence of cisterns. These cisterns serve as dedicated, year-round water supply sources specifically for firefighting purposes and are often mandated in regions lacking a centralized piped water supply. Cisterns are particularly prevalent in mountainous areas and small towns where piped water infrastructure is minimal.

Although cisterns serve a crucial role, they are less effective than hydrants. Unlike hydrants, which are pressurized, cisterns provide static water that must be drafted and pumped into fire engines, requiring more time and resources to establish adequate water pressure. Additionally, cisterns have a limited capacity, often around 10,000 gallons, which can be quickly depleted during large-scale firefighting operations. This contrasts with hydrants, which offer an essentially unlimited water supply. In BMFPD, hydrants are found in only a few areas, and cisterns are the predominant water source. Although cisterns are vital, their static nature and limited capacity introduce additional challenges and risks for fire suppression efforts.

**Methodology:** To evaluate the impact of water sources on the risk profile of each study area within BMFPD, we analyzed detailed mapping data and firefighter surveys to determine the prevalence of cisterns and hydrants across the district. The evaluation takes into account whether a study area is fully, partially, or not served by hydrants. A high risk area is served exclusively by cisterns, which require additional time and resources to access and utilize during fire suppression. Moderate risk areas have hydrants, but coverage is incomplete—only parts of the area are hydranted, requiring additional water sources or coordination to support firefighting efforts in areas without hydrants. Low risk areas are fully served by hydrants, providing a pressurized, continuous water supply for firefighting operations.

### Risk Class Assigned Scores:

**High Risk:** 12 Points

(The study area has cisterns)

**Moderate Risk:** 6 Points

(The study area hydrants, but coverage is incomplete)

**Low Risk:** 0 Points

(The study area has hydrants)

## Category 9 of 9: Number of Evacuation Routes

### (12 Points Maximum)

**Overview:** In parallel with concerns about road construction and width, the availability of evacuation routes emerged as a prominent issue in the BMFPD community survey. Many residents voiced apprehension regarding the limited number of evacuation routes available to them. BMFPD, characterized by its winding roads through mountainous terrain, presents several challenges in this regard. Many of the roads are unpaved, uneven, and narrow. In addition, some areas have only a single point of entry and exit. This creates significant concerns for life safety and property protection during a wildfire event. Roads that offer only one way in and one way out become rapidly congested in an emergency as residents attempting to evacuate can find themselves in direct conflict with first responders who are simultaneously trying to access the fire. This bottleneck effect not only hampers the evacuation process but also delays the critical response time of emergency services, thereby amplifying the risks associated with wildfire incidents.

**Methodology:** To assess the risks posed by the number of evacuation routes within each study area, we conducted an in-depth analysis of supplemental data across the district. This analysis incorporated detailed mapping data alongside insights from firefighter surveys, allowing for a comprehensive understanding of the evacuation infrastructure in each area. To designate the number of evacuation routes in each study area, we examined published evacuation maps to identify roads that lead residents out of the study area and out of the district. Each evacuation route was selected based on its ability to connect directly to areas outside of the study area, and beyond the immediate vicinity of a wildfire event within the study area. This approach allowed us to categorize the level of evacuation risk within each study area.

The evaluation categorized areas into three risk levels. Study areas with only 1 evacuation route were assigned 12 points, indicating the highest level of risk due to the severe limitations on egress. Areas with 2 evacuation routes received 8 points, reflecting a moderate level of risk, and areas with 3 or more evacuation routes were assigned 4 points because they posed the least risk by offering multiple pathways for evacuation. This nuanced approach enables a clear prioritization of areas that require enhanced evacuation planning and infrastructure improvements to mitigate the dangers posed by wildfire emergencies.

## **Risk Class Assigned Scores:**

**High Risk:** 12 Points

(The study area has 1 evacuation route)

**Moderate Risk:** 8 Points

(The study area has 2 evacuation routes)

**Low Risk:** 4 Points

(The study area has 3 or more evacuation routes)

## Community Study Areas in Order of Overall Risk Score

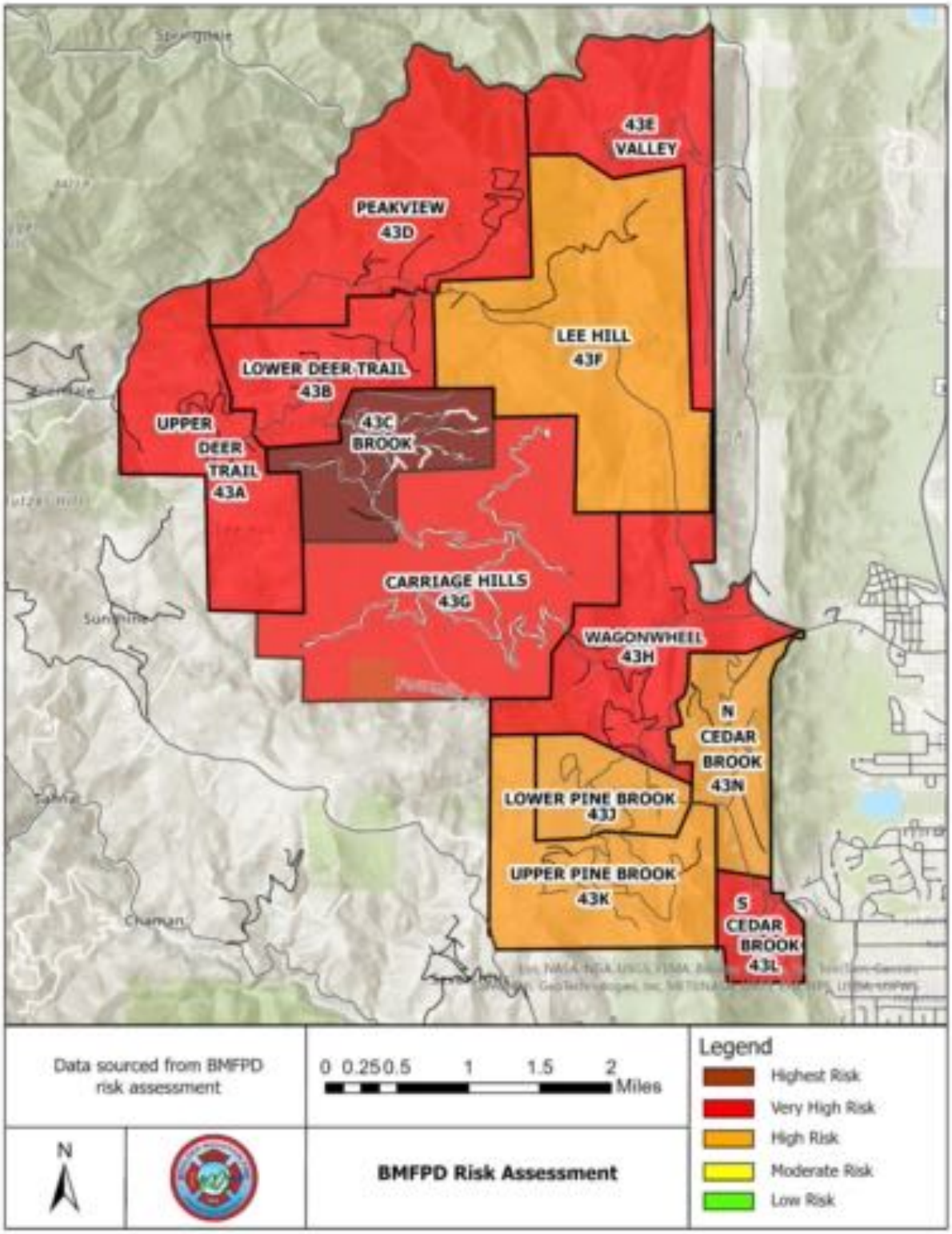
All of the 12 study areas in BMFPD fell under the category **Highest Risk**, **Very High Risk**, or **High Risk.** The first table below shows the risk category and the range of points for each category. The second table shows each study area in order of its risk score. See **Figure 3-2** for a map of the community risk assessment findings.

| Risk Category | Number of Points |
|---|---|
| Highest Risk | >161 |
| Very High Risk | 151-160 |
| High Risk | 141-150 |
| Moderate Risk | 131-140 |
| Low Risk | <130 |

| Community Study Area | Risk Score |
|---|---|
| Brook | 181 |
| Upper Deer Trail | 158 |
| Lower Deer Trail | 158 |
| Peakview | 155 |
| South Cedar Brook | 155 |
| Carriage Hills | 153 |
| Wagonwheel | 153 |
| Valley | 152 |
| North Cedar Brook | 150 |
| Lower Pine Brook | 145 |
| Lee Hill | 143 |
| Upper Pine Brook | 143 |

# Risk Assessment Results: BMFPD Study Areas

***Figure 3-2:*** *Map of community risk assessment findings in BMFPD.*




*Source: BMFPD CWPP Risk Assessment*

# Brook Study Area

Risk Category: **Highest Risk**

Total Risk Score : **181**

(200 points maximum)

## Section 1: Baseline Wildfire Risk (140 points maximum)

| CO-WRA Data Category | Points Earned |
|---|---|
| **Wildland-Urban Interface Risk** (40 points maximum) | **37** |
| **Fire Intensity Scale** (40 points maximum) | **38** |
| **Wildfire Risk to Assets** (40 points maximum) | **40** |
| **Watershed Protection Risk** (20 points maximum) | **10** |
| **TOTAL:** | **125** |

## Section 2: Supplemental Analysis (60 points maximum)

| Category | Points Earned |
|---|---|
| **Cellular Coverage** (12 points maximum) | 12 points: **Highest Risk** - The majority of Brook has 1 or 0 bars. This inadequate service makes it difficult for residents to receive emergency notifications during the event of a wildfire. |
| **Road Lanes (1.5 vs. 2 Lanes)** (12 points maximum) | 12 points: **High Risk** - The majority of roads in this area are 1.5 lanes wide. The narrow roads in this area present a higher risk because 1.5-lane roads can cause congestion during evacuation and hinder emergency vehicle access. The few 2-lane roads offer some relief, but the overall risk remains elevated. |
| **Road Construction (Paved vs. Unpaved)** (12 points maximum) | 12 points: **High Risk** - All of the roads in this area are dirt roads. Brook faces high evacuation challenges because dirt roads can cause slower traffic and greater delays for emergency access. |
| **Water Sources (Hydrants vs. Cisterns)** (12 points maximum) | 12 points: **High Risk** - Cisterns are the main water source for Brook. The presence of cisterns provides a water source, but the lack of pressurized water and limited capacity makes fire suppression more challenging in comparison to hydrants. |
| **Number of Evacuation Routes** (12 points maximum) | 8 points: **Moderate Risk** - With 2 evacuation routes, this area offers some flexibility for residents to evacuate and for emergency responders to access the fire. |
| **TOTAL:** | **56** |

# Upper Deer Trail Study Area

Risk Category: **Very High Risk**

Total Risk Score : **158**

(200 points maximum)

## Section 1: Baseline Wildfire Risk (140 points maximum)

| CO-WRA Data Category | Points Earned |
|---|---|
| **Wildland-Urban Interface Risk** (40 points maximum) | **27** |
| **Fire Intensity Scale** (40 points maximum) | **38** |
| **Wildfire Risk to Assets** (40 points maximum) | **39** |
| **Watershed Protection Risk** (20 points maximum) | **10** |
| **TOTAL:** | **114** |

## Section 2: Supplemental Analysis (60 points maximum)

| Category | Points Earned |
|---|---|
| **Cellular Coverage** (12 points maximum) | 12 points: **Highest Risk** - Upper Deer Trail has areas showing 1 bar or less. Only one small area reached 3 bars, leaving much of the study area vulnerable to insufficient emergency coverage. |
| **Road Lanes (1.5 vs. 2 Lanes)** (12 points maximum) | 0 points: **Low Risk** - This area has mostly 2-lane roads, posing a reduced risk compared to others because most roads allow for smoother evacuations and emergency response. However, the presence of 1.5-lane roads still introduces some bottlenecks. |
| **Road Construction (Paved vs. Unpaved)** (12 points maximum) | 12 points: **High Risk** - The majority of this area has dirt roads with some roads being paved. This poses a challenge because unpaved roads hinder evacuation efforts and slow emergency response times. |
| **Water Sources (Hydrants vs. Cisterns)** (12 points maximum) | 12 points: **High Risk** - Cisterns are the primary water source for this area. Although cisterns offer a year-round water supply for firefighters, their finite capacity and lack of pressure mean that firefighting efforts can be slower and less efficient in this area. |
| **Number of Evacuation Routes** (12 points maximum) | 8 points: **Moderate Risk** - Upper Deer Trail has 2 evacuation routes. Although 2 routes provide some relief, there is still a risk of congestion because the limited options may slow down both evacuations and first responder access during a wildfire. |
| **TOTAL:** | **44** |

# Lower Deer Trail Study Area

Risk Category: **Very High Risk**

Total Risk Score : **158**

(200 points maximum)

## Section 1: Baseline Wildfire Risk (140 points maximum)

| CO-WRA Data Category | Points Earned |
|---|---|
| **Wildland-Urban Interface Risk** (40 points maximum) | **37** |
| **Fire Intensity Scale** (40 points maximum) | **39** |
| **Wildfire Risk to Assets** (40 points maximum) | **40** |
| **Watershed Protection Risk** (20 points maximum) | **10** |
| **TOTAL:** | **126** |

## Section 2: Supplemental Analysis (60 points maximum)

| Category | Points Earned |
|---|---|
| **Cellular Coverage** (12 points maximum) | 12 points: **Highest Risk** - Coverage in Lower Deer Trail is primarily 1 or 0 bars, with only a few areas reaching 2 bars. This level of coverage is insufficient for reliable emergency communication. |
| **Road Lanes (1.5 vs. 2 Lanes)** (12 points maximum) | 0 points: **Low Risk** - This area has a majority of 2-lane roads, posing the lowest risk during an evacuation, as 2-lane roads allow for efficient traffic flow in both directions. Residents can evacuate quickly, and first responders can access the area without delays. |
| **Road Construction (Paved vs. Unpaved)** (12 points maximum) | 0 points: **Low Risk** - The majority of roads in this area are paved. Although some roads are dirt and pose a risk, the majority of roads are paved so most residents will be able to evacuate more quickly, reducing the overall hazard. |
| **Water Sources (Hydrants vs. Cisterns)** (12 points maximum) | 12 points: **High Risk** - This area has cisterns that serve as essential water sources, but their static nature and limited water supply make them less effective than hydrants in controlling fires quickly. |
| **Number of Evacuation Routes** (12 points maximum) | 8 points: **Moderate Risk** - This area has 2 evacuation routes, which helps mitigate some risk, although there is still a possibility of delays due to limited options for movement. |
| **TOTAL:** | **32** |

# Peakview Study Area

Risk Category: **Very High Risk**

Total Risk Score : **155**

(200 points maximum)

## Section 1: Baseline Wildfire Risk (140 points maximum)

| CO-WRA Data Category | Points Earned |
|---|---|
| **Wildland-Urban Interface Risk** (40 points maximum) | **28** |
| **Fire Intensity Scale** (40 points maximum) | **38** |
| **Wildfire Risk to Assets** (40 points maximum) | **36** |
| **Watershed Protection Risk** (20 points maximum) | **9** |
| **TOTAL:** | **111** |

## Section 2: Supplemental Analysis (60 points maximum)

| Category | Points Earned |
|---|---|
| **Cellular Coverage** (12 points maximum) | 12 points: **Highest Risk** - Peakview proved to have the worst cellular coverage in the district. The majority of Peakview has 0 bars, with a few areas reaching 1 bar. This results in limited ability to receive evacuation notifications during a power outage. |
| **Road Lanes (1.5 vs. 2 Lanes)** (12 points maximum) | 0 points: **Low Risk** - The majority of roads in this area are 2 lanes, with some 1.5-lane roads. Most roads allow for smooth evacuations and emergency response. However, the presence of 1.5-lane roads still introduces some delays during evacuations. |
| **Road Construction (Paved vs. Unpaved)** (12 points maximum) | 12 points: **High Risk** - The majority of roads in this area are unpaved, which could cause significant slowdowns during an evacuation despite the few paved sections. |
| **Water Sources (Hydrants vs. Cisterns)** (12 points maximum) | 12 points: **High Risk** - Cisterns are the primary water source for this area. Although cisterns offer a year-round water supply for firefighters, their finite capacity and lack of pressure mean that firefighting efforts can be slower and less efficient in this area. |
| **Number of Evacuation Routes** (12 points maximum) | 8 points: **Moderate Risk** - With 2 evacuation routes offering some flexibility for residents to evacuate and for emergency responders to access a fire, this area faces a moderate risk. |
| **TOTAL:** | **44** |

# South Cedar Brook Study Area

Risk Category: **Very High Risk**

Total Risk Score : **155**

(200 points maximum)

## Section 1: Baseline Wildfire Risk (140 points maximum)

| CO-WRA Data Category | Points Earned |
|---|---|
| **Wildland-Urban Interface Risk** (40 points maximum) | **38** |
| **Fire Intensity Scale** (40 points maximum) | **37** |
| **Wildfire Risk to Assets** (40 points maximum) | **40** |
| **Watershed Protection Risk** (20 points maximum) | **19** |
| **TOTAL:** | **134** |

## Section 2: Supplemental Analysis (60 points maximum)

| Category | Points Earned |
|---|---|
| **Cellular Coverage** (12 points maximum) | 9 points: **High Risk** - South Cedar Brook showed the least risk in the district with regard to cellular coverage. The majority of South Cedar Brook receives 2 or 3 bars, providing adequate coverage in many areas for emergency notifications. However, there are still a few spots with 1 or 0 bars, which creates pockets of vulnerability. |
| **Road Lanes (1.5 vs. 2 Lanes)** (12 points maximum) | 0 points: **Low Risk** - This study area has all 2-lane roads. This poses a lower risk during an evacuation because 2-lane roads allow for efficient traffic flow in both directions. Residents can evacuate quickly, and first responders can access the area without delays. |
| **Road Construction (Paved vs. Unpaved)** (12 points maximum) | 0 points: **Low Risk** - All but 1 road in this area is paved, allowing for quicker and more efficient traffic flow during a wildfire emergency. |
| **Water Sources (Hydrants vs. Cisterns)** (12 points maximum) | 0 points: **Low Risk** - The availability of hydrants in his area significantly reduces risk because they provide a continuous, pressurized water supply, enabling firefighters to combat fires more effectively. |
| **Number of Evacuation Routes** (12 points maximum) | 12 points: **High Risk** - This area has only 1 evacuation route. As such, this area is at high risk for bottlenecks and congestion, significantly delaying both residents and emergency responders during a wildfire. |
| **TOTAL:** | **21** |

# Carriage Hills Study Area

Risk Category: **Very High Risk**

Total Risk Score : **153**

(200 points maximum)

## Section 1: Baseline Wildfire Risk (140 points maximum)

| CO-WRA Data Category | Points Earned |
|---|---|
| **Wildland-Urban Interface Risk** (40 points maximum) | **25** |
| **Fire Intensity Scale** (40 points maximum) | **38** |
| **Wildfire Risk to Assets** (40 points maximum) | **39** |
| **Watershed Protection Risk** (20 points maximum) | **10** |
| **TOTAL:** | **112** |

## Section 2: Supplemental Analysis (60 points maximum)

| Category | Points Earned |
|---|---|
| **Cellular Coverage** (12 points maximum) | 9 points: **High Risk** - Most areas in Carriage Hills have 1 or 0 bars, with only a few areas having 2 or 3 bars. This leaves most of the neighborhood at significant risk during emergencies. |
| **Road Lanes (1.5 vs. 2 Lanes)** (12 points maximum) | 12 points: **High Risk** - The roads in this area are mostly 1.5 lanes wide. This area is at high risk during a wildfire evacuation due to the narrow and curvy roads, which can cause significant delays for both residents evacuating and first responders trying to reach the scene. |
| **Road Construction (Paved vs. Unpaved)** (12 points maximum) | 0 points: **Low Risk** - Carriage Hills has all paved roads so residents and first responders can move more quickly than if the roads were dirt, reducing the risk during an evacuation. |
| **Water Sources (Hydrants vs. Cisterns)** (12 points maximum) | 12 points: **High Risk** - Cisterns are the main water source for Carriage Hills. The presence of cisterns provides a dedicated water source for firefighting, but the lack of pressurized water and limited capacity makes fire suppression more challenging. |
| **Number of Evacuation Routes** (12 points maximum) | 8 points: **Moderate Risk** - This area has 2 evacuation routes, presenting a moderate risk and offering some flexibility for residents to evacuate and for emergency responders to access the fire, although bottlenecks remain a concern. |
| **TOTAL:** | **41** |

# Wagonwheel Study Area

Risk Category: **High Risk**

Total Risk Score : **153**

(200 points maximum)

## Section 1: Baseline Wildfire Risk (140 points maximum)

| CO-WRA Data Category | Points Earned |
|---|---|
| **Wildland-Urban Interface Risk** (40 points maximum) | **32** |
| **Fire Intensity Scale** (40 points maximum) | **37** |
| **Wildfire Risk to Assets** (40 points maximum) | **40** |
| **Watershed Protection Risk** (20 points maximum) | **10** |
| **TOTAL:** | **119** |

## Section 2: Supplemental Analysis (60 points maximum)

| Category | Points Earned |
|---|---|
| **Cellular Coverage** (12 points maximum) | 12 points: **Highest Risk** - Wagonwheel has only a few spots with 1 or 2 bars, while the rest of the area is 0 bars. This limited coverage poses a hazard for residents trying to access emergency alerts. |
| **Road Lanes (1.5 vs. 2 Lanes)** (12 points maximum) | 0 points: **Low Risk** - Most roads in this study area are 2 lanes wide. This area has a reduced risk compared to others because most roads allow for smoother evacuations and emergency response. However, the presence of 1.5-lane roads still introduces some bottlenecks. |
| **Road Construction (Paved vs. Unpaved)** (12 points maximum) | 12 points: **High Risk** - Most of the roads in this area are dirt roads. This significantly raises the risk during an evacuation because vehicles will need to travel at slower speeds, delaying both residents and first responders. |
| **Water Sources (Hydrants vs. Cisterns)** (12 points maximum) | 6 points: **Moderate Risk** - This area is partially hydranted, meaning some parts of the area have hydrants, but coverage is incomplete. While hydrants provide a reliable and pressurized water supply in served areas, other parts of the area will still rely on cisterns or alternative water sources, requiring additional coordination for firefighting efforts. |
| **Number of Evacuation Routes** (12 points maximum) | 4 points: **Low Risk** - This area has 3 evacuation routes, which significantly reduces the risk because multiple paths allow for more efficient evacuation and quicker access for first responders. |
| **TOTAL:** | **34** |

# Valley Study Area

Risk Category: **Very High Risk**

Total Risk Score : **152**

(200 points maximum)

## Section 1: Baseline Wildfire Risk (140 points maximum)

| CO-WRA Data Category | Points Earned |
|---|---|
| **Wildland-Urban Interface Risk** (40 points maximum) | **30** |
| **Fire Intensity Scale** (40 points maximum) | **39** |
| **Wildfire Risk to Assets** (40 points maximum) | **37** |
| **Watershed Protection Risk** (20 points maximum) | **10** |
| **TOTAL:** | **116** |

## Section 2: Supplemental Analysis (60 points maximum)

| Category | Points Earned |
|---|---|
| **Cellular Coverage** (12 points maximum) | 12 points: **Highest Risk** - Valley has some locations with 2 bars, a few spots with 1 bar, and the remainder at 0 bars. Although a few areas have minimal coverage, most of the neighborhood remains at high risk for emergency communication failure. |
| **Road Lanes (1.5 vs. 2 Lanes)** (12 points maximum) | 0 points: **Low Risk** - Valley's roads are mostly 2 lanes wide. This area poses a low risk during an evacuation, as 2-lane roads allow for efficient traffic flow in both directions. Residents can evacuate quickly, and first responders can access the area without delays. |
| **Road Construction (Paved vs. Unpaved)** (12 points maximum) | 0 points: **Low Risk** - All roads in this area are paved, allowing for quicker and more efficient traffic flow during a wildfire emergency. |
| **Water Sources (Hydrants vs. Cisterns)** (12 points maximum) | 12 points: **High Risk** - Cisterns are the primary water source for this area. Although cisterns offer a year-round water supply for firefighters, their finite capacity and lack of pressure mean that firefighting efforts can be slower and less efficient in this area. |
| **Number of Evacuation Routes** (12 points maximum) | 12 points: **High Risk** - Valley only has 1 evacuation route. The single point of entry and exit creates a dangerous bottleneck in the event of an evacuation, making it difficult for residents to leave quickly and for first responders to access the area. |
| **TOTAL:** | **36** |

# North Cedar Brook Study Area

Risk Category: **High Risk**

Total Risk Score : **150**

(200 points maximum)

## Section 1: Baseline Wildfire Risk (140 points maximum)

| CO-WRA Data Category | Points Earned |
|---|---|
| **Wildland-Urban Interface Risk** (40 points maximum) | **38** |
| **Fire Intensity Scale** (40 points maximum) | **36** |
| **Wildfire Risk to Assets** (40 points maximum) | **40** |
| **Watershed Protection Risk** (20 points maximum) | **15** |
| **TOTAL:** | **129** |

## Section 2: Supplemental Analysis (60 points maximum)

| Category | Points Earned |
|---|---|
| **Cellular Coverage** (12 points maximum) | 9 points: **High Risk** - Most areas in North Cedar Brook have 1 bar and some areas reach 2 or 3 bars. |
| **Road Lanes (1.5 vs. 2 Lanes)** (12 points maximum) | 0 points: **Low Risk** - The majority of roads in this area are 2 lanes. This poses a low risk because 2-lane roads allow for efficient traffic flow in both directions. Residents can evacuate quickly, and first responders can access the area without delays. |
| **Road Construction (Paved vs. Unpaved)** (12 points maximum) | 0 points: **Low Risk** - The majority of roads in this area are paved, with a few dirt roads. The few dirt roads may slow down evacuation in certain spots, but the majority of paved roads help keep the risk level lower. |
| **Water Sources (Hydrants vs. Cisterns)** (12 points maximum) | 0 points: **Low Risk** - This area is hydranted. Hydranted areas benefit from a reliable and ample water supply, ensuring that first responders can control wildfires more quickly and safeguard properties and lives. |
| **Number of Evacuation Routes** (12 points maximum) | 12 points: **High Risk** - This area has 1 evacuation route. Having only 1 evacuation route poses a serious safety risk because the potential for congestion during an emergency could delay evacuations and emergency services. |
| **TOTAL:** | **21** |

# Lower Pine Brook Study Area

Risk Category: **High Risk**

Total Risk Score : **145**

(200 points maximum)

## Section 1: Baseline Wildfire Risk (140 points maximum)

| CO-WRA Data Category | Points Earned |
|---|---|
| **Wildland-Urban Interface Risk** (40 points maximum) | **38** |
| **Fire Intensity Scale** (40 points maximum) | **37** |
| **Wildfire Risk to Assets** (40 points maximum) | **40** |
| **Watershed Protection Risk** (20 points maximum) | **17** |
| **TOTAL:** | **132** |

## Section 2: Supplemental Analysis (60 points maximum)

| Category | Points Earned |
|---|---|
| **Cellular Coverage** (12 points maximum) | 9 points: **High Risk** - Lower Pine Brook has a few areas with 2 bars, but the rest of the area has 1 or 0 bars. A few locations may be able to load emergency pages, but the overall coverage remains a concern. |
| **Road Lanes (1.5 vs. 2 Lanes)** (12 points maximum) | 0 points: **Low Risk** - The majority of the roads in Lower Pine Brook are 2 lanes wide. This area has a reduced risk compared to others because most roads allow for smoother evacuations. |
| **Road Construction (Paved vs. Unpaved)** (12 points maximum) | 0 points: **Low Risk** - The majority of roads in Lower Pine Brook are paved. Although there is some risk from a few dirt roads, the majority of paved roads means most residents will be able to evacuate more quickly, reducing the overall hazard. |
| **Water Sources (Hydrants vs. Cisterns)** (12 points maximum) | 0 points: **Low Risk** - This area is hydranted. The availability of hydrants significantly reduces risk because they provide a continuous, pressurized water supply, enabling firefighters to combat fires more effectively and efficiently. |
| **Number of Evacuation Routes** (12 points maximum) | 4 points: **Low Risk** - This area has 3 evacuation routes, reducing the chances of congestion and ensuring smoother evacuations in a wildfire event. |
| **TOTAL:** | **13** |

# Lee Hill Study Area

Risk Category: **High Risk**

Total Risk Score : **143**

(200 points maximum)

## Section 1: Baseline Wildfire Risk (140 points maximum)

| CO-WRA Data Category | Points Earned |
|---|---|
| **Wildland-Urban Interface Risk** (40 points maximum) | **26** |
| **Fire Intensity Scale** (40 points maximum) | **38** |
| **Wildfire Risk to Assets** (40 points maximum) | **38** |
| **Watershed Protection Risk** (20 points maximum) | **9** |
| **TOTAL:** | **111** |

## Section 2: Supplemental Analysis (60 points maximum)

| Category | Points Earned |
|---|---|
| **Cellular Coverage** (12 points maximum) | 12 points: **Highest Risk** - Most areas in Lee Hill have 0 bars, with only a few areas having 1 bar. This coverage is inadequate to ensure timely receipt of emergency alerts and access to evacuation information during a wildfire. |
| **Road Lanes (1.5 vs. 2 Lanes)** (12 points maximum) | 0 points: **Low Risk** - The majority of the roads in Lee Hill are 2 lanes wide. This area has a reduced risk compared to others because most roads allow for smoother evacuations and emergency response. However, the presence of 1.5-lane roads still introduces bottlenecks. |
| **Road Construction (Paved vs. Unpaved)** (12 points maximum) | 0 points: **Low Risk** - The majority of roads in this area are paved. The dirt roads may slow down evacuation in certain spots, but the majority of roads being paved keeps the risk low. |
| **Water Sources (Hydrants vs. Cisterns)** (12 points maximum) | 12 points: **High Risk** - Lee Hill has cisterns. The presence of cisterns provides a dedicated water source for firefighting, but the lack of pressurized water and limited capacity makes fire suppression more challenging in comparison to hydrants. |
| **Number of Evacuation Routes** (12 points maximum) | 8 points: **Moderate Risk** - This area has 2 evacuation routes that presents a moderate risk, offering some flexibility for residents to evacuate and for emergency responders to access the fire. |
| **TOTAL:** | **32** |

# Upper Pine Brook Study Area

Risk Category: **High Risk**

Total Risk Score : **143**

(200 points maximum)

## Section 1: Baseline Wildfire Risk (140 points maximum)

| CO-WRA Data Category | Points Earned |
|---|---|
| **Wildland-Urban Interface Risk** (40 points maximum) | **33** |
| **Fire Intensity Scale** (40 points maximum) | **36** |
| **Wildfire Risk to Assets** (40 points maximum) | **40** |
| **Watershed Protection Risk** (20 points maximum) | **17** |
| **TOTAL:** | **126** |

## Section 2: Supplemental Analysis (60 points maximum)

| Category | Points Earned |
|---|---|
| **Cellular Coverage** (12 points maximum) | 9 points: **High Risk** - Upper Pine Brook has multiple locations with 2 bars, while the rest of the neighborhood experiences 1 bar. Though some areas may be able to access evacuation information via cell phones, the majority still faces a communication risk. |
| **Road Lanes (1.5 vs. 2 Lanes)** (12 points maximum) | 0 points: **Low Risk** - The majority of the roads in Upper Pine Brook are 2 lanes wide. This area has a reduced risk compared to others, as most roads allow for smoother evacuations and emergency response. |
| **Road Construction (Paved vs. Unpaved)** (12 points maximum) | 0 points: **Low Risk** - Upper Pine Brook contains a majority of paved roads. Although there is some risk from the dirt roads, the majority of paved roads means most residents will be able to evacuate quickly. |
| **Water Sources (Hydrants vs. Cisterns)** (12 points maximum) | 0 points: **Low Risk** - Upper Pine Brook has hydrants. The availability of hydrants significantly reduces risk because they provide a continuous, pressurized water supply, enabling firefighters to combat fires more effectively and efficiently. |
| **Number of Evacuation Routes** (12 points maximum) | 8 points: **Moderate Risk** - This area has 2 evacuation routes. Although 2 routes provide some relief, there is still a risk of congestion because the limited options may slow down both evacuations and first responder access during a wildfire. |
| **TOTAL:** | **17** |

# 4. Recommendations

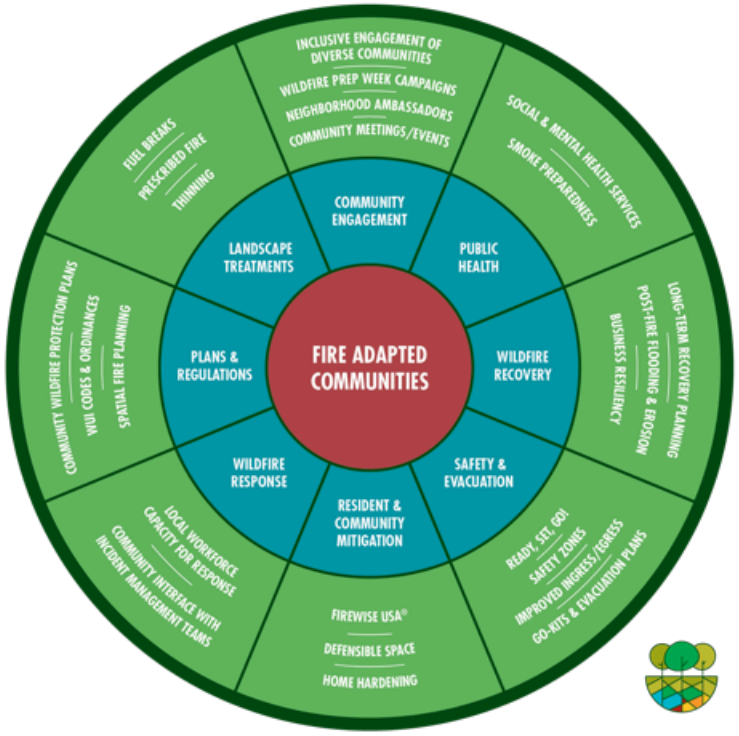
## Becoming a Fire Adapted Community

It is recommended that Boulder Mountain Fire Protection District (BMFPD) and its homeowners associations (HOAs) and residents embrace the concept of becoming a fire adapted community. The National Wildfire Coordinating Group defines a fire adapted community as "a human community consisting of informed and prepared citizens collaboratively planning and taking action to safely coexist with wildland fire." This concept can guide residents, fire practitioners, and communities through a holistic approach to become more resilient to fire (**Figure 4-1**).

The *BMFPD Community Wildfire Protection Plan* (CWPP) sets the stage for fire adaptation. The next step is on-the-ground action and an ongoing commitment to risk mitigation at all levels of the community. This includes individual homeowners, neighborhoods, HOAs, BMFPD, land managers, and other partners. This section of the CWPP includes recommendations and resources for mitigating wildfire risk and enhancing emergency preparedness. BMFPD and public land managers have an important role to play in implementing the recommendations in this CWPP, and they have committed to take action as outlined in this section**.**

Homeowners, neighborhoods, and HOAs also have a vital role to play in addressing shared wildfire risk. Action and community-building centered around mitigation have reduced wildfire risk and increased community resilience across the Mountain West. Mitigation work by residents can spur mitigation by their neighbors (Brenkert-Smith et al., 2013). The cumulative impact of linked defensible space and fuels treatments across private properties can improve the likelihood of home survival and protect firefighters during wildfire events (Jolley, 2018; Knapp et al., 2021).

***Figure 4-1:*** *The Fire Adapted Communities graphic provides specific programs and activities that communities can take to reduce their wildfire risk and increase their resilience.*




*Source:* [*Fire Adapted Community Learning Network*]

# Recommendations for Individuals

## Mitigate Your Home Ignition Zone

During catastrophic wildfires, property loss happens mostly due to conditions in the home ignition zone. The home ignition zone includes your home and other structures (e.g., sheds and garages) and the 100-foot-area surrounding each structure. Firefighter intervention, adequate defensible space, and home hardening measures were common factors of homes that survived major wildfires (IIBHS, 2019; Maranghides et al., 2022). Research following the 2018 Camp Fire in California showed that homes were more likely to burn down when they were close to other structures that had burned, when they had vegetation within 100 feet, or when they had combustible materials such as firewood or propane tanks nearby (Knapp et al., 2021).

You can increase the likelihood that your home will survive a wildfire and help protect the safety of firefighters by creating defensible space, replacing or altering building materials to make your home less susceptible to ignition, and taking steps to increase firefighter access along your driveway.

It is important for residents to work together as a community to mitigate shared wildfire risk in the home ignition zone. Structure-to-structure ignition is a major concern in wildland-urban interface (WUI) communities and can cause substantial property loss. Neighbors can increase the chances that their homes will survive a wildfire if they work together to reduce hazards in their overlapping defensible space.

Defensible space is the area around a building where vegetation, debris, and other types of combustible fuels have been treated, cleared, or reduced to slow the spread of fire and reduce exposure to radiant heat and direct flame. This area encompasses no less than 100 feet around the perimeter of a structure and can extend up to 300 feet depending on the local slope and terrain. Residents should create defensible space around their home to reduce hazards so that firefighters can more easily defend their home.

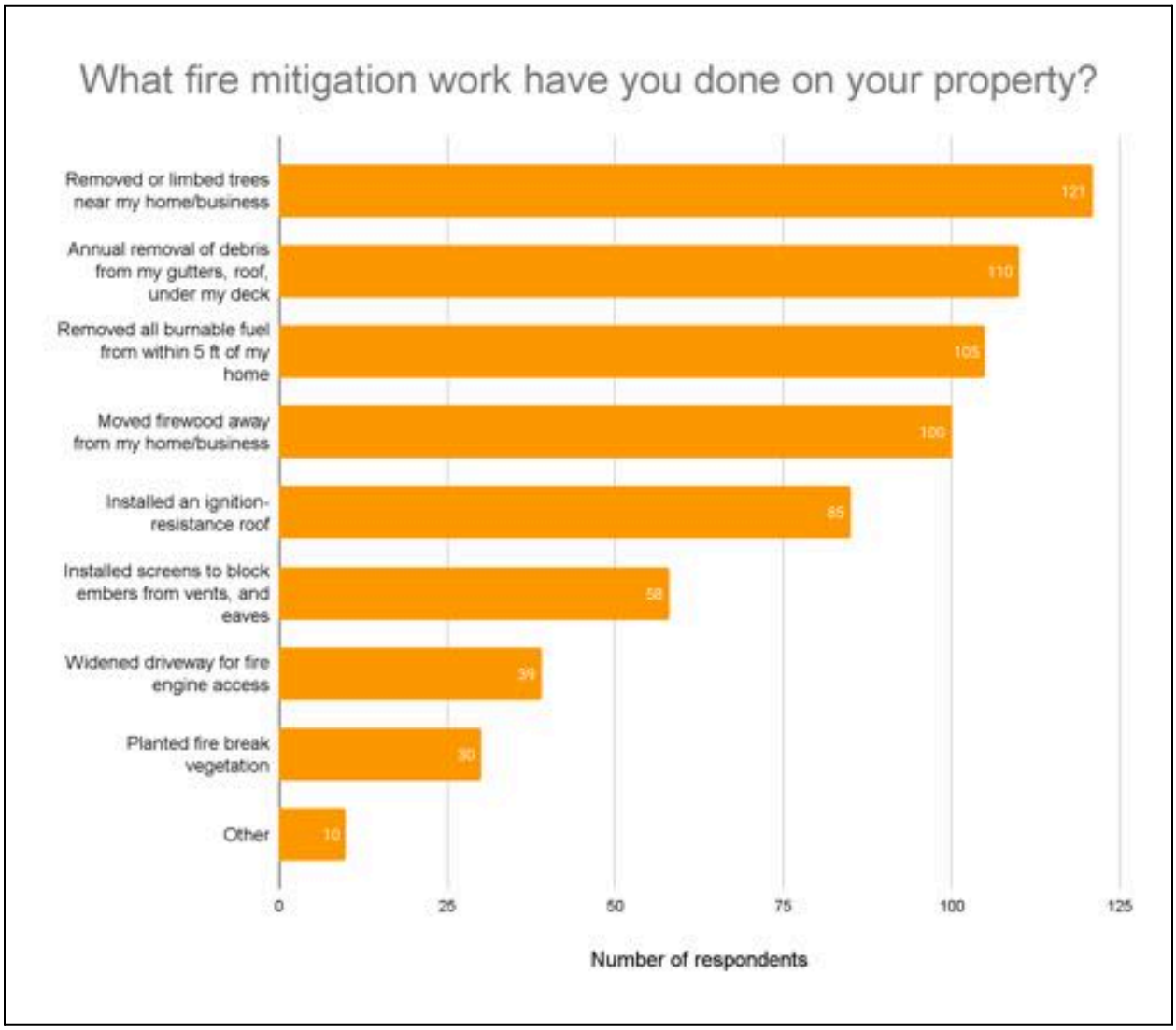
*Photo credit: Rob Bozeman (BMFPD)*

*Defensible space allowed firefighters to protect this home during the 2024 Stone Canyon Fire near Lyons, CO.*

**Home hardening** is the practice of making a home less likely to ignite from the radiant heat of a wildfire or direct contact with flames or embers. It is important to understand that embers can ignite homes even when the flaming front of a wildfire is a distance from the structure. Home hardening involves reducing this risk by changing a home's building materials, installation techniques, and structural characteristics. Home hardening measures are particularly important for WUI homes; 50% to 90% of homes ignite due to embers rather than radiant heat during wildfires (Babrauskas, 2018; Gropp, 2019).

Fortunately, many residents in BMFPD have already started taking actions to mitigate their home ignition zone. Over 97% of residents who responded to the BMFPD community survey have removed trees or low limbs on their property, and 88% of residents annually remove debris from around their home (**Figure 4-2**). Residents are encouraged to follow the defensible space and home hardening recommendations outlined below to continue increasing their home's chances of surviving a wildfire event.

***Figure 4-2:*** *Residents responded to the BMFPD community survey and provided data about various actions they have completed to mitigate risk in their home ignition zone.*




*See **Appendix B** on page 126 for complete BMFPD community survey results*

## Create Defensible Space

Defensible space creates a buffer between your home and grass, trees, and shrubs that could ignite during a wildland fire. Defensible space can slow the spread of wildfire, prevent flames from directly contacting a structure, and reduce the chance that embers will ignite material on or near your home (Hakes et al., 2017). Substantially reducing vegetation within the home ignition zone and removing vegetation that overhangs decks and roofs can reduce structure loss, especially for homes on slopes (Syphard et al., 2014).

Defensible space is divided into multiple zones around a home, and recommended practices vary among zones. The Colorado State Forest Service (CSFS) defines Zone 1 as 0 to 5 feet from the home, Zone 2 as 5 to 30 feet from the home, and Zone 3 as 30 to about 100 feet from the home (**Figure 4-3**). Some organizations call Zone 1 the "noncombustible zone" (0 to 5 feet from the home) and Zone 2 the "lean, clean, and green zone" (5 to 30 feet from the home).

Property owners should establish defensible space around each building on their property, including campers/RVs, detached garages, storage buildings, barns, and other structures. Accessory buildings on a property can ignite and emit embers that might catch nearby homes and vegetation on fire. Removing all vegetation under and around structures within the defensible space is crucial. Campers/RVs, boats, detached garages, storage buildings, barns, and other large structures should be placed at least 50 feet away from primary structures to prevent structure-to-structure fire spread (Maranghides et al., 2022).

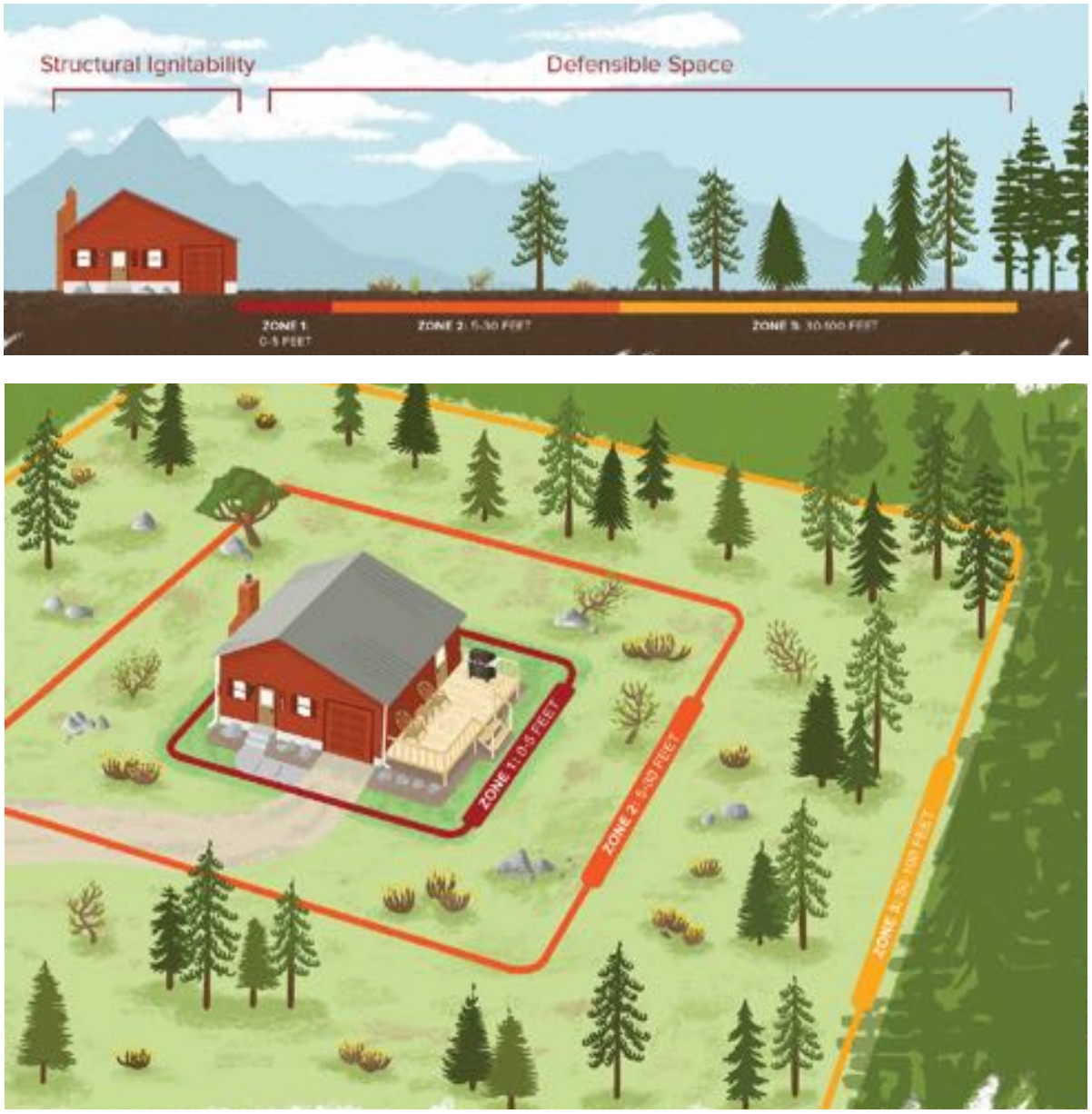
> Do not count on firefighters staying to defend your home. Your home should be able to survive a wildfire on its own. There are often not enough firefighters to stay and defend every single home during large incidents.

Treatments in Zone 3 should focus on reducing wildfire risk to the home, creating safe conditions for firefighters, and increasing the visibility of your home from the road for firefighters. Following Zone 3 treatment, homeowners often enjoy the more open forest around their home because it lets in more light, which encourages understory grasses and shrubs to grow and, in turn, can attract wildlife. Zone 3 often overlaps adjacent properties, requiring residents to work together to address shared wildfire risk.

The Boulder County Wildfire Partners program offers free, individualized home assessments to eligible homeowners in west Boulder County to reduce wildfire risk. A Wildfire Mitigation Specialist conducts a comprehensive on-site evaluation, marking vegetation for removal and assessing vulnerabilities in and around your home. Homeowners receive a detailed report with actionable steps, photos, and emergency preparedness guidance within 10 days. This program is funded by Boulder County and the Colorado State Forest Service. Assessments take about 2 hours and are conducted year-round. In BMFPD, 558 residents have applied to the Wildfire Partners program. Of these, 230 have completed home assessments and 288 have taken all necessary steps to become certified, demonstrating their commitment to wildfire preparedness.

A 2021 study from the University of Colorado-Boulder showed that homeowners living in the WUI in Bailey, CO, typically underestimated their home's risk to wildfire and overestimated the amount of work they had done to protect their property (Simpkins, 2021). Make sure you are informed about best practices for protecting your home. See the CSFS publication The Home Ignition Zone for recommendations (**Figure 4-4**).

***Figure 4-3:*** *Home ignition zones recommended by the Colorado State Forest Service. Using ignition-resistant building materials and removing burnable fuel around primary structures, outbuilding such as sheds, and campers/RVs is crucial for increasing your home's chance of surviving a wildfire and creating safe conditions for wildland firefighters.*




*Source: Colorado State Forest Service, [The Home Ignition Zone]*

***Figure 4-4:*** *Home ignition zone recommendations based on the CSFS publication The Home Ignition Zone. This is not an all-inclusive list of activities.*

| **Zone 1: 0 to 5 feet from your home – the noncombustible zone.** |
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| **Goal: Prevent flames from having direct contact with your home.** |
| • Create a noncombustible border 5 feet around your home (aka, hardscaping). Replace flammable wood chips with alternatives such as dirt, stone, or gravel.<br>• Remove branches that hang over your roof and drop needles onto your roof and remove all fuels within 10 feet of the chimney.<br>• Remove combustible materials (dry vegetation, wooden picnic tables, juniper shrubs, etc.) from underneath, on top of, or within 5 feet of decks, overhangs, windows, and doors.<br>• Regularly remove dead or dry leaves, pine needles, and dead plants within 5 feet of your home and off your deck, roof, and gutters. Beyond 5 feet from structures, raking material will not significantly reduce the likelihood of ignition and can negatively affect other trees.<br>• Move firewood or other combustible materials to Zone 3.<br>• Do not use space under decks for storage. |
| **Zone 2: 5 to 30 feet from your home – the lean, clean, and green zone.** |
| **Goal: Slow the movement of flames approaching your home and lower the fire intensity.** |
| • Irrigate and mow grasses to 4 inches tall or less. If you are unable to irrigate, replace dry grasses with Firewise Plant Materials that are more drought tolerant and less flammable.<br>• Remove any accumulated surface fuels such as logs, branches, slash, and mulch.<br>• Remove all common junipers because they are highly flammable and tend to hold a layer of flammable material beneath them. Landscape with plants that have more fire-resistant attributes, such as those with short statures, deciduous leaves, and higher moisture contents. See Firewise Plant Materials from Colorado State University Cooperative Extension for suggestions.<br>• Remove enough trees to create at least 10 feet of space between crowns. Measure from the outermost branch of one tree to the nearest branch on the next tree. Create even more space between trees if your home is on a slope. See **Figure 4-5** for how to measure crown spacing.<br>• Favor the retention of aspen trees because this species has naturally high fuel moisture, no low branches, and smooth bark, making them less likely to ignite than conifer trees.<br>• Remove ladder fuels under remaining trees. This is any vegetation that can bring fire from the ground up into taller fuels.<br>• Remove limbs so branches do not hang below 6 feet above the ground, and ideally not below 10 feet above the ground. See **Figure 4-5** for a depiction of how to measure limb height.<br>• Keep spacing between shrubs at least 2 to 3 times their height.<br>• Relocate wood piles and propane tanks to Zone 3.<br>• Remove stressed, diseased, dead, or dying trees and shrubs. This reduces the amount of vegetation available to burn and improves forest health.<br>• Keep shrubs at least 10 feet away from the edge of tree branches. |

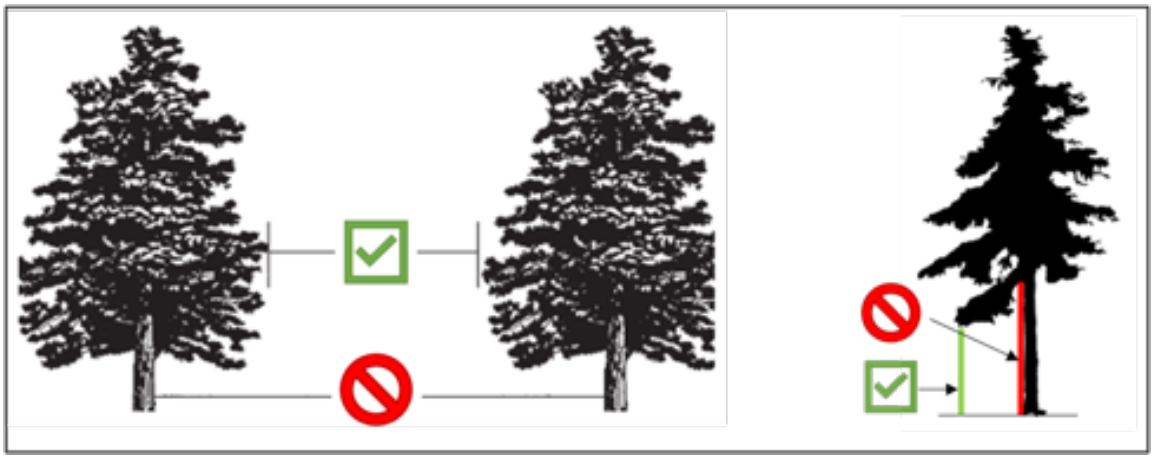
**Zone 3: 30 to 100 feet from your home**

**If you live on a slope, this zone should be larger due to the greater potential for extreme fire behavior.**

**Goal: Slow movement of flames, move fire to the ground, and reduce ember production.**

- Store firewood and propane tanks at least 30 feet away and uphill from your home and away from flammable vegetation. Store even farther away if your home is on a slope.
- Move campers/RVs, boats, detached garages, storage buildings, barns, and other large structures at least 50 feet away from your home.
- Mow or trim grasses to a maximum height of 6 inches. Grasses can be taller in Zone 3 than Zone 2 because of the greater distance from your home, but shorter grass is always better for reducing potential flame lengths and therefore radiant heat exposure.
- Remove enough trees to create at least 6- to 10-foot spacing between the outermost branches of remaining trees. Create even more space between trees if your home is on a slope. See **Figure 4-5** for a depiction of how to measure crown spacing.
- Favor the retention of aspen trees because this species has naturally high fuel moisture, no low branches, and smooth bark, making them less likely to ignite than conifer trees.
- Remove limbs so branches do not hang below 6 feet above the ground, ideally not below 10 feet above the ground. See **Figure 4-5** for a depiction of how to measure limb height.
- Remove shrubs and saplings that can serve as ladder fuels.
- Remove heavy accumulations of dead trees and branches and piles of fallen leaves, needles, twigs, pinecones, and small branches. Thin trees to increase spacing and remove ladder fuels to reduce the likelihood of torching, crown fires, and ember production.
- Consult with a qualified forester to develop a plan to manage your property to achieve fuel reduction and other goals, such as creating wildlife habitat.

***Figure 4-5:*** *Spacing between tree crowns is measured from the edge of tree crown to tree crown, NOT from tree stem to tree stem (left). Height of limbs above the ground is measured from the ground to the lowest point of the limb, NOT from where the limb attaches to the tree (right).*



*Source: Colorado State Forest Service, The Home Ignition Zone*

Homeowners in the WUI who are concerned that removing trees will destroy the forest or reduce the aesthetic and monetary value of their property are urged to also consider the many benefits of good forest management. Historically, tree density along the Front Range was much lower than it is today. This density supported forest health and was maintained naturally by frequent low-intensity wildfires that reduced the number of new trees that became established while allowing older trees to flourish.

BMFPD has many dense ponderosa pine forests that are unhealthy and greatly diverge from historical conditions. These dense forests are susceptible to disease and to wildfire, contributing to the possibility of a high-severity fire burning all or nearly all of the trees in the community as well as many homes. Obviously, this would severely reduce the aesthetic and monetary value of properties.

Effective forest management, which includes removing trees, helps build forest health and reduce these threats. Removing trees can also increase a property's beauty by opening up views of mountains, rock formations, scenic vistas, and wildlife attracted to forests with lower tree densities and an abundance of understory plants. Moreover, several years following tree removal, grasses, shrubs, and wildflowers rebound in response to the increased sunlight, creating beautiful ecosystems with lower fire risk (**Figure 4-6**).

***Figure 4-6:*** *Grasses, shrubs, and wildflowers quickly respond to increased light availability after tree removal, resulting in beautiful ecosystems with lower fire risk. The green star in each photo indicates the same tree. Image sizes vary due to the use of different cameras over the years.*


*Photo credit: Jefferson Conservation District*

## Harden Your Home

Home hardening involves modifying your home to reduce the likelihood of structural ignition. Homes in denser neighborhoods are threatened by short-range embers from nearby homes, which could lead to structure-to-structure ignitions. Homes are also threatened by more distant fire because wind-blown embers can travel long distances, get lodged in gutters or gaps, and cause structural ignition.

Buildings cannot be made fireproof, but the chance of your home surviving wildfires increases when you reduce structural ignitability through home hardening in tandem with the creation and maintenance of defensible space. **Figure 4-7** depicts important home hardening measures.

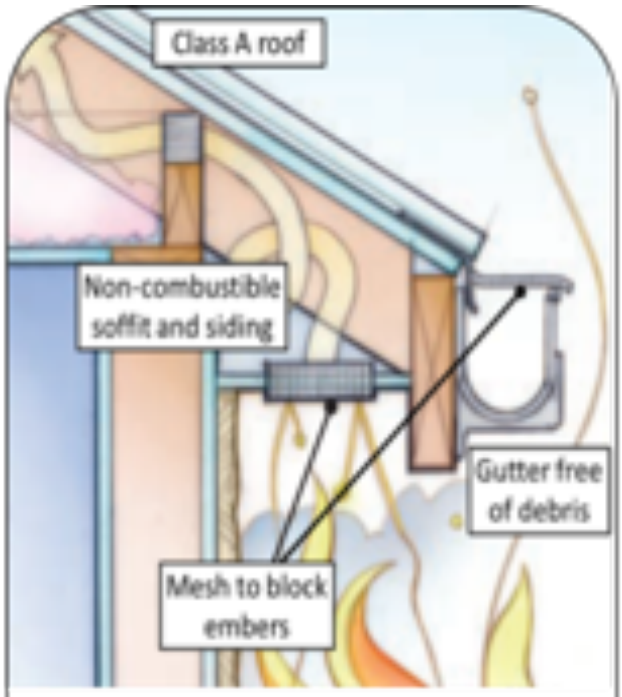



***Figure 4-7:*** *Residents can increase their home's chance of survival by making it harder for embers to enter and ignite the building. Source: Healthy Building Science*

Roofs, vents, windows, exterior siding, decks, and gutters are particularly vulnerable to wildfires. Research on home survival during wildfires demonstrates that enclosed eaves and vent screens can reduce the penetration of wind-born embers into structures (Hakes et al., 2017; Syphard and Keeley, 2019).

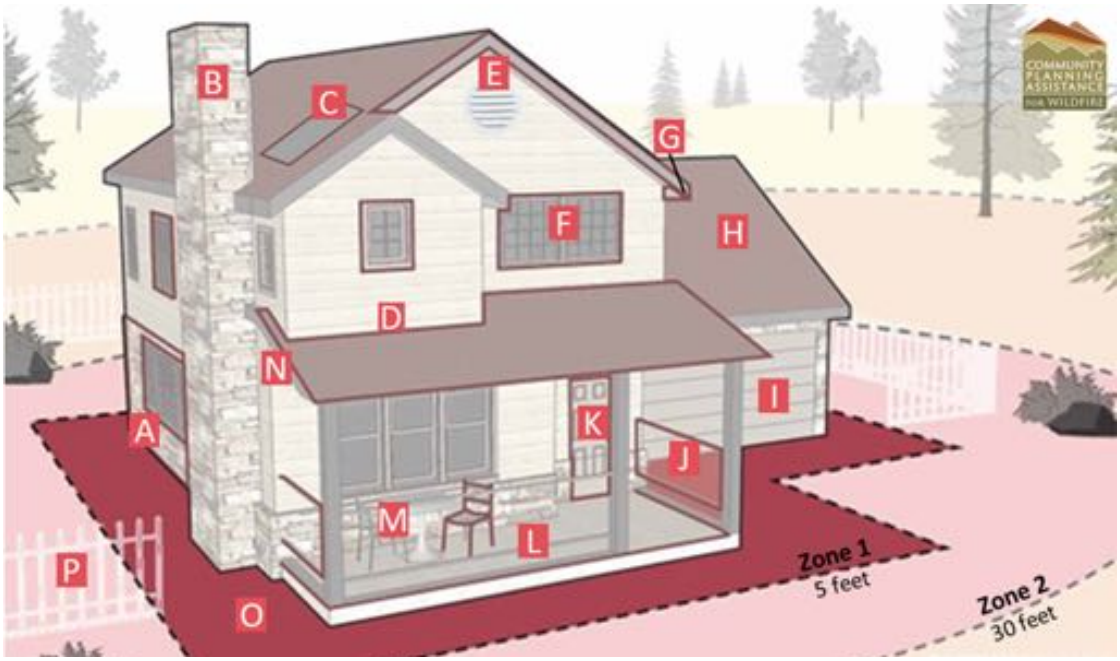
Multipaned windows have greater resistance to radiant heat. Windows often fail before a home ignites, providing a direct path for flames and airborne embers to enter a home (CSFS, 2021).

Replacing wood or shingle roofs with noncombustible materials such as composite, metal, or tile is another home-hardening measure. (See the **Glossary** on page 115 for the definition of terms used to describe the performance of building materials when exposed to fire). Ignition-resistant or noncombustible siding and decking further reduce the risk of home ignition, particularly when homes also have a 5-foot noncombustible border of dirt, stone, or gravel. As an added benefit, non-wood siding and decking are often more durable and require less routine maintenance than natural wood products.

There are many low-cost actions you can start with to harden your home, such as removing combustible materials from underneath, on top of, and within 5 feet of the deck; covering all eves with screen vents; and clearing debris from roof and gutters regularly (**Figure 4-8**). Many BMFPD residents already undertake some of these efforts. According to the BMFPD community survey, 88% of respondents reported that they participated in annual removal of debris such as dead vegetation and pine needles from gutters and roofs and under decks. In addition, 84% of respondents reported that they removed all burnable fuel (e.g., mulch, grass, flammable furniture) from within 5 feet of the base of their home. (See **Appendix B** on page 126 for complete BMFPD community survey results.)

In the longer term, keep home-hardening practices in mind and use ignition-resistant materials if you remodel your home, need to replace your roof, or have other opportunities to make protective upgrades.

***Figure 4-8:*** *A home can never be made fireproof, but home-hardening practices decrease the chance that flames, radiant heat, and embers will ignite your home.*




**Low-cost actions:**

- Cover chimneys and stovepipe outlets with ⅜- to ½-inch corrosion-resistant metal mesh.
- Minimize debris accumulation under and next to solar panels.
- Cover vent openings with 1/16- to ⅛-inch corrosion-resistant metal mesh. Install dryer vents with metal flappers and keep closed unless in use.
- Clear debris from roof and gutters regularly.
- Install metal flashing around and under garage doors that goes up at least 6 inches inside and outside the door.
- Use noncombustible lattice, trellis, or other decorative features.
- Install weather stripping around and under doors.
- Remove combustible materials from underneath, on top of, and within 5 feet of the deck.
- Use noncombustible patio furniture.
- Cover all eaves with screened vents.
- Establish and maintain a 5-foot noncombustible buffer around the home.

**Actions to plan and save for:**

- Use noncombustible or ignition-resistant siding and trim (e.g., stucco, fiber cement, fire-retardant treated wood) at least 2 feet up around the base of your home.
- Use multipaned glass for skylights, not materials that can melt (e.g., plexiglass), and use metal flashing.
- Install a 6-inch vertical noncombustible surface on all gables above roofs.
- Install multipaned windows with at least 1 tempered-glass pane and metal mesh screens. Use noncombustible materials for window frames.
- Install noncombustible gutters, gutter covers, and downspouts.
- Install ignition-resistant or noncombustible roofs (composite, metal, or tile).
- Install 1-hour fire rated garage doors.
- Install 1-hour fire rated doors.
- Use ignition-resistant or noncombustible decking. Enclose crawl spaces.
- Use noncombustible eaves.
- Replace wooden fences with noncombustible materials and keep at least 8 feet away from the home. Keep double combustible fences at least 20 feet away from the home.

*Infographic by Community Planning Assistance for Wildfire*

## Complete Annual Safety Measures and Home Maintenance

Reviewing safety protocols, creating defensible space, and hardening your home are not one-time actions, but part of *annual* home maintenance when living in the WUI. The Colorado State Forest Service provides recommendations for annual home maintenance (**Figure 4-9**). During a wildland fire, homes that have clear defensible space can be protected by wildland firefighters, and homes that are not safely defensible usually do not receive firefighter protection.

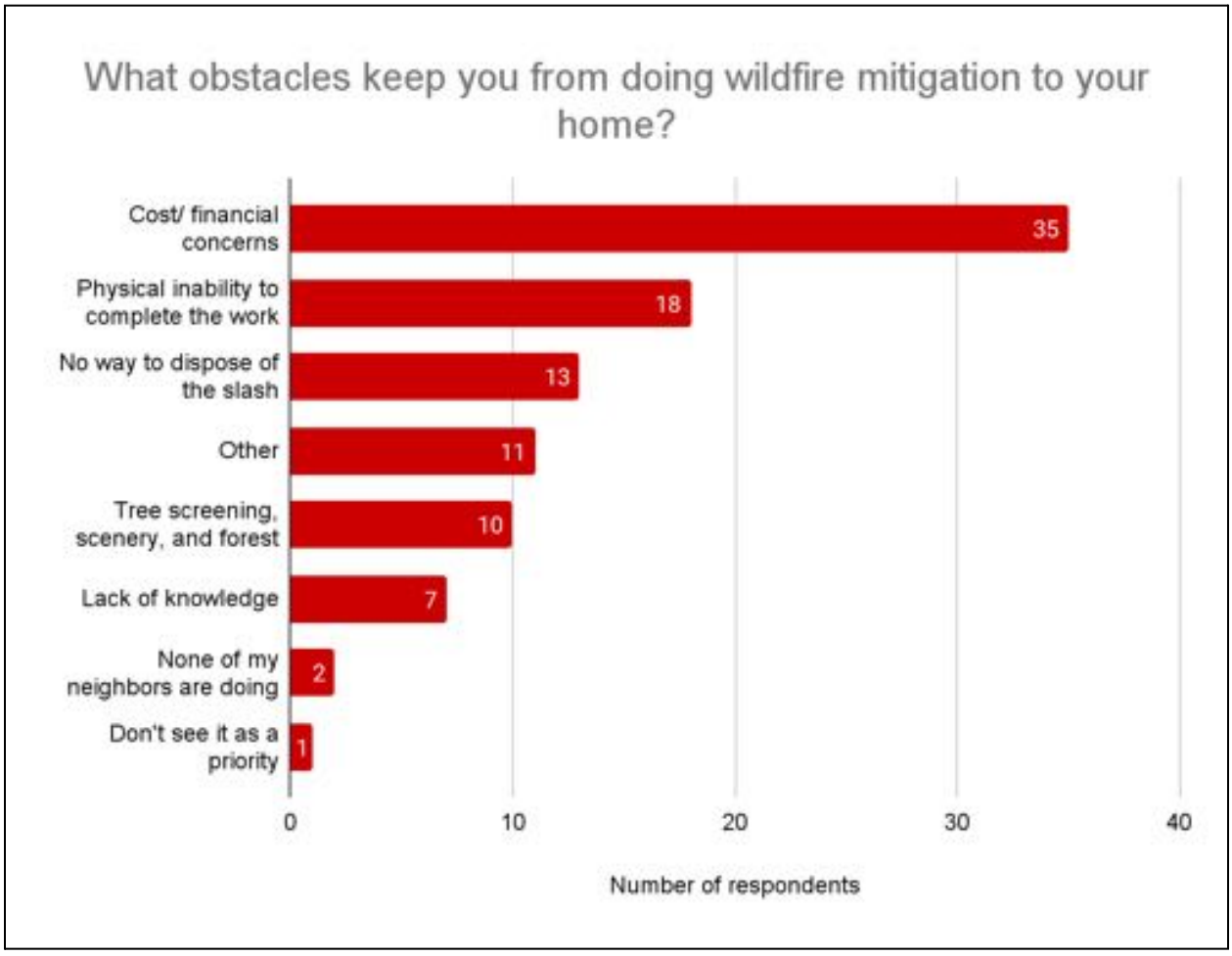
***Figure 4-9:*** *The Colorado State Forest Service provides the following recommendations for annual activities to mitigate risks and increase your wildfire preparedness.*

- ✔ Check fire extinguishers to ensure they have not expired and are in good working condition.
- ✔ Review your family's evacuation plan and practice family fire and evacuation drills.
- ✔ Verify that your home telephone number, cell phone, and/or email are properly registered for emergency notifications. Visit Boulder County's Website for information about emergency notifications. (See **Appendix E** on page 195 for website URLs.)
- ✔ Review the contents of your "go bag" and make sure it is packed and ready. Visit the Ready.gov to learn about preparing go bags. (See **Appendix E** on page 195 for website URLs.) Your go bag should include to last at least 3 days, and include cash, water, clothing, food, first aid, and prescription medicines for your family and pets. Keep important documents and possessions in a known and easily accessible location so you can quickly grab them during an evacuation.
- ✔ Pay attention to red flag day warnings from the National Weather Service and stay vigilant. Ensure your family is ready to go in case of an emergency.
- ✔ Walk your property to identify new hazards and ways to maintain and improve current defensible space. Take pictures of your defensible space to help you monitor regrowth and determine when additional vegetation treatments are necessary.
- ✔ Clear roofs, decks, and gutters of pine needles and other debris. Remove all pine needles and flammable debris from around the foundation of your home and deck. Remove trash and debris accumulations within 30 feet of your home. Repeat throughout the year as necessary.
- ✔ Properly thin and prune trees and shrubs that have regrown in Zone 1 and Zone 2 (0 to 5 feet and 5 to 30 feet from your home, respectively). Remove branches that overhang the roof and chimney. Prune trees and shrubs that are encroaching on the horizontal and vertical clearance of your driveway.
- ✔ Mow grass to a height of 4 inches or less within 30 feet of your home, camper/RV, sheds, and barns. If possible, keep your lawn irrigated, particularly within 30 feet of your home. Consider replacing dry grasses with firewise plants that are more drought tolerant and less flammable.
- ✔ Ensure your address number is visible from both directions, and remove any vegetation that obscures it.
- ✔ Dispose of leaves, needles, and branches during slash drop-off dates organized by Boulder county. See the Boulder County - Yard Waste and Food Scrap Drop-Off website for more information. (See **Appendix E** on page 195 for website URLs.)
- ✔ Get slash piles chipped through the Wildfire Partners program. See the Wildfire Partners Chipping Program website for information. (See **Appendix E** on page 195 for website URLs.)
- ✔ Check screens over chimneys, eaves, and vents to make sure they are in place and in good condition.
- ✔ Ensure that an outdoor water supply is available for responding firefighters. Put a hose and nozzle in a visible location. The hose should be long enough to reach all parts of your home.

## Overcome Mitigation Barriers and Seek Opportunities

Homeowners and residents in the WUI share concerns about mitigating risk and maintaining safe conditions in their home ignition zone. The BMFPD community survey asked residents what obstacles prevented them from mitigating their property. The biggest concern expressed by residents was the cost and financial barriers (**Figure 4-10**). Physical inability to complete the work was also expressed as a significant obstacle to completing home mitigation. Residents also had concerns about disposing of the slash as well as worries regarding scenery and forest ecology. See **Figure 4-11** for a list of common concerns from residents with potential solutions to encourage mitigation measures.

***Figure 4-10:*** *Responses from the BMFPD community survey regarding barriers to wildfire mitigation.*




*See **Appendix B** on page 126 for complete BMFPD community survey results.*

***Figure 4-11:*** *Common concerns from residents and solutions to encourage mitigation measures.*

| Concern | Potential solutions |
|---|---|
| **I don't have the resources to invest in defensible space.** | Creating adequate defensible space can take years and a financial investment to implement. Fortunately, there are **effective, low-cost measures** that residents can start with and funding sources to complete this work:<br>✔ Annually remove leaves, needles, and other vegetation from roofs, gutters, decks, and around the base of homes.<br>✔ Use hand tools like a pole saw to remove tree branches that hang less than 10 feet above the ground.<br>✔ Remove combustible materials from underneath, on top of, and within 5 feet of decks.<br>✔ Remove downed branches within 30 feet of all structures.<br>✔ Participate in community chipping events.<br>✔ See **Funding Opportunities for BMFPD Residents** on page 87.<br>✔ Take advantage of available tax credits to help offset the costs of mitigation activities. |
| **I don't have the physical ability to complete wildfire mitigation to my home.** | For residents who may not have the physical ability to complete wildfire mitigation work, several options are available to ensure their properties are protected without the need for strenuous labor. Local resources to manage mitigation efforts include:<br>✔ **The BMFPD Mitigation Crew**:<br>BMFPD offers free site assessments for district residents and a variety of paid services to assist residents with wildfire mitigation projects. Residents can hire this skilled crew to ensure their properties are properly mitigated without needing to perform the physical labor themselves.<br>✔ **Senior and Disability Support Programs**:<br>Boulder County's **Aging Services** program and the **Boulder County Area Agency on Aging** can help senior citizens or individuals with disabilities connect with local services for home maintenance, including fire mitigation.<br>✔ **Neighbor-to-Neighbor Assistance**:<br>Encourage participation in neighborhood fire mitigation groups |

| | |
|---|---|
| | where physically able residents volunteer to help their neighbors who may not be able to perform the labor. Community involvement could be encouraged through neighborhood wildfire preparedness days.<br><br>✔ **Wildfire Partners Program**:<br><br>Boulder County's **Wildfire Partners** program helps residents of all abilities implement mitigation projects. It offers assessments, expert advice, and access to contractors who can help implement defensible space. |
| **I don't have a way of disposing of the slash after completing mitigation work.** | For residents concerned about the disposal of slash, a variety of options are available to help manage and remove the debris efficiently. Local programs and resources can assist homeowners in properly handling branches, logs, and other vegetation removed during mitigation without overwhelming personal resources or capabilities. Below are some solutions:<br><br>✔ **Wildfire Partners Chipping Program**:<br><br>Wildfire Partners offers a community chipping program. The program supports residents with managing high-risk vegetation and reducing slash buildup. For more information, visit the Wildfire Partners website. (See **Appendix E** on page 195 for website URLs.)<br><br>✔ **Boulder County Community Forestry Sort Yards**:<br><br>Boulder County residents can drop off tree branches and logs free of charge in Nederland and Allenspark. Residents can visit the Boulder County website for details on what is accepted at the sort yards and how to prepare the materials. |
| **I am afraid that removing trees will destroy the forest and reduce the aesthetic and monetary value of my property.** | The reality is that a high-severity wildfire that consumes vast amounts of vegetation will have a detrimental effect on the valuation of a property. Below are some helpful tips:<br><br>✔ **Neighborhood Defensible Space Inspiration**<br><br>Drive around the community and look for homes that have followed the guidelines in **Figure 4-4**. Some properties in BMFPD have exemplary defensible space and beautiful landscaping at the same time.<br><br>✔ **Fire-Resistant Landscaping**<br><br>Consult Colorado State University Extension's Firewise Plant Materials and Fire Safe Marin's Firescaping for suggestions on beautiful fire-resistant landscaping. (See **Appendix E** on page 195 for website URLs.) As an added benefit, fire-resistant landscaping is often especially drought tolerant. |

| | |
|---|---|
| | ✔ **Benefits of Restoring Ecosystems**<br>Restored ecosystems can be aesthetically pleasing, benefit wildlife and light-loving wildflowers and grasses, and protect your home from high-severity wildfires. |

*Fire-resistant landscaping in BMFPD. Zone 1 can be aesthetically pleasing and more drought tolerant, requiring less watering during the summer. Limbed and thinned trees in Zone 2 (as seen in the background of this photo) can create beautiful, open conditions that allow understory vegetation to flourish under higher light conditions and provide habitat for wildlife.*

*Photo credit: Washington State University Master Gardener Program*

## Be Prepared to Evacuate

Evacuating when wildfire threatens can be extremely stressful. Advanced planning and practice can help reduce your stress and help you and your family and pets get out quickly and safely.

### *Remember, You Are Your Own First Emergency Alert*

Remember that ultimately, you are your own best emergency alert system. Stay vigilant and aware of your surroundings. If you see, smell, hear, or sense a potential hazard, act to keep yourself and those around you safe. In the case of a wildfire, if you sense an immediate threat, you may choose to evacuate based on your assessment alone. Trust your instincts and know that you do not need to wait for an official evacuation order to leave.

### *Sign Up for Boulder County Emergency Alerts*

To receive timely evacuation orders and alerts about imminent threats, visit BoCoAlert.org and register to receive notifications via phone, text, and email. We highly recommend that each household member sign up individually—this ensures everyone receives alerts even if you are not together during an emergency. Remember, only landlines and some VOIP lines are automatically enrolled, so it is essential to sign up if you primarily use a cell phone.

### *Consider Adding Yourself or a Family Member to BMFPD's Special Needs List*

BMFPD maintains a list of individuals who may require extra help in the event of an emergency. We call this the special needs list. It is used by BMFPD's incident commanders, and is kept confidential. To get yourself or a family member on this list, reach out to specialneeds@bouldermoutainfire.org.

### *Prevent Your Cell Phone from Blocking Emergency Alerts*

Boulder County's emergency notifications use the caller ID 303-441-1400. Make sure to set this number as a contact that can bypass Do Not Disturb and silent modes on your phone. For guidance on how to set this up, please see BMFPD - Evacuation Preparedness. Additionally, check that your cell phone settings allow Wireless Emergency Alerts (WEAs), a public safety system that sends geographically targeted, alert-like texts during imminent threats. WEAs don't require registration; learn more about them at the Wireless Emergency Alerts website. (See **Appendix E** on page 195 for website URLs.)

### *Familiarize Yourself with District Evacuation Maps*

In the event of an evacuation, it is critical that every household member knows how to reach safety. Remember that your usual route out of the neighborhood may not be the safest or quickest option during an emergency. Take time to familiarize yourself with all possible evacuation routes from your area. BMFPD evacuation maps are available online, see BMFPD - District Evacuation Maps. (See **Appendix E** on page 195 for website URLs.) We encourage you to download, review, and print these maps. Place copies in each of your vehicles to ensure they are accessible if an evacuation order is issued.

***Follow evacuation etiquette*** *to increase the chance of everyone exiting BMFPD in a safe and timely manner during a wildfire incident:*

- Register your phones and email with BoCoAlert.org, Boulder County's emergency alert notification system, to receive evacuation notifications. (See **Appendix E** on page 195 for website URLs.)
- Visit the Boulder Office of Disaster Management for additional information about evacuations and notifications. (See **Appendix E** on page 195 for website URLs.)
- When in doubt, get out. You do not need to wait for an evacuation notice to leave. If you feel threatened, trust your gut and evacuate.
- Leave as quickly as possible after receiving an evacuation notice.
- Have a go bag packed and always ready, especially on days with red flag warnings.
- Leave with as few vehicles as necessary to reduce congestion and evacuation times across the community.
- Drive safely and with headlights on. Maintain a safe and steady pace. Do not stop to take pictures.
- Yield to emergency vehicles.
- Follow directions of law enforcement officers and emergency responders.

## Increase Accessibility and Navigability for Firefighters

### *Address Signs*


Installing reflective address numbers can save lives by making it easier for firefighters to navigate to your home at night and under smokey conditions. Reflective signs are available for purchase online from the BMFPD Community Safety Store. (See **Appendix E** on page 195 for URLs.) Mount reflective address signs on noncombustible posts, not on stumps, trees, wooden posts, or chains across driveways. Chains across driveways might be removed during wildfire suppression to facilitate access to your property. Make sure the numbers are clearly visible from both directions on the roadway.

### *Driveways*

It is important to ensure emergency responders can locate and access your home. Narrow driveways without turnarounds, tree limbs hanging over the road, and lots of dead and down trees by the road may make firefighters choose to not defend your home during a wildfire event (Brown, 1994).

Many roads in BMFPD have accessibility and navigability issues, such as narrow widths, inadequate vertical clearance for engines, and heavy fuel loading on the sides of the road. These unsafe road and driveway conditions could turn firefighters away from attempting to defend homes. According to the National Fire Protection Association, driveways and roads should have a minimum of 20 feet of horizontal clearance and 13.5 feet of vertical clearance to allow engines to safely access the roads (O'Connor, 2021).


Where possible, residents should improve roadway access, and where this is not feasible, it is vital that homeowners take measures to harden their home and create defensible space. Some actions to increase access to your home are simple, such as installing reflective address numbers, and others take time and investment, such as widening driveways to accommodate fire engines.

## *Steps to Enhance Firefighter Safety and Access to Your Home:*

- Install reflective address numbers on the street to make it easier for firefighters to navigate to your home under smokey conditions and at night. Make sure the numbers are clearly visible from both directions on the roadway. Use noncombustible materials for your address sign and sign supports. Installing reflective address numbers can save lives and is inexpensive and easy to accomplish.
- Address roadway accessibility for fire engines. Long, narrow, steep, and curving private drives and driveways without turnarounds significantly decrease firefighter access to your property, depending on fire behavior.
- Fill potholes and eroded surfaces on private roads and driveways.
- Increase fire engine access to your home by removing trees along narrow private roads and driveways so the horizontal clearance is 20 feet wide, and prune low-hanging branches of remaining trees so the unobstructed vertical clearance is at least 13.5 feet, per guidelines from the National Fire Protection Association.
- Park cars in your driveway or garage, not along narrow roads, to make it easier for fire engines to access your home and your neighbors' homes.
- Clearly mark septic systems with signs or fences. Heavy fire equipment can damage septic systems.
- Clearly mark wells and water systems. Leave hoses accessible for firefighters to use when defending your home, but DO NOT leave the water running. This can reduce water pressure to hydrants across the community and reduce the ability of firefighters to defend your home. Visit Fire Safe Marin - Evacuation Planning and Checklists about why it is dangerous to leave water running when you evacuate during a wildfire. (See **Appendix E** on page 195 for URLs.)
- Post the load limit at any private bridges or culverts on your property.
- Leave gates unlocked during mandatory evacuations to facilitate firefighter entrance to your property.
- Leave exterior lights on to increase visibility.
- If time allows, leave a note on your front door confirming that all parties have evacuated and providing your contact name and phone number.

# Recommendations for Neighborhoods

This CWPP is a useful planning document, but it will affect real change only if residents, neighborhoods, BMFPD, community groups, and agency partners come together to address shared risk and implement strategic projects. This section of the CWPP discusses the concept of linked defensible space and provides relative hazard ratings and specific recommendations for the 12 CWPP study areas in BMFPD. CWPP study areas are groups of neighborhoods with shared fire risk, as discussed and analyzed in **Section 3**. We encourage residents within study areas to organize and support each other to effectively reduce wildfire risk and enhance emergency preparedness.

## Create Linked Defensible Space

The home ignition zone of individual residents can overlap with that of their neighbors, so wildfire hazards on one property can threaten adjacent properties. This is because structures that are on fire can emit significant radiant heat and embers, endangering nearby homes and other structures.

A shared or linked defensible space creates continuous buffer zones among neighboring properties, enhancing protection for an entire neighborhood. This is particularly important in areas where properties are in close proximity. A linked defensible space involves a collective effort to reduce combustible vegetation and manage potential ignition sources between neighboring properties, thereby expanding the buffer zones and increasing wildfire resilience for the area.

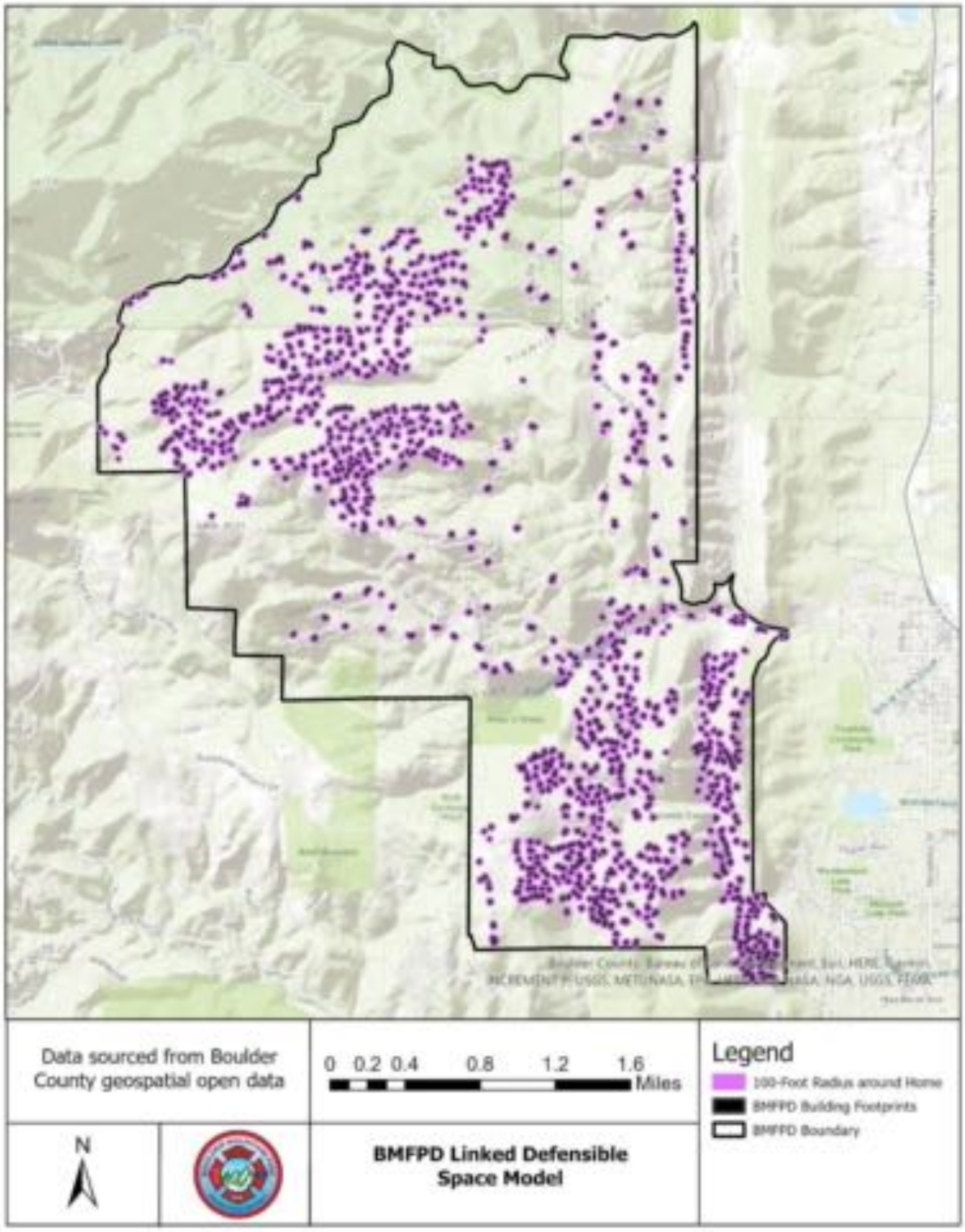
By working together to create linked defensible space, neighbors can increase each of their home's chances of survival during a wildfire. Linked defensible space also creates safer conditions and better tactical opportunities for wildland firefighters. According to James White, a prescribed fire and fuels specialist for the Arapaho/Roosevelt National Forests, "Broadcast burning, mechanical thinning, and other treatments are proven to mitigate wildfire risk, but they are even more effective when we work together to integrate treatments across the landscape, across borders and ownerships" (Avitt, 2021). In addition, defensible space projects that span ownership boundaries are better candidates for grant funding due to their strategic value.

BMFPD has varying home densities throughout its neighborhoods. Areas where home ignition zones overlap are particularly vulnerable to home-to-home ignition. Residents in those areas are encouraged to approach defensible space treatments as a community for maximum chances of success during a wildfire event. **Figure 4-12** shows building footprints of the residential homes in BMFPD, along with a 100-foot radius around each building. This map is a model showing what the district would look like if all homes were properly mitigated to create a 100-foot radius of defensible space. This map shows the importance of linked defensible space.

How can you help inspire action by your neighbors? Start by creating defensible space and hardening your own home. Then try the following ideas:

- Invite your neighbors over for a friendly conversation about the risk assessment in this CWPP. Review resources about defensible space together, discuss each other's concerns and values, and develop joint solutions to address shared risk.
- Help organize walking tours in your neighborhood to visit the property of residents with exemplary defensible space. Seeing the type of work that can be done and that a mitigated property can still be aesthetically pleasing can encourage others to follow suit.

***Figure 4-12**: 100-foot radius around each home and building in BMFPD. This map shows the mitigation work that should be completed for all homes in BMFPD to create linked defensible space.*




*Source: Created by BMFPD using data from Boulder County geospatial open data*

# Recommendations for the Entire BMFPD Community

## Improve Evacuation Planning and Capacity

Reliable technology to provide warnings and information about evacuations can help residents feel confident in their ability to evacuate during a wildfire. Boulder County uses BOCO Alert to notify county residents of emergency situations. (See **Appendix E** on page 195 for URLs.) Residents can receive notifications in a variety of ways, including on cell, work, and home phones, as well as via text messages and emails (Boulder County, 2024). BMFPD, HOAs, and district residents should actively extend awareness about the BOCO Alert system to neighbors who are unaware of the program. Fortunately, 99.2% of respondents to the CWPP community survey indicated that they have signed up for emergency notifications through the county, but this number should ideally be 100%. (See **Appendix B** on page 126 for complete BMFPD community survey results.)

BMFPD, district residents, HOAs, and community groups can help address evacuation planning, capacity, and concerns by doing the following:

- Remove trees, cut low limbs, and mow grass along roadways to increase the likelihood of survivable conditions during a wildfire. Prioritize the roads with the most traffic and congestion and work out to the less congested roads.
- Coordinate with BMFPD to conduct evacuation drills to practice safe and effective evacuation for the entire district.
- Increase resident knowledge about registrations with BOCO Alert.
- Educate residents about warning systems, protocols for evacuation orders, and evacuation etiquette prior to the need to evacuate the community. Communicate the importance of following evacuation orders; failing to leave the community in a timely manner during a wildfire emergency can put residents and first responders at risk.
- Encourage households to evacuate together in a single vehicle to reduce congestion for everyone.
- Encourage all households to develop family evacuation plans and to pack go bags. Currently, 90.2% of respondents to the BMFPD community survey have evacuation plans for their family and only 67% have go bags ready. (See **Appendix B** on page 126 for complete BMFPD community survey results.)
- Encourage residents to work with their neighbors to develop a plan for helping each other with evacuation if a resident is not at home, school-aged children or pets might be home alone, or residents have mobility impairments and need special assistance.
- Encourage residents to evacuate whenever they feel unsafe, even before receiving mandatory evacuation orders. All residents should leave promptly when they receive a mandatory evacuation order. This means having a family emergency plan already in place and having go bags ready.
- Educate residents about BMFPD's special needs list that helps first responders provide additional help to those who may need extra help evacuating.

## Improve Shared Driveways and Community Roads

Residents, HOAs, and Boulder County can work together to ensure emergency responders are able to locate and access everyone's home. Narrow roads without turnarounds, tree limbs hanging over roads, and lots of dead and down trees by roads may make it difficult for firefighters to protect homes during a wildfire event (Brown, 1994).

Where feasible, BMFPD and HOAs should improve roadway access by widening road networks in areas with narrow roads and creating turnarounds and pullovers to accommodate fire engines and two-way traffic during evacuation. The community can apply for grants and work with the Boulder County Sheriff's Office to remove trees from along roads to reduce the chance of unsurvivable conditions occurring during wildfires. Residents can remove trees along driveways and prune low-hanging branches to increase horizontal and vertical clearance. According to the National Fire Protection Association, driveways and roads should have a minimum of 20 feet of horizontal clearance and 13.5 feet of vertical clearance to allow engines to safely access the roads (O'Connor, 2021).

## Improve Roadside Fuel Treatments

During a wildfire in BMFPD, there is a high likelihood of evacuation congestion and long evacuation times. The district's terrain and infrastructure make evacuation planning particularly challenging. A significant number of unpaved roads make rapid evacuation and timely first responder access difficult. Unpaved roads may slow response times and create dust that limits visibility, while narrow roads can lead to congestion, complicating the safe and efficient movement of residents and emergency personnel during a wildfire event.

Certain roads, both paved and unpaved, within BMFPD are at high risk of becoming "potentially unsurvivable" under wildfire conditions due to dense vegetation and overhanging limbs near the roadway. These areas require targeted mitigation efforts, such as the reduction of combustible vegetation along roadways, to improve evacuation routes. Proactively mitigating high-risk sections of these critical roadways can enhance survivability for residents sheltering in vehicles during an emergency and decrease the risk of impassable roads due to encroaching flames. At the same time, some roads within the district have already undergone substantial mitigation or possess naturally lower-risk vegetation and thus pose lower threat during an evacuation due to a wildfire event.

Treatments along roadways require a dramatic reduction of fuels to create safe and survivable conditions. This includes removing most trees adjacent to the roadway, limbing remaining trees, and regularly mowing grass and shrubs (**Figure 4-13**).

It is recommended that every vehicular road within BMFPD receives wildfire mitigation efforts (**Figure 4-15**). The width of an effective roadside fuel treatment (distance to the left and right of a road) is dependent on slope. It is recommended that treatments extend 150 to 240 feet off the downhill side of the road and 100 to 150 feet off the uphill side. Wider treatments are necessary on the downhill side on steeper slopes due to the exacerbating effect of slope on fire intensity when fires travel uphill (Dennis, 2005). See **Figure 4-14** for examples of roadway conditions and suggestions for treatment and improvement. Important aspects of all roadside fuel treatments include:

- Removing limbs overhanging the road to create *at least* 13.5 feet of vertical clearance.
- Removing trees alongside the road to create *at least* 20 feet of horizontal clearance.
- Removing trees to create *at least* 10 feet crown spacing between remaining trees within the roadside treatment zone.
- Removing shrubs and regeneration that can serve as ladder fuels.
- Mowing grasses adjacent to the road.
- Remove slash following fuel treatments.

Along important evacuation routes that could experience extreme congestion, roadside treatments should be more aggressive and consist of near removal of all trees within at least 30 feet of roadways. Clear-cutting along roads when surrounding forests remain dense can cause problems with snow drifting, so in areas where drifting is more likely, shaded fuelbreaks might be more appropriate or snow fences might need to be installed.

Some residents find roadside fuel treatments aesthetically displeasing because of the removal of so many trees, but these treatments are vital for increasing the safety of residents and firefighters in BMFPD. Roadside treatments must dramatically reduce fuel loads to effectively reduce the risk of unsurvivable conditions developing during wildfires.

***Figure 4-13:*** *Effective roadside fuel treatments remove enough trees to result in widely spaced crowns, remove ladder fuels (seedlings, saplings, shrubs, and low limbs), and reduce surface fuels. More dramatic tree removal along roadways can create even safer roadside conditions where appropriate.*

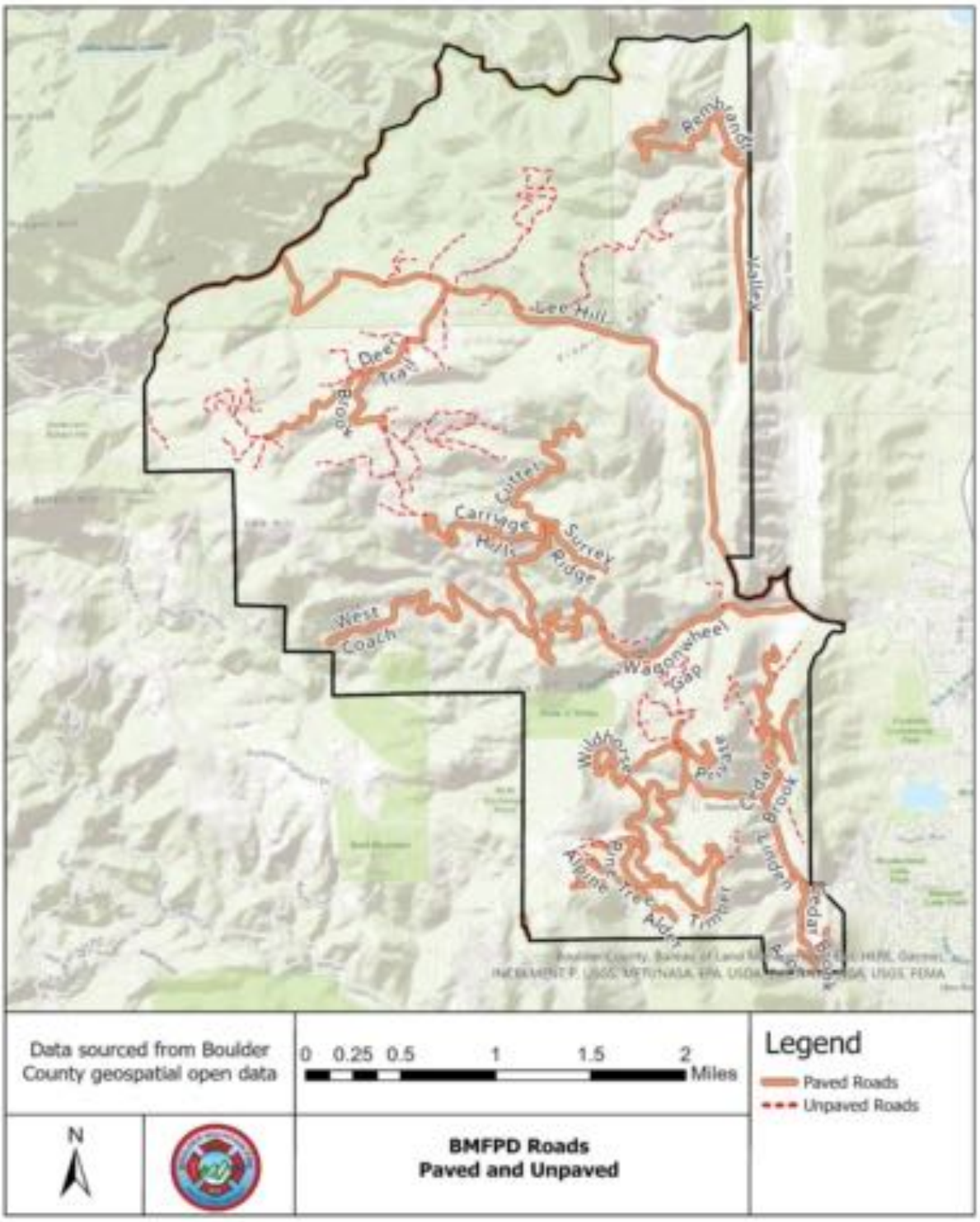

*Photo credit: Genesee Foundation (top) and USDA/FPAC/GEO/Google Earth (bottom)*

***Figure 4-14:*** *Examples of conditions occurring along roadways in BMFPD and suggestions for treatment and improvement.*

| Roadway example | Suggestions for improvement |
|---|---|
|  | • Clear trees and tall shrubs away from the roadways to create *at least* 20 feet of horizontal clearance.<br>• Clear extra vegetation on the downhill side.<br>• Create regular pullouts and turnaround locations for fire engines. |
|  | • Mow tall grasses along the side of the road.<br>• The trees along this roadway are away from and upslope of the road, which is good. Nonetheless, additional trees should be removed to further reduce roadside vegetation, but this treatment is a lower priority than others. |
|  | • Remove trees that are leaning over the roadway to create *at least* 13.5 feet of vertical clearance, because they could fall and trap residents during an evacuation.<br>• Clear all trees on the sides of the roadways.<br>• Install mirrors on switchbacks to improve visibility. |

*Photo credit: Julie Pitney (BMFPD)*

***Figure 4-15:*** *BMFPD has a complex road network, including narrow streets and unpaved roads. It is important to treat the fuels along these roadways.*




*Source: Created by BMFPD using data from Boulder County geospatial open data*

# Funding Opportunities for Wildfire Mitigation

Property owners can access a variety of funding opportunities available from federal, state, and county partners to assist with forest health and wildfire mitigation projects. These funds pertain to both defensible space projects and larger wildfire mitigation treatments. Some of the opportunities are cost-share and require funds from property owners, and some cover the full costs of projects. BMFPD offers free site assessments to district residents to assist with project scopes and identify which funding sources would best suit each property. This following list is current as of 2025.

## Funding Opportunities for BMFPD Residents

- ### *Wildfire Partners Defensible Space Funding*

  Boulder County residents are eligible for funding to assist with the completion of wildfire mitigation work to create defensible space. Following a site assessment from Wildfire Partners personnel and upon completion of required mitigation work, property owners can receive a standard award covering 50% of the cost of the mitigation work, up to $2,000. Participants with limited incomes can apply for a need-based award that covers additional costs. (See **Appendix E** on page 195 for website URLs.)

  Wildfire Partners Defensible Space Program

- ### *Wildfire Partners Rebate Program*

  A $500 rebate is available to Boulder County residents who complete 1 or more of eligible Wildfire Partners mitigation actions: junk your junipers, fences are fuses, the first 5 feet, and screening or replacing vents.

  Wildfire Partners Rebate Program

- ### *Wildfire Partners Need-Based Funding Program*

  For Boulder County residents with limited incomes, Wildfire Partners offers additional funding opportunities to support wildfire mitigation projects. Participants may qualify for awards covering up to 100% of eligible mitigation costs. This funding is designed to ensure equitable access to defensible space and wildfire preparedness.

  Wildfire Partners Need-Based Funding Program

- ### *Wildfire Partners Community Chipping Program*

  Wildfire Partners offers a free chipping and hauling away of slash (small branches, twigs, brush, and small trees) program to Boulder County residents. Homeowner groups of 5 or more work together to hold a chipping event, meeting the program's requirements.

  Wildfire Partners Chipping Program

- *Boulder Mountain Fire Fuel Break Funding*

  BMFPD has secured county, state, and federal grant funds to offset the costs associated with larger wildfire mitigation treatments (1 acre or greater). These projects are generally designed to tie into defensible space treatments and extend further out into forested areas to maximize mitigation efforts. These funding sources are also available for larger, full community protection projects, and for treatments along evacuation routes. A free site assessment from BMFPD personnel is suggested to identify if your property is eligible for this funding source and to discuss treatment scope and project size.

  Boulder Mountain Fire Site Assessment Request

# Recommendations for Fuel Treatment Implementation

## Objectives and Benefits of Fuel Treatments and Ecological Restoration

### *Fuel Treatments*

Fuel treatments are a land management tool for reducing wildfire hazard by decreasing the amount of wildland fuels and altering their distribution. Common goals of stand-scale fuel treatments are to reduce the risk of active or passive crown fires and to reduce fire intensity. This is achieved by removing trees; increasing the distance between tree crowns; removing small trees, shrubs, and low branches to increase the distance between surface fuels and tree crowns; and removing downed trees and other dead vegetation (Agee and Skinner, 2005). Fuel treatment methods include tree thinning, tree pruning, pile burning, broadcast prescribed burning, and fuel mastication.

> "Given the right conditions, wildlands will inevitably burn. It is a misconception to think that treating fuels can 'fire-proof' important areas... Fuel treatments in wildlands should focus on creating conditions in which fire can occur without devastating consequences, rather than on creating conditions conducive to fire suppression" (Reinhardt et al., 2008).

Strategically located, high-quality fuel treatments can create tactical options for fire suppression (Jolley, 2018; Plucinski, 2019; Reinhardt et al., 2008). Fuel treatments along trails, ridgelines, and other features can allow firefighters opportunities to use direct or indirect suppression techniques to contain fire spread. Since its inception in 1999, BMFPD's Wildfire Mitigation Program has implemented hundreds of acres of fuels treatments throughout the district. Some of these treatments have experienced wildfire events and helped contribute to the successful containment of these fires. One example is the Bristlecone Fuel Break, located in the Pine Brook Hills neighborhood, and its assistance in halting the spread of the 2022 Sanitas Fire before it could move further into the community and threaten more homes and infrastructure.

Several organizations and fire departments around Boulder County are actively engaged in fuel mitigation efforts to reduce wildfire risk. BMFPD's Wildfire Mitigation Program, which in 2024 numbered 34 members, works to create and maintain large-scale fuel breaks within the district and across Boulder County. Lefthand Fire Protection District and Fourmile Fire Protection District also have dedicated fuels crews, addressing vegetation reduction and strategic fuel breaks within their respective districts.

In addition, the City of Boulder's Open Space and Mountain Parks conducts mitigation work around Boulder, focusing on city lands to reduce fire risk near urban areas. The United States Forest Service also completes fuels treatments throughout Boulder County and within BMFPD's boundaries. The combined efforts of these departments are crucial for comprehensive wildfire risk reduction in Boulder County, leveraging localized expertise and resources to protect communities and critical infrastructure.

### *Ecological Restoration*

Ecological restoration is the process of assisting the recovery of an ecosystem that has been damaged, degraded, or destroyed (SER, 2004). Many forests in the Western United States have been damaged, degraded, or destroyed because of changes to their historical fire regimes following Euro-American colonization.

BMFPD assessed multiple objectives in its approach to wildfire mitigation and fuels treatment projects. These include, but are not limited to, forest health and wildfire mitigation. The department is a strong proponent of restoring its forested areas to a natural density and promoting healthy ecosystems. The district has experienced numerous outbreaks of predatory tree insects over the past few decades and prioritizes healthy forest stands to help combat future outbreaks.

In some cases, fuel treatments can achieve both ecological objectives and wildfire risk reduction. Restoration treatments in dry mixed-conifer and ponderosa pine forests tend to achieve both fuel treatment and ecological restoration objectives. In contrast, a treatment that creates a forest with widely and evenly spaced trees could serve as an effective fuel treatment but would not achieve ecological objectives in most forest types.

## Priorities for Ecological Restoration and Fuel Treatments in BMFPD

Altering potential wildfire behavior and restoring ecological conditions requires a landscape-scale approach to treatments across ownership boundaries. As part of this CWPP, BMFPD located and prioritized project areas for ecological restoration and stand-level fuel treatments within the study area. These project areas cross ownership boundaries and require community-wide commitment, coordination, and collaboration among private landowners, public land managers, and forestry professionals to create successful outcomes.

The following section describes the current conditions in each of the 17 project areas. Additionally, treatment objectives and benefits, potential treatment types, project leads, and relative importance have been identified. Project treatments were intentionally ambitious in size and scope, representing a long-term approach to fuels reduction within BMFPD. The project areas are large, involve many property and stakeholders, and will take significant financial resources to complete. Prioritization of projects was completed using the risk assessments compiled for the BMFPD CWPP and are a relative rating. Consideration was taken for projects that provide direct benefit to the maximum number of residents and values at risk. Implementers should work off of the prioritization list while seizing opportunities to work in any project areas as they are presented, regardless of their relative priority rating.

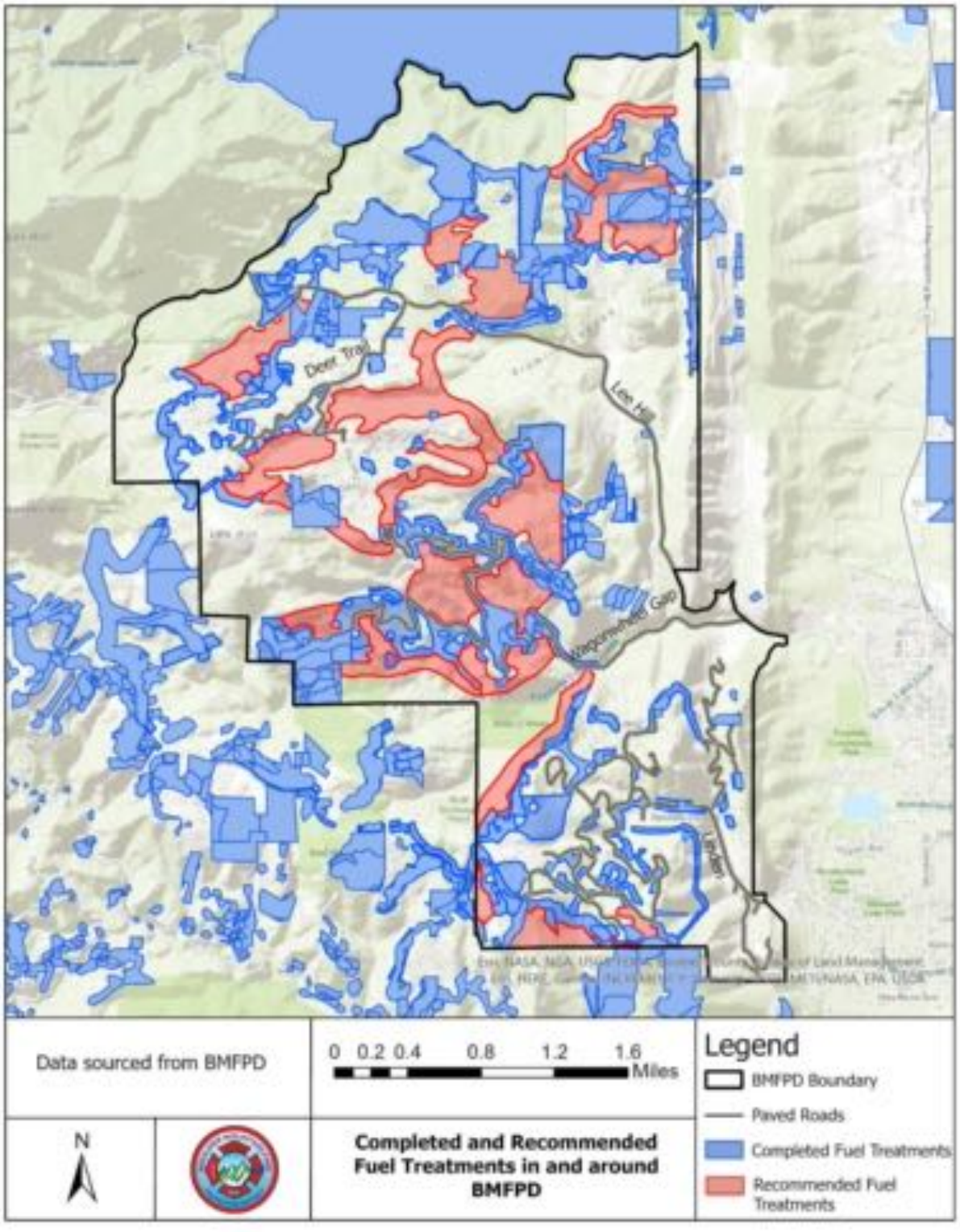
It is realistic that these large projects are divided into smaller units for implementation, and that approach is encouraged. Variation on project footprints is also appropriate, and implementers have the liberty to make changes to final locations based on site-specific considerations. Land managers should prioritize the feasibility of project implementation over adherence to the final footprints identified in this CWPP.

The implementation plan for stand-level treatments focuses on locations identified in the CWPP, but this does not discourage ecological restoration and fuel mitigation in other areas. If multiple

neighbors work together to mitigate fire risk across ownership boundaries, it could attract funding and increase the priority and effectiveness of treating those areas. The completion of large-scale fuels treatments takes a combination of property owner cooperation, funding sources, project coordination, and the ability to implement. Portions of the district that have momentum in these areas should continue to take advantage of these opportunities to complete fuels treatment projects. BMFPD, HOAs, residents, and land managers should also consistently reevaluate fire risks and reprioritize treatment units as conditions change over time.

For maximum chances of success during a wildfire incident, all of the fuels treatments identified in the CWPP abut previously completed projects within BMFPD (**Figure 4-16**). Implementation dates of these existing projects range from very recent to many decades in the past. It is expected that yearly vegetation growth and updated fuels treatment standards will demand re-entry into previously treated areas to keep projects effective with current wildfire behavior. Land managers should routinely evaluate existing fuels treatments with BMFPD and coordinate efforts to re-treat these areas to maintain their efficacy during a wildfire.

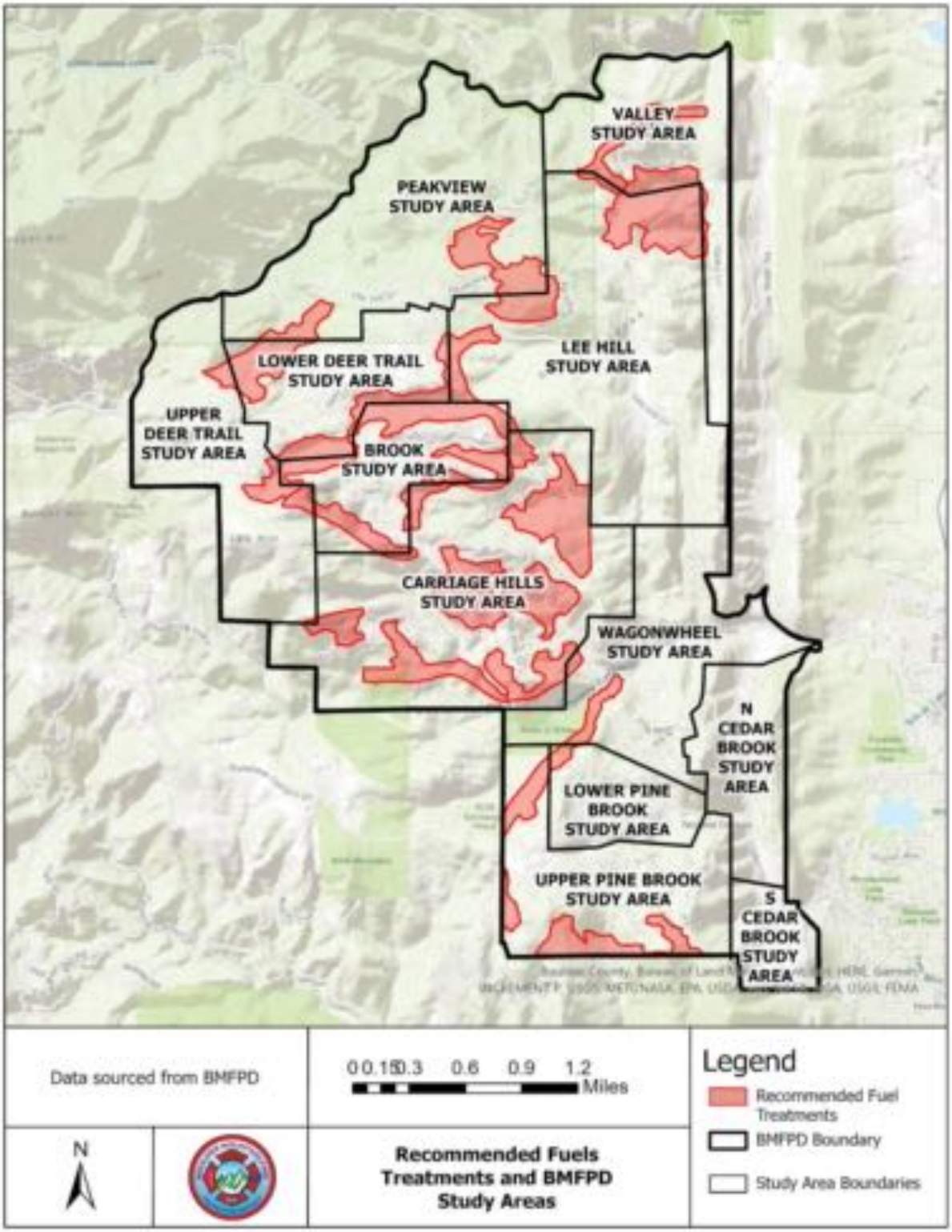
***Figure 4-16:*** *Completed and recommended fuel treatments for implementation in BMFPD. (Note: completed fuel treatments do not include individual structure's defensible space.)*




*Source: Created by BMFPD using BMFPD data*

## Recommended Fuels Treatments in BMFPD

***Figure 4-17:*** *Map of BMFPD's 17 recommended fuels treatments and the 12 BMFPD study areas.*




*Source: Created by BMFPD using BMFPD data*

## Priority of Recommended Fuels Treatments in BMFPD

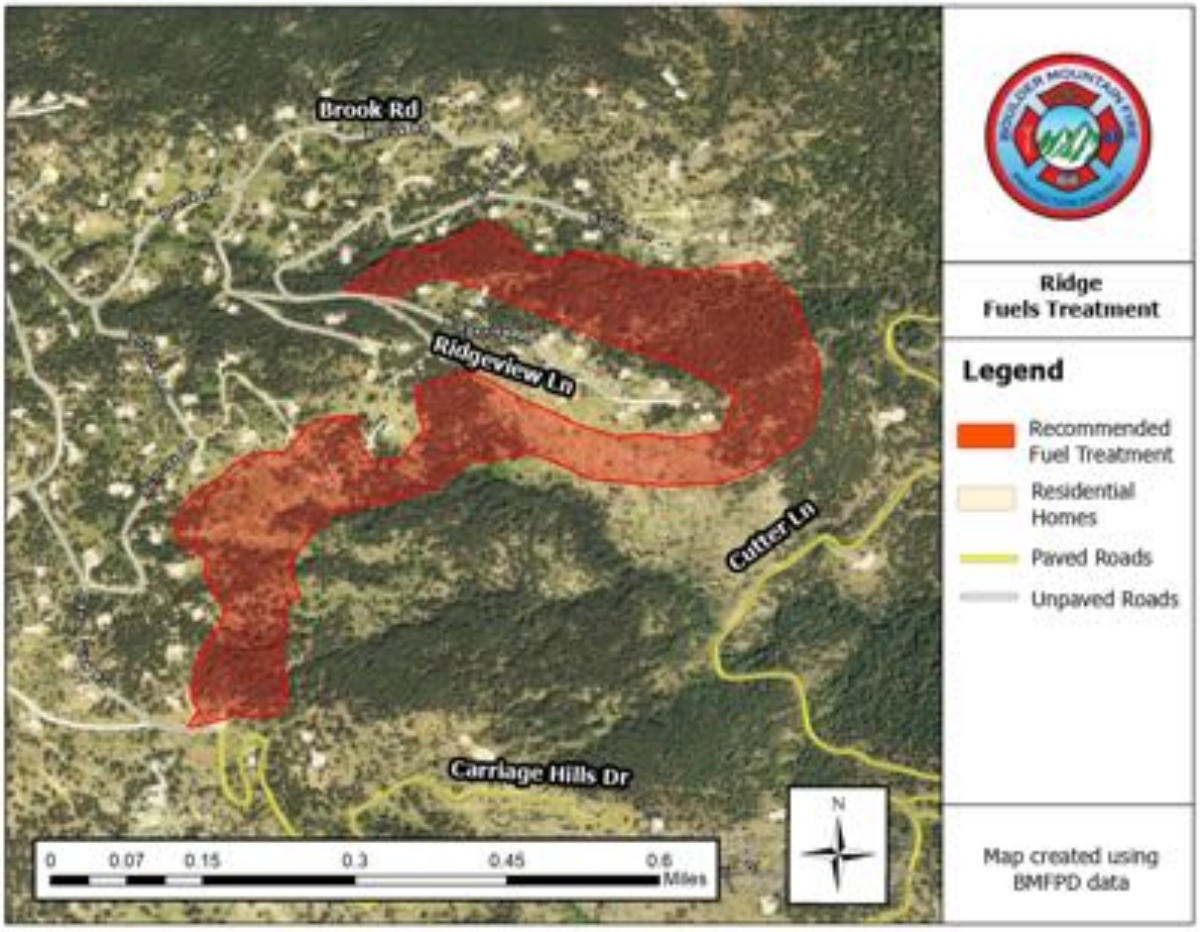
| Fuels Treatment Name | Priority |
|---|---|
| *Ridge* | *Highest* |
| *Brook* | *Highest* |
| *Rembrandt* | *Highest* |
| *South Pine Brook* | *Highest* |
| *Anne White* | *High* |
| *Fourmile Canyon Creek* | *High* |
| *Lower Carriage Hills* | *High* |
| *Surrey* | *High* |
| *Canon View* | *High* |
| *Deer Trail* | *High* |
| *Peakview* | *High* |
| *Reed Ranch* | *Moderate* |
| *West Coach* | *Moderate* |
| *Bristlecone* | *Moderate* |
| *Upper Carriage Hills* | *Moderate* |
| *Sky Trail* | *Moderate* |
| *Cutter* | *Moderate* |

## *Ridge Fuels Treatment*

The Ridge fuels treatment project encompasses 50 acres of privately owned land in BMFPD (**Figure 4-18**). This area was selected because it builds upon existing fuels treatments and provides protection to the Boulder Heights community from wildfires approaching from the southeast. The project area provides a barrier of protection to areas off Brook Circle and sits above steep terrain. Slope aspects are varied, with stands of ponderosa pine and pockets of dense Douglas fir.

| Ridge Fuels Treatment | |
|---|---|
| **Treatment objectives:** | **Forested stand thinning for the purposes of reducing wildfire behavior and improving forest health** |
| **Treatment type:** | **Hand thinning, broadcast chipping, slash-pile burning** |
| **Priority:** | **Highest** |
| **Lead and support organizations:** | **BMFPD, private residents** |

***Figure 4-18:*** *Map of the Ridge fuels treatment project area.*



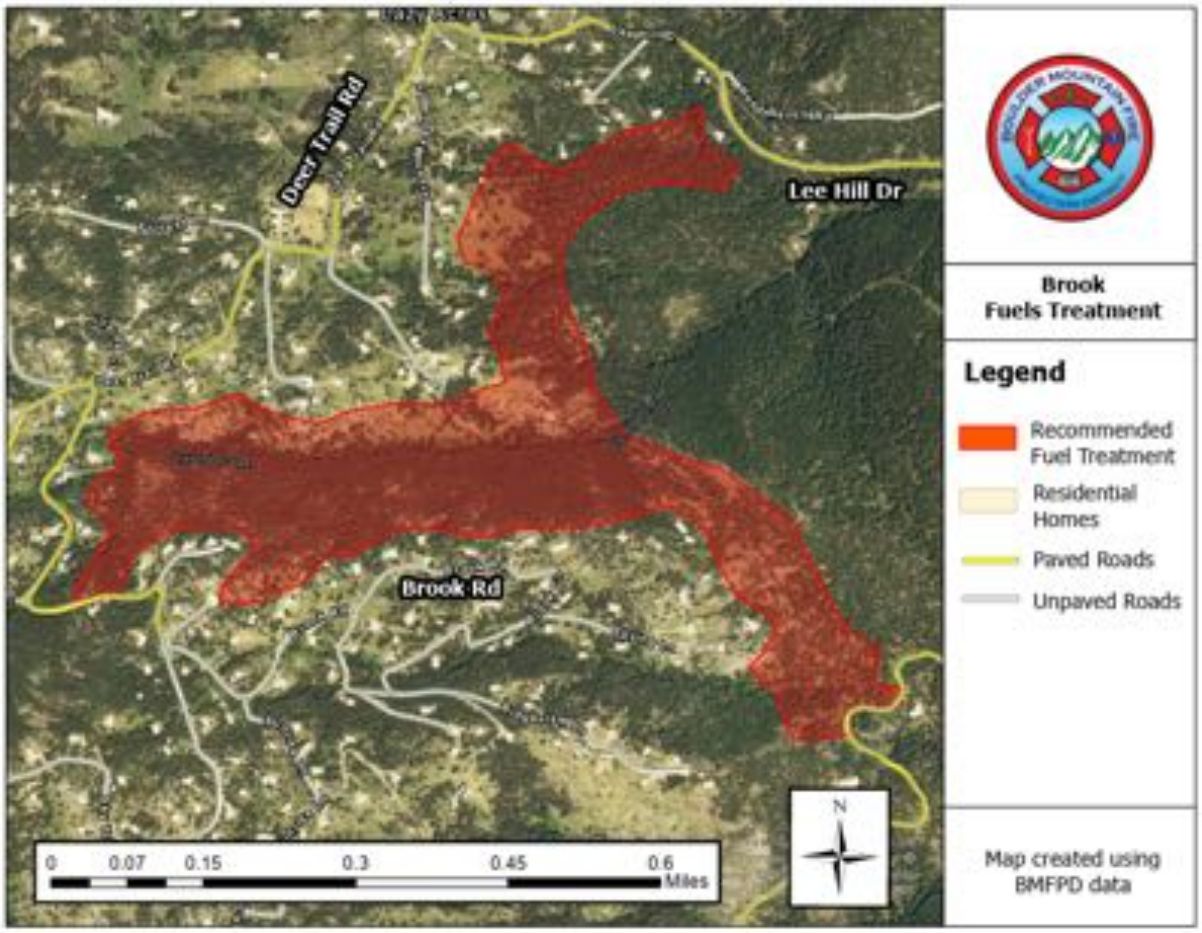

*Source: Created by BMFPD using BMFPD data*

## *Brook Fuels Treatment*

The Brook fuels treatment project encompasses 127 acres of privately owned land in BMFPD (**Figure 4-19**). This area was selected because it builds upon existing fuels treatments and provides protection to the Boulder Heights community from wildfires approaching from the east. The area is dominated by a large gulley running through the middle of the project and steep terrain. Slope aspects are a majority north facing, with portions east facing. It has stands of ponderosa pine and dense Douglas fir.

| **Brook Fuels Treatment** | |
|---|---|
| **Treatment objectives:** | **Forested stand thinning for the purposes of reducing wildfire behavior and improving forest health** |
| **Treatment type:** | **Hand thinning, broadcast chipping, slash-pile burning** |
| **Priority:** | **Highest** |
| **Lead and support organizations:** | **BMFPD, private residents** |

***Figure 4-19:*** *Map of the Brook fuels treatment project area.*



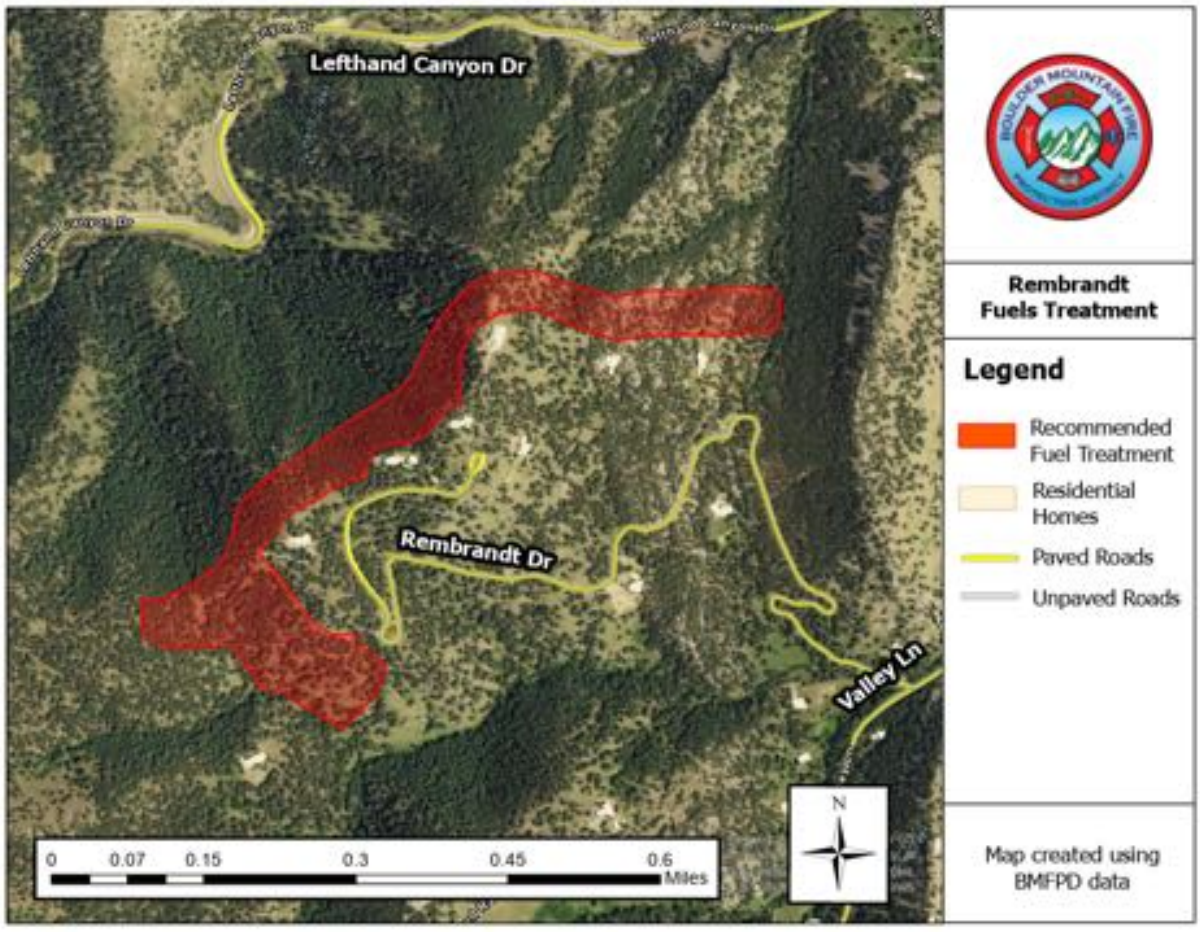

*Source: Created by BMFPD using BMFPD data*

## *Rembrandt Fuels Treatment*

The Rembrandt fuels treatment project encompasses 36 acres of privately owned land in BMFPD (**Figure 4-20**). This area was selected because it builds upon existing fuels treatments and provides protection to the Rembrandt community from wildfires originating along Lefthand Canyon. The project area sits above steep terrain and provides protection to the northern portion of the Rembrandt neighborhood. Slope aspects are primarily north, with dense stands of Douglas fir.

| **Rembrandt Fuels Treatment** | |
|---|---|
| **Treatment objectives:** | **Forested stand thinning for the purposes of reducing wildfire behavior and improving forest health** |
| **Treatment type:** | **Hand thinning, broadcast chipping, slash-pile burning** |
| **Priority:** | **Highest** |
| **Lead and support organizations:** | **BMFPD, Rembrandt HOA** |

***Figure 4-20:*** *Map of the Rembrandt fuels treatment project area.*



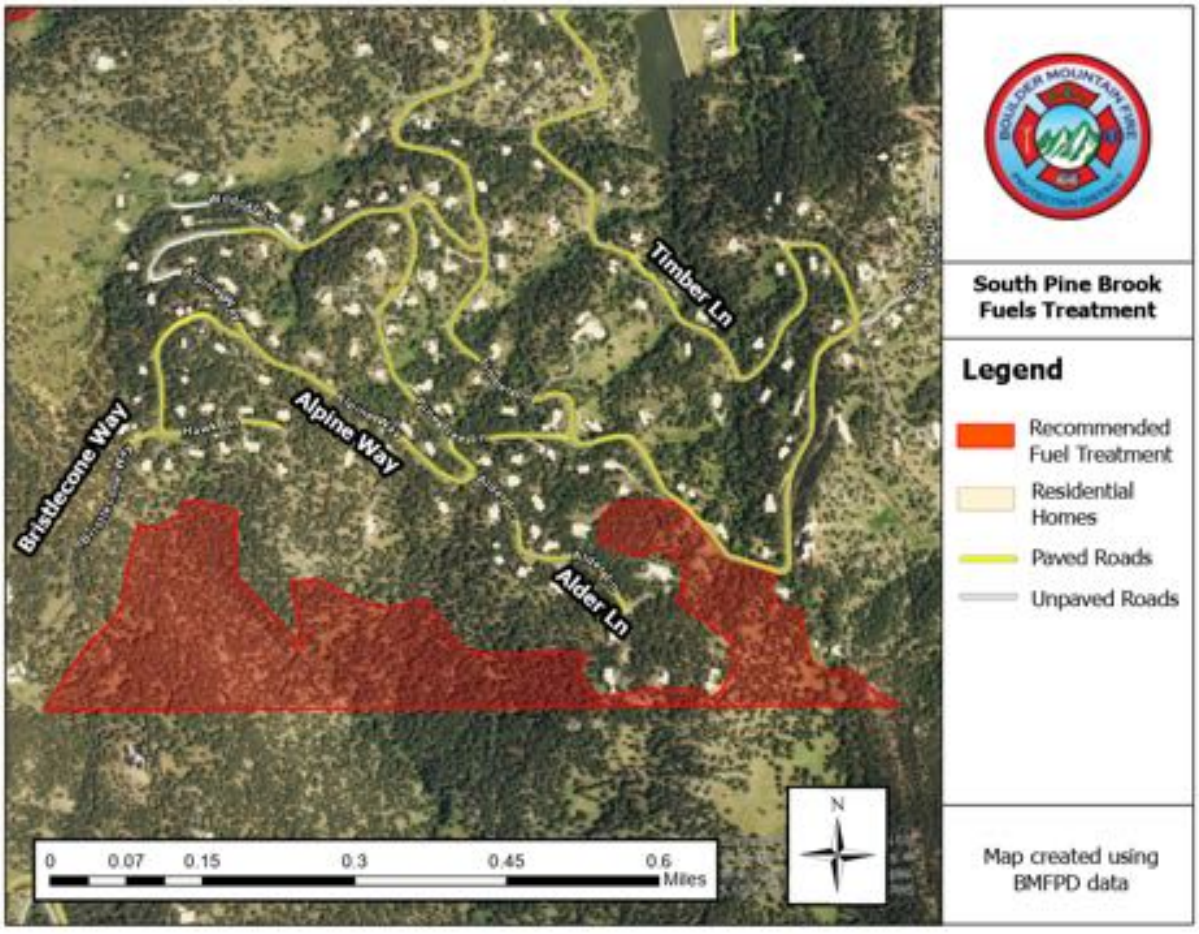

*Source: Created by BMFPD using BMFPD data*

## *South Pine Brook Fuels Treatment*

The South Pine Brook fuels treatment project encompasses 58 acres of privately owned land in BMFPD (**Figure 4-21**). This area was selected because it builds upon existing fuels treatments and provides protection to the Pine Brook Hills community from wildfires originating in the Sunshine Canyon and Mt. Sanitas areas. Providing additional protection along the southern edge of Pine Brook Hills, the project's slope aspects are primarily southern, with stands of ponderosa pine.

| **South Pine Brook Fuels Treatment** | |
|---|---|
| **Treatment objectives:** | **Forested stand thinning for the purposes of reducing wildfire behavior and improving forest health** |
| **Treatment type:** | **Hand thinning, broadcast chipping, slash-pile burning** |
| **Priority:** | **Highest** |
| **Lead and support organizations:** | **BMFPD, Pine Brook HOA** |

***Figure 4-21:*** *Map of the South Pine Brook fuels treatment project area.*



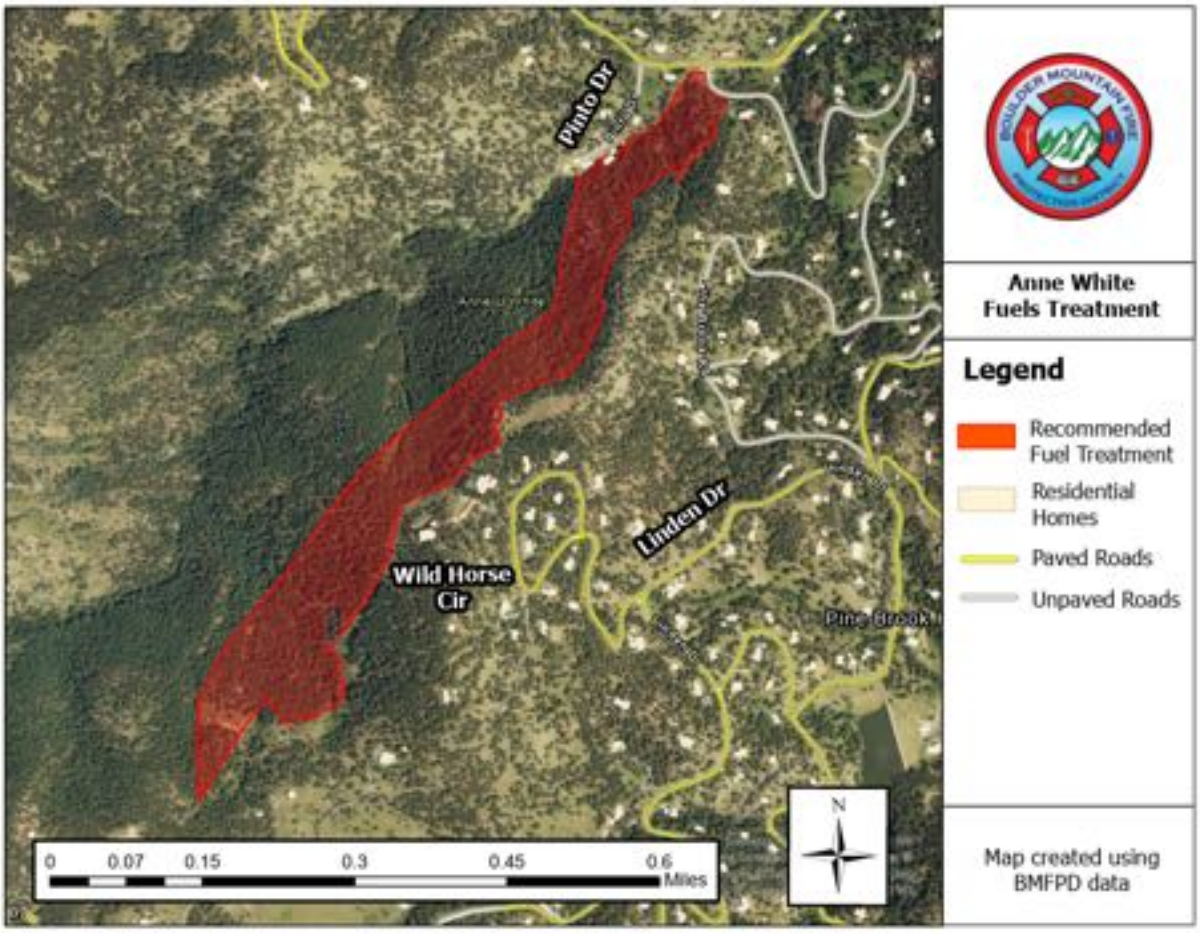

*Source: Created by BMFPD using BMFPD data*

## *Anne White Fuels Treatment*

The Anne White fuels treatment project encompasses 51 acres of private and agency-owned land in BMFPD (**Figure 4-22**). This area was selected because it builds upon existing fuels treatments and provides protection to the Pine Brook Hills community from wildfires threatening from the west. The project area expands upon previously completed work along a ridge and sits above a steep drainage. Slope aspects are a majority north/northwest, with ponderosa pine and dense stands of Douglas fir.

| **Anne White Fuels Treatment** | |
|---|---|
| **Treatment objectives:** | **Forested stand thinning for the purposes of reducing wildfire behavior and improving forest health** |
| **Treatment type:** | **Hand thinning, broadcast chipping, slash-pile burning** |
| **Priority:** | **High** |
| **Lead and support organizations:** | **BMFPD, Pine Brook HOA, Boulder County** |

***Figure 4-22:*** *Map of the Anne White fuels treatment project area.*



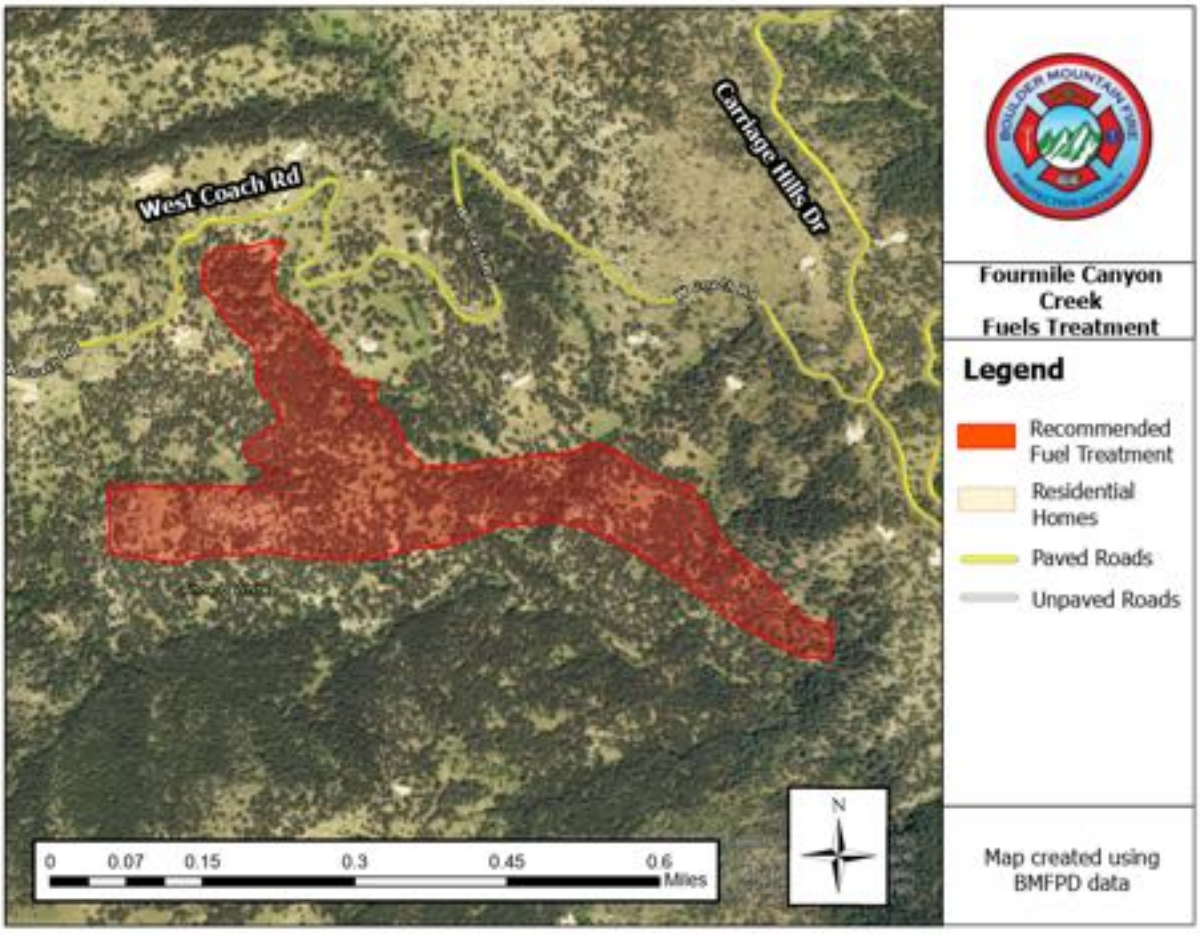

*Source: Created by BMFPD using BMFPD data*

## *Fourmile Canyon Creek Fuels Treatment*

The Fourmile Canyon Creek fuels treatment project encompasses 55 acres of private and agency-owned land in BMFPD (**Figure 4-23**). This area was selected because it builds upon existing fuels treatments and provides protection to the Carriage Hills community from wildfires originating along the western portions of the Anne U. White trail. The project area encompasses numerous gullies and slope aspects, primarily south/southwest, with stands of ponderosa pine.

| **Fourmile Canyon Creek Fuels Treatment** | |
|---|---|
| **Treatment objectives:** | **Forested stand thinning for the purposes of reducing wildfire behavior and improving forest health** |
| **Treatment type:** | **Hand thinning, broadcast chipping, slash-pile burning** |
| **Priority:** | **High** |
| **Lead and support organizations:** | **BMFPD, Carriage Hills HOA, Boulder County** |

***Figure 4-23:*** *Map of the Fourmile Canyon Creek fuels treatment project area.*



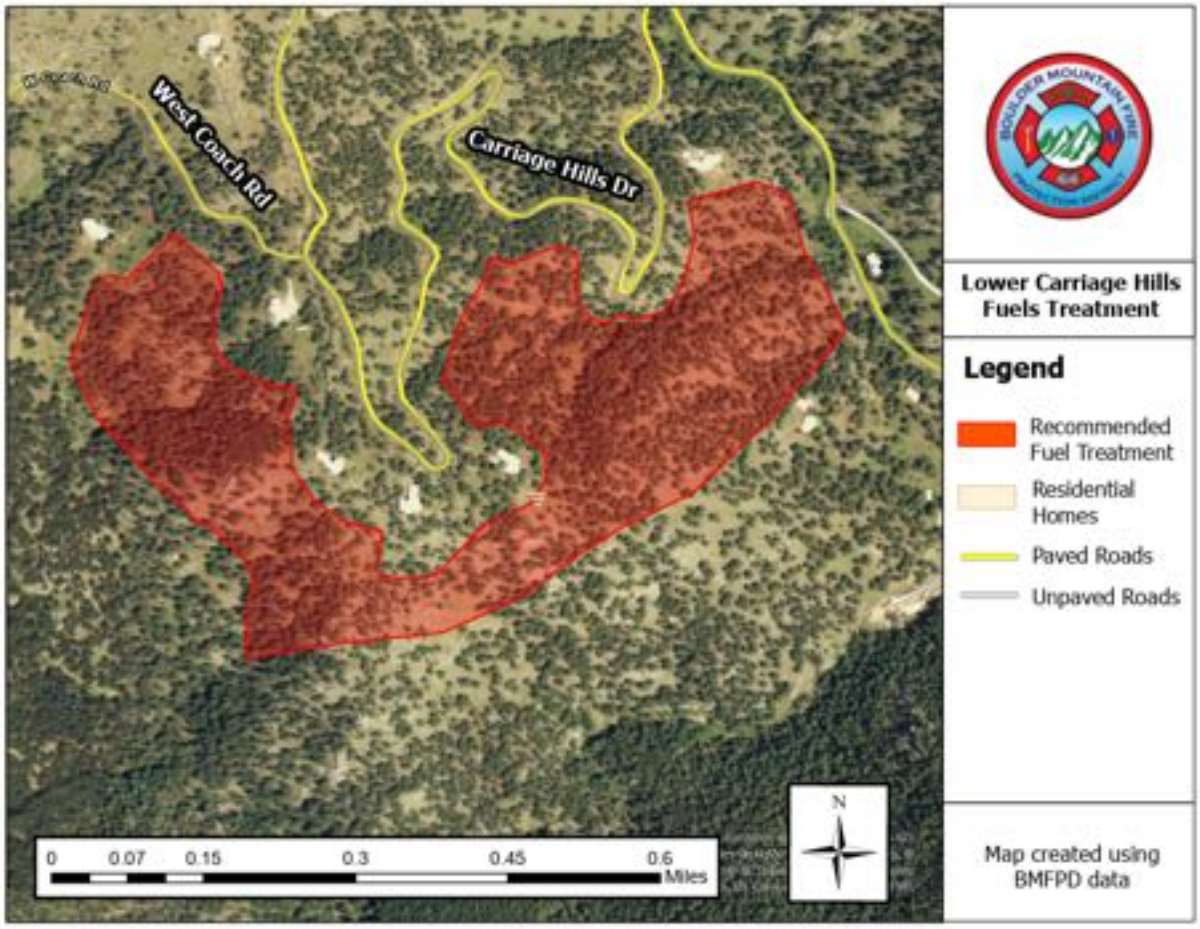

*Source: Created by BMFPD using BMFPD data*

## *Lower Carriage Hills Fuels Treatment*

The Lower Carriage Hills fuels treatment project encompasses 44 acres of privately owned land in BMFPD (**Figure 4-24**). This area was selected because it builds upon existing fuels treatments and provides protection to the Carriage Hills community from wildfires originating along the eastern portions of the Anne U. White trail. The project provides a barrier to the southeastern portion of the Carriage Hills community. Slope aspects range from west to south to east, with stands of ponderosa pine and Douglas fir.

| Lower Carriage Hills Fuels Treatment | |
|---|---|
| **Treatment objectives:** | **Forested stand thinning for the purposes of reducing wildfire behavior and improving forest health** |
| **Treatment type:** | **Hand thinning, broadcast chipping, slash-pile burning** |
| **Priority:** | **High** |
| **Lead and support organizations:** | **BMFPD, Carriage Hills HOA** |

***Figure 4-24:*** *Map of the Lower Carriage Hills fuels treatment project area.*



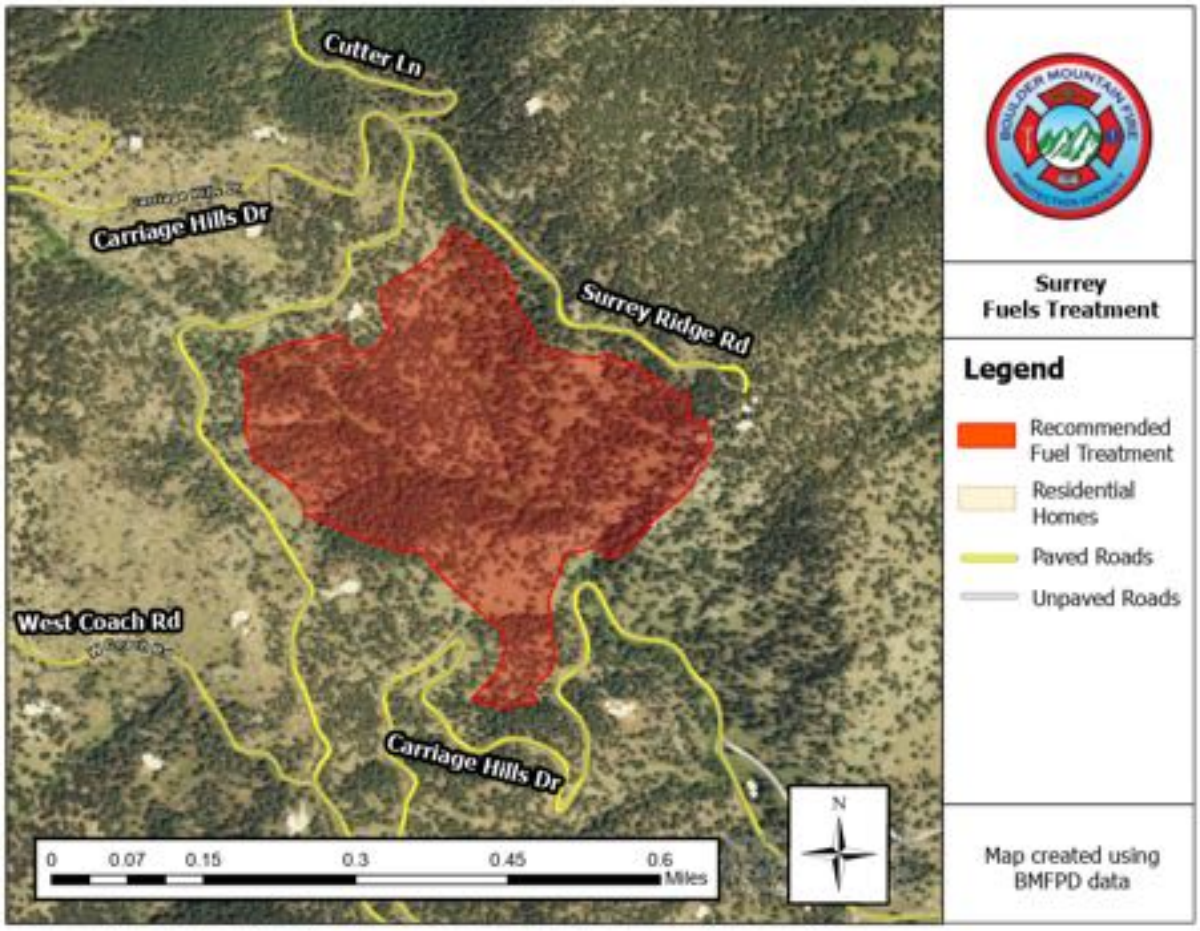

*Source: Created by BMFPD using BMFPD data*

## *Surrey Fuels Treatment*

The Surrey fuels treatment project encompasses 52 acres of privately owned land in BMFPD (**Figure 4-25**). This area was selected because it builds upon existing fuels treatments and provides protection to the Carriage Hills community from wildfires within the neighborhood. The project area is encircled by previous work and ties all of these treatments together. A large gulley runs through the area, and slope aspects vary, with stands of ponderosa pine and Douglas fir.

| Surrey Fuels Treatment | |
|---|---|
| **Treatment objectives:** | **Forested stand thinning for the purposes of reducing wildfire behavior and improving forest health** |
| **Treatment type:** | **Hand thinning, broadcast chipping, slash-pile burning** |
| **Priority:** | **High** |
| **Lead and support organizations:** | **BMFPD, Carriage Hills HOA** |

***Figure 4-25:*** *Map of the Surrey fuels treatment project area.*



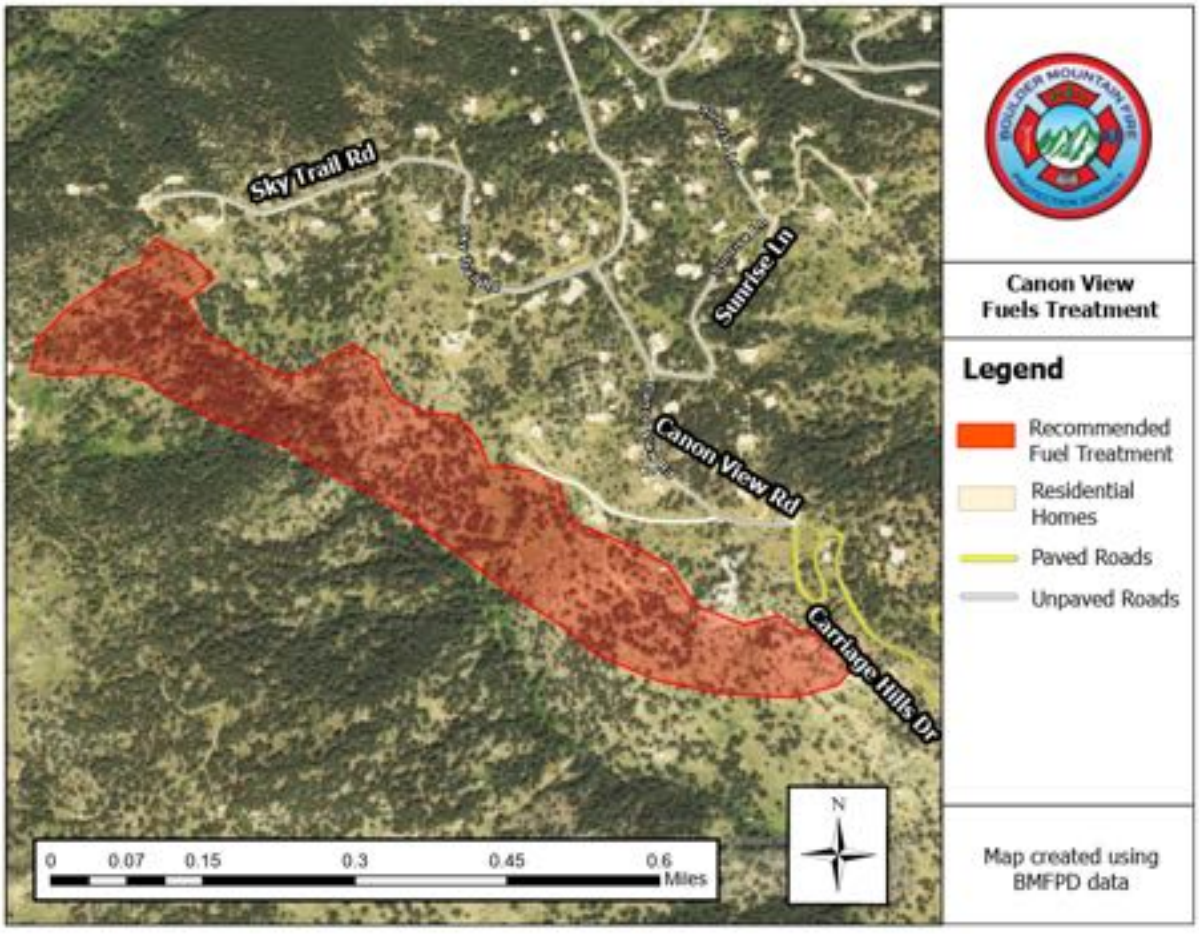

*Source: Created by BMFPD using BMFPD data*

## *Canon View Fuels Treatment*

The Canon View fuels treatment project encompasses 41 acres of privately owned land in BMFPD (**Figure 4-26**). This area was selected because it builds upon existing fuels treatments and provides protection to the Boulder Heights community from wildfires approaching from the west. The project area is located above steep terrain and provides protection to the southwest edge of Boulder Heights. Slope aspects are a majority south and southwest, with ponderosa pine stands.

| **Canon View Fuels Treatment** | |
|---|---|
| **Treatment objectives:** | **Forested stand thinning for the purposes of reducing wildfire behavior and improving forest health** |
| **Treatment type:** | **Hand thinning, broadcast chipping, slash-pile burning** |
| **Priority:** | **High** |
| **Lead and support organizations:** | **BMFPD, private residents** |

***Figure 4-26:*** *Map of the Canon View fuels treatment project area.*



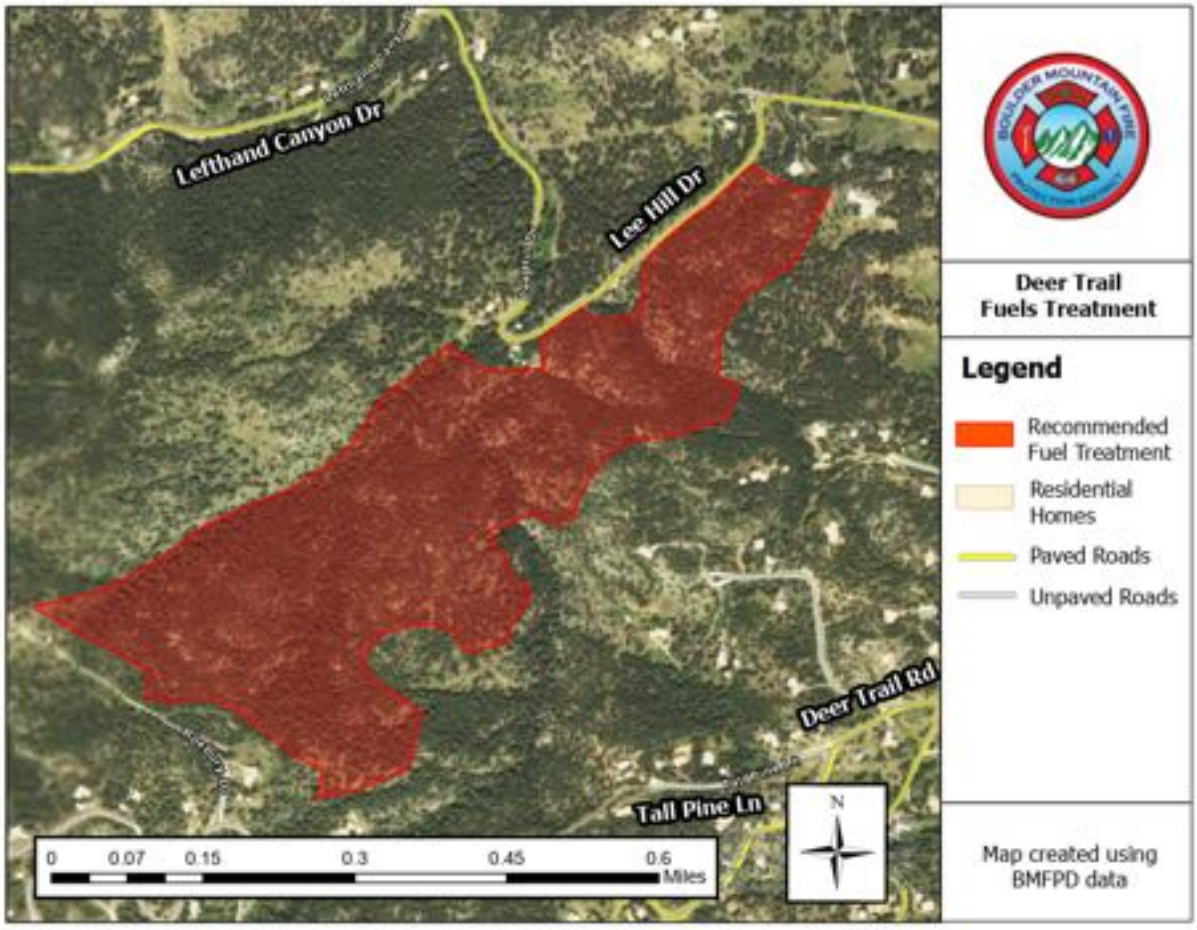

*Source: Created by BMFPD using BMFPD data*

## *Deer Trail Fuels Treatment*

The Deer Trail fuels treatment project encompasses 73 acres of privately owned land in BMFPD (**Figure 4-27**). This area was selected because it builds upon existing fuels treatments and provides protection to the Boulder Heights community from wildfires originating in the Lefthand Canyon area. The project area includes steep terrain located on the western edge of Boulder Heights. Slope aspects are primarily north, with dense Douglas fir throughout the area.

| **Deer Trail Fuels Treatment** | |
|---|---|
| **Treatment objectives:** | **Forested stand thinning for the purposes of reducing wildfire behavior and improving forest health** |
| **Treatment type:** | **Hand thinning, broadcast chipping, slash-pile burning** |
| **Priority:** | **High** |
| **Lead and support organizations:** | **BMFPD, private residents** |

***Figure 4-27:*** *Map of the Deer Trail fuels treatment project area.*



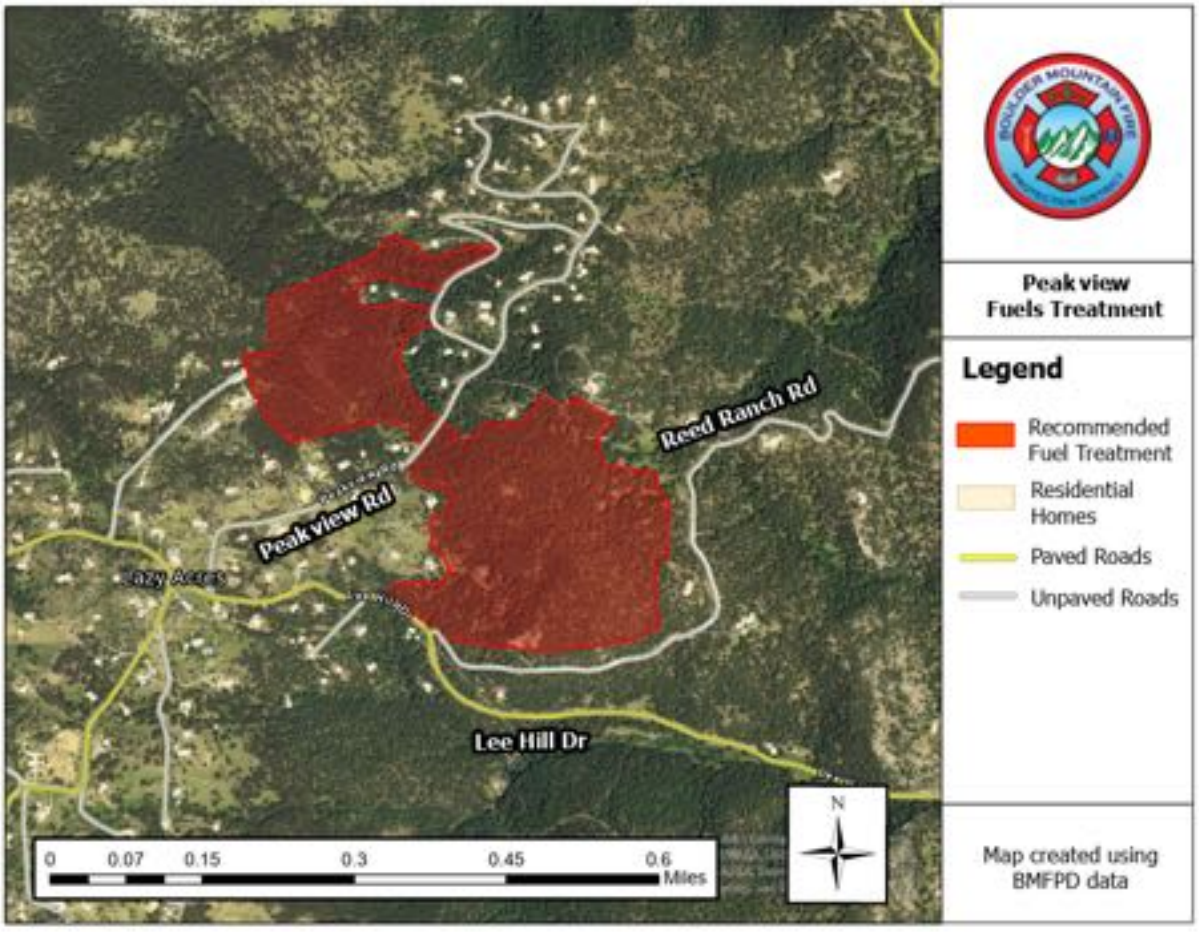

*Source: Created by BMFPD using BMFPD data*

## *Peakview Fuels Treatment*

The Peakview fuels treatment project encompasses 92 acres of privately owned land in BMFPD (**Figure 4-28**). This area was selected because it builds upon existing fuels treatments and provides protection to the Boulder Heights community from wildfires approaching from the southeast. The project area is located within the northern portion of Boulder Heights and addressed large pockets of untreated land within the community. Slope aspects are varied, with stands of ponderosa pine and areas of dense Douglas fir.

| **Peakview Fuels Treatment** | |
|---|---|
| **Treatment objectives:** | **Forested stand thinning for the purposes of reducing wildfire behavior and improving forest health** |
| **Treatment type:** | **Hand thinning, broadcast chipping, slash-pile burning** |
| **Priority:** | **High** |
| **Lead and support organizations:** | **BMFPD, private residents** |

***Figure 4-28:*** *Map of the Peakview fuels treatment project area.*



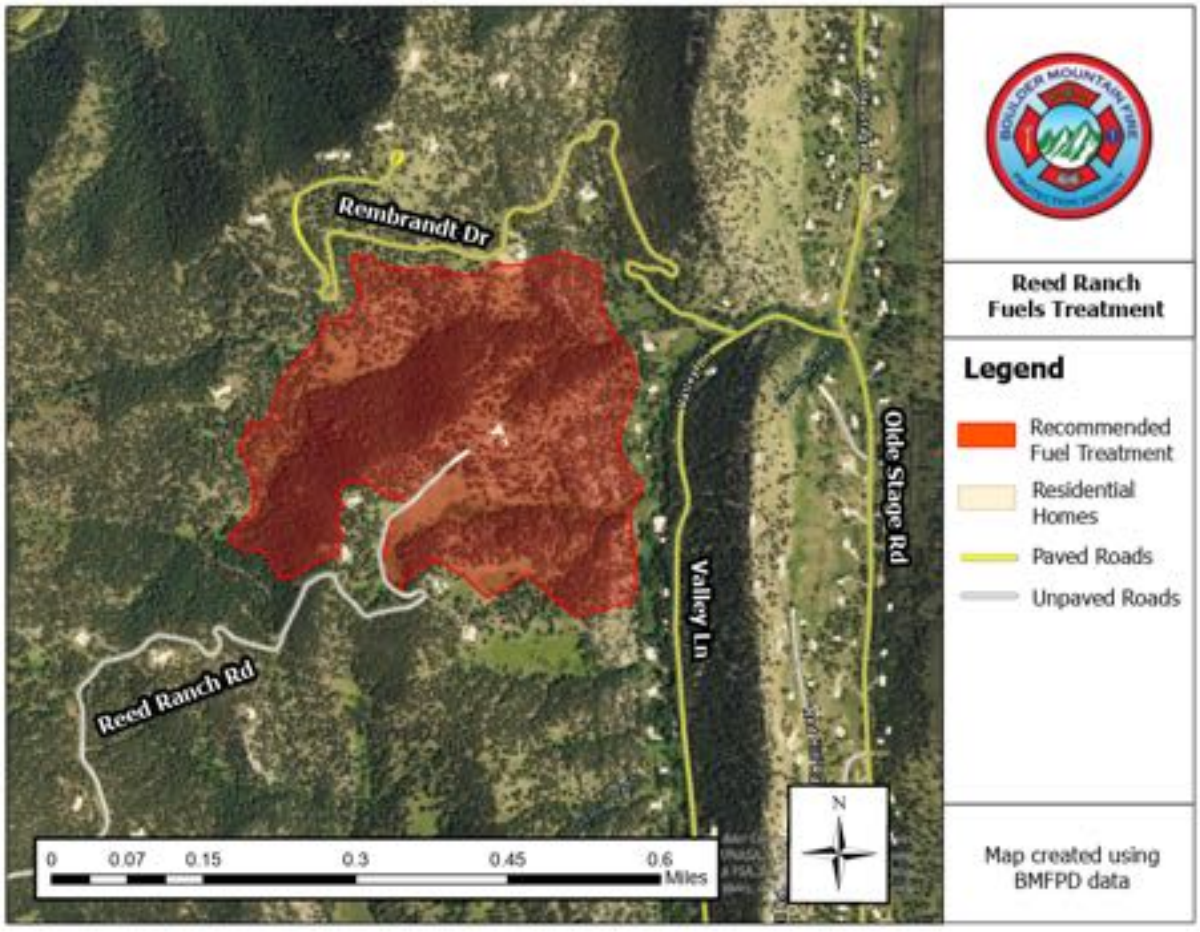

*Source: Created by BMFPD using BMFPD data*

## *Reed Ranch Fuels Treatment*

The Reed Ranch fuels treatment project encompasses 127 acres of privately owned land in BMFPD (**Figure 4-29**). This area was selected because it builds upon existing fuels treatments and provides protection to the Boulder Heights, Rembrandt, and Valley Lane communities from wildfires. The project area has previously completed treatments on all sides and would address a large untreated area within the communities. Slope aspects are a majority north/northeast, with stands of ponderosa pine and Douglas fir.

| **Reed Ranch Fuels Treatment** | |
|---|---|
| **Treatment objectives:** | **Forested stand thinning for the purposes of reducing wildfire behavior and improving forest health** |
| **Treatment type:** | **Hand thinning, broadcast chipping, slash-pile burning** |
| **Priority:** | **Moderate** |
| **Lead and support organizations:** | **BMFPD, private residents** |

***Figure 4-29:*** *Map of the Reed Ranch fuels treatment project area.*



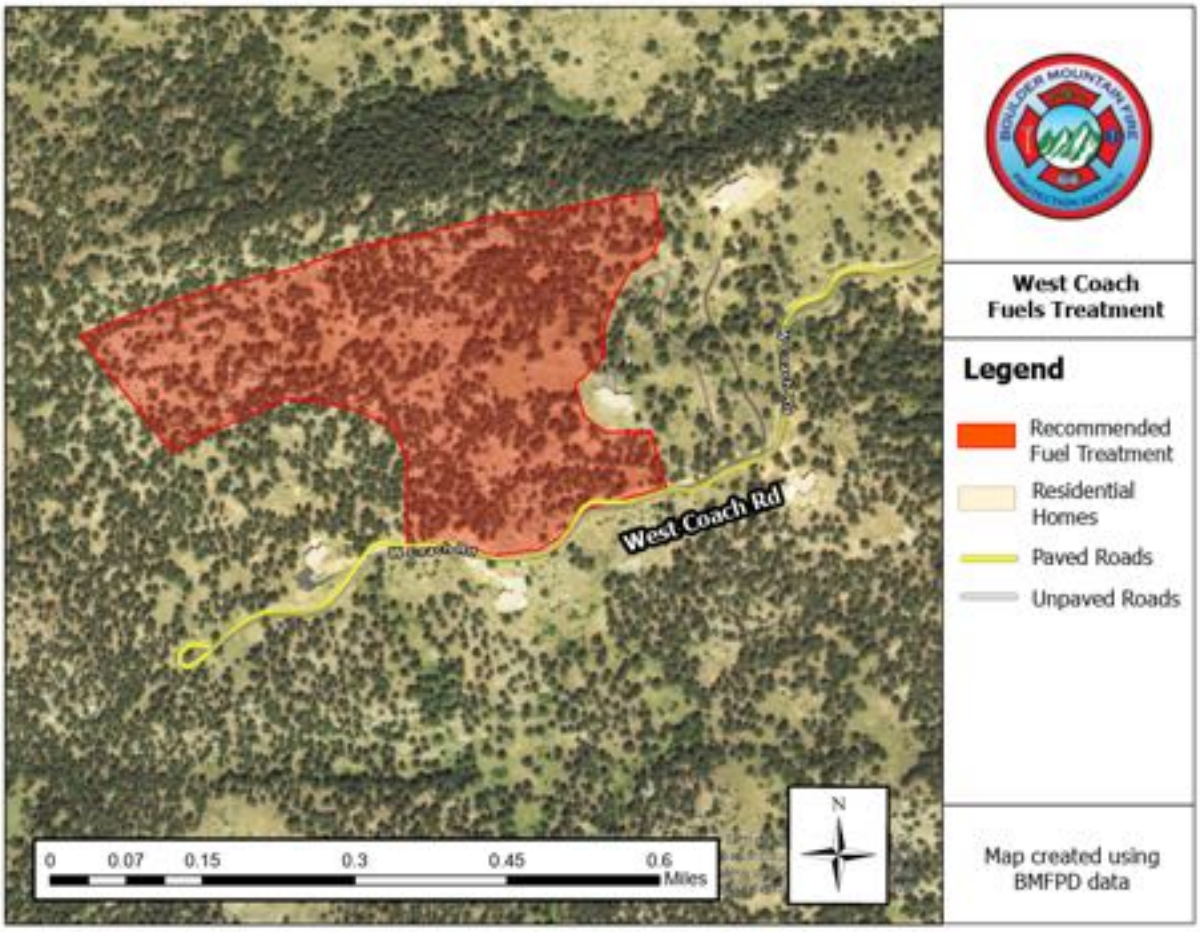

*Source: Created by BMFPD using BMFPD data*

## *West Coach Fuels Treatment*

The West Coach fuels treatment project encompasses 23 acres of privately owned land in BMFPD (**Figure 4-30**). This area was selected because it builds upon existing fuels treatments and ties together work previously completed at the western end of West Coach Road. Slope aspects are a majority south/southwest, with stands of ponderosa pine.

| **West Coach Fuels Treatment** | |
|---|---|
| **Treatment objectives:** | **Forested stand thinning for the purposes of reducing wildfire behavior and improving forest health** |
| **Treatment type:** | **Hand thinning, broadcast chipping, slash-pile burning** |
| **Priority:** | **Moderate** |
| **Lead and support organizations:** | **BMFPD, Carriage Hills HOA** |

***Figure 4-30:*** *Map of the West Coach fuels treatment project area.*



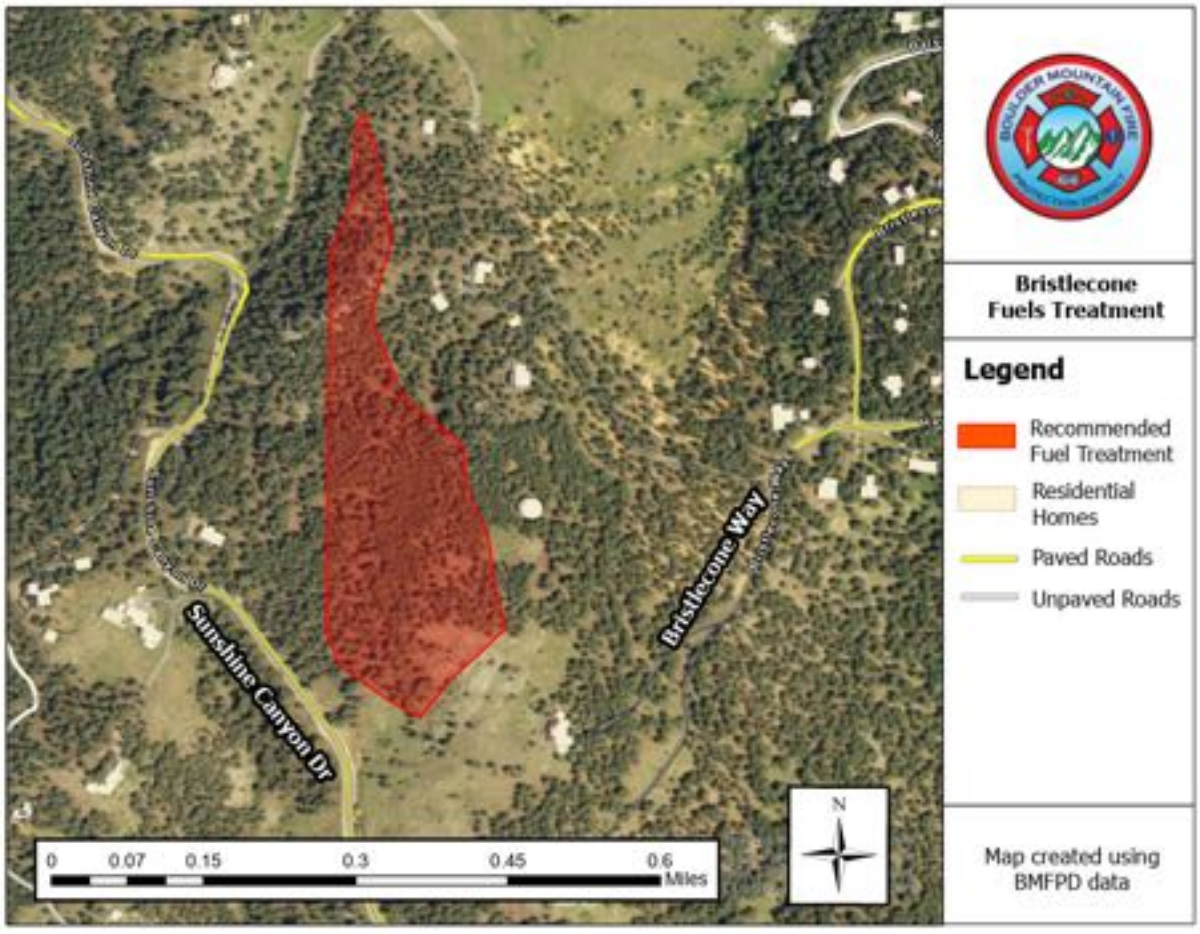

*Source: Created by BMFPD using BMFPD data*

## *Bristlecone Fuels Treatment*

The Bristlecone fuels treatment project encompasses 11 acres of privately owned land in BMFPD (**Figure 4-31**). This area was selected because it ties together existing fuels treatments and provides protection to the Pine Brook Hills community from wildfires originating in the Sunshine Canyon area. This area fills in a gap from a number of previously completed projects to create a contiguous fuels treatment. Slope aspects are primarily west, with dense stands of ponderosa pine.

| **Bristlecone Fuels Treatment** | |
|---|---|
| **Treatment objectives:** | **Forested stand thinning for the purposes of reducing wildfire behavior and improving forest health** |
| **Treatment type:** | **Hand thinning, broadcast chipping, slash-pile burning** |
| **Priority:** | **Moderate** |
| **Lead and support organizations:** | **BMFPD, Pine Brook HOA** |

***Figure 4-31:*** *Map of the Bristlecone fuels treatment project area.*



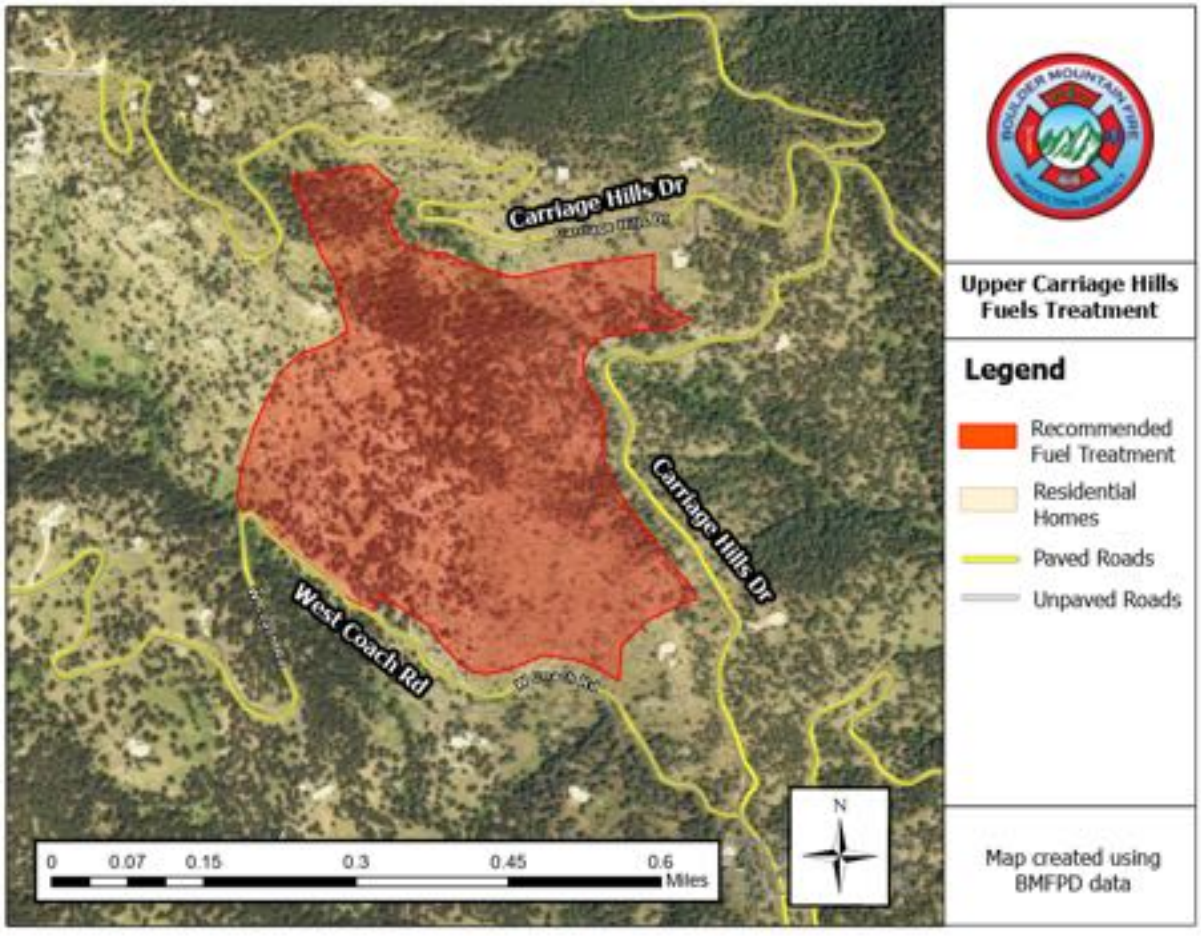

*Source: Created by BMFPD using BMFPD data*

## *Upper Carriage Hills Fuels Treatment*

The Upper Carriage Hills fuels treatment project encompasses 68 acres of privately owned land in BMFPD (**Figure 4-32**). This area was selected because it builds upon existing fuels treatments and provides protection to the Carriage Hills community from wildfires approaching from the west. The project straddles a large ridge, and slope aspects are primarily southwest and east, with stands of ponderosa pine and Douglas fir.

| **Upper Carriage Hills Fuels Treatment** | |
|---|---|
| **Treatment objectives:** | **Forested stand thinning for the purposes of reducing wildfire behavior and improving forest health** |
| **Treatment type:** | **Hand thinning, broadcast chipping, slash-pile burning** |
| **Priority:** | **Moderate** |
| **Lead and support organizations:** | **BMFPD, Carriage Hills HOA** |

***Figure 4-32:*** *Map of the Upper Carriage Hills fuels treatment project area.*



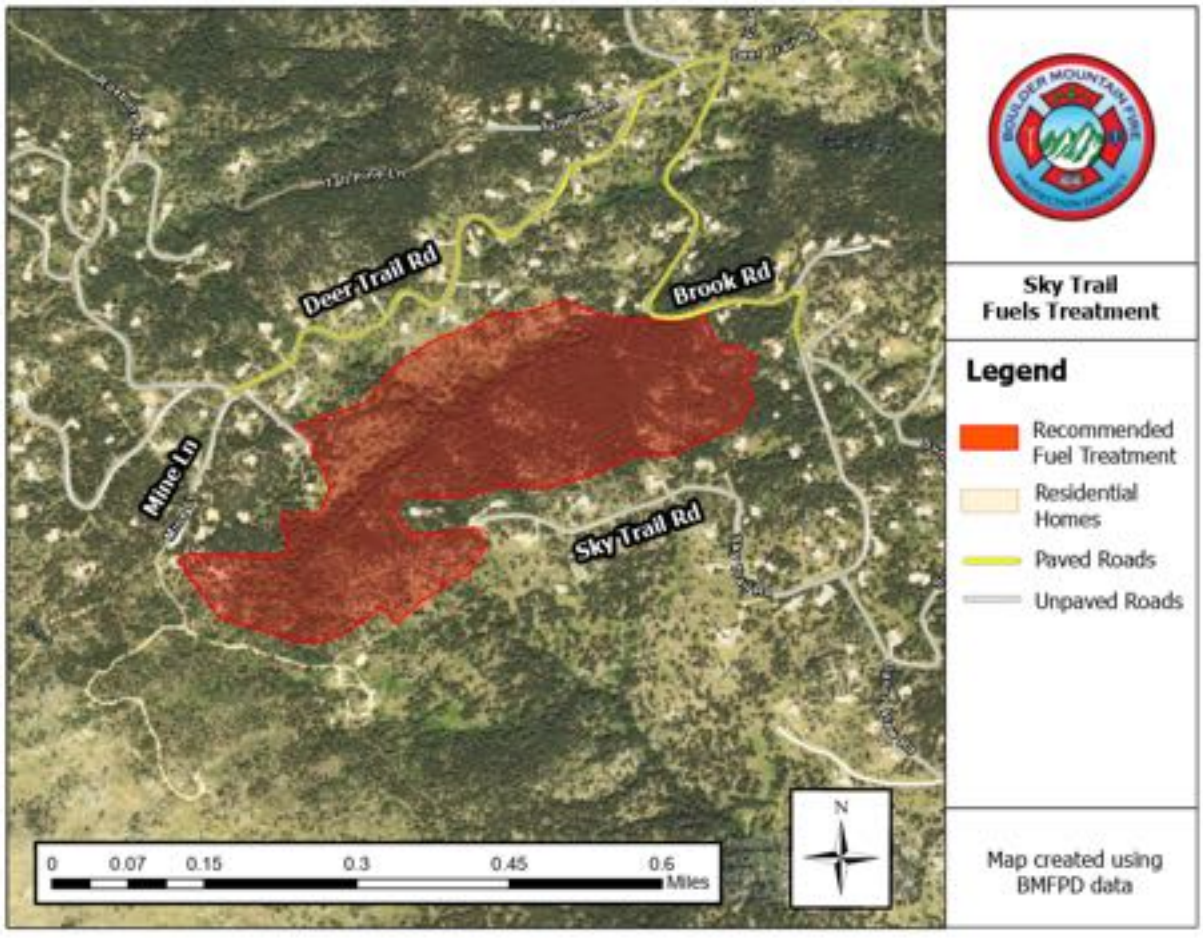

*Source: Created by BMFPD using BMFPD data*

## *Sky Trail Fuels Treatment*

The Sky Trail fuels treatment project encompasses 63 acres of privately owned land in BMFPD (**Figure 4-33**). This area was selected because it builds upon existing fuels treatments and provides protection to the Boulder Heights community from wildfires occurring within the neighborhood. The project area encompasses a steep gully that runs through the Boulder Heights community. Slope aspects are a majority north, with dense stands of Douglas fir.

| Sky Trail Fuels Treatment | |
|---|---|
| **Treatment objectives:** | **Forested stand thinning for the purposes of reducing wildfire behavior and improving forest health** |
| **Treatment type:** | **Hand thinning, broadcast chipping, slash-pile burning** |
| **Priority:** | **Moderate** |
| **Lead and support organizations:** | **BMFPD, private residents** |

***Figure 4-33:*** *Map of the Sky Trail fuels treatment project area.*



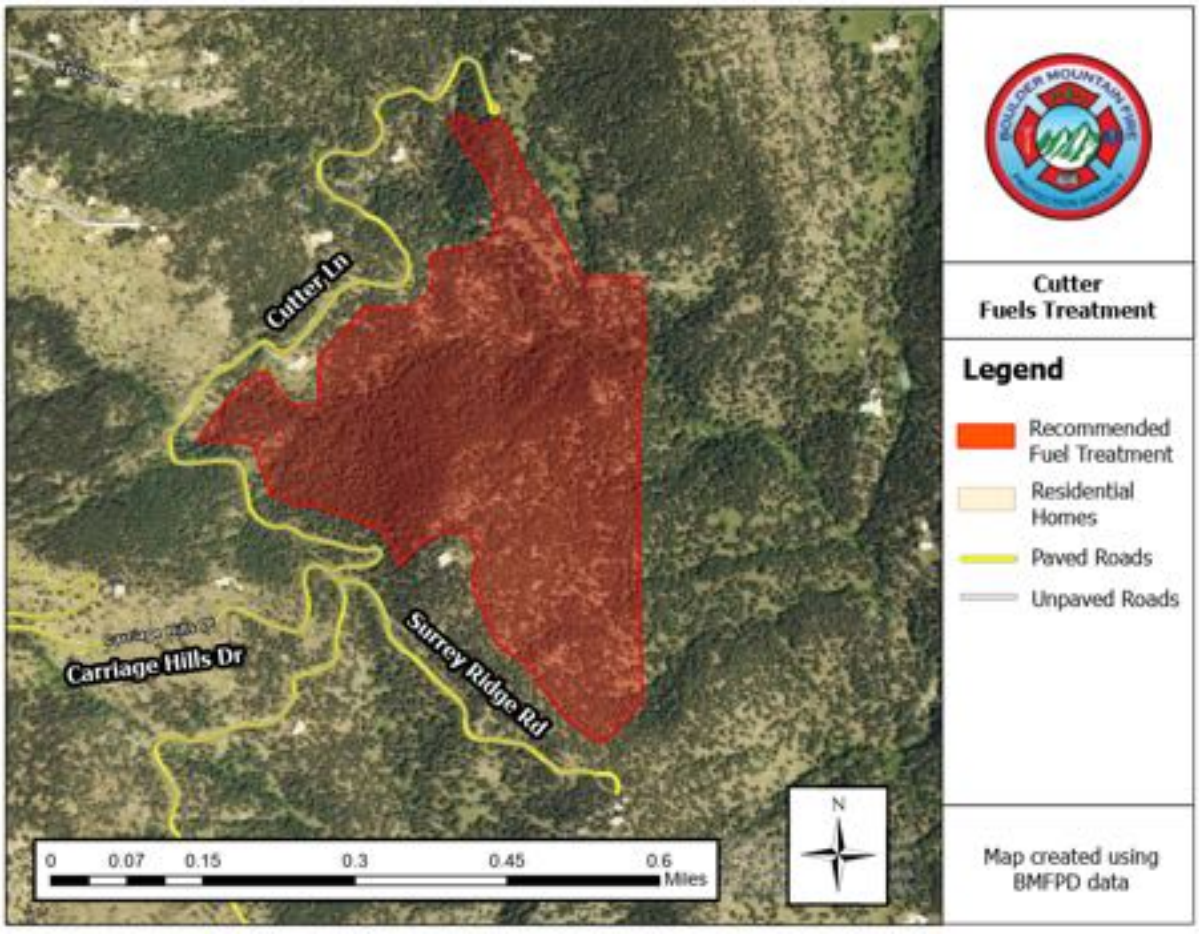

*Source: Created by BMFPD using BMFPD data*

## *Cutter Fuels Treatment*

The Cutter fuels treatment project encompasses 92 acres of privately owned land in BMFPD (**Figure 4-34**). This area was selected because it builds upon existing fuels treatments and provides protection to the Carriage Hills community from wildfires approaching from the east. The project area spans a gulley with steep terrain. Slope aspects are primarily north/northeast, with dense stands of Douglas fir and some ponderosa pine.

| **Cutter Fuels Treatment** | |
|---|---|
| **Treatment objectives:** | **Forested stand thinning for the purposes of reducing wildfire behavior and improving forest health** |
| **Treatment type:** | **Hand thinning, broadcast chipping, slash-pile burning** |
| **Priority:** | **Moderate** |
| **Lead and support organizations:** | **BMFPD, Carriage Hills HOA** |

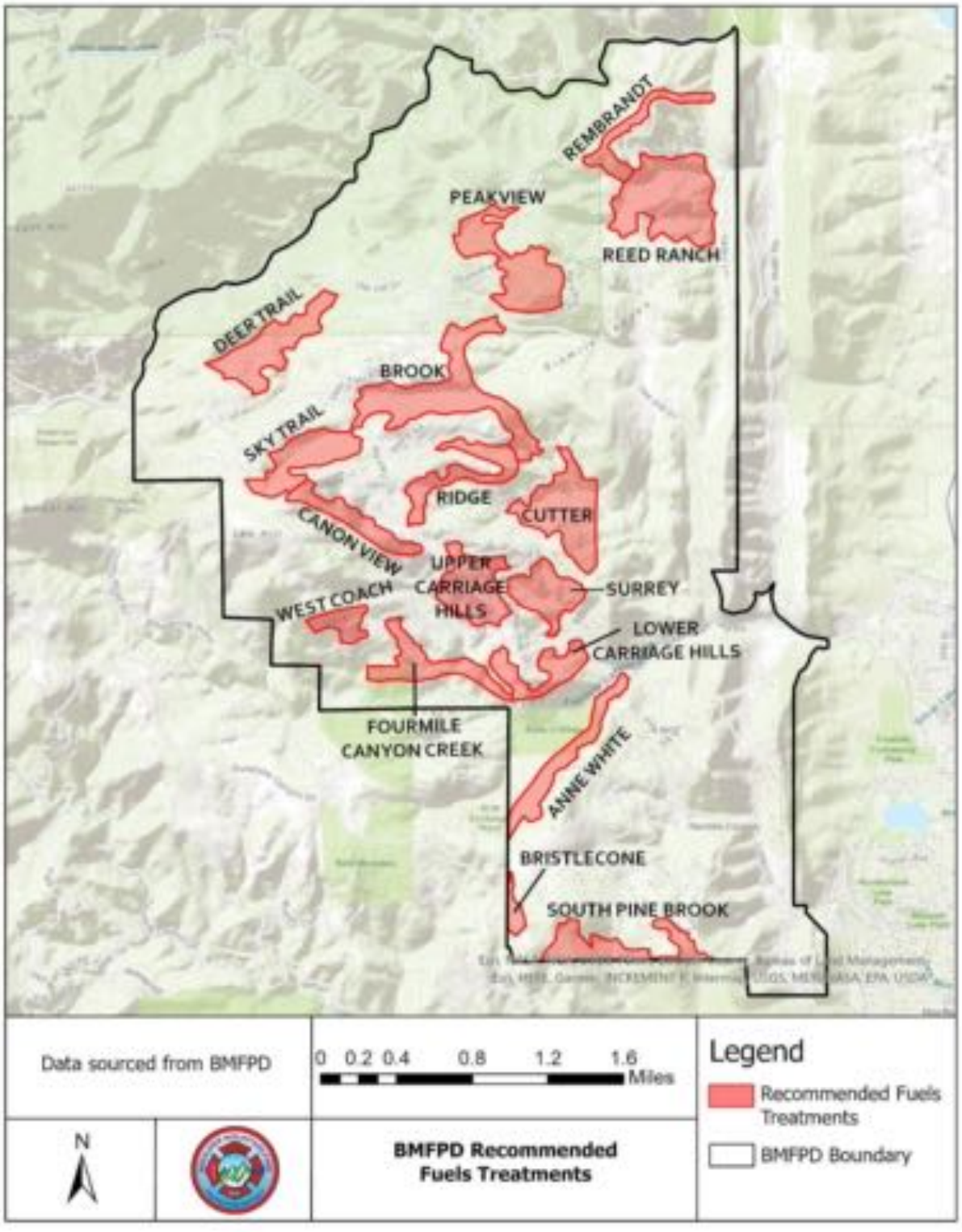
***Figure 4-34:*** *Map of the Cutter fuels treatment project area.*




*Source: Created by BMFPD using BMFPD data*

## Map of 17 Recommended Fuels Treatments

***Figure 4-35:*** *Map of BMFPD's 17 recommended fuels treatments.*



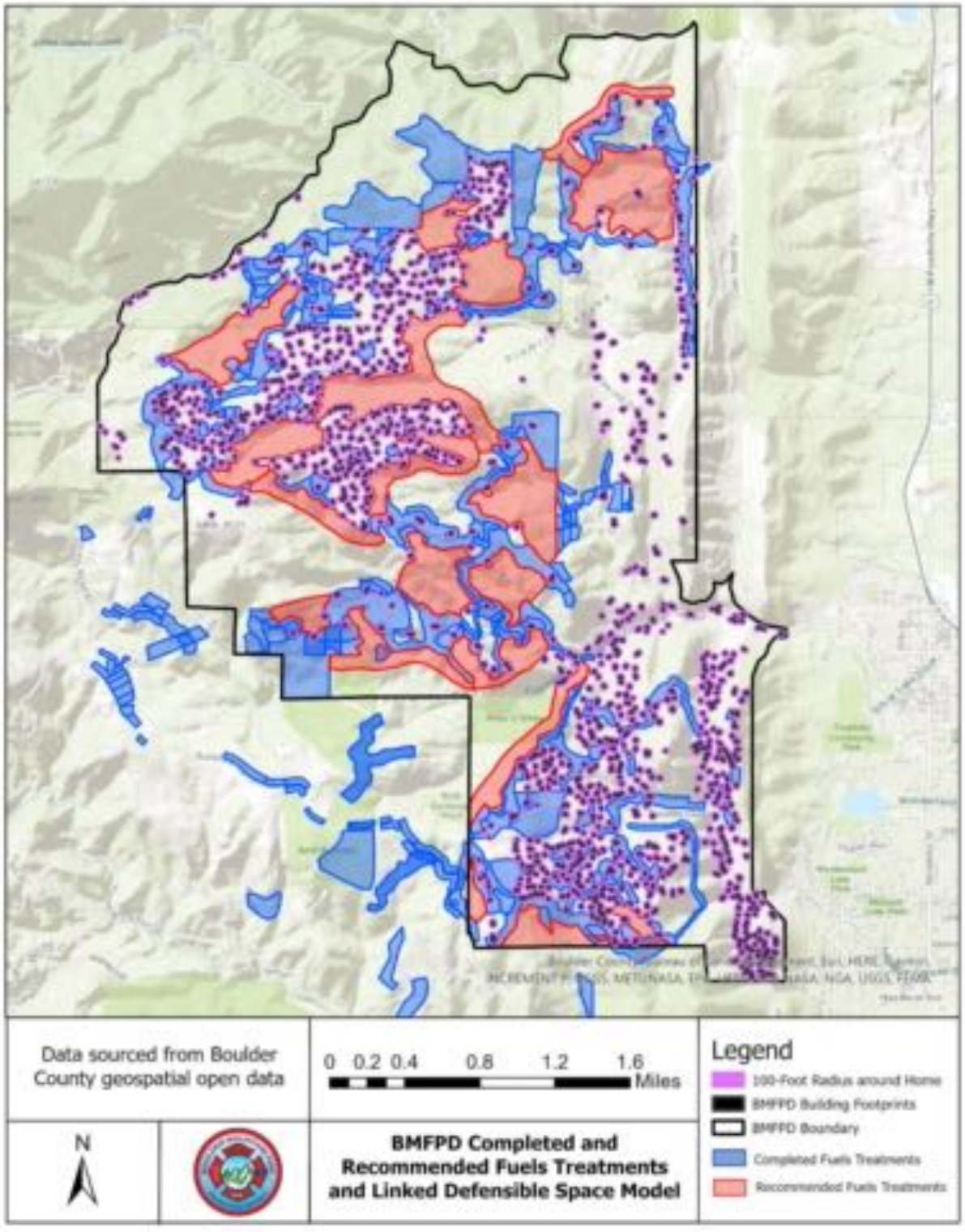

*Source: Created by BMFPD using BMFPD data*

## Synergy of BMFPD's Fuels Treatments and Defensible Space

Following the above detailed discussion of BMFPD's 17 recommended fuel breaks, it is essential to highlight how these treatments integrate with existing fuel treatments and defensible space zones to form a comprehensive mitigation network. While recommended fuels treatments provide critical buffers across key areas within the district, these strategic points of intervention are reinforced by completed fuel breaks that enhance continuity in fuel reduction. Together, they create a layered landscape of fire defense that helps slow wildfire spread, control fire behavior, and increase the efficacy of suppression efforts (**Figure 4-36**).

Defensible space around each home is another essential layer in this mitigation strategy, reinforcing both recommended and completed fuel breaks by reducing flammable vegetation in immediate proximity to residential structures. The map in **Figure 4-36** highlights how completed and recommended fuel breaks align with the recommended 100-foot defensible space buffers around each home, forming an interconnected and resilient system. The 100-foot radius of defensible space shown in **Figure 4-36** is simply a model that shows what the district would look like if all homes were properly mitigated. With each layer snugly fitting into the next, this approach demonstrates BMFPD's commitment to community wildfire protection by ensuring that defensible space and strategically placed fuel breaks work together to provide robust, district-wide resilience.

***Figure 4-36**: Map of BMFPD completed and recommended fuel treatments seamlessly aligned with the model of 100-foot defensible space buffers around each home. These layers work in tandem to enhance community wildfire resilience.*




*Source: Created by BMFPD using BMFPD data*

# History, Progress, and the Future of the CWPP

## BMFPD's CWPP History and Progress

BMFPD last completed a CWPP in 2006, marking over a decade since its initial development. Recognizing the need for a more current strategy, BMFPD began work on an updated CWPP in 2023 and completed this new edition in January 2025. This update reflects BMFPD's commitment to maintaining the CWPP as a living document—a resource that evolves with the district's needs and wildfire risk environment. Moving forward, BMFPD plans to reassess and revise the CWPP as necessary, with substantial updates every 5 years or following major events that significantly affect the district's wildfire risk profile. This proactive approach will help ensure that the CWPP remains a relevant and effective guide for wildfire mitigation and emergency response.

## CWPP as a Living Document

Regular updates to the CWPP, ideally every 5 years, are crucial to ensure that plans remain relevant and actionable. A CWPP that is over 10 years old may not reflect current conditions, making it difficult for communities to qualify for competitive funding opportunities. By keeping the CWPP current, communities demonstrate their commitment to wildfire preparedness, which helps secure resources and support for local initiatives. Updates should document past accomplishments, adapt strategies to demographic shifts, identify emerging risks, and outline newly prioritized mitigation projects, supported by up-to-date maps and risk analyses.

Updates to this CWPP can either be incorporated as a preface or added as a new accompanying document. Plan updates should include:

- A description of progress made since the current CWPP was created
- A description of demographic changes in the community
- A description of any important infrastructure changes in BMFPD and the surrounding area
- Identification of new risks in the community
- Updated risk analysis if major changes have happened between revisions
- Updated and prioritized projects for the community with maps and descriptions

The suggested review process involves:

- Reviewing the existing CWPP
- Engaging partners that have a vested interest in the plan
- Hosting collaborative meetings
- Documenting completed projects as well as demographic and landscape changes
- Developing updated wildfire risk reduction priorities
- Updating maps
- Distributing updated drafts to key partners for review and input prior to final approval
- Finalizing the updated CWPP with core team signatures and submitting it to the Colorado State Forest Service

This CWPP is a **call to action!** Becoming a fire adapted community and decreasing wildfire risk take concerted effort, time, and coordination. Use the CWPP to spark action on your property and across your neighborhood and entire community. The need to protect lives and property from wildfire and enhance personal and community safety is too great to wait.

# Glossary

**Active crown fire:** Fire in which a solid flame develops in the crowns of trees and advances from tree crown to tree crown independently of surface fire spread (NWCG, 2018b).

**Backfire:** A fire set along the inner edge of a fireline to consume the fuel path of a wildfire or change the direction of force of the fire's convection column (NWCG, 2018b).

**Broadcast prescribed burning (aka prescribed burn and controlled burn):** A wildland fire originating from a planned ignition in accordance with applicable laws, policies, and regulations to meet specific objectives (NWCG, 2018b).

**Canopy cover:** The ground area covered by the crowns of all trees in an area as delimited by the vertical projection of their outermost crown perimeters (NWCG, 2019).

**Canopy:** The more or less continuous cover of branches and foliage formed collectively by adjacent tree crowns (USFS, 2021b).

**Canyon:** A long, deep, very steep-sided topographic feature primarily cut into bedrock and often with a perennial stream at the bottom (NRCS, 2017).

**Chain:** A chain is a measure of distance commonly used in forestry and fire management. 1 chain is equivalent to 66 feet. Chains were used for measurements in the initial public land survey of the United States in the mid-1800s.

**Chute:** A steep V-shaped drainage that is not as deep as a canyon but is steeper than a draw. Normal upslope air flow is funneled through a chute and increases in speed, causing upslope preheating from convective heat, thereby exacerbating fire behavior (NWCG, 2008).

**Community wildfire protection plan (CWPP):** A plan developed in the collaborative framework established by the Wildland Fire Leadership Council and agreed to by state, tribal, and local governments; local fire departments; other partners; and federal land management agencies in the vicinity of the planning area. CWPPs identify and prioritize areas for hazardous fuel reduction treatments, recommend the types and methods of treatment on federal and non-federal land that will protect one or more at-risk communities and essential infrastructure, and recommend measures to reduce structure ignitability throughout the at-risk community. A CWPP may address issues such as wildfire response, hazard mitigation, community preparedness, and structure protection (NWCG, 2018b).

**Control line:** An inclusive term for all constructed or natural barriers and treated fire edges used to control a fire (NWCG, 2018b).

**Convection:** A type of heat transfer that occurs when a fluid, such as air or a liquid, is heated and travels away from the source, carrying heat with it. Air around and above a wildfire expands as it is heated, causing it to become less dense and rise into a hot convection column. Cooler air flows in to replace the rising gases, and in some cases, this inflow of air creates local winds that further fan the flames. Hot convective gases move upslope and dry out fuels ahead of the flaming front, lowering their ignition temperature and increasing their susceptibility to ignition and fire spread. Homes located at the top of a slope can become preheated by convective heat transfer. Convection columns from wildfires carry sparks and embers aloft.

**Crown (aka tree crown):** The upper part of a tree, including the branches and foliage (USFS, 2021b).

**Defensible space:** The area around a building where vegetation, debris, and other types of combustible fuels have been treated, cleared, or reduced to slow the spread of fire and reduce

exposure to radiant heat and direct flame. Residents are encouraged to create defensible space to reduce hazards so that during a wildfire, their home should be able to survive on its own without relying on limited firefighter resources to protect it. The Colorado State Forest Service defines three zones of defensible space: Zone 1 is 0 to 5 feet from the home, Zone 2 is 5 to 30 feet from the home, and Zone 3 is 30 to about 100 feet from the home (CSFS, 2021).

**Direct attack:** Any treatment applied directly to burning fuel such as wetting, smothering, or chemically quenching the fire or physically separating the burning from unburned fuel (NWCG, 2018b).

**Draw:** A topographic feature created by a small natural watercourse cutting into unconsolidated materials. Draws generally have a broader floor and more gently sloping sides than a chute (NRCS, 2017).

**Ecological restoration:** The process of assisting the recovery of an ecosystem that has been damaged, degraded, or destroyed (SER, 2004). In ponderosa pine and dry mixed-conifer forests of the Colorado Front Range, ecological restoration involves transforming dense forests into a mosaic of single trees, clumps of trees, and meadows similar to historic forests that were maintained by wildfires and very resilient to them (Addington et al., 2018).

**Ember (aka firebrand):** Small, hot, and carbonaceous particles that are airborne and carried for some distance in an airstream (Babrauskas, 2018).

**Fire adapted community:** A human community consisting of informed and prepared citizens collaboratively planning and taking action to safely coexist with wildland fire (NWCG, 2018b). There is not a checklist or one silver bullet to become a fire adapted community; many strategic actions and tools should be used together to reduce shared risk. Risk mitigation is the responsibility of everyone who lives and works in the community—residents, community groups, fire protection districts, agency partners, nongovernmental organizations, etc. Fire adaptation is an ongoing process of collaborative action to identify risk, mitigate it, and maintain the work over time.

**Fire behavior:** The manner in which a fire reacts to the influences of fuel, weather, and topography. Characteristics of fire behavior include rate of spread, fire intensity, fire severity, and fire behavior category (NWCG, 2018b).

**Fire history:** A general term referring to the historic fire occurrence in a specific geographic area (NWCG, 2018b).

**Fire intensity (aka fireline intensity):** (1) The product of the available heat of combustion per unit of ground and the rate of spread of the fire, interpreted as the heat released per unit of time for each unit length of fire edge, or (2) the rate of heat release per unit time per unit length of fire front (NWCG, 2018b).

**Fire regime:** A description of the patterns of fire occurrences, frequency, size, and severity in a specific geographic area or ecosystem. A fire regime is a generalization based on fire histories at individual sites. Fire regimes can often be described as cycles because some parts of the histories usually get repeated, and the repetitions can be counted and measured, such as fire return interval (NWCG, 2018b).

**Fire severity.** The degree to which a site has been altered or disrupted by fire; loosely, a product of fire intensity and residence time (NWCG, 2018b). Fire severity is determined by visually inspecting or measuring the effects that wildfire has on soil, plants, fuel, and watersheds. Fire severity is often classified as low severity (less than 20% of overstory trees killed) and high severity (more than 70% of overstory trees killed). Moderate or intermediate fire severity falls between these two extremes (Agee, 1996). Specific cutoffs for fire-severity classifications differ among researchers. For

example, Sherriff et al. (2014) define high-severity fires as those killing more than 80% of overstory trees.

**Fire weather conditions:** Weather conditions that influence fire ignition, behavior, and suppression, for example, wind speed, wind direction, temperature, relative humidity, and fuel moisture (NWCG, 2018b).

**Firebreak:** A natural or constructed barrier where all vegetation and organic matter have been removed down to bare mineral soil. Firebreaks are used to stop or slow wildfires or to provide a control line from which to work (Bennett et al., 2010; NWCG, 2018b).

**Fireline:** (1) The part of a containment or control line that is scraped or dug to mineral soil, or (2) the area within or adjacent to the perimeter of an uncontrolled wildfire of any size in which action is being taken to control fire (NWCG, 2018b).

**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). Flame length is measured on an angle when the flames are tilted due to effects of wind and slope. Flame length is an indicator of fire intensity (NWCG, 2018b).

**Fuel reduction:** The manipulation, combustion, or removal of fuels to reduce the likelihood of ignition and/or to lessen potential damage from wildfires and resistance to control (NWCG, 2018b).

**Fuelbreak:** A natural or manmade change in fuel characteristics that affects fire behavior so that fires burning into them can be more readily controlled. Unlike firebreaks, fuelbreaks have vegetation and organic soil within them. Trees in shaded fuelbreaks are thinned and pruned to reduce the fire potential, but enough trees are retained to make a less favorable microclimate for surface fires (NWCG, 2018b).

**Fuels mitigation/management:** The act or practice of controlling flammability and reducing resistance to control of wildland fuels through mechanical, chemical, biological, or manual means, or by fire, in support of land management objectives (NWCG, 2018b).

**Fuels:** Any combustible material, most notably vegetation in the context of wildfires, but also including petroleum-based products, homes, and other man-made materials that might combust during a wildfire in the wildland-urban interface. Wildland fuels are described as 1-, 10-, 100-, and 1,000-hour fuels. 1-hour fuels are dead vegetation less than 0.25 inch in diameter (e.g., dead grass), 10-hour fuels are dead vegetation 0.25 inch to 1 inch in diameter (e.g., leaf litter and pine needles), 100-hour fuels are dead vegetation 1 inch to 3 inches in diameter (e.g., fine branches), and 1,000-hour fuels are dead vegetation 3 inches to 8 inches in diameter (e.g., large branches). Fuels with larger diameters have a smaller surface area-to-volume ratio and take more time to dry out or to become wetter as relative humidity in the air changes (NWCG, 2018b).

**Handcrews:** A number of individual wildland firefighters who have been organized and trained and are supervised principally for operational assignments on an incident (NWCG, 2018b).

**Hazards:** Any real or potential condition that can cause injury, illness, or death of personnel, or can damage or destroy equipment or property (NWCG, 2018b).

**Home hardening:** Steps taken to improve the chance of a home and other structures withstanding ignition by radiant and convective heat and direct contact with flames or embers. Home hardening involves reducing structure ignitability by changing building materials, installation techniques, and structural characteristics of a home (California Fire Safe Council, 2020). A home can never be made fireproof, but home hardening practices combined with defensible space increases the chance that a home will survive a wildfire.

**Home ignition zone:** The characteristics of a home and its immediate surroundings within 100 feet of structures. Conditions in the home ignition zone largely determine home ignition potential from radiant heat, convective heat, and ember cast (NWCG, 2018b).

**Ignition-resistant building materials:** Materials that resist ignition or sustained flaming combustion. Materials designated ignition resistant have passed a standard test that evaluates flame spread on the material (Quarles, 2019; Quarles and Pohl, 2018).

**Incident Response Pocket Guide:** A document that establishes standards for wildland fire incident response. The guide provides critical information on operational engagement, risk management, all hazard response, and aviation management. It provides a collection of best practices that have evolved over time within the wildland fire service (NWCG, 2018a).

**Indirect attack** A method of suppression in which the control line is located a considerable distance away from the fire's active edge. The method is generally done in the case of a fast-spreading or high-intensity fire and to utilize natural or constructed firebreaks or fuelbreaks and favorable topography. The intervening fuel is usually backfired, but occasionally the main fire is allowed to burn to the line, depending on conditions (NWCG, 2018b).

**Ladder fuels:** Fuels that are vertically continuous, thereby allowing fire to carry from surface fuels into the crowns of trees with relative ease. Ladder fuels help initiate torching and crowning and assure the continuation of crowning. Ladder fuels can include small trees, brush, and lower limbs of large trees (NWCG, 2018b).

**Mastication:** A slash management technique that involves using a machine to grind, chop, or shred vegetation into small pieces that then become surface fuel (Jain et al., 2018).

**Mitigation actions:** Actions implemented to reduce or eliminate (mitigate) risks to persons, property, and natural resources. These actions can be undertaken before and during a wildfire. Actions before a fire include treating fuels, modifying vegetation in the home ignition zone, and employing home hardening to increase the chance a structure will survive a wildfire. Mitigation actions during a wildfire include mechanical and physical tasks, specific fire applications, and limited suppression actions, such as constructing firelines to limit fire spread and behavior (NWCG, 2018b).

**Mosaic landscape:** A heterogeneous area composed of different communities or a cluster of different ecosystems that are similar in function and origin in the landscape. This landscape consists of patches arranged in a matrix, where the patches are the different ecosystems and the matrix is how they are arranged over the land (Hansson et al., 1995).

**National Wildfire Coordinating Group (NWCG):** An operational group established in 1976 through a Memorandum of Understanding between the U.S. Department of Agriculture and U.S. Department of the Interior to coordinate programs of the participating agencies to avoid wasteful duplication of effort and to provide a means of constructively working together. The NWCG provides a formalized system and agreed-upon standards of training, equipment, aircraft, suppression priorities, and other operational areas related to wildfire. More information about NWCG is available online at https://www.nwcg.gov/.

**Noncombustible building materials:** Materials of which no part will ignite or burn when subjected to fire or heat, even after exposure to moisture or the effects of age. Materials designated noncombustible have passed a standard test (Quarles, 2019; Quarles and Pohl, 2018).

**Overstory:** A layer of foliage in a forest canopy, particularly tall mature trees that rise above the shorter immature understory trees (USFS, 2021b).

**Passive crown fire:** Fire that arises when surface fire ignites the crowns of trees or groups of trees (aka torching). Torching trees reinforce the rate of spread, whereas passive crown fires travel along with surface fires (NWCG, 2018b).

**Pile burning:** Piling slash resulting from logging or fuel management activities into manageable piles that are subsequently burned during safe and approved burning conditions (NWCG, 2018b).

**Public Safety Answering Point (PSAP):** A call center or dispatch center that receives and handles emergency calls from the public, typically by dialing 911, and then routes the call to the appropriate emergency services, such as police, fire, or ambulance, based on the caller's location.

**Pyrolysis:** The thermal or chemical decomposition of fuel at an elevated temperature. This is the pre-ignition combustion phase of burning during which heat energy is absorbed by the fuel, which in turn gives off flammable tars, pitches, and gases (NWCG, 2018b).

**Radiation:** A method of heat transfer by short-wavelength energy through air (aka infrared radiation). Surfaces that absorb radiant heat warm up and radiate additional short-wavelength energy themselves. Radiant heat is what you feel when sitting in front of a fireplace. Radiant heat preheats and dries fuels adjacent to the fire, which initiates combustion by lowering the fuels' ignition temperature. The amount of radiant heat received by fuels increases as the fire front approaches. Radiant heat is a major concern for the safety of wildland firefighters and can ignite homes without direct flame contact.

**Rate of spread:** The relative activity of a fire in extending its horizontal dimensions. It is expressed as rate of increase of the total perimeter of the fire, as rate of forward spread of the fire front, or as rate of increase in area, depending on the intended use of the information. Rate of spread is usually expressed in chains or acres per hour for a specific period in the fire's history (NWCG, 2018b).

**Ravine:** A topographic feature created by streams cutting into unconsolidated materials and that is narrow, steep-sided, and commonly V-shaped. Ravines are steeper than draws (NRCS, 2017).

**Risk:** (1) The chance of fires starting as determined by the presence and activity of causative agents (e.g., lightning), (2) a chance of suffering harm or loss, or (3) a causative agent (NWCG, 2018b).

**Roadside fuel treatment:** A natural or manmade change in fuel characteristics along a roadway that affects fire behavior so that fires burning into them can be more readily controlled, survivable conditions with shorter flame lengths are more likely during a wildfire, and firefighter access is enhanced (NWCG, 2018b).

**Saddle:** A low point on a ridge or interfluve (plateau-like ridge), generally a divide or pass between the heads of streams flowing in opposite directions. The presence of a saddle funnels airflow and increases wind speed, thereby exacerbating fire behavior (NRCS, 2017).

**Shaded fuelbreak:** Fuel treatments in timbered areas where the trees on the break are thinned and pruned to reduce fire potential, yet enough trees are retained to make a less favorable microclimate for surface fires (NWCG, 2018b).

**Slash:** Debris resulting from natural events such as wind, fire, or snow breakage or from human activities such as road construction, logging, pruning, thinning, or brush cutting. Slash includes logs, bark, branches, stumps, treetops, and broken understory trees or brush (NWCG, 2018b).

**Spot fire:** Fire ignited outside the perimeter of the main fire by an ember (NWCG, 2018b). Spot fires are particularly concerning because they can form a new flaming front, move in unanticipated directions, trap firefighters between two fires, and require additional firefighting resources to control.

**Spotting:** When a fire produces sparks or embers that are carried by the wind and start new fires beyond the zone of direct ignition by the main fire (NWCG, 2018b).

**Stand:** An area of forest that possesses sufficient uniformity in species composition, age, size, structural configuration, and spatial arrangement to be distinguishable from adjacent areas (USFS, 2021b).

**Structure protection:** The protection of homes or other structures by firefighters from an active wildland fire (NWCG, 2018b).

**Suppression:** The work and activity used to extinguish or limit wildland fire spread (NWCG, 2018b).

**Surface fire:** Fire that burns fuels on the ground, which include dead branches, leaves, and low vegetation (NWCG, 2018b).

**Surface fuels:** Fuels lying on or near the ground, consisting of leaf and needle litter, dead branch material, downed logs, bark, tree cones, and low-stature living plants (NWCG, 2018b).

**Torching:** The burning of the foliage of a single tree or a small group of trees from the bottom up. Torching is the type of fire behavior that occurs during passive crown fires and can initiate active crown fires if tree canopies are close to each other (NWCG, 2018b).

**Unsurvivable road:** Portions of roads adjacent to areas with predicted flame lengths greater than 8 feet under severe fire weather conditions. Potentially unsurvivable flame lengths start at 8 feet, according to the Haul Chart, which is a standard tool used by firefighters to relate flame lengths to tactical decisions (NWCG, 2019). Drivers stopped or trapped on these roadways would have a low chance of surviving radiant heat from fires of this intensity. Unsurvivable conditions are more common on roads lined with thick forests, particularly with trees that have limbs all the way to the ground and/or abundant saplings and seedlings.

**Values at risk:** The aspects of a community or natural area considered valuable by an individual or community that could be negatively impacted by a wildfire or wildfire operations. These values can vary by community and include diverse characteristics such as homes, specific structures, water supplies, power grids, natural and cultural resources, community infrastructure, and other economic, environmental, and social values (NWCG, 2018b).

**Watershed (aka drainage basin or catchment):** An area of land where all precipitation falling in that area drains to the same location in a creek, stream, or river. Smaller watersheds come together to create basins that drain into bays and oceans (NOAA, 2021).

**Wildfire-resistant building materials:** A general term used to describe a material and design feature that can reduce the vulnerability of a building to ignition from wind-blown embers or other wildfire exposures (Quarles, 2019; Quarles and Pohl, 2018).

**Wildland-urban interface (WUI):** Any area where the built environment meets wildfire-prone areas—places where wildland fire can move between natural vegetation and the built environment and result in negative impacts on the community (Forge, 2018). Strategic wildfire mitigation across the WUI can increase the safety of residents and wildland firefighters and reduce the chances of home loss.

**Wireless Emergency Alert (WEA):** A public safety system that allows customers who own compatible mobile devices to receive geographically targeted, text-like messages alerting them of imminent threats to safety in their area.

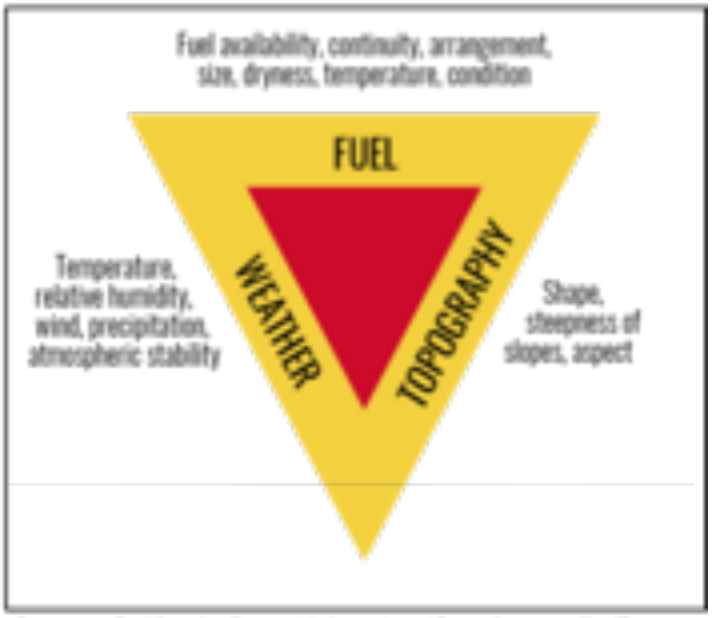
# Appendix A

# Introduction to Wildfire Behavior and Terminology

## Fire Behavior Triangle

Complex interactions among wildland fuels, weather, and topography determine how wildfires behave and spread. These three factors make up the sides of the fire behavior triangle (**Figure A-1**), and they are the variables that wildland firefighters pay attention to when assessing potential wildfire behavior during an incident (NWCG, 2019).

*Figure A-1: Interactions between fuels, weather, and topography dictate fire behavior.*




Source: California State University. (See **Appendix E** on page 196 for URLs.)

### Fuels

Fuels include live vegetation such as trees, shrubs, and grasses; dead vegetation such as pine needles and cured grass; and other materials such as houses, sheds, fences, trash piles, and combustible chemicals.

Grasses and pine needles are known as flashy fuels because they easily combust and burn the fastest of all fuel types. If you think of a campfire, flashy fuels are the kindling that you use to start the fire. Flashy fuels dry out faster than other fuel types when relative humidity drops or when exposed to radiant and convective heat.[1] Fires in grassy fuel types can spread quickly across large areas, and fire behavior can change rapidly with changes in weather conditions.

Dead branches on the ground dry out slower than flashy fuels, release more radiant heat when they burn, and take longer to completely combust. The rate of spread is fast to moderate through shrublands depending on their moisture content, and the long flame lengths of fire in shrublands can preclude direct attack by firefighters. Shrubs and small trees can also act as ladder fuels that carry fire from the ground up into the tree canopy.

Dead trees (aka snags) and large downed logs are called heavy fuels. They take the longest to dry out when relative humidity drops and when exposed to radiant and convective heat. Heavy fuels release tremendous radiant heat when they burn, and they take longer to completely combust, just

[1] Radiant heat transfer occurs by short-wavelength energy traveling through air. Radiant heat is what you feel when sitting in front of a fire. Radiant heat preheats and dries fuels adjacent to a wildfire, which initiates combustion by lowering the fuel's ignition temperature. Convective heat transfer occurs when air is heated, travels away from the source, and carries heat along with it. Convective heat is what you would feel if you put your hand in the air above an open flame. Air around and above a wildfire expands as it is heated, causing it to become less dense and rise into a hot convection column. Cooler air flows in to replace the rising gases, and in some cases, this inflow of air creates local winds that further fan the flames. Hot convective gases move up slope and dry out fuels ahead of the flaming front, lowering their ignition temperature and increasing their susceptibility to ignition and fire spread.

like a log on a campfire. Fire spread through a forest is slower than in a grassland or shrubland, but forest fires release more heat and can be extremely difficult and unsafe for firefighters to suppress. An abundance of dead trees killed by drought, insects, or disease can exacerbate fire behavior, particularly when dead trees still have dry, red needles (Moriarty et al., 2019; Parsons et al., 2014).

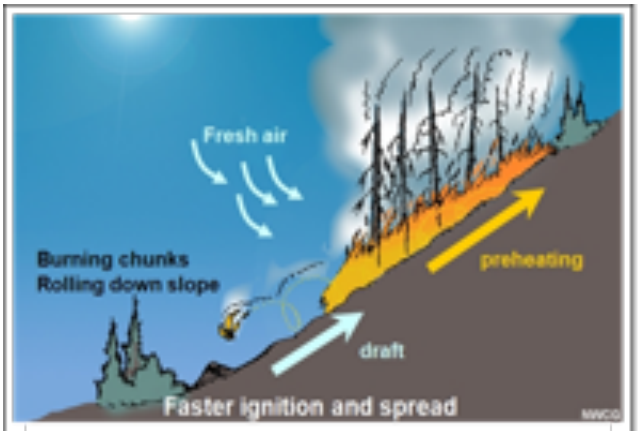
## Topography

Topography (slope and aspect) influences fire intensity, speed, and spread (**Figure A-2**). In the northern hemisphere, north-facing slopes experience less sun exposure during the day, resulting in higher fuel moistures. Tree density is often higher on north-facing slopes due to higher soil moisture. South-facing slopes experience more sun exposure and higher temperatures and are often covered in grasses and shrubs. The hotter and drier conditions on south-facing slopes mean fuels are drier and more susceptible to combustion, and the prevalence of flashy fuels results in fast rates of fire spread.

Fires burn more quickly up steep slopes due to radiant and convective heating. Fuels are brought into closer proximity with the progressing fire, causing them to dry out, preheat, and become more receptive to ignition, thereby increasing rates of spread. Steep slopes also increase the risk of burning material rolling and igniting unburned fuels below.

Narrow canyons can experience increased combustion because radiant heat from fire burning on one side of the canyon can heat fuel on the other side of the canyon. Embers can easily travel from one side of a canyon to the other. Topography also influences wind behavior and can make fire spread unpredictable. Wildfires burning through steep and rugged topography are harder to control due to reduced access for firefighters and more unpredictable and extreme fire behavior.

***Figure A-2**: Steep slopes and topographic features such as narrow canyons exacerbate fire behavior.*




Slope increases fire spread through radiant and convective heating (source: NWCG).


Fires can easily cross narrow canyons (source: U.S. Forest Service).

## Weather

Weather conditions that affect fire behavior include temperature, relative humidity, precipitation, and wind speed and direction. The National Weather Service uses a system called a red flag warning to indicate local weather conditions that can combine to produce increased risk of fire danger and behavior. Red flag warning days indicate increased risk of extreme fire behavior due to a combination of hot temperatures, very low humidity, dry fuels, strong winds, and the presence of thunderstorms (**Figure A-3**).

Direct sunlight and hot temperatures affect how ready fuels are to ignite. Warm air preheats fuels and brings them closer to their ignition point. When relative humidity is low, the dry air can absorb moisture from fuels, especially flashy fuels, making them more susceptible to ignition. Long periods of dry weather can dehydrate heavier fuels, including downed logs, increasing the risk of wildfires in areas with heavy fuel loads.

Wind influences fire behavior by drying out fuels (think how quickly your lips dry out in windy weather), increasing the amount of oxygen feeding the fuel, preheating vegetation through convective heat, and carrying embers more than a mile ahead of an active fire. Complex topography, such as chutes, saddles, and draws, can funnel winds in unpredictable directions, increasing wind speeds and resulting in erratic fire behavior.

***Figure A-3**. Red flag days are warnings issued by the National Weather Service using criteria specific to a region.*

| **National Weather Service – Colorado Forecast Office<br>Red Flag Warning Criteria** | |
|---|---|
| **Option 1** | **Option 2** |
| Relative humidity less than or equal to 15% | Widely scattered dry thunderstorms |
| Wind gusts greater than or equal to 25 mph | Lightning activity level (LAL) 6 |
| (Both conditions must occur simultaneously for at least 3 hours in a 12-hour period) | (A thunderstorm is considered dry if it produces less than 0.10 inch rainfall) |

*Source: National Weather Service - Colorado Forecast Office*

## Fire Types

Weather, topography, and fuels influence fire behavior, and fire behavior in turn influences the tactical options available to wildland firefighters and the risks posed to lives and property. There are three general categories of fire described in this CWPP: surface fire, passive crown fire, and active crown fire.

- **Surface fire:** Fire that burns fuels on the ground, which include dead branches, leaves, and low vegetation. Surface fires can be addressed with direct attack using handcrews when flame lengths are less than 4 feet and with equipment when flame lengths are less than 8 feet. Surface fires can emit significant radiant heat, which can ignite nearby vegetation and homes.
- **Passive crown fire:** Fire that arises when surface fire ignites the crowns of trees or groups of trees (aka torching). Torching trees reinforce the rate of spread, whereas passive crown fires travel along with surface fires. Firefighters can sometimes address passive crown fires with indirect attack, such as dropping water or retardant out of aircraft or digging fireline at a safe distance from the flaming front. The likelihood of passive crown fire increases when trees have low limbs and when smaller trees and shrubs grow below tall trees and act as

ladder fuels. Radiant heat and ember production from passive crown fires can threaten homes during wildfires.

- **Active crown fire:** Fire in which a solid flame develops in the crowns of trees and advances from tree crown to tree crown independently of surface fire spread. Crown fires are very difficult to contain, even with the use of aircraft dropping fire retardant, due to long flame lengths and tremendous release of radiant energy. The likelihood of active crown fires increases when trees have interlocking canopies. Radiant heat and ember production from active crown fires can threaten homes during wildfires.

Passive and active crown fires can result in short- and long-range ember production that can create spot fires and ignite homes. Spot fires are particularly concerning because they can form a new flaming front, move in unanticipated directions, trap firefighters between two fires, and require additional firefighting resources to control. Crown fires are generally undesirable in the wildland-urban interface (WUI) because of the risk to lives and property; however, passive and active crown fires are part of the natural fire regime for some forest types and result in habitat for plant and animal species that require recently disturbed conditions (Keane et al., 2008; Pausas and Parr, 2018). Passive and active crown fires historically occurred in some lodgepole pine forests and higher-elevation ponderosa pine and mixed-conifer forests on north-facing slopes (Addington et al., 2018; Romme, 1982).

## Wildfire Threats to Homes

Wildfires can ignite homes through several pathways: radiant heat, convective heat, and direct contact with flames or embers. The ability for radiant heat to ignite a home is based on the properties of the structure (i.e., wood, metal, or brick siding), the temperature of the flame, the ambient air temperature, and distance from the flame (Caton et al., 2016). Ignition from convective heat is more likely for homes built along steep slopes and in ravines and draws. For flames to ignite a structure, they must directly contact the building long enough to cause ignition. Flames from a stack of firewood near a home could cause ignition to the home, but flames that quickly burn through grassy fuels are less likely to ignite the home (although the potential still exists). Fires can also travel between structures along fuel pathways such as a fence or row of shrubs connecting a shed and a home (Maranghides et al., 2022). Some housing materials can burn hotter than the surrounding vegetation, thereby exacerbating wildfire intensity and initiating home-to-home ignition (Mell et al., 2010).

*Homes built mid-slope, at the top of steep slopes, or in ravines or draws are at greater risk of convective heat from wildfires. A wildfire could rapidly spread up this steep slope and threaten the home above.*

*Photo credit: The Ember Alliance*

Homes can be destroyed during wildfires even if surrounding vegetation has not burned. During many wildland fires, 50% to 90% of homes ignite due to embers rather than radiant heat or direct flame (Babrauskas, 2018; Gropp, 2019). Embers can ignite structures when they land on roofs, enter homes through exposed eaves or vents, or get under wooden decks. Embers can also ignite nearby vegetation and

other combustible fuels, which can subsequently ignite a home via radiant heating or direct flame contact. Burning homes can release embers that land on and ignite nearby structures, causing home-to-home ignitions, as evidenced by the destructive 2021 Marshall Fire in Boulder County. A home's structural characteristics, such as wood shingle roofs and unenclosed eaves and vents, can increase its exposure to embers and risk of combustion, (Hakes et al., 2017; Syphard and Keeley, 2019). Embers can also penetrate homes if windows are destroyed by radiant or convective heat. See **Harden Your Home** on page 69 for ways to harden your home against wildfires.

## Resources for More Information on Fire Behavior

- Introduction to Fire Behavior from the National Wildfire Coordinating Group (9:57 minute video)
- The Fire Triangle from the National Wildfire Coordinating Group (7:26 minute video)
- Understanding Fire Behavior in the Wildland/Urban Interface from the National Fire Protection Association (NFPA) (20:51 minute video)
- Understanding Fire from California State University (website)

# Appendix B

# BMFPD Community Survey Methodology and Results

## Methodology

The Boulder Mountain Fire Protection District (BMFPD) community survey was initially sent to residents via email on November 14, 2023, through 9 group lists maintained by and for various neighborhoods within BMFPD. During the May 2024 National Wildfire Awareness Month, the BMFPD's public information officer captain sent out weekly emails to the same 9 groups about how to prepare your family for wildfire, how to make your home and property more resistant to wildfire, and other related topics. The link for the BMFPD community survey was sent again on May 31, 2024, in the fourth email of the series.

The emailed community survey reached approximately 1,300 residents within BMFPD. Of those, 307 started the survey and 126 residents responded and submitted the survey. This is a response rate of 10.32%. See **Figure B-1** for the complete community survey.

***Figure B-1:*** *Complete BMFPD Community Survey.*

# Boulder Mountain Fire Protection District

## Wildfire Preparedness Community Survey

This survey will take approximately 10 minutes to complete

Boulder Mountain Fire Protection District (BMFPD) is revising its Community Wildfire Protection Plan (CWPP), which was last updated in 2006. A CWPP helps improve the ability of BMFPD and district residents and landowners prepare for, respond to, and adapt to wildfires. Up-to-date information and fire modeling will be used to assess local hazards and identify strategic investments to mitigate risk and promote preparedness. In addition, your ideas and opinions as a community member is vital for helping BMFPD develop and implement an updated CWPP.

Please take this anonymous survey to share your insights and thoughts about your wildfire risk and our community's preparedness. Your information will be kept confidential.

If you would like to receive updates on the CWPP project via email from Boulder Mountain Fire, please submit your email to [email protected]

*Thank you for your time! We value your ideas and opinions as a member of this community.*

### Section 1: About you

**1. What is your residency status in Boulder Mountain Fire PD? Check all that apply.**

- ☐ Full-time resident
- ☐ Seasonal resident
- ☐ Owner of undeveloped lots
- ☐ Business owner
- ☐ Owner of rental property
- ☐ Other

### Section 2: Wildfire knowledge and concerns

**2. Check the box if you agree with the following statements.**

- ☐ I believe our community is at risk from wildfires
- ☐ Each landowner is responsible for wildfire mitigation efforts
- ☐ I know how to reduce wildfire hazards around my home or business
- ☐ I've completed some wildfire mitigation on my property, and it's time to complete additional work
- ☐ I'm aware of BMFPD's state/federal grant program to assist with costs for wildfire mitigation within the district
- ☐ I'm aware of Boulder County's Wildfire Partners program to help landowners prepare for wildfire
- ☐ I'm aware Boulder County has building codes for ignition-resistant construction

- [ ] It's important to remove tress on my property for wildfire protection
- [ ] It's important to remove trees along roads to enhance the safety of roads during wildfire evacuation
- [ ] Burning slash piles is an essential part of wildfire mitigation
- [ ] Prescribed (controlled) burning is a useful tool to reduce wildfire risk

**3. Are you concerned about the following wildfire-related issues? Check all that apply.**

- [ ] Receiving timely and accurate information about the incident
- [ ] Evacuating safely and promptly
- [ ] Damage to my home/business/property
- [ ] Loss of life
- [ ] Impacts to my livelihood
- [ ] Impacts to water resources
- [ ] Impacts to historical or cultural assets
- [ ] Impacts to the economy and home values
- [ ] Damage to wildlife habitat
- [ ] Loss of recreational opportunities
- [ ] Loss of insurance coverage
- [ ] Reduced air quality due to smoke
- [ ] Post-fire erosion and flooding
- [ ] Decreased scenery due to wildfire damage

## Section 3: Reducing wildfire hazards

**4. I have completed the following work to my home/business/property to lessen the risk of wildfire. Check all that apply.**

- [ ] Removed or limbed trees near my home/business
- [ ] Annual removal of debris (e.g., dead vegetation, pine needles) from my gutters, my roof, and under my deck or porch
- [ ] Removed all burnable fuel (e.g., mulch, grass, flammable furniture) from within 5 feet of the base of my home/business
- [ ] Moved firewood away from my home/business
- [ ] Installed or repaired screens to block embers from entering vents, eaves, and gutters
- [ ] Installed an ignition-resistance roof
- [ ] Widened driveway so fire engines can access my property
- [ ] Planted fire break vegetation, such as aspen trees
- [ ] Other

**5. What obstacles have stopped you from doing wildfire mitigation? Check all that apply.**

- [ ] Lack of knowledge
- [ ] Cost/financial concerns
- [ ] None of my neighbors are doing it

- [ ] Physical inability to complete the work
- [ ] No way to dispose of the slash (tree, limbs, etc.)
- [ ] Don't see it as a priority
- [ ] Concerns about tree screening, scenery, and forest ecology
- [ ] Other

**6. Which of the following do you believe would encourage BMFPD residents to perform wildfire mitigation? Check all that apply.**

- [ ] Financial assistance
- [ ] Curbside chipping for slash removal
- [ ] Property assessment by wildfire mitigation specialists that specifies priorities/actions to be taken
- [ ] HOA enforcement of Covenants, Conditions, and Restrictions (CCRs)
- [ ] Risk of losing insurance coverage
- [ ] Boulder County building codes
- [ ] A list of recommended contractors for hire to do the work
- [ ] Other

**7. How much are you willing to spend annually on wildfire mitigation to your property or home?**

- ◯ Nothing
- ◯ $1 - $2,000
- ◯ $2,000 - $5,000
- ◯ $5,000 - $10,000
- ◯ Over $10,000

## Section 4: Evacuation preparedness

**8. Do you have an evacuation plan?**

- ◯ Yes
- ◯ No

**9. Have you and your family practiced evacuating your home within 20 minutes or less?**

- ◯ Yes, for people in my household
- ◯ Yes, for people and pets in my household
- ◯ Yes, for people, pets, and livestock in my household and on my property
- ◯ No

**10. Do you have a plan for evacuating your pets if you are not at home**

- ◯ Yes
- ◯ No

- ◯ Not applicable

**11. If you rent out your house (short-term or long-term), do you have a method of communicating a mandatory evacuation order to your tenants?**

- ◯ Yes
- ◯ No
- ◯ Not applicable

**12. Have you prepared a "go bag"?**

- ◯ Yes
- ◯ No
- ◯ I do not know what a "go bag" is

**13. Have you signed up with Boulder County to receive emergency notification during wildfire incidents?**

- ◯ Yes
- ◯ No
- ◯ I have never heard of Boulder County's emergency notification system

**14. If there were an evacuation in the community because of wildfire, are you concerned about the following issues? Check all that apply.**

- ☐ I or my family have physical limitations
- ☐ I have children that might be home alone
- ☐ My neighborhood does not have enough roads to handle evacuation traffic
- ☐ I do not know where to go if asked to evacuate
- ☐ I am not aware of primary evacuation routes in my neighborhood
- ☐ I am not aware of secondary evacuation routes in my neighborhood
- ☐ I might not receive timely information about an evacuation
- ☐ It would take me over 20 minutes to gather my personal belongings and pets to evacuate

## Section 5: Resource and educational opportunities

**15. From what resources have you found or received wildfire information? Check all that apply.**

- ☐ Colorado State Forest Service (CSFS)
- ☐ U.S. Forest Service (USFS)
- ☐ Wildfire Partners
- ☐ Boulder Mountain Fire Protection District
- ☐ Your HOA
- ☐ Your insurance agency
- ☐ Your neighbors
- ☐ Other

**16. Which of the following educational opportunities would you participate in to learn about wildfire risk mitigation and emergency preparedness? Check all that apply.**

- [ ] Neighborhood programs about wildfire risk
- [ ] In-person workshops
- [ ] A nationwide program like Firewise or a local program
- [ ] Wildfire mitigation assessment on my property
- [ ] Ready Set Go program (which helps residents prepare for fires)
- [ ] Online articles or videos on wildfire preparedness
- [ ] Written documents explaining home ignition zone and mitigation steps for my property
- [ ] Other

**17. What BMFPD methods are best to communicate with you? Check all that apply.**

- [ ] Email
- [ ] Open house opportunities
- [ ] Community forums
- [ ] Postcards or pamphlets
- [ ] Other

**18. Do you have other thoughts or comments about wildfire risk and community preparedness within the district?**

0/500

*Thank you for your time and providing insights on your values and needs as we are completing the Community Wildfire Protection Plan.*

Submit Survey

# Results

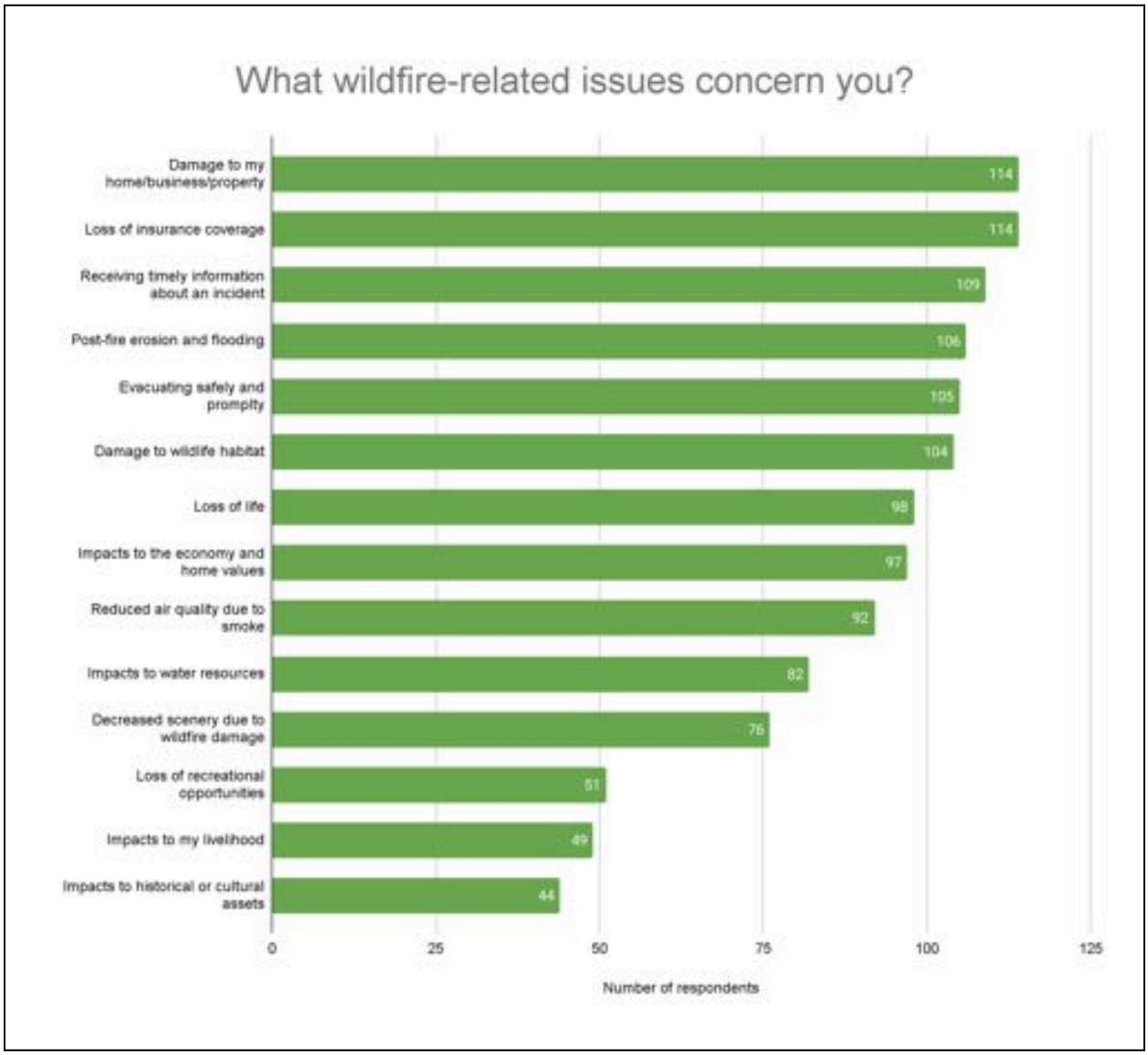
## Values at Risk

Based on the survey data, BMFPD residents have substantial concerns regarding wildfire-related issues, with a particular emphasis on the potential damage to their homes, businesses, and properties (**Figure B-2**). This concern, shared by 114 respondents, ties with the fear of losing insurance coverage as the highest priority, reflecting the community's deep anxiety about the financial and material impacts of wildfires. This underscores the critical importance of ensuring that protective measures and insurance options are accessible and reliable for residents.

Other significant concerns include the need for timely and accurate information during wildfire events, with 109 respondents highlighting this as a major issue. This is closely followed by worries about post-fire erosion and flooding, which received 106 mentions, and the ability to evacuate safely and promptly, a concern for 105 respondents. These findings suggest that the community is acutely aware of the multifaceted risks associated with wildfires, not only in terms of immediate threats to life and property but also regarding the longer-term environmental and logistical challenges that can arise in the aftermath of such events.

Additionally, the data reveals a strong concern for environmental impacts, with 104 respondents citing damage to wildlife habitats as a significant issue. The potential loss of life, which was highlighted by 98 respondents, further emphasizes the gravity of the situation. The community's focus on these areas indicates a balanced awareness of both human and ecological vulnerabilities, reinforcing the need for comprehensive preparedness strategies that address the full spectrum of wildfire-related risks.

***Figure B-2:*** *Graph of BMFPD community survey results showing wildfire-related concerns among residents.*




*Source: BMFPD community survey*

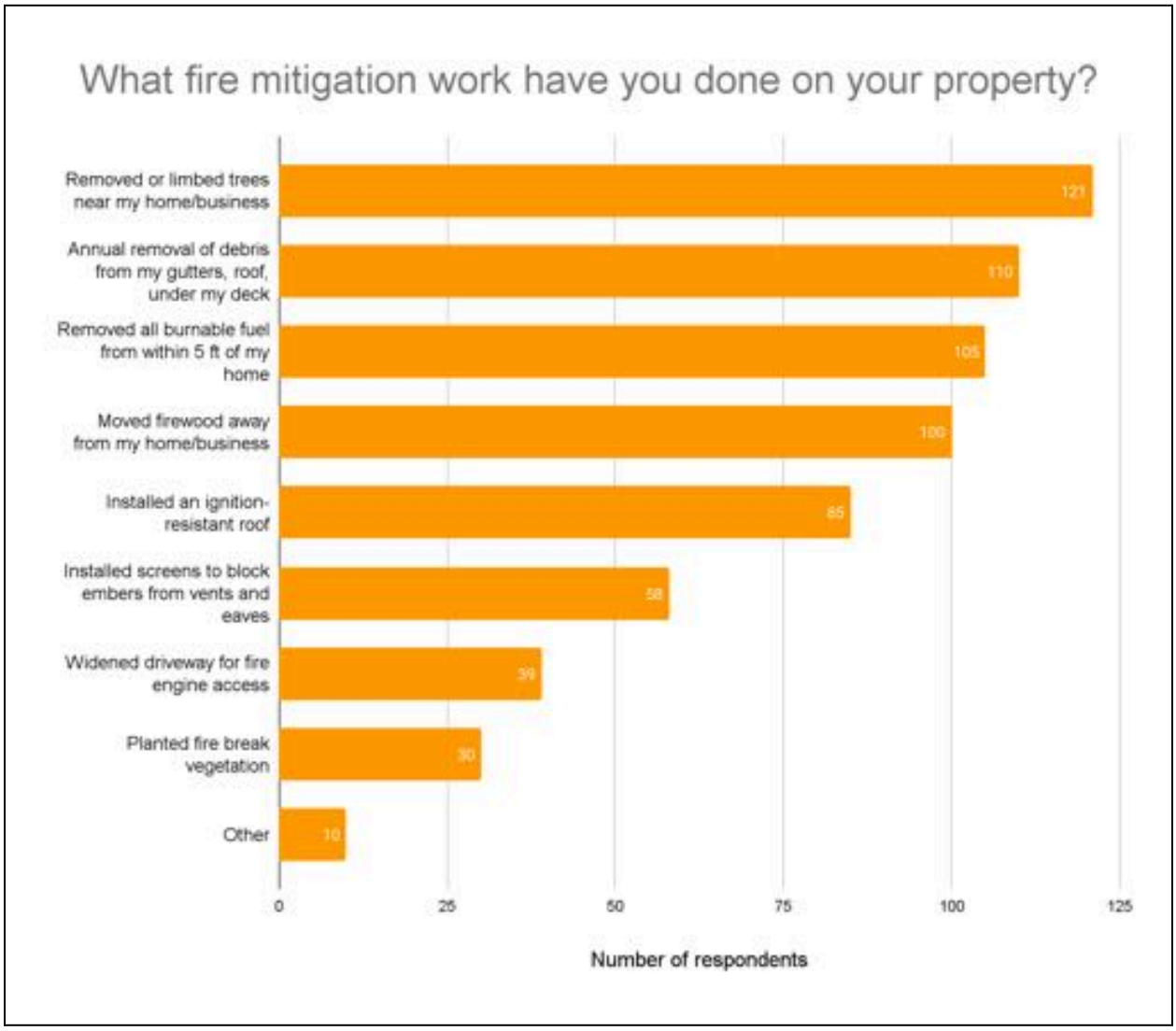
## Mitigation Work

Based on the survey data concerning fire mitigation efforts undertaken by BMFPD residents, it is evident that a significant portion of the community is actively engaged in reducing wildfire risks on their properties (**Figure B-3**). The most common mitigation measure, reported by 121 respondents, is the removal or limbing of trees near homes and businesses. This proactive step highlights the community's awareness of the dangers posed by overhanging and nearby vegetation, which can act as fuel during a wildfire, potentially endangering structures.

Following closely, 110 respondents indicated they perform annual debris removal from gutters, roofs, and under decks—an essential practice in preventing the accumulation of combustible materials that could easily ignite during a fire. Similarly, 105 respondents have taken the precaution of removing all burnable fuel within 5 feet of their homes, further underscoring the community's commitment to creating defensible spaces that can slow the spread of fire and provide a buffer zone for firefighters.

Other significant actions include moving firewood away from structures, as reported by 100 respondents, and the installation of ignition-resistant roofs, noted by 85 respondents. These measures demonstrate a comprehensive approach to fire mitigation, addressing both the immediate environment around properties and the structural vulnerabilities of homes and businesses. However, less common but still important actions, such as widening driveways for fire engine access (39 respondents) and planting firebreak vegetation (30 respondents), suggest that although many residents are taking critical steps, there may be additional opportunities to educate and encourage the adoption of a broader range of mitigation strategies. Overall, the data reflects a community that is actively engaged in fire preparedness, with varying levels of intervention depending on individual property characteristics and perceived risks.

***Figure B-3:*** *Graph of BMFPD community survey results showing what types of wildfire mitigation work residents have done.*




*Source: BMFPD community survey*

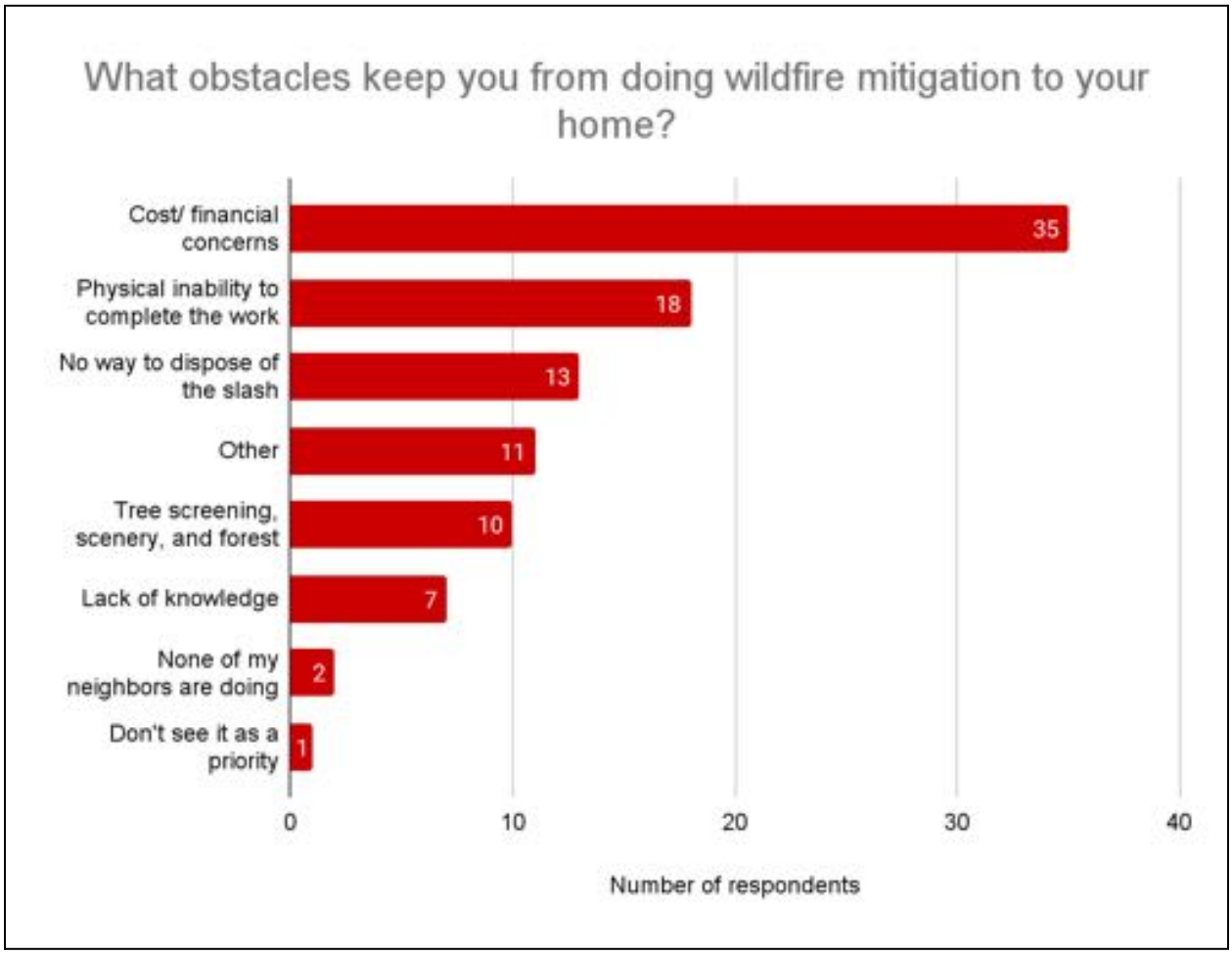
## Obstacles to Mitigation

The survey data reveals that while a majority of BMFPD residents have undertaken some form of wildfire mitigation on their properties, a considerable number still face obstacles in fully completing these efforts (**Figure B-4**). The most significant barrier, as indicated by 35 respondents, is cost and financial concerns. This finding underscores the financial burden that effective mitigation can place on homeowners, which can be a deterrent despite the known risks of wildfire.

Interestingly, the survey also highlights that financial concerns are not the only impediments. Physical inability to complete the work was cited by 18 respondents, reflecting the challenges faced by residents who may lack the physical capacity to perform the often labor-intensive tasks required for comprehensive mitigation. Additionally, the disposal of slash—an essential part of fire mitigation—poses a problem for 13 respondents, indicating logistical hurdles that can prevent the completion of necessary work.

Although cost is the predominant concern, it is noteworthy that a small but significant number of respondents also cited other barriers, such as tree screening, scenery, and forest ecology (10 respondents) and a lack of knowledge (7 respondents). This suggests that whereas some residents are motivated by financial and physical limitations, others may be influenced by environmental considerations or simply lack the information needed to take appropriate action. The data clearly points to a need for greater support, both financial and educational, to help residents overcome these barriers and complete essential wildfire mitigation work.

***Figure B-4:*** *Graph of BMFPD community survey results showing the obstacles residents face when conducting wildfire mitigation work to their homes.*




*Source: BMFPD community survey*

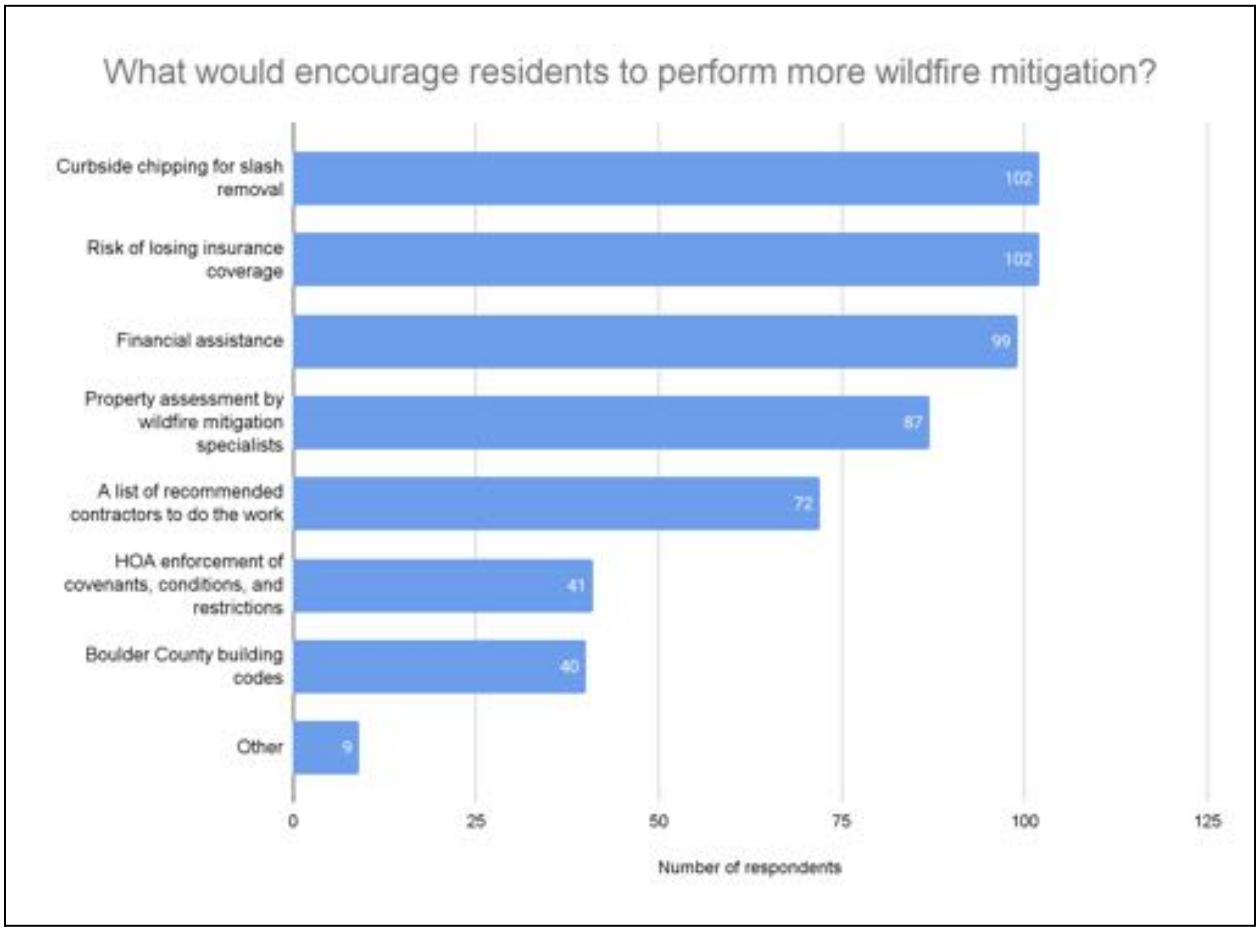
## Aids to Mitigation

The survey data reveals significant insights into the concerns and motivations of BMFPD residents regarding wildfire mitigation efforts (**Figure B-5**). Among the various aids to mitigation, curbside chipping for slash removal and the risk of losing insurance coverage emerged as the top concerns, with 102 residents identifying each of these as crucial factors. This suggests that residents are highly motivated by the practical aspects of managing vegetation and the financial implications of maintaining insurance coverage, both of which are essential in a wildfire-prone area.

Financial assistance was another prominent concern, with 99 respondents highlighting it as a key aid to mitigation. This indicates that cost remains a substantial barrier for many residents when it comes to implementing effective wildfire mitigation strategies. The desire for property assessments by wildfire mitigation specialists, cited by 87 respondents, further underscores the need for expert guidance in these efforts.

Additional support such as a list of recommended contractors (72 respondents) and homeowners association (HOA) enforcement of covenants, conditions, and restrictions (41 respondents) were also noted, though to a lesser extent. This suggests that while residents value professional assistance and regulatory enforcement, their primary concerns lie with more immediate and tangible forms of support, such as financial help and practical services like chipping. The relatively lower interest in Boulder County building codes (40 respondents) and other unspecified aids (9 respondents) indicates that these are less influential in motivating residents to participate in wildfire mitigation.

***Figure B-5:*** *Graph of BMFPD community survey results showing what would motivate residents to properly mitigate their homes.*




*Source: BMFPD community survey*

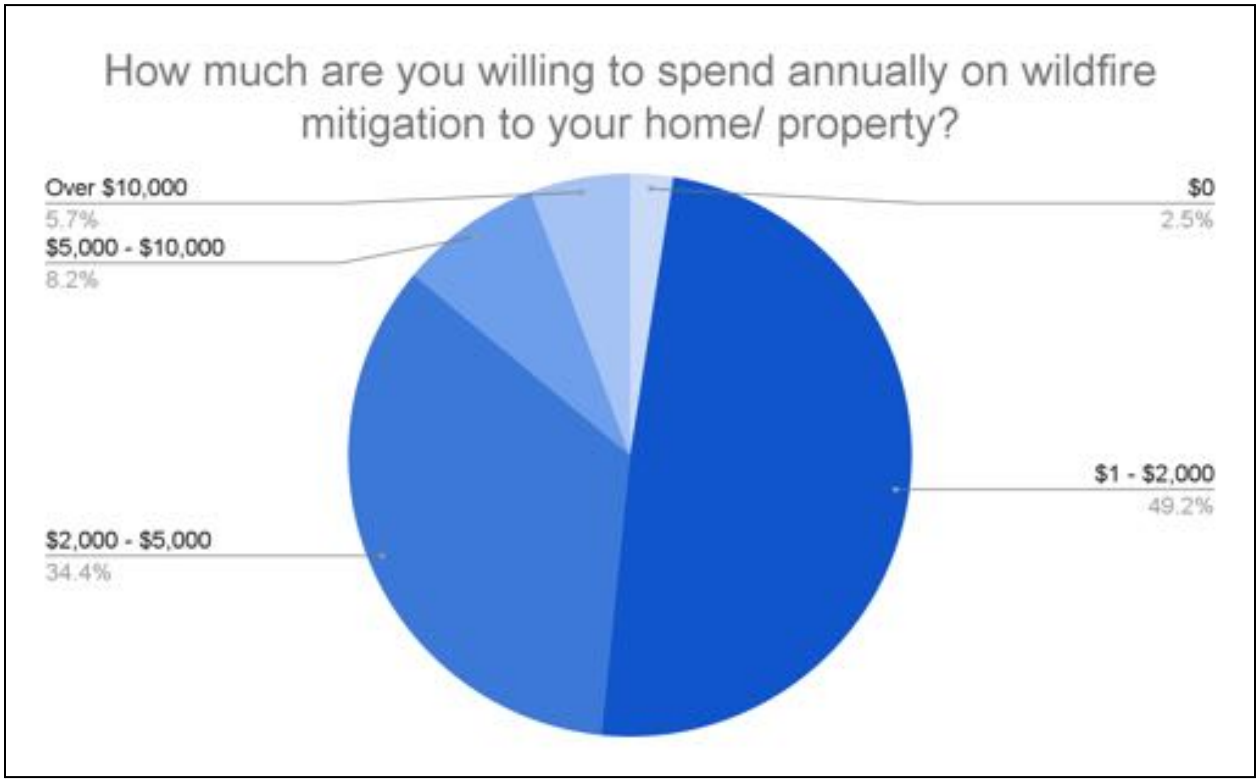
## Spending on Wildfire Mitigation

The survey data on how much BMFPD residents are willing to spend annually on wildfire mitigation reveals a range of financial commitments, with the majority of respondents indicating a moderate willingness to invest in protective measures (**Figure B-6**). The largest group, comprising 60 respondents, is willing to spend between $1,000 and $2,000 annually on mitigation efforts. This suggests that although residents are aware of the need for investment in wildfire protection, many are constrained by budgetary limits.

A smaller, yet significant, group of 42 respondents is prepared to allocate between $2,000 and $5,000 annually, indicating a recognition of the importance of more substantial mitigation measures. However, as the potential cost increases, the number of residents willing to spend decreases significantly. Only 10 respondents are willing to invest $5,000 to $10,000 annually, and just 7 are prepared to spend over $10,000 annually.

Interestingly, only 3 respondents indicated they are unwilling to spend anything on mitigation, which suggests a widespread acknowledgment of the need for some level of financial commitment to wildfire preparedness. Overall, the data reflects a community that is generally aware of the risks but varies in the financial capacity or willingness to invest heavily in mitigation efforts.

***Figure B-6:*** *Graph of BMFPD community survey results showing residents' willingness to spend on wildfire mitigation.*




*Source: BMFPD community survey*

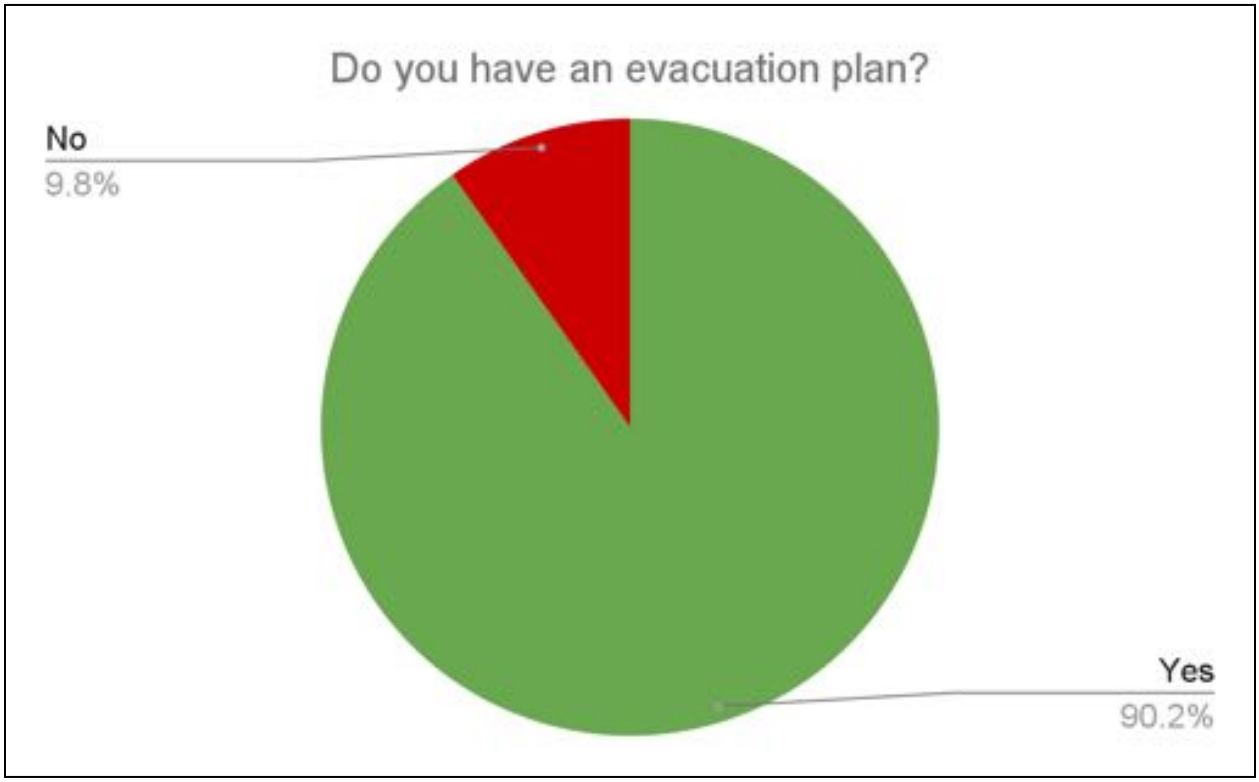
## Evacuation Readiness

The survey data regarding evacuation plans among BMFPD residents shows a strong awareness of the importance of being prepared for a wildfire emergency (**Figure B-7**). A significant majority of 111 respondents have an evacuation plan in place, indicating a high level of preparedness within the community. This suggests that most residents recognize the potential dangers posed by wildfires and have taken proactive steps to ensure their safety in the event of an evacuation.

However, there are still 12 respondents who do not have an evacuation plan. Although this represents a small portion of the population, it highlights a critical area for improvement. Ensuring that all residents are equipped with a clear and effective evacuation plan is essential for community-wide safety during a wildfire incident.

Overall, the data reflects a community that is largely prepared for emergencies but underscores the need for continued outreach and education to ensure that every resident has a well-thought-out evacuation strategy in place.

***Figure B-7:*** *Graph of BMFPD community survey results showing evacuation readiness among residents.*




*Source: BMFPD community survey*

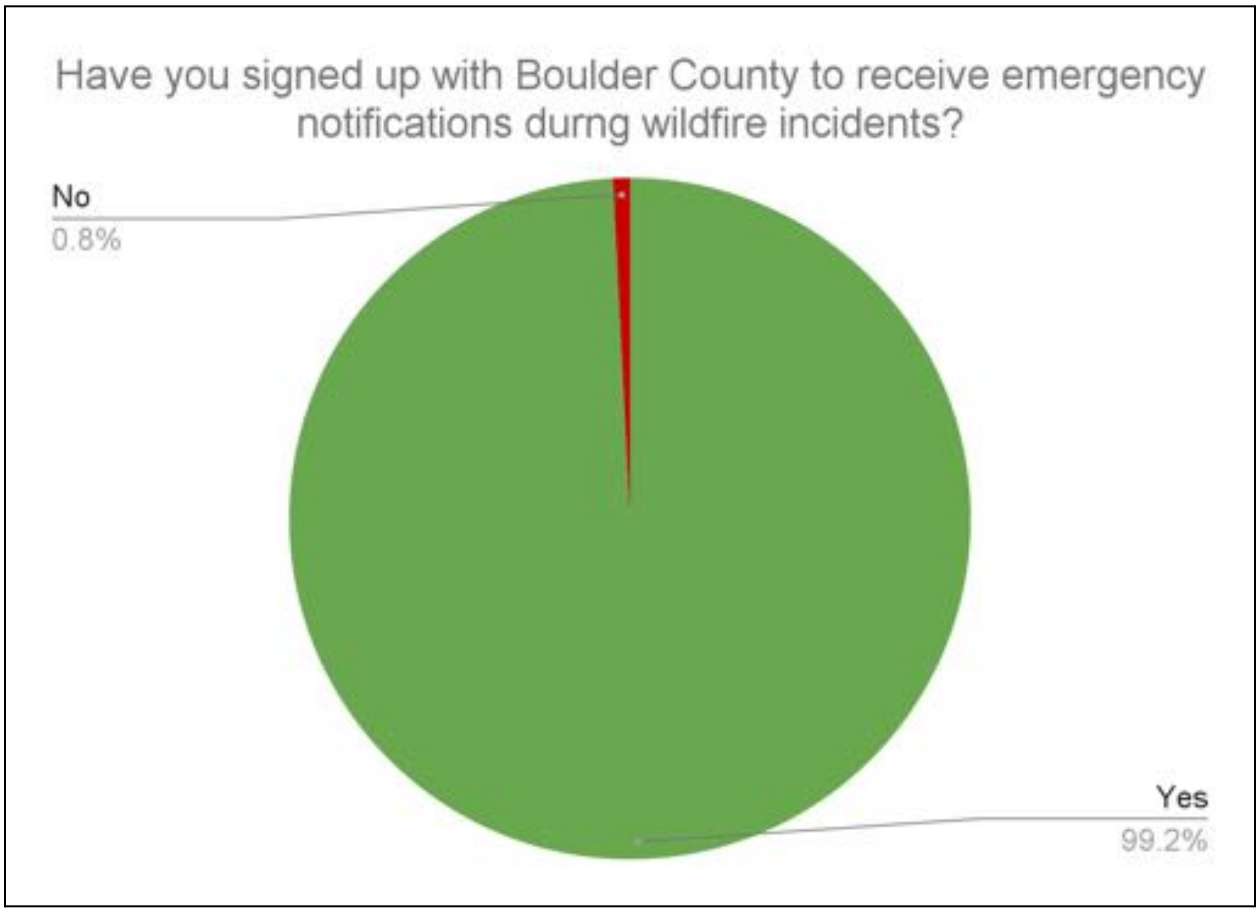
## Emergency Notification

The survey data reveals a strong commitment among BMFPD residents to staying informed during wildfire incidents, with an overwhelming 123 respondents having signed up for emergency notifications through Boulder County (**Figure B-8**). This high level of enrollment underscores the community's recognition of the critical importance of receiving timely information during emergencies, which is essential for making quick and informed decisions.

On the other hand, only 1 respondent has not signed up for these notifications. Although this is an encouragingly small number, it highlights the necessity of ensuring that every resident is connected to this vital communication tool. Even 1 unregistered resident could be at a significant disadvantage in a rapidly evolving wildfire situation.

Overall, the data demonstrates a community that is highly proactive in its approach to wildfire preparedness, particularly in terms of staying informed through emergency notifications. This strong engagement is a positive indicator of the community's readiness to respond effectively in the event of a wildfire.

***Figure B-8:*** *Graph of BMFPD community survey results showing the percentage of residents who are signed up to receive emergency notifications.*




*Source: BMFPD community survey*

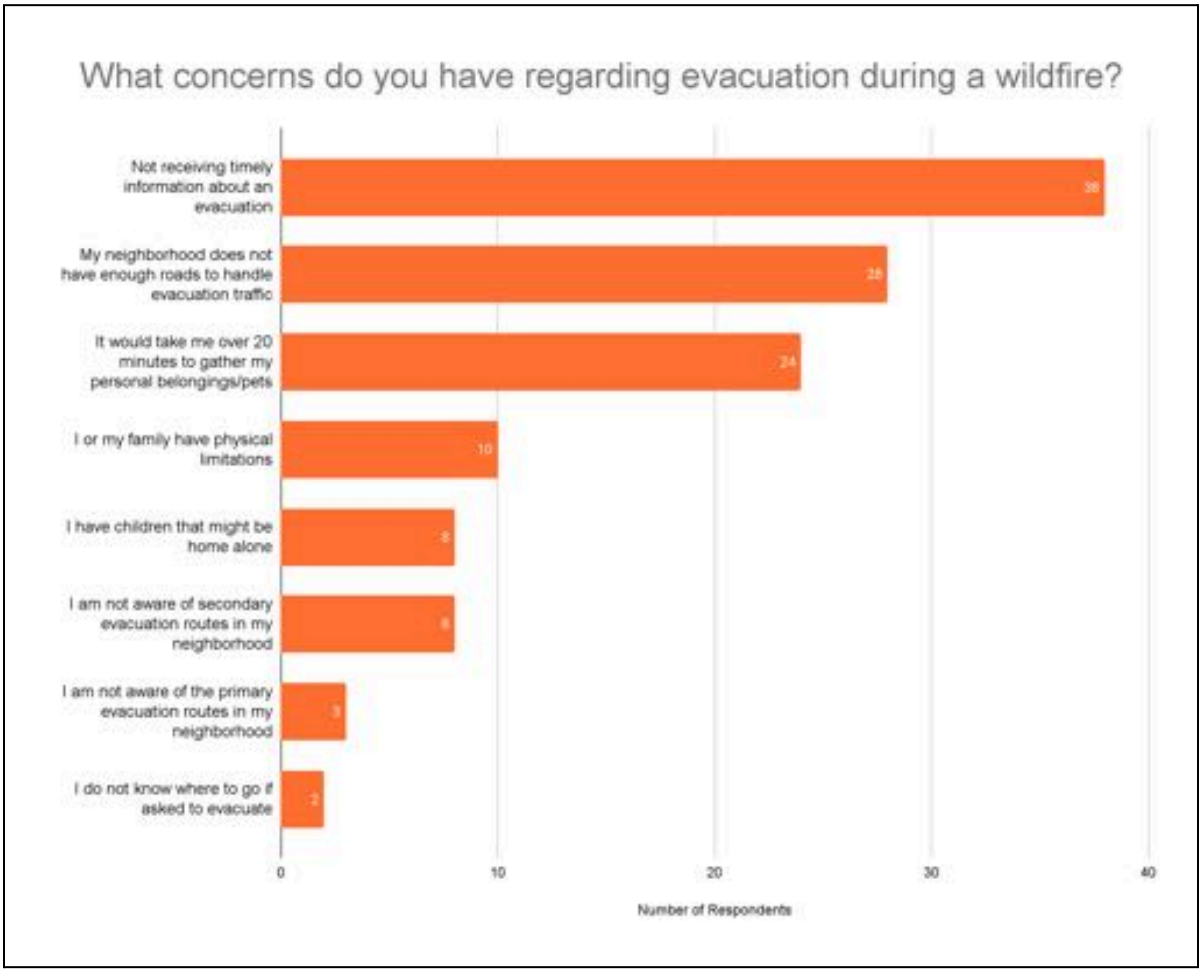
## Evacuation Concerns

The survey data highlights several key concerns among BMFPD residents regarding evacuation during a wildfire (**Figure B-9**). The most significant worry, expressed by 38 respondents, is the fear of not receiving timely information about an evacuation. This underscores the community's reliance on effective communication systems to ensure they are alerted promptly in an emergency.

Another prominent concern is the adequacy of neighborhood roadways, with 28 respondents worried that their area lacks enough roads to handle evacuation traffic. This points to the logistical challenges of safely evacuating residents while ensuring that first responders can access the affected areas. Additionally, 24 residents expressed concerns about needing more than 20 minutes to gather personal belongings and pets, which suggests the need for better preparedness and preplanning for a swift evacuation.

Other concerns include physical limitations, potential child supervision challenges, and a lack of awareness regarding primary and secondary evacuation routes. These responses indicate that while some residents feel prepared, others may benefit from additional education and resources.

***Figure B-9:*** *Graph of BMFPD community survey results showing residents' concerns regarding evacuation during a wildfire event.*



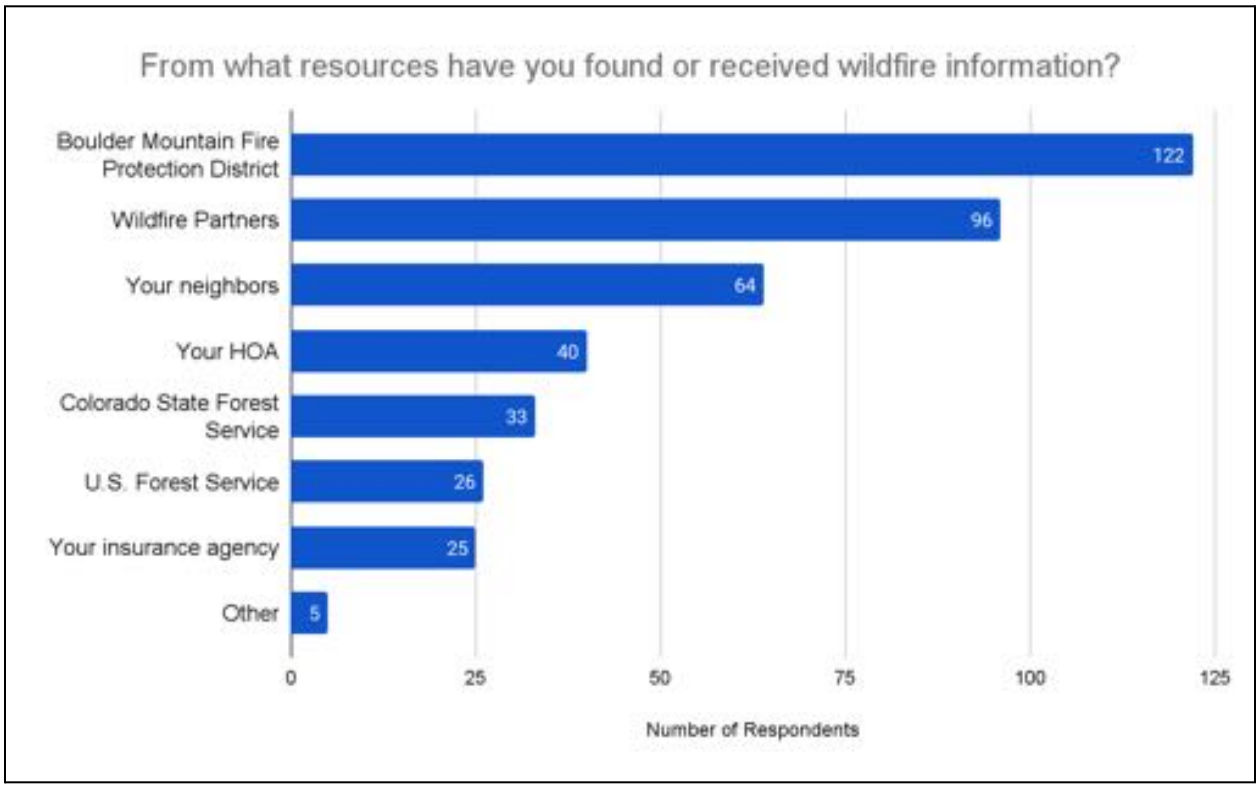

*Source: BMFPD community survey*

## Wildfire Information Resources

The data reveals that BMFPD is the primary source of wildfire information for residents, with 122 respondents indicating they rely on this local authority (**Figure B-10**). This demonstrates the community's trust in BMFPD as a key communicator of vital wildfire preparedness and safety information. Wildfire Partners also plays a significant role, with 96 respondents receiving information from this collaborative mitigation program, highlighting its effectiveness in educating homeowners on wildfire risks and mitigation strategies.

Additionally, informal community networks are important, as 64 respondents cited their neighbors as a source of wildfire information. This suggests that word-of-mouth and community interactions play a valuable role in spreading awareness. HOAs, though less prominent, still contribute to wildfire education for 40 residents, with the Colorado State Forest Service (33 respondents) and U.S. Forest Service (26 respondents) also playing a role. Insurance agencies (25 respondents) are another notable source, offering guidance related to coverage and fire risks, indicating that wildfire preparedness is communicated through a variety of channels.

***Figure B-10:*** *Graph of BMFPD community survey results showing what resources residents found useful for wildfire information.*




*Source: BMFPD community survey*

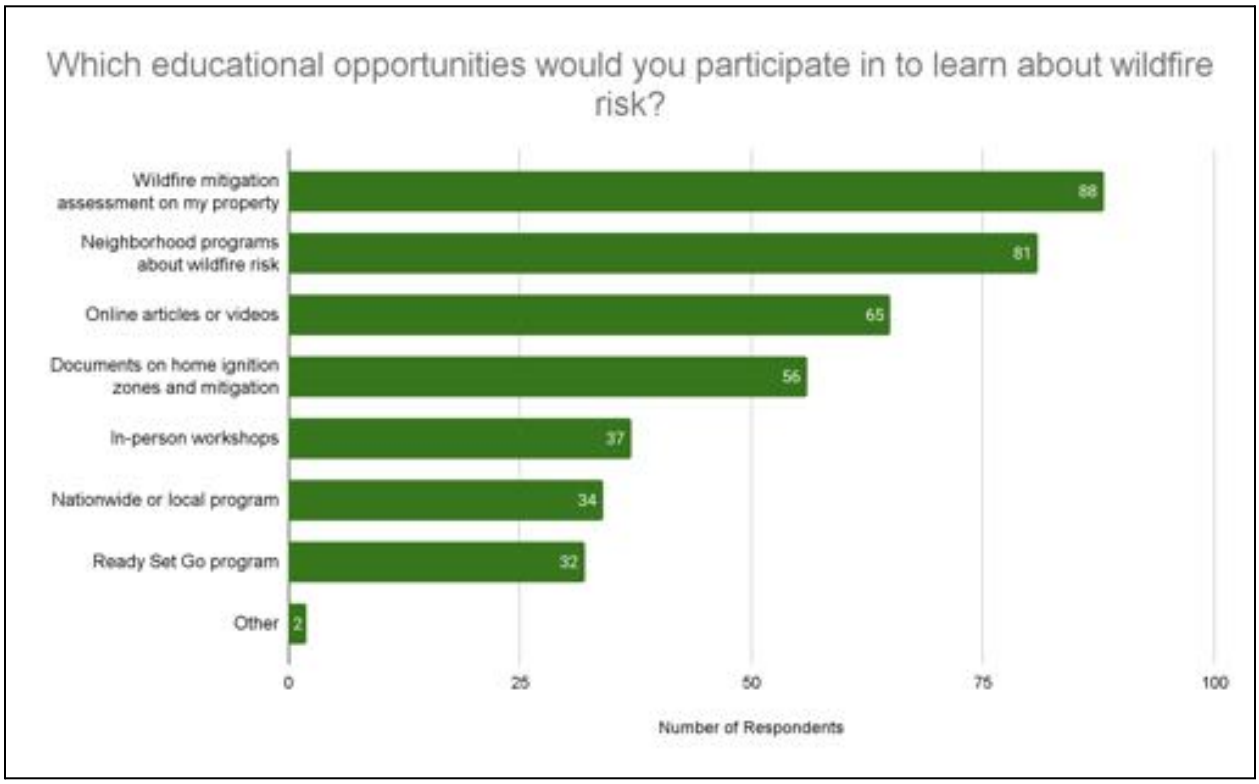
## Educational Opportunities

The survey data indicates that homeowners in BMFPD are most interested in direct, personalized educational opportunities, with 88 respondents expressing a desire to participate in wildfire mitigation assessments on their properties (**Figure B-11**). This preference reflects a need for tailored advice that specifically addresses the unique risks of individual homes and landscapes.

Neighborhood programs about wildfire risk are also popular, with 81 respondents showing interest, emphasizing the community's inclination toward localized, collective learning experiences. Digital resources such as online articles or videos (65 respondents) and documents about home ignition zones and mitigation steps (56 respondents) also represent important learning tools, suggesting that many residents prefer convenient, self-guided education options.

In-person workshops and formal programs, although not as widely sought after, still hold appeal, with 37 and 34 respondents, respectively, interested in these interactive formats. This mix of preferences highlights the importance of offering diverse educational opportunities to engage residents across different formats and learning styles.

***Figure B-11:*** *Graph of BMFPD community survey results showing how residents responded when asked what educational opportunities they would participate in*.




*Source: BMFPD community survey*

# Appendix C

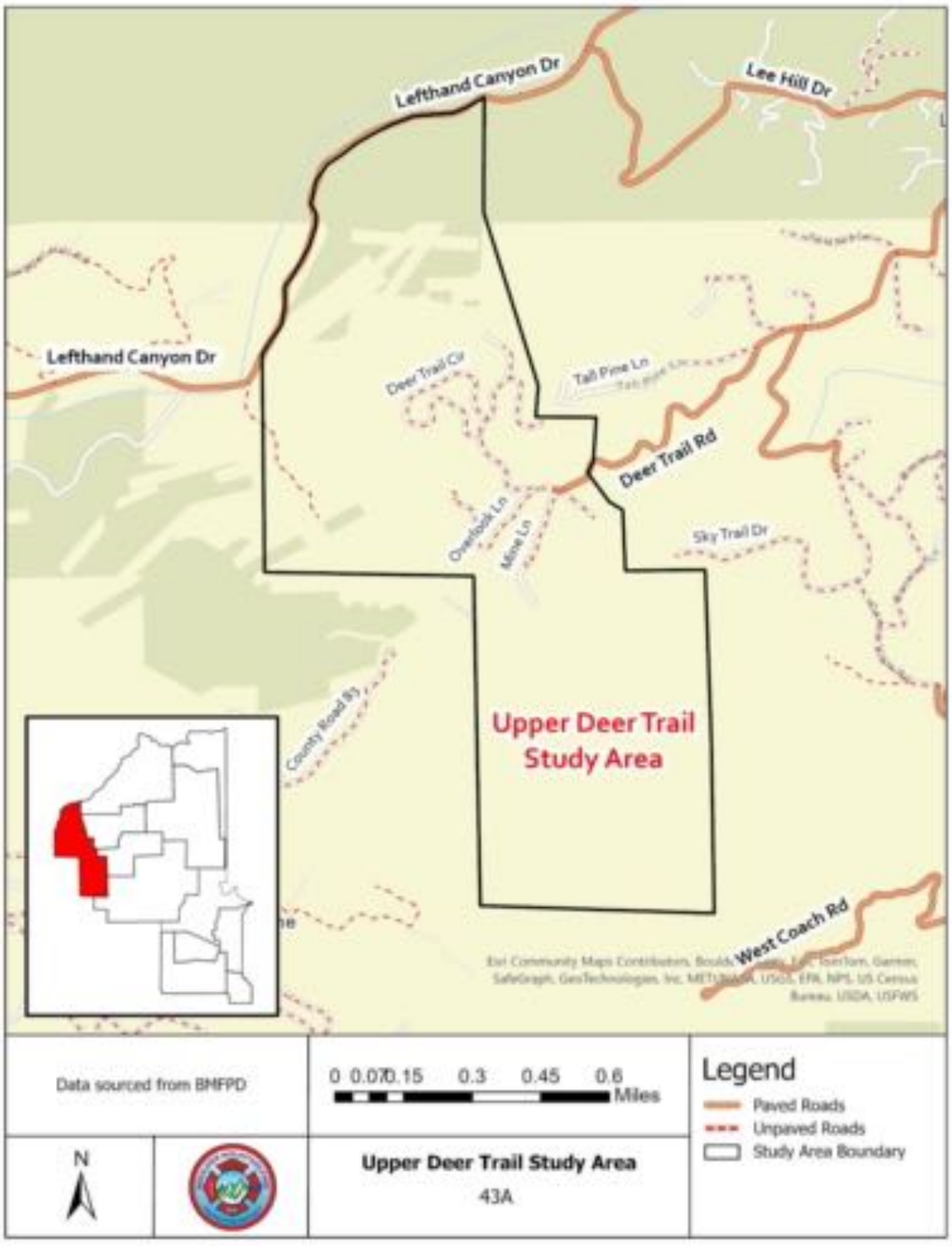
# 12 Study Areas Individual Maps

## 12 Study Areas:

| Study Area | Boulder County All-Hazard Emergency Evacuation Polygon Identifier | Study Area Map |
|---|---|---|
| Upper Deer Trail Study Area | 43A | **Figure C-1** |
| Lower Deer Trail Study Area | 43B | **Figure C-2** |
| Brook Study Area | 43C | **Figure C-3** |
| Peakview Study Area | 43D | **Figure C-4** |
| Valley Study Area | 43E | **Figure C-5** |
| Lee Hill Study Area | 43F | **Figure C-6** |
| Carriage Hills Study Area | 43G | **Figure C-7** |
| Wagonwheel Study Area | 43H | **Figure C-8** |
| Lower Pine Brook Study Area | 43J | **Figure C-9** |
| Upper Pine Brook Study Area | 43K | **Figure C-10** |
| South Cedar Brook Study Area | 43L | **Figure C-11** |
| North Cedar Brook Study Area | 43N | **Figure C-12** |

## Upper Deer Trail Study Area - 43A

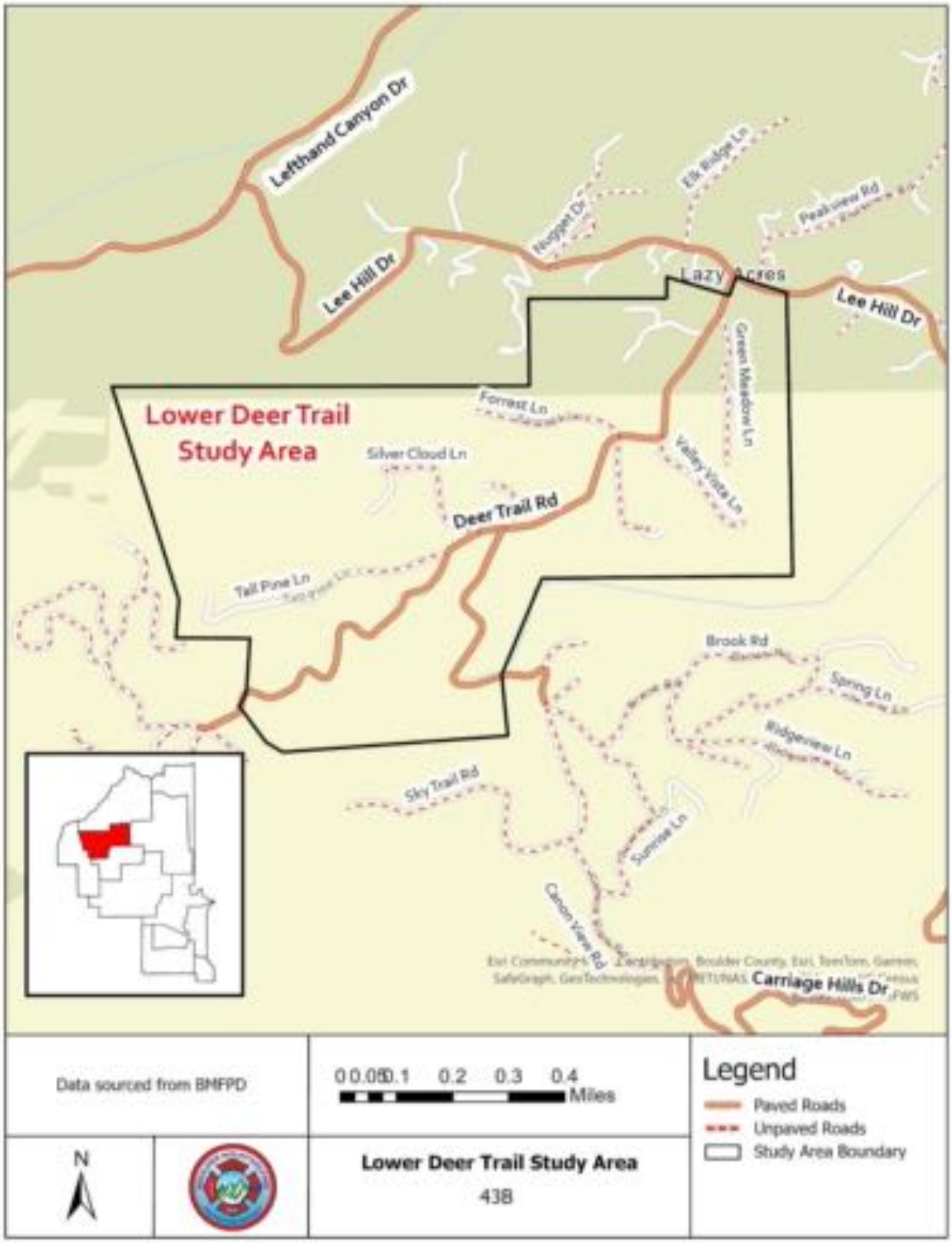
***Figure C-1:*** *BMFPD map of the Upper Deer Trail Study Area.*




*Source: Created by BMFPD using BMFPD data*

## Lower Deer Trail Study Area – 43B

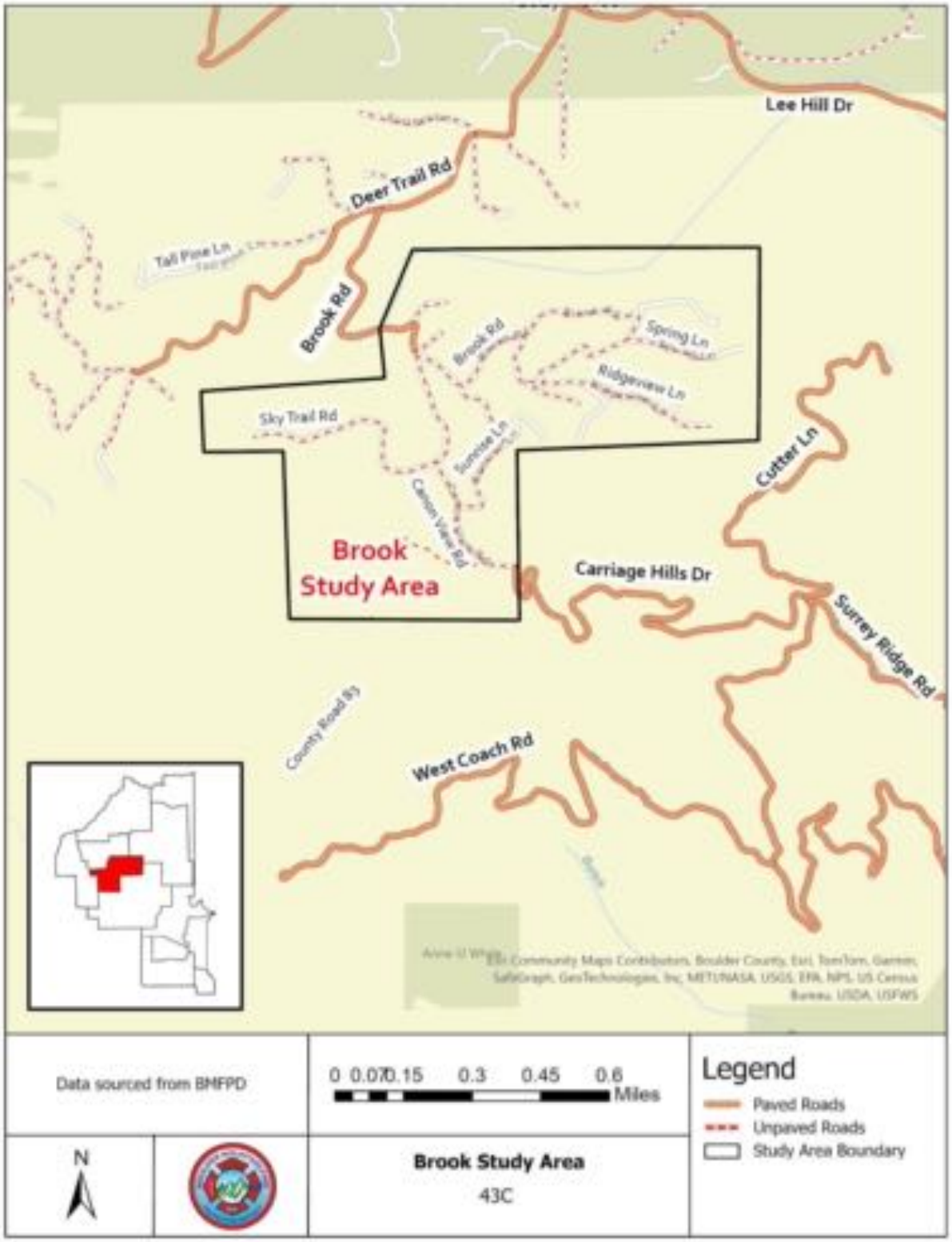
***Figure C-2:*** *BMFPD map of the Lower Deer Trail Study Area.*




*Source: Created by BMFPD using BMFPD data*

## Brook Study Area – 43C

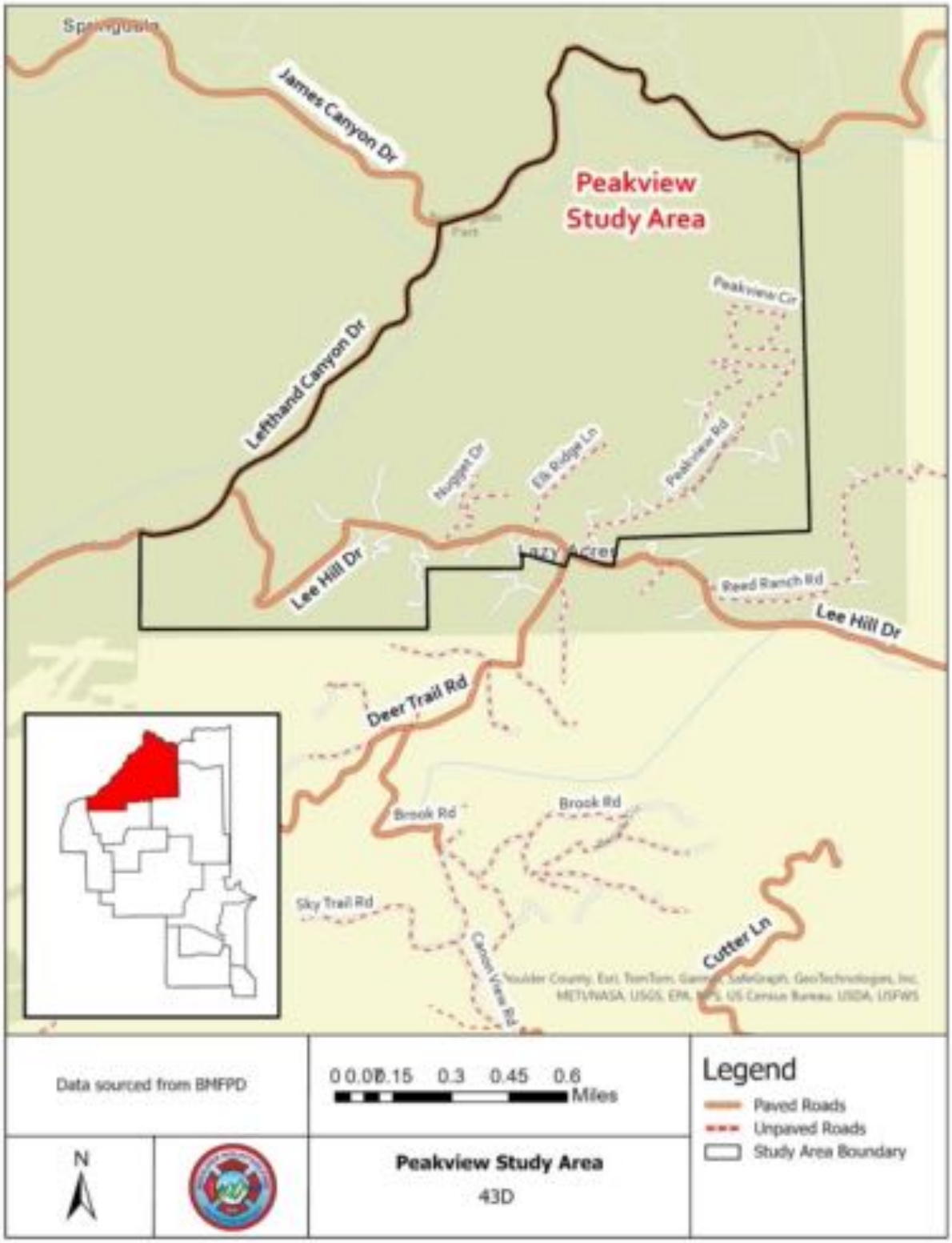
***Figure C-3:*** *BMFPD map of the Brook Study Area.*




*Source: Created by BMFPD using BMFPD data*

## Peakview Study Area – 43D

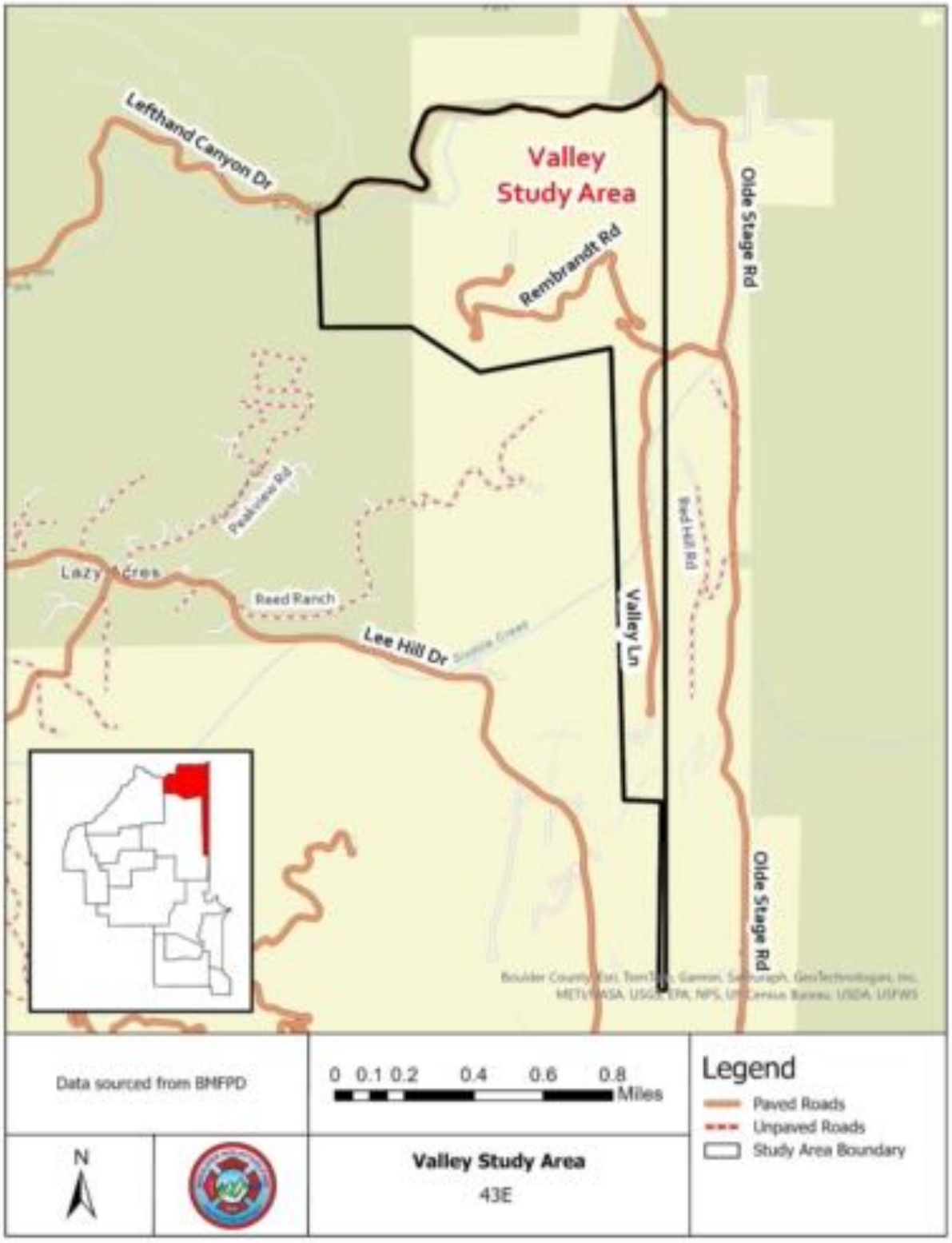
***Figure C-4:*** *BMFPD map of the Peakview Study Area.*




*Source: Created by BMFPD using BMFPD data*

## Valley Study Area – 43E

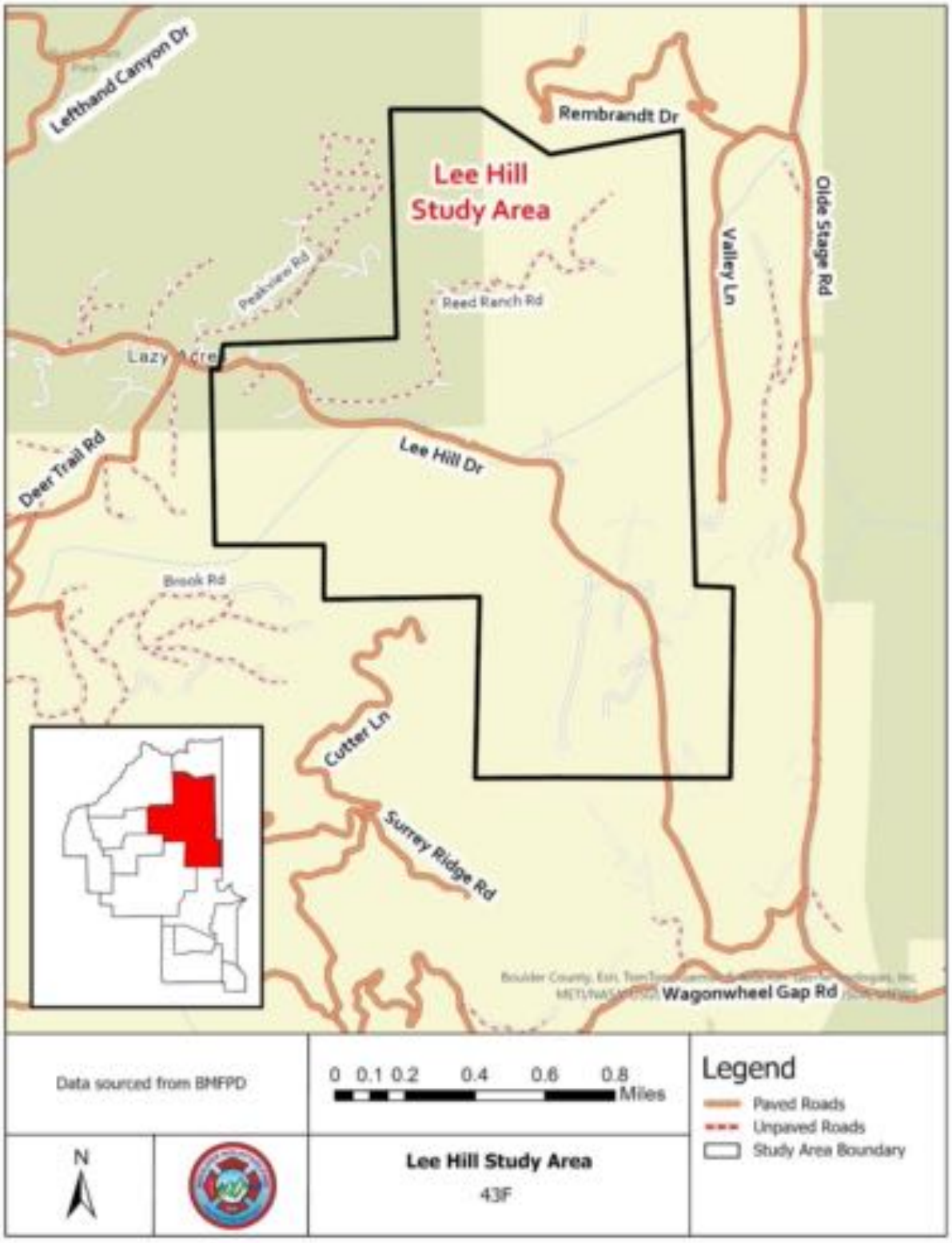
***Figure C-5:*** *BMFPD map of the Valley Study Area.*




*Source: Created by BMFPD using BMFPD data*

## Lee Hill Study Area – 43F

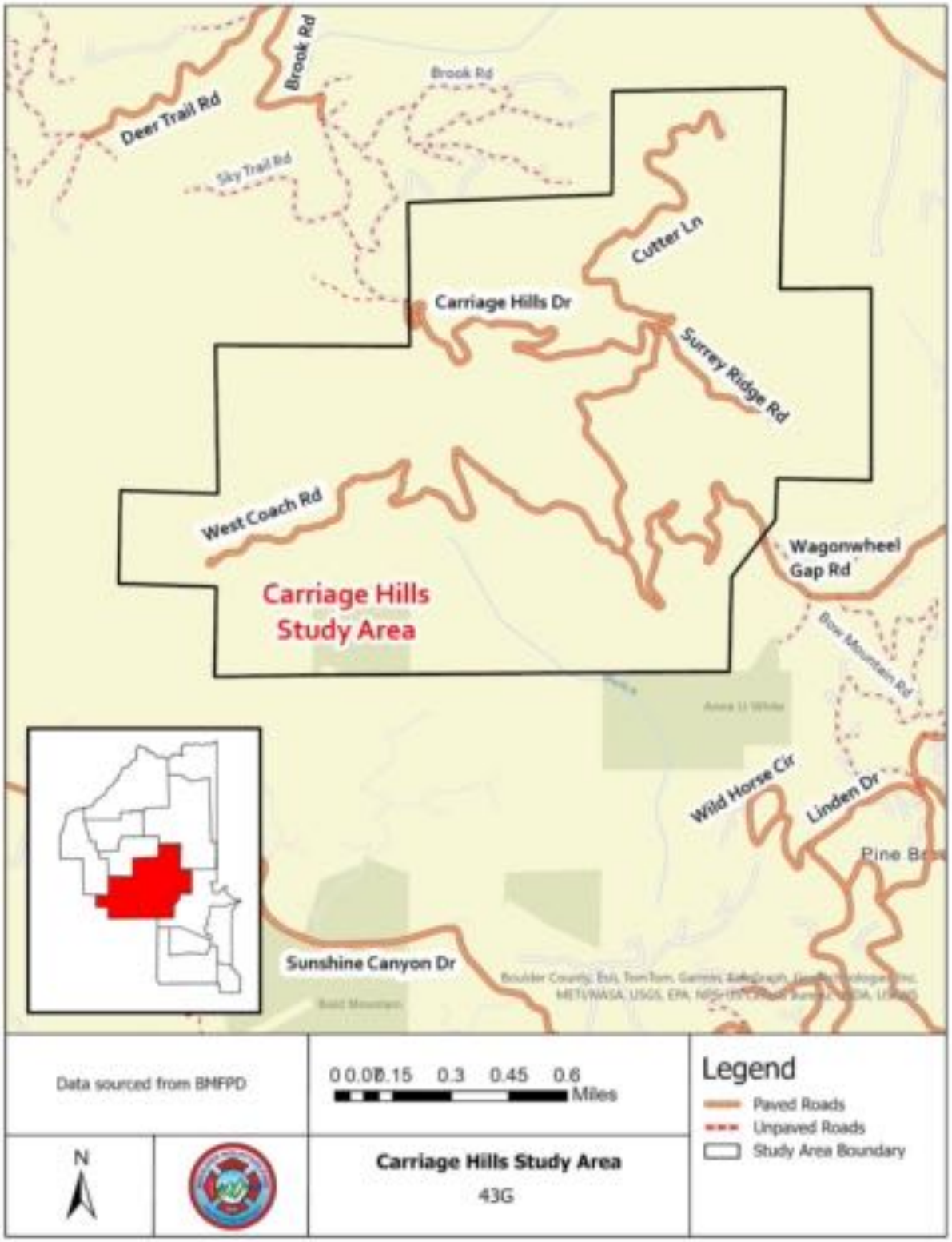
***Figure C-6:*** *BMFPD map of the Lee Hill Study Area.*




*Source: Created by BMFPD using BMFPD data*

## Carriage Hills Study Area – 43G

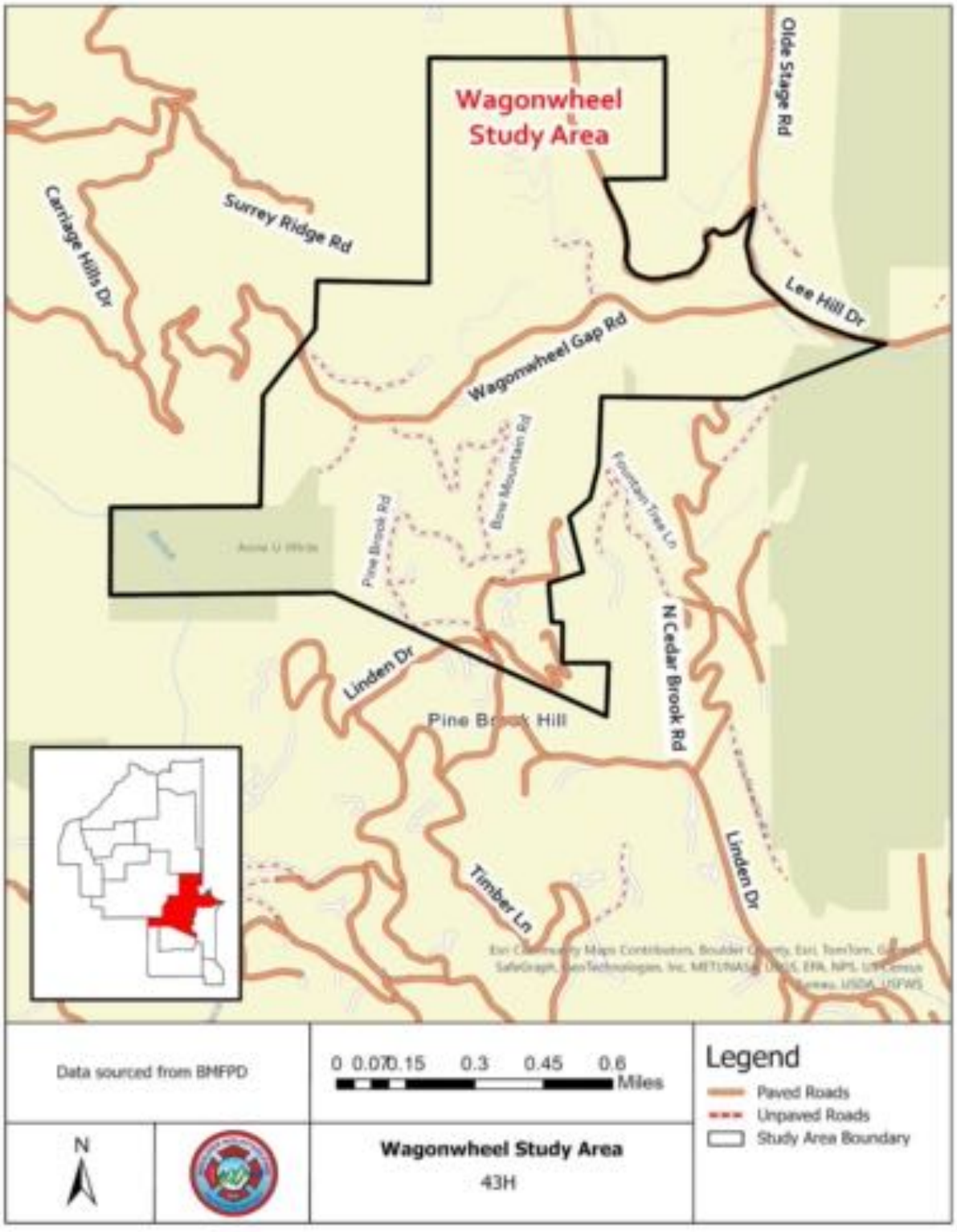
***Figure C-7:*** *BMFPD map of the Carriage Hills Study Area.*




*Source: Created by BMFPD using BMFPD data*

## Wagonwheel Study Area – 43H

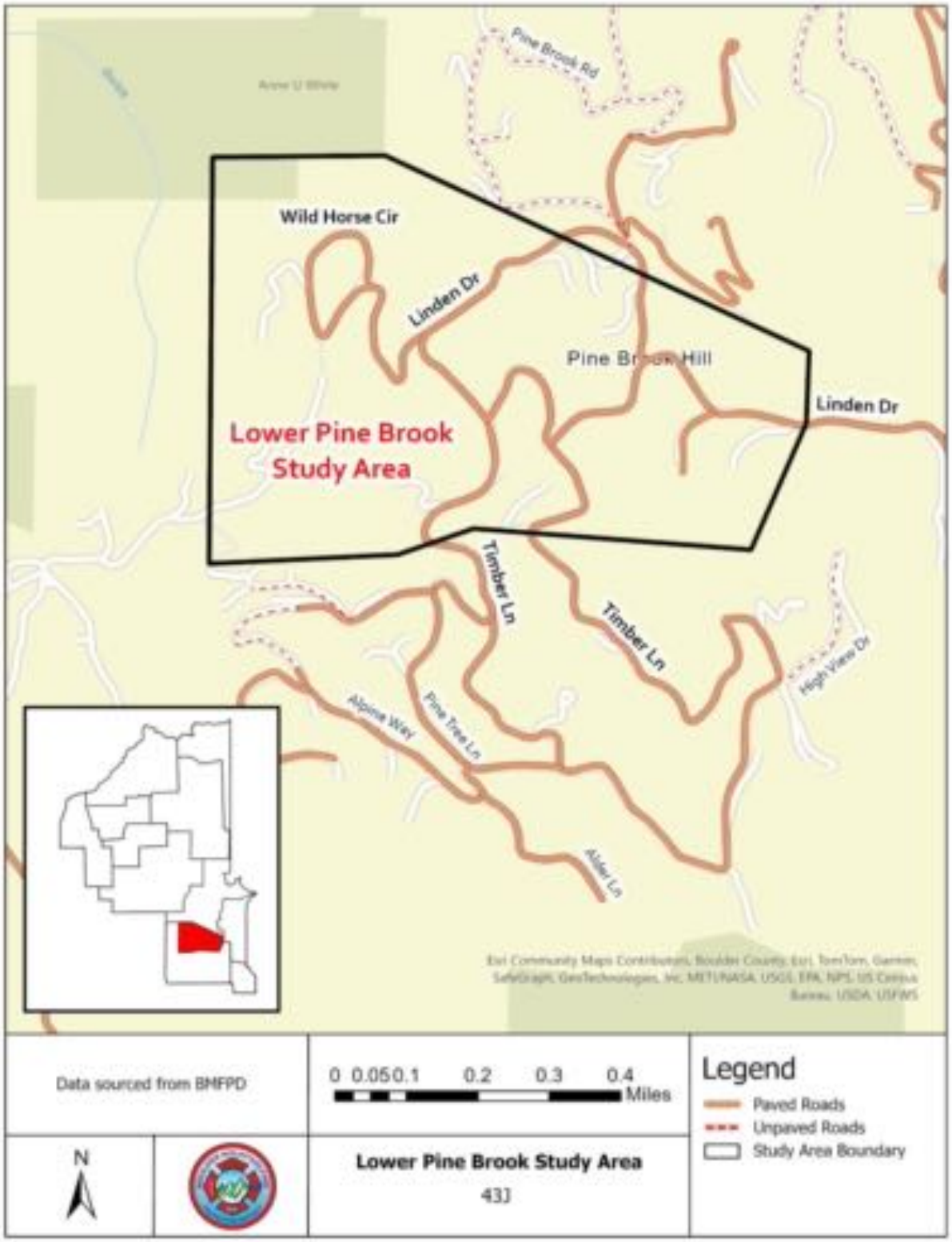
***Figure C-8:*** *BMFPD map of the Wagonwheel Study Area.*




*Source: Created by BMFPD using BMFPD data*

## Lower Pine Brook Study Area – 43J

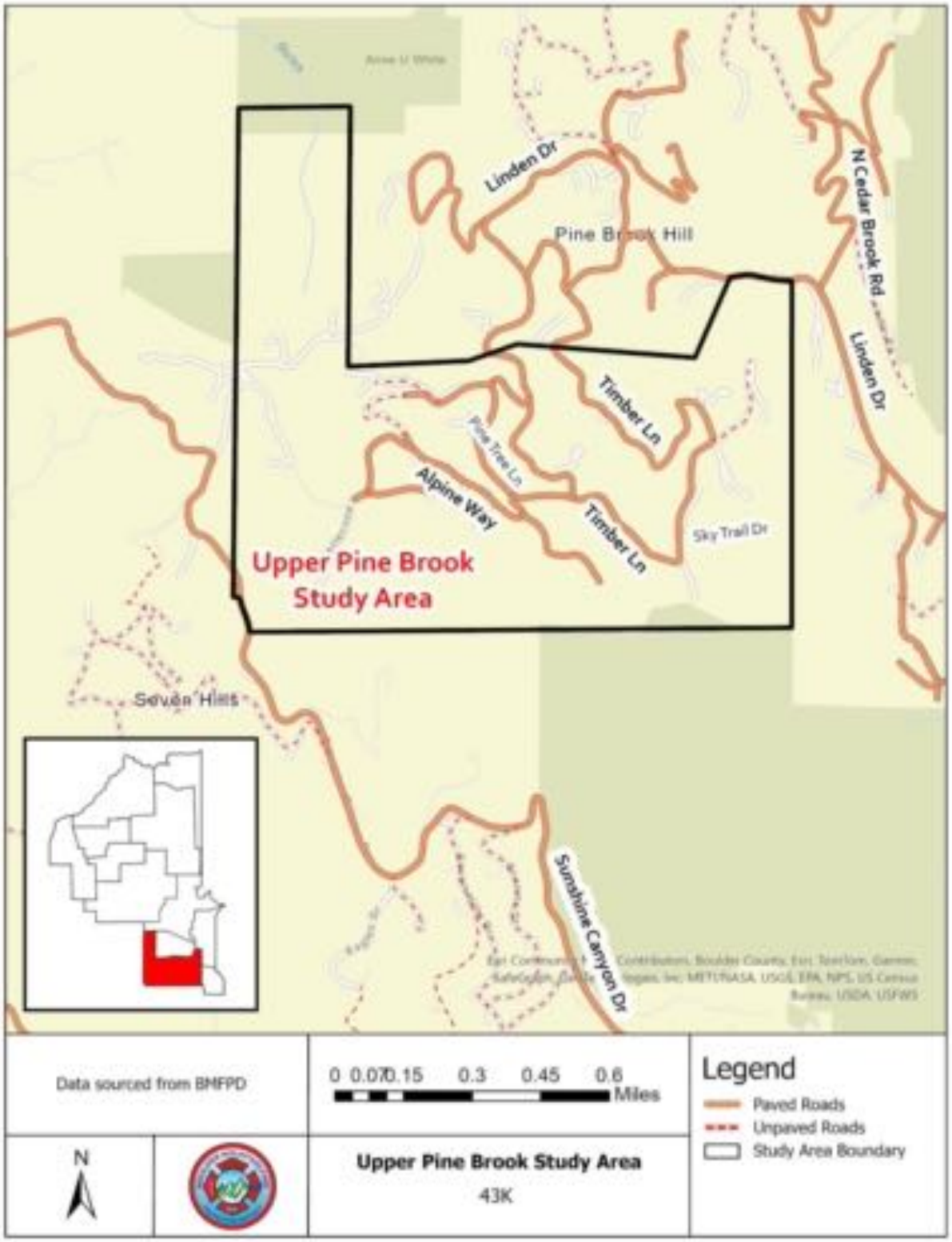
***Figure C-9:*** *BMFPD map of the Lower Pine Brook Study Area.*




*Source: Created by BMFPD using BMFPD data*

## Upper Pine Brook Study Area – 43K

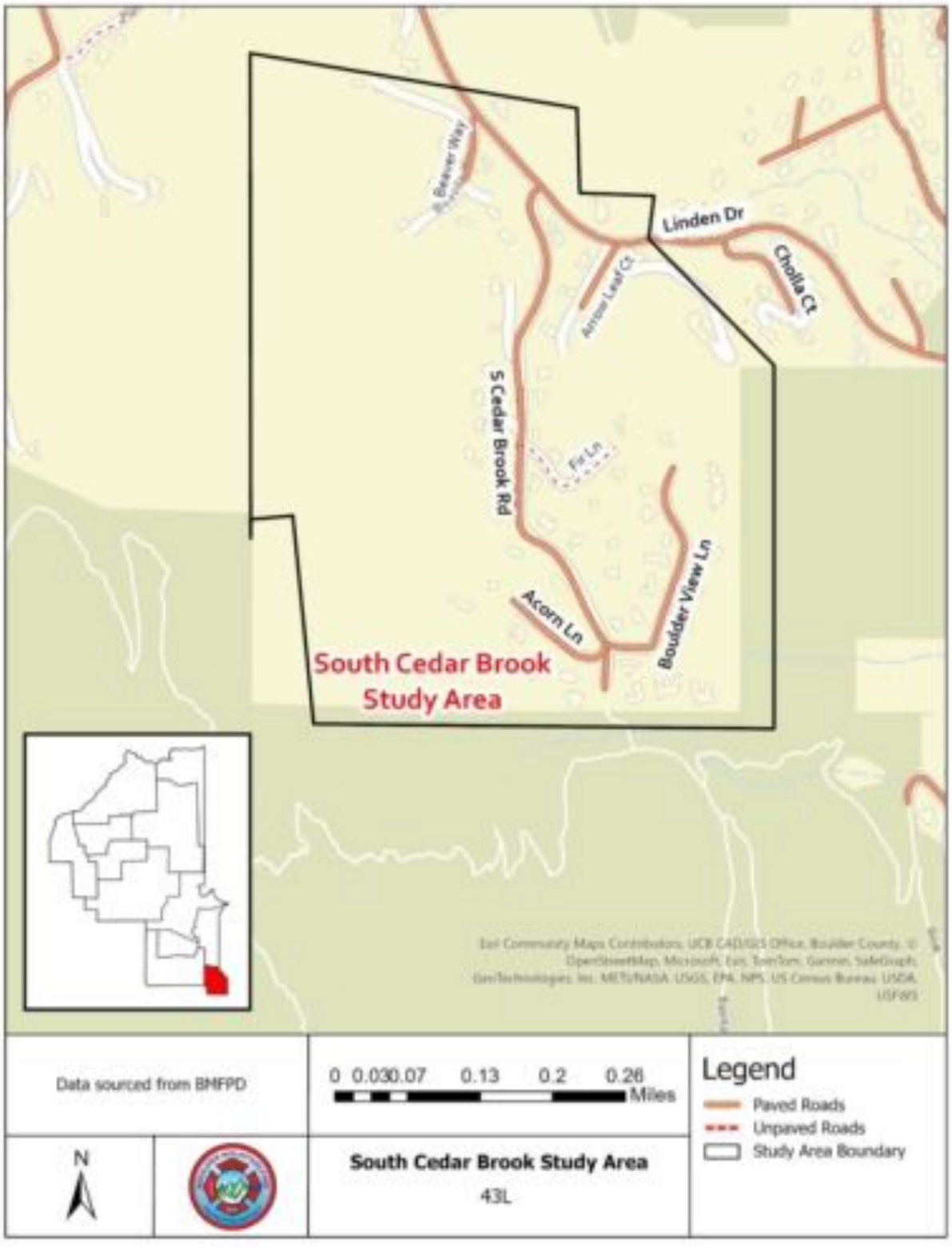
***Figure C-10:*** *BMFPD map of the Upper Pine Brook Study Area.*




*Source: Created by BMFPD using BMFPD data*

## South Cedar Brook Study Area – 43L

***Figure C-11:*** *BMFPD map of the South Cedar Brook Study Area.*




*Source: Created by BMFPD using BMFPD data*

## North Cedar Brook Study Area – 43N

***Figure C-12:*** *BMFPD map of the North Cedar Brook Study Area.*


*Source: Created by BMFPD using BMFPD data*

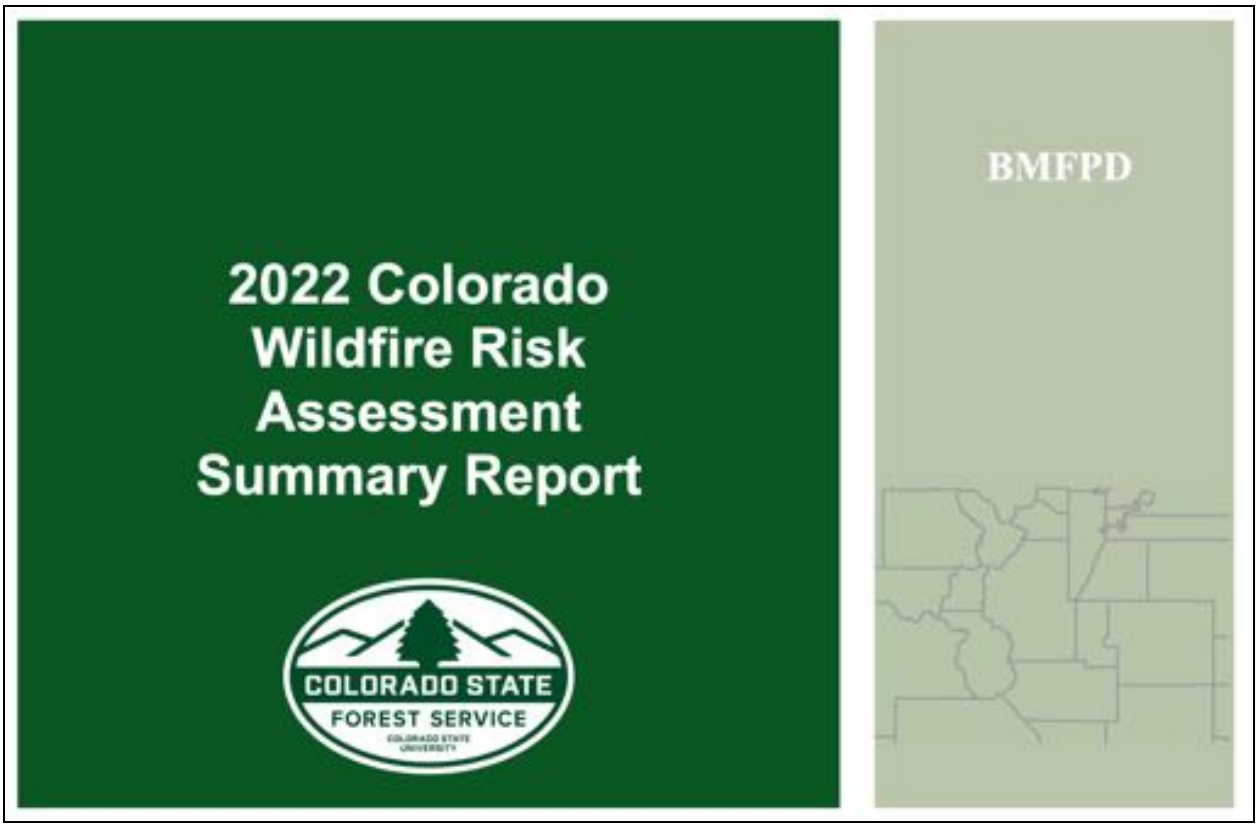
# Appendix D

## BMFPD CO-WRA Report

In the Boulder Mountain Fire Protection District (BMFPD) risk analysis, we utilized data from the Colorado Wildfire Risk Assessment (CO-WRA) to gain insight into the wildfire risk specific to our district and its surrounding areas. The CO-WRA is a statewide geospatial analysis that evaluates wildfire risk based on local fire history, fuels, and landscape conditions. Originally launched in 2013 and updated in 2017, the most recent CO-WRA update, released in July 2023, represents a significant enhancement, integrating advanced modeling techniques, high-resolution LiDAR (laser imaging, detection, and ranging) data, and refined fire behavior outputs to assess wildfire hazard levels and improve risk accuracy.

In particular, the CO-WRA provided valuable datasets such as burn probability, flame length, and surface and crown fuel types for our analysis. These elements are critical to understanding potential fire behavior in specific areas of BMFPD, especially within our identified study zones. Using the CO-WRA's consistent statewide data and methodologies, we were able to create a robust framework for evaluating wildfire risk within our community and identifying areas where risk reduction and mitigation efforts are most needed. See the complete CO-WRA report for BMFPD below (**Figure D-1**). Additionally, resources including the Colorado Forest Atlas and LiveWildfireReady.org were instrumental in contextualizing CO-WRA data, offering interactive tools and guidance that help inform our community's planning and decision-making.

***Figure D-1:*** *Complete CO-WRA report for BMFPD*

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## Disclamer

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User should also note that property boundaries included in any product do not represent an on-the-ground survey suitable for legal, engineering, or surveying purposes. They represent only the approximate relative locations.

# Introduction

## Colorado Wildfire Risk Assessment Report

Welcome to the Colorado Wildfire Risk Assessment Summary Reporting Tool.

This tool allows users of the Risk Reduction Planner application of the Colorado Forest Atlas web portal to define a specific project area and generate information for this area. A detailed risk summary report can be generated using a set of predefined map products developed by the Colorado Wildfire Risk Assessment project which have been summarized explicitly for the user defined project area. The report is generated in PDF format.

The report has been designed so that information from the report can be copied and pasted into other specific plans, reports, or documents depending on user needs. Examples include, but are not limited to, Community Wildfire Protection Plans, Local Fire Plans, Fuels Mitigation Plans, Hazard Mitigation Plans, Homeowner Risk Assessments, and Forest Management or Stewardship Plans. Example templates for some of these reports are available for download on the Colorado Forest Atlas web portal.

The Colorado WRA provides a consistent, comparable set of scientific results to be used as a foundation for wildfire mitigation and prevention planning in Colorado.

Results of the assessment can be used to help prioritize areas in the state where mitigation treatments, community interaction and education, or tactical analyses might be necessary to reduce risk from wildfires.

The Colorado WRA products included in this report are designed to provide the information needed to support the following key priorities:

- Identify areas that are most prone to wildfire
- Plan and prioritize hazardous fuel treatment programs
- Allow agencies to work together to better define priorities and improve emergency response, particularly across jurisdictional boundaries
- Increase communication with local residents and the public to address community priorities and needs

# Products

Each product in this report is accompanied by a general description, table, chart and/or map. A list of available Colorado WRA products in this report is provided in the following table.

| COWRA Product | Description |
|---|---|
| **Wildland Urban Interface** | Housing density depicting where humans and their structures meet or intermix with wildland fuel |
| **Wildland Urban Interface Risk** | A measure of the potential impact on people and their homes from wildfire |
| **Wildfire Risk to Assets** | The overall composite risk occurring from a wildfire derived by combining Burn Probability and Values at Risk Rating |
| **Burn Probability** | Annual probability of any location burning due to wildfire |
| **Terrain Difficulty Index** | Reflects the difficulty to suppress a fire given the terrain and vegetation conditions that may impact ground resource access and capabilities |
| **Characteristic Flame Length** | A measure of the expected flame length of a potential fire |
| **Fire Intensity Scale** | Quantifies the potential fire intensity by orders of magnitude |
| **Fire Type** | Potential for canopy fire type for extreme weather conditions (canopy fire potential) |
| **Rate of Spread** | The speed with which a fire moves in a horizontal direction across the landscape |
| **Surface Fuels** | Characterization of surface fuel models that contain the parameters for calculating fire behavior outputs |
| **Vegetation** | General vegetation and landcover types |
| **Watershed Protection Risk** | A measure of risk to watershed protection areas based on the potential negative impacts from wildfire. |
| **Riparian Assets Risk** | A measure of the risk to riparian areas based on the potential negative impacts from wildfire |
| **Forest Assets Risk** | A measure of the risk to forested areas based on the potential negative impacts from wildfire |

| COWRA Product | Description |
| --- | --- |
| **Building Damage Potential** | Estimates the potential for building loss |
| **Defensible Space Index** | The arithmetic mean of the three defensible space components: canopy, fuels, and slope. The colors shown represent the relative range and are the average for all of the buildings in the hexagon. |

# Wildland Urban Interface

**Reflects housing density depicting where humans and their structures meet or intermix with wildland fuels**

Colorado is one of the fastest growing states in the Nation, with much of this growth occurring outside urban boundaries. This increase in population across the state will impact counties and communities that are located within the Wildland Urban Interface (WUI). The WUI is described as the area where structures and other human improvements meet and intermingle with undeveloped wildland or vegetative fuels. Population growth within the WUI substantially increases the risk from wildfire.

The Wildland Urban Interface (WUI) layer reflects housing density depicting where humans and their structures meet or intermix with wildland fuels. In the past, conventional wildland-urban interface data sets, such as USFS SILVIS, have been used to reflect these concerns. However, USFS SILVIS and other existing data sources did not provide the level of detail needed by the Colorado State Forest Service and local fire protection agencies, particularly reflecting encroachment into urban core areas.

For the **BMFPD** project area, it is estimated that **2,561** people or **100%** percent of the total project area population (2,561) live within the WUI.

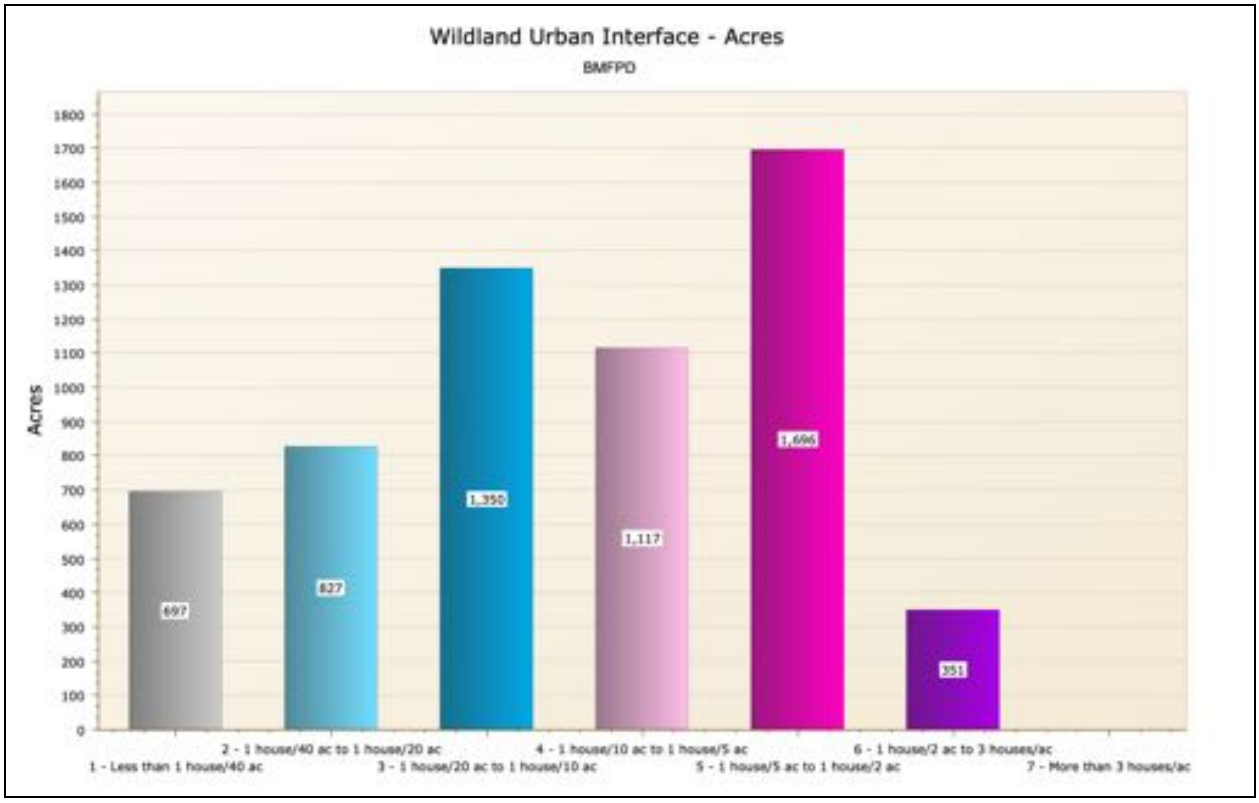
The new WUI data set is derived using advanced modeling techniques based on the Where People Live (housing density) data set and 2021 LandScan USA population count data available from the Department of Homeland Security, HSIP data. WUI is simply a subset of the Where People Live data set. The primary difference is populated areas surrounded by sufficient non-burnable areas (i.e. interior urban areas) are removed from the Where People Live data set, as these areas are not expected to be directly impacted by a wildfire. Fringe urban areas, i.e. those on the edge of urban areas directly adjacent to burnable fuels are included in the WUI. Advanced encroachment algorithms were used to define these fringe areas.

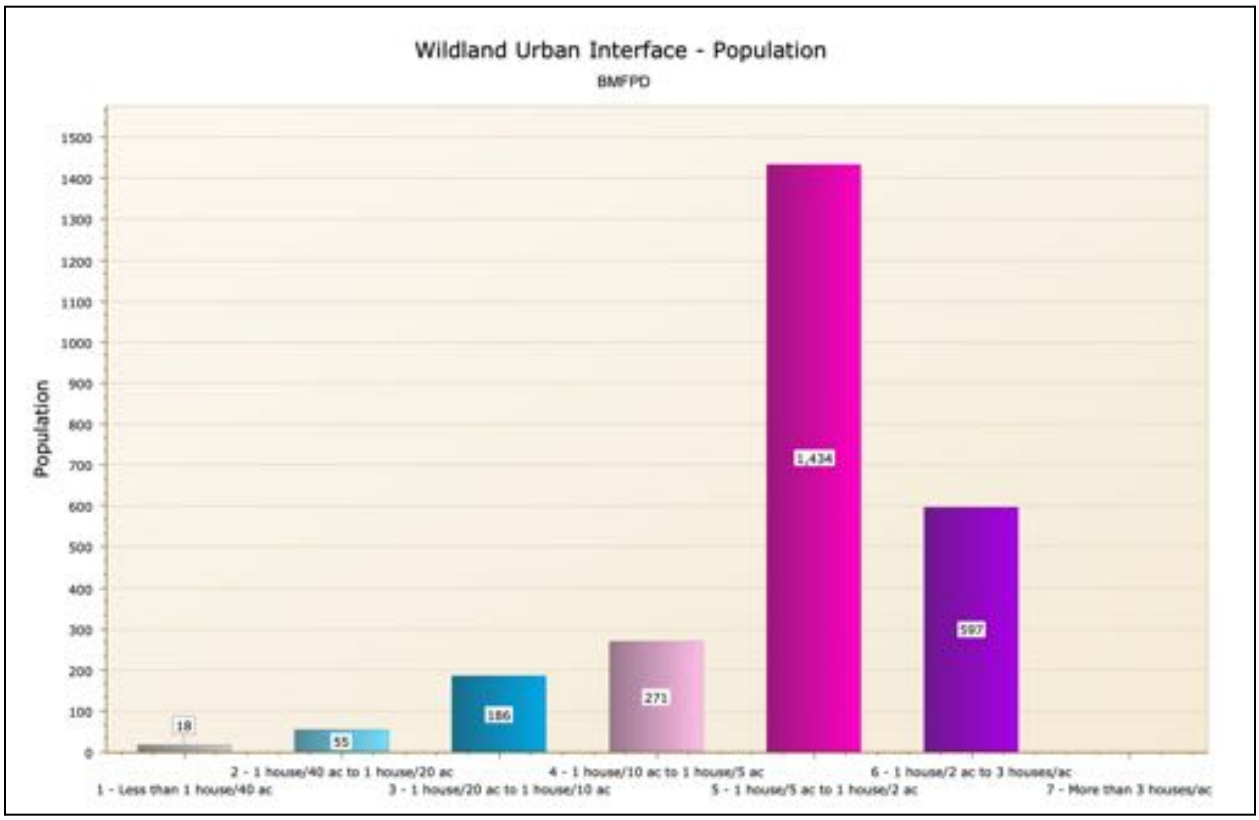
Data is modeled at a 20-meter grid cell resolution, which is consistent with other CO-WRA layers. The WUI classes are based on the number of houses per acre. Class breaks are based on densities well understood and commonly used for fire protection planning.

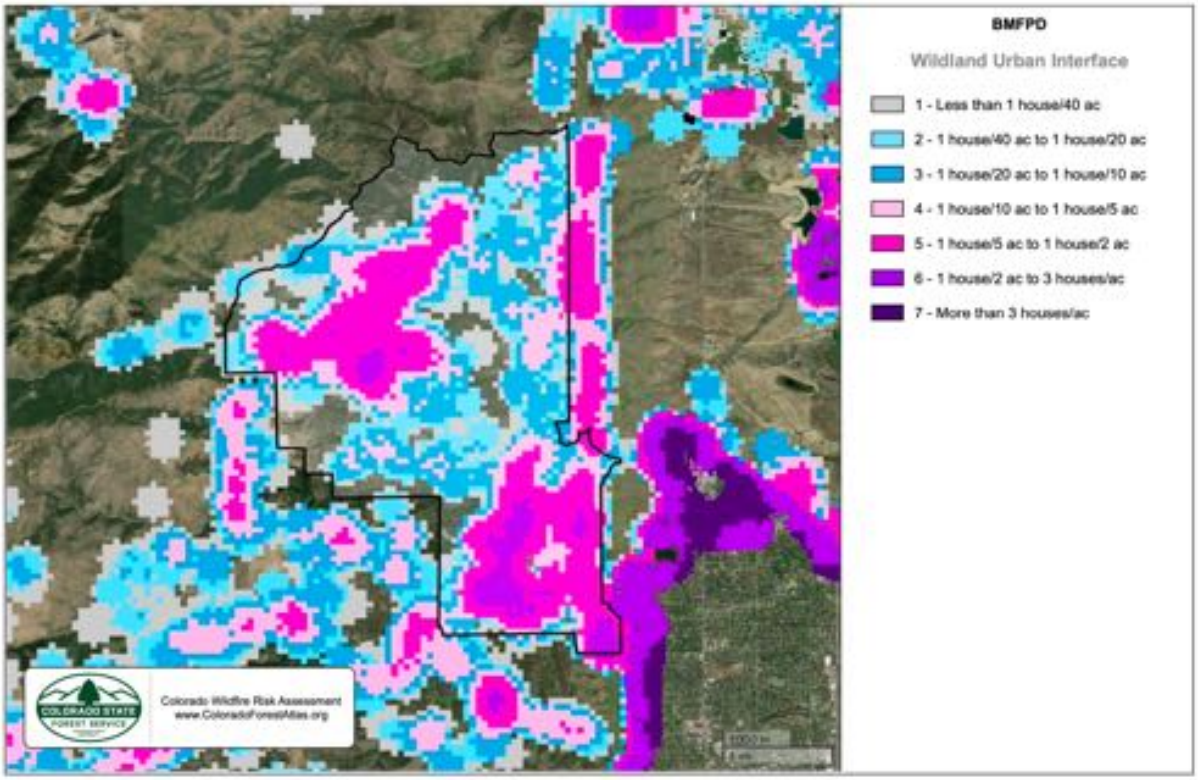
A more detailed description of the risk assessment algorithms is provided in the Colorado Wildfire Risk Assessment (Colorado WRA) Final Report, which can be downloaded from www.ColoradoForestAtlas.com

| Housing Density | WUI Population | Percent of WUI Population |
|---|---|---|
| 1 - Less than 1 house/40 ac | 18 | 0.7% |
| 2 - 1 house/40 ac to 1 house/20 ac | 55 | 2.1% |
| 3 - 1 house/20 ac to 1 house/10 ac | 186 | 7.3% |
| 4 - 1 house/10 ac to 1 house/5 ac | 271 | 10.6% |
| 5 - 1 house/5 ac to 1 house/2 ac | 1,434 | 56% |
| 6 - 1 house/2 ac to 3 houses/ac | 597 | 23.3% |
| 7 - More than 3 houses/ac | 0 | 0% |
| **Total** | **2,561** | **100%** |

| Housing Density | WUI Acres | Percent of WUI Acres |
|---|---|---|
| 1 - Less than 1 house/40 ac | 697 | 11.5% |
| 2 - 1 house/40 ac to 1 house/20 ac | 827 | 13.7% |
| 3 - 1 house/20 ac to 1 house/10 ac | 1,350 | 22.4% |
| 4 - 1 house/10 ac to 1 house/5 ac | 1,117 | 18.5% |
| 5 - 1 house/5 ac to 1 house/2 ac | 1,696 | 28.1% |
| 6 - 1 house/2 ac to 3 houses/ac | 351 | 5.8% |
| 7 - More than 3 houses/ac | 0 | 0% |
| **None** | **6,038** | **100%** |


Wildland Urban Interface - Acres
BMFPD
Acres
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
697
827
1,350
1,117
1,696
351
1 - Less than 1 house/40 ac
2 - 1 house/40 ac to 1 house/20 ac
3 - 1 house/20 ac to 1 house/10 ac
4 - 1 house/10 ac to 1 house/5 ac
5 - 1 house/5 ac to 1 house/2 ac
6 - 1 house/2 ac to 3 houses/ac
7 - More than 3 houses/ac


Wildland Urban Interface - Population
BMFPD
Population
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
18
55
186
271
1,434
597
1 - Less than 1 house/40 ac
2 - 1 house/40 ac to 1 house/20 ac
3 - 1 house/20 ac to 1 house/10 ac
4 - 1 house/10 ac to 1 house/5 ac
5 - 1 house/5 ac to 1 house/2 ac
6 - 1 house/2 ac to 3 houses/ac
7 - More than 3 houses/ac




# Wildland Urban Interface (WUI) Risk

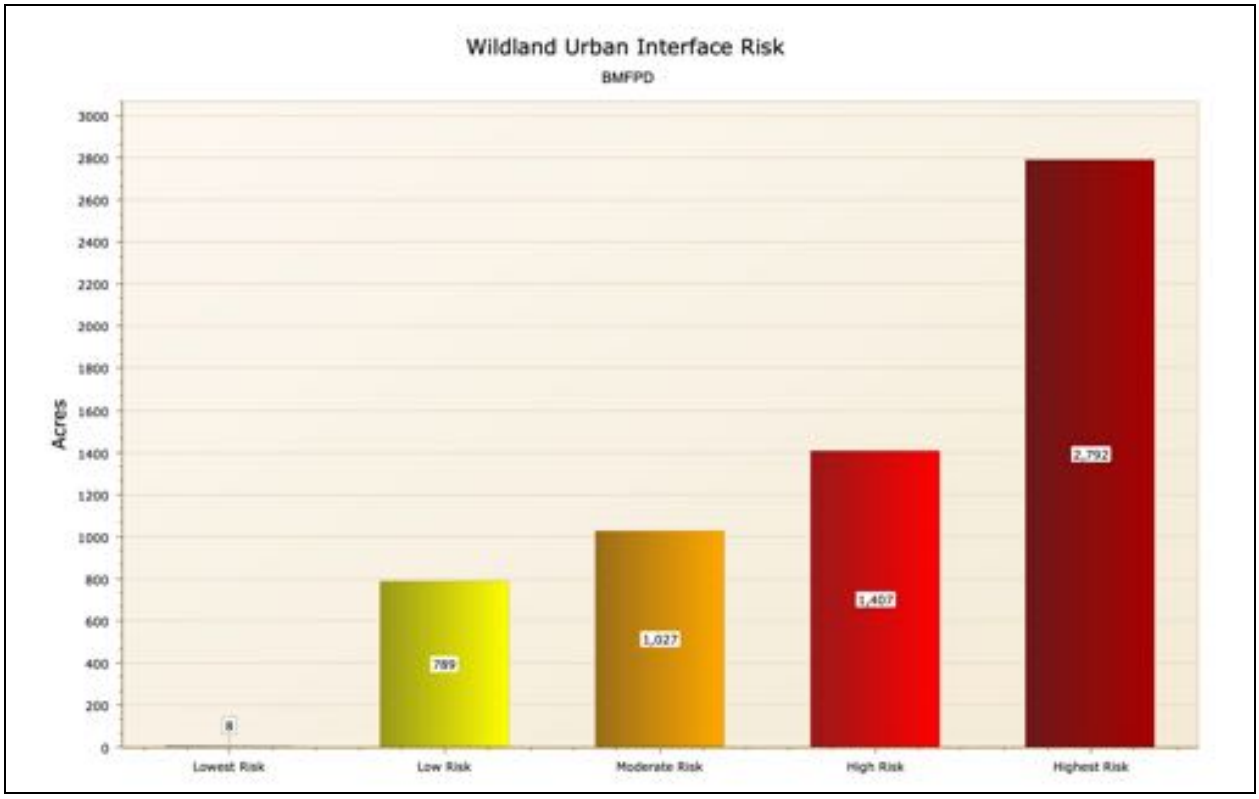
**The Wildland-Urban Interface (WUI) Risk Index layer is a rating of the potential impact of a wildfire on people and their homes.**
The key input, WUI, reflects housing density (houses per acre) consistent with Federal Register National standards. The location of people living in the wildland-urban interface and rural areas is essential for defining potential wildfire impacts to people and homes.

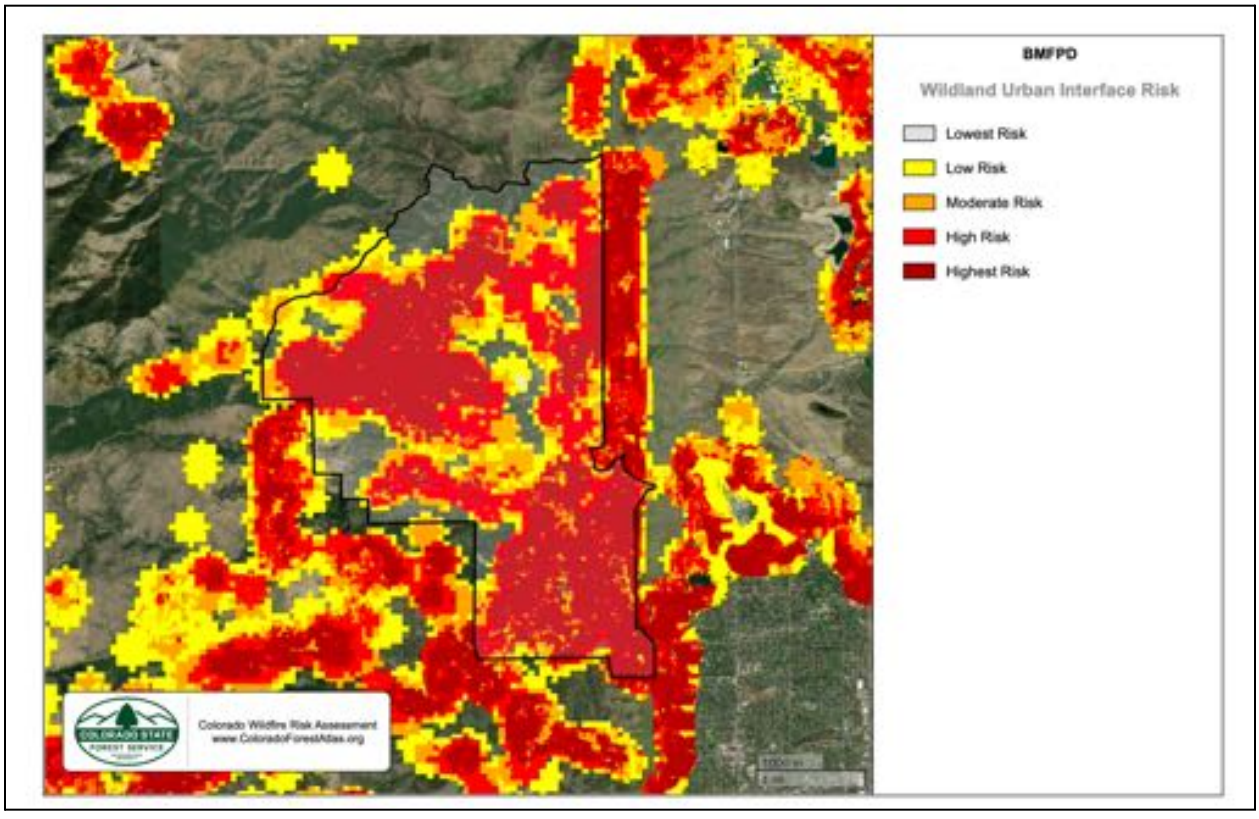
The WUI Risk Index is derived using a response function modeling approach. Response functions are a method of assigning a net change in the value to a resource or asset based on susceptibility to fire at different intensity levels, such as flame length.

To calculate the WUI Risk Index, the WUI housing density data were combined with flame length data and response functions were defined to represent potential impacts. The response functions were defined by a team of experts led by Colorado State Forest Service mitigation planning staff. By combining flame length with the WUI housing density data, it is possible to determine where the greatest potential impact to homes and people is likely to occur. Customized urban encroachment algorithms were used to ensure those fringe urban areas were included in the WUI Risk outputs. Encroachment distances into urban areas were based on the underlying fuel models and their fuel types and propensity for spotting and spreading.

The WUI Risk Index has been calculated consistently for all areas in Colorado, which allows for comparison and ordination of areas across the entire state. Data is modeled at a 20-meter cell resolution, which is consistent with other CO-WRA layers.

| WUI Risk Class | Acres | Percent |
|---|---|---|
| Lowest Risk | 8 | 0.1% |
| Low Risk | 789 | 13.1% |
| Moderate Risk | 1,027 | 17% |
| High Risk | 1,407 | 23.4% |
| Highest Risk | 2,792 | 46.3% |
| Total | 6,023 | 100% |


Wildland Urban Interface Risk
BMFPD
Acres
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
8
789
1,027
1,407
2,792
Lowest Risk
Low Risk
Moderate Risk
High Risk
Highest Risk


BMFPD
Wildland Urban Interface Risk
Lowest Risk
Low Risk
Moderate Risk
High Risk
Highest Risk
Colorado Wildfire Risk Assessment
www.ColoradoForestAtlas.org

# Firewise USA Recognized Sites

## Description

Firewise USA® is a national recognition program that provides resources to inform communities how to adapt to living with wildfire and encourages neighbors to take action together to reduce their wildfire risk. Colorado communities that take the following five steps can be recognized as Firewise:

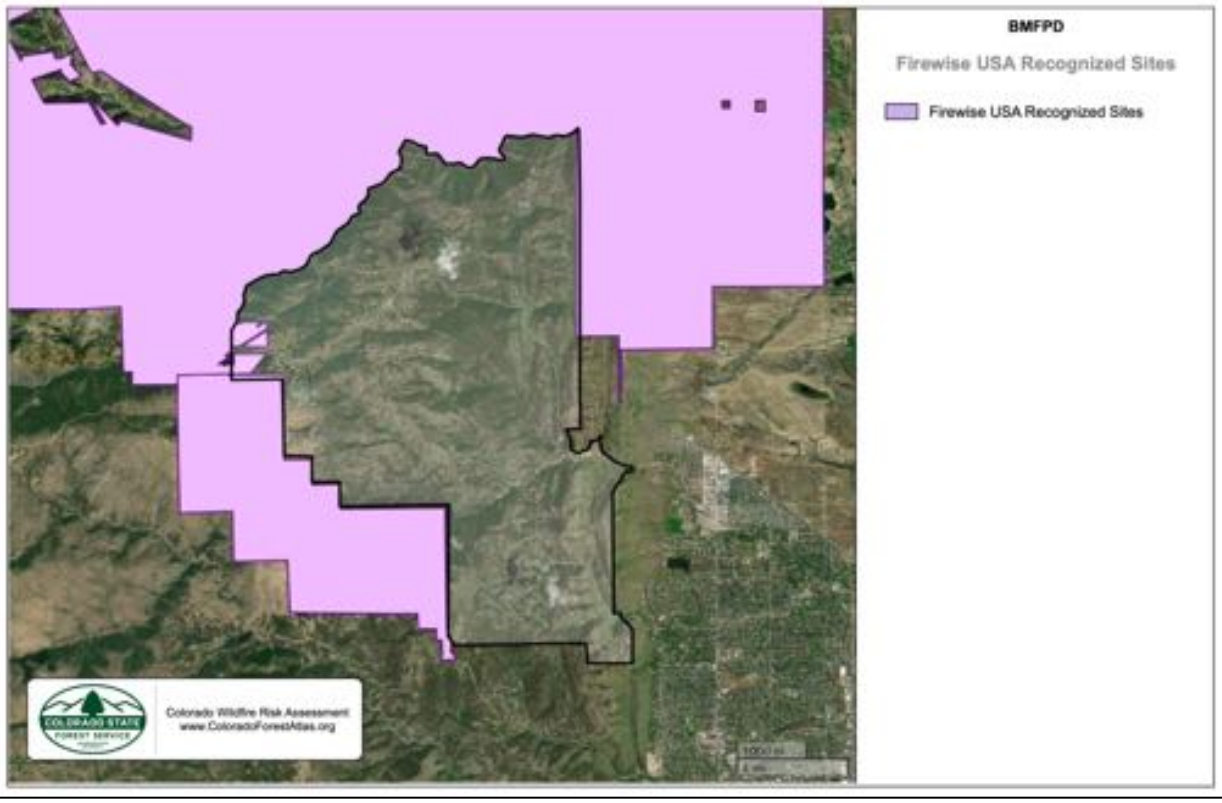
1. Form a Firewise board or committe
2. Obtain a wildfire risk assessment from the CSFS or local fire department, and create an action plan
3. Hold a Firewise event once per year
4. Invest a minimum of $24.14 per dwelling unit in local Firewise actions annually
5. Create a National Fire Prevention Association (NFPA) profile and follow the application directions located at https://portal.firewise.org/user/login

The Firewise USA® dataset defines the boundaries of the recognized communities. Mapping Firewise USA® boundaries will generally be completed by CSFS staff.

FIREWISE USA®
Residents reducing wildfire risks

Note: These are estimated boundaries using a variety of methods with varying degrees of accuracy. These are not legal boundaries and should not be construed as such. The boundaries may overlap with CWPP areas and are subject to change over time as the communities develop, change, and continue to implement wildfire mitigation efforts. To learn more about the Firewise USA® recognition program or to fill out an application, visit https://www.nfpa.org/Public-Education/By-topic/Wildfire/Firewise-USA - OR https://csfs.colostate.edu/wildfire-mitigation/colorado-firewise-communities/

| Name | County | Acres Inside Project Area | Total Acres |
|---|---|---|---|
| Sunshine Fire Protection District | BOULDER | 20 | 2,060 |
| Left Hand Canyon | BOULDER | 116 | 38,149 |
| **Total** | | **135** | **40,209** |



# Community Wildfire Protection Plans (CWPPs)

## Description

A Community Wildfire Protection Plan (CWPP) is a document developed and agreed upon by a community to identify how the community will reduce its wildfire risk. CWPPs identify areas where fuels reduction is needed to reduce wildfire threats to communities and critical infrastructure, address protection of homes and other structures, and plan for wildfire response capability. The Colorado State Forest Service (CSFS) supports the development and implementation of CWPPs and provides resources, educational materials and information to those interested in developing CWPPs.

The CWPP dataset represents the boundaries of those areas that have developed a CWPP. Note that CWPPs can be developed by different groups at varying scales, such as county, Fire Protection District (FPD), community/subdivision, HOA, etc., and as such, can overlap. In addition, the CWPPs can be from different dates. Often a county CWPP is completed first with subsequently more detailed CWPPs done for local communities within that county or FPD. CO-WRAP provides a tool that allows the user to select the CWPP area and retrieve the CWPP document for review (PDF).

At a minimum, a CWPP should include:

- The wildland-urban interface (WUI) boundary, defined on a map, where people, structures and other community values are most likely to be negatively impacted by wildfire
- The CSFS, local fire authority and local government involvement and any additional stakeholders
- A narrative that identifies the community's values and fuel hazards
- The community's plan for when a wildfire occurs
- An implementation plan that identifies areas of high priority for fuels treatments

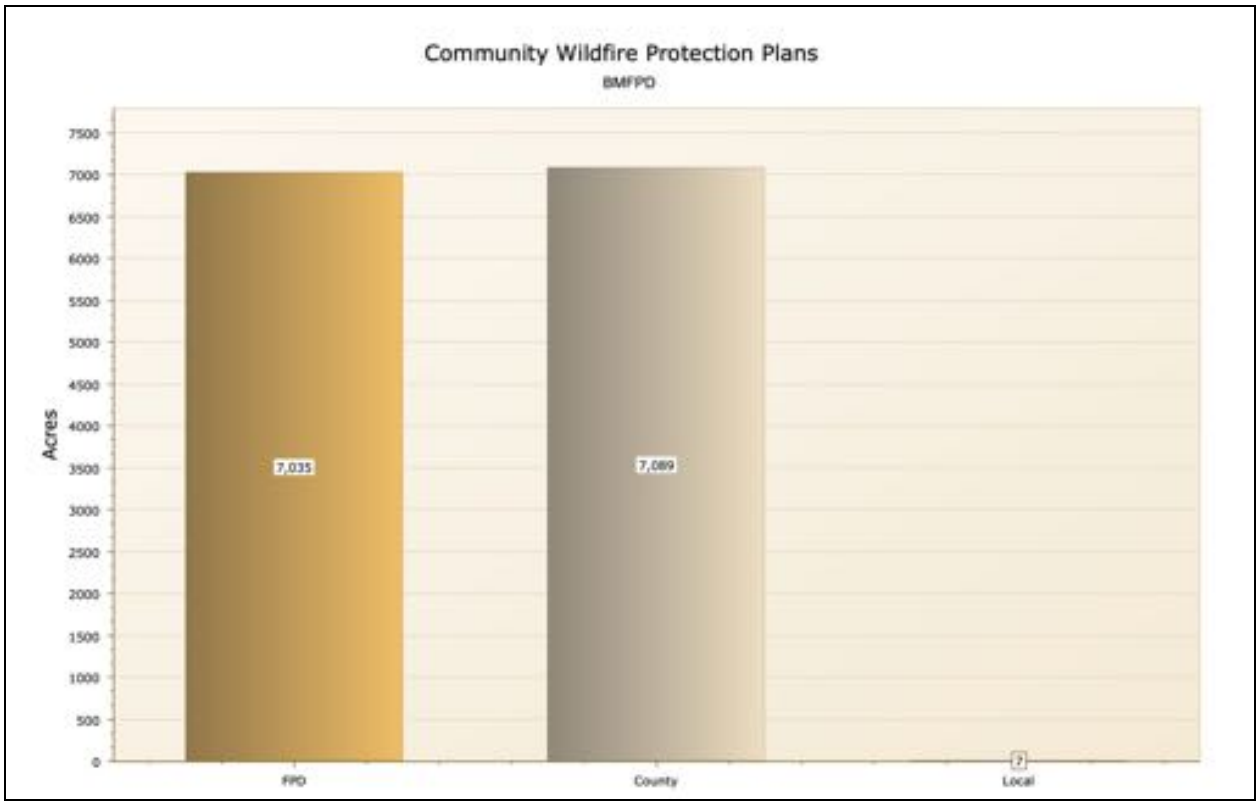
CWPPs are not shelf documents and should be reviewed, tracked and updated. A plan stays alive when it is periodically updated to address the accomplishments of the community. Community review of progress in meeting plan objectives and determining areas of new concern where actions must be taken to reduce wildfire risk helps the community stay current with changing environment and wildfire mitigation priorities.

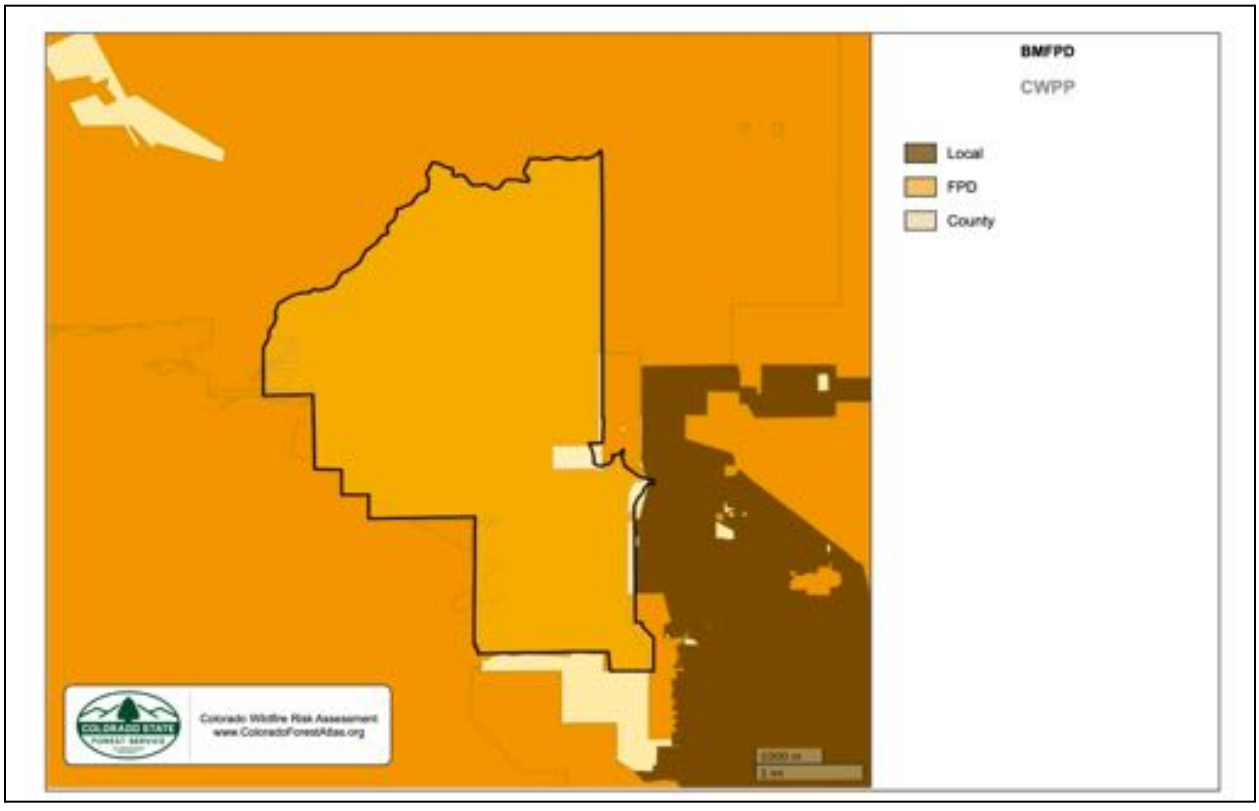
**Community input is the foundation of a Community Wildfire Protection Plan that identifies community needs and garners community support.**

If your community is in an area at risk from wildfire, now is a good time to start working with neighbors on a CWPP and preparing forfuture wildfires. Contact your local CSFS district to learn how to start this process and create a CWPP for your community: http://csfs.colostate.edu/pages/your-local-forester.html

For the **BMFPD** test project area, there are 7 CWPPs areas that are totally or partially in the defined project area.

| CWPP Name | CWPP Type | CSFS District | Acres inside project area | Total Acres |
|---|---|---|---|---|
| Boulder Mountain FPD | FPD | Boulder | 6,786 | 6,875 |
| Boulder Rural FPD | FPD | Boulder | 42 | 16,063 |
| Lefthand FPD | FPD | Boulder | 115 | 38,150 |
| Sunshine FPD | FPD | Boulder | 25 | 2,065 |
| Boulder West Wildfire Authority | FPD | Boulder | 66 | 28,765 |
| Boulder County | County | Boulder | 7,089 | 473,518 |
| City of Boulder | Local | Boulder | 7 | 16,239 |
| **Total Acres** | | | **14,131** | **581,675** |


Community Wildfire Protection Plans
BMFPD
Acres
7500
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
7,035
7,089
7
FPD
County
Local


BMFPD
CWPP
Local
FPD
County
Colorado Wildfire Risk Assessment
www.ColoradoForestAtlas.org

# Wildfire Risk to Assets

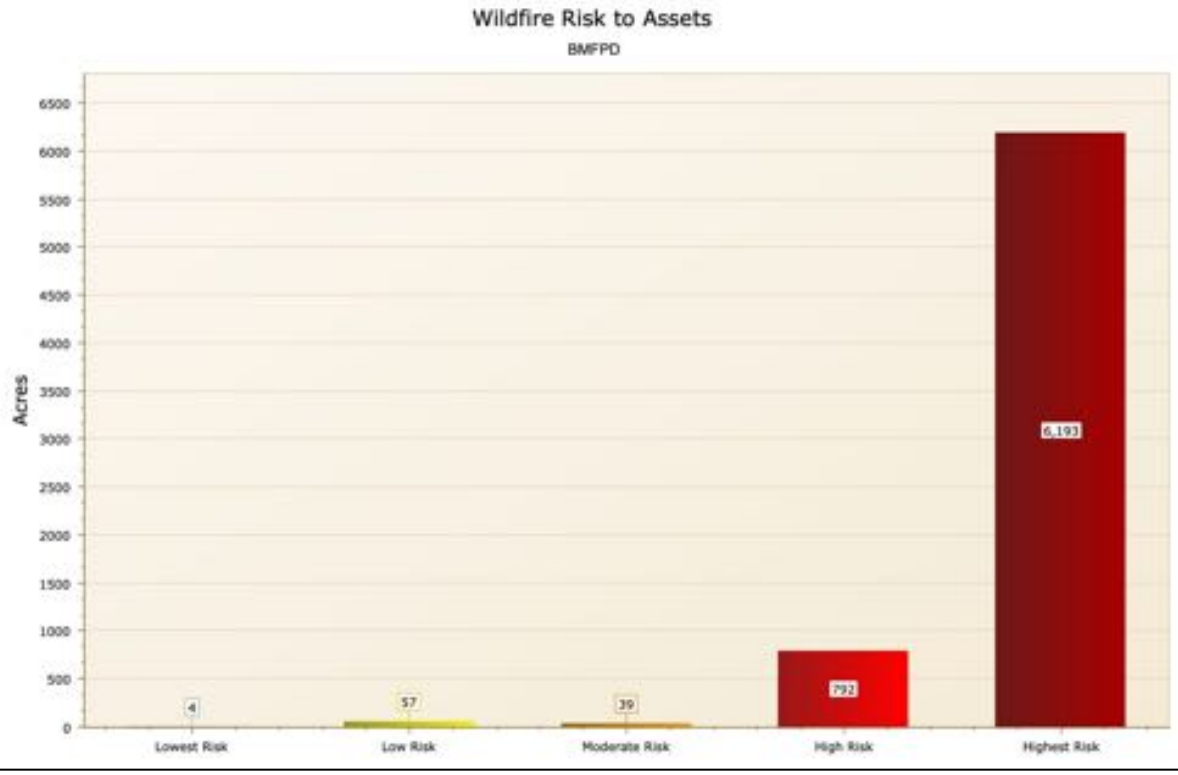
## Description

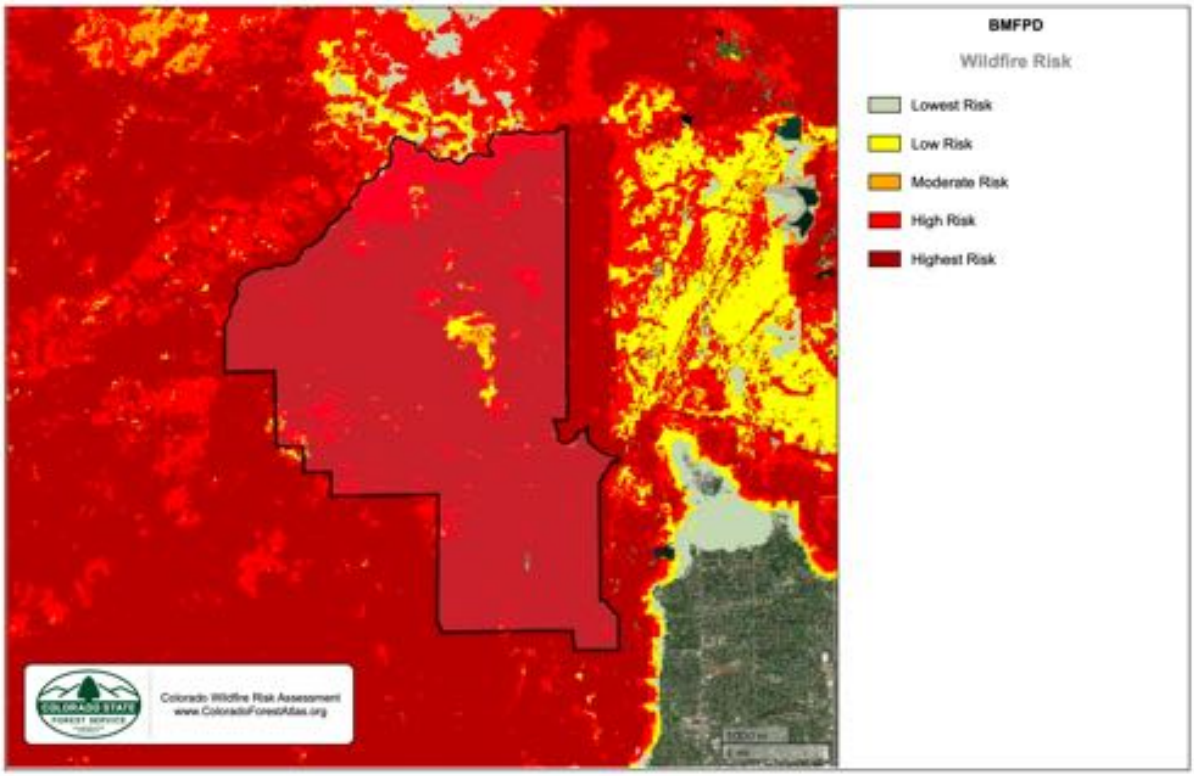
**Wildfire Risk is a composite risk map created by combining the Values at Risk Rating and the Burn Probability layers.**
It identifies areas with the greatest potential impacts from a wildfire – i.e., those areas most at risk when considering the four values layers.

The Values at Risk Rating is a key component of Wildfire Risk. It is comprised of several individual risk layers including Wildland Urban Interface (housing density), Forest Assets, Riparian Assets and Watershed Protection risk outputs. The WUI component is a key element of the composite risk since it represents where people live in the wildland and urban fringe areas that are susceptible to wildfires and damages. The found individual risk layers are weighted to derive the Values at Risk Rating layer.

The risk map is derived at a 20-meter resolution. This scale of data was chosen to be consistent with the accuracy of the primary surface fuels dataset used in the assessment. While not appropriate for site specific analysis, it is appropriate for regional, county, or local planning efforts.

| Wildfire Risk | Acres | Percent |
|---|---|---|
| Lowest Risk | 4 | 0% |
| Low Risk | 57 | 0.8% |
| Moderate Risk | 39 | 0.5% |
| High Risk | 792 | 11.2% |
| Highest Risk | 6,193 | 87.4% |
| **Total** | **7,085** | **100%** |






# Burn Probability

## Description

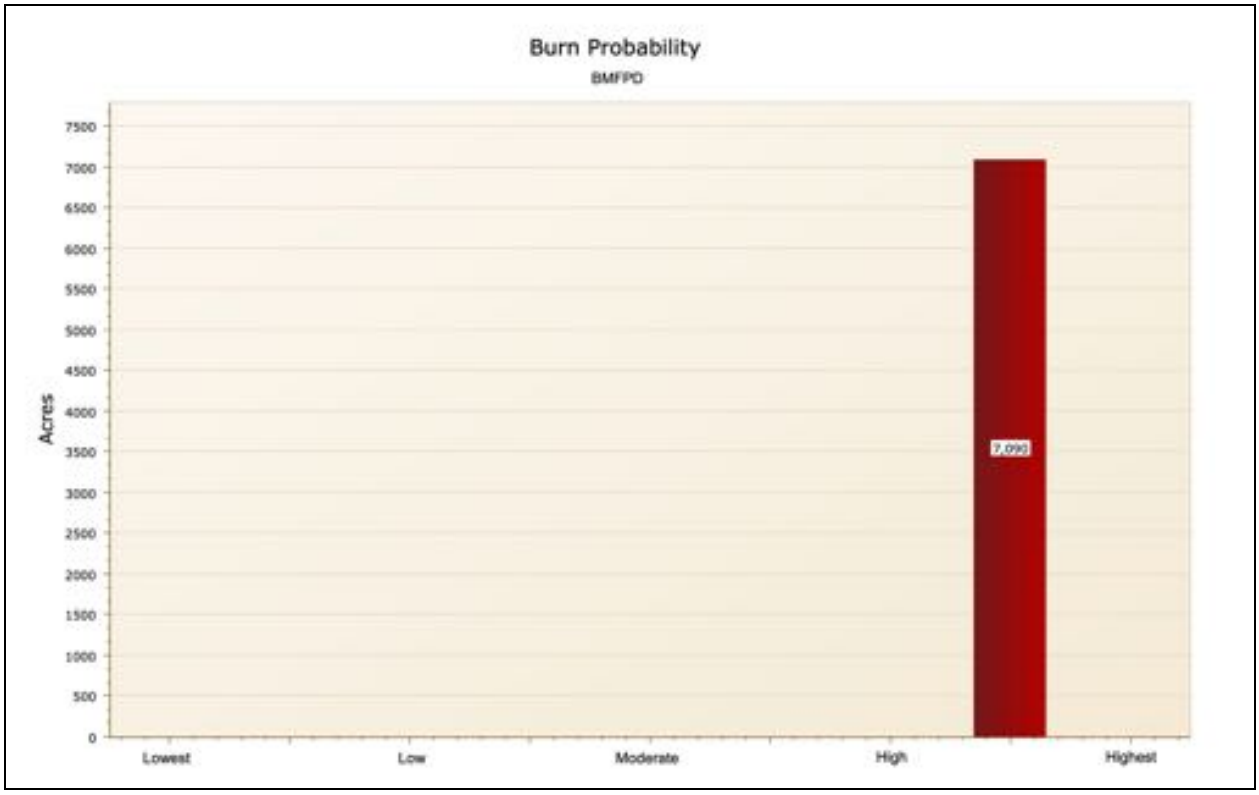
**Burn Probability (BP) is the annual probability of any location burning due to a wildfire.**

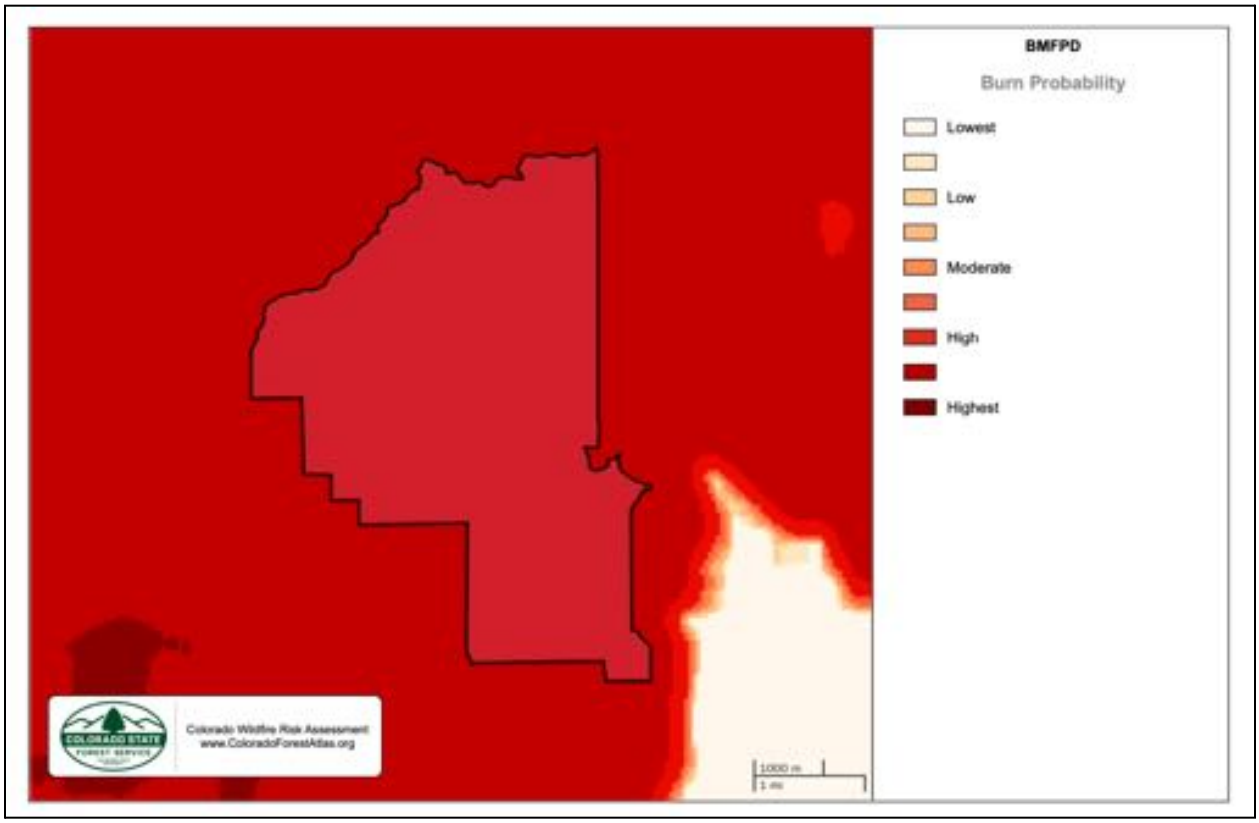
The annual BP was calculated as the number of times that a cell was burned and the number of iterations used to run the models. The annual BP was estimated for Colorado by using a wildfire simulation approach with Technosylva's Wildfire Analyst software (Wildfire Analyst). A total number of 2,342,334 fires were simulated (3,200,000 if we consider those fires outside the Colorado border which were used in a buffer area around the study area to compute BP) with a mean ignition density of 8.68 fires/km2. The ignition points were spatially distributed evenly every 500 meters across the state. Only high and extreme weather conditions were used to run the single fires because they usually burn most of the annual burned area. All fires simulations had a duration of 8 h. After simulating all the fires, some cells were not burned by any simulated fire, resulting in a BP value of zero. Some cells were non-burnable due to the associated fuel type (i.e. water, roads, urban, agricultural areas, barren areas). However, the lowest BP value found in "burnable" cells was assigned to cells where the simulated fires did not reach.

The Wildfire Analyst fire simulator considered the number of times that the simulated fires burned each cell. After that, results were weighted by considering the historical fire occurrence. The weighting was done by assessing the relation between the annual historical fire ignition density in Colorado and the total number of simulated fires with varying input data in high and moderate weather scenarios and the historical spatial distribution of the ignition points.

The probability map is derived at a 20-meter resolution. This scale of data was chosen to be consistent with the accuracy of the primary surface fuels dataset used in the assessment. While not appropriate for site specific analysis, it is appropriate for regional, county or local protection mitigation or prevention.

| Burn Probability | Acres | Percent |
|---|---|---|
| Lowest | | 0% |
| | | 0% |
| Low | | 0% |
| | | 0% |
| Moderate | | 0% |
| | | 0% |
| High | | 0% |
| | 7,090 | 100% |
| Highest | | 0% |
| **Total** | **7,090** | **100%** |


Burn Probability
BMFPD
Acres
7500
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
7,090
Lowest
Low
Moderate
High
Highest


BMFPD
Burn Probability
Lowest
Low
Moderate
High
Highest
Colorado Wildfire Risk Assessment
www.ColoradoForestAtlas.org

# Terrain Difficulty Index

## Description

The 2012 and 2017 CO-WRA included a simple metric that described suppression difficulty based on fireline dozer rates. For 2022 CO-WRA, this standalone metric has been updated to reflect a more enhanced definition of areas where access to fires and suppression from ground resources is difficult. Although not a component of the standard risk assessment outputs, this metric is provided as it helps inform which areas may have limited suppression capabilities, especially for initial attack, across the State.

The Terrain Difficulty Index (TDI) is a metric that describes the characteristics of the landscape which evaluates the difficulty of extinction, especially in initial attack, although it can also be extrapolated to extended attacks. This static index quantifies the availability of access for the arrival of terrestrial means, the ability to penetrate the area where the fire originates, and the difficulty of extinguishing fuels.

Indicators such as the Accessibility Index, Penetrability Index and Fireline Opening Index (construction) have been used for the formulation of TDI. This index is based on other indices such as the Wildfire Suppression Difficulty Index (terrestrial) (SDIt) (Matthew P Thompson et al, 2018. Francisco Rodriguez and Silva et al, 2020. ) which is a quantitative rating of the relative difficulty to perform fire control work. However, TDI is dynamic as it incorporates changes in surface fuels over time providing a less static perspective for a planning point of view.

**The designated area does not contain data for this section.**

# Wildfire Behavior Outputs

## Description

**Fire behavior is the way a fire reacts to the following environmental influences:**

**1. Fuels**
**2. Weather**
**3. Topography**

Fire behavior characteristics are attributes of wildland fire that pertain to its spread, intensity, and growth. Fire behavior characteristics utilized in the Colorado WRA include fire type, rate of spread, flame length and fireline intensity (fire intensity scale). These metrics are used to determine the potential fire behavior under different weather scenarios. Areas that exhibit moderate to high fire behavior potential can be identified for mitigation treatments, especially if these areas are in close proximity to homes, business, or other assets.

**Fuels**

The Colorado WRA includes composition and characteristics for both surface fuels and canopy fuels. Assessing canopy fire potential and surface fire potential allows identification of areas where significant increases in fire behavior affects the potential of a fire to transition from a surface fire to a canopy fire.

Fuel datasets required to compute both surface and canopy fire potential include:

1.Surface Fuels are typically categorized into one of four primary fuel types based on the primary carrier of the surface fire: 1) grass, 2) shrub/brush, 3) timber litter, and 4) slash. They are generally referred to as fire behavior fuel models and provide the input parameters needed to compute surface fire behavior. The 2022 assessment uses the latest 2022 calibrated fuels for Colorado. The following custom fuels were included to improve the fire modeling in timber, WUI and agricultural areas:

- Timber: 2 new categories (171 and 191)

- Urban: 7 new categories (911,912,913,914,915,916 and 919)

- Roads: 5 new categories (941,942,943,944 and 949)

- Agriculture: 4 new categories (931,932,938 and 939)

- Water: 3 new categories (981,982 and 989)

2. Canopy Cover is the horizontal percentage of the ground surface that is covered by tree crowns. It is used to compute wind-reduction factors and shading.

3.Canopy Ceiling Height/Stand Height is the height above the ground of the highest canopy layer where the density of the crown mass within the layer is high enough to support vertical movement of a fire. A good estimate of canopy ceiling height is the average height of the dominant and co-dominant trees in a stand. It is used to compute wind reduction to mid-flame height, and spotting distances from torching trees.

4.Canopy Base Height is the lowest height above the ground above which sufficient canopy fuel exists to vertically propagate fire (Scott & Reinhardt, 2001). Canopy base height is a property of a plot, stand or group of trees, not an individual tree. For fire modeling, canopy base height is an effective value that incorporates ladder fuels, such as tall shrubs and small trees. Canopy base height is used to determine whether a surface fire will transition to a canopy fire.

5. Canopy Bulk Density is the mass of available canopy fuel per unit canopy volume (Scott & Reinhardt, 2001). Canopy bulk density is a bulk property of a stand, plot, or group of trees, not an individual tree. Canopy bulk density is used to predict whether an active crown fire is possible.

**Weather**

Weather data (1979-2022) from gridMET was used to analyze potential weather scenarios in which assessing fire behavior and spread. gridMET is a dataset of daily high-spatial resolution (~4-km, 1/24th degree) surface meteorological data covering the contiguous US. Air temperature data at 2m, relative humidity at 2m, and wind speed and direction at 10 m were all downloaded and used.

After computing the weather percentiles of the gridMET variables, data was interpolated using IDW algorithms (Inverse Distance Weighting) at 20-meter pixel resolution.

Dead fuel moisture content was estimated using the model of Rothermel and Rinehart (1983). Both temperature and air relative humidity at 2m from gridMET was used to define the fuel moisture model. The model also considered elevation and aspect to take into account the accumulated solar radiation at 14h (local time). 1% and 2% were added to the 1h-dead fuel moisture content to estimate 10h and 100h dead fuel moisture content, respectively.

For the first time in CO-WRA risk assessments, both herbaceous and woody live fuel moisture content was modelled using Technosylva's proprietary models based on optical imagery, drought indices and phenology. The models were trained with the WFAS National live fuel moisture content. Foliar moisture content in the canopies was considered as a constant value (80%) across the entire state.

Wind speed at 10 m was estimated at 20 ft applying a wind adjustment factor to use 20-ft wind speed in the fire spread and behavior equations. Afterward, wind speed percentiles were computed to use these data in the FB analysis at 20-meter pixel resolution. Wind direction for Colorado was analyzed for a 40-year period (1979-2022) considering the calculated wind speed percentiles from gridMET data. Predominant wind direction is from SW to NE, especially when wind speed is high or very high.

# Characteristic Flame Length

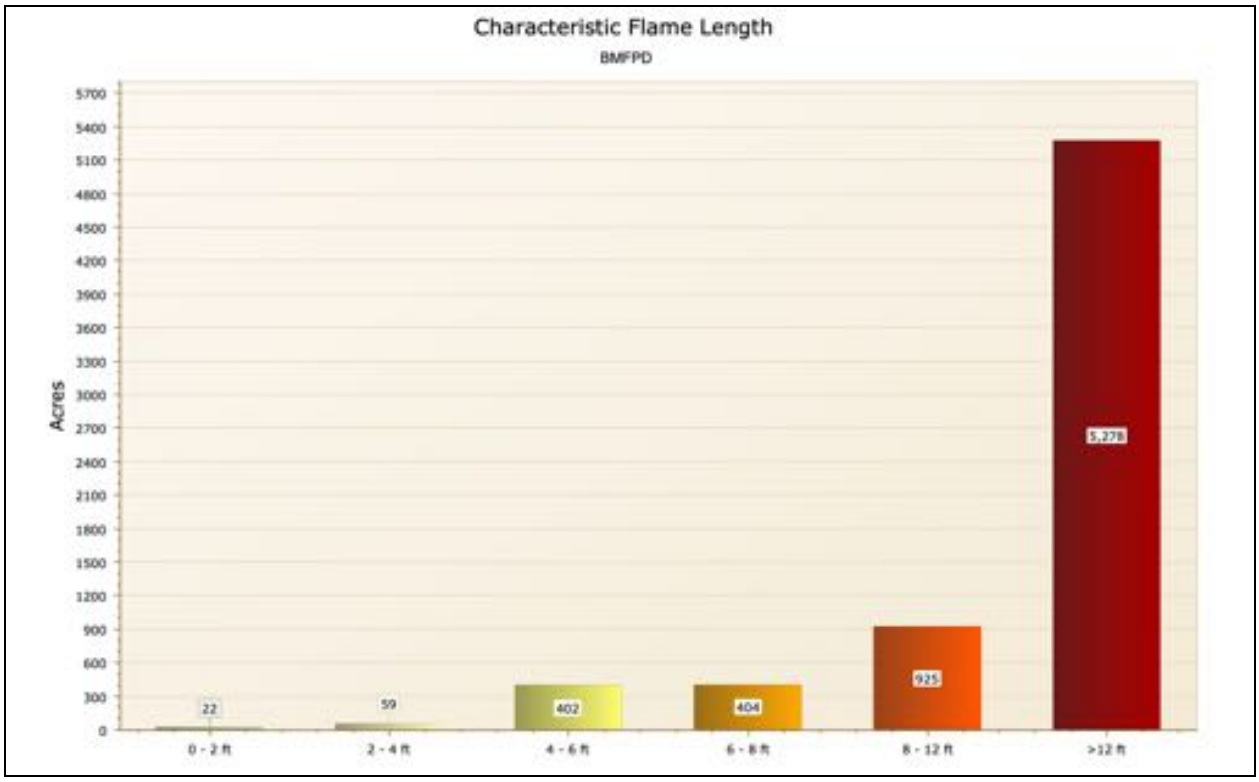
**The typical or representative flame length of a potential fire based on a weighted average of four percentile weather categories.**

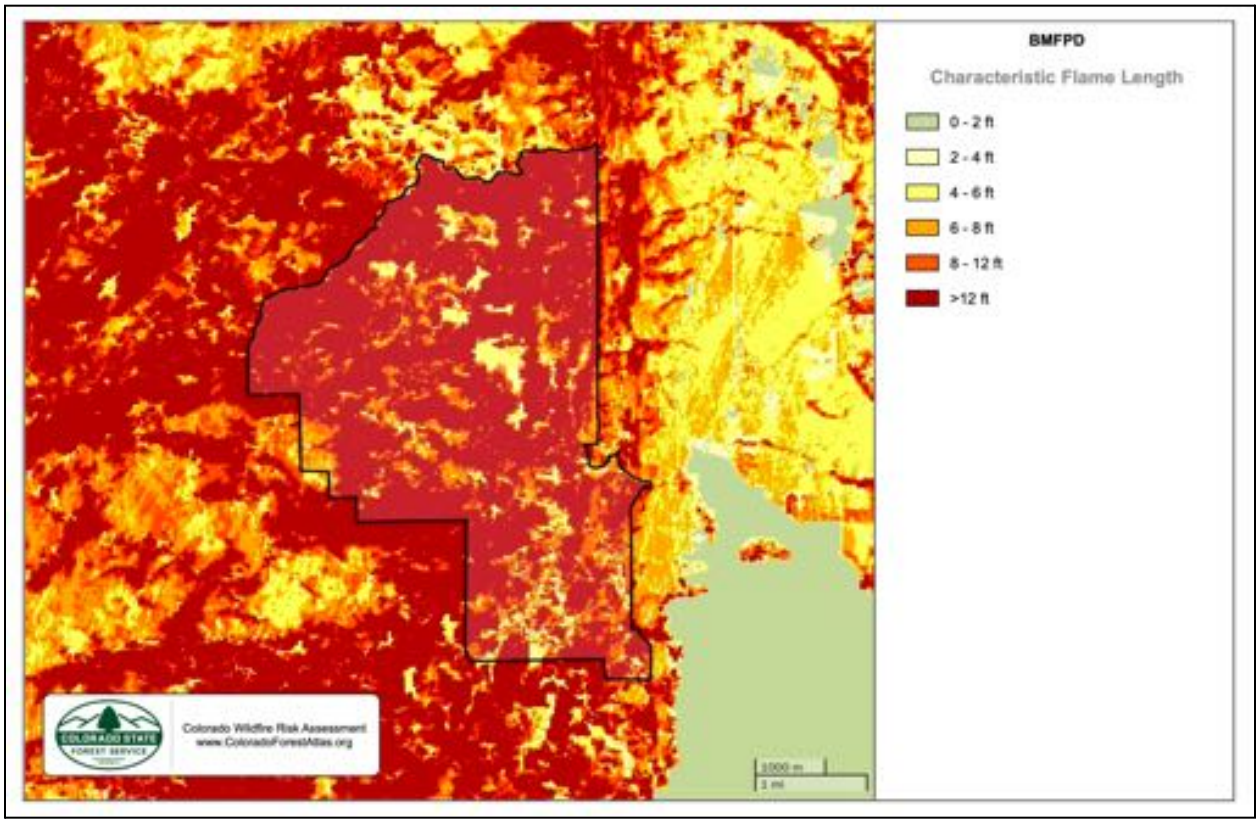
Flame Length is defined as the distance between the flame tip and the midpoint of the flame depth at the base of the flame, which is generally the ground surface. It is an indicator of fire intensity and is often used to estimate how much heat the fire is generating.

Flame length is typically measured in feet. Flame length is the measure of fire intensity used to generate the Fire Effects outputs for the CO-WRA and it is influenced by three environmental factors - fuels, weather, and topography. Weather is by far the most dynamic variable as it changes frequently. To account for this variability, four percentile weather categories were created from historical weather observations to represent low, moderate, high, and extreme weather days for each 20-meter grid cell in Colorado.

The Characteristic Flame Length represents the weighted average for all four weather percentiles. While not discussed in this report, the individual percentile weather Flame Length outputs are available in the CO-WRA data.

| Characteristic Flame Length | Acres | Percent |
|---|---|---|
| 0 - 2 ft | 22 | 0.3% |
| 2 - 4 ft | 59 | 0.8% |
| 4 - 6 ft | 402 | 5.6% |
| 6 - 8 ft | 404 | 5.6% |
| 8 - 12 ft | 925 | 12.9% |
| >12 ft | 5,278 | 73.7% |
| **Total** | **7,090** | **99%** |


Characteristic Flame Length
BMFPD
Acres
5700
5400
5100
4800
4500
4200
3900
3600
3300
3000
2700
2400
2100
1800
1500
1200
900
600
300
0
22
59
402
404
925
5,278
0 - 2 ft
2 - 4 ft
4 - 6 ft
6 - 8 ft
8 - 12 ft
>12 ft


BMFPD
Characteristic Flame Length
0 - 2 ft
2 - 4 ft
4 - 6 ft
6 - 8 ft
8 - 12 ft
>12 ft
Colorado Wildfire Risk Assessment
www.ColoradoForestAtlas.org

# Fire Intensity Scale

## Description

**Quantifies the potential fire intensity by orders of magnitude.**
Fire Intensity Scale (FIS) specifically identifies areas where significant fuel hazards and associated dangerous fire behavior potential exist. Similar to the Richter scale for earthquakes, FIS provides a standard scale to measure potential wildfire intensity. FIS consist of five (5) classes where the order of magnitude between classes is ten-fold. The minimum class, Class 1, represents very low wildfire intensities and the maximum class, Class 5, represents very high wildfire intensities.

1. Class 1, Lowest Intensity:
Very small, discontinuous flames, usually less than 1 foot in length; very low rate of spread; no spotting. Fires are typically easy to suppress by firefighters with basic training and non-specialized equipment.

2. Class 2, Low:
Small flames, usually less than two feet long; small amount of very short-range spotting possible. Fires are easy to suppress by trained firefighters with protective equipment and specialized tools.

3. Class 3, Moderate:
Flames up to 8 feet in length; short-range spotting is possible. Trained firefighters will find these fires difficult to suppress without support from aircraft or engines, but dozer and plows are generally effective. Increasing potential for harm or damage to life and property.

4. Class 4, High:
Large Flames, up to 30 feet in length; short-range spotting common; medium range spotting possible. Direct attack by trained firefighters, engines, and dozers is generally ineffective, indirect attack may be effective. Significant potential for harm or damage to life and property.

5. Class 5, Highest Intensity:
Very large flames up to 150 feet in length; profuse short-range spotting, frequent long-range spotting; strong fire-induced winds. Indirect attack marginally effective at the head of the fire. Great potential for harm or damage to life and property.

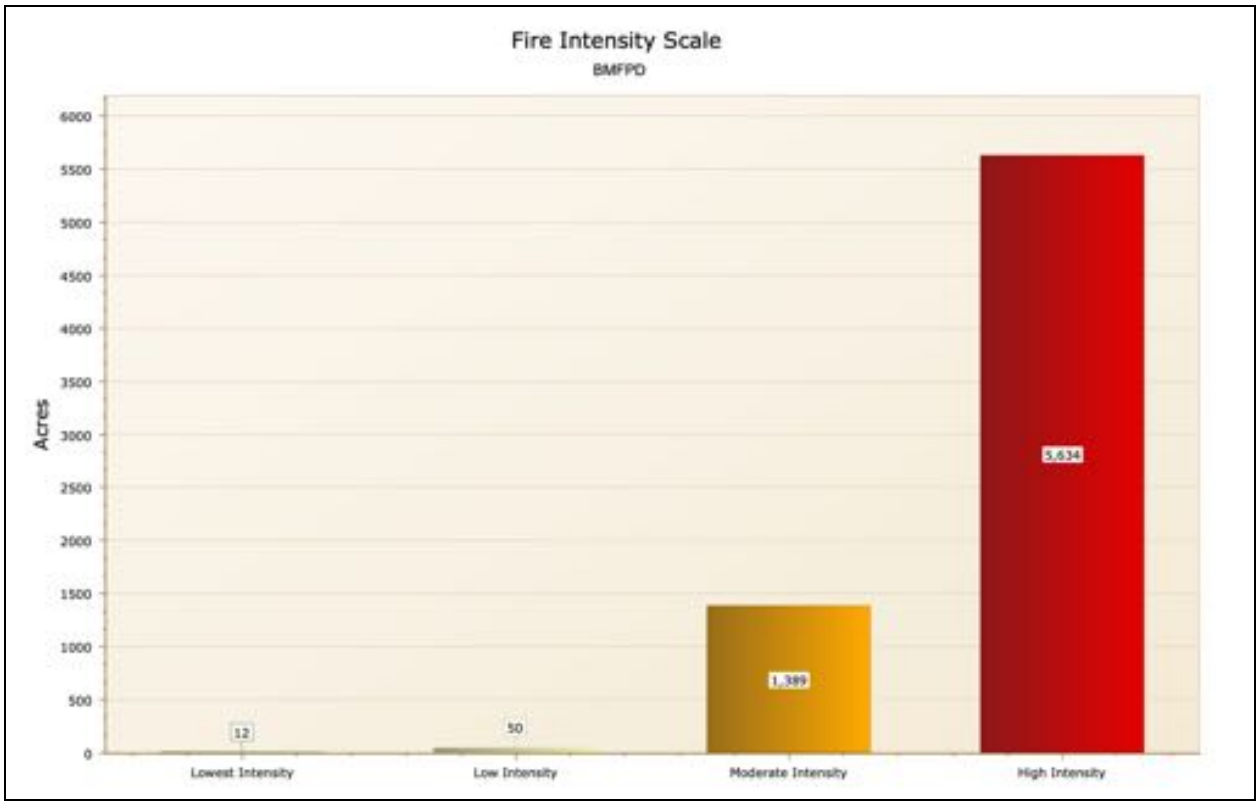
Burn Probability and Fire Intensity Scale are designed to complement each other. Unlike Wildfire Threat, the Fire Intensity Scale does not incorporate historical occurrence information. It only evaluates the potential fire behavior for an area, regardless if any fires have occurred there in the past. This additional information allows mitigation planners to quickly identify areas where dangerous fire behavior potential exists in relationship to nearby homes or other valued assets.

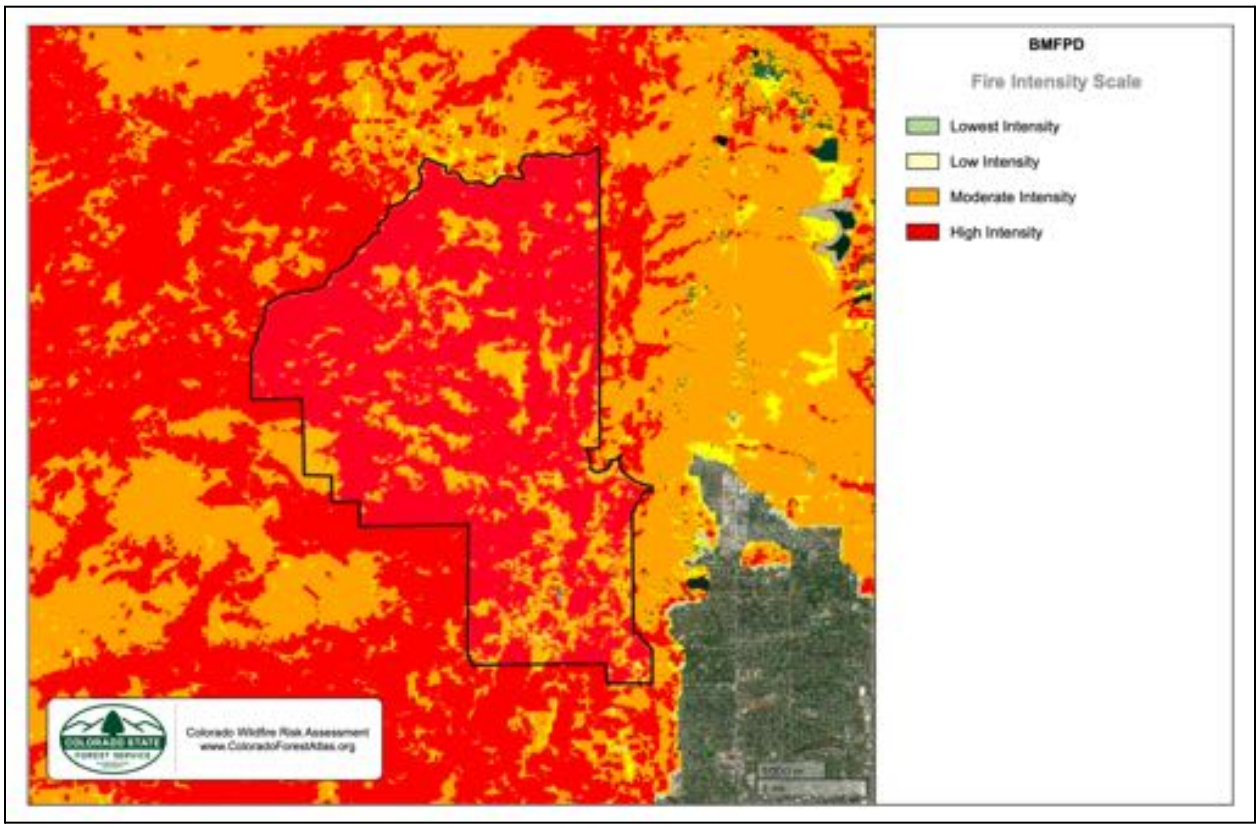
Since all areas in Colorado have fire intensity scale calculated consistently, it allows for comparison and ordination of areas across the entire state. For example, a high fire intensity area in Eastern Colorado is equivalent to a high fire intensity area in Western Colorado.

Fire intensity scale is a fire behavior output, which is influenced by three environmental factors - fuels, weather, and topography – and the spread itself (back, flank or head fire influences fire behavior for a given pixel for a specific fire simulation). Weather is by far the most dynamic variable as it changes frequently. Thus, each pixel may burn many times with different fire spread patterns based on the aforementioned factors. The fire intensity scale maps represent an average fire intensity map.

The fire intensity scale map is derived at a 20-meter resolution. This scale of data was chosen to be consistent with the accuracy of the primary surface fuels dataset used in the assessment. While not appropriate for site specific analysis, it is appropriate for regional, county, or local planning efforts.

| FIS Class | Acres | Percent |
|---|---|---|
| Lowest Intensity | 12 | 0.2% |
| Low Intensity | 50 | 0.7% |
| Moderate Intensity | 1,389 | 19.6% |
| High Intensity | 5,634 | 79.5% |
| Total | 7,085 | 100% |


Fire Intensity Scale
BMFPD
Acres
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
12
50
1,389
5,634
Lowest Intensity
Low Intensity
Moderate Intensity
High Intensity


BMFPD
Fire Intensity Scale
Lowest Intensity
Low Intensity
Moderate Intensity
High Intensity
Colorado Wildfire Risk Assessment
www.ColoradoForestAtlas.org

# Fire Type

**Represents the potential fire type under the extreme percentile weather category.**

Canopy fires are very dangerous, destructive and difficult to control due to their increased fire intensity. From a planning perspective, it is important to identify where these conditions are likely to occur on the landscape so that special preparedness measure can be taken if necessary. The Fire Type layer shows the footprint of where these areas are most likely to occur. However, it is important to note that canopy fires are not restricted to these areas. Under the right conditions, it can occur in other canopied areas.

There are two primary fire types – surface fire and canopy fire. Canopy fire can be further subdivided into passive canopy fire and active canopy fire. A short description of each of these is provided below.

• Surface Fire - A fire that spreads through surface fuel without consuming any overlying canopy fuel. Surface fuels include grass, timber litter, shrub/brush, slash and other dead or live vegetation within about 6 feet of the ground.

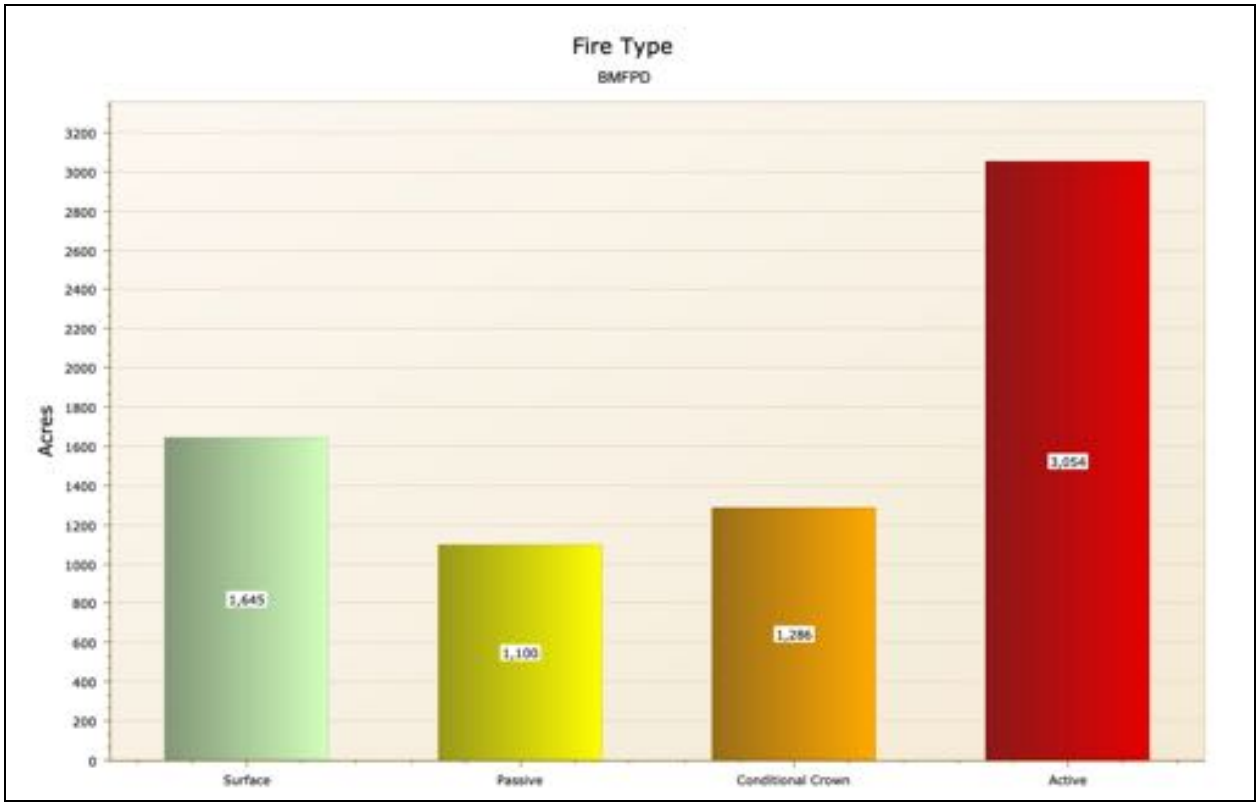
• Passive Canopy Fire – A type of crown fire in which the crowns of individual trees or small groups of trees burn, but solid flaming in the canopy cannot be maintained except for short periods (Scott & Reinhardt, 2001).

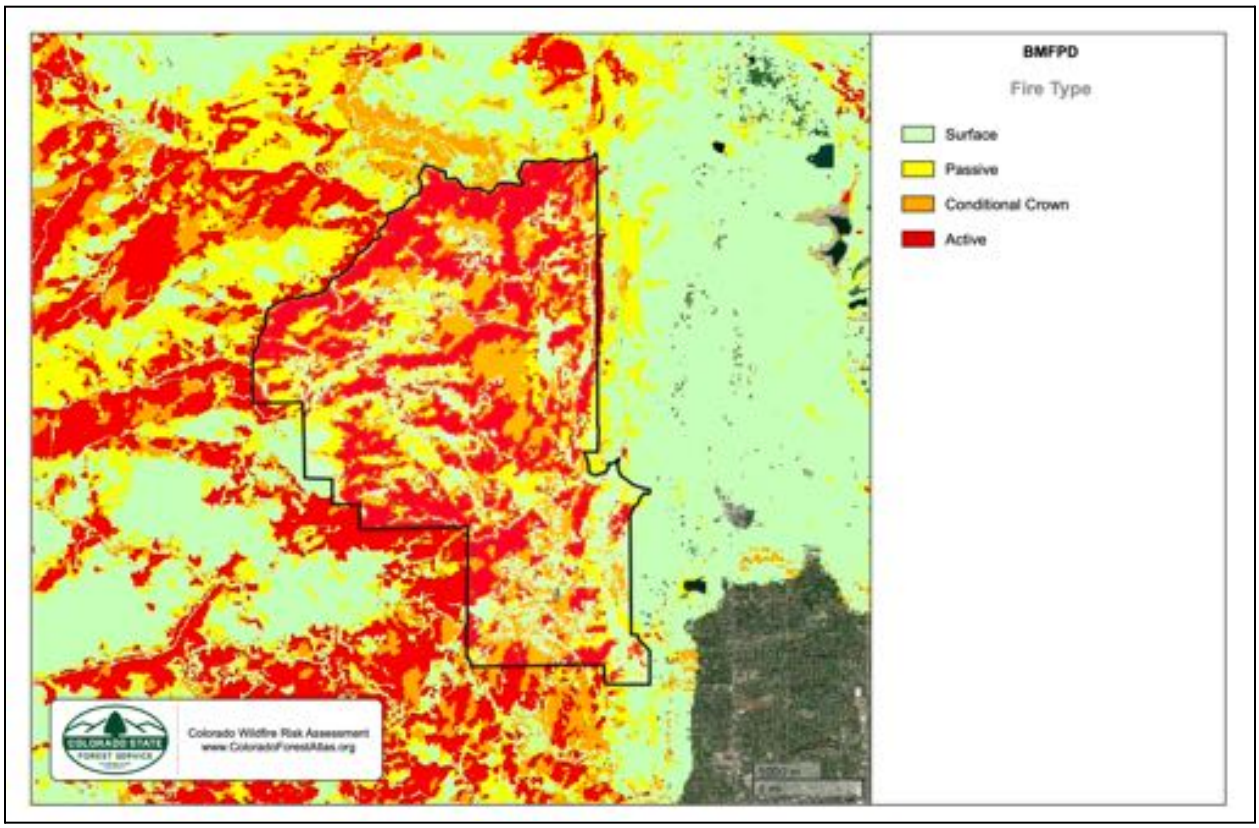
• Conditional Crown Fire – A type of crown fire in which an active crown fire is possible but one would not be predicted to initiate. Two outcomes are possible in that situation: surface fire if the fire starts in the stand as a surface fire, or active crown fire if fire enters the stand as an active crown fire.

• Active Canopy Fire - A crown fire in which the entire fuel complex (canopy) is involved in flame, but the crowning phase remains dependent on heat released from surface fuel for continued spread (Scott & Reinhardt, 2001).

The fire type map is derived at a 20-meter resolution and was estimated based on the extreme weather scenario (percentile 97th). This scale of data was chosen to be consistent with the accuracy of the primary surface fuels dataset used in the assessment. While not appropriate for site specific analysis, it is appropriate for regional, county or local planning efforts.

| Fire Type | Acres | Percent |
|---|---|---|
| Surface | 1,645 | 23.2% |
| Passive | 1,100 | 15.5% |
| Conditional Crown | 1,286 | 18.2% |
| Active | 3,054 | 43.1% |
| **Total** | **7,085** | **100%** |


Fire Type
BMFPD
Acres
3200
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1,645
1,100
1,286
3,054
Surface
Passive
Conditional Crown
Active


BMFPD
Fire Type
Surface
Passive
Conditional Crown
Active
Colorado Wildfire Risk Assessment
www.ColoradoForestAtlas.org

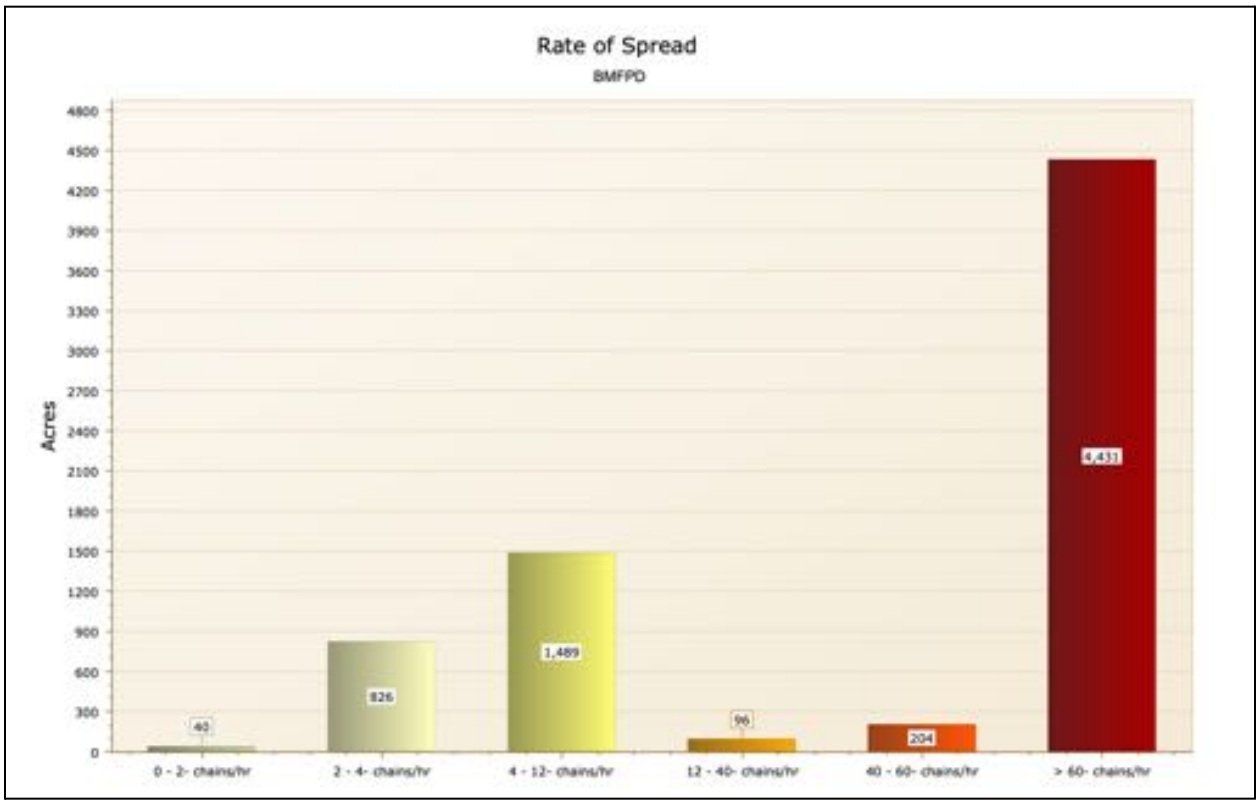
# Rate of Spread

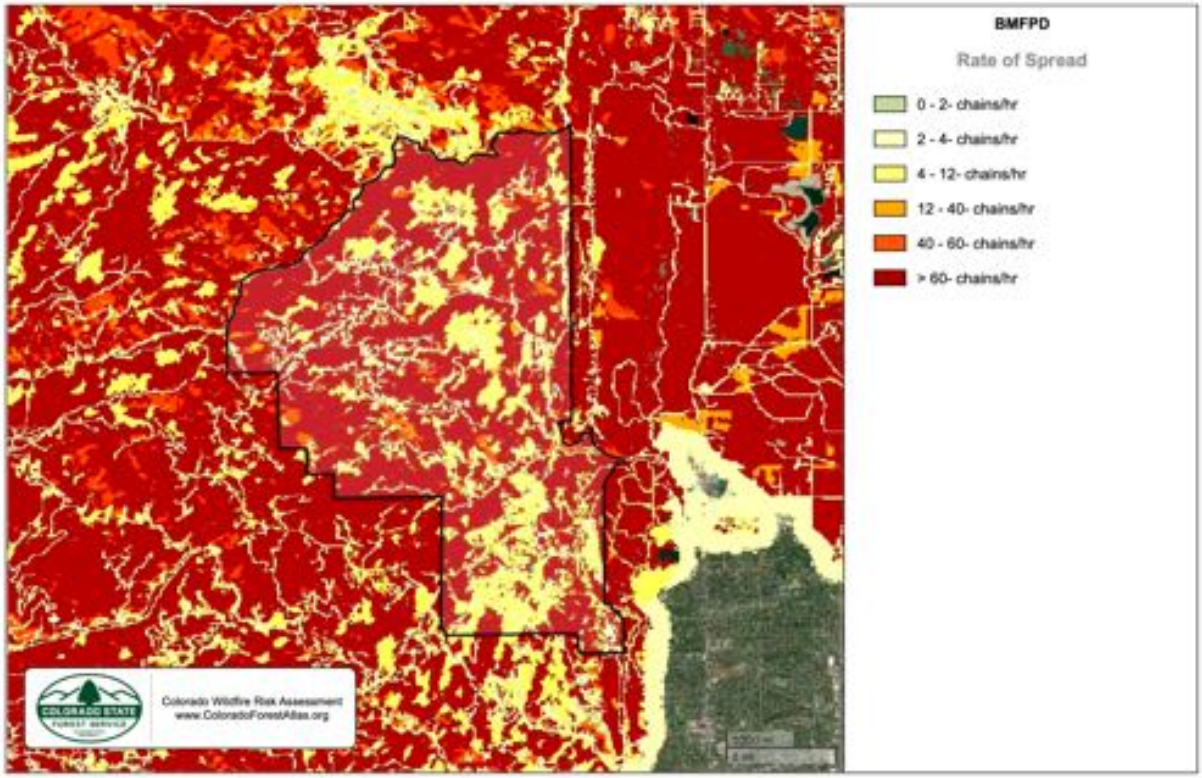
**The typical or representative rate of spread of a potential fire based on a weighted average of four percentile weather categories.**

Rate of spread is the speed with which a fire moves in a horizontal direction across the landscape, usually expressed in chains per hour (ch/hr) or feet per minute (ft/min). For purposes of the CO-WRA, this measurement represents the maximum rate of spread of the fire front.

Rate of spread is a fire behavior output, which is influenced by three environmental factors - fuels, weather, and topography. Weather is by far the most dynamic variable as it changes frequently. To account for this variability, four percentile weather categories were created from historical weather observations to represent low, moderate, high, and extreme weather days for a 20-meter grid cell in Colorado.

| Rate of Spread | Acres | Percent |
|---|---|---|
| 0 - 2- chains/hr | 40 | 0.6% |
| 2 - 4- chains/hr | 826 | 11.6% |
| 4 - 12- chains/hr | 1,489 | 21% |
| 12 - 40- chains/hr | 96 | 1.4% |
| 40 - 60- chains/hr | 204 | 2.9% |
| > 60- chains/hr | 4,431 | 62.5% |
| Total | 7,085 | 100% |






## Surface Fuels

**Fire behavior fuel models that contain the parameters required to calculate fire behavior outputs.**

Surface fuels, or fire behavior fuel models as they are technically referred to, contain the parameters needed by the Rothermel (1972) surface fire spread model to compute surface fire behavior characteristics, e.g. rate of spread, flame length, fireline intensity, and other fire behavior metrics. As the name might suggest, surface fuels account only for surface fire potential. Canopy fire potential is computed through a separate but linked process. The CO-WRA accounts for both surface and canopy fire potential in the fire behavior outputs.

An up-to-date surface fuel dataset at 20-meter (m) resolution was developed for this project, based on Scott and Burgan (2005) fuel models, enhanced with custom fuels created by Technosylva. The custom fuels distinguish this assessment from previous ones performed in Colorado as they allow a better characterization of fire behavior across the landscape. Additionally, the urban and road custom fuel models included in the assessment are key for better characterizing the exposure, vulnerability and risk of both buildings and population in the Wildland Urban Interface (WUI). This also allows for better modeling of fire encroachment in urban areas considering the building density, community structure and fuels surrounding the buildings and urban areas.

The following custom fuels were included in order to improve the fire modeling in timber, WUI and agricultural areas:

- Timber: 2 new categories (171 and 191)
- Urban: 7 new categories (911,912,913,914,915,916 and 919)
- Roads: 5 new categories (941,942,943,944 and 949)
- Agriculture: 4 new categories (931,932,938a and 939)
- Water: 3 new categories (981,982 and 989)

Additionally, we also considered canopy fuel data to better simulate crown fire behavior. This includes:

- canopy bulk density (CBD),
- canopy base height (CBH),
- canopy cover (CC) and
- canopy height (CH).

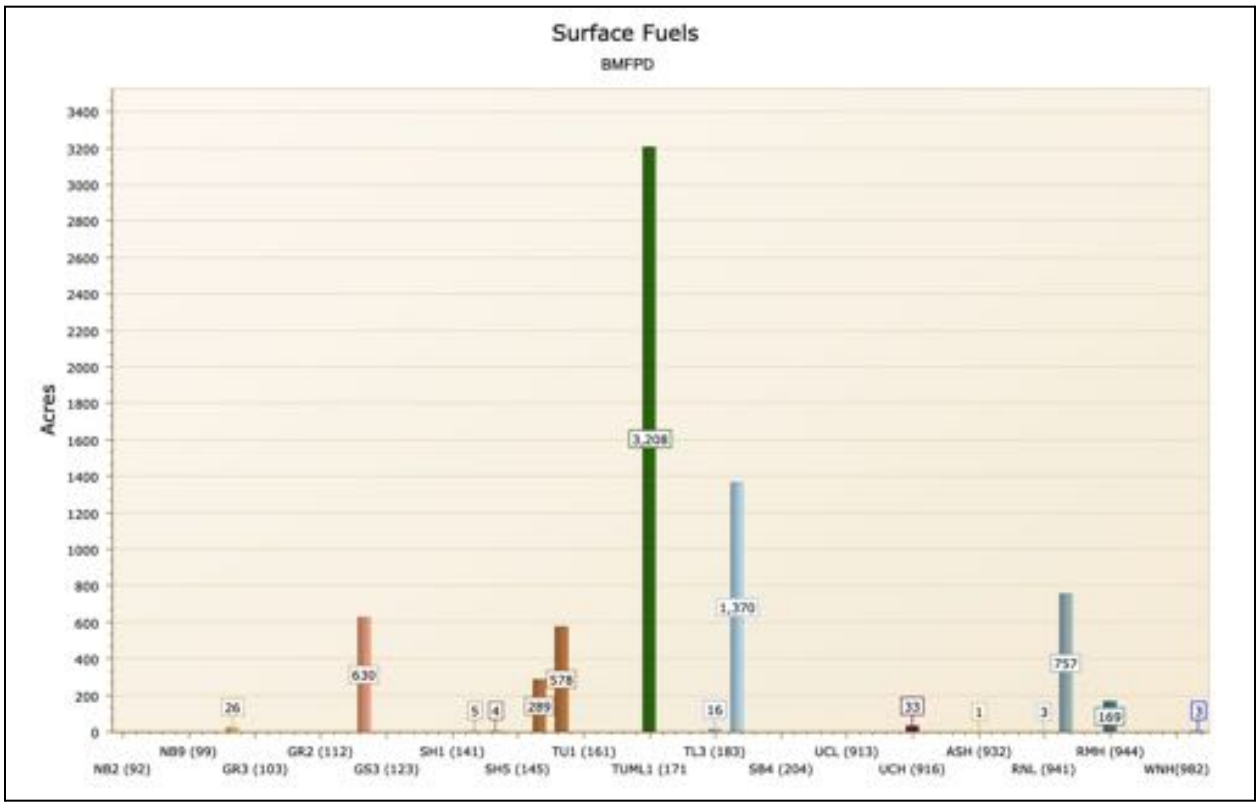
Unmanaged forest with dead and downed trees and branches

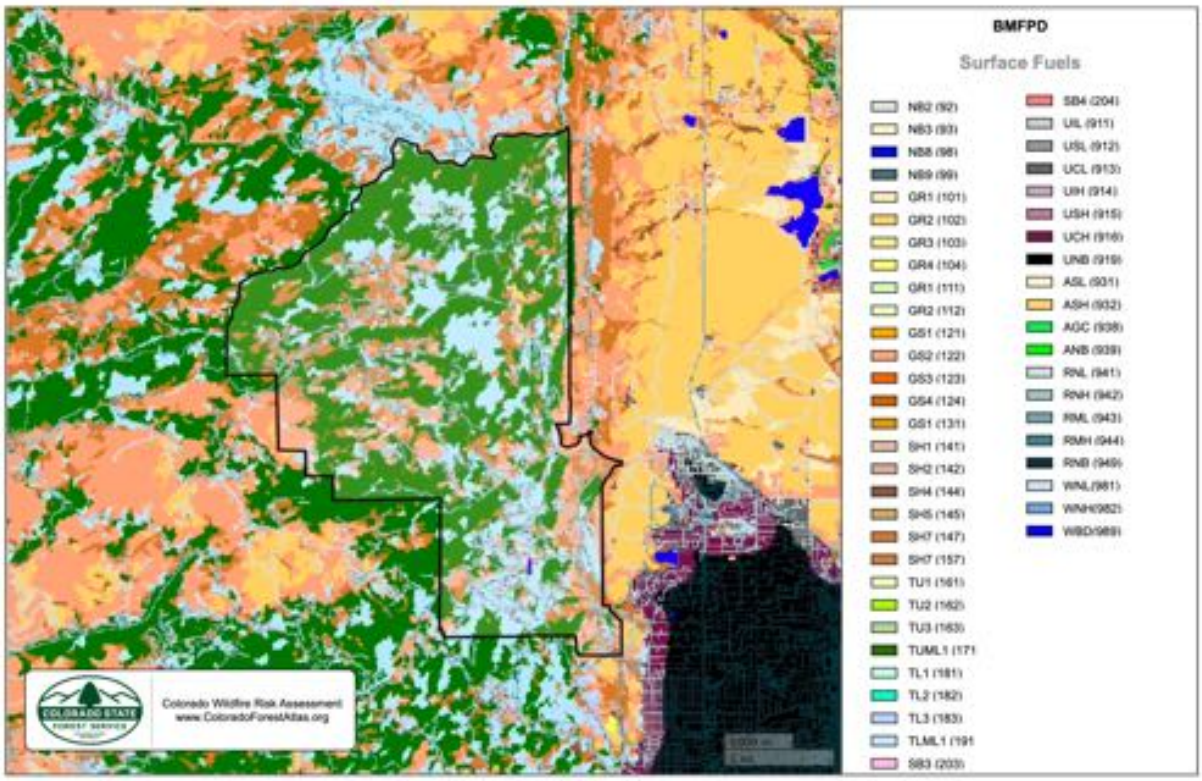
Slash on the ground indicates that forest management treatments have occurred in this area

The updated fuel dataset also considered the effects of natural disturbances on vegetation (fires, insect and disease, and harvesting/fuel treatments) that occurred in Colorado from 2013 to 2022. More information about the methods used can be found in the Colorado 2022 Fuels Mapping Final Report.

| Surface Fuels | Description | Acres | Percent |
|---|---|---|---|
| NB2 (92) | Snow/Ice | | 0% |
| NB3 (93) | Agricultural | | 0% |
| NB8 (98) | Open Water | | 0% |
| NB9 (99) | Bare Ground | | 0% |
| GR1 (101) | Short, Sparse Dry Climate Grass | | 0% |
| GR2 (102) | Low Load, Dry Climate Grass | 26 | 0.4% |
| GR3 (103) | Low Load, Very Coarse, Humid Climate Grass | | 0% |
| GR4 (104) | Moderate Load, Dry Climate Grass | | 0% |
| GR1 (111) | Short, Sparse Dry Climate Grass - ALPINE | | 0% |
| GR2 (112) | Low Load, Dry Climate Grass - ALPINE | | 0% |
| GS1 (121) | Low Load, Dry Climate Grass-Shrub | | 0% |
| GS2 (122) | Moderate Load, Dry Climate Grass-Shrub | 630 | 8.9% |
| GS3 (123) | Moderate Load, Humid Climate Grass-Shrub | | 0% |
| GS4 (124) | High Load, Humid Climate Grass-Shrub | | 0% |
| GS1 (131) | Low Load, Dry Climate Grass-Shrub - ALPINE | | 0% |
| SH1 (141) | Low Load Dry Climate Shrub | | 0% |
| SH2 (142) | Moderate Load Dry Climate Shrub | 5 | 0.1% |
| SH4 (144) | Low Load, Humid Climate Timber-Shrub | 4 | 0.1% |
| SH5 (145) | High Load, Dry Climate Shrub | | 0% |
| SH7 (147) | Very High Load, Dry Climate Shrub | 289 | 4.1% |
| SH7 (157) | Very High Load, Dry Climate Shrub | 578 | 8.1% |
| TU1 (161) | Low Load Dry Climate Timber-Grass-Shrub | | 0% |
| TU2 (162) | Moderate Load, Humid Climate Timber-Shrub | | 0% |
| TU3 (163) | Moderate Load, Humid Climate Timber-Grass-Shrub | | 0% |
| TUML1 (171 | Timber Understory Dynamic ML (TSYL 2022) | 3,208 | 45.2% |
| TL1 (181) | Low Load Compact Conifer Litter | | 0% |
| TL2 (182) | Low Load Broadleaf Litter | | 0% |
| TL3 (183) | Moderate Load Conifer Litter | 16 | 0.2% |
| TLML1 (191 | Timber Litter ML (TSYL 2022) | 1,370 | 19.3% |

| Surface Fuels | Description | Acres | Percent |
|---|---|---|---|
| SB3 (203) | High Load Activity Fuel or Moderate Load Blowdown | | 0% |
| SB4 (204) | High Load Blowdown | | 0% |
| UIL (911) | Isolated urban surrounded by Low FB fuel | | 0% |
| USL (912) | Scattered urban surrounded by Low FB fuel | | 0% |
| UCL (913) | Urban core surrounded by Low FB fuel | | 0% |
| UIH (914) | Isolated urban surrounded by High FB fuel | | 0% |
| USH (915) | Scattered urban surrounded by High FB fuel | | 0% |
| UCH (916) | Urban core surrounded by High FB fuel | 33 | 0.4% |
| UNB (919) | Unburnable urban areas | | 0% |
| ASL (931) | Agricultural Low Load Fuels, with seasonal changes of its Burnable condition | | 0% |
| ASH (932) | Agricultural High Load Fuels, with seasonal changes of its Burnable condition | 1 | 0% |
| AGC (938) | Golf courses - Non-Burnable (no encroachment) | | 0% |
| ANB (939) | Agricultural Fields, maintained in a Non-Burnable condition | | 0% |
| RNL (941) | Minor roads Low FB | 3 | 0% |
| RNH (942) | Minor roads High FB | 757 | 10.7% |
| RML (943) | Major roads Low FB | | 0% |
| RMH (944) | Major roads High FB | 169 | 2.4% |
| RNB (949) | Roads surrounded by non-burnable fuels | | 0% |
| WNL(981) | Minor Water streams surrounded by Low Load Fuel (moderate encroachment) | | 0% |
| WNH(982) | Minor Water streams surrounded by High Load Fuel (high encroachment) | | 0% |
| WBD(989) | Water Bodies | 3 | 0% |
| Total | | 7,090 | 100% |






# Vegetation

**The Vegetation map describes the general vegetation and landcover types across the state of Colorado.**

In the CO-WRA, the Vegetation dataset is used to support the development of the Surface Fuels, Canopy Cover, Canopy Stand Height, Canopy Base Height, and Canopy Bulk Density datasets.
The 2020 LANDFIRE program data product (Existing Vegetation Type) was used to compile the Vegetation data for the CO-WRA. This reflects data current to 2020. The LANDFIRE EVT data were classified to reflect general vegetation cover types for representation with CFA.

Oak shrublands are commonly found aflong dry foothills and lower mountain slopes, and are often situates above Pifyon-juniper.

Pifyon-juniper woodlands are common in southern and southwestern Colorado

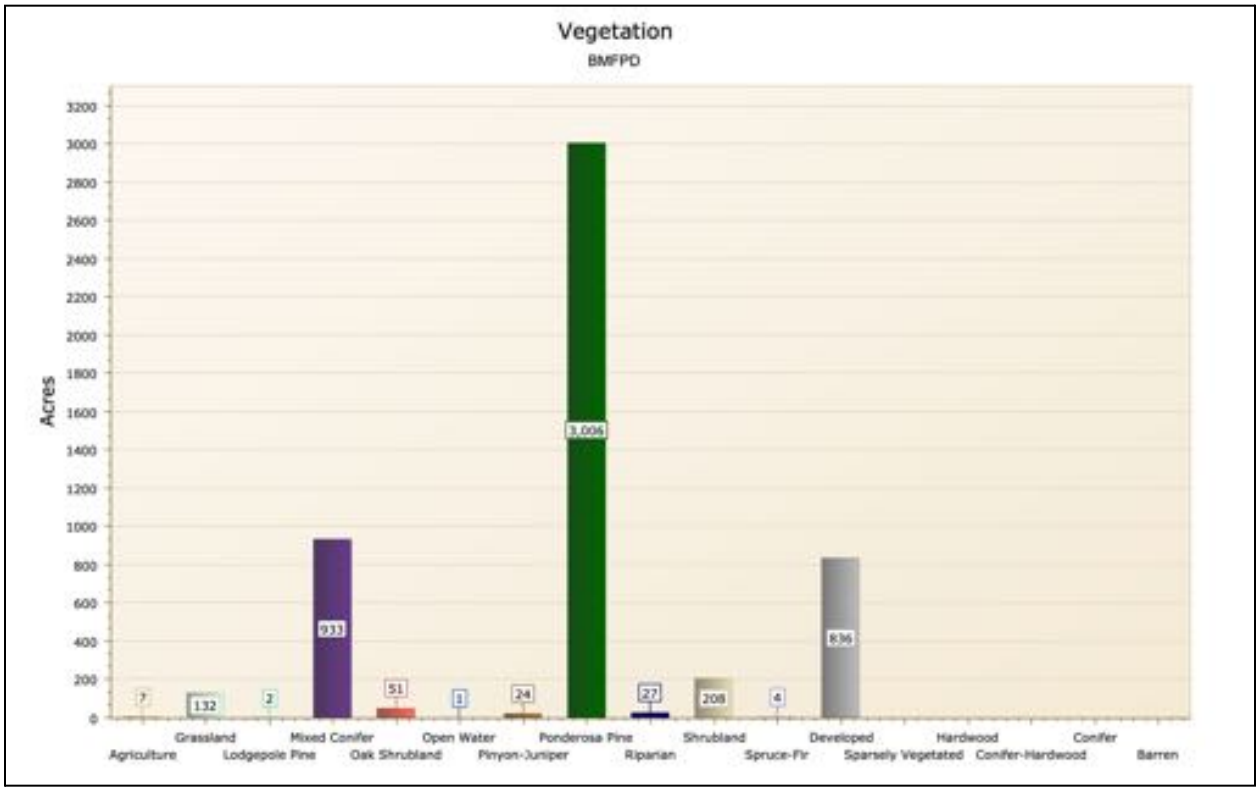
Douglas-fir understory in a ponderosa pine forest

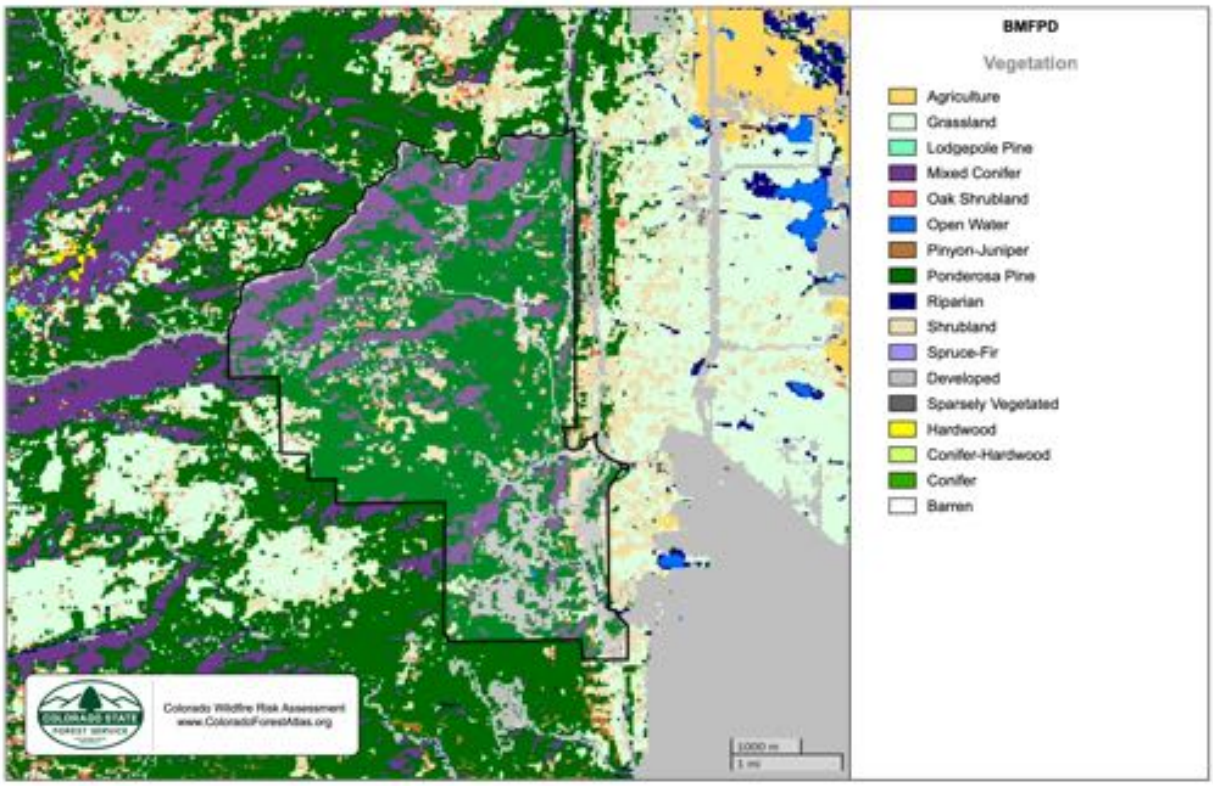
Grasslands occur both on Colorado's Eastern Plains and on the Western Slope.

Wildland fire threat increases in lodgepole pine as the dense forest grow old

Overly dense ponderosa pine, a dominant species of the montane zone

| Vegetation Class | Acres | Percent |
|---|---|---|
| Agriculture | 7 | 0.1% |
| Grassland | 132 | 2.5% |
| Lodgepole Pine | 2 | 0% |
| Mixed Conifer | 933 | 17.8% |
| Oak Shrubland | 51 | 1% |
| Open Water | 1 | 0% |
| Pinyon-Juniper | 24 | 0.4% |
| Ponderosa Pine | 3,006 | 57.5% |
| Riparian | 27 | 0.5% |
| Shrubland | 208 | 4% |
| Spruce-Fir | 4 | 0.1% |
| Developed | 836 | 16% |
| Sparsely Vegetated | | 0% |
| Hardwood | | 0% |
| Conifer-Hardwood | | 0% |
| Conifer | | 0% |
| Barren | | 0% |
| **Total** | **5,231** | **100%** |



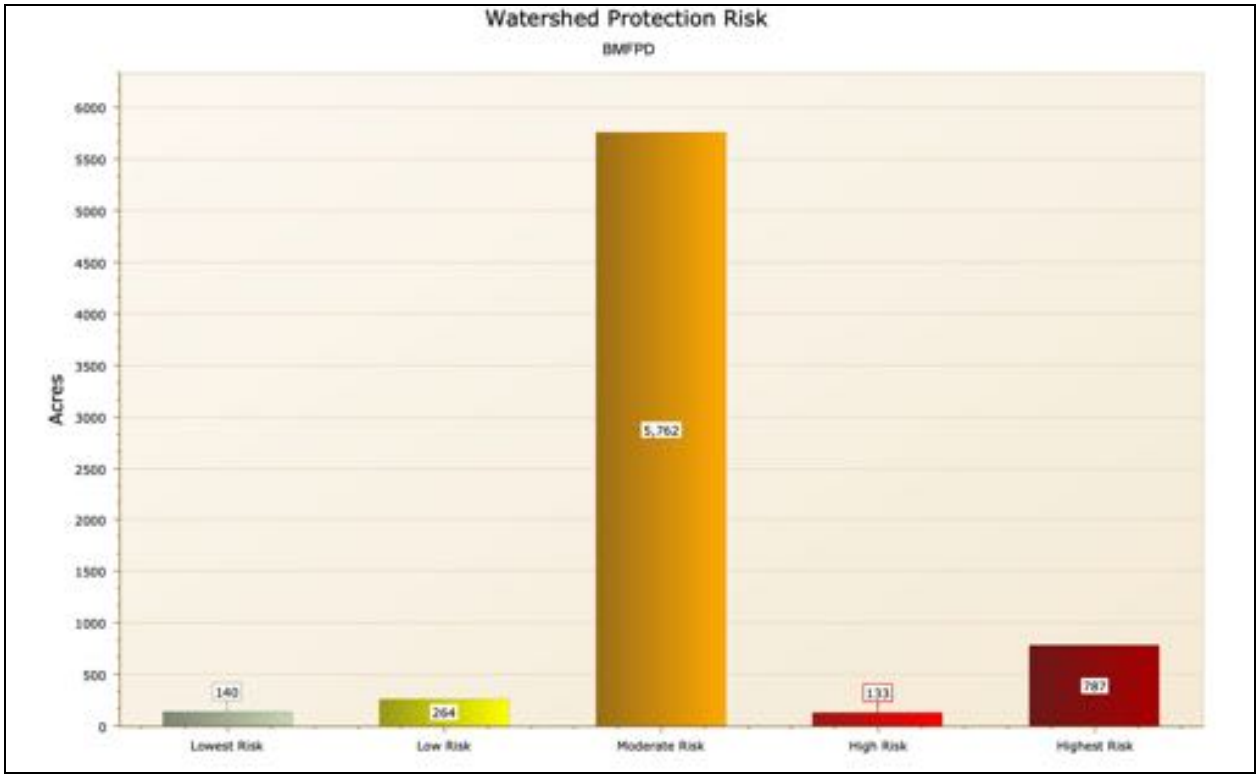


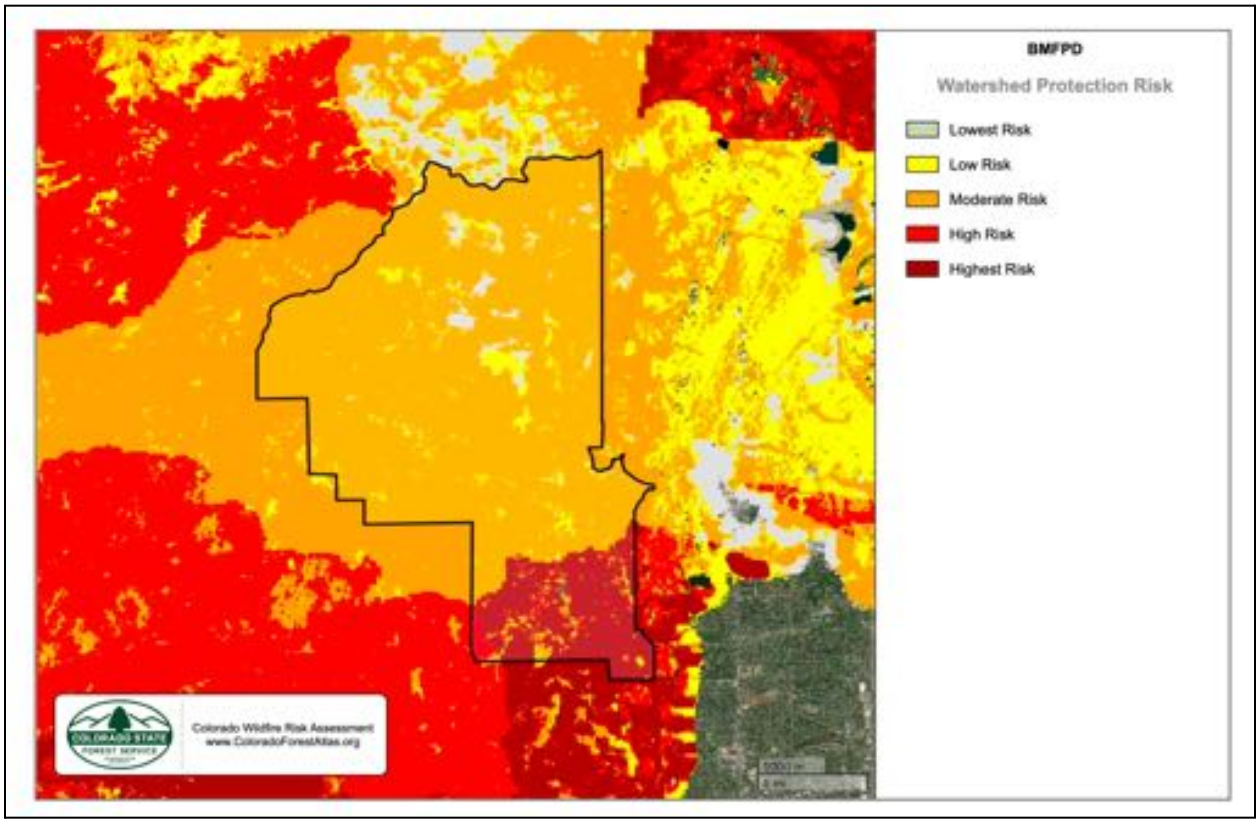

## Watershed Protection Risk

**A measure of the risk to Watershed Protection Areas based on the potential negative impacts from wildfire.**

In areas that experience low-severity burns, fire events can serve to eliminate competition, rejuvenate growth and improve watershed conditions. But in landscapes subjected to high, or even moderate-burn severity, the post-fire threats to public safety and natural resources can be extreme.
High-severity wildfires remove virtually all forest vegetation -- from trees, shrubs and grasses down to discarded needles, decomposed roots and other elements of ground cover or duff that protect forest soils. A severe wildfire also can cause certain types of soil to become hydrophobic by forming a waxy, water-repellent layer that keeps water from penetrating the soil, dramatically amplifying the rate of runoff.
The loss of critical surface vegetation leaves forested slopes extremely vulnerable to large-scale soil erosion and flooding during subsequent storm events. In turn, these threats can impact the health, safety and integrity of communities and natural resources downstream. The likelihood that such a post-fire event will occur in Colorado is increased by the prevalence of highly erodible soils in several parts of the state, and weather patterns that frequently bring heavy rains on the heels of fire season.
In the aftermath of the 2002 fire season, the Colorado Department of Health estimated that 26 municipal water storage facilities were shut down due to fire and post-fire impacts. The potential for severe soil erosion is a consequence of wildfire because as a fire burns, it destroys plant material and the litter layer. Shrubs, forbs, grasses, trees and the litter layer disperse water during severe rainstorms. Plant roots stabilize the soil, and stems and leaves slow the water to give it time to percolate into the soil profile. Fire can destroy this soil protection.
The risk index has been calculated by combining the Watershed Protection data with a measure of fire intensity using a Response Function approach. Those areas with the highest negative impact (-9) represent areas with high potential fire intensity and high importance for ecosystem services. Those areas with the lowest negative impact (-1) represent those areas with low potential fire intensity and a low importance for ecosystem services. The response function outputs were combined into 5 qualitative classes.

| Watershed Protection Risk | Acres | Percent |
|---|---|---|
| Lowest Risk | 140 | 2% |
| Low Risk | 264 | 3.7% |
| Moderate Risk | 5,762 | 81.3% |
| High Risk | 133 | 1.9% |
| Highest Risk | 787 | 11.1% |
| **Total** | **7,085** | **100%** |


Watershed Protection Risk
BMFPD
Acres
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
140
264
5,762
133
787
Lowest Risk
Low Risk
Moderate Risk
High Risk
Highest Risk


BMFPD
Watershed Protection Risk
Lowest Risk
Low Risk
Moderate Risk
High Risk
Highest Risk
Colorado Wildfire Risk Assessment
www.ColoradoForestAtlas.org

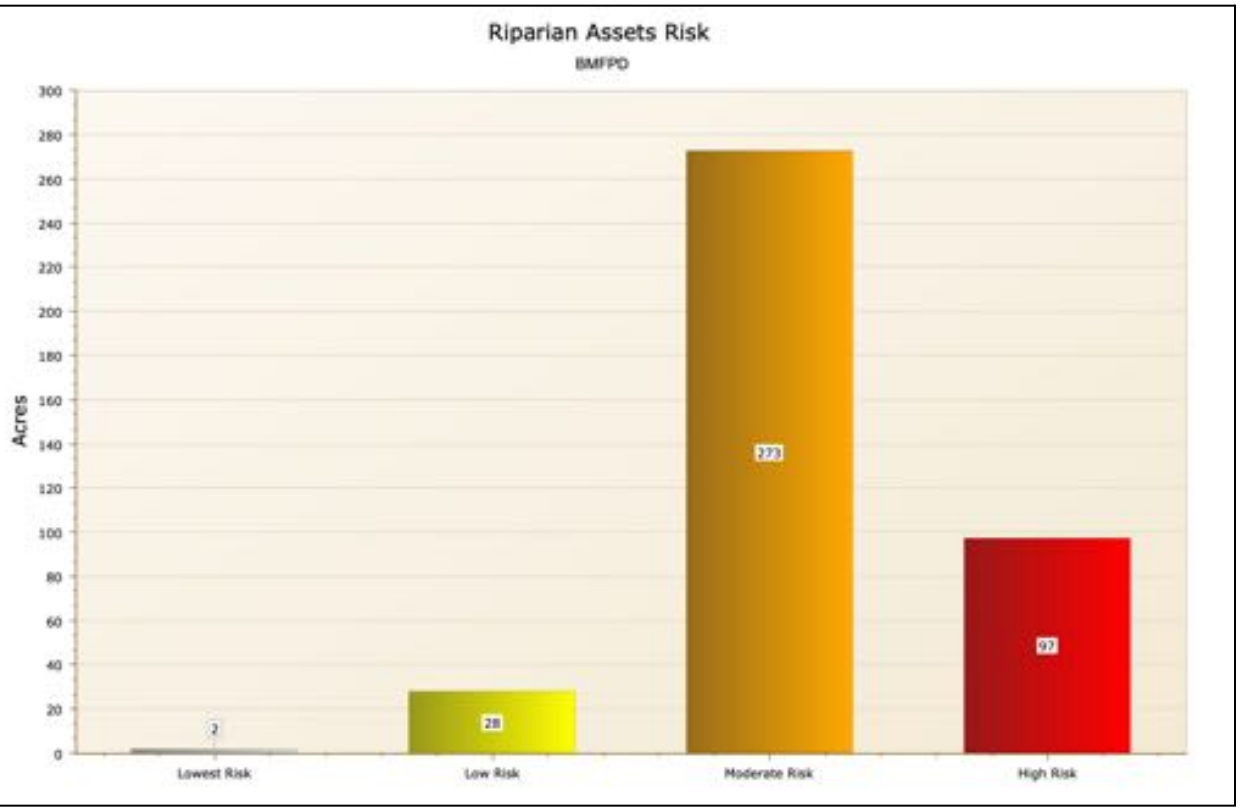
# Riparian Assets Risk

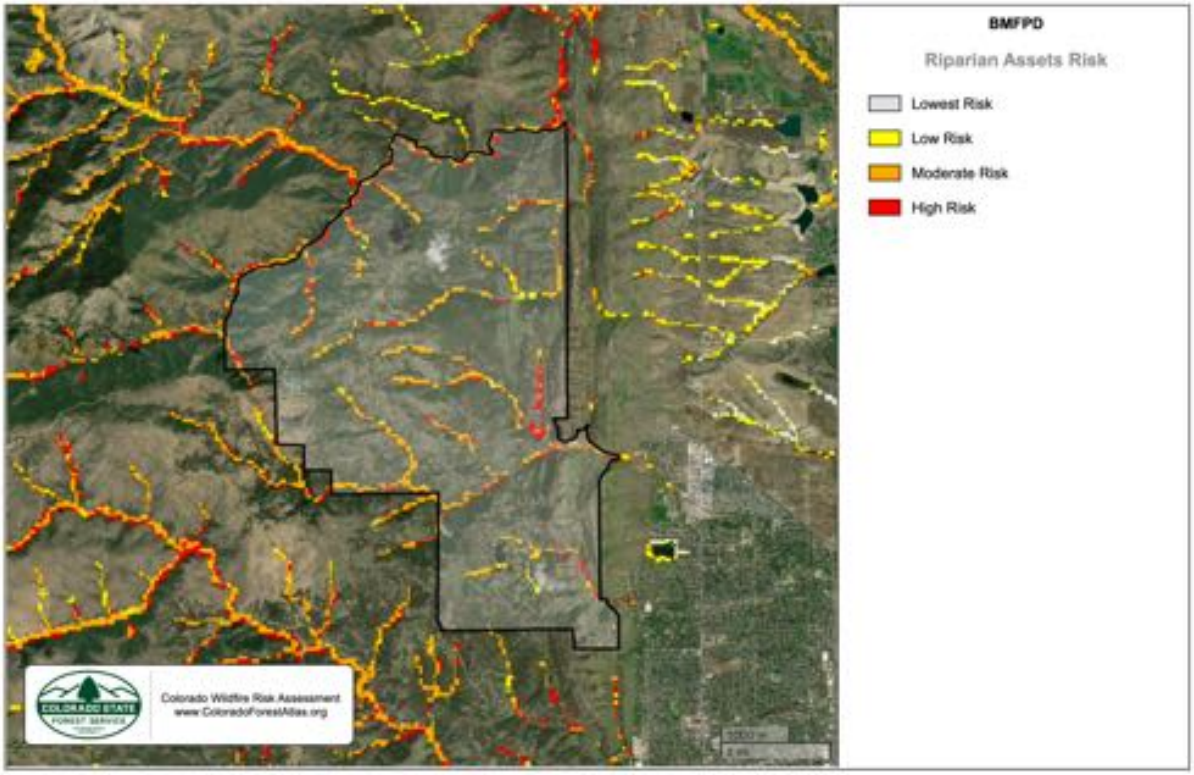
**A measure of the risk to riparian areas based on the potential negative impacts from wildfire.**

The risk index has been calculated by combining the Riparian Assets data with a measure of fire intensity using a Response Function approach. Those areas with the highest negative impact (-9) represent areas with high potential fire intensity and high importance for ecosystem services. Those areas with the lowest negative impact (-1) represent those areas with low potential fire intensity and a low importance for ecosystem services. The response function outputs were combined into 5 qualitative classes.

This risk output is intended to supplement the Watershed Protection Risk Index by identifying wildfire risk within the more detailed riparian areas.

| Riparian Assets Risk | Acres | Percent |
|---|---|---|
| Lowest Risk | 2 | 0.5% |
| Low Risk | 28 | 7% |
| Moderate Risk | 273 | 68.2% |
| High Risk | 97 | 24.3% |
| **Total** | **400** | **100%** |





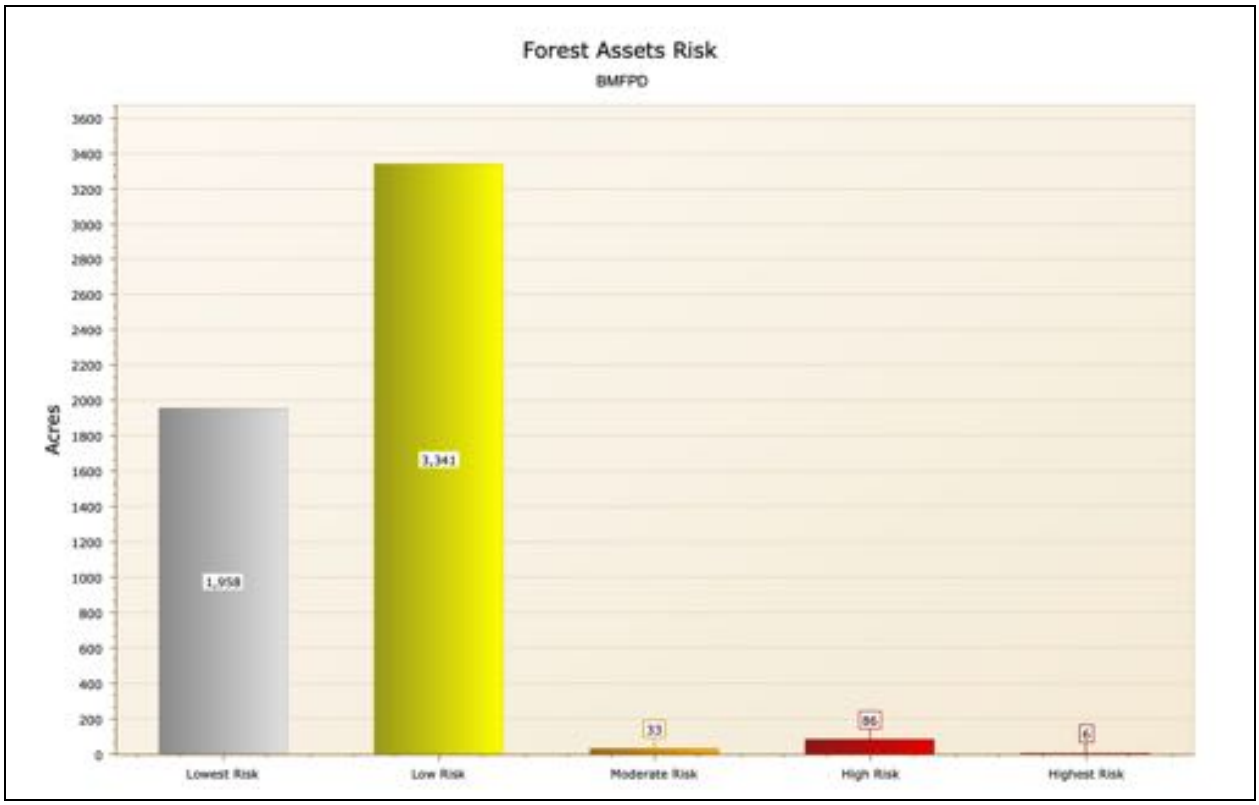

## Forest Assets Risk

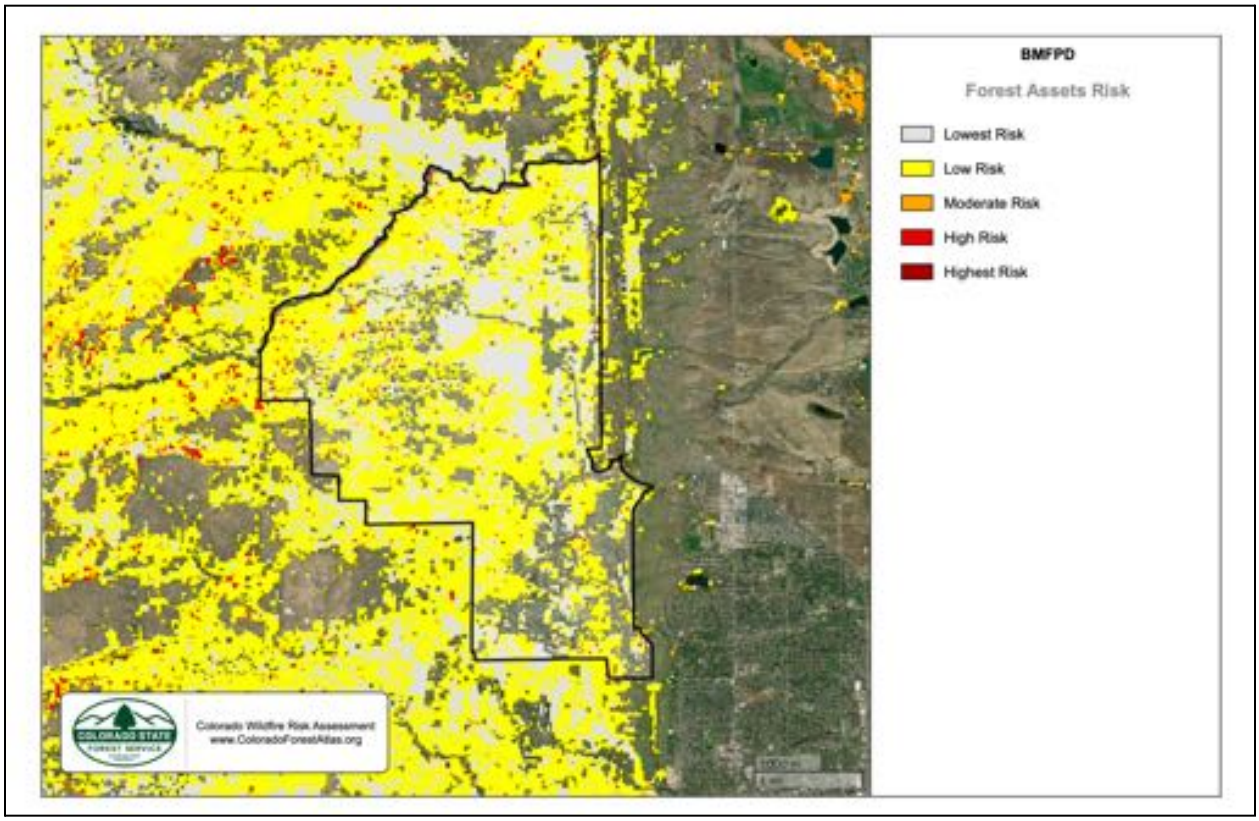
**A measure of the risk to forested areas based on the potential negative impacts from wildfire.**
This layer identifies those forested areas with the greatest potential for adverse effects from wildfire.This layer identifies those forested areas with the greatest potential for adverse effects from wildfire.

The risk index has been calculated by combining the Forest Assets data with a measure of fire intensity using a Response Function approach. Those areas with the highest negative impact (-9) represent areas with high potential fire intensity and low resilience or adaptability to fire. Those areas with the lowest negative impact (-1) represent those areas with low potential fire intensity and high resilience or adaptability to fire. The response function outputs were combined into 5 qualitative classes.

This risk output is intended to provide an overall forest index for potential impact from wildfire. This can be applied to consider aesthetic values, ecosystem services, or economic values of forested lands.

| Forest Assets Risk | Acres | Percent |
|---|---|---|
| Lowest Risk | 1,958 | 36.1% |
| Low Risk | 3,341 | 61.6% |
| Moderate Risk | 33 | 0.6% |
| High Risk | 86 | 1.6% |
| Highest Risk | 6 | 0.1% |
| Total | 5,423 | 100% |


Forest Assets Risk
BMFPD
Acres
3600
3400
3200
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1,958
3,341
33
86
6
Lowest Risk
Low Risk
Moderate Risk
High Risk
Highest Risk


BMFPD
Forest Assets Risk
Lowest Risk
Low Risk
Moderate Risk
High Risk
Highest Risk
COLORADO STATE FOREST SERVICE
Colorado Wildfire Risk Assessment
www.ColoradoForestAtlas.org

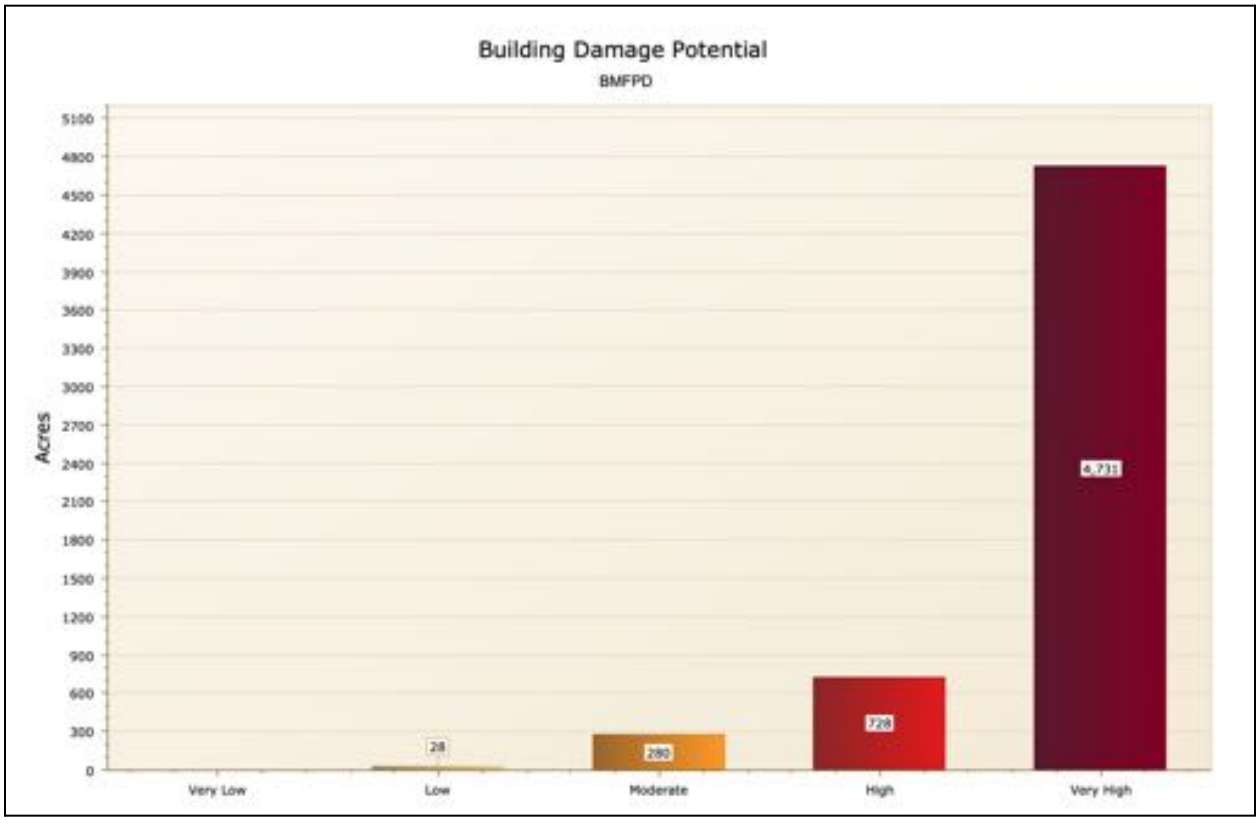
# Building Damage Potential

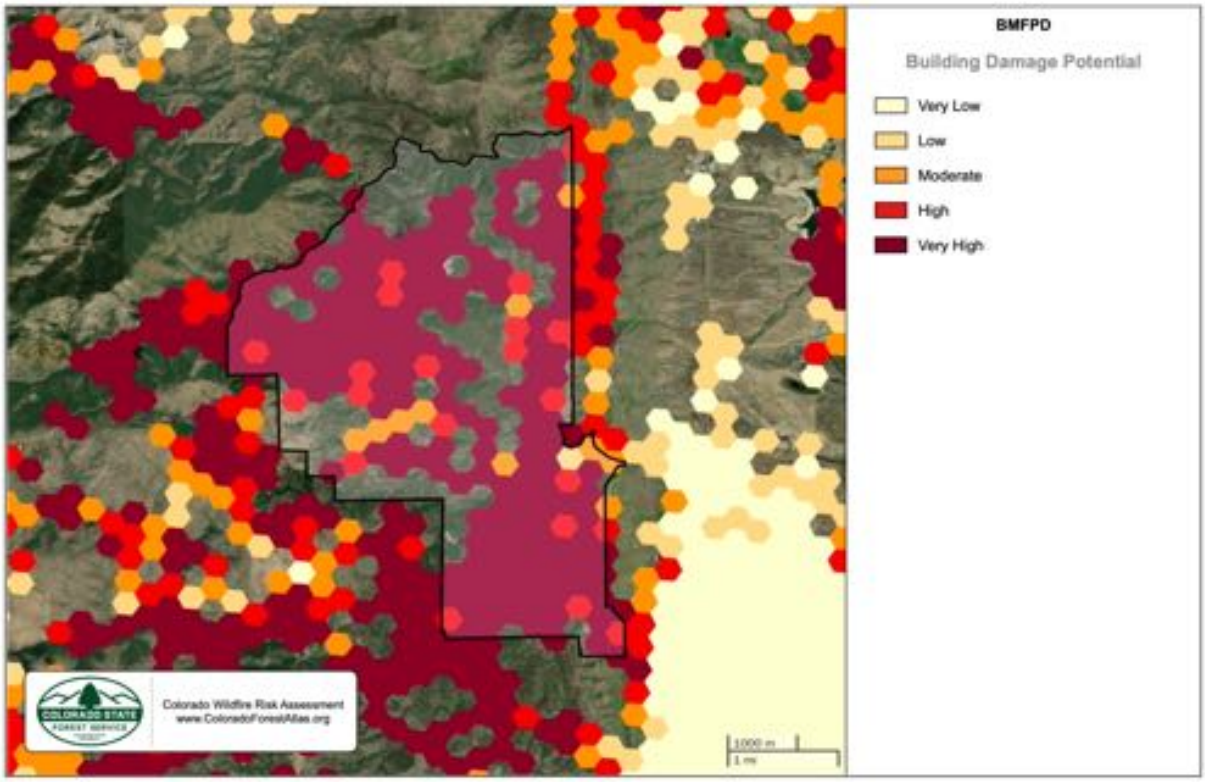
This metric estimates the potential for building loss and was derived using proprietary data from Technosylva Inc. on building damages that was created by analyzing 13 years of building damage data from state agency inspections after large fires.

BDP is a spatially variable metric that is calculated on a building-by-building basis and aggregated to Uber H3 hexagons, providing a measure of the number of potential buildings lost based on the number of buildings threatened by fires in the specific area. BDP was calibrated using Machine Learning algorithms that identified the key factors that influenced building loss from historical damage inspection databases. The model has been calibrated using 13 years of damage inspection data and validated across multiple Western States with current wildfire data.

BDP is available as a static risk layer, although a key factor involved in the metric is conditional fire behavior. Conditional Flame Length derived in the fire behavior analysis conducted for the 2022 CO-WRA was used. However, the metric can also be used as a dynamic layer when modulated by the fire intensity of an active wildfire through conventional fire behavior analysis. Although applied as a static layer for the 2022 CO-WRA, the metric is used operationally in California by state agencies and private industry for risk forecasting

| Building Damage Potential | Acres | Percent |
|---|---|---|
| Very Low | | 0% |
| Low | 28 | 0.5% |
| Moderate | 280 | 4.8% |
| High | 728 | 12.6% |
| Very High | 4,731 | 82% |
| **Total** | **5,767** | **100%** |





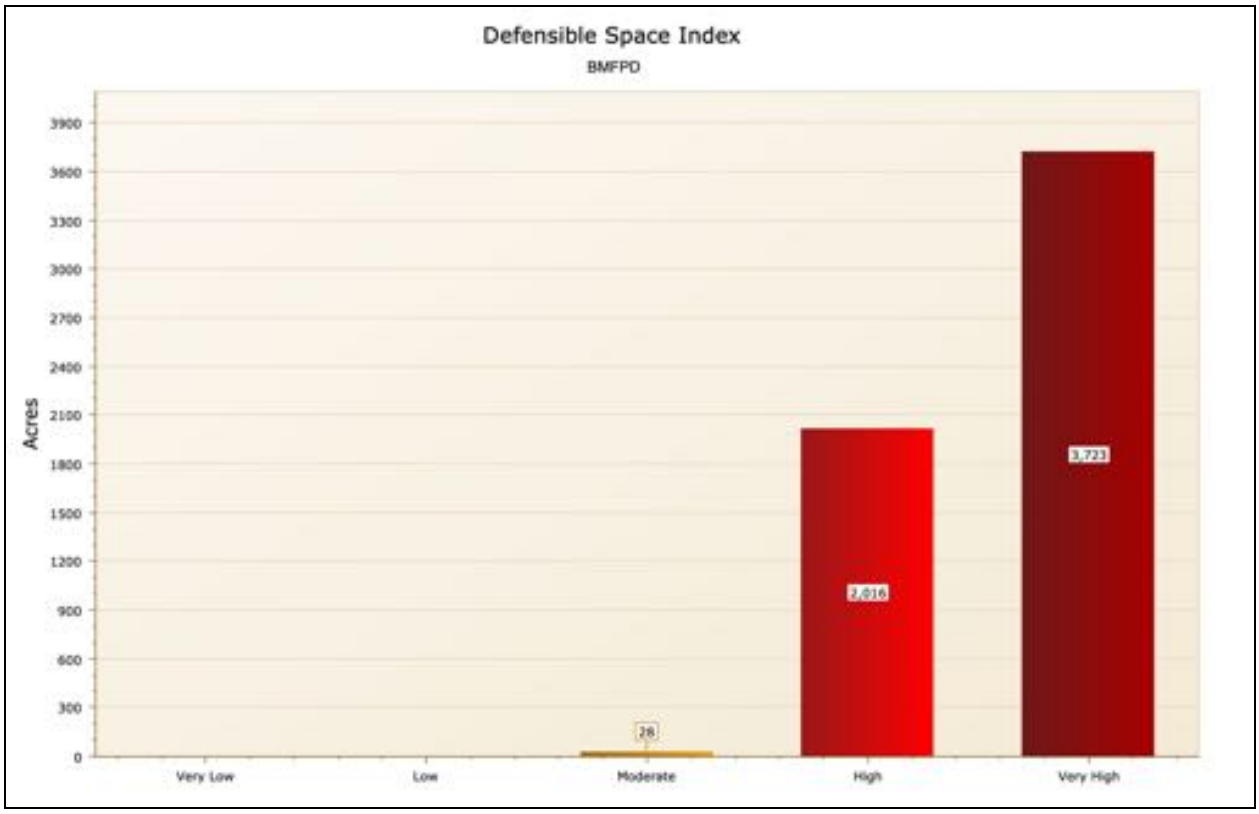

## Defensible Space Index

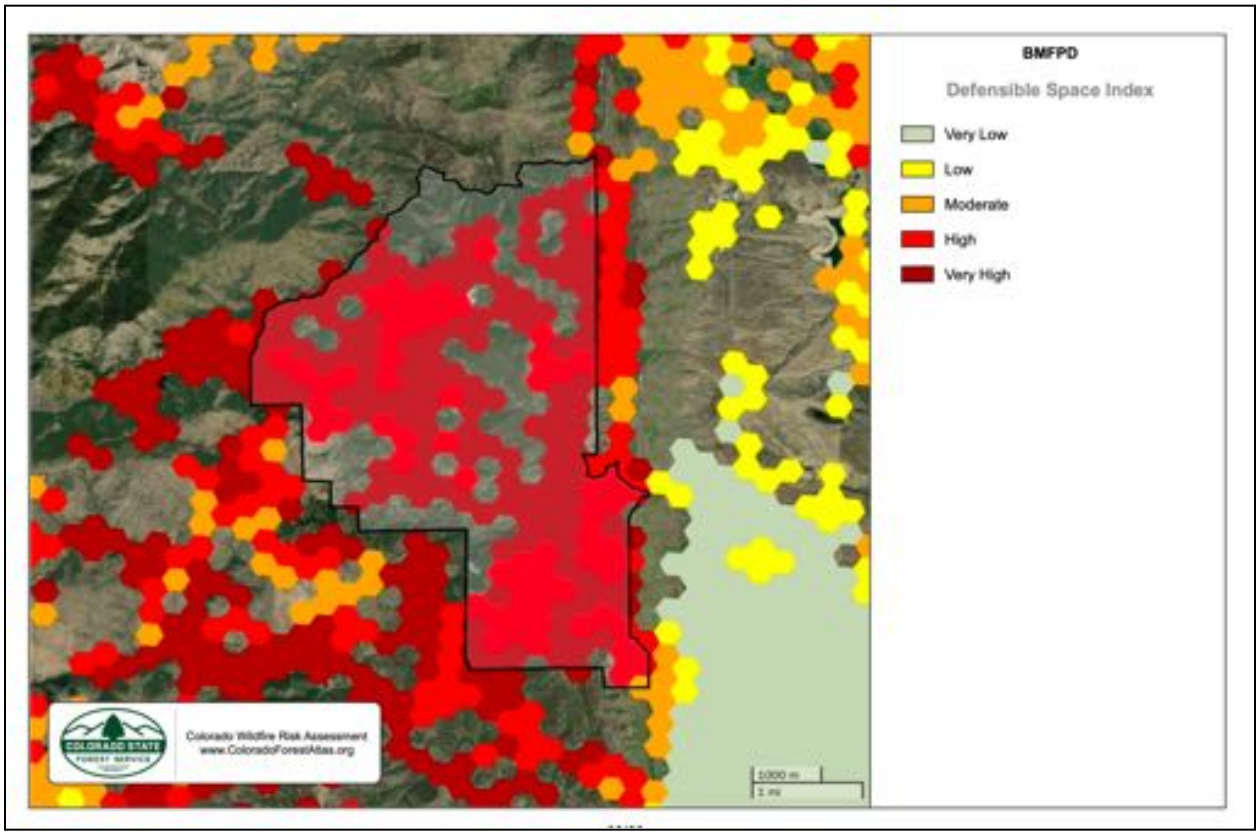
The defensible space in a Wildfire Urban Interface (WUI) analysis context refers to the space that surrounds a specific building and can be used to define the hazard, or the exposure, to a wildfire occurrence. In this area, natural and manmade fuels are treated, cleared or reduced to slow the spread of wildfire near structures.

Individual building footprints were used to identify structure locations. Buildings were then grouped using Uber's hexagonal hierarchical spatial index. Within each hexagon, the building values were averaged and applied to the hexagon to remove building specific metrics. This provides a detailed measure of defensible space characteristics for small areas consistent with the accuracy of the structure locations and wildfire fuels and risk analysis data.

Each hexagon in the defensible space risk has a relative value from 0 to 1 that represents the average building hazard in that hexagon. This defensible space value is based on three spatial components/variables: 1) canopy cover, 2) slope, and 3) fuel models present within the buffer around the buildings analyzed.

| Defensible Space Index | Acres | Percent |
|---|---|---|
| Very Low | | 0% |
| Low | | 0% |
| Moderate | 28 | 0.5% |
| High | 2,016 | 35% |
| Very High | 3,723 | 64.6% |
| **Total** | **5,767** | **100%** |


Defensible Space Index
BMFPD
Acres
3900
3600
3300
3000
2700
2400
2100
1800
1500
1200
900
600
300
0
28
2,016
3,723
Very Low
Low
Moderate
High
Very High


BMFPD
Defensible Space Index
Very Low
Low
Moderate
High
Very High
Colorado Wildfire Risk Assessment
www.ColoradoForestAtlas.org

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# Appendix E

# Informational Resources

**The Fire Adapted Communities Learning Network** connects leaders with tools, resources, and support to build wildfire resilience and promote fire adaptation practices nationwide. (Referenced on page 61 of BMFPD's CWPP.)
URL: https://fireadaptednetwork.org/

**The Home Ignition Zone** is a guide to preparing your home for a wildfire and creating defensible space. (Referenced on pages 64, 65, 66, and 67 of BMFPD's CWPP.)
URL: https://csfs.colostate.edu/wp-content/uploads/2021/04/2021_CSFS_HIZGuide_Web.pdf

**Firewise Plant Materials** is a Colorado State University Extension document that provides a comprehensive guide to selecting fire-resistant plants that reduce wildfire risk and enhance defensible space around homes. (Referenced on pages 66 and 74 of BMFPD's CWPP.)
URL: https://extension.colostate.edu/wp-content/uploads/2022/02/6.305-FireWise-Plant-Materials.pdf

**Jefferson County Conservation District** is a non-regulatory special-purpose district in Washington State that helps land users conserve natural resources and address resource concerns while also meeting their land use goals. (Referenced on page 68 of BMFPD's CWPP.)
URL: https://www.jeffersoncd.org/

**Community Planning Assistance for Wildfire** provides land use planning solutions, communication assistance, and customized research to better understand and manage wildfire-prone areas and reduce risks. (Referenced on page 20, and 70 of BMFPD's CWPP.)
URL: https://cpaw.headwaterseconomics.org/

**Boulder County - Emergency** provides information regarding emergency notification systems and disaster management as well as online access to the sheriff and fire radio for residents to monitor. (Referenced on page 72 of BMFPD's CWPP.)
URL: https://bouldercounty.gov/safety/emergency/

**Ready.gov** provides tips and resources to prepare for severe weather, flooding, hurricanes, and power outages, along with information about emergency kits, go bags, and FEMA resources. (Referenced on page 71 of BMFPD's CWPP.)
URL: https://www.ready.gov/

**Boulder County - Yard Waste and Food Scrap Drop-Off** provides a list of drop-off centers for residents to dispose of their slash. (Referenced on pages 71 and 74 of BMFPD's CWPP.)

URL: https://bouldercounty.gov/environment/composting/yard-waste-and-food-scrap-drop-off/

**Wildfire Partners - Chipping Program** provides detailed information about the free chipping program. (Referenced on pages 71, 74, and 87 of BMFPD's CWPP.)
URL: https://wildfirepartners.org/chipping-program/

**Fire Safe Marin's Firescaping** provides resources and information for creating a fire smart landscape. (Referenced on page 74 of BMFPD's CWPP.)
URL: https://firesafemarin.org/create-a-fire-smart-yard/

**BOCO Alert** is Boulder County's official emergency notification system. (Referenced on pages 76, 77, and 82 of BMFPD's CWPP.)
URL: https://member.everbridge.net/453003085612231/login

**BMFPD - Evacuation Preparedness** provides an evacuation preparedness guide for BMFPD residents. (Referenced on page 76 of BMFPD's CWPP.)
URL: https://www.bmfpd.org/evacuation-preparation

**Wireless Emergency Alerts (WEA)** is a public safety system that allows customers with compatible mobile devices to receive geographically targeted messages alerting them of threats to safety in their area. (Referenced on page 76 of BMFPD's CWPP.)
URL: https://www.fcc.gov/consumers/guides/wireless-emergency-alerts-wea

**BMFPD - District Evacuation Maps** is a page on BMFPD's website that provides evacuation maps for the district. (Referenced on page 76 of BMFPD's CWPP)
URL: https://www.bmfpd.org/evac-maps

**Boulder County Disaster Management** provides information on emergency status, road closures, and disaster preparedness. (Referenced on page 77 of BMFPD's CWPP.)
URL: https://boulderodm.gov/about-odm/

**BMFPD Community Safety Store** is an online store where residents can purchase fire safety items such as fire extinguishers, smoke detectors, and reflective address signs. (Referenced on page 78 of BMFPD's CWPP.)
URL: https://www.bouldermountainfireauxiliary.org/community-safety-store

**Fire Safe Marin - Evacuation Planning and Checklists** provides planning resources and checklists for evacuation during a wildfire incident. (Referenced on page 79 of BMFPD's CWPP.)
URL: https://firesafemarin.org/prepare-yourself/evacuation-guide/create-an-evacuation-plan/

**Wildfire Partners - Defensible Space Program** provides funding opportunities to assist with the completion of wildfire mitigation work. (Referenced on page 87 of BMFPD's CWPP.)
URL: https://wildfirepartners.org/west-boulder-county/individual-home-assessments/

**Wildfire Partners - Rebate Program** offers $500 rebates to Boulder County residents who complete a Wildfire Partners mitigation action. (Referenced on page 87 of BMFPD's CWPP.)
URL: https://wildfirepartners.org/rebate/

**BMFPD Site Assessment Request** is a resource that offers county, state, and federal grant funds to offset costs associated with wildfire mitigation projects. Fill out the request form available on BMFPD's Wildfire Mitigation Crew's website. (Referenced on page 88 of BMFPD's CWPP.)
URL: https://www.bmfmitcrew.com/take-action

**California State University - Understanding Fire** provides information and resources on extreme fires in California. (Referenced on pages 125 of BMFPD's CWPP.)
URL: https://www.calstate.edu/csu-system/news/Pages/understanding-fire.aspx

**National Wildfire Coordinating Group - Introduction to Fire Behavior** provides a 10-minute video about fire behavior. (Referenced on page 125 of BMFPD's CWPP.)
URL: https://www.nwcg.gov/training-courses/rt-130/fire-environment/fe404

**National Wildfire Coordinating Group - The Fire Triangle** provides a video on the fire triangle. (Referenced on page 125 of BMFPD's CWPP.)
URL: https://www.nwcg.gov/training-courses/rt-130/operations/op803

**NFPA - Understanding Fire Behavior in the Wildland-Urban Interface** provides a 20-minute video on fire behavior in the WUI. (Referenced on page 125 of BMFPD's CWPP.)
URL: https://www.youtube.com/watch?v=pPQpgSXG1n0

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